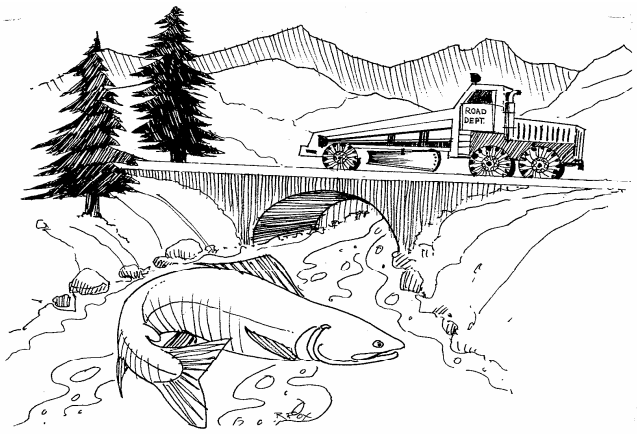
A WATER QUALITY AND STREAM HABITAT PROTECTION MANUAL for COUNTY ROAD MAINTENANCE IN NORTHWESTERN CALIFORNIA WATERSHEDS



Prepared for the
Five Counties Salmon Conservation Program

ADMINISTRATIVE DRAFT

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Prepared for the Five Counties Salmon Conservation Program

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INTRODUCTION

Why the Manual is Needed

Purpose

The purpose of this manual is to provide a user-friendly, fish-friendly guide for County road maintenance staff as part of each county's primary mission to provide a safe and open road system for the traveling public**.** The manual is intended to also be part of an evolving, proactive process by the counties of the northwestern region of California – Del Norte, Humboldt, Mendocino, Siskiyou, and Trinity – to address their mutual needs as part of the Five County Salmon Conservation Program.

As a group and individually, the counties will continue to compile and recommend the best available management practices for protecting local water quality and stream habitat while maintaining county roads and maintenance facilities. Each of the county public works /road /transportation departments already performs many preventative and remedial practices, but none had available a useful written compilation for use by their employees. These and other beneficial practices can now be shared through the manual, to be used as a daily reference for standard operating procedures and as a training tool by county road managers, engineers, supervisors, and crews.

Besides its practical need, the manual can also help serve a legal need for the counties. The most immediate need is to provide a way for road maintenance practices to be performed without unnecessary delays (and expenses) from the regulatory permit process. By clearly identifying the best practices that will be used regularly for protecting water quality and salmon habitat, the counties can assure the responsible agencies that these resources will not be harmed through their actions. As a result, permits for routine road maintenance practices should not need to be scrutinized under a lengthy permit process. Permits have become more challenging to obtain particularly since the late 1990s when coho salmon, chinook salmon, and steelhead became listed under the federal Endangered Species Act.

Scope of Maintenance Practices Covered by Manual

This manual covers management practices related to the routine and emergency repair and maintenance of county roads and related facilities. Road maintenance includes actions taken to prevent erosion and/or the deterioration of a roadway, such as the cutbank, road surface, fillslope and all drainage structures. Other related facilities are bridges and county road maintenance yards. The replacement of existing structures with different types of structures, such as replacing a culvert with a bridge, is included. The manual also involves measures to protect the traveling public, such as snow and ice removal. Not addressed in this manual is the construction, or a major expansion or change in use, of such roadways and facilities beyond those which existed previously. The time scale to accomplish road improvements, such as the replacement of ineffective or old culverts, is expected to be over a 50 year period.

Endangered Species Act Listings of Salmon and Steelhead

Several salmon species are in serious decline in the Pacific Coastal states. Many distinct populations (known as Evolutionarily Significant Units, or ESUs) of Pacific salmon or steelhead have been listed in recent years under the federal Endangered Species Act (ESA) as threatened or endangered. Coho salmon (also known as "silver" salmon), chinook salmon (also called "king" salmon), and steelhead (the ocean-migrating form of rainbow trout) are presently listed in all or parts of the five county region of Northwestern California.

The National Marine Fisheries Service (NMFS) is charged with the responsibility for implementing the provisions of the ESA for ocean species like salmon. As a result, the agency cannot allow the "take" of these listed species through even unintentional harmful actions, such as road-related stream sedimentation or culvert blockages to fish passage. The only exception provided in the Act is where the "take" is associated with an approved program by NMFS. "Take" exceptions can be provided for under Section 4(d) (with a special rule for certain practices), Section 7 (for federally funded or permitted activities), and Section 10 (for non-federal activities) of the ESA.

Five Counties Salmon Conservation Program

Soon after the first salmon species (coho) was listed as threatened in 1997, elected supervisors from the five county region of the listing (also known as the Southern Oregon-Northern California Coasts ESU, or SONCC) met and agreed that a cooperative venture to address possible local strategies was in order. The Five Counties Salmon Conservation Program ("5 Cs"), also referred to in the past as a plan or a process, became the result. The term "salmon" is intended to generally connote anadromous forms of salmonids, including steelhead.

A University of California (U.C.) study was commissioned by the 5 C Program to evaluate the effects of Northwestern California county regulations and management on salmonids and their habitats (Harris and Kocher, 1998). One of the final report's conclusions regarding County Maintenance Mitigation Practices was:

> *"The lack of written road and bridge maintenance policies and procedures makes it difficult to determine if practices which contributed to protection and/or maintenance of fish habitat and water quality are standard operating procedures or extraordinary efforts of individuals."*

As a result of this finding, the U.C. report made three recommendations:

1. Some maintenance procedures can be improved, especially through implementation of the five county work group and training.
2. Road and bridge maintenance policies should be institutionalized so that they become standard organizational practice, rather than the result of individual initiative.
3. There should be a continuing emphasis on education and training of personnel in biological resources management. Exceptional cases of fish friendly road improvements already existing in the counties, such as Siskiyou County's French Creek Watershed project, should be used as examples.

Another purpose of this manual is to address the above recommendations.

Clean Water Act

Beyond endangered species listings are the regulatory demands of the Clean Water Act. Permits have long been required from the Corps of Engineers for Section 404 of the Act for any activities that might involve the discharge of dredged or fill material into "waters of the U.S.". More recently, the Environmental Protection Agency (EPA) and the State Water Resources Control Board have issued new regulations that also can affect road maintenance activities. Storm water discharge permits (Section 402) will soon be required for county road maintenance yards and municipal facilities with storm water systems. For streams that are listed as "impaired", the agencies are requiring a remedial strategy calling for the establishment of Total Maximum Daily Loads, or TMDLs, for each pollutant. All of the major north coast streams are listed for sediment and/or temperature, and limits on the amount of erosion and sediment that will be allowable from roads is being addressed. With this manual recommending methods to reduce erosion and protect water quality, the counties are proactively tackling these issues.

Scope of Road Maintenance Needs

The importance of having a manual to address County road maintenance needs related to stream and watershed conditions in Northwestern California is indicated by the extent of the county road systems, as indicated in the following tables:

Table A. Estimated Miles of County Maintained Roads (1/01) in Region

County	Surfaced County Road Miles	Unsurfaced County Road Miles	Total County Road Miles
Del Norte	302	199	501
Humboldt	907	300	1207
Mendocino	706	312	1018
Siskiyou	808	556	1364
Trinity	455	245	700
Total	3,178 (66%)	1,612 (34%)	4,790

Table B. Estimated County Maintained Culverts & Stream Crossings (1/01) in Region

County	Culverts[1]	Bridges	Low Water Crossings
Del Norte	~2000	32	0
Humboldt	~3000	162	3
Mendocino	~2500	157	19
Siskiyou	~4000	175	0
Trinity	~5000	93	9
Total	~16,000 (est.)	619	31

[1] *Culvert estimates include stream crossings and cross-drains.*

Two inventories are being sponsored by the Five County Salmon Conservation Program to provide better numbers: County Road Sediment Source Inventory and County Culvert Fish Migration Barrier Inventory. As of Spring 2002, the Road Sediment Inventory had surveyed 38% of all of the county road miles in the region but had not yet begun in Siskiyou County. Of

1,700 miles of road surveyed, it had identified over 7,000 sites needing treatment to prevent the future delivery of sediment into streams from county roads. Priority sites for treatment were identified, with two-thirds of the potential problems related to stream crossings. However, routine maintenance activities can help prevent many potential problems documented in the Inventory from occurring. In addition, the Culvert Barrier Inventory has identified and prioritized about 250 fish migration barriers on the county road systems, with over 30 barriers since corrected or funded for replacement (Trinity County 2002a, b).

How the Manual was Developed

Categories of critical road, bridge and maintenance activities that have the potential to adversely affect water quality or salmon habitat were initially identified by the project managers and consultants. Existing road maintenance and erosion control manuals were reviewed for relevant policies and practices. Publications from both within and outside of California were used, produced by entities such as Association of Bay Area Governments, Pacific Watershed Associates, California Dept. of Transportation (Caltrans), California Regional Water Quality Control Board, Oregon Dept. of Transportation (ODOT), Washington Dept. of Transportation (WashDOT), USDA Forest Service, and International Erosion Control Association. Some contents were relevant to county road maintenance issues, but not all.

ODOT's Manual & 4(d) Rule Special Exception

In particular, the Oregon Dept. of Transportation (ODOT) manual, "Routine Road Maintenance - Water Quality and Habitat Guide" *(*July 1999), deserves noting. NMFS has indicated in its formal comments how this program "greatly improves" protections for listed fish that might be affected from a range of routine maintenance activities "by minimizing the activities' impacts on streams". While carrying out the agency's basic mission to provide a safe and effective transportation system, the ODOT program also works well within the mandates of the ESA and the Clean Water Act (see Chapters 1 & 2 for more information on these acts and issues*)*. The ODOT plan has also been accepted at the state level for the agency's training, documentation, reporting, and accountability.

As a result of the manual's comprehensive content, the National Marine Fisheries Service has found it <u>not</u> necessary or advisable to apply the "take prohibitions" under the ESA to routine road maintenance activities conducted by employees or agents of ODOT or other entities if their program complies substantially with that contained in the ODOT guide or has been determined to meet or exceed the protections provided by the ODOT guide (NMFS, 2000). This specific exception was provided for in the July 10, 2000 rule by NMFS under the Act's Section 4(d), which is one of the legal means for local government to obtain permission to continue actions which could possibly cause any unintentional take to a listed species.

NMFS encourages counties to follow the ODOT example: "Any jurisdiction wanting its routine road maintenance activities to be within this exception to ESA's take prohibition must first commit in writing to apply management practices that provide protection equivalent to or better than those provided by the ODOT guide." The ODOT routine road maintenance plan has been accepted and implemented by the Association of Oregon Counties within each of the counties'

ordinances. Similar assurances for implementation and monitoring must accompany a strategy for the Five County region if NMFS is to grant an exception to the take prohibitions for ESA listed species.

Five Counties Road Managers Committee

Since 1997, the counties within the northwestern region of California have worked closely together to address the local impacts of the initial listing of coho salmon and the subsequent listing of chinook salmon and steelhead trout under the Five Counties Salmon Conservation Program. Work began on this manual in late 1999, with Trinity County and Humboldt County alternately serving as project managers for the grant funding received from state and federal sources that was used to hire consultants in its preparation. Closely overseeing the process was the Five Counties Road Managers Committee, composed of several representatives of each of the counties' public works or transportation departments. Meetings were held every few months to review progress and make recommendations on content. Practices were also demonstrated and debated during the annual "Roads, Salmon, and Water Quality Workshop" and field tours held in Trinity County for road maintenance managers, engineers, and supervisors in September from 1999 to 2001. Upon completion of the third draft in mid-2001, the manual was presented to regulatory agencies for comment. Following discussion and incorporation of proposed changes, this fourth – or administrative – draft is now being released for Public Review and formal comment.

Manual Format

The intent is to provide a user-friendly format that can be easily updated. To ease updating, the pages are three-hole punched and kept in a three-ring binder instead of being bound. Replacement pages can be added and old ones retired without affecting the order. Drawings and other graphics were borrowed from existing sources where relevant and new drawings or photographs added where needed to help depict a particular practice. Updates of this manual are anticipated, based on feedback, monitoring, and other "adaptive management" practices, and are provided for under policies proposed in Chapter 10.

Each category of Maintenance Activities is located under a separate chapter. Within each chapter are uniquely numbered parts and sub-parts for the various topics. Within each chapter / part / sub-part are these standard headings:

- Topic Title
- Description of action
- Environmental Concerns
- Best Management Practices (BMPs)
- Permits

Chapters 1 and 2 provide background information to help explain the natural setting (watersheds, streams, and fish), road management principles, and the legal setting. Chapters 3 through 9 describe different categories of maintenance activities and the recommended practices for each. Chapters 10 and 11 recommend pragmatic monitoring and training programs for the county road maintenance departments. Information sources, including references, are found in Chapter 12.

The appendices provide more specific information about Permitting and Erosion Control Practices – topics that will likely need regular updating.

Other Tools

This manual is only one new tool available to the counties to address road-related issues. Grading ordinances for private roads and updated county road standards for new road construction are also being prepared by one or more of the counties and can be used as models for the others.

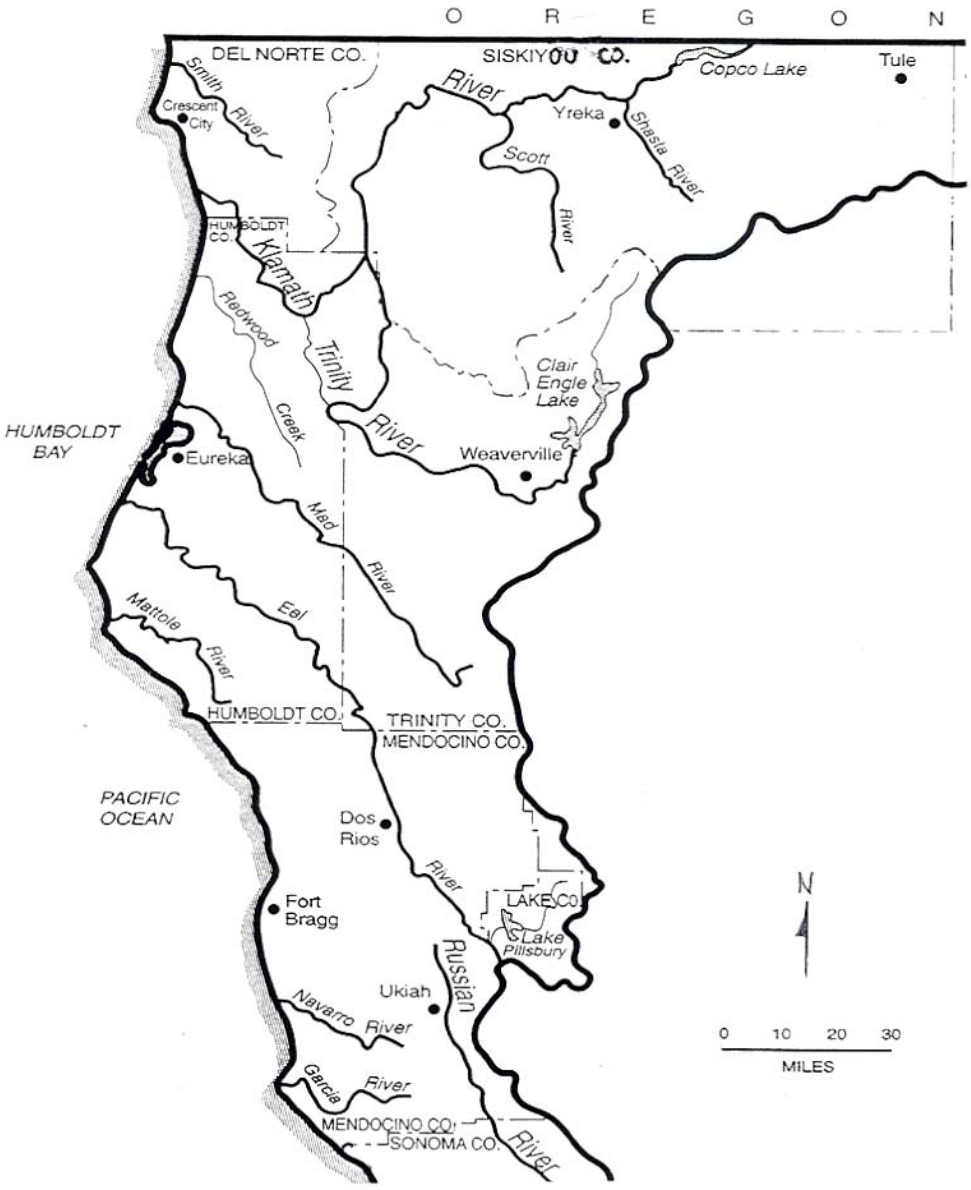


Figure 1. The Northwestern Region of California, indicating the five counties and their major rivers
(Source: North Coast Regional Water Quality Control Board)

CHAPTER 1
WORKING IN THE WATERSHED

All of the rivers and streams drain from an area called a watershed. What happens in each watershed affects the quality of the streams and the fish habitat they provide. This chapter gives a basic background about how watersheds work and what stream habitat salmon and steelhead (and other species) need. Finally, basic road treatment principles are listed – how to protect water quality and stream habitat while maintaining safe county roads for the traveling public.

1-A Watershed Basics

1-B Stream Habitat Needs

1-C Road Treatment Principles

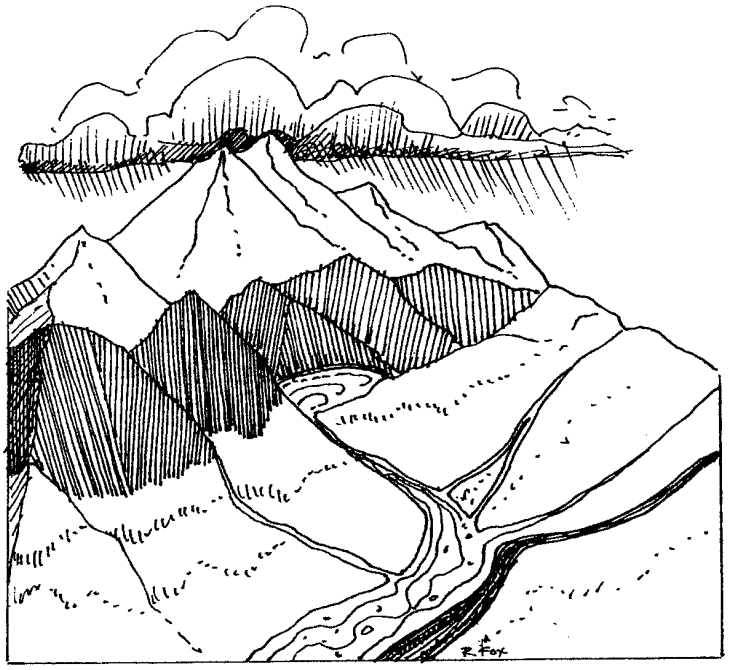
Photo of Navarro River, Mendocino County: Copyright © 1991 Dr. Oren Pollak

1-A WATERSHED BASICS

Northwestern California is often described by its spectacular rivers - like the Klamath, Trinity, Smith, and Eel. From the largest rivers to the smallest creeks, these streams are each part of a drainage basin or watershed. Understanding the basics of how watersheds work in affecting water quality and stream habitat is the purpose of this chapter. These basics can then be translated into principles for treating county roads.

1-A Watershed Basics

- Watershed Approach
- What is a Watershed?
- Watershed Processes
- Water Quality



1-A WATERSHED BASICS

THE WATERSHED APPROACH

Watersheds and watershed management represent a useful approach to solving local road-related problems because:

1. Salmon & steelhead species in northwestern California watersheds are now listed, or proposed to be listed, as threatened or endangered under the federal Endangered Species Act, leading to new legal restrictions on watershed activities.
2. Almost all of the streams in the region are listed under the federal Clean Water Act as "impaired" by excessive sediment & temperature, triggering a requirement for "TMDL" pollution limits for each stream system (which includes the watershed).
3. Inadequate staffing and funding are available at the county level to meet all county road maintenance needs.
4. Since water moves downstream in a watershed, and road work and other watershed activities can affect water quality at locations downstream, it takes a "Big Picture" watershed view to make sure the human-caused problems are solved.
5. Solutions need to address the causes and not just the symptoms of stream and fish conditions – and watersheds provide a way to do this.

WHAT IS A WATERSHED?

The basic definition of a watershed is fairly simple:

> **Watershed** – an area of land which drains water, sediment, and dissolved materials into waterways; defined by the ridges of the hills or mountains that divide them.

Other terms often used to mean the same thing include: basin, drainage, or catchment. While technically the term 'watershed' can refer to any size of an area, there is less confusion if terms are consistently used and defined by size. A system of terms exists for subdividing large watersheds into smaller ones based on relative watershed size:

River Basin – A river system or a group of streams composing a coastal drainage area.
Examples: Eel River Basin, Klamath River Basin, Northern California Coastal Basin.

Subbasin - A geographic area representing part or all of a surface drainage area, a combination of drainage areas, or a distinct hydrologic feature. Almost all subbasins are larger than 700 square miles in size, though some in Northern California are smaller.
Examples: Middle Fork Eel River, Scott River, Mattole River.

Watershed – The next smallest subdivision of a subbasin.
Examples: Mill Creek, Moffett Creek, Honeydew Creek

1-A WATERSHED BASICS

Subwatershed – A logical subdivision of an area within a watershed, based on geography (major tributary) or a distinctive feature or use (municipal water supply).
Examples: Upper Mill Creek, McAdams Creek, East Fork Honeydew Creek

Drainage – An area within a subwatershed based on the development of the stream channel network, including draws and swales.
Examples: Unnamed Creek, Upper McAdams Creek, Lower East Fork Honeydew Creek

While most people find it difficult to be consistent in using these terms as defined, communication is improved when the words are properly applied.

Water Bodies

Water flows through channels having many different names also: river, stream, creek, gulch, ditch, and estuaries. Water is also stored on the surface in different types of water bodies – lakes, lagoons, reservoirs, and ponds. Together, all of these flowing and stored surface water bodies are called **watercourses**. In contrast, the standing body of water stored beneath the surface of the ground is called **groundwater.** Most of this groundwater is surface water that has seeped down into the earth.

Stream Order

Stream channels connect like the veins on a leaf. This network of increasingly larger streams, as tributaries connect, has several numbering systems. The stream "order" system refers to numbering tributaries starting in the headwaters.

1. First-order streams (Order 1) have no tributaries;
2. Second-order streams (Order 2) have as tributaries only first-order channels, or are where two first-order streams come together;
3. A third-order stream is formed by the joining of two second-order streams; and so on.

Using the USGS topographic maps at 1:24,000 scale (also called 7.5 minute scale), most watershed streams (as defined above) would be fourth-order while subwatershed streams would be third-order. However, smaller scale maps (such as 15 minute scale) would show fewer streams and the stream order would likely be different.

1-A WATERSHED BASICS

WATERSHED PROCESSES

Understanding the physical processes that shape a watershed's condition can help in making better decisions about road management practices. The quality of the stream and its fish habitat is directly influenced by these watershed processes.

Rainfall, Streamflow, And Runoff

- **Hydrologic cycle** is the term used to describe the continuous circulation of the Earth's waters from the ocean to the atmosphere to the land and then back to the ocean. **Hydrology** is the science of water, or the study of water and its environment in the hydrologic cycle.

- Water falling to earth, or **precipitation,** can be in the form of rainfall or snow. Rainfall or snowmelt entering a stream channel becomes stream flow.

- **Runoff** occurs when the ground in the watershed is no longer capable of absorbing the precipitation.
    - Some soils absorb water from rainfall more easily than others, so runoff occurs less rapidly.
    - Vegetation can affect the rate of runoff, with more runoff usually coming off bare areas. Urban or paved areas speed the movement of water and shorten the time between rainfall and runoff.

- **Precipitation** affects runoff based on the following aspects:
    - Intensity of rainfall – measured in inches per hour – varies from low to high; high intensity rainfall leads to large amounts of runoff.
    - Duration of rainfall, together with intensity, affects the runoff – the longer the rain storm, the greater the amount of water to runoff.
    - Frequency of rainstorms during a period of time – multiple storms over a short period of time creates the greater runoff than single storms or those spread out over a long period of time.
    - Type of precipitation – rain or snow – controls the timing of runoff; snowpack spreads out the effects of storms, leading to delayed runoff in warmer months.

Geology and Soil Landscape

- **Geology** is the science of the earth. A more specific study is geomorphology, or the study of the physical features of the surface of the earth. Understanding the regional landscape of northwestern California requires reference to these sciences.

- The Northwestern Region's watersheds are underlain by three major geologic landscapes:

    - Coast Range - These mountain ranges and valleys are parallel to the coast and subparallel to the San Andreas Fault, running in a northwesterly direction. Most of

the rocks in the north are dominated by the Franciscan Formation, which is a "wild, messy" assortment of rocks. Muddy sandstone, or graywacke, is the most common rock type. Being naturally unstable, more landslides are associated with the Franciscan than any other geologic formation.

- Klamath Mountains – These rugged mountains in Siskiyou and Trinity counties (and southwestern Oregon) are a single, extremely complex, block of the earth's crust. Originally at the northern end of the Sierra Nevada, the Klamath block's rocks get older moving from west to east. The youngest region is adjacent to the Coast Range. Granitic rocks can be found in separate masses or plutons. Metamorphic rock is the other common rock type.
- Cascade Range – A chain of volcanic cones, this range includes Siskiyou County from Shasta Valley to the east and south. Mt. Shasta is the highest point. Basalt is the dominant and oldest rock, followed by andesite as typified by Mt. Shasta.

♦ Soils are weathered rocks mixed with some other materials. The stability of soils in the region vary by type, and is closely associated with the qualities of their underlying rocks. Two soil types known for their high tendency for erosion are:
- "Blue goo"soils in the Coastal Franciscan formation; these soils are derived from incompetent schist high in clay content and tend to act very "slippery" on steep slopes. Slopes composed of this type of soil are often hummocky and grass-covered.
- Decomposed granite (or "DG") soils in the Klamath Mountains region; these soils do not stick together well (are "non-cohesive") due to high sand and low silt and clay content.

Soil Erosion and Sedimentation

♦ **Erosion Processes**
- ♦ Soil erosion is mainly caused by water (though wind is also a factor).
- ♦ Erosion is a natural process linked to the hydrologic cycle.
- ♦ Not all soil that is eroded enters the stream or drainage system.
- ♦ Streams do work by eroding, transporting, and depositing material (silt, sand, gravel, cobbles, boulders). Examples of this process include streambank erosion, muddy streams, and new gravel bars.

♦ **Types of erosion,** and examples of their causes, include:
- Gully – An erosion channel formed by concentrated runoff, usually larger than one foot deep and wide. Gullies often form where road surface or ditch runoff is directed onto unprotected slopes.
- Sheet & Rill – Sheet erosion is the loss of soil in thin layers of soil across a large surface area, while Rill erosion is a small erosion channel (larger channels are called gullies). Rill erosion can be seen where rainfall and surface runoff is concentrated on unprotected fillslopes, cutbanks, and ditches.
- Dry Ravel – On steeper slopes, gravity can bring dry soil downhill. Frost heaves can create this condition also. Raveling is most obvious along bare, steep road cuts.

- Landslides - The downslope movement of a mass of earth caused by gravity. Examples include debris slides, torrents, rock falls, debris avalanches, and soil creep. They may be caused by natural erosional processes, natural disturbances (such as earthquakes, floods, fires), or human disturbances.

♦ **Sedimentation**
- Soil erosion that enters the stream channel or drainage system (ditches, storm water drains, etc.) becomes sediment.
- Natural levels of sediment in a stream system are referred to as "background levels".
- Excessive levels of sediment are those amounts above background, and can cause habitat problems when pools and spawning gravels are filled with fine sediment.
- High levels of sediment suspended in the stream flow cause cloudy water, or turbidity. Persistent muddy appearance is usually due to high silt and clay content.
- Sediment becomes deposited in the stream channel when the flows slow down, such as in gravel or sand bars, pools, or other areas of the stream bed. Floods can cause sediment to deposit outside of the channel in the flood plain.

Stream Channel and Floodplains

♦ Stream channels carry runoff flows from precipitation in the watershed. The channel is carved by the flowing water, but it takes its shape from the sediment carried.

♦ Too much sediment for a stream's capacity to move sediment becomes deposited in a stream channel, which will cause it to fill or aggrade. Too little sediment, compared to what the stream was historically carrying, can cause the channel to downcut or degrade in elevation. When either of these conditions happen, the stream channel must adjust upstream and downstream. Streambank erosion, channel widening, and headcut erosion (in the headwaters of a stream) are some of the symptoms of this readjustment to a new equilibrium condition.

♦ Stream crossings on roads, particularly bridges, can be seriously impacted by the changes in stream channel depth and width.

♦ **Connectivity** is a term that refers to the physical connection between tributaries and the river, between surface water and groundwater, and between wetlands and water sources. Roads can also be connected to the stream system when runoff flows along the road system before entering the stream network (also called "hydrologically connected road")(Fig.1-2).

Flood Frequency and Floodplain Size

Stream channels can contain within their banks flows of only modest size. Bankfull stage is when the water fills the channel to the level of the floodplain, which occurs about twice each year. Flows in excess of the channel's capacity are floods. Floods are natural events and should be expected. Most rivers overflow their banks every 2 or 3 years. However, catastrophic floods may occur any year. The probability of occurrence of a particular size flood, based on the years

of record, is often used to predict the frequency of floods for planning purposes. Potential frequency of 25, 50, and 100 year flood events are commonly used.

The overflow onto the floodplain makes this area part of the channel during unusual storms. Floodplains occur in large river valleys and also in the valleys of creeks just a few feet wide, but are usually not present along most headwater tributaries. Structures that encroach onto this floodplain – such as roads and buildings – are encroaching on the stream and may be damaged or destroyed when floods occur. The "100-year floodplain" represents the area potentially inundated for an unusual but possible flood event with the probability of occurring once every 100 years on the average. This potential 100-year flood scenario is being used more and more for engineering designs for any structures within a stream channel or floodplain.

Flood Frequency & Size Concepts: (Mount, 1995)

1. The probability that a 100-year flood will strike a river in California is the same every year, regardless of how long it has been since the last 100-year flood.
2. It is not a certainty that the 100-year event will occur sometime in the next 100 years (although it is pretty likely).
3. In California, where historic data sets are small, the 100-year floodplain is likely to grow following a major flooding event.
4. It is a virtual certainty that the defined 100-year floodplain is not the actual 100-year floodplain.

Stream Categories

Streams are often identified by their flow condition:

- perennial – those streams which carry water the year round, except for infrequent and extended periods of severe drought.
- ephemeral – streams consisting of a dry channel throughout most of the year, bearing water only during or immediately after a rain..
- intermittent – stream channels which carry water only part of the year and are dry the other part, but which receive flow from the groundwater table when it is high enough.

These stream types are indicated on topographic ("topo") maps of the U.S. Geological Survey (USGS), with perennial streams identified by solid blue lines ("blue line streams") and intermittent streams by dash-dot blue lines. However, these USGS map indications were only estimates made at the date of the original map development, and should not be used as a substitute for more accurate descriptions of current conditions – especially for smaller creeks.

Stream Class: Another way to categorize streams is by the water's use, such as for aquatic species or domestic water supply. The terms below are also commonly used, particularly by the California Dept. of Forestry and Fire Protection (CDF) and the Dept. of Fish and Game (DFG) to help define the degree of state forestry regulations:

1-A WATERSHED BASICS

Class I Watercourse: A stream (or lake) that is used for a domestic water supply (including springs) on the site and/or within 100 feet downstream of the operations area; and/or fish always or seasonally present onsite, including habitat to sustain fish migration and spawning. (It typically flows year round, but may flow seasonally.)

Class II Watercourse: A stream (or lake) that has fish always or seasonally present offsite within 1000 feet downstream, and/or aquatic habitat for nonfish aquatic species; excludes Class III waters that are tributary to Class I waters. (These streams may flow year round or seasonally; many springs and wetlands are also included.)

Class III Watercourse: A stream channel (or lake) with no aquatic life present but showing evidence of being capable of sediment transport to Class I or II waters under normal high water flow conditions.

Class IV Watercourse: Man-made watercourses, usually downstream, for established domestic, agricultural, hydroelectric supply or other beneficial use.

Other stream terms are often based on legal definitions from one or more laws. The Clean Water Act refers to "Waters of the U.S.", and "Ordinary High Water Mark", both of which are defined under the Act in Chapter 2 of this manual.

VEGETATION

All plants affect the amount and pattern of runoff in the watershed.

Upland:

- Vegetation on the slopes helps to slow runoff, which allows better seepage of rainfall into the soils and groundwater and better water storage for summer streamflows.
- Plant roots hold soil in place, with deeper-rooted trees helping to prevent deeper erosion like landslides.
- Plant litter, like dead leaves, needles and branches, provides a protective layer over the soil from the erosive impacts of rainfall and snowmelt.
- Loss of vegetation, such as from fires, disease, logging, grazing, or urbanization, can increase soil erosion and increase the rate of runoff (usually temporarily).

Riparian:

- Streamside vegetation provides many benefits to a healthy stream:
  - Shade to the stream, to help cool the water;
  - Food for fish from insects, leaf litter and organic material falling into the stream;
  - Bank protection from erosion through root strength;
  - Structure for instream habitat when trees fall into the stream (also known as Large Woody Debris, or LWD), creating scour pools and trapping sediment for slow release during storms;
  - Filter for surface sources of erosion, minimizing sedimentation;

  - During floods, slows the energy of the flow and causes sediment to deposit in the floodplain instead of in the channel.
- In turn, the stream provides both surface and underground water to the riparian vegetation.
- This narrow plant zone offers habitat for many animal species dependent on its unique features.

Wetlands:
- These areas generally include, but are not limited to, marshes, bogs, estuaries, and similar areas. Some are near or directly connected to the stream channel system.
- Wetland plants aid in trapping sediment and filtering excess nutrients, which can cause water quality problems.
- Wetlands help slow floodwaters and function to recharge groundwater areas, or aquifers.
- Many wildlife species are dependent upon wetlands for their habitat.

WATER QUALITY

Clean water means good water quality. Water quality is not so good, for example, when a stream is too muddy (or turbid) or too warm to support the natural and human uses dependent on the water – "beneficial" uses like recreation, drinking water, or cold water fish. Control of the sources of water pollution is a major focus of state and federal laws.

Types of Water Pollution

Pollution from sewage and industrial wastes – usually entering the water from pipes – is known as point source pollution. Runoff or indirect pollution – from a variety of less obvious sources – is called nonpoint source (NPS) pollution. Rural roads and road maintenance activities have the potential to contribute to nonpoint pollution – the major type of water pollution problem in California today. Road maintenance yards and other "industrial" type facilities, if not managed well, can be the source of runoff or "storm water" pollution and even hazardous waste contamination of the surface (stream) and ground waters.

Water Quality Protection and Improvement

A watershed approach looks at both point and nonpoint sources of pollution and looks for solutions across all land ownerships. Ways can be found to prevent, reverse, and eliminate damage caused by both types of pollution. Sometime the solutions – especially for runoff sources – need to be quite creative as the traditional pollution treatment plants will not work. Prevention is always the first and best approach – and the cheapest.

Water quality protection laws and programs seek to prevent pollution or to clean it up. For this region, water quality objectives are set and beneficial uses are stated for each water body in the North Coast Basin Plan adopted by two state agencies – the North Coast Regional Water Quality Control Board (RWQCB) and the State Water Resources Control Board (SWRCB). These objectives are for many water quality factors, such as: temperature, sediment, turbidity, oil and

grease, bacteria, toxicity, pesticides, and specific chemicals. Most of the waters of northwestern California are much cleaner than these quality objectives.

Finding cooperative ways to protect and restore watershed "health" among all of the owners and users of a watershed is becoming a common aspect of the "watershed approach". Community-based watershed groups form and seek common solutions to the watershed's problems. Often, a watershed assessment of the current and historic conditions is performed, followed by a jointly prepared strategy or plan for solving identified problems. For county road issues, this cooperative approach can be of benefit when other road ownerships are part of the problem, or when non-county upslope or upstream sources create erosion or runoff problems on county roads. One example of a successful watershed partnership with county road department involvement is the French Creek Watershed Advisory Group in Siskiyou County. This sediment-control effort developed a Road Management Plan for the decomposed granite (DG) problem areas of the watershed and implemented it together. Within several years, water quality improvement in French Creek (as measured by deeper pools) was significant.

TMDLs – Coming to a River Near You!

TMDL = Total Maximum Daily Load = pollution limits by stream & by source

When a river does not meet state and federal water quality standards, it usually becomes earmarked for a remedial strategy under the federal Clean Water Act. The state has identified streams that are polluted with various pollutants. This list of "impaired water bodies" was adopted by the two state water quality agencies (see above) in 1998 and is referred to as the "303(d) list", which refers to a section of the Clean Water Act. Also mandated by the act is the establishment of Total Maximum Daily Loads (TMDLs) as a means to address each pollutant.

The amount and sources of each pollutant are identified and a strategy is developed for restoring the stream to state standards. In California, a lawsuit settlement (or consent decree) required that the Environmental Protection Agency (EPA) and the North Coast Regional Water Quality Control Board (RWQCB) complete TMDLs on a 13-year schedule for the listed streams in the region. This list and timetable is found in Table 1-1 below. For some rivers, EPA is the lead agency for developing the TMDL targets for the listed pollutants while others have the RWQCB as the lead.

Since roads are a known source of sediment, each of the sediment TMDLs will be addressing limits to the amount of erosion and sediment that will be allowable from roads: both public and private. The methods will be outlined in an Implementation Plan. Getting ahead of the curve in meeting this challenging regulation will benefit counties and county road managers.

Table 1-1. Rivers Scheduled for a TMDL Pollutant Target

River Name	County Location	Listed Pollutant	Due Date
Albion River	Mendocino	Sediment	12/01
Big River	Mendocino	Sediment	12/01
Eel River – Delta	Humboldt	Sediment & Temperature	12/06
Eel R. – Middle Fk	Mendocino	Sediment & Temperature	12/03
Eel R. – Middle Main	Mendocino	Sediment & Temperature	12/05
Eel R. – North Fk.	Mendocino / Trinity	Sediment & Temperature	12/02
Eel R. – South Fk	Mendocino/ Humboldt	Sediment & Temperature	12/99
Eel R. – Upper Main	Mendocino	Sediment & Temperature	12/04
Elk River	Mendocino	Sediment	12/09
Freshwater Creek	Humboldt	Sediment	12/10
Garcia River	Mendocino	Temperature / Sediment	12/00
Gualala River	Mendocino/Sonoma	Sediment	12/01
Klamath River – all	Siskiyou /Humboldt / Del Norte	Nutrients & Temperature	4/04
Klamath - mainstem	Siskiyou /Humboldt / Del Norte	Low Dissolved Oxygen	12/04
Mad River	Humboldt / Trinity	Sediment & Turbidity	2/07
Mattole River	Mendocino/ Humboldt	Sediment & Temperature	12/02
Navarro River	Mendocino	Sediment & Temperature	12/00
Noyo River	Mendocino	Sediment	12/99
Redwood Creek	Humboldt	Sediment	12/98
Russian River	Mendocino/Sonoma	Sediment	12/11
Scott River	Siskiyou	Sediment & Temperature	4/05
Shasta River	Siskiyou	Low DO & Temperature	9/05
Ten Mile River	Mendocino	Sediment	12/00
Tomki Creek	Mendocino	Sediment	12/04
Trinity River	Trinity/ Humboldt	Sediment	12/01
Trinity R.-South Fk.	Trinity/ Humboldt	Sediment	12/98
Trinity R.-South Fk.	Trinity/ Humboldt	Temperature	12/08
Van Duzen River	Humboldt	Sediment	12/99

For more information on the TMDL efforts above, see RWQCB website at: //www.swrcb.ca.gov/rwqcb1

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1-B STREAM HABITAT NEEDS

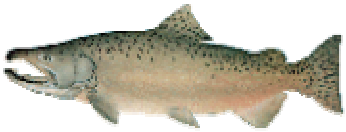
In the last section, the basics of how watersheds affect water quality and stream habitat were described. Here the focus is on fish within the watersheds – primarily salmon and steelhead. These fish use the streams that county roads cross or affect. Understanding what the fish need in our county's streams will help in performing better road maintenance practices.

1-B STREAM HABITAT NEEDS

- What Fish?
- Salmon & Steelhead Life Cycles
- Salmon & Steelhead Habitat Needs
- Locations of Salmon and Steelhead
- Threatened and Endangered Status
- Other Aquatic or Riparian Species of Concern

coho salmon – male

steelhead - male



chinook salmon - male

1-B STREAM HABITAT NEEDS

There's lots of talk about salmon and steelhead these days – usually about their low numbers and what can be done to help restore their populations. Road workers are among those who like to fish these streams (and even more so in their retirement years). But what do salmon and steelhead need to thrive in our county's streams? Here is some basic salmon information to help everyone's common understanding.

WHAT FISH?

More than one species of fish in the salmon and trout family are presently of concern due to their dwindling numbers in our region's streams:

Common Name	Genus & species
➢ Coho ("Silver") Salmon	*Oncorhynchus kisutch*
➢ Chinook ("King") Salmon	*Oncorhynchus tshawytscha*
➢ Steelhead	*Oncorhynchus mykiss iredeus*
➢ Coastal Cutthroat Trout	*Salmo clarki clarki*

These species and others in the salmon and trout family are referred to by biologists as salmonids. However, "salmon" generally refers to all ocean-migrating forms of these fish.

SALMON & STEELHEAD LIFE CYCLES

Salmon, steelhead and coastal cutthroat trout must use streams and rivers during a part of their life cycle. They are all born in freshwater, move to the ocean, and return to their native stream to spawn (Figure 1-1). Their river-to-ocean, ocean-to-river life cycle makes them anadromous fish.

Anadromous (a-nad'-ru-mus) **fish -** Fish which migrate between fresh and salt water during a species' life span; literally, "running upward".
Juvenile fish – Young salmon and steelhead that include the stages from: emergence from the egg with yolk sac (**alevin**), to instream **fry** stage, to **smolt** phase as they start migrating to the ocean.
Redd – The nest depression constructed by spawning adults in stream gravels in which the eggs are laid.

Timing of Salmon & Steelhead Runs & Habitat Use

All chinook and coho salmon die soon after spawning, while a small percentage of steelhead and cutthroat trout will live to return to spawn the next year. When the fish enter our streams for spawning depends on the specific river system – it differs on coastal streams from inland ones, and from one major river to another. Timing also depends on runoff conditions and whether the sandbars at the mouths of streams have been breached yet by high flows.

Table 1-2 gives the range of months when these species can be found in our streams. Besides their spawning period, the fish use the stream for months to years during the juvenile rearing

1-B STREAM HABITAT NEEDS

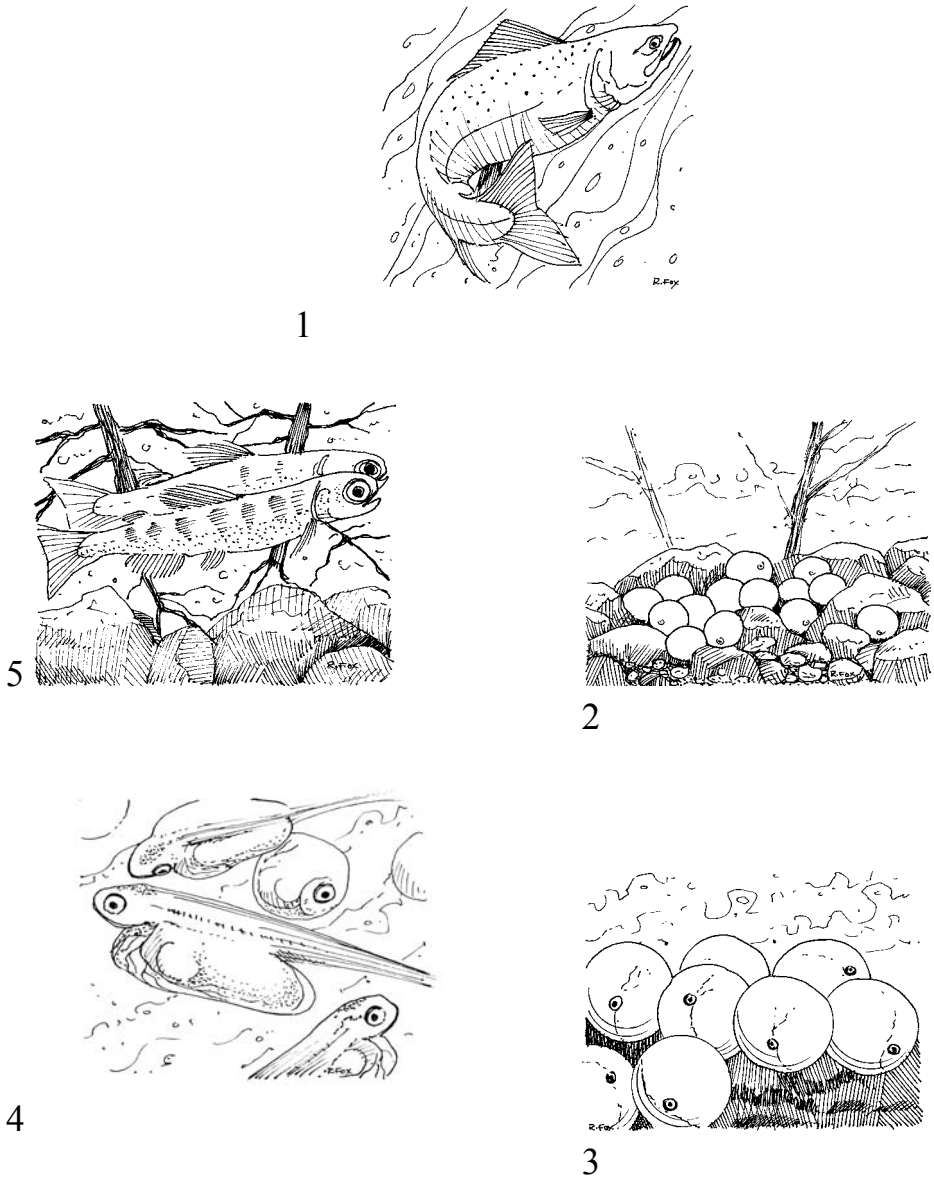


Figure 1-1. Life cycle of the Pacific salmon.

1) Adults move from ocean into freshwater for upstream spawning migration to their original homes – 2) Spawning and egg laying in redds – 3) Incubation of eggs in redd – 4) Hatched fish (fry) have attached yolk sac for initial food – 5) Juvenile fish live and grow in fresh water before transforming into a smolt for the saltwater phase. Salmon and steelhead grow into adults during the ocean phase. Immature adults may also return to the streams of their birth.

(Artwork by Richard Fox

)

phase. These young then move downstream during their out-migration phase to the estuaries and the ocean at various months of the year.

Table 1-2. General Salmonid Life Cycle Timing in NW California Streams[1]

Species	Spawning	Rearing	Out-Migration	Time in Freshwater
Chinook Salmon				
Fall-run	Sept - Feb	all year	Mar - Sept	1- 15 months
Spring-run	mid Sept – mid Oct	all year	April - Oct	1 – 15 months
Coho Salmon	Oct - Mar	all year	Mar - May	1+ yr
Steelhead				
Winter-run	Nov - June	all year	Mar - Nov	1+ to 2 yrs
Summer-run	Mar - June	all year	Mar - Nov	1+ to 2 yrs
Coastal cutthroat trout	Dec - May	all year	Only some migrate to ocean	1+ to 4-6 yrs

1/ Sources: Ross Taylor, consultant; Al Olson, Klamath National Forest; Greg Bryant, NMFS

SALMON AND STEELHEAD HABITAT NEEDS

- **Access** to stream habitat – upstream for adults and up/downstream for juveniles
- **Clean gravels** in riffles and runs where adults can build nests (redds) in which to lay their eggs, juveniles can rear, and stream insects (macro-invertebrates) can produce to provide food for the fish
- **Pools** that are cool and deep where young can rear and adults can rest
- **Instream shelter** (created by large woody debris (LWD), boulders, undercut banks) where fish can hide from predators or avoid being swept downstream
- **Overhead cover** to provide shade and sources of insect food
- **Sidechannels and smaller tributaries** for over-wintering use
- **Cool, flowing water** free of pollutants, with good clarity, and sufficient dissolved oxygen
- **Estuary space**_, where salt and fresh water mix, for adjustment by adults moving upstream, and juveniles (smolts) moving into the ocean

Another way to look at salmon habitat needs is to remember the "**Four C's**":

- **Cold**
- **Clean**
- **Complex**
- **Connected**

1-B STREAM HABITAT NEEDS

COLD: Water that is too warm (>60° F) for a prolonged time can be stressful to the health of these coldwater fish, while water that is too hot (>73-79° F) will kill them.
CLEAN: Water, pools and gravels should be clean and not be polluted from excess sediment or nutrients or any chemicals.
COMPLEX: A stream should not be cleaned or altered significantly of its naturally complex structure, such as large wood, overhanging riparian vegetation, meanders, flow patterns, and floodplain connections.
CONNECTED: Fish must be able to get from the ocean to their spawning areas and juveniles to the ocean, with no manmade, impassable barriers preventing this migration.

SALMON & STEELHEAD LOCATIONS

Salmon and steelhead use stream systems from the top to the bottom. Adults will go up as high in the system as they can physically reach, which depends upon the species. Steelhead tend to go higher up in the drainages than coho, which are found higher than chinook. Steelhead can also use streams that only flow seasonally (winter & spring) during a part of their life cycle. Coastal cutthroat trout will often spawn in very small streams of Del Norte and Humboldt counties.

Barrier Forms:
1) Physical Barriers (too tall or long)
2) Flow Barriers (too little, too fast)
3) Thermal Barriers (too hot)

Types of Physical Barriers:
- Natural waterfalls
- Water diversion dams and weirs (without fish ladders)
- Flood debris dams (without fish ladders)
- Water storage dams (without fish ladders)
- Landslides in stream ⇐ SOMETIMES ROAD-RELATED
- Culverts & other types of stream crossings ⇐ ROAD-RELATED (See: Ch. 4)

When are they barriers?
- Seasonally, during low – or very high - flow periods
- Temporarily – if alteration is not completely successful
- Permanently – if not altered

Sources of Information on Local Salmon Habitat & Barrier Locations

Not all of the streams crossed by County roads provide habitat for salmon and steelhead. Some may have natural barriers while others may be too steep for upstream migration. If you want to know specific stream areas of use by salmon and steelhead, here are some useful references:

1-B STREAM HABITAT NEEDS

1) NMFS Salmon & Steelhead Habitat Distribution Tables – by County & Stream – website (//swr.nmfs.noaa.gov)
2) California Dept. of Fish and Game (DFG) Fishery Biologists & Wardens – each county
3) "County Culvert Fish Migration Barrier Inventory for the Five Counties" – 2001-02 – prepared by Ross Taylor & Associates (available at each county DPW/DOT office.)

NOTE: Upper reaches of streams may still be home to other coldwater fish, such as resident rainbow trout, as well as other sensitive aquatic species (Table 1-3). Barriers to migration may not be their problem, but clean water is still needed.

THREATENED OR ENDANGERED STATUS

Not all salmon and steelhead are equal when it comes to getting listed as "threatened" or "endangered" under the federal Endangered Species Act (ESA). The National Marine Fisheries Service (NMFS) adopted the concept of an "evolutionarily significant unit" (ESU) to define distinct population segments of the anadromous Pacific salmon and trout species. The intent is to conserve the genetic diversity of these species and the ecosystems they inhabit. Northwestern California encompasses 8 different ESUs for the 3 species, each with a different listing status under the ESA (see Table 1-3 below).

Endangered species – Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened species – Any species which is likely to become an endangered species within the foreseeable future throughout all of a significant portion of its range.

Table 1-3. Status of ESA Listings of Salmon & Steelhead in the Five County Region[1]

Species / ESU	Listing Status[1]	ESU Area	Counties in NW Calif.
COHO SALMON			
So. Oregon / Northern California	Threatened / Interim 4(d) rule	Elk River, OR to Mattole River / Klamath & Trinity Basins	Del Norte / Humboldt / Mendocino / Trinity / Siskiyou
Central Calif. Coast	Threatened /4(d) rule	Punta Gorda to San Lorenzo River	Mendocino / Sonoma / others south
CHINOOK SALMON			
Calif. Coastal	Threatened	Redwood Creek through Russian River basin	Humboldt / Mendocino / Sonoma
Upper Klamath / Trinity	Not listed	Klamath /Trinity basins, above confluence with Trinity River	Siskiyou / Trinity / Humboldt
Southern Oregon / Northern California	Not listed	Cape Blanco south to lower Klamath R. downstream of Trinity River	Del Norte/ Humboldt/ Mendocino
STEELHEAD			
Central Calif. Coast	Threatened /4(d) rule	Russian R. thru Aptos Cr.	Mendocino /Sonoma /others
No. Calif. Coast	Threatened	Redwood Cr. through Gualala River	Mendocino/ Humboldt

1-B STREAM HABITAT NEEDS

Species / ESU	Listing Status[1]	ESU Area	Counties in NW Calif.
Klamath Mountains Province	Not listed	Cape Blanco, OR to South Fork Trinity Basin	Del Norte / Humboldt / Siskiyou / Trinity
COASTAL CUTTHROAT TROUT **-** status reviewed, not warranted for ESA listing			

1/ As of 12/01; Species status updates can be found at NMFS website: //www.nwr.noaa.gov

OTHER AQUATIC OR RIPARIAN SPECIES OF CONCERN

In addition to the species listed under the federal Endangered Species Act are those animal species identified under the California Endangered Species Act (CESA) as threatened and endangered. Often these species are on both state and federal lists, but occasionally some are only on the state list or only on the federal list. The implications of these two lists in getting road maintenance projects performed are described in Chapter 2 – Getting the Permits.

Another designation used by the California Department of Fish and Game (DFG) is California Special Concern (CSC) species: these vertebrate species have declining population levels, limited ranges, and/or continuing threats that have made them vulnerable to extinction. Also, there is the Federal Special Concern (FSC) species list. Some of these species may soon reach the point where they meet the criteria for listing as threatened or endangered under the State and/or Federal Endangered Species Acts. [However, these CSC and FSC listed species do not have the legal protections of the ESA and CESA listed ones.]

Table 1-4. Status of Other Aquatic & Riparian Animal Species Listed under the Federal or California ESA, or as Special Concern Species

Common Name	Status[1]	NW County Locations[2]
➢ Point Arena Mountain Beaver	Endangered (F) / CSC	M
➢ Trinity Bristle Snail	Threatened (S)	T
➢ Siskiyou Mountains Salamander	Threatened (S)	DN, S
➢ Coho Salmon	Endangered/ Threatened (S)	DN, S, H, T, M
➢ Coastal Cutthroat Trout	CSC	DN, H
➢ Klamath River Lamprey	CSC	DN, H, S
➢ Green Sturgeon	CSC / FSC	DN, H, S, T
➢ Eulachon	CSC	DN, H
➢ Del Norte Salamander	CSC / FSC	DN, S, H, T
➢ Southern Seep (Torrent) Salamander	CSC / FSC	DN, S, H, T, M
➢ Northern Red-legged Frog	CSC / FSC	DN, H, M
➢ Tailed Frog	CSC / FSC	DN, H, S, T, M
➢ Foothill Yellow-legged Frog	CSC / FSC	DN, S, H, T, M
➢ Cascades Frog	CSC / FSC	S, T
➢ Northwestern Pond Turtle	CSC / FSC	DN, S, T, H, M

1/ (S) State-listed under California Endangered Species Act; (F) Federally listed under ESA; CSC = California Special Concern species; FSC = Federal Special Concern species; 2/ County initials used as abbreviation. Sources: Jennings & Hayes (1994), Amphibian and Reptile Species of Special Concern in California, Calif. Dept. of Fish and Game (CDFG), Sacramento; CDFG (2001) "State and Federally Listed Endangered and Threatened Animals of California", 10 p.; "Special Animals", 46 p. [See website for updated status: www.dfg.ca.gov/whdab/html/lists.html]

1-C ROAD TREATMENT PRINCIPLES

All county roads need to be maintained to ensure they remain open and safe to the traveling public. They also need routine maintenance and upgrading to meet environmental standards, such as TMDLs. Proper practices, upgrading techniques, and "storm-proofing" routines should also significantly lower the long-term maintenance requirements and costs of county roads.

1-C ROAD TREATMENT PRINCIPLES

- Goals of Treating County Roads
- Road Problem Identification
  - Sources of Road Sediment & Runoff Problems
  - "Big 3" Road Maintenance Problems
- Ten Principles for Treating County Roads

1-C ROAD TREATMENT PRINCIPLES

GOALS OF TREATING COUNTY ROADS

The goals of treating maintenance problems on county roads are to:

⇒ **Maintain public safety and open roads.**
⇒ **Prevent or minimize delivery of sediment and chemicals to streams.**
⇒ **Prevent or minimize the interruption of normal runoff into streams.**
⇒ **Protect aquatic and riparian habitat.**
⇒ **Restore access for fish movement at stream crossings.**

One can accomplish this goal by creating:

- Low impact solutions
- Low cost solutions
- Permanent solutions
- Self-maintaining roads

ROAD PROBLEM IDENTIFICATION

Recognizing the major sources of road problems and how they might impact streams is essential to understanding the Principles for treating county roads.

SOURCES OF ROAD SEDIMENT AND RUNOFF PROBLEMS: [See Figure 1-2]

- A **gully** is very efficient at delivering sediment to the hillslope and to the stream channel.

- **Fillslopes** are very efficient deliverers of sediment to sites below the roads, especially on very steep slopes. Some roads are so close to streams that the fillslope encroaches on the stream (as at road-stream crossings).

- **Cutbank** slope failures deliver sediment to the road, which can be cleaned off or delivered to ditches and the stream. Cutting into the toe of the cutslope during cleaning can cause more bank sloughing, especially in granitic soils.

- Large, deep-seated **landslides** "take the road for a ride" and can contribute huge amounts of sediment during a single event. Landslide scars or rock outcrops can also create a surface flow path from the road to an adjacent channel.

- **Inboard ditches** deliver to a road-stream crossing, or to a cross-drain where sufficient discharge is available to create a gully, sediment plume, or both, that extends to a stream channel. They also capture subsurface and surface runoff and can redirect it from established channels to form a new one.

1-C ROAD TREATMENT PRINCIPLES

- Other **cross-drainage features**, such as waterbars, dips or cross-drains, can discharge sufficient water to create a gully, sediment plume, or both, that extends to a stream channel. Adding water from roads into sidehill channels can increase the amount of water they normally carry and cause the channel to adjust by eroding its banks.

- **Culverts** that are improperly placed, undersized, or poorly maintained are a major cause of erosion when plugged, causing loss of the road and/or diversion of the stream onto and across the road.

"BIG 3" ROAD MAINTENANCE PROBLEMS Most Often Affecting Stream Quality In Northwestern California: (Bill Weaver, Pacific Watershed Associates; Greg Bryant, NMFS)

1. Road surface drainage – including roadside ditches – can contribute to chronic erosion and sediment delivery as well as alter the timing and volume of streamflow by diverting water from one watercourse to another;

2. Storm-related stream crossing failures, which can wash large sections of road into the stream below;

3. Road-related landslides, which are mostly fillslope failures, that can contribute large amounts of sediment directly into the stream.

TEN PRINCIPLES FOR TREATING COUNTY ROADS

Remembering and practicing the following ten road treatment principles should go a long ways toward protecting water quality and stream habitat. Of course, ensuring that roads are open and safe to the traveling public remains the number one priority for the county. These principles are demonstrated in the specific Best Management Practices (BMPs) that follow in later chapters of this manual.

1. Prevention of erosion is better and cheaper than trying to control erosion.

- It is more expensive to fix up mistakes. Environmental damage = expensive costs to repair.
- Primary erosion control costs are cheaper than the cost of removing sediment. Less erosion = lower maintenance costs.
- The cost of potential legal fines for water quality violations needs to be included in the prevention cost.

2. Treat the cause - <u>not</u> the symptom - of erosion.

- Treat active, rather than inactive, sources of sediment. Look upslope and upstream first before deciding on the cause of an erosion problem and its best solution.
- If you don't change anything, it's just going to happen again (such as chronic flood damage).

1-C ROAD TREATMENT PRINCIPLES

3. Disconnect the road from the stream channel. (See Fig. 1-2)

- Do not allow drainage from a road directly into a stream channel, or from a stream directly onto a road.
- Upgrade drainage systems to prevent the potential for these direct connections.

4. Protect the riparian zone.

- Streamside vegetation provide a buffer for filtering pollutants, a shade canopy for cooling stream temperature, and a source of food and habitat for aquatic and other sensitive species.
- Replacing riparian plants can be difficult and expensive.

5. Keep existing vegetative cover wherever possible.

- Plant cover provides your cheapest form of effective erosion control.
- Grasses, shrubs and trees help stabilize cut and fill slopes; native species are best.
- Exception is made for invasive plants and noxious weeds, which should be removed.

6. Direct runoff away from bare soil or disturbed areas.

- Erosion is sure to occur when drainage washes over bare ground.

7. Keep runoff velocities low, using energy reduction or control measures where possible.

- Rapid runoff has more erosive force than slow runoff.
- If runoff is carrying sediment, cross drains or velocity controls are needed.

8. Each solution should not create more problems than it is solving.

- Look before you leap & anticipate possible effects of a proposed solution.

9. Connect the stream channel for fish passage at stream crossings.

- No stream crossings should block the upstream or downstream migration of salmon and steelhead.
- Stream crossings should be sufficiently sized and placed to allow for normal stream processes.

10. **Work within the limitations of the existing county road system as best you can while keeping the roads open and safe to the traveling public.**

- The county road system was developed over the past 150 years based on local, public transportation needs. Some road sections are not "ideally" located from a watershed quality perspective, but they cannot be relocated - for practical and financial reasons.
- Balancing the public's need for safe and open roads with the environment's need for clean water and healthy streams can be challenging but is not impossible.

1-C ROAD TREATMENT PRINCIPLES

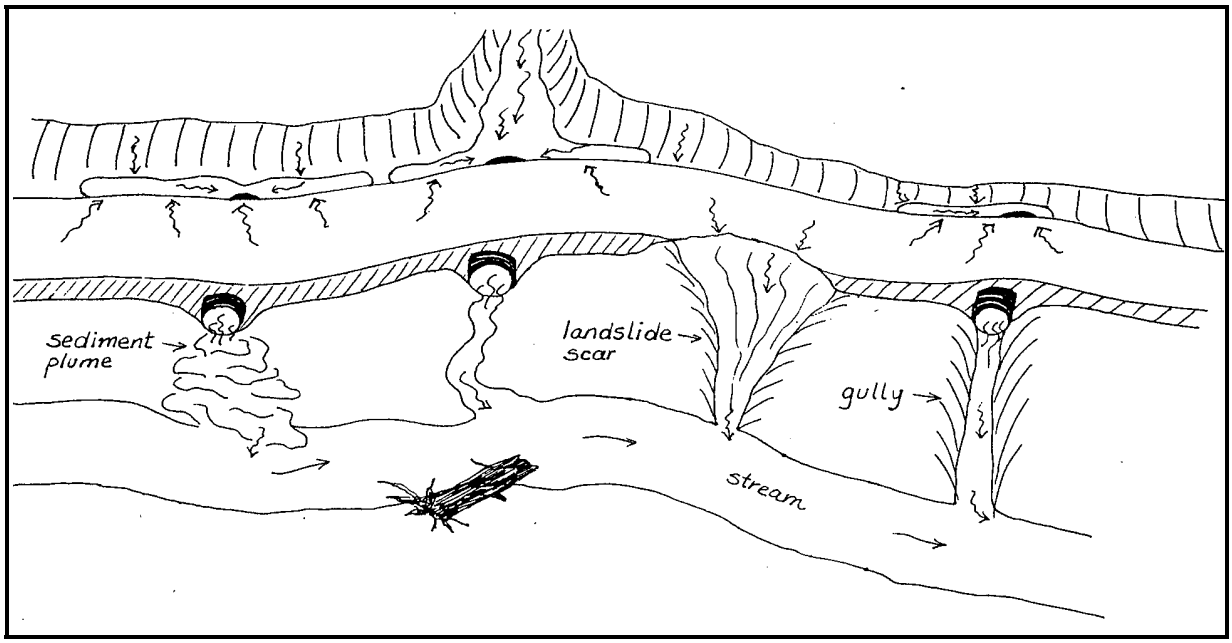
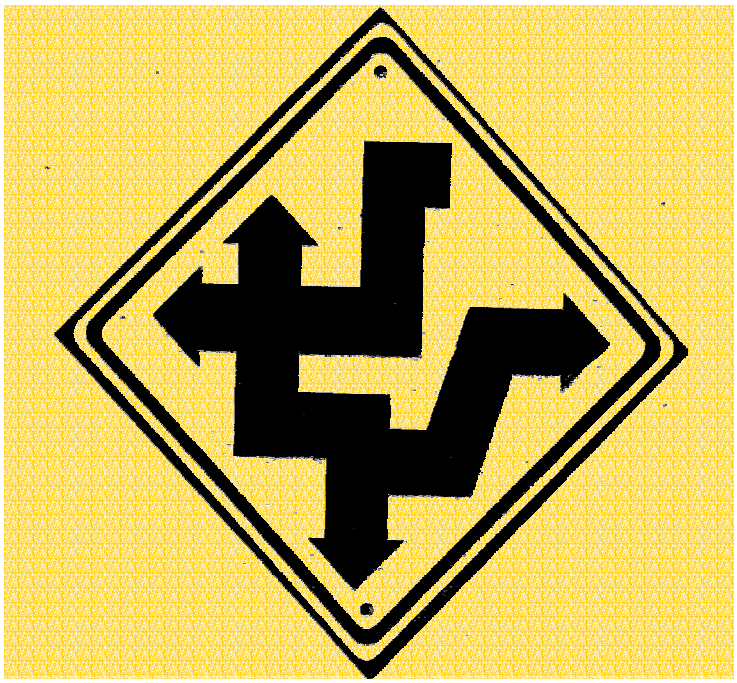


Figure 1-2. How roads can be connected to streams.

Inboard ditches, gullied cross-drain discharges, sediment plumes below cross-drain discharges, and road-stream crossings create connected surface flowpaths between roads and natural stream networks. Disconnecting roads from streams involves limiting the concentration of surface discharge and using permeable soils on the natural ground and road fill slopes to infiltrate runoff and convert it to subsurface flow before it can reach a stream.

(Source: Furniss, M., Flanagan, S., and B. McFadin. 2000. "Hydrologically-connected Roads". Stream Systems Technology Center, Stream Notes (July 2000), pp. 5-7)

CHAPTER 2
FOLLOWING THE RULES



Getting a project done these days – even a routine road maintenance project – can require obtaining a permit, or several permits. A permit is how laws and rules are applied. These laws and rules are intended to help protect the environment. This chapter gives background information about the "who, why, what, when, and where" of the environmental permit process. Staff needs to follow these rules to help protect water quality and stream habitat, to minimize project delays, and to prevent legal and financial penalties to the county.

The management staff of the County DPW/ DOT will normally be the ones obtaining the permits, and they will usually have to deal with the details - the "how" of getting permits - described in Appendix A.

2-A **WHO sets the Rules: The Agencies**

2-B **WHY the Rules are Made: The Laws & Regulations**

2-C **WHAT is Required: The Permits**

2-D **WHEN Permits Happen**

2-E **WHERE to Find Help**

Appendix A: **HOW to Get Permits**

2-A WHO SETS THE RULES: THE AGENCIES

MOST COMMON PLAYERS IN PERMIT PROCESS
For Road Maintenance Projects

The following state and federal agencies are the most common players in setting the rules for projects that could potentially affect water quality, stream habitat, or salmon and steelhead. For county road maintenance projects, it is important to know who they are and why they're significant players. Getting to know the abbreviations or acronyms for the agencies will also be helpful in permit discussions.

- **California Dept. of Fish and Game (DFG)**
  - Responsible agency for the public trust resources of fish and wildlife in California
  - Regulates activities potentially resulting in alteration of streambeds or diversion of a stream's natural flow, as per the Fish and Game Code
  - Protects species listed under the California Endangered Species Act (CESA).
  - Commenting agency (not permit-issuing) for federal and state permits under the Clean Water Act, Coastal Act and for regulations under California Environmental Quality Act (CEQA)
  - Website: //www.dfg.ca.gov

- **California Regional Water Quality Control Board (RWQCB), North Coast Region**
  - Responsible agency for water quality implementation at the regional level of the State Porter-Cologne Water Quality Control Act and the federal Clean Water Act.
  - Regulates activities which may potentially discharge pollutants into watercourses or storm water drainage systems
  - Issues permits under the Clean Water Act, such as the Sect. 401 certification (or waiver) required for a US Army Corps of Engineers permit under Sect. 404 (see below), and Waste Discharge Requirements under the State Porter-Cologne Act.
  - Website: //www.swrcb.ca.gov/rwqcb1

- **California Coastal Commission** (coastal counties only)
  - Responsible for administering the California Coastal Act and the federally approved California Coastal Management Program of the Coastal Zone Management Act (CZMA)
  - Regulatory jurisdiction within the coastal zone extends up to five miles inland from the mean high tide line. Permit jurisdiction for proposed projects within the immediate ocean or bay shoreline (tidelands, submerged lands, and public trust lands)
  - Counties and cities implement Coastal Act policies through their adopted Local Coastal Plans (LCPs) certified by the Commission; permits usually issued by local planning agency.
  - Coordinates with local and state commenting agencies
  - Website: //www.coastal.ca.gov/web

2-A WHO SETS THE RULES: THE AGENCIES

- **U.S. Army Corps of Engineers (COE)**
  - Major agency responsible for regulation of Sect. 404 under the federal Clean Water Act, which includes "waters of the U.S." and almost all wetlands. Jurisdiction essentially includes all bodies of surface water in California.
  - Coordinates with federal consulting agencies and DFG (under the Fish & Wildlife Coordination Act) for its permit process
  - Initiates consultation with NMFS and USFWS under the Endangered Species Act
  - Website: //www.spn.usace.army.mil/regulatory/

- **National Marine Fisheries Service (NMFS)**
  - Responsible agency for almost all marine species, including protection of salmon and steelhead listed as threatened or endangered under the federal Endangered Species Act, and their designated critical habitat; also implements Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act;
  - Issues Incidental Take Permits under Section 10 of the Endangered Species Act for non-federal projects involving a "take" of federally listed species ("take" includes harassment that disrupts behavior patterns and habitat modification that kills or injures the species), indirect take associated with otherwise lawfully authorized activities, and directed take for research and monitoring.
  - Conducts ESA Section 7 consultation for any activity funded, carried out or permitted by a federal agency that might jeopardize the continued existence of a listed salmon or steelhead species or adversely affect their critical habitat.
  - Commenting agency (not permit-issuing) for federal Clean Water Act permits (Sect. 404), and for any project with federal involvement (permits, funding, assistance, etc.) due to Fish and Wildlife Coordination Act requirement.
  - Websites: SW Region - //www.swr.nmfs.noaa.gov; NW Region - //www.nwr.noaa.gov

- **U.S. Fish and Wildlife Service (USFWS)**
  - Responsible agency for protection of terrestrial and non-marine (non-salmon) aquatic species listed as threatened or endangered under the federal Endangered Species Act
  - Commenting agency (not permit-issuing) for federal Clean Water Act permits (Sect. 404) and for any project with federal involvement (permits, funding, assistance, etc.) due to Fish and Wildlife Coordination Act requirement.
  - Issues Incidental Take Permits under Section 10 of the Endangered Species Act for non-federal projects involving a "take" of federally listed species ("take" includes harassment that disrupts behavior patterns and habitat modification that kills or injures the species).
  - Conducts ESA Section 7 consultation for any activity funded, carried out or permitted by a federal agency that might jeopardize the continued existence of a listed non-salmon species or adversely affect their critical habitat.

- Website: //www.ccfwo.r1.fws.gov/

LESS COMMON PLAYERS IN PERMIT PROCESS
For Road Maintenance Projects

Only in limited instances do the following agencies require permits or get involved in the permit process for county road maintenance projects:

- **County / City Planning Department and/or Public Works Department**
  - Responsible for permits to be issued under ordinances, such as Grading Ordinance, Tree Protection, Surface Mining and Reclamation, and encroachment.

- **California Dept. of Conservation**
  - Office of Mine Reclamation implements reporting, compliance, and reclamation requirements of the Surface Mining and Reclamation Act (SMARA) for rock and gravel mines and quarries
  - Website: //www.consrv.ca.gov/omr/

- **State Lands Commission (SLC)**
  - Authorizes leases for use of the state's tide and submerged lands and beds of historically navigable rivers, including sites for bridge supports
  - Website: //www.slc.ca.gov/

- **State Water Resources Control Board (SWRCB)**
  - Delegates most federal and state water quality permit and enforcement activity to its 9 Regional Water Quality Control Boards (RWQCB)
  - Adopted statewide General Permit for Storm Water Discharges, issued by SWRCB and enforced by the RWQCBs.
  - Website: //www.swrcb.ca.gov/

- **U.S. Environmental Protection Agency (EPA)**
  - Delegates most federal water quality permit and enforcement activity to the State
  - Reserves compliance authority for runoff ("nonpoint source") pollution unless delegated to the State (delegated to RWQCB in California)
  - Shares responsibility with RWQCB for developing Total Maximum Daily Load (TMDL) allocation for pollutants for listed North Coast streams; gives final approval authority for each proposed TMDL.
  - Website: //www.epa.gov/ow

- **Federal Highway Administration (FHWA)**
  - Funds many road and bridge rehabilitation projects and emergency repairs on Forest Highways, including STIP & HBRR.

2-A WHO SETS THE RULES: THE AGENCIES

- Federal funding triggers environmental review under the National Environmental Policy Act (NEPA), Endangered Species Act (Section 7 Consultation), and Historic Preservation Act (Section 106 consultation).
- Website: //www.fhwa.dot.gov

➢ **U.S Forest Service (USFS)**

- Requires an easement, encroachment, right-of-way or Special Use Permit on repairs to Forest Highways (local roads through National Forests) if working outside of the transportation easement.
- Administers projects under the Emergency Relief for Federally Owned Roads (ERFO).
- USFS involvement triggers NEPA, ESA Section 7, National Historic Preservation Act Section 106, and other requirements, depending on the Forest Plan or other land management plan.
- Assesses and determines in writing that a project (such as rip-rapping) will not adversely affect a Wild and Scenic River designation.
- Website: //www.r5.fs.fed.us/

➢ **Bureau of Land Management (BLM)**

- May own road right-of-way or adjacent land needed for road project staging and construction.
- BLM involvement triggers NEPA, ESA Section 7, National Historic Preservation Act Section 106, and other requirements, depending on the Forest Plan or other land management plan.
- For road project near a National Wild & Scenic River, see USFS above.
- Website: //www.ca.blm.gov/caso

➢ **State Historic Preservation Office (SHPO)**

- Consults with federal agencies regarding the significance of historic and archaeological resources in the projects Area of Potential Effect for projects outside the County's right-of-way, with federal involvement.
- Website: //ohp.parks.ca.gov

⇒ **Underground Service Alert (USA)**

- Not an agency, this non-profit service helps locate underground facilities before excavation or drilling projects are begun
- Requires at least 2 working days notice before digging once excavation limits are marked.
- (800) 642-2444

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

Laws are acts of legislation passed by the legislative branch of government: Congress, the State Legislature, or the County Boards of Supervisors. Regulations are developed by the executive branch's agencies assigned to administering the implementation of the laws. Although distinct, the terms "laws" and "regulations" are often combined to describe the rules that must be followed to avoid breaking the law.

FEDERAL LAWS & REGULATIONS

ENDANGERED SPECIES ACT (ESA)

- Act provides a program for the conservation of endangered and threatened species and provides for the conservation of designated critical habitat of listed species. Federal agencies have a duty to insure no "jeopardy" to the continued existence of listed species and a duty to insure no destruction or adverse modification of critical habitat for the listed species.
- Defines "take" of a species: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" with respect to federally listed species under ESA. Includes modifying the habitat of a listed species in such a way that interferes with essential behavioral patterns including breeding, feeding, or sheltering.
- **ESA Section 4** – Determination of Endangered & Threatened Species and designation of critical habitat, which requires development of a recovery plan. For threatened species, allows certain exceptions to "take" by special rule under Section 4(d), such as for ODOT's routine road maintenance practices.
- **ESA Section 7** – Interagency Cooperation. Requires federal agencies, in consultation with NMFS and USFWS, to ensure these duties are complied with, and requires a Biological Assessment (BA) if one or more listed species may be present in the project action area. This section applies to federally-funded and federally-permitted projects.
  - NMFS and/or USFWS must prepare a Biological Opinion (BO) within 135 days of beginning formal consultation after Biological Assessment (BA) is completed; consultation begins after a completed initiation package has been submitted and accepted by the agencies. "Reasonable and prudent" mitigation measures must be agreed upon before project can proceed.
- **ESA Section 9** – Prohibited Acts. Provides guidance regarding activities determined to result in "take".
- **ESA Section 10** – Exceptions - applies to those projects with no federal involvement. Provides guidance on the issuance of "incidental take" permits when potential "take" of listed species, which requires development of a satisfactory Habitat Conservation Plan (HCP) for the species. Also deals with direct take associated with authorized monitoring and research activities.

CLEAN WATER ACT (CWA)

- The nation's primary water quality protection law authorizing the Environmental Protection Agency (EPA) to restrict pollution discharges.

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

- Certain sections require permits, based on regulations promulgated by the EPA and the State Water Resources Control Board (SWRCB):
  - **Section 401** – Requires that anyone discharging dredge or fill material into a surface water of the U.S. must not violate the State's water quality standards (tied to Section 404 federal process below). "Water Quality Certification" permitting carried out by the SWRCB, enforcement by RWQCB. The RWQCB may waive the State's right to regulate if the proposed project will not violate water quality standards.
  - **Section 402** – Prohibits the discharge of all pollution unless permitted; Provides for permits for discharges of storm water from: (a) construction activity >1 acre of soil disturbance; (b) certain industrial activities including mining and vehicle maintenance (such as County Road Maintenance Yards); and c) municipal facilities, including roads. Phase II permits by 3/03. Notice of Intent (NOI) to SWRCB; permitting by RWQCB.
- **Section 404** - Regulates the discharge of dredged or fill material into "waters of the United States", including wetlands (tied to Sect. 401 State process above). Permitting carried out by US Army Corps of Engineers (COE).
  - **"Waters of the U.S."** - In nontidal waters, jurisdiction extends:
    a) to the ordinary high water mark in the absence of adjacent wetlands.
    b) beyond the ordinary high water mark to the limit of the adjacent wetlands, when present.
    c) to the limit of the wetland when only wetlands exist.
  - **"Ordinary High Water Mark"** – "That line on the shore established by the fluctuations of water and indicated by physical characteristics such as [a] clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area." [33 CFR 328.3(e)]
  - See Figure 2-1 for scope of COE jurisdiction under Section 404 & Figure 2-2 for examples of activities requiring a permit.

FISH AND WILDLIFE COORDINATION ACT

- Requires all federal agencies to consult with USFWS, NMFS and DFG for activities that "affect, control, or modify waters of any stream or other bodies of water." These agencies review applications for Clean Water Act Sect. 404 permits and provide comments to the Corps about the environmental impacts of the proposed project.
- Gives USFWS & NMFS an expanded responsibility for review of federal projects (including those with federal permits or funding) that includes concerns about general plant and wildlife species that may not be addressed by the Endangered Species Act, particularly a project's secondary effects.

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

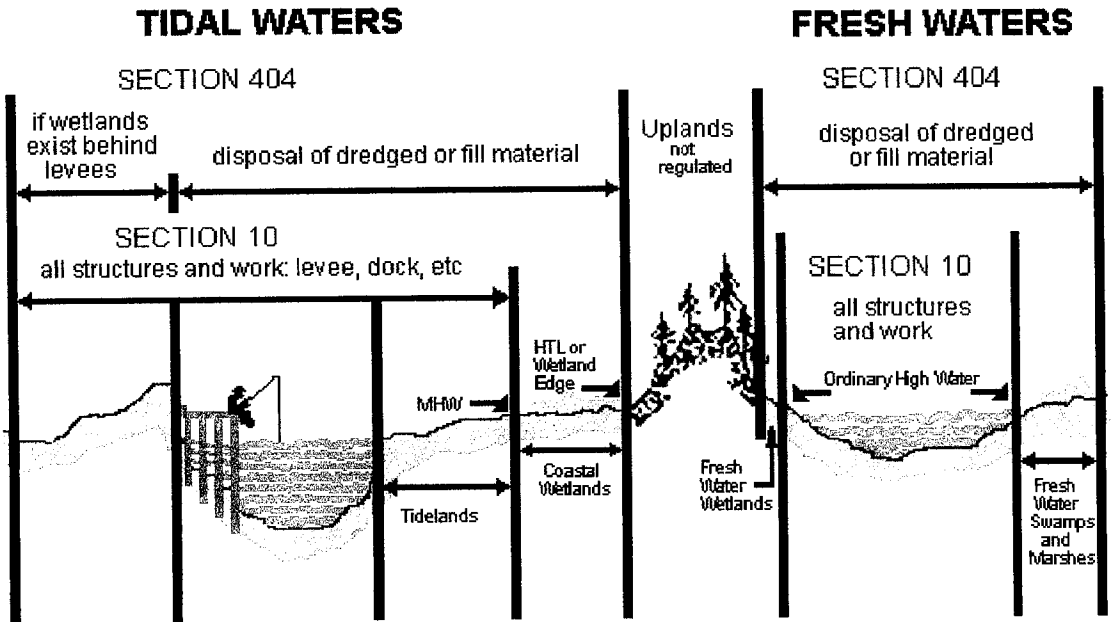


Figure 2-1. Scope of Corps of Engineers (COE) regulatory jurisdiction
Clean Water Act, Section 404 and Rivers and Harbors Act, Section 10

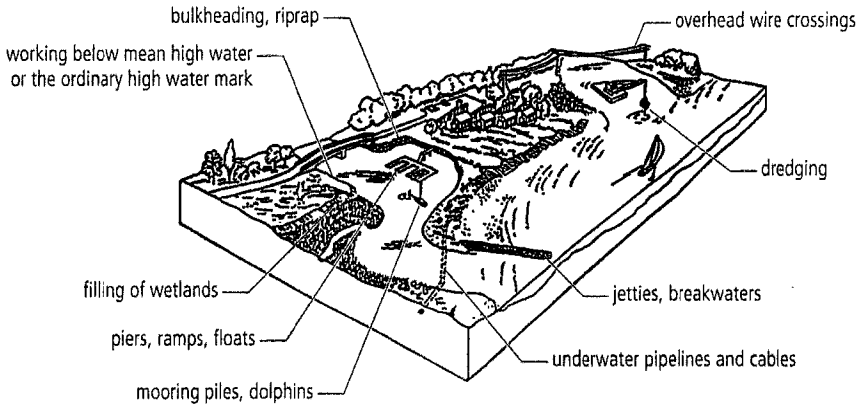


Figure 2-2. Examples of activities requiring a COE permit
under CWA Section 404 and River and Harbors Act, Section 10

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

COASTAL ZONE MANAGEMENT ACT (CZMA)

- Implemented through the State by the Coastal Commission and the County or City Local Coastal Plan (LCP).
- Requires that Clean Water Act Section 404 general permit must comply with CZMA.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

- Requires federal agency decision-makers to document and consider the environmental implications of their actions, including the issuance of permits, funding, and rights-of-entry.

RIVERS AND HARBORS ACT OF 1899 - Section 10

- Prohibits the unauthorized obstruction or alteration of any navigable waters of the U.S. without a permit from the Corps of Engineers (COE).
- Jurisdiction is limited to those activities affecting the "navigable waters of the U.S." See Figures 2-1 and 2-2.
- Original regulatory authority has been superseded by Section 404 of the Clean Water Act to a great extent.

NATIONAL HISTORIC PRESERVATION ACT OF 1966 – Section 106

- Requires federal agencies to review projects for impacts to historic and archeological resources.
- Requires projects with federal involvement to determine the significance of cultural resources with the Area of Potential Effect.
- Requires consultation and concurrence with the State Office of Historic Preservation (SHPO).

NATIONAL WILD & SCENIC RIVERS ACT

- Protects free-flowing rivers or river segments designated within the National Wild & Scenic River System from development of water projects by the federal government: Eel, Klamath, Smith and Trinity Rivers are included in the North Coast region.
- River-managing agencies seek to avoid adverse effects on water quality and "outstandingly remarkable" values near a ½ mile river corridor on designated and recommended rivers
- Clean Water Act's 404 Nationwide Permit process requires federal land-managing agencies to assess and determine in writing that a project (such as road rip-rapping) will not adversely affect the wild and scenic river designation.
- See Appendix A for a list of which federal agency is responsible for various segments of the designated rivers in our region.
- Website: //www.nps.gov/rivers

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

STATE LAWS & REGULATIONS

CALIFORNIA FISH AND GAME CODE

Sections 1600-1607 - "Lake and Streambed Alteration Agreement Process"

- Public agencies must comply under Section 1601 of code
- Requires notification to DFG for any project that will impact a river, stream or lake; measures to prevent substantial adverse affect on fish or wildlife are developed with applicant in an Agreement.
- Agreement is technically not a "permit" but a "mutual agreement" between DFG and project proponent.
- Projects must also (since 5/1/99) be reviewed under the California Environmental Quality Act (CEQA), which extends the time and cost (to some degree) of obtaining a final agreement with DFG.
- No pre-notification is required for emergency projects by a public agency to maintain, repair or restore an existing highway, within the existing right-of-way, within one year of damage; notification required within 14 days of beginning work.
- Jurisdictional limit is usually marked by DFG – in practice - to be at the top of the stream or lake bank or at the outer edge of the riparian vegetation, whichever is wider. However, the broad definition in F&G Code Section 1601 gives DFG great flexibility in deciding what constitutes a stream – sometimes to the 100-year flood plain.

Section 5650 – Water Pollution

- Prohibits anyone from depositing, permitting to pass into, or place where it can pass into the waters of this state most pollutants, including any petroleum, acid, asphalt, bitumen, or residuary product of petroleum; …or any substance or material "deleterious to fish, plant life, or bird life."
- Does not apply to pollution discharged under a permit from RWQCB or SWRCB.

PORTER-COLOGNE WATER QUALITY CONTROL ACT

- Regulates both point (pipe) and nonpoint (runoff) sources of water pollution in California
- Precedes and supplements the federal Clean Water Act
- Administered by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB)

CALIFORNIA ENDANGERED SPECIES ACT (CESA)

- Prohibits the "take" of plant and animal species designated by the California Fish and Game Commission as either endangered or threatened. Seeks to ensure that action is not likely to destroy or adversely modify "essential habitat" necessary to the continued existence of the species. [Fish & Game Code Sections 2080-2081]

- "Take" includes hunting, pursuing, catching, capturing, killing, or attempting such activity, but does not now include indirect mortality resulting from habitat modification (due to change by recent legislation).
- Section 2080 states no further state authorization needed if a federal ESA's Section 10 Incidental Take Permit has been obtained. Section 2081 authorizes incidental take permits by DFG, under certain conditions (see adopted regulations for procedure).
- (Sect. 2090, state agency consultation requirement, was repealed effective 1/1/99.)
- When a species is also listed under the Federal ESA, DFG must participate in the federal consultation to the greatest extent practicable and adopt the federal Biological Opinion as its Biological Opinion, wherever possible.
- Website: www.dfg.ca.gov/hcpb/ceqacesa/cesa/cesa.html

SURFACE MINING AND RECLAMATION ACT (SMARA)

- Requires local government to adopt and implement ordinances regulating upland surface mines and instream gravel mining and to require Reclamation Plans for each mining site obtaining a local use permit.
- Reclamation plans overseen in an advisory capacity by the Calif. Dept. of Conservation, Office of Mine Reclamation.
- Caltrans reviews reclamation plans for mines in the 100-year floodplain, or within 1 mile upstream or downstream of a Caltrans bridge.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

- Requires state, regional, and local agencies to assess the significant environmental effects of proposed projects and to circulate these assessments to other agencies and the public for comment before making decisions on the proposed projects.
- Exempts most road maintenance actions through the use of a Categorical Exemption ("CE" or "Cat Ex"), when no potential for significant environmental impact exists. Cat Ex examples include:
  - Class 1 (Existing Facilities): Includes maintenance of existing public facilities, such as road grading for purpose of public safety; rehabilitation of damaged facilities to meet current standards of public health and safety; maintenance of stream channels (clearing of debris) to protect fish and wildlife resources;
  - Class 2 : Replacement or Reconstruction of existing facilities involving negligible or no expansion of capacity
  - Class 4 (Minor Alterations to Land): Minor alterations (excluding removal of healthy, mature scenic trees), such as grading on slope <10% not in waterway, wetland, or geologic hazard area; filling of earth into previously excavated land.
- Other actions (or group of actions) should achieve CEQA compliance through completion of an Initial Study supporting a Negative Declaration ("Neg Dec"), a Mitigated Negative Declaration ("Mit. Neg Dec"), or an Environmental Impact Report (EIR).

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

- Issuance of Local and State permits, such as DFG's 1601 agreement or a County Use Permit, also must comply with CEQA procedural requirements.

CALIFORNIA COASTAL ACT

- Sets policy for land use within the coastal zone and assigns decision-making and administration to the Coastal Commission
- Implemented at the local level primarily through County or City Local Coastal Plans (LCP) and local agencies, once LCPs are approved by the Coastal Commission.
- No coastal development permit is required for repair and maintenance of existing public roads, including resurfacing, ditch cleaning, and slide removal. A permit is required for excavation or disposal of fill outside of the roadway prism. (Section 30610)

LOCAL LAWS & REGULATIONS

COUNTY GRADING ORDINANCE

- Grading permits can be required under County Ordinance for private and or public earthmoving activities that exceed a minimum volume. Local public works departments are usually in charge of the permit process.
- Trees within a protected designation may require a tree permit if removal is part of the grading project.

COUNTY SURFACE MINING & RECLAMATION ORDINANCE

- Required of counties by the State Surface Mining and Reclamation Act (SMARA)
- Regulates through the conditional use or use permit process the opening, operation, and closing of mining sites, including rock quarries, gravel pits, and instream gravel mining.
- Requires site Reclamation Plan be prepared, reviewed by Calif. Dept. of Conservation - Office of Mine Reclamation, attached with financial assurances, and adopted by local governing body.

COUNTY TREE ORDINANCE

- May require tree removal permit to remove any trees designated as protected (such as by species, size, or location) under local ordinance.

COUNTY GENERAL PLAN

- Establishes land use designations, standards, and policies, which may address erosion control, water quality protections, riparian set-backs, and other habitat-related issues.
- Local Coastal Plans (LCPs) must comply with the California Coastal Act.

2-B WHY THE RULES ARE MADE: THE LAWS & REGULATIONS

- Adopted as an element of the General Plan and provide special standards and policies for activities within the coastal zone (extending up to five miles inland from the mean high tide line).
- Clean Water Act Section 404 general permit must comply with Coastal Zone Management Act (CZMA), which is implemented through the State by the Coastal Commission and the County or City LCP.

COUNTY FLOODPLAIN ORDINANCE

- Limits activities and permanent structures within designated floodplain area.
- Usually requires "floodproofing" of structures or facilities located within floodplain area (100 year flood event)

COUNTY PESTICIDE ORDINANCE

- Restricts use of pesticides and herbicides.
- Prohibits, in some counties, the use of herbicides by county departments and employees for vegetation control on county land or projects.

2-C WHAT IS REQUIRED: THE PERMITS

Permits are needed from different agencies for many types of project and purposes. To help you find out what permit is required, from which agency, and for what types of projects, three tables are provided below. You can look up the permit by agency name, by permit name, or by project type.

Once you have a permit, you need to know what is important about its contents. A checklist of important categories to look for in each permit is provided. Compliance with the rules is essential – penalties and fines for the county and individuals can be stiff!

Table 2-1. TYPES OF PERMITS – BY AGENCY

AGENCY	PERMIT	WHAT TYPES OF PROJECTS
Federal		
U.S. Army Corps of Engineers (COE)	CWA Section 404 Permit	Projects that will deposit dredged or fill material into "waters of the U.S.", including wetlands
	• Individual Permit	All activities not covered by General Permit (see below)
	• General -Nationwide Permit (NWP) NWPs related to road maintenance	Categories of activities with minimal impacts on aquatic resources: #3 – Maintenance #7 – Outfall Structures and Maintenance #12 – Utility Line Activities #13 – Bank Stabilization #14 – Linear Transportation Crossings #23 – Approved Categorical Exclusions #27 – Stream & wetland restoration #33 – Temporary Construction, Access, and Dewatering #41 – Reshaping existing drainage ditches #43 - Storm Water Management Facilities
	• Regional General Permit (RGP) 1 – San Francisco District	Only for fish passage/ sediment reduction projects at water crossings in the San Francisco District
National Marine Fisheries Service (NMFS)	ESA Section 4(d) rules ESA Sect. 7 Consultation to COE 404 permit, or other federal agency ESA Section 10	When project involves work in a stream with listed salmon or steelhead species.
Fish and Wildlife Service (USFWS)	ESA Sect. 7 Consultation to COE 404 permit or other federal agency ESA Section 10	When project could jeopardize an endangered or threatened species (non-salmonid) or result in adverse impact to its critical habitat

2-C WHAT IS REQUIRED: THE PERMITS

AGENCY	PERMIT	WHAT TYPES OF PROJECTS
State		
Dept. of Fish & Game (DFG)	Fish & Game Code Sect. 1601 Streambed Alteration Agreement	Instream projects / culverts / stream crossings / fish screens/ water & stream diversions / bank stabilization/ bridges / riparian plant removal
	CESA Section 2081 Incidental Take Permit	For projects likely to cause the death of a species listed as threatened or endangered under CESA
State Water Resources Control Board (SWRCB) / Regional Water Quality Control Bd. (RWQCB) – North Coast Region	CWA Section 401 – Water Quality Certification	Same as 404 (Corps) – 401 needed whenever 404 required. If no 404 required (isolated wetlands), may need waste discharge requirements or waiver under Porter-Cologne Act. File Notice of Intent (NOI) with RWQCB.
	CWA Section 402 – Storm Water Permit	Construction projects that cover > 1 acre of soil disturbance; industrial activities including mining and vehicle maintenance
State Lands Commission (SLC)	Land use lease	Installation of structures or disposal of dredged material on beds of navigable streams, bays and estuaries.
Lead Agency	CEQA compliance (not a permit)	State permit-issuing agencies must comply with CEQA process during permit process
Local – County / City		
Planning Dept.	Use or Conditional Use permit	Rock quarries / gravel extraction
Public Works Dept.	Grading permit	Soil disturbance > X cu. yds. (depending on county grading ordinance)
Lead Agency	CEQA compliance (not a permit)	Permit-issuing agency must comply with CEQA process during permit process

Table 2-2. TYPES OF PERMITS – BY PERMIT NAME

PERMIT Informal / Formal Name	AGENCY	PURPOSE
"401" / CWA Section 401 – Water Quality Certification or Waiver	SWRCB / Regional Water Quality Control Bd. (RWQCB) – North Coast Region	Same as 404, but for up to 5 years and multiple projects.
"402" or "SWP" / CWA Section 402 – Storm Water Permit		Storm water runoff – minimize impacts
"404" / CWA Section 404 Permit	U.S. Army Corps of Engineers (COE)	Protection of wetlands and waters of the U.S. from discharge of dredged or fill material
• Individual permit		Regulate specific activities on an individual basis

2-C WHAT IS REQUIRED: THE PERMITS

PERMIT Informal / Formal Name	AGENCY	PURPOSE
• General – Nationwide Permit "NWP"		Regulate specific categories of activities, usually with minimal impacts on aquatic resources, on a national basis
• "RGP" or Regional General Permit		Regulate specific categories of activities, usually with minimal impacts on aquatic resources, on a regional basis
• Section 4(d) ESA Rule • Section 7 Consultation / • Section 10 HCP / "take" for monitoring & research	National Marine Fisheries Service (NMFS)	Protect federally-listed anadromous fish species (salmon & steelhead) & habitat
	U.S. Fish & Wildlife Service (USFWS)	Protect other federally- listed species & their habitat
"1601" / Fish & Game Code Sect. 1601 Streambed Alteration Agreement	Calif. Dept. of Fish & Game (DFG)	Ensure no net loss of stream habitat values or acreage
"2081" / Fish & Game Code Sect. CESA Incidental Take Permit		Protect State-listed animal and plant species & habitat
CEQA compliance (not a permit)	Lead Agency = Implementing or Permit-issuing agency	Assess the significant environmental effects of proposed projects.
Use permit or Conditional Use Permit	County or City Planning Dept.	Ensure compliance with General Plan & ordinances
Local Coastal permit	County or City Planning Dept.	Ensure wetland impacts are avoided or minimized in the coastal zone
Grading permit	County or City Public Works Dept.	Minimize or avoid erosion and sedimentation

Are These Permits Always Required?

The need for permits and CEQA compliance can depend on the size and location of a project and the methods being used for the project. Site-specific conditions are important to consider. For more specific information on the permits which may be needed for each project or BMP, see the list under "Permits" at the end of each category in Chapters 3 through 9.

2-C WHAT IS REQUIRED: THE PERMITS

Table 2-3. PERMITS - BY GENERAL PROJECT TYPE For Routine Road Maintenance

General Road Maintenance Project Category[1]	General Environmental Concerns about Activity	Permits or Approval that may be required[2]
Streambank erosion control	• Sediment discharge to stream • Riparian plant impact	• 404 CWA permit – NWP #13 or RGP #1 • 401 CWA permit • NMFS consultation • 1601 DFG agreement
Ditch maintenance	• Sediment discharge to stream from ditch • Aquatic habitat removal	• 404 CWA permit if "water of the US" – NWP #41 for reshaping • 401 CWA if 404 needed • 1601 DFG agreement
Culvert maintenance & replacement	• Sediment or debris discharge into stream • Fish stranding or blockage to migration	• 1601 DFG agreement • 404 CWA – NWP #14 or RGP #1 • 401 CWA • Culvert size approval by NMFS for streams with listed salmon/ steelhead
Vegetation management	• Loss of riparian plants • Create erosion risk	• County Tree Ordinance • 1601 DFG if working within riparian zone • County Pesticide Ordinance • Special use permit if trees located on federal land
Spoil disposal	• Sediment and debris discharge to stream • Harms slope stability of site • Filling wetlands	• County conditional use permit / coastal permit • County grading permit • Special use permit if on federal land • 404 CWA if wetlands or floodplain involved • 401 CWA if 404 needed
Maintenance yard management	• Stormwater runoff of stored materials to streams • Spills of hazardous materials • Contamination of groundwater & soils	• 402 CWA Stormwater Plan & General Industrial Stormwater Permit • County Pesticide Ord. • Compliance with County Spill Plan • CWA Waste Discharge Permit for petroleum discharge to septic system or for oil/water separators
Bridge maintenance	• Discharge of bridge materials into stream • Damage to riparian area • Harm to bats & swallows	• CWA Waste discharge permit for lead-based paint discharge • DFG & USFWS notification • 404 CWA permit for instream work

2-C WHAT IS REQUIRED: THE PERMITS

General Road Maintenance Project Category[1]	General Environmental Concerns about Activity	Permits or Approval that may be required[2]
		• 401 CWA permit for instream work • 1601 DFG agreement for instream work
Emergency maintenance	• Discharge of sediment and debris into stream system • Stream habitat damage due to heavy equipment instream or in riparian zone	• 1601 DFG post-project notification • 404 CWA pre-project notification • 401 CWA post-project notification • Hazardous spill notification process to checklist agencies

1/ Specific project types are listed in each section, Chapters 3 through 9.
2/ Site-specific conditions that may or may not require the permit for a specific project are described in more detail under each section of manual, Chapters 3 through 9.

2-C WHAT IS REQUIRED: THE PERMITS

Categories of Permit Conditions

The following checklist includes most of the categories of requirements, conditions, mitigations, and limits often placed on a permit:

- **Project Description and Purpose** – Scope of proposed action
- **Timing of Project Actions** – Limits to season, month, time of day, particularly **Limited Operating Periods** (LOPs) which can restrict action during special periods for sensitive animals (e.g., spawning, nesting)
- **Project Location** – Map or description of project site
- **Mitigations** included in the original Project Description – Practices proposed by the applicant (County) to minimize or avoid environmental impacts
- **Revised or Additional Mitigations** – Other practices required by the permitting agency) to minimize or avoid environmental impacts
- **Monitoring Requirements** – Records that must be kept and data that must be collected during and after the project
- **Endangered or Threatened Species** – List of those known or possible at the site
- **Site Inspections** – Who and when an agency representative may need to be on-site during the project and his/her right to be there
- **Emergency Actions** – Clarifies which emergency actions can begin without prior notification or permit; agency must still be notified after action has begun.
- **Duration of Permit** – Beginning and Ending Date of permit's active status
- **Penalties for Violation** of Permit Conditions – Potential fines and jail sentence
- **Biological Assessment (BA)** – As required by federal Endangered Species Act
- **Alternatives Analysis** - Alternative actions to the original proposal

Compliance with the Rules On-the-Ground and In-the-Stream

BEFORE performing a Routine Maintenance Project, be sure of the following:

- ✓ All necessary permits / agreements / consultations are completed for this project
- ✓ The final permit paperwork is available in the Project file
- ✓ Review with all the road crew involved the specific conditions listed on the permits (see Permit Conditions above) *and make sure they understand the requirements.*
- ✓ Post Final permits on site, if required. DFG 1601 Agreements must be available on site.
- ✓ Notify permit-issuing agencies prior to beginning the project.

2-C WHAT IS REQUIRED: THE PERMITS

Consequences of Not Complying with Permit Requirements

If permits are not complied with, or the necessary permits are not obtained, the penalties to the County (with liability including the responsible individual) for unpermitted activity can be quite strong:

1. **Regional Water Quality Control Board (RWQCB)** enforcement of violations to the Clean Water Act, the Porter-Cologne Act, and the Basin Plan can involve the following actions:
   a) Administrative Civil Liabilities, with fines at $10 per gallon of spill ($673 /cu yd., or $6,730 per 10 yd. dump truck) of liquid or sediment.
   b) Cleanup and Abatement Order – with fines for non-compliance
   c) Time Schedule Order – with fines for non-compliance with deadlines
   d) Cease and Desist Order – subject to fines
   e) Fines < $50,000 can be issued by the Executive Officer or Board; larger fines can be decided by the Board.

2. **California Dept. of Fish and Game (CDFG)** can issues fines and penalties for violations of the **Fish & Game Code** (see Section 12000-):
   a) Most violations are misdemeanors.
   b) Punishment is a fine <$1,000, imprisonment in the county jail for not more than six months, or both fine and imprisonment.
   c) Violation of pollution prohibitions under F& G Code Section 5650 punishable by civil penalty of not more than$25,000 for each violation; imprisonment in the county jail for not more than one year, or both fine and imprisonment. Person is also liable for all actual damages and for reasonable costs incurred in cleaning up the deleterious substance or material.
   d) Punishment for a second or subsequent violation of Section 1601 on the same project or streambed alteration agreement, or any violation of the State Endangered Species Act (CESA), is a fine of <$5,000 or imprisonment in the county jail for a period not to exceed one year, or both.

3. **Federal Endangered Species Act (ESA)** violations are assessed by the NMFS Director (SW Region) or the USFWS Director (Western Region) and may involve the following penalties:
   a) Civil penalty of up to $25,000 per violation against any person who knowingly violates any provision of the ESA or any regulation issued to implement the taking and no damage/destruction provisions of Section 9.
   b) Criminal penalties of up to $50,000 (total) and/or one year's imprisonment for knowing violations of the act or regulations.
   c) Penalties are most often assessed against private individuals and entities for section 9 violations.
   d) Citizens may bring suit to enforce the act when compliance is not followed.

4. **Clean Water Act Section 404** violations are similar to the RWQCB actions above. Both the Corps (COE) and the EPA have independent enforcement authority.:
   a) Administrative penalties for EPA involve:

   i) Class I violations – for less serious unpermitted activities, carry a maximum of $10,000 per violation, with a total maximum of $25,000;
   ii) Class II violations – for more serious unpermitted activities, carry a maximum of $10,000 per day for each day during which the violation continues, with a total maximum of $125,000.

b) Corps' enforcement has a maximum of $25,000 per day for both classes.
c) Negligent violations carry misdemeanor sanctions, including penalties of $2,500 to $25,000 per day and imprisonment of up to one year.
d) Knowing violations carry felony sanctions, including penalties of $5,000 to $50,000 per day and imprisonment of up to three years.

2-D WHEN PERMITS HAPPEN

TIME REQUIRED FOR PERMITS

Since the time for obtaining necessary permits can be lengthy and delay the start of road maintenance projects, it is very important to begin the permit process as soon as possible and to start the clock ticking on each of the permits that will or may be needed. Table 2-4 lists the estimated time required for most permits. Some permit time schedules are established by statute (*), while other time periods are set at the discretion of the agency. Timing can also be delayed by complex projects, incomplete application materials, insufficient staffing for permit reviews, and "surprise" issues during inspection of the proposed project site. Note that the clock usually does not start ticking until the agency formally deems the application to be "complete".

Table 2-4. Estimated Time Required for Permits, by Permit Name

PERMIT / Other Requirement	AGENCY	TIME REQUIRED Minimum / Maximum
401 CWA – Water Quality Certification or Waiver (from discharge requirements)	RWQCB – Regional Water Quality Control Board	30 days to determine if application is "complete"; 60 days from complete application
402 CWA – General Storm Water Permit	RWQCB / SWRCB	Valid on receipt of complete Notice of Intent (NOI) (30 days)
404 CWA – Individual	COE – US Army Corps of Engineers	60-90 days / 2 years + (?)
404 CWA – General / Nationwide		30 days to determine if application complete; 45 days from "complete" application
404 CWA – General / Regional (RGP)		Same as Nationwide
Section 4(d) rule take limitation	NMFS - National Marine Fisheries Service / or US Fish & Wildlife Service (USFWS)	No time limit
Section 7 ESA - Informal Consultation		30 days to get species list + 180 days max. for Biological Assessment (BA) + 30 days to accept BA*
Section 7 ESA - Formal Consultation		135 days max. for Biological Opinion, after acceptance of BA * (unless agreement to extend)
Section 10 ESA - Habitat Conservation Plan - Incidental Take Permit		No time limit
1601 – F&G Streambed Alteration Agreement	DFG – Calif. Dept. of Fish and Game	45 days* / 65 days*
2081 – CESA - Incidental Take Permit		120 days *
Use Permit	County / City	45-90 days
Grading Permit	County / City	varies

** Time limit set by statute*

2-E WHERE TO FIND HELP

HELPFUL REFERENCES

Bass, R., Herson, A., and K. Bogdan. 1999. CEQA Deskbook: A step-by-step guide on how to comply with the California Environmental Quality Act. (2nd edition) Solano Press Books, Pt. Arena, CA. [(707)884-4508]

California Dept. of Fish and Game. 2000. Lake & streambed alteration agreement process. Sacramento. 153 p. [//www.dfg.ca.gov/1600/1600.html]

Cylinder, P.D., Bogdan, K.M., Davis, E.M., and A. I. Herson. 1995. Wetlands regulation: A complete guide to Federal and California programs. Solano Press Books, Pt. Arena, CA. 363 p. [(707)884-4508]

Jones & Stokes Associates, Inc. 1997. Handbook of regulatory compliance for the Anadromous Fish Restoration Program. Sacramento, CA. Prepared for U.S. Fish and Wildlife Service, Stockton, CA. [(209)946-6400]

Mueller, T.L. 1996. Guide to federal and California endangered species laws. Planning and Conservation League Foundation. Sacramento. [(916) 444-8726]

National Marine Fisheries Service. Endangered Species Act – Section 7 and Section 10 handbooks. [//www.nwr.noaa.gov/]

Oregon Association of Clean Water Agencies. 2000. Endangered Species Act assessment manual. Prepared by CH2MHill. [(503)236-6722, or //www.oracwa.org]

U.S. Fish and Wildlife Service. "Habitat Conservation Plans and the Incidental Take Permitting Process." [//endangered.fws.gov/hcp/hcpplan.html]

HOW TO GET PERMITS – See APPENDIX A

A-1 Permit Flow Charts
A-2 Directory of Agencies

NOTE: The management staff of the County DPW or DOT will normally be the ones obtaining the permits, and will usually have to deal with the details described in Appendix A.

CHAPTER 3
MAINTAINING THE ROADS

Roads can be a source of erosion, sedimentation, and pollution. Whether it's surface runoff or concentrated storm runoff, sediment and other pollutants are reaching streams and harming our natural resources. Sometimes sediment is also delivered to the county road drainage system from other sources, such as upslope property.

Each county has, or will soon have, a County Road Erosion Inventory to help it develop priorities for a Capital Improvement Program. Supplemental funding will likely be needed to upgrade the quality of the road systems in many areas.

The primary Goals for this chapter are:

- Maintain public safety and open roads for the traveling public.
- Prevent or minimize delivery of sediment and chemicals to streams.
- Prevent or minimize the interruption of normal runoff into streams.
- Protect aquatic and riparian habitat.

3-A Grading Practices

3-B Road Surfacing and Dust Abatement

3-C Vegetation Management

3-D Winterizing the Road System

3-A GRADING PRACTICES

During grading practices such as roadway and shoulder blading and rebuilding, slope grading, and sidecast construction, it is important to keep in mind the following general principles to reduce erosion and sedimentation that may enter fish- bearing streams:

- Fit grading to the surrounding terrain.
- Retain existing vegetation to the greatest extent feasible.
- Time grading operations to minimize soil exposure in the rainy seasons.
- Minimize the length and steepness of slopes.
- Emphasize erosion controls by vegetating and mulching.
- Direct runoff away from disturbed areas.
- Keep runoff velocities low, using energy dissipating control measures.
- Trap sediment on site using a combination of erosion and sediment control measures.
- Inspect and maintain control measures regularly (especially before and after major rainstorms).

Specific practices are detailed in the following sections.

3-A-1 Shoulder Blading and Rebuilding

3-A-2 Erosion Repair and Control

3-A-3 Ditch Shaping and Cleaning

3-A-4 Channel Maintenance

SHOULDER BLADING & REBUILDING 3-A-1

Description: This action includes shoulder blading and rebuilding to correct rutting and buildup of materials, to remove weeds, for safety, and to maintain proper drainage. This activity is similar to ditching and has similar best management practices. However, it should be considered a different activity than ditching.

Environmental Concerns:

- Sidecasting material and discharging sediment and organic material into streams or storm water drainage systems.
- Damaging vegetation beneficial to erosion control on cutslopes and fillslopes.
- Damaging rare plant populations.

Best Management Practices:

1. **Do not sidecast** when the bladed material can enter the stream directly or indirectly as sediment. Sidecast material can indirectly enter the stream when placed in a position where rain or road runoff can later deliver it to a channel that connects with the stream. [See: Figure 1-2.)

2. Ensure spoil disposal sites are not going to add any sediment to the stream system. [See: 5-A Spoil Disposal]

3. Treat berms as temporary spoil disposal sites unless made of non-erodible material (such as rock & cobbles). Remove the excess berm material immediately after re-grading is completed, including non-erodible material if it changes drainage patterns and concentrates flow to areas where erosion can result.

4. When berms are needed as a permanent measure, daylight berms (make "knockouts") at frequent intervals to break up the length of the berm and the accumulated runoff, making sure that a non-erodible material is used as a drain to carry runoff downslope past the base of the erodible fillslope . See Table 3-A-1.1 below for suggested spacing. The location and frequency of berm drains will also be determined by the presence of downslope land uses and ownerships compatible with the additional drainage as well as by the terrain and other site characteristics.

Table 3-A-1.1 Maximum suggested road surface drainage spacing based on road gradient and soil composition (in feet)

Soil composition	Road gradient (%)		
	2-4%	5-8%	9-12%
Granitic or sandy	400	300	200
Clay or loam	500	400	250
Shale or gravel	600	500	300

Source: Montana Dept. of State Lands (1991) in: Weaver & Hagans (1994).

5. On roads that are unsurfaced with low volume traffic (usually < 100 vehicles per day) and low speeds (usually < 25 MPH), determine if outsloping the surface during grading in order

to improve drainage pattern is feasible. Check with County Engineer for the design criteria for the degree of outsloping needed to drain road surfaces on differing grades and to protect public safety. Make sure that stormwater from outsloped road surface runs off onto a protected shoulder and slope. [See: Appendix B – Erosion Control Methods.]

6. Evaluate the width of the blading activity and, if appropriate, modify the width to minimize disturbance of vegetation.

7. Blade in dry weather when possible, but while moisture is still present in soil and aggregate to minimize dust and maximize compaction to prevent road fines from being discharged from the road surface.

8. Incorporate this activity into local vegetation management plans to consider and minimize impacts of this activity on streams.

9. Permanently stabilize disturbed or bare soils along cutslopes and fillslopes using erosion control BMPs (native seeding, plants, etc.), where geologically stable and where significant sediment is being delivered to the stream system. Correct priority sites identified from the County Road Erosion Inventory, as funding is available. [See: Appendix B- Erosion Control Methods.]

10. Pursue the surfacing of unsurfaced roads that yield significant amounts of sediment, dependent on available funding. Use the County Road Erosion Inventory to help select road sections for priority treatment.

Permits Possibly Needed:

- Maintenance activities are currently exempt from the CWA 402 Storm Water Permit (SWRCB/RWQCB).

Useful References:

EPA. 2000. Recommended Practices Manual: A Guideline for Maintenance and Service of Unpaved Roads. [www.epa.gov/owow/nps/unpavedroads.html]

Oregon State University. 2001. Primer: Environmental Impact of Construction and Repair Materials on Surface and Ground Waters. NR 443. Transportation Research Board, National Research Council. [www.nationalacademies.org/trb/bookstore]

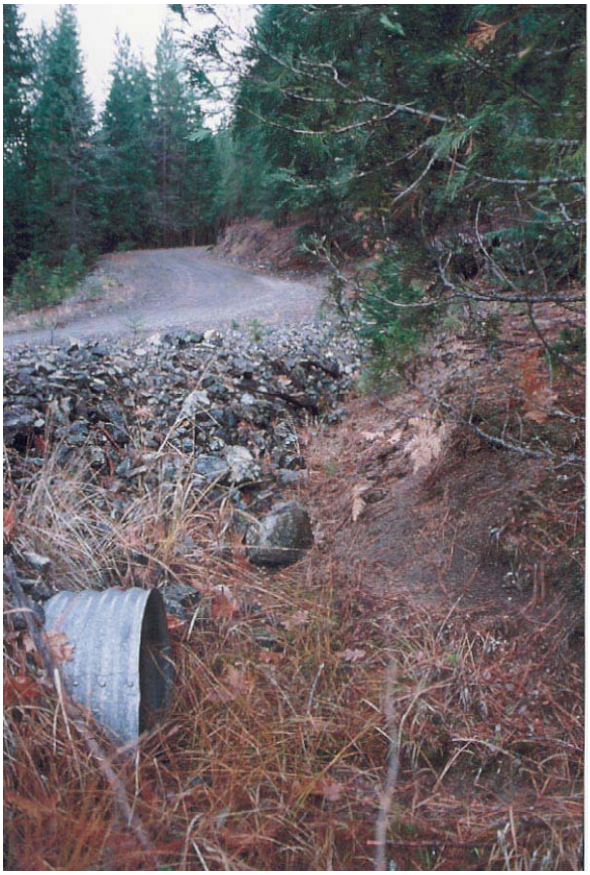
SHOULDER BLADING & REBUILDING 3-A-1

Beneficial Effects of Outsloping and Rocking a County Road

May 1990

A. Before – Insloped, unsurfaced road on decomposed granitic soils with heavy sediment runoff

November 1999



B. After – Outsloped, rocked road with no sediment runoff to culvert and into stream

Road treatment completed in Spring 1991 and sustained with minimal maintenance.

Location: French Creek County Road, Siskiyou County.

Photos taken by Sari Sommarstrom, Sommarstrom & Associates & John Hamilton, US Fish & Wildlife Service

EROSION REPAIR AND CONTROL 3-A-2

Description: This action involves repairing water damage to roadways, cutslopes, and fill-slopes, including the importing and shaping of material to restore slopes and grade lines. In-water work covered by this action could include, but is not limited to, replacement of riprap or rock, which has been removed due to bank erosion or to establish and maintain a vegetative cover to prevent erosion. See County Road Erosion Inventory for sites needing to be repaired, particularly for priority areas.

Environmental Concerns:

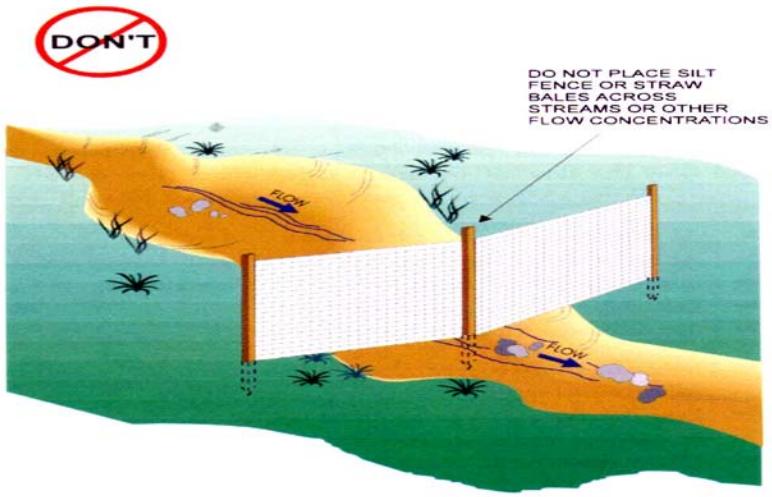
- Discharge of sediment and organic material into the stream or storm water drainage system.

Best Management Practices: See: Appendix B for specific Erosion Control standard designs and procedures

1. Avoid removing vegetation from erodible surface areas during road maintenance activities as a preventative measure.

2. Dispose of removed material at appropriate sites (stable locations outside the maintenance area, or if within the maintenance area, where the material won't be washed into wetlands or waterways). [See Chapter 5 – Disposing of Spoil]

3. Apply appropriate erosion control BMPs based on the standard designs and procedures described for each practice in Appendix B, sections B-4 and B-9, and the reference sources. Seek special training in the application of these techniques if possible, including certification as an erosion control specialist. Be aware of where not to apply certain measures, as noted in the example below.



Silt fencing placed across streams or other flow concentrations is ineffective in ponding water and leads to undercutting, gully formation, and fence failure.

4. Apply erosion control measures in a timely manner. Treating sources by anticipating erosion from existing or potential problem sites before the rainy season is best, focusing on priority erosion sites identified in the County Road Erosion Inventory. For maintenance projects causing temporary site disturbance, install erosion control measures nightly after October 15th.

5. Check temporary measures during and after storms, and remove sediment as needed (such as with silt fences, sandbags, and sediment traps). Materials used as temporary measures may need to be removed once the source of the erosion is stopped. Permanent measures, such as seeding, planting, and rocking, are preferred once the source of any runoff problem is corrected.

6. Coordinate any erosion repair activities (responses and cleanup of erosion problems, not the erosive action itself) which cause significant changes in the topography or vegetation within the riparian management area with the regulatory agencies.

7. Repair instream bank erosion sites by following these guidelines:
   a. Any installation of material that exceeds the material removed by bank erosion (below bankfull stage) will constitute significant action. Increases in the material profile will require additional coordination with regulating agencies, and are not covered in this document.
   b. Replacement of riprap will follow DFG and NMFS in-water work periods, in non-emergency situations. Situations which require expedited County Maintenance action, but which are not technically defined as 'emergencies' will be addressed with the DFG, and potentially the National Marine Fisheries Service/U.S. Fish and Wildlife Service individually. [See also: Chapter 8 – Emergency Work]
   c. Use bioengineering solutions where practicable. Practicable use areas include areas not shaded by bridge elements, and where success is probable and safety of the structural elements are assured. [See BMPs B-7.1 to 7.7 in Appendix B.]
   d. In large fluvial systems where in-water replacement of riprap is required, attempt to increase backwater areas, where appropriate, practical, and feasible.
   e. Follow one of the standard practices and procedures for streambank protection and channel improvement depicted in Appendix B-7.

8. Place a sediment filter or excavated impounding area around storm drain drop inlets and curb inlets in disturbed areas to prevent sediment from entering and clogging storm drain systems. Regularly inspect the storm drain inlet protection, especially during and after large storm events, for damage, clogging, and sediment build-up. Remove once the disturbed site is no longer contributing erosion. [Appendix B-9]

9. Straw bale barriers can be used below areas subject to sheet and rill erosion. Do not use straw bale barriers in active streams, for extended periods of time, or for sheet flow on slopes greater than 2%, as they will decompose and are very heavy and difficult to move when saturated . [Appendix B-9].

10. Use check dams to temporarily reduce the velocity of concentrated storm water flows in a channel or ditch, thereby reducing erosion and allowing sediment to settle out of the water. Remove trapped sediment to an appropriate disposal site. Line channel with rock or grass as a permanent measure and remove check dam. [Appendix B-9]

Permits Possibly Needed:

- 404 CWA permit from COE for any instream work. Bank stabilization work qualifies for a COE General Nationwide Permit No. 13. Regional General Permit 1 may also apply to sediment reduction measures at water crossings.

- DFG 1601 Agreement for instream work (includes bank and riparian areas).

- For Emergency erosion repair and control, see Chapter 8 – Fixing an Emergency.

DITCH SHAPING AND CLEANING 3-A-3

Definition: Ditch: a facility, typically parallel to the road, which carries stormwater runoff from a county facility and/or adjacent properties; it is not a channelized stream or a fish-bearing stream.

Description: This action includes the use of equipment for cleaning, reshaping, and stabilizing ditches. Ditches are needed along insloped roadways to intercept and carry non-stream flows to a location where the flow can be safely dispersed downslope, predominantly by way of ditch relief culverts (see section 4-E). Drainage options from county roads are often quite restricted due to potential conflicts with downslope property owners and land uses. The goal of routine ditch maintenance is to keep the ditchline free flowing. Subsequent actions include loading, hauling, and disposing of excess materials. This activity is performed in all weather. Material is removed to an appropriate location for disposal or storage (see Chapter 5).

Environmental Concerns:

- Discharge of sediment into a ditch, which may discharge into a stream or storm water drainage system that contains fish or contributes resources that support fish.
- Discharge of sediment into a stream from erosion within the ditch.
- Road surface erosion or roadway failure due to a plugged ditch or ditch relief culvert.
- Rerouting water into a stream above its normal carrying capacity and causing channel adjustments.
- Removal of riparian vegetation or damage to aquatic habitat.

Best Management Practices:

1. Grade ditches only when and where necessary, since frequent routine mechanical grading can cause erosion of the ditch, undermine banks, and expose the toe of the cutslope to erosion. Do not remove more grass and weeds than necessary to keep water moving, as vegetation prevents scour and filters out sediment.

2. Ditch spoil can be windrowed at the inside road shoulder for later endhauling by loader, backhoe, and/or truck. Never sidecast material into a waterway or the adjacent riparian area. Dispose of removed material at safe spoil disposal sites and not within any waterway, wetland, or riparian area. [See: Chapter 5 – Disposing the Spoil].

3. Adjust BMPs for ditch cleaning according to the area in which the work is being performed, that is, more stringent for an area near or hydrologically connected to a stream or drainage system (including lower order watercourses), and less for areas not connected. [See: Figure 1-2.]

4. Use erosion control devices, such as check dams, sand/gravel bag barriers, and other acceptable techniques, when it is neither practical nor environmentally sound to disperse ditch water immediately before the ditch reaches a stream. These sediment catchment facilities require routine maintenance to be effective. [Appendix B-9]

5. Minimize impact to existing vegetation on the cutbank above the ditch. If erosion from the cutbank is causing the ditch to fill with sediment, perform appropriate erosion control measures. Ditches functioning as rock fall areas, as opposed to drainage facilities, do not need to be treated. [Appendix B-4.]

6. When possible, perform ditch work in dry weather to minimize environmental impacts, and consult with appropriate county staff members if silt devices are inadequate to filter water prior to draining to watercourses.

7. Recycle excavated material when feasible. [See: Chapter 5 – Spoil Disposal]

8. Add filtering devices along the ditches or at the ditch relief culvert inlets. [Appendix B]

9. Retain water in its drainage of origin, to the extent practical, to avoid creating unwanted downstream impacts, using downslope opportunities that may be available.

10. Maintain artificial drainage ditches to prevent development of new wetlands by keeping water moving and preventing establishment of wetland plants, which can impede the permitting of ditch maintenance practices.

Permits Possibly Needed:

- Jurisdiction under CWA 404 may depend upon the following:
  - When a natural drainage channel (even an ephemeral stream) flows into a drainage ditch, then the ditch becomes a "water of the U.S." and requires 404 permitting.
  - Tidal drainage ditches and ditches through wetlands are "waters of the US" also.
  - If the ditch only collects rainfall off of the road, then it is not a jurisdictional water.
- If not reshaping the ditch but cleaning only (including removal of sediment, debris and vegetation), then the practice may be considered maintenance only and is exempt from the 404 permit process. See Corps' definition of maintenance exemption (33 CFR 323.4) if needed.
  - Ditch must be returned to its original dimensions and configuration.
- If reshaping a ditch, County may need CWA 404 permit from COE – General Nationwide Permit No. 41 – "Reshaping Existing Drainage Ditches".
  - Design capacity or area drained cannot be expanded.
  - Centerline of reshaped drainage ditch must be essentially in the same location as the centerline of the existing ditch.
  - Does not authorize reconstruction of drainage ditches that have become ineffective through lack of regular maintenance.
  - Notify COE if greater than 500 feet in length.
  - No mitigation required.
- CWA 401 Water Quality Certification permit from RWQCB
- Coastal Zone: Exempt from coastal development permit unless subject to review under Section 1601 of the Fish and Game Code, or excavation or disposal of fill is outside of the roadway prism.

CHANNEL MAINTENANCE 3-A-4

Definition: A channel is different from a ditch in that a channel is a facility that collects drainage water parallel or perpendicular to the roadway. A channel may or may not be a natural stream but intercepts and conveys natural flow.

Description: This action includes cleaning and repairing existing channels, as well as placing riprap to restore the grade. Drainage options from county roads and channels are often quite restricted due to potential conflicts with downslope property owners and land uses.

Environmental Concerns:

- Impacts on listed aquatic species.
- Discharge of sediment or debris into a channel, which may discharge into a stream or storm water drainage system.
- Rerouting water into a stream above its normal carrying capacity and causing channel adjustments.
- Removal of riparian vegetation and aquatic habitat.

Best Management Practices:

1. Installation of new sections of riprap in existing drainage systems (i.e., in systems acting as streams) will be considered significant action, and is not addressed within this manual.

2. During replacement of significant sections of riprap within drainage channels acting as streams, employ bioengineering solutions where the structures are stable and not cost-prohibitive. [See Appendix B-7]

3. Remove any excess material from channels after maintenance actions are completed and place in locations that will not reenter the drainage system, away from channel banks, riparian areas, wetlands, and waterways. [See Chapter 5- Spoil Disposal]

4. Within stream systems supporting sensitive fish species, perform work during the window of time that will have the smallest impact. See Table 1-2 for salmonid life cycle timing.

5. During any in-water work, minimize sediment impacts and ensure that fish stranding does not occur. [See Appendix B-9 for sediment control measures and B-5 for fish rescue practices.]

6. Use clean rock sources for channel maintenance work.

7. Retain water in its drainage of origin to the extent practical during channel maintenance for existing roads, using downslope opportunities that may be available.

Permits Possibly Needed:

When replacing riprap within original footprint, these permits may be required:

- CWA 404 permit from COE – NWP #13
- CWA 401 from RWQCB, if 404 needed
- DFG 1601 agreement
- Consultation with NMFS
- Coastal Zone: Exempt from coastal development permit unless subject to review under Section 1601 of the Fish and Game Code, or excavation or disposal of fill is outside of the roadway prism.

3-B ROAD SURFACING & DUST ABATEMENT

One objective of working on a road surface, paved or unpaved, is to keep pollutants from discharging into watercourses. For paved roads, pollutants include asphalt and concrete products, as well as oil and fuel from surfacing equipment. On unpaved roads, the main pollutant is sediment. Dust control or abatement helps reduce erosion caused by wind or storm water runoff. In dry climates, several applications of water may be used each day. Water drafting is often required to supply the needed water for dust abatement. When drafting water from a stream system, it is important to use a screen at all times to prevent the taking of adult or juvenile fish and to ensure that adequate water is left in the stream for use by fish that may be present. Low water stream crossings also must address possible sediment and fish impacts.

Topics addressed in this section are:

3-B-1 Surface Work

3-B-2 Dust Abatement

3-B-3 Water Drafting

3-B-4 Low Water Crossing Maintenance

SURFACE WORK 3-B-1

Description: Surface and inlay repair includes all repairs of road bases, surface, and shoulder irregularities, including asphalt and concrete surfaces. Asphalt plant production includes production of asphalt for patching materials, staging, moving, stockpiling and setup of asphalt plants. During on-site road grading, paving, surfacing or resurfacing, and asphalt removal activities, the proper management of concrete, asphalt, and seal coat can minimize or eliminate discharges of pollutants into watercourses.

Environmental Concerns:

- Discharge of the following materials into the stream or storm water drainage system: sediment, asphalt concrete binder, asphalt cement, liquid asphalt, asphalt concrete (AC), asphaltic emulsion, sealant material, Portland cement concrete (PCC), concrete rinse water, concrete grindings and cuttings, concrete waste, diesel oil.

- Harm to riparian vegetation adjacent to stream.

Best Management Practices:

1. Eliminate diesel and use only environmentally sensitive cleaning and releasing agents.

2. Use heat sources to heat and clean tack nozzles during operations.

3. Avoid road surface maintenance during wet weather to minimize the discharge of potential pollutants into the storm water drainage system. However, during periods of rain, road surface maintenance may be necessary.

4. Cover storm drain inlets and manholes when paving or maintaining road surfaces if runoff is anticipated.

5. Identify drain inlets and watercourses both upstream and downstream of the work site. Identify where the flow of a leak, spill or other runoff would go.

6. Protect waterways with straw bales, sandbags, filter fabric, or other diversion or filtering controls. [Appendix B-9]

7. Set-up the work area to minimize the tracking of material by vehicles and equipment in or out of the work area.

8. Always park paving machines over drip pans or absorbent materials. Keep equipment out of the riparian area.

9. A spill contingency plan and resources to contain a small to moderate spill (1-10 gallons) shall be in place. Carry adequate erosion control supplies and oil absorbent materials (diapers, kitty litter, shovels, etc.) to keep materials out of water bodies.

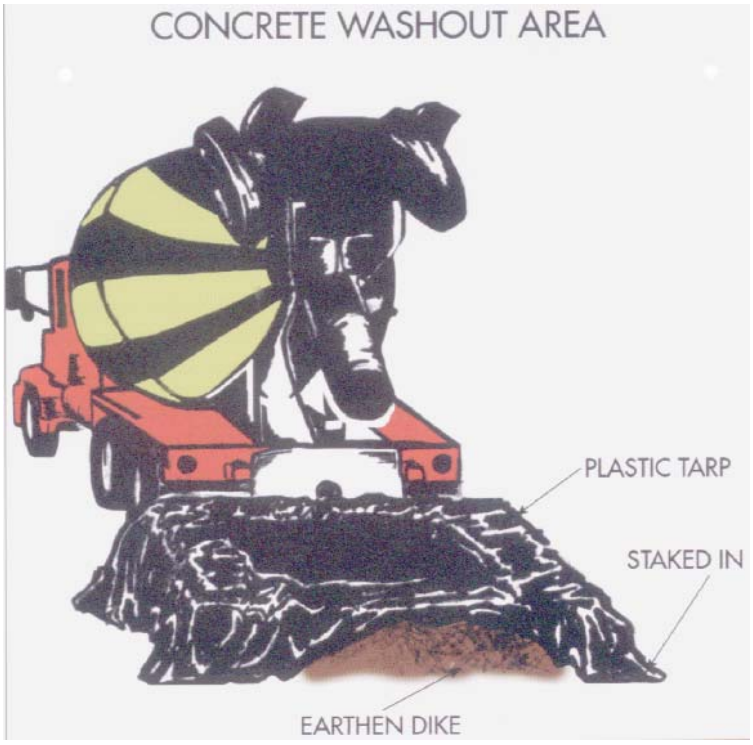
10. Dispose of excess material at appropriate sites, depending upon material being disposed. Keep material out of the riparian area. [See: Chapter 5 - Spoil Disposal and Stockpiling]

11. Asphalt concrete (AC) chunks and pieces may be used in embankments when these materials are placed where they will not enter the waters of the state. Keep material out of the riparian area.

12. AC pavement grindings may be used as road shoulder backing when these materials are placed where they will not enter the water of the state. Keep material out of the riparian area.

13. Follow these best management practices for concrete mixing on site:

    a. Ensure that contractors who fuel and operate asphalt plants or cement mixing operations on site have an adequate spill plan and materials for spill containment.
    b. Mixing excess amounts of fresh concrete or cement on site should be avoided.
    c. Establish mixing plants outside of riparian corridors.
    d. Dry and wet materials should be stored away from waterways and storm drains and should be covered and contained to prevent runoff from rainfall.
    e. Ensure that contractors provide areas for truck chute cleanout with proper containment of wet concrete.
    f. Protect inlets and catchments from fresh concrete.



14. Make inspection an ongoing practice:

a. After rainfall events, inspect drainage protection measures. In the case of an extended storm, inspect at least once per day. If the protection measures are subjected to non-stormwater flows, inspect daily.
b. Inspect inlet protection to prevent water from backing up. If back-up occurs, the protection needs to be replaced with an alternative device.
c. Monitor the concrete wash-out, waste storage and disposal sites and on-site procedures at least weekly.
d. Make sure employees and contractors are following pollution control measures.

Permits Possibly Needed:

- None required for surface work
- Temporary concrete batch plant may need a County Use Permit and air quality permit from Air Quality District.
- Note: Air quality rules by California Air Resources Board prohibit the use of serpentine rock and asbestos-containing aggregate for unpaved surfacing.
- To ensure that aggregate is asbestos-free, outside contractors paid to resize and/or crush rock must have MSHA (Mining Safety and Health Administration) 46 Identification number.

DUST ABATEMENT 3-B-2

Description: Dust abatement involves application of dust palliative to non-paved road surfaces to temporarily stabilize surface soils, leading to a reduction in erosion caused by traffic, wind, or storm water runoff. Palliatives are applied in liquid form and could include water, calcium magnesium acetate, magnesium chloride, emulsified asphalt, or lignin sulfonates.

Environmental Concerns:

- Discharge of sediment or dust abatement chemicals into a stream or storm water drainage system.

- Pumping water from streams for dust abatement can reduce flows to levels that harm fish and aquatic life.

Best Management Practices:

1. Do not apply chemical dust palliatives during rain or immediately before anticipated rain to lower the risk of running off into a watercourse.

2. Apply methods and materials in a matter that is not detrimental to either water or vegetation. See Table 3-B-2.1 below for selection criteria and recommended application rates.

3. Use environmentally friendly dust palliatives where warranted.

4. Carry adequate spill protection materials when applying chemicals.

5. Use environmentally sensitive cleaning agents.

6. Dispose of excess materials at appropriate sites. Never dispose of materials in the riparian area or the floodplain.

7. Avoid applying excessive amounts of water onto road surface to prevent sediment runoff into ditches and the stream system.

8. When applying chemical dust palliatives, follow these site preparation practices:
    A. Blade and compact a smooth surface. Never sidecast the surface material where it could be delivered directly or indirectly into a stream.
    b. Crown or slope the surface to avoid ponding. Compact soils if needed.
    c. Pre-wet the surface uniformly with water @ 0.03-0.3 gal/sq. yd.
    d. Apply the first treatment under pressure and overlap solution (6-12 in.). Apply the second treatment, before first treatment becomes ineffective at 50% application rate.
    e. Allow treated area to cure 0-4 hours. Compact area after curing.
    f. Reactivate chemicals in low humidity by re-wetting @ 0.1-0.2 gal/ sq. yd.

Table 3-B-2.1. Selecting and Applying Dust Abatement Chemicals

Method	Selection	Recommended Application rate
Chemicals-Inorganic		
Water	- most commonly used practice - evaporates quickly - lasts less than 1 day	0.125 gal/yd^2 every 20 to 30 minutes
Salts - Calcium Chloride (CaCl)	- restricts evaporation - lasts 6-12 months - can be corrosive - less effective in low humidity - can buildup in soils and leach by rain	Apply 38% solution at 0.27 gal/ sq.yd., or as loose, dry granules per manufacturer.
- Magnesium Chlorite (MgCl)	- better in higher temps and humidity - more costly than CaCl	Apply 26-32% solution at 0.5 gal/ sq.yd..
- Sodium Chloride (NaCl)	- not as effective - less expensive - corrosive - less effective in low humidity	Per manufacturer.
Silicates	- generally expensive - available in small quantities - requires at least two applications	
Surfactants	- short effectiveness period - high evaporation rates - must apply frequently	
Chemicals-Organic		
- Copolymers	- form semi-permeable, transparent crust - resist ultraviolet radiation and moisture induced breakdown - last 1 to 2 years	80-100 gal/ac.
- Lignin Sulfonate	- acts as dispersing agent - best in dry climates - can be slippery	Loosen 1-2 in of surface. Need 4-8% fines on first application.
- Spray-on Adhesives	- available as organic or synthetic - effective on dry hard soils - form a crust - can last 3 to 4 years	Per manufacturer.

(Taken and modified from San Francisco RWQCB (1999), Erosion and Sediment Control Field Manual, Table 1)

WATER DRAFTING 3-B-3

Description: Water drafting is a short-term, small portable pump operation that withdraws water from the streams or impoundments to fill tank trucks or trailers for the purposes of dust abatement or related water use needs for road maintenance practices. Typically, operators pump at or near maximum rates to limit down time and to maximize the amount of road surface that can be watered in a given period but the drafting rate can be adjusted. Official criteria for pumping and fish screening protections may change as biological knowledge improves and/or state or federal regulations change. Both NMFS and DFG have developed water drafting specifications that need to be followed - see Appendix D.

Environmental Concerns:

- Taking fish, particularly fry-size salmonids, from the stream system due an unscreened or inadequately screened diversion.
- Reducing flows or dewatering streams to levels that harm fish and other aquatic life.
- Increasing the water temperature due to over-drafting of the stream.
- Discharge of sediment into stream system caused by runoff from water spills at unsurfaced streamside drafting site for water truck

Best Management Practices: See: Appendix D

1. Seek drafting sites at streams and pools where water is deep and flowing, as opposed to streams with low flow and small, isolated pools. Do not draft water from the stream if any of the following conditions would result:
   a. bypass flows within the stream are less than 2 cubic feet per second
   b. pool volumes at the water drafting site would be reduced by 10% or more
   c. instantaneous diversion rate exceeds 350 gallons per minute
   d. pumping rate exceeds 10% of the stream flow
   e. fish may become stranded or adequate fish screens cannot be put in place.

2. Where seasonal drafting locations on Class I and Class II streams cannot meet the above conditions, develop appropriate off-stream reservoirs or adjacent watering hole or sump, or use existing fire hydrants. The county may propose to draw down Class I and II streams below the flow and pool volume conditions stated in #1 if DFG determines that such actions will not have an adverse impact on Class I beneficial uses downstream.

3. Draft water from Director-approved County sites. For each approved site:
   a. Describe and map the proposed water drafting location
   b. The watercourse or lake classification
   c. The general drafting location use parameters (i.e., yearly timing, estimated total volume needed, estimated total uptake rate and filling time)
   d. Recgonize the effects of the pumping operations proposed, particularly during dry and critically dry years.
   e. Proposed alternatives to prevent adverse effects (e.g. reduction on hose diameter, reduction in total intake at one location, described allowances for recharge time, and alternative water drafting locations).
   f. Plans for fish screening design, installation, and maintenance.

4. Provide adequate fish screening of each surface water diversion in Class I and II waters. Follow the latest, updated "Water Drafting Specifications" by NMFS and "Guidelines for Temporary Water Drafting from Watersheds Supporting Anadromous Salmonids" by DFG (see Appendix D). In general, these practices address the following:
   a. Design screens to prevent the entrainment or impingement of all life stages of fish or amphibians and to minimize adverse alterations to stream habitat. To be addressed are approach velocity (velocity of water through the screen openings), size of screen (proportional to diversion rate), and screen opening size (not usually larger than 3/32" in diameter). Work with County Engineer in this design or purchase NMFS / DFG approved pre-built fish screens for temporary sites.
   b. Use the screen on the pump intake whenever surface water is diverted in Class I and II waters.
   c. Orient the screen face parallel to flow for best screening performance. The approach velocity shall not exceed 0.33 cubic feet per second at any point on the screen surface. Submerge the screen below the water surface, with clearance above and below of at least one screen-height.
   d. Clean the screen to be free of accumulated algae, leaves or other debris which could block portions of the screen surface and increase approach velocities at any point on the screen.
   e. Keep the screen in good repair.

5. Surface the road approaches to drafting sites on streams with rock or other suitable material to avoid the generation of sediment-carrying runoff due to water spills or rainfall.

6. Require water drafting operators to keep a water diversion log on the water truck which records the operator's name, date, time, location, pump rate, filling time, screen cleaning and inspection, and bypass flow from the source stream.

7. Ensure that water drafting operators and county engineer have completed training by DFG, NMFS, or other appropriate entity in the above practices.

Permits Possibly Needed:

- DFG 1601 Agreement

LOW WATER CROSSING MAINTENANCE 3-B-4

Description: This practice involves maintaining fords of perennial, ephemeral or intermittent streams or channels which can be wet ("wet fords") or dry at different times of the year. Fords within the stream channel are typically made of permeable trench drains of coarse cobbles and boulders. Annual maintenance involves regrading the access ramps into the stream channel, while repair work involves replacing the entire washed-out ford after an extreme flood event. Streams with high stream banks require the maintenance of substantial "through-cut" ramps to get vehicles down to the streambed.

Environmental Concerns:

- Discharge of sediment into the stream or drainage system.
- Continuous clouding (persistent turbidity) of the stream due to high traffic disturbance of fine sediment within the stream channel or on the access road, and downstream deposition.
- Discharge of oil products from vehicles passing through deep water crossings
- Barrier to migrating fish at crossing and direct mortality of fish from vehicles instream

Best Management Practices:

1. Armor the road approach to the crossing with clean rock aggregate or paved surfacing to minimize erosion into the stream. When rocking, use coarse rock armor to protect the outer edge of the road bed.

2. Within the ford, use aggregate large enough to resist transport during winter flows. Protect the fill face on the downstream side of the fill with rock armor or a large overside drain (berm drain) to prevent erosion.

3. If traffic is more than infrequent, pave wet fords to maintain water quality if funding and permits are available. Paving consists of a concrete, slightly dish-shape slab across the watercourse, and a discharge apron or energy dissipator on the downstream side to prevent scour during high flows. Design the structure to pass both sediment and debris during high flows. Be aware that concrete fords tend to have scour around their edges, leaving the ford elevated and impassable. They also can be moved downstream during large flood flows.

4. Evaluate how to best eliminate low water crossings through a practical and economically feasible alternative, such as road relocation or permanent culverts or bridges, and implement the best option if supplemental funding is available. Base priorities on:
   a. where it fits within the infrastructure needs of the county;
   b. erosion and sediment potential of site as identified in County Road Erosion Inventory;
   c. degree the site serves as a barrier to anadromous fish passage; and/or
   d. degree the site cuts off access in winter and high flow periods for inspecting and maintaining the county road and drainage structures beyond the crossing.

5. Maintain riparian vegetation adjacent to the crossing site.

6. If possible, limit the use of the road crossing during the winter period and encourage an alternate route on public roads.

Permits Possibly Needed:

- DFG 1601 permit for repair or reinstallation of an instream low water crossing.
- CWA 404 permit from Corps of Engineers for any instream work.
- CWA 401 Water Quality Certification from RWQCB / SWRCB if 404 permit needed.
- NMFS consultation for instream work.

3-C VEGETATION MANAGEMENT

Vegetation management typically includes:

- Mechanical: using equipment such as mowers, chain saws, brushers, etc.
- Biological: using a natural predator to control the pest (flea beetle or Cinnabar Moth to control tansy ragwort, for example)
- Cultural: incorporating native, or more appropriate, plant material to out-compete the pest
- Chemical: use of herbicides and pesticides. However, none of the county road departments in the region presently apply such chemical treatments.

Note that noxious weed abatement may be required by the County Agricultural Commissioner. An Invasive Weed Management section will be added at a later date but is beyond the current scope of this manual.

In the future, the County should encourage the development of a Vegetation Management Plan. Each plan should typically include:

- Goals and objectives for Vegetation Management
- Maps of roads and management zones
- Methods (in some cases by mile point) to be used to control vegetation
- Reports
- Best Management Practices

The county should incorporate routine maintenance activities into the Vegetation Management program.

3-C-1 Mowing and Cutting

3-C-2 Tree Removal

3-C-3 Invasive Weed Management *(to be prepared in future)*

MOWING AND CUTTING 3-C-1

Description: These actions are designed to restore sight distance, reduce ice (due to shading) and to control/prevent slope failure. These actions involve mechanical mowing, trimming, removal of brush and cleanup.

Environmental Concerns:

- Excessive removal of vegetation can cause soil erosion or loss of riparian vegetation.
- Removal of rare plants, scenic trees, privacy & vegetative screens.

Best Management Practices:

1. Leave cut brush in riparian areas in place to minimize erosion, where doing so does not interfere with sight distance, create safety issues, cause fire hazards, involve noxious weeds or impair the proper functioning of road features, such as drainage.

2. Limit mowing to no more than 8 feet off edge of pavement in significant resource areas, unless needed to maintain proper functioning of road features, such as drainage.

3. Maintain shade trees along streams and rivers, unless those trees are hazard trees, could potentially impact bridge structures, or could impact line of sight. If trees provide shade or bank stabilization and are determined to be danger trees that must be removed, coordinate tree removal with DFG, CDF or other regulatory agency.

4. Remove only brush within 20 feet (on either side) of the road and under all bridge structures. All other brush not within County clear zones will be left in its current condition, unless the brush interferes with sight distance, shades the structure, or the brush is a noxious weed (e.g. scotch broom). Mapping of sensitive resource areas may lead to additional areas not being brushed.

5. On culverts 6 feet or greater, remove 10 feet of brush on both sides of the culvert, on the upstream end of the culvert and 10 feet on both ends on the downstream side, unless the brush around the culvert is noxious weed.

Permits Possibly Needed:

- Comply with County Tree Ordinance, County Herbicide/Pesticide Ordinance and regulations, and other relevant local ordinances.
- DFG 1601 agreement may be needed if working within riparian zone.
- Coastal Zone: Vegetation control is exempt from a coastal development permit for maintenance treatment of all vegetative material growing native within the highway rights-of-way. Included is cutting and trimming by hand and mechanical means.

TREE REMOVAL 3-C-2

Description: The appropriate county staff identifies and county maintenance crews remove hazard trees. County maintenance also removes trees from forested areas where the trees on unstable slide areas have the potential to reach the highway. They also may remove trees from designated fuelbreaks adjacent to county roads. County maintenance occasionally removes trees that threaten to fall, and in falling or uprooting, remove large portions of bank area. Large tree removal within a "clear recovery zone" adjacent to roads may sometimes be required under AASHTO's safety rules when road projects are federally-funded.

Definitions: Hazard Tree: Trees or snags on or near the highway that are found to be weakened, unsound, undermined, leaning, or exposed so they may fall across the highway, impair sight while driving, or damage structures within the near future (2-3 years). Mature tree: a tree with width greater than a 12-inch (30cm) diameter at breast height (dbh).

Environmental Concerns:

- Excessive or inappropriate removal of trees can lead to soil erosion and/or loss of riparian vegetation or habitat.
- Potential loss of trees as a source of large woody debris (LWD) in stream system
- Aesthetic concerns about loss of scenic trees.

Best Management Practices:

1. Maintain all riparian shade trees and other vegetation along streams or rivers unless those trees are "hazard trees" or within road-related, shaded fuelbreaks as described above. Where possible, attempt to maintain these suggested buffer strips:
   Stream Class I - 100 feet
   Stream Class II - 50 feet

2. When removing mature trees in riparian areas, replant two native, site-appropriate trees for every tree removed. Ensure that the replanted trees will not pose a future threat to county structures. Leave the downed tree in the riparian corridor for recruitment as large woody debris, as long as it does not pose an immediate threat to infrastructure or property downstream.

3. When permission to remove hazard trees cannot be obtained, it is necessary to trim and do whatever else is reasonable to alleviate the hazard.

Permits Possibly Needed:

- Comply with County Tree Ordinance.
- Federal Lands: Tree removal adjacent to County roads going through federal lands may need to be cut as part of a formal timber sale by the USFS or BLM. This action triggers NEPA review, ESA biological assessment, and possibly consultation with USFWS.
- Private Lands: Contact local CDF office to see if the proposed quantity, location and use of trees to be removed require a permit under the State Forest Practice Rules.

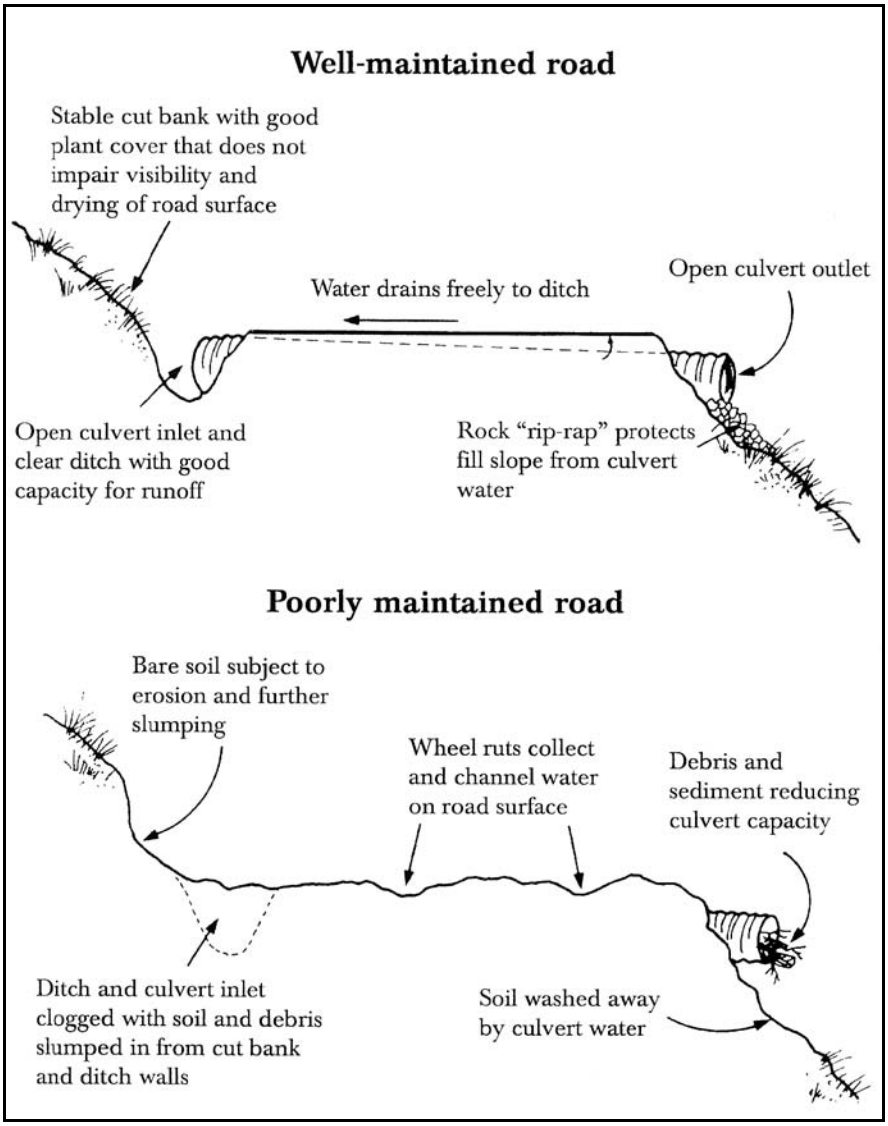
- Coastal Zone: Vegetation control is exempt from a coastal development permit for maintenance treatment of all vegetative material growing native within the highway rights-of-way. Included is cutting and trimming by hand and mechanical means.

3-D WINTERIZING ROADS

Introduction

Each year before the winter season the county monitors its paved and unpaved county roads within the priority system of the county and the resources available. It has always been in the county's interest of maintaining safe, open roads to prevent roads from washing out due to plugged culverts and other problems. An additional interest in not leaving roads with clogged culverts and ditches during the rainy season is that this lack of maintenance may lead to increased levels of sediment discharging into streams.

3-D-1 Winterizing Roads



Source: Oregon State Univ. (1998). Watershed Stewardship Guide.

WINTERIZING ROADS 3-D-1

Description: Winterizing includes preparing and inspecting the drainage conditions of all permanent, seasonal, and temporary roads– including the low traffic ones that may receive minimal year-round maintenance - for the coming rains. Activities included in the winterizing process consist of maintenance and erosion work necessary to drain the road surface, to open all culverts to their maximum capacity, and to ensure that ditches and drains are free flowing.

Environmental Concerns:

- Discharge of sediment into a stream or storm water drainage system.

- Plugging of culverts, inlets, and trash racks with debris & sediment could cause the road to wash out and deposit sediment into stream systems

Best Management Practices:

1. Clean floatable debris and sediment accumulations around culverts, drop inlets, and trash racks. [See: 4-A Culvert Cleaning; 4-B Culvert Improvement]

2. Remove soil and debris in ditches and trim vegetation that impedes ditch flow. [See: 3-A-3 Ditch Shaping & Cleaning; 3-A-4 Channel Maintenance; 3-C-1 Mowing & Cutting]

3. Excavate all unstable or potentially unstable fills and sidecast that could fail and enter watercourses during the winter period. [See: 3-A-1 Shoulder Blading & Rebuilding ; 5-A-2 Disposal Site Maintenance]

4. Culvert cleaning should be performed on a regular basis, usually just before the wet season begins. [See: 4-A Culvert Cleaning]

5. Apply erosion repair and control to bare ground where dirt may wash into ditch and stream system. [See: 3-A-2 Erosion Repair & Control]

Permits Possibly Needed:

- See relevant sections referenced above for possible permits needed

CHAPTER 4
MAINTAINING THE CULVERTS

Existing culverts need to be well maintained or they will be subject to eventual failure. It is important to distinguish between stream culverts and ditch relief culverts. In the case of all stream culverts, disturbance to the stream banks and streambed should be minimized during stream crossing construction and maintenance. Culverts within anadromous fish-bearing streams now have special fish passage requirements for both adult and juvenile fish based on guidelines by NMFS and DFG. Ditch relief culverts – to remove water from an inside ditch to an outside area - have less stringent standards because they do not involve work within the active stream channel. However, ditch relief culverts can still fail or cause problems if they are installed improperly or not maintained. Each county has, or will soon have, a Culvert Fish Migration Barrier Inventory to help it develop priorities for a Capital Improvement Program. Supplemental funding will likely be needed to upgrade many of the culverts for fish passage.

The primary goals for this chapter are:

- Maintain public safety and open roads
- Restore access for fish movement at stream crossings
- Prevent or minimize the interruption of normal runoff into streams

4-A Culvert Cleaning

4-B Culvert Improvement and Repair

4-C Culvert Sizing

4-D Culvert Replacement

4-E Ditch Relief Culverts

4-F Temporary Stream Diversions

4-A CULVERT CLEANING

Description: This action includes clearing of sediment and debris from all culvert inlets and outlets to restore function, and repairing of damaged passing devices (culverts, siphons, and box culverts, catch basins, drop inlets). Culvert cleaning is done by equipment including backhoe, vactor/jet router (a machine with a high-pressure hose and/or powerful vacuum), and shovels. Culvert cleaning can be performed in all weather. Culvert/inlet cleaning also includes removal of beaver dam material that clogs culverts to prevent flooding and culvert failure. See Appendix B-3.2 for types of culvert plugging hazards.

Sediment traps can be used to significantly reduce the amount of upslope and road-generated sediment capable of reaching streams if a constant maintenance schedule is employed to keep the associated sediment basins from reaching maximum capacity. If the sediment basin reaches maximum capacity (i.e., the sediment fills the basin to the elevation of the water inlet), then the sediment trap will no longer serve its purpose. The culvert can then become plugged and suffer reduced capacity and longevity. Furthermore, maintenance costs to clear a plugged culvert inlet are considerably higher than clearing a sediment basin. However, sediment traps can only be used in drainage sites where they will not block fish.

Environmental Concerns:

- Discharge of sediment and debris into a stream or storm water drainage system.
- Altered flows, flooding, or washout of road due to plugged culvert
- Blocking of fish passage by debris at the inlet
- Stranding of juvenile or adult fish during operation.

Best Management Practices: See Appendix B-3

1. Remove material from culverts and sediment traps and endhaul to safe, stable disposal sites away from the stream channel and its floodplain where there is no chance of the material returning to a stream network. (See: 5-A Spoil Disposal)

2. During any in-water work, minimize sediment impacts and ensure that no fish stranding occurs. [See: 4-F Temporary Stream Diversions and Appendix B-8 and B-9]

3. Perform culvert cleaning on a regular basis, usually during the dry season before the wet season begins around October 15th as well as during and after any large storm event. Focus on those sites with the highest risk of plugging during the winter season.

4. Target culverts with chronic plugging problems for replacement, based on the County Road Erosion Inventory and field experience in setting priorities. Ensure the correct size and adequate grade of the culvert to minimize culvert plugging. (See: 4-D Culvert Replacement)

5. Examine and address sources of erosion within the culvert's drainage area (including contributing ditches) if within the county's jurisdiction to operate. Outside of this jurisdiction, encourage upslope landowners to address sediment sources on their property. (See: 3-A Grading Practices)

4-A CULVERT CLEANING

6. Excavate excess material in the channel above and below a stream culvert only to the original baselevel of the streambed, not below it. If too much is removed, a new channel is created causing headcuts to migrate upstream within the floodplain and altering the ability of the floodplain to store fine sediment. This practice is particularly critical where roads cross forested floodplains and floodplain fans where sediment is stored at the mouth of small ephemeral tributary canyons.

7. Use sediment traps only where excessive sediment and debris is a chronic problem and not as a remedy for a poorly designed culvert. Do not use in drainage sites where fish passage is needed. [See Appendix B-3.8]

8. Make sure that the amount of sediment removed is similar to the amount accumulated over the maintenance period to assure proper function of the sediment trap. This removal practice will assure that such contributed sediment will not enter the stream system.

9. Design inlets on sediment traps to be similar in area to the culvert inlet.

Permits Possibly Needed:

- DFG 1601 agreement
- Coastal Zone: Exempt from coastal development permit unless subject to review under Section 1601 of the Fish and Game Code, or excavation or disposal of fill is outside of the roadway prism.

A culvert that needs cleaning. See also: Hazardous Materials

Photo source: Caltrans, Tehama County, CA (2002)

4-B CULVERT IMPROVEMENT & REPAIR

Description: Culvert improvement and repair addresses erosion and fish passage issues through the rehabilitation or retrofit of existing culverts. It includes the installation of baffles to slow the water velocity or weirs to increase the water depths within the culvert or downstream of the culvert in an anadromous fish-bearing stream. However, such modifications will decrease the culvert's ability to convey water that could increase the risk of flood damage above or below the site. Fish passage adjustments to the existing culvert should be seen as temporary, beneficial solutions until appropriate, longer term solutions (culvert replacement, bridge, or other remedy) can be put into place. Guidelines and criteria for culvert retrofit are provided by DFG and NMFS. See County Culvert Migration Barrier Inventory for location and description of problem sites and priorities.

Environmental Concerns:

- Discharge of sediment into the stream or storm water drainage system.
- Prevention of fish passage through the stream crossing due to excessive velocities, inadequate depths, or excessive outlet perch/ jump heights.
- Removal of riparian vegetation.

Best Management Practices: See Appendix B-3: Culvert BMP Design & Procedures

1. Install erosion/sediment control during culvert trash rack replacement, where erosion control devices can feasibly be installed. Do not install trash racks near culvert inlets in fish-bearing streams or debris will accumulate and restrict fish passage.

2. Add large, competent rock to the catchment areas below pre-existing shotgun culvert outlets since the falling water often produces a substantial amount of erosion. Avoid placing new shotgun installations without energy dissipation structures in the future. Seek supplemental funding, if needed, to correct problem sites.

3. In anadromous fish-bearing streams, use baffles as a last resort to correct the problem of excessive water velocities within culverts when other improvements are not feasible. Alternatives to baffles may be called for. Install baffles within culverts only after consulting with DFG and a qualified engineer to ensure that the change will be beneficial and not increase flood risk or contribute to channel instability. Since baffles decrease the culvert capacity and increase the potential for debris clogging, they can decrease the life of the culvert. To compensate for the loss of hydraulic capacity, inspections and maintenance may have to occur more often.

4. Use fish passage improvements on existing culverts as temporary solutions until a proper culvert installation, bridge, or other remedy can be done. Install fish passage improvements in existing culverts on anadromous fish-bearing steams where there is at least 20 years of culvert life remaining, and where county or supplemental funding is available. [See also: Appendix B-6 Fish Ladders].

5. Replacing the existing culvert with a bridge, a natural bottom system, or a properly designed and installed culvert is desirable when a high jump and/or the velocity of the water in a culvert may result in a probable fish migration barrier (usually less than 1 foot).

6. The problem of jump barriers in anadromous fish-bearing streams can often be corrected by installing back-flooding weirs. Weirs can be constructed using either logs or boulders. The weir directly below the culvert should be of sufficient height to back-flood the culvert to a depth of 12 inches. Each subsequent weir, downstream of the culvert, should be no more than 12 inches below the previous weir. Obtain approval from all property owners or engineer the weirs to avoid flooding of adjacent property. [See Appendix B-3.3]

7. For pipes that are to be replaced, design for anadromous fish passage as per the most recent NMFS and DFG guidelines. [See: 4-C and 4-D]

8. Minimize disturbance of riparian vegetation during culvert improvement and repair operations and replace lost plants if needed to provide critical shade cover.

Permits Possibly Needed:

- NOTE: On natural channels with anadromous fish habitat, fish passage capability for adults and juveniles through the culvert is required as condition of state and federal permits. DFG's Fish Passage Criteria and Guidelines address the passage needs of all aquatic animals, not just anadromous fish. NMFS's Guidelines for Salmonid Passage on Stream Crossings address the needs of migrating salmonid fish.
- DFG 1601 Agreement
- CWA 404 permit from COE as either: (a) Nationwide General Permit No. 14 – "Linear Sediment Reduction Projects at Water Crossings", or 9b) Regional General Permit (RGP 1) – "Fish Passage / Sediment Reduction Projects at Water Crossings"
- CWA 401 permit from RWQCB

Class II stream crossing with a nicely installed inlet, not a fish-bearing stream
Orr Springs Road, Mendocino County

4-C CULVERT SIZING

Description: Correct culvert sizing is important for preventing road washouts and erosion, and for providing fish passage in fish-bearing streams. It involves determining the proper diameter and length of the culvert needed for a given stream crossing to pass flood flows (with debris) and fish. Determining the proper diameter requires estimating the magnitude of runoff that would occur at each stream crossing during the most probable 100-year flood and then calculating the size of the culvert crossing which would handle that flow. A culvert is a portion of the stream crossing, and sizing must include the capacity of the stream crossing – in most cases at least spanning the active channel width. Estimating the culvert length is based on road width, slope steepness, and fill depth. In anadromous fish streams, culverts now have to be designed to provide passage for both adult and juvenile fish according to the NMFS & DFG fish passage criteria and guidelines. See also the County Culvert Migration Barrier Inventory for a description of problem sites and priorities.

Environmental Concerns:

- If the culvert diameter is too small, it may create a velocity barrier for fish, increase outlet downcutting, and wash out the road, causing discharge of sediment to the stream.

- If the culvert length is too small, then the culvert inlet and outlet will not extend sufficiently beyond the base of the fill and may result in sediment delivery to the stream.

Best Management Practices:

1. Size crossings to handle most probable 100-year flood flows and associated debris and bedloads, given the watershed and specific conditions present in each county. Site-specific constraints may warrant a different standard.

2. See the County Engineer for determining the correct culvert diameter and length for a given stream crossing to meet hydraulic capacity requirements for flood risk and channel stability.

3. Refer to the latest NMFS and DFG fish passage guidelines and criteria to size replacement culverts for fish passage in anadromous fish-bearing streams. Consult with NMFS and DFG early in the design process. [See Appendix C]

Tools:

- "FishXing" software is intended to assist engineers, hydrologists, and fish biologists in the design and evaluation of culverts for fish passage. (www.stream.fs.fed.us/fishxing)
  - Allows for comparison of multiple culverts designs within a single project.
  - Calculates hydraulic conditions within circular, box, pipe-arch, open-bottom arch, and embedded culverts.
  - Contains default swimming abilities for numerous North American fish species.
  - Contains three different options for defining tailwater elevations.
  - Calculates water surface profiles through the culvert using gradually varied flow equations, including hydraulic jumps.

- Outputs tables and graphs summarizing the water velocities, water depths, outlet conditions, and lists the limiting fish passage conditions for each culvert.

Permits Possibly Needed:

- Sizing is determined as part of the practices described in Section 4-D Culvert Replacement
- Note: DFG's Fish Passage Criteria and Guidelines (also in DFG's 2002 updated California Salmonid Stream Habitat Manual) address the passage needs of all aquatic animals, not just anadromous fish. NMFS's Guidelines for Salmonid Passage on Stream Crossings address the needs of migrating salmonid fish (http://swr.nmfs.noaa.gov/hcd/NMFSSCG.PDF).

Measuring an existing culvert for size and slope

4-D CULVERT REPLACEMENT

Description: This action addresses culvert replacement only, while the rehabilitation or retrofit of existing culverts is addressed in section 4-B. Key practices involve determining the correct type and size of culvert to use at a given stream crossing, planning for failures, culvert alignment, and streambed impact minimization. Incorrect installation of culverts can prevent fish passage through a stream crossing. Culverts must now be designed and placed to provide passage in anadromous fish streams for both adult and juvenile stages. See County Culvert Migration Barrier Inventory for fish passage problem sites and priorities and the County Road Erosion Inventory for potential sediment problems related to culverts and for priority culverts to replace.

Additionally, County road managers and engineers must consider other important factors when making decisions about culvert replacements. They must consider possible effects of the change on: downstream flooding and potential property damage, upstream channel change, property access, future floodplain development, and legal liabilities. The County is usually not responsible for upslope sources of culvert problems (such as debris or increased flood flows) but must deal with the effects.

* See also Five County website for examples of projects in other counties://www.5counties.org
* Refer to Appendix B-3.1 for terms related to culvert hydraulics.

Environmental Concerns:

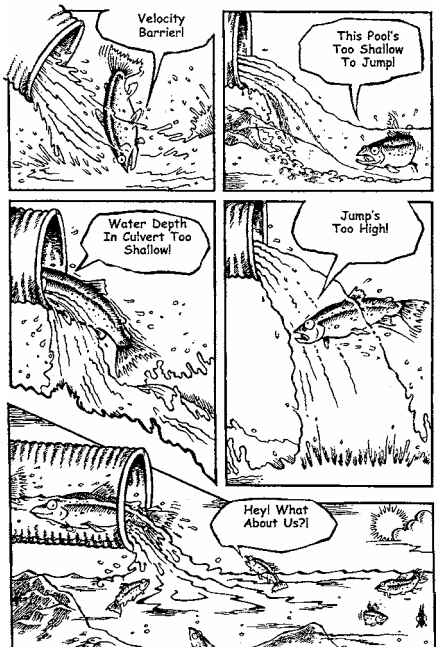
- Discharge of sediment into the stream or storm water drainage system.
- Prevention of fish passage through the stream crossing.
- Removal of riparian vegetation.

Best Management Practices: **See Appendix B-3 for BMP designs**

1. Consider a single span bridge as the first option for culvert replacement in anadromous fish bearing streams. Bottomless arch culverts or partially buried "embedded" culverts are preferred over non-embedded culverts for fish passage purposes. Baffled culverts or fishways (> 0.5% slope) are the least preferred of the passage improvements.

2. Avoid the conditions in the diagram which are detrimental to fish passage at stream crossings: (A) high water velocities, (B) shallow water depths within the culvert, (C) a lack of adequate resting pools above and below culvert outlet, (D) culvert outlets too high above water surface, and (E) inadequate juvenile fish passage.

3. Coordinate closely with NMFS and DFG about replacement of culverts identified as requiring fish passage. Early consultation can avoid timing problems with permitting.



Source: Oregon Watershed Assessment Manual

4-D CULVERT REPLACEMENT

4. Ensure that all replacement culverts on anadromous fish-bearing streams meet the most recent version of the NMFS & DFG fish passage criteria and guidelines. Variances can be allowed where meeting the guidelines can be shown to be unreasonable or impractical, based on biological and/or hydrologic rationale.

5. Have the County Engineer evaluate the site to be sure that the proposed replacement structure will not increase the flood risk or cause sediment routing problems.

6. Only install replacement culverts in a dewatered site, with a sediment and flow routing plan. [See: 4-F Temporary Stream Diversions]

7. Store excavated spoils and equipment in a location that will prevent sediment delivery to watercourses. [See: Chapter 5 - Spoil Disposal]

8. Maintain equipment to prevent leaks that may reach streams and clean before use near watercourses. Keep all fuel storage and staging materials out of the riparian area.

9. Place spill contingency resources to contain a small to moderate spill (1-10 gallons) at each job site where equipment is used. Install oil absorbent materials downstream of in-water work sites to trap accidental spills or leaks into streams from equipment. Keep a Notification Checklist for hazardous spills on site and use if spill into stream occurs. [See: 8-C Accident Clean-up.]

10. Fully restore disturbed sites within the riparian area with a mix of native, riparian plant species where disturbance of the shade canopy was significant due to the replacement project. If bare dirt sites result, apply erosion control measures. [See: Appendix B-4]

11. To design for the possibility of conduit failure due to blockage or other problem, include additional surface routes which will redirect flood waters into the natural drainage course at non-erosive velocities as soon as possible.

12. Align culverts and other structures with the stream, with no abrupt changes in flow direction upstream or downstream of the crossing. This can often be accommodated by changes in road alignment or slight elongation of the culvert.

13. Place bottomless arches and embedded culverts at or near the same gradient as the natural streambed and wider than the active stream channel. The active channel is considered to be the wetted channel up to the ordinary high water marks. Minimize the possibility that the new culvert will not cause any existing downstream channel enlargement to migrate upstream.

14. At stream crossings, place embedded culverts at least one foot deeper than the streambed grade, or embedded at least 20% of its height; whichever is greater. If the culvert is placed too low, the inlet can easily plug and overflow. If the culvert is placed too high in the fill, flow could potentially undercut the inlet, and erode the streambed and fill at the outlet.

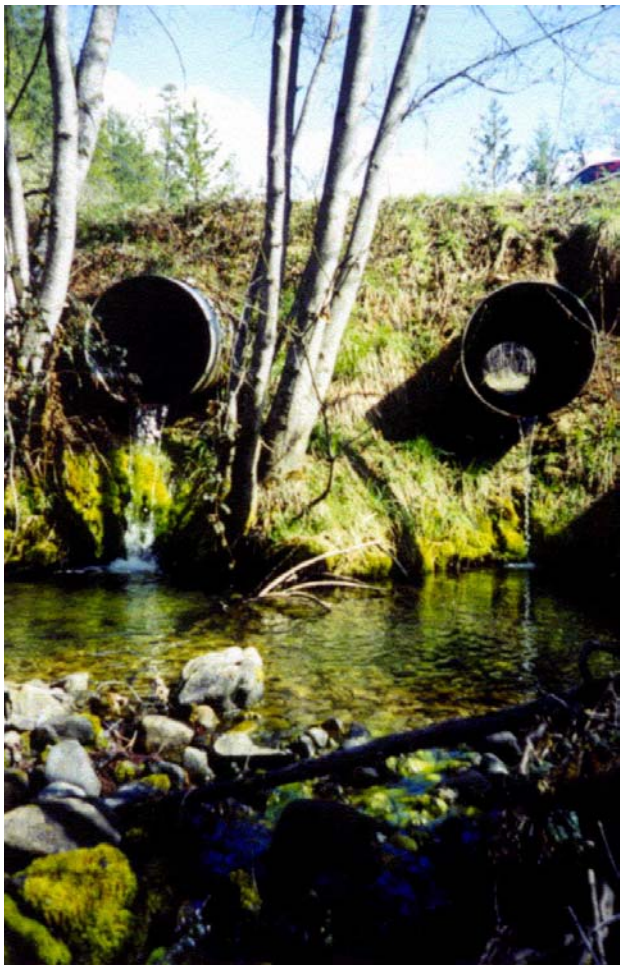
15. Protect both the inlet and the outlet with armor to protect from scour, if feasible. [See: Appendix B-3]

16. Avoid installing shotgun culverts.

Permits Possibly Needed:

- NOTE: On natural channels with anadromous fish habitat, fish passage capability for adults and juveniles through the culvert is required as condition of state and federal permits.
- DFG 1601 Agreement
- CWA 404 permit from COE as either: (a) Nationwide General Permit No. 14 – "Linear Sediment Reduction Projects at Water Crossings", or 9b) Regional General Permit (RGP 1) – "Fish Passage / Sediment Reduction Projects at Water Crossings"
  - As part of CWA 404, NMFS consultation is triggered under Section 7 of ESA for federally-funded and permitted activities. Take permission is required if take of listed salmonid species will occur and culvert replacement is outside of agreed upon take limits.
- CWA 401 permit from RWQCB
- CESA 2081 incidental take permit from DFG if state-listed endangered or threatened species is in the stream and if a ESA Section 4, 7, or 10 incidental take permit has not already been obtained.

4-D CULVERT REPLACEMENT



Culverts needing replacement to provide fish passage

A successful culvert replacement (Morrison Gulch, Humboldt County)

4-E DITCH RELIEF CULVERTS

Description: Ditch relief culverts are needed to divert ditch water from the inside of a road to a location on the outside of the road where concentrated flow can be safely dispersed downslope beyond the outer edge of the road fill. This section describes those additional factors that should be considered in the location, stabilization, and maintenance of ditch relief culverts as opposed to stream culverts. Right-of-way or ownership issues can be a problem in locating sites for downstream drainage off of county roads. It is important to avoid concentrating flow into ditches in the design of roads whenever possible, which would minimize the need for ditch-relief culverts. However, rolling dips and outsloping may not be a feasible drainage option for certain county roads due to the public safety issue. Fish passage is not an issue in these off-stream culverts.

Environmental Concerns:

- Discharge of sediment into a ditch, which may discharge into a stream or storm water drainage system that contains fish or contributes resources that support fish.
- Discharge of sediment into a stream from erosion within the ditch or below culvert.
- Road surface erosion or roadway failure from a plugged ditch relief culvert or outlet flows.
- Surface erosion or failures resulting from concentrated ditch water.

Best Management Practices: See: Appendix B-3

1. During reconstruction of unsurfaced roads, consider out-sloping the road instead of installing inboard ditches, which require ditch-relief culverts. Safety factors such as traffic use, maximum safe speed, slipperiness of surface material, and winter conditions need to be considered in the determination as this design is not always practical on public roads.
   [See: 3-A-1 Shoulder Blading and Rebuilding]

2. Divert ditch water through ditch relief culverts, where feasible and practical [See Appendix B-3.6 for a standard design.]. The location of a ditch relief culvert depends on water volume and velocity, soil types, hillslope aspect, elevation, vegetation, rainfall intensity, the incidence of rain-on-snow events, and the downslope conditions. With so many factors influencing the location of ditch relief culverts, it is not recommended that tables alone be used. Instead, use site-specific guidelines for all ditch relief culvert locations:

   a. Do not locate ditch relief culverts on unstable slope areas.

   b. Generally, mid- and upper-slope roads require shorter ditch lengths between ditch relief culverts than do valley bottom roads, primarily due to the steeper ditch gradients and fewer well defined stream channels on the slopes.

   c. Typical locations for ending the ditch at a ditch relief culvert are:
   - at the top of a steep gradient. The intent is to disperse ditch water before volume and velocity increase downgrade, resulting in accelerated ditch, subgrade and cutbank erosion.
   - at seepage zones.

- at zones that have localized flow with no defined channels. It is critical to ensure that ditch water is diverted at the downgrade side of these zones. Otherwise, water flow will carry on to the next segment of ditch, thereby increasing the flow and potential for erosion.
- at low points in the road profile.
- where right-of-way or ownership issues are not a problem for downstream drainage.

d. See Table 3-A-1.1 for suggested road surface drainage spacing based on road gradient and soil type. Combine these spacing suggestions with the above criteria to best place ditch relief culverts.

6. Direct ditch culvert outlets past the end of the road fill and onto erosion-resistant areas, or onto outlet protection such as rock rip rap. Never direct outflow water onto unprotected loose erodible fill.

7. Retain water in the drainage of origin whenever possible. When choosing the location for ditch relief culverts, minimize the transfer of water by ditches to other drainages, where feasible, practical and consistent with downstream ownership or use.

8. Seat ditch relief culverts on the natural slope like stream-crossing culverts, if possible. Make sure that bedding and fill material are free of rocks and debris that could puncture the pipe.

   a. Compact backfill materials from the bed in accordance with County standards. Extend the outlet beyond the base of the road fill (or a flume downspout if used) and empty onto an apron of rock, gravel, brush or logs.
   b. Install at a 30-degree angle to the ditch to lessen the chance for inlet erosion and plugging. Use a slope of 2-4 percent more than the ditch grade, or at least 5 inches every 10 feet to ensure sufficient water velocities to carry sediment through the pipe.
      [See: Appendix B-3.6 for a standard design]

9. Install ditch blocks to direct water into the culvert inlet. Construct ditch blocks of erosion-resistant material, with the crest being approximately 1 foot lower than the adjacent road grade. This last step is critical because if the culvert becomes plugged and the water rises above the ditch block, then the flow will continue down the next section of ditchline rather than being directed onto the roadway surface over the ditch block.

10. Inlet protection for ditch relief culverts may often include drop inlets or sediment traps to trap sediment and debris. For ditch relief culverts on steep road grades, lining the ditch block and the bottom of the culvert channel with rock may be necessary to minimize scouring.

11. Avoid installing shotgun ditch relief culverts! (See #8 above.)

Permits Possibly Needed:

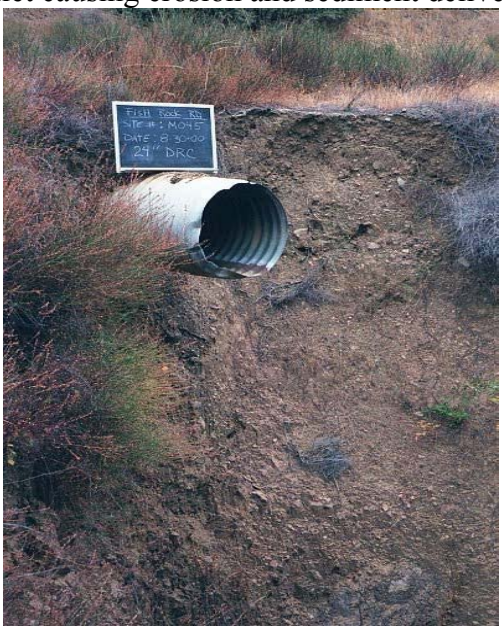
- None usually required to install new ditch relief culverts in uplands (not "Waters of the US").

4-E DITCH RELIEF CULVERTS

- If placing outlet protection at discharge in a stream below "Ordinary High Water Mark" (see Chapter 2 under CWA Section 404) :
  a) COE 404 – Nationwide Permit 7 (Outfall Structures & Maintenance) will apply
  b) RWQCB 401 permit
  c) DFG 1601 agreement
- Maintaining the ditch relief culvert may require permits if the ditch conveys natural waters (e.g., the ditch picks up an ephemeral stream). [See: 3-A-3 Ditch Shaping & Cleaning]

The Bad & the Good

Shotgun outlet causing erosion and sediment delivery to stream



Downspout to a Class I stream

4-F TEMPORARY STREAM DIVERSIONS

Description: Temporary diversions are often required during in-stream projects designed to maintain fish passage and water quality. Culvert replacements commonly need temporary or short duration stream channel diversions. A stream reach may be temporarily dewatered after the fish are removed and relocated upstream of the work area, and then excluded from the site until the project is completed. Fish exclusion of listed species is done only under the supervision of an agency, or other qualified, fishery biologist with an "incidental taking permit" from NMFS and DFG.
* See Appendix B-5 for specific Fish Exclusion practices.

Environmental Concerns:

- Discharge of sediment and debris into a stream or storm water drainage system.
- Stranding and loss of juvenile or adult fish, and affecting instream habitat.
- Loss of riparian vegetation due to temporary lack of water.

Best Management Practices: See Appendix B-5 for Fish Exclusion BMPs

1. Make sure the temporary diversion channel is capable of carrying the anticipated streamflows during the construction period.

2. Where anadromous fish are present, work closely with a qualified agency or consulting fishery biologist who has the needed permits. For listed species, the incidental and direct take permits will require reasonable and prudent measures (RPMs) to be used. Follow these permit requirements under the supervision of the fishery biologist.

3. Have the supervising biologist remove all fish out of the affected area before dewatering any stream section. If fish are still found stranded in the dewatered channel, immediately transport them to the active channel following the directions of the biologist (usually by netting, electrofishing and/or pumping the fish with an approved fish-friendly method).

4. Complete the diversion before or after typical upstream fish migration periods (see Table 1-2 and ask local DFG fishery biologist for local timing). If this is not possible, install a diversion pipe capable of passing fish or other method approved by DFG. [See: Appendix B-3.4 for baffle designs]

5. Maintain fish passage in the new channel at all times and make sure that the water pumping hose/culvert has an adequate screen to avoid fish entrainment, unless otherwise approved by NMFS and DFG. [See: 3-B-3 Water Drafting for temporary screening practices.]

6. Isolate the diversion channel from the natural channel during excavation.

7. For each job site where equipment is used:

a) Install oil absorbent materials downstream of in-water work sites to trap accidental spills or leaks into streams from equipment. Store excavated spoils and equipment to prevent sediment delivery to watercourses. [See: Chapter 5 – Spoil Disposal]

b) Ensure spill contingency resources to contain a small to moderate spill (1-10 gallons) are in place.

8. Line diversion channel with filter fabric, visqueen or a similar material and anchor with rock or sandbags to hold it in place. The purpose is to prevent the bed and banks of the diversion channel from eroding at expected flows.

9. When diverting the flow into the temporary channel, first remove the downstream plug of the temporary channel, followed by the upstream plug. Next, close the upstream end of the natural channel and then close the downstream end.

10. If a tributary enters the former channel within the diversion area, connect the tributary to the new dewatering channel. If any channel change is done to intercept a tributary, move the channel back to its original shape and location at the completion of the temporary diversion.

11. To restore flow to the natural channel, first remove the downstream and then the upstream plug of the natural channel. Next, close the upstream end and the then the downstream end of the diversion channel.

12. After removing any man-made material, backfill the diversion channel and stabilize the stream banks. Revegetate disturbed riparian areas with naturally occurring plants and grasses.

13. An alternative to a temporary stream diversion channel is to impound the flow and transport the flow around the site via pumps and piping (see pictures below). This practice requires screening of the stream at the pumps and removal of any fish from the dewatered site after installing fish blocking screens above and below the site.

Permits Possibly Needed:

These permits may already have been obtained for the project which the temporary stream diversion is part of , such as culvert replacement:

- DFG 1601 Streambed Alteration Agreement
- CWA 404 permit from COE: (a) Regional General Permit 1, or (b) nationwide General Permit No. 12 – "Utility Line Activities"
- CWA 401 permit from RWQCB
- ESA Section 4 or 7 consultation incidental take or Section 10 incidental take permit, and Section 10 direct take permit for the supervising biologist
- CESA 2081 incidental take permit from DFG if state-listed endangered or threatened species is in the stream and if a ESA Section 10 incidental take permit has not already been obtained.

4-F TEMPORARY STREAM DIVERSIONS

Two methods of temporary stream diversion

CHAPTER 5
DISPOSING OF THE SPOIL

Maintenance activities such as grading, culvert cleaning, slide debris removal and snow removal, require stable locations where excess spoil can be stored without contributing sediment to streams. Sites should be located and prepared before the need for disposal areas arise. The five counties involved with this manual are currently inventorying existing and potential disposal sites as part of the County Road Erosion Inventory Program. The spoil should be disposed of in a way that will prevent erosion. Disposal sites should be maintained periodically, depending on the season and type of material. Temporary disposal sites, or stockpiles, are useful when materials can be reused for other County maintenance or construction activities. Stockpiles also require periodic maintenance to ensure no discharge into the stream system.

The primary Goals for this chapter are:

- Maintain public safety and open roads for the traveling public.
- Prevent or minimize delivery of sediment and chemicals to streams.
- Prevent or minimize the interruption of normal runoff into streams.
- Protect aquatic and riparian habitat.

5-A Spoil Disposal

5-B Stockpiling for Reuse

5-A SPOIL DISPOSAL

Introduction:

Spoil disposal includes site selection, site permitting, maintaining the site to control erosion, and the temporary or final closure of the disposal site.

5-A-1 Site Selection

5-A-2 Disposal Site Maintenance

5-A-3 Disposal Site Closure

SITE SELECTION 5-A-1

Description: This activity involves the selection of sites in advance of the need for long-term and short-term stockpiling of materials for County maintenance activities and disposing of excess materials from excavations, grading and culvert basin cleaning. The general watershed criteria for selecting any disposal site is a site where the material will not erode into any part of the channel network, and where it will not initiate a formerly dormant landslide.

Environmental Concerns:

- Filling wetlands with spoil material.
- Discharge of sediment or organic material into the stream or storm water discharge system.
- Damage to endangered or threatened plant species on site.
- Slope stability of both the disposal site and the spoil pile.

Best Management Practices:

1. Determine the location of existing disposal sites, potential disposal sites, and locations of significant spoil generation along county roads. Incorporate data collected from County Road Erosion Inventory as much as possible.
   a. Conduct site investigations of existing and potentially suitable County disposal sites. Site investigations should include the disposal area size, distance to watercourses, potential slope instabilities, listed species habitat, archaeological sites, nearby residential areas, access, and other limiting factors.
   b. Prepare a map and data set indicating sites (existing and potential) with acceptable site characteristics (see below). Prioritize acceptable sites and initiate the permitting process.
   c. Develop site plans for sites adjacent to or near riparian areas or streams to identify erosion and sediment control needs, and to ensure stability of the material.

2. Follow these acceptable site characteristics in the site election & design process:
   a. Seek a stable site where sediment cannot reach the stream during any high water event.
   b. Avoid adjacent riparian corridors or any area within the 100-year floodplain.
   c. Avoid all wetland sites as these sites are protected from disposal activities and permits will be required and may not be granted.
   d. Avoid placing spoil on unstable slopes, where the added weight could trigger a land movement. Excessive loading of clay or silt soils could also trigger a failure.
   e. Use wide, stable locations such as rock pits, ridges, and benches as places to dispose of fill. Avoid locations where ground water emerges or a thick organic layer is present.
   f. Avoid sites with endangered or threatened plant species. Search the California Natural Diversity Database [//www.dfg.ca.gov/whdab/html/cnddb.html] for any known listed plant sites in the area. Seek site evaluations by qualified botanists during the appropriate season before selecting a new site.

Permits Possibly Needed:

- A conditional use permit is often required from the County Planning Department. Coastal development permit may be needed in coastal zone.

- Grading permit may be required by County under Grading Ordinance.
- County Floodplain Development permit if located within 100 year floodplain
- An agreement must be executed with the landowner, such as an encroachment permit. USFS or BLM special use permits may be required if the site is on federal land; surveys of additional species of concern may be required by those agencies.
- Permits from State and Federal agencies are usually not required as long as waters outside of the "ordinary high water" zone are avoided.

A potential spoil disposal site identified in the County Road Erosion Inventory

DISPOSAL SITE MAINTENANCE 5-A-2

Description: This action involves disposing excess materials from excavations, grading and culvert basin cleaning at designated long-term disposal sites. Once the materials are properly disposed of, the site should be maintained on a regular basis. Long-term site maintenance is the emphasis here. See 5-B for short-term stockpile maintenance of materials intended for reuse.

Environmental Concerns:

- Discharge of sediment and organic material into stream or storm water drainage system.
- Introduction of noxious weeds, invasive plants, or plant disease to the site from imported materials.

Best Management Practices:

1. Avoid placing excess spoils into stream courses and adjacent riparian zones where it could potentially result in sediment delivery to streams.

2. Drain spoil piles to prevent the concentration of flow and to prevent rill and gully erosion.

3. Spread material not to be re-used in compacted layers and generally conforming to the local topography.

4. Separate organic material (e.g., roots, stumps) from the dirt fill and store separately. Place this material in long-term, upland storage sites, as it cannot be used for fill. Leave all organic material that can safely remain in adjacent riparian zones. Make stored woody debris available to others as large wood for placement in streams for habitat improvement.

5. Store "clean" material in a short-term disposal site (stockpile) if it will likely be re-used for fill or shoulder widening projects. Verify if material can be used for shoulder widening. [See: 5-B-1]

6. Where feasible, recycle asphalt material in embankments and shoulder backing. Place these materials where they will not enter the stream system. Asphalt that is 5 years old is considered "inert" (that is, all oils washed off).

7. Encourage stockpiling and reusing concrete materials when possible. [See: 5-B-1]

Permits Possibly Needed:

- Permits from State and Federal agencies are usually not required as long as wetlands and ordinary high water areas are avoided.
- Compliance with County Noxious Weeds Ordinance.
- A conditional use permit is often required from the County Planning Department.
- An agreement must be executed with the landowner. USFS permits may be required if the site is on national forest land.

DISPOSAL SITE CLOSURE 5-A-3

Description: This action involves temporary and permanent closure of a disposal site. Temporary closure of a disposal site allows for reopening of the site if necessary. Permanent closure of a disposal site occurs when no additional material can be added to the site.

Environmental Concerns:

- Discharge of sediment and organic material into a stream or storm water drainage system.
- Introduction of noxious weeds or invasive plants to the site from imported materials.
- Slope stability of the closed disposal site.

Best Management Practices:

1. Do not add excess unusable material to permanently closed sites.

2. Spread material not to be re-used in compacted layers, generally conforming to the local topography.

3. Design the final disposal site reclamation topography to minimize the discharge of concentrated surface water and sediment off the site and into nearby watercourses.

4. Cover the compacted surfaces with a 6-inch layer of organic or fine-grained soil, if feasible.

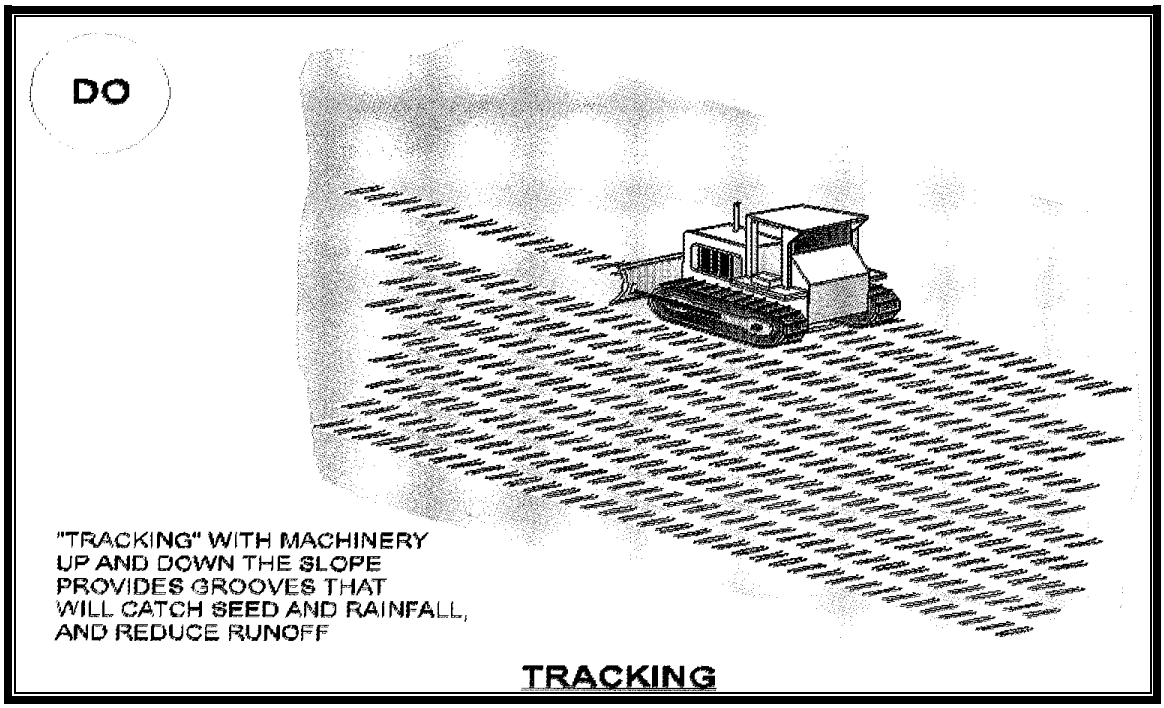
5. After placement of the soil layer, track walk the slopes perpendicular to the contour to stabilize the soil until vegetation is established. Track walking creates indentations that trap seed and decrease erosion of the reclaimed surfaces. (See figure on next page.)

6. Revegetate the disposal site with a mix of native plant species. Cover the seeded and planted areas with straw compost, mulched with straw at a rate of 1 to 1 ½ tons per acre. Apply jute netting or similar erosion control fabric on slopes greater than 2:1 if site is erosive.

Permits Possibly Needed:

- Permits from State and Federal agencies are usually not required as long as "waters of the U.S." are avoided.
- Compliance with County Noxious Weeds Ordinance.
- Notify permitting agencies and landowner that site is permanently closed.

DISPOSAL SITE CLOSURE 5-A-3



Source: San Francisco RWQCB (1999) Erosion & Sediment Control Field Manual

5-B STOCKPILING

Introduction

Temporary disposal sites, or stockpiles, are useful when materials can be reused for other County maintenance or construction activities. Proper management of stockpiles on site eliminates or minimizes the discharge of pollutants to the storm water drainage system and watercourses. Temporary stockpiling of certain spoil, such as asphalt or fine-grained sediments, may necessitate stringent drainage-related controls during the wet season.

5-B-1 Stockpile Maintenance

STOCKPILE MAINTENANCE 5-B-1

Description: Stockpiled materials at approved disposal sites, even those stored for a short time, need to be maintained. Some sites, particularly of clean fill material such as gravel and crushed rock, may need only short-term maintenance as the spoil is usually reused for other projects. All stockpile sites need to be "storm-proofed" to prevent slumping or erosion of stored material into the stream system.

Environmental Concerns:

- Discharge of sediment, organic material, concrete, or asphalt into the stream or storm water discharge system.

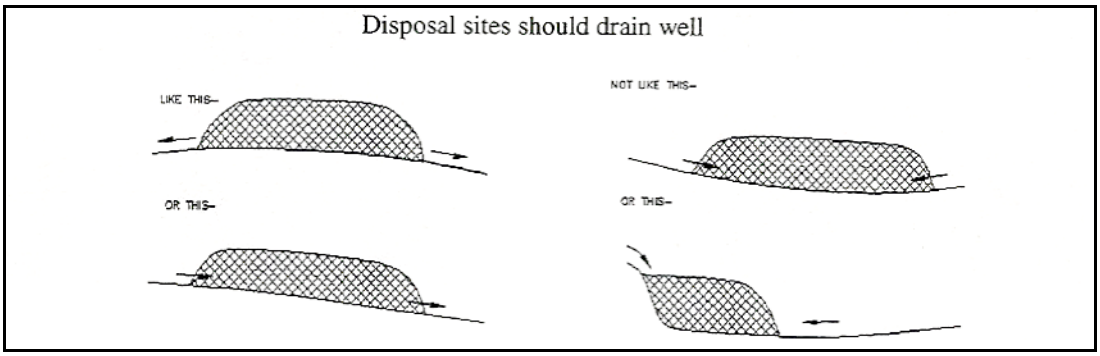
Best Management Practices:

1. Keep temporary disposal sites out of wetlands, adjacent riparian corridors, and ordinary high water areas as well as high risk zones, such as 100-year floodplain and unstable slopes.

2. Anticipate sufficient storage area with no risk for sediment delivery for piles that may slump. Stress cracks indicate that the pile is at risk of slumping. *See figure below.*

3. Follow BMPs in 6-D-4 (Outdoor Storage of Raw Materials), where possible.

4. Reuse and recycle concrete, asphalt, and other construction waste when possible.

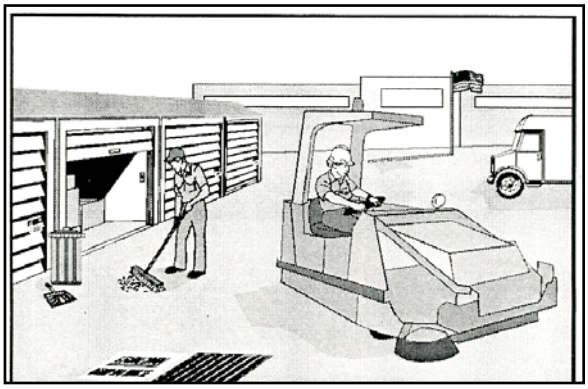


Source: Choctawhatchee, Pea & Yellow Rivers Watershed Management Authority (2000)

Permits Possibly Needed:

- Discharge of pollutants into stream from stockpiles can lead to stiff fines from RWQCB or DFG.
  Note: RWQCB issued a cleanup and abatement order (CAO 99-77) to the USFS for the discharge and threatened discharge of sediment from a 15,000 cu. yd. stockpile near a tributary of the South Fork Trinity River in 1999, with civil penalties of $10,000 per day and $2,000 per cubic yard ($10 per gallon).
- Caltrans was also cited for having stockpiles in the 100-year floodplain.

CHAPTER 6
MANAGING THE MAINTENANCE YARD



This chapter looks at daily practices at county road maintenance yards and suggests ways to avoid spills, site contamination, and runoff problems. BMP emphasis is on controlling the potential pollutant sources. Much of this material came from the BMPs recommended in the Caltrans Storm Water Quality Handbook – Maintenance Staff Guide and is anticipating BMPs that may soon be required. In March 2003, Phase II of EPA's Storm Water Rule will take effect for areas with small populations and the County will need a Storm Water Management Plan and General Industrial Storm Water Permit from the Regional Water Quality Control Board for each of its maintenance yards. This chapter should assist with the required strategy and its compliance.

Each maintenance yard site has different pollution risks – those close to streams and in high rainfall areas are of course at higher risk than those connected to sewer systems and with low rainfall. Unlike urban areas, rural sites often do not have a sanitary sewer system nearby that can be connected to for liquid waste disposal, nor are there developed storm water drains. Care must always be taken when dealing with potentially hazardous materials ("hazmat"). Safer alternative products are encouraged to minimize the risk of toxic spills that could contaminate surface water as well as groundwater.

The primary goals for this chapter are:

- Prevent or minimize delivery of sediment and chemicals to streams
- Protect aquatic and riparian habitat

6-A Facility Housekeeping Practices

6-B Building & Grounds Maintenance

6-C Vehicle & Equipment Maintenance

6-D Material Use & Storage

6-A FACILITY HOUSEKEEPING PRACTICES

Description: Daily activities occurring at Maintenance facilities often involve the use of materials and products that are potentially harmful to the environment. Good housekeeping practices are intended to reduce the potential for discharge of pollutants to the storm water drainage system or watercourses by promoting efficient and safe storage, use and clean-up methods of potentially harmful materials.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: fuel, oil (machine, hydraulic, crankcase), chemicals (acids, solvents & degreasers, corrosives, antifreeze), hazardous waste, heavy metals, nutrients, and sediments.

Best Management Practices:

1. Sweep or vacuum maintenance facility floors and pavement to prevent tracking of materials outdoors. Use mopping as an alternative to hosing down work areas when possible.

2. If mopping is used to clean floors or pavement, contain and dispose of the mop water following these guidelines:

   a) Remove any spilled oil or other liquids using dry sweep or rags.

   b) Do not dispose of mop water into the parking lot, street, gutter, or drain inlet.

   c) If an oil/water separator is available, pour the mop water into the separator so that the wastewater is treated before being discharged to the sanitary sewer system.

   d) If sanitary sewer system connection is not available, provide dead-end sump to collect liquids. Periodically clean out sump and haul to sewer system.

   e) Dispose of used rags and other contaminated materials in a safe manner.

3. Use drip pans or absorbent material under leaking vehicles and equipment to capture fluids. Promptly remove absorbent material or drip pan after use and dispose properly.

4. Recycle materials such as used oil, antifreeze, solvents or asphaltic emulsion whenever possible.

5. Ensure containers are clearly labeled.

6. Use safer alternative housekeeping products to minimize the potential discharge of toxic products to storm water drainage systems or watercourses, where practical and effective.
[See 6-D-7: Safer Alternative Products]

6-A FACILITY HOUSEKEEPING PRACTICES

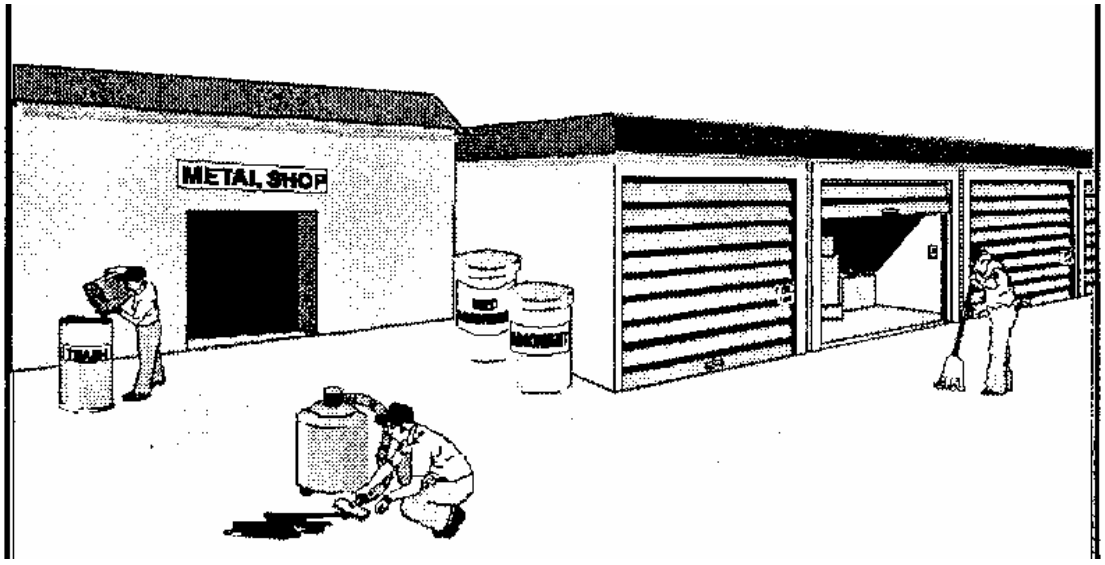
7. Perform periodic employee education about storm water management on the site.

8. Locate the expansion of existing, or the construction of new, maintenance yards outside of the 100-year floodplain.

Permits Possibly Needed:

- Notice of Intent (NOI) to SWRCB for preparation of Storm Water Management Plan to cover all BMPs for each maintenance yard site
- Preparation and compliance with Storm Water Management Plan and General Industrial Storm Water Permit from RWQCB to cover all BMPs for each maintenance yard, by March 2003.

General, every day good practices!



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

6-B BUILDING & GROUNDS MAINTENANCE

Description: Permanent maintenance facilities require building and grounds maintenance. Building and grounds maintenance includes care of landscaped areas around the facility, cleaning of parking areas and pavements other than in the area of industrial activity, and maintenance of the storm water drainage system. Minimization of water use, proper handling and disposal of waste collected and wash waters used during building and grounds maintenance, and immediate clean-up of spills are key elements in the protection of storm water quality.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: litter and debris, organic material, fertilizer, pesticides, and herbicides.

Best Management Practices:

1. For Building Maintenance:

   a) Minimize water use in washing activities.

   b) Properly dispose of wash water and sediment generated by building maintenance activities. Dispose of wash water to the sanitary sewer system where feasible. Dispose of sediment as solid waste.

   c) Regularly inspect, clean, and maintain the storm water drainage system. This is particularly important in the fall prior to the first rains.

   d) Dispose of sweepings and cleaning wastes as solid waste.

   e) Cover all dumpsters during the rainy season.

2. For Grounds Maintenance:

   a) Apply fertilizer and pesticides in accordance with the label instructions. Use integrated pest management where appropriate. (See: 3-D Vegetation Management)

   b) Avoid excessive irrigation of landscaped areas to minimize runoff containing nutrients, pesticides, and herbicides. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area. Program the amount and timing of irrigation through automatic controllers to minimize runoff and encourage deep rooting of vegetation.

   c) When flushing water lines, reuse the rinse water for landscaping purposes if possible. Note that a discharge from water line flushing is considered to be a permissible non-storm water discharge as long as large volume discharges do not adversely impact the receiving waters.

d) Shut off water source and make necessary repairs on broken water lines, sprinkler valves, or nozzles as soon as possible. When digging out the irrigation line, return the soil to the same area after repair is complete.

e) Protect downstream storm water drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines. For example, cover or block drain inlets with sand bags or plastic bags filled with native material. Remove covers/blocks once clean-up is completed.

f) Perform erosion and sediment control on erodible sites through the use of appropriate BMPs. (See: 3-A-2 Erosion Repair & Control; Appendix B-4)

3. Ensure that drains within buildings and outside storage areas do not discharge directly to the storm sewer system. Grade process and storage areas to minimize run-on into drains, such as from building downspouts. Connect on-site drains with potentially polluted runoff to the sanitary sewer system or an on-site recycling or treatment unit.

4. Ensure that any spill can be diked and contained immediately by having necessary materials on-site and appropriate training. Clean up all smaller spills using absorbent material or a dry mop method. Place absorbent material collected by sweeping into a waste container. Dispose of the contents according to approved disposal procedures. Large spills may require a private company or Hazmat (Hazardous Materials) team for complete clean-up.

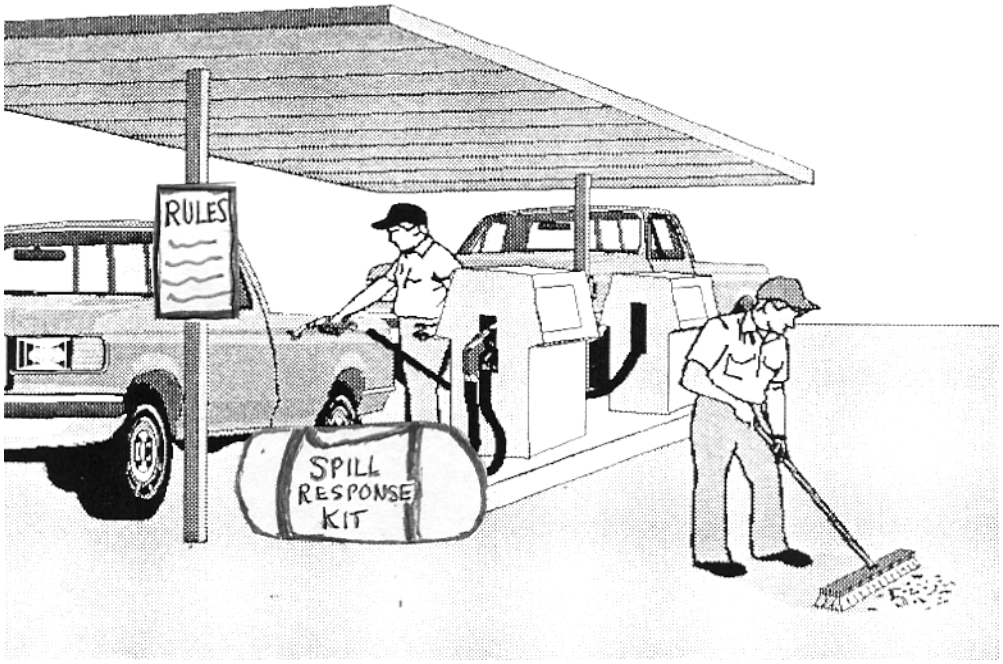
Permits Possibly Needed:

- County Pesticide Ordinance and Hazmat (Hazardous Materials) protocols.
- Comply with County Spill Prevention Control and Countermeasure Plan (SPCC) for each road maintenance yard site
- Comply with RWQCB General Industrial Storm Water Plan and Permit (March 2003)

Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

6-C VEHICLE & EQUIPMENT MAINTENANCE

This section addresses all of the activities performed for maintaining county vehicles and equipment at the maintenance yard.



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

6-C-1 Fueling

6-D-2 Maintenance & Repair

6-D-3 Pressure Washing

6-D-4 Oil/Water Separators

FUELING 6-C-1

Description: When vehicle and equipment fueling takes place at a Maintenance facility, the potential exists for fuel to be leaked or spilled at the site. The procedures for vehicle and equipment fueling are designed to minimize contact between storm water runoff and spilled fuel, oil, or other leaked vehicle fluids at equipment fueling areas.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: fuel, vehicle fluids, oil.

Best Management Practices:

1) Implement the following practices for vehicle and equipment fueling activities at each maintenance facility:
   a) Keep an ample supply of spill clean-up materials and spill control equipment near fueling areas to clean-up spills. Verify weekly that sufficient spill control clean-up materials are located near fueling areas.

   b) Post proper fueling and spill clean-up instructions at fueling areas.

   c) Never leave the area while equipment is being fueled.

   d) Install automatic shut off valves at each pump, and install manual shut off valves inside and outside of shop buildings.

   e) Provide fueling areas with secondary containment with enough capacity to contain a large spill. Pave the ground where fueling takes place, such as with concrete or chip seal, and clean up spilled fuel immediately. If ground is not paved, remove any contaminated soil and dispose as hazardous material.

   f) Ensure that fuel tanks and fuel dispensers have current permits from the appropriate agencies.

   g) Update spill prevention and control plans at least every 2 years.

2) Ensure that personnel who are involved in vehicle and equipment fueling activities adhere to the following guidelines:
   a) When cleaning the area, use a "dry shop" principle (a damp cloth on the pumps and damp mop on the pavement).

   b) Avoid hosing off the area.

   c) Inspect portable fueling tanks regularly for cracks and leaks. Repair as necessary.

   d) Handle and dispose of used spill pillows and other absorbents as hazardous waste. Be on the alert for possible fire hazards. [See: 6-D-3]

3) Clean up all spills. For example, use absorbent material or a dry mop method. Place absorbent material collected by sweeping into a waste container. Dispose of the contents according to approved disposal procedures.

Permits Possibly Needed:

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for each maintenance yard site.
- Comply with General Industrial Storm Water Management Plan and Storm Water Permit from RWQCB (3/03).
- Comply with fuel storage tank regulations of the SWRCB

Some safe fueling practices (with operator taking picture while observing fueling).

VEHICLE & EQUIPMENT MAINTENANCE & REPAIR 6-C-2

Description: Vehicle and equipment maintenance and repair may include vehicle fluid removal, engine and parts cleaning, body repair, and painting. This BMP is intended to reduce the discharge of potential pollutants from areas in which vehicle maintenance and repair activities are conducted by employing controls which minimize contact between storm water and the activity areas and products used in each activity.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: oil, vehicle fluids, fuel, solvents, paint products, or metals

Best Management Practices:

1. Perform vehicle and equipment maintenance in a designated covered facility, where feasible.

2. For Vehicle Fluid Removal:

   a) Transfer contents to designated vehicle waste fluid storage barrels or tanks as soon as possible. (See: 6-D-2 Used Oil Recycling)

   b) If required, drain fluid into a pan and immediately transfer fluid to the designated waste vehicle fluid storage barrel or tank. A larger drip pan may be placed under the primary drain pan to catch any spilled fluids.

   c) Promptly remove drip pan after use.

   d) Ensure safeguards, such as oil shut-off valves, are installed and maintained.

3. For Engine and Parts Cleaning:

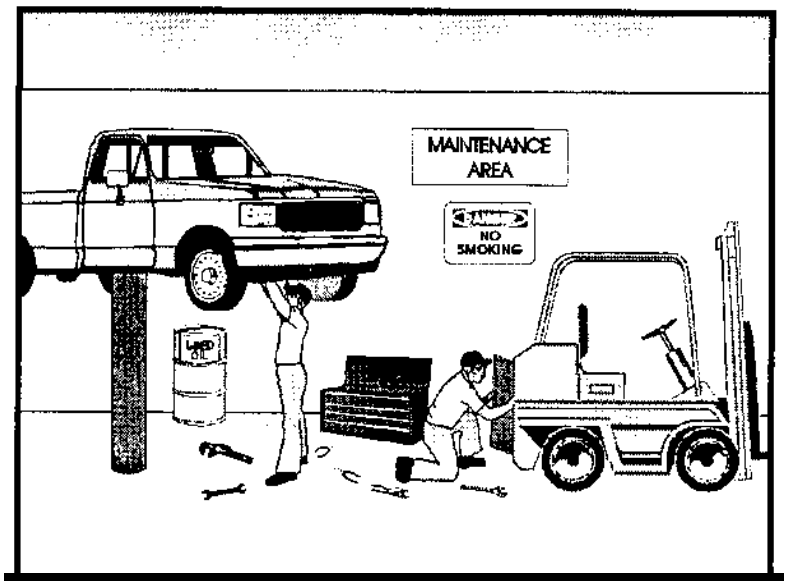
   a) Use self-contained sinks or tanks when working with solvents. Periodically check degreasing solvent tanks for leaks. Make necessary repairs as soon as possible.

   b) Allow parts to drain over solvent sink or tanks, rather than allowing the solvents to drip or spill onto the floor.

   c) Allow parts to dry over the hot tank, if available. If rinsing is required, rinse over the hot tank.

   d) Recycle wastewater from steam-cleaning or pressure washing procedures as much as possible. Wastewater from steam-cleaning cannot be poured into storm drains. Discharges of this wastewater to any sanitary sewer system may require permits and/or pretreatment (oil/water separator). [See: 6-C-4 Oil/Water Separators]

VEHICLE & EQUIPMENT MAINTENANCE & REPAIR 6-C-2



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

e) Designate specific areas in service bay for parts cleaning. Do not wash or rinse parts outdoors, since the discharge may enter a storm drain. Drains should be appropriately labeled to indicate whether they flow into a treatment system such as an oil/water separator, the sanitary system, or directly to the storm water drainage system.

4. For Body Repair and Painting:

   a) When receiving damaged vehicles, inspect for fluid leaks and use drip pans, if necessary.

   b) Minimize use of hose-off degreasers to clean body parts before painting. Instead, brush off loose debris and use rags to wipe down parts. Dispose of rags as solid waste or hazardous waste, depending on what is on them.

   c) Use a shop vacuum to clean-up dust from sanding material. Do not use vacuums for flammable liquids. Debris from wet sanding can be allowed to dry overnight and then swept or vacuumed. Dispose of dust as solid waste.

   d) Minimize waste paint and thinner by carefully calculating paint needs based on surface area and using proper sprayer cup size.

   e) Do not use water to control overspray or dust in the paint booth unless you collect this wastewater. Treat this water prior to discharge into a sanitary sewer system, if available.

   f) Clean spray guns in a self-contained cleaner. Recycle the cleaning solution when it becomes too dirty to use. Do not discharge cleaning waste to the sewer or storm drain.

5. For Drain Control:

   a) Keep internal floor drains plugged unless they drain to the sanitary sewer. Permanently seal any internal drains that still connect to the storm drain. Use dry clean-up methods, such as sweeping, when possible.

   b) Keep spill control equipment and covers available to protect external drain inlets.

Permits Possibly Needed:

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for each site
- Comply with General Industrial Storm Water Management Plan and Storm Water Permit from RWQCB for each site (to be in place by 3/03).

PRESSURE WASHING 6-C-3

Description: When vehicle and equipment pressure washing is conducted at a Maintenance facility, it is essential that the wash water not be disposed to the storm water drainage system. Alternative disposal methods include recycling or discharge to a sanitary sewer system. Proper vehicle and equipment pressure washing minimizes contact between storm water runoff and the equipment washing area, and ensures that the wash water is not discharged to the storm water drainage system or watercourses.

Environmental Concerns:

- Discharge of the following materials into groundwater (via septic system), the storm water drainage system, or watercourses: oil, fuel, cleaning products (detergents), vehicle fluids, sediment, and metals

Best Management Practices:

1. Locate vehicle and equipment pressure washing activities within a structure or building equipped with a connection to the sanitary sewer system or a closed loop system.

2. If a washing area must be located outside, the area should have the following characteristics:

   a) surrounded by berms or graded to minimize contact with storm water running onto the area;

   b) paved with concrete;

   c) draining to a dead-end sump or directly into the sanitary sewer system;

   d) no draining of the wash water containing cleaning solutions such as detergents and degreasers, or hydrocarbons, to the storm water drainage system or watercourses.

3. Designate an area for pre-wash of vehicles and equipment to capture solid materials, where feasible.

4. Inspect vehicle and equipment washing areas periodically.

5. Service the sump regularly.

6. Implement good housekeeping practices. (See: 6-A Facility Housekeeping Practices)

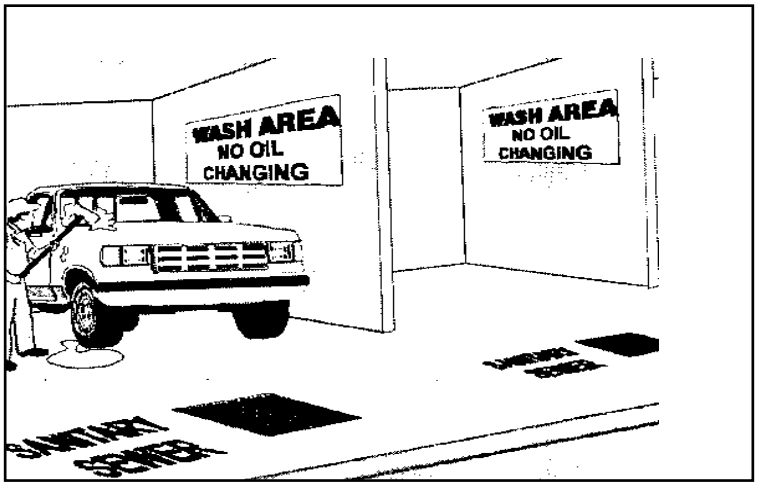
7. Inspect containment structures (such as berms) to ensure they are intact.

Permits Possibly Needed:

- Waste Discharge Permit from the North Coast RWQCB to set limits for petroleum hydrocarbons is required if wastewater discharges to a septic system leach field. The

discharge of detectable levels of petroleum constituents to groundwater is prohibited. A monitoring well may be required adjacent to the leach field to monitor the groundwater on a monthly schedule.

- Sewage treatment districts may require pretreatment and monitoring of wash water discharges to sanitary sewer.
- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for the site.
- Compliance with General Industrial Storm Water Management Plan and Storm Water Permit from RWQCB (3/03).



Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

OIL/WATER SEPARATORS 6-C-4

Description: Maintenance facilities which have vehicle wash racks or other vehicle washing areas typically have oil/water separators installed at the vehicle wash areas. Additionally, Maintenance facilities may have portable oil/water separators for pretreatment of mop water and other wash waters prior to disposal to the sanitary sewer. Oil/water separators may be used when floating product or high concentrations of oil and grease are present in wastewater and source controls will not be effective. This BMP promotes proper maintenance of oil/water separators, which reduces the potential for water pollution. These procedures are for separators that use gravity separation with baffles. Other types of separators may require other maintenance guidelines.

Environmental Concerns:

- Discharge of oil, grease, or other hydrocarbons into the storm water drainage system , watercourse, or groundwater
- Discharge of soluble oils and hydrocarbons into the soil via leach fields

Best Management Practices:

1. Oil/water separators require frequent maintenance throughout the life of the structure. The following procedures should be implemented by Maintenance personnel who are responsible for operation and maintenance of oil/water separators:

    a) Inspect and clean oil/water separators on a regular basis. Scheduled maintenance includes removal of accumulated oil and grit to maintain effective performance.

    b) Dispose of oil properly, following all applicable hazardous waste disposal guidelines. Recycle oil if possible. (See: 6-D-2 Used Oil Recycling)

    c) Grit removed from the oil/water separator may be classified as hazardous waste if it is contaminated with oil or heavy metals. Check with the local Hazmat Manager for proper procedures for disposal.

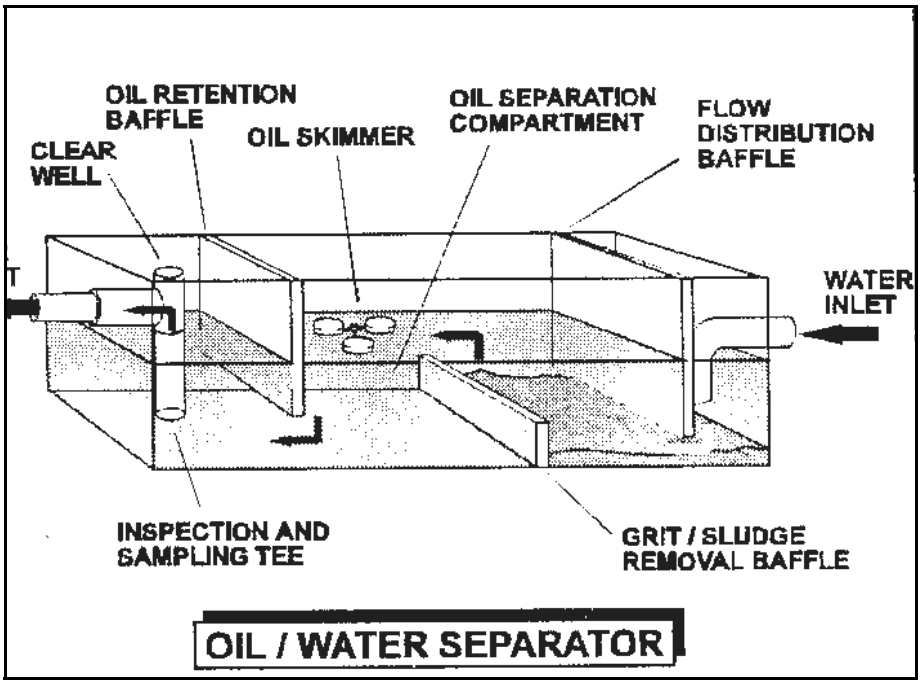
    d) Record maintenance dates of oil/water separators in order to track upkeep and to prolong the life of the device.

2. Do not discharge oils & hydrocarbons into septic tanks or leach fields.

Permits Possibly Needed:

- Separator may be a requirement of a Waste Discharge Permit from the RWQCB (SEE: 6-C-3 Pressure Washing)
- County Spill Prevention Control and Countermeasure (SPCC) Plan
- Compliance with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit (by 3/03)

OIL/WATER SEPARATORS 6-C-4



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

6-D MATERIAL USE & STORAGE

This section covers the handling, storage, and disposal of the hazardous, non-hazardous, and raw materials used in the Maintenance Yard. Hazardous material practices are included even though counties have already had to address many of these issues in separate county Hazmat programs, Hazardous Materials Business Plans, and Spill Prevention Control and Countermeasure (SPCC) Plans.

6-D-1 Waste Minimization, Handling & Disposal

6-D-2 Used Oil Recycling

6-D-3 Storage of Hazardous Materials

6-D-4 Outdoor Storage of Raw Materials

6-D-5 Outdoor Loading / Unloading of Materials

6-D-6 Above Ground Tank Leak & Spill Control

6-D-7 Safer Alternative Products

WASTE MINIMIZATION, HANDLING & DISPOSAL 6-D-1

Description: This practice is intended to reduce the potential for the discharge of potential pollutants generated during waste handling and disposal activities to the storm water drainage system or watercourses by minimizing exposure of the waste to storm water. Hazardous waste generators have specific waste minimization requirements that must be documented.

Environmental Concerns:

- Discharge of the following material into the storm water drainage system or watercourses: litter and debris, sediment, or organic and inorganic material

Best Management Practices:

1. Methods for reducing the discharge of potential pollutants in waste include source reduction, reuse and recycling, tracking of waste generation, safe storage and disposal practices, and minimizing contact between storm water and waste.

2. Purchase or order supplies in smaller quantities to minimize excess or expired materials, when possible.

3. Closely evaluate waste streams: processes generating waste, chemical spill records, shelf life expiration, and product or raw material inventory records.

4. Inspect waste storage areas to ensure that materials stored in the area are not leaking, and if they do leak, take immediate measures to repair the leak.

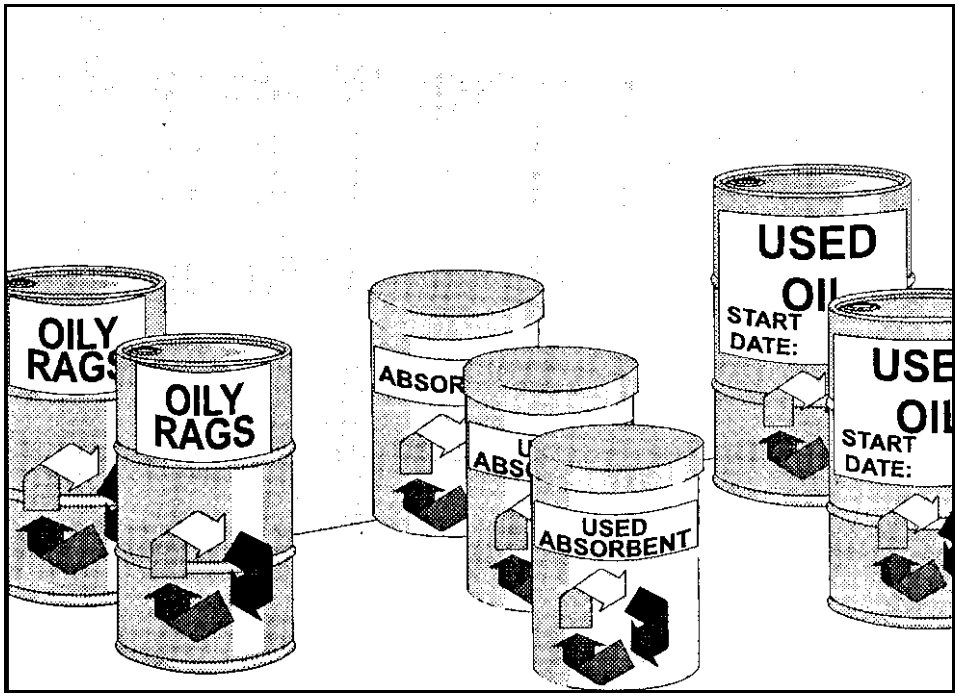
5. Train staff to minimize wastes (e.g., use all paint, stop leaks and spills, and recycle all oil). Allow empty paint containers to evaporate prior to disposal.

6. Reduce or minimize waste handling activities when it is raining, the ground is frozen, or the ground is saturated.

Permits Possibly Needed:

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for site and County Hazmat protocols.
- Comply with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit for each site (3/03).

WASTE MINIMIZATION, HANDLING & DISPOSAL 6-D-1



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

USED OIL RECYCLING 6-D-2

Description: This BMP applies to vehicle and equipment maintenance activities and other activities occurring at Maintenance facilities which generate oil. Used oil is classified as a hazardous waste and is harmful to the environment. Recycling waste oil in conformance with State regulations removes it from classification as a hazardous waste.
This practice applies primarily to uncontaminated used crankcase oil and waste equipment oil. It does not apply to waste oil containing chlorinated hydrocarbons (e.g., methyl chloride) or other hazardous substances.

Environmental Concerns:

- Discharge of oil into the storm water discharge system or watercourses

Best Management Practices:

1. Handle waste oil following the requirements for hazardous waste generators (manifest, accumulation time, biennial report, etc.).

2. Establish the following procedures for all activities that use oil:

   a) Locate a designated waste oil drum or tank near the activities that generate used oil.
   b) Designate containers for used oil filters.

   c) Cover all waste oil containers stored outside and provide secondary containment.

   d) Clearly label all containers "Used Oil" or "Used Oil Filters" and include the accumulation start date.

   e) Do not mix waste oil with any other type of waste or material, so that the oil can be recycled.

3. Manage the waste oil and filters in the following way:

   a) Drain the oil in the used filters into the waste oil drum or tank, and close the drum/tank cover securely after use.

   b) Place the used oil filter in the designated drum and close the cover securely.

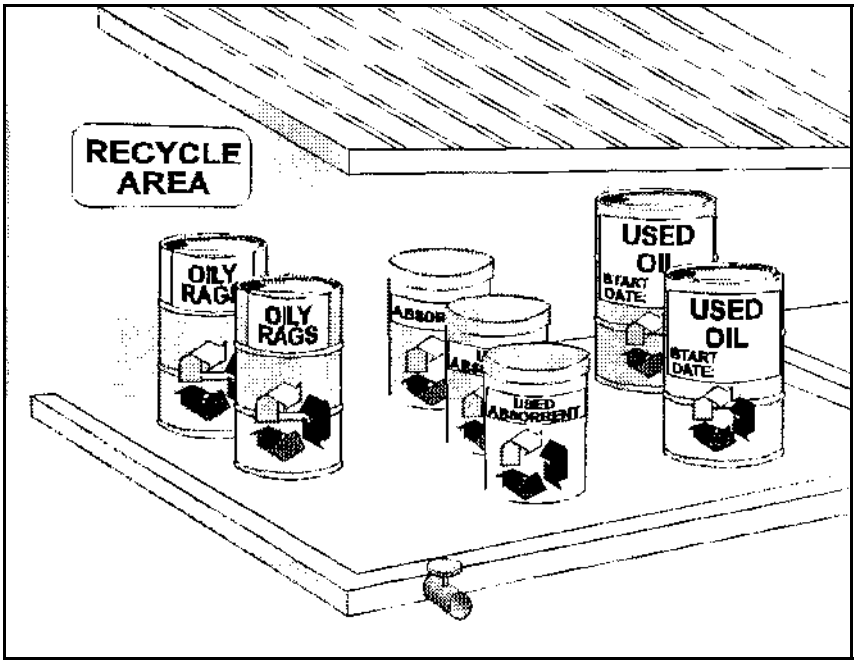
   c) Oily rags and wipes are a potential fire hazard. Place oily rags and papers in a fire-proof can designated for this purpose. Use a rag cleaning service for disposal of the rags if possible. If the rag or wipe is potentially contaminated with a listed hazardous waste, handle it as hazardous waste.

4. Typically, empty oil containers can be disposed of as solid waste if the containers are smaller than 5 gallon size. If the container size is 5 gallons or larger, send it for metal reclamation or reconditioning. Follow local regulations, which may vary.

USED OIL RECYCLING 6-D-2

Permits Possibly Needed:

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for site and County Hazmat protocols.
- Comply with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit for each site (3/03).



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

STORAGE OF HAZARDOUS MATERIALS 6-D-3

Description: Maintenance facilities store a variety of products that may be harmful to the environment if they come in contact with surface waters. This BMP is intended to reduce the potential for the discharge of materials from hazardous material storage sites to the storm water drainage system or watercourses by minimizing exposure of the materials to storm water and safeguarding against accidental release of materials.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: acids, solvents, paint products, pesticides, fertilizers, fuels, oils

Best Management Practices:

1. Follow the Hazardous Materials Business Plan filed for the Maintenance site with the County Dept. of Public Health. Hazardous materials storage must conform to this plan.

2. For Hazardous Materials Storage (General):

   a) Store hazardous materials in a designated area containing similar and chemically compatible materials. Do not store incompatible products in the same storage area without some type of physical barrier separating the containers. For example, do not store oxidizers, such as hydrogen peroxide, with organics, or flammable materials such as oil.

   b) Store hazardous materials under cover and away from areas that might drain into the storm water drainage system or watercourses, where feasible,. Store granular materials at least 10 feet from waterways, storm drains, curbs, and gutters and under cover.

   c) Keep labels on containers and ensure that covers or caps are secure.

   d) Install safeguards to prevent accidental releases such as overflow protection devices, automatic shutdown transfer pumps, protection guards around tanks and piping to prevent vehicle or forklift damage, and labeling. Limit access to unauthorized persons.

   e) Use mats during delivery and storage.

   f) Train personnel on proper handling procedures and familiarize them with the procedures in the emergency response plan. Training subjects and schedule may be listed in the Hazardous Materials Business Plan for the site.

   g) Maintain hazardous materials storage areas to minimize exposure to storm water by storing materials on paved surfaces, covering from rain and snow, minimizing storage and handling of materials, and regularly inspecting storage facilities.

h) Maintain an ample inventory of appropriate spill clean-up materials near the storage area. Keep absorbent and baking soda on hand to soak up spilled fluids and to neutralize spilled acid from cracked batteries.

i) Attend to any spills immediately.

j) **Notify County Environmental Health office and the State Office of Emergency Services (OES) at 800-852-7550 when a hazardous spill occurs**. [See: 8-C Accident Clean-Up, for Notification Process]

k) Store hazardous liquid and solid materials with secondary containment (Uniform Fire Code Article 80, Section 8003.1.3.3).

l) Store used lead acid batteries, including cracked batteries, in secondary containment.

m) Have proper storage instructions posted at all times in an open and conspicuous location.

3. For Regular Maintenance of Outdoor Container Storage Area:

   a) Inspect storage areas regularly or weekly and before and after rainfall events. Ensure all containers are properly labeled, covered, securely fastened, and in good condition. Check for external corrosion or other signs of wear of material containers (CCR Title 22 Section 66265.174).

   b) If a container is corroded or leaking, have trained and qualified personnel or the local Hazmat Manager transfer wastes to a new clean container. Label the new container appropriately and properly dispose of the old container. The old container may be classified as hazardous waste.

   c) Repair and/or replace perimeter controls, containment structures, and covers as necessary to ensure their proper functioning.

4. For Paint Storage Area:

   a) Inspect all pallets of paint to ensure that they are securely fastened before moving.

   b) Load and off-load paint on level ground when using a forklift to minimize possible spills and ruptures of paint containers.

   c) Where feasible, store paint materials in an area with a canopy or roof designed to direct run-on away from the area.

5. For Wood Post Storage Area:

   a) Cover wood post storage areas during the rainy season.

6. For Disposal:

   a) Dispose of hazardous waste only at authorized treatment, storage and disposal facilities. Illegal dumping of hazardous waste is a violation subject to fine and/or time in jail.

   b) Use licensed hazardous waste haulers for threshold quantities as required by state and federal regulations.

   c) Cover trailers carrying hazardous materials during transit. Illegal transit of hazardous waste is a violation subject to fine and/or jail time.

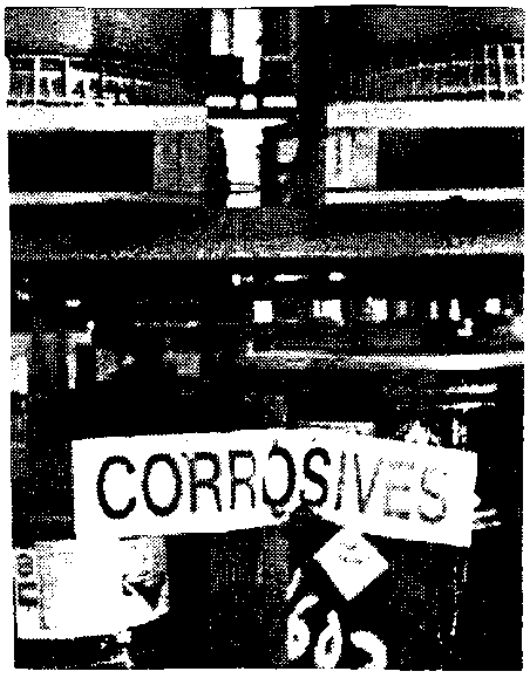
Permits Possibly Needed:

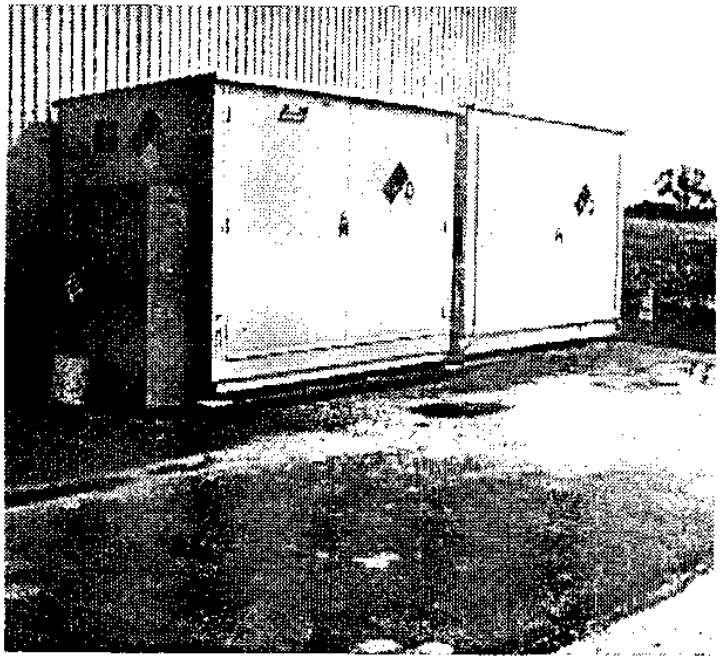
- Transport and disposal of contaminated material and hazardous waste must be in accordance with the rules and regulations of the following agencies:
  - U.S. Dept. of Transportation (USDOT)
  - U.S. Environmental Protection Agency (USEPA)
  - California Environmental Protection Agency (CAL-EPA)
    - California Dept. of Toxic Substances Control (DTSC)
  - California Div. of Occupational Safety and Health Administration (CAL-OSHA)
  - Local Regulatory Agencies (e.g., County Dept. of Public Health)

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan *f*or site and Hazmat Plan protocols.

- Comply with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit for each site (3/03).

STORAGE OF HAZARDOUS MATERIALS 6-D-3





Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

OUTDOOR STORAGE OF RAW MATERIALS 6-D-4

Description: Maintenance facilities and activities based out of Maintenance facilities store a variety of products (e.g., asphalt, sand, soils, treated wood posts, and mulch) that may be harmful to the environment if they come in contact with storm water runoff. The BMP is intended to reduce the potential for the discharge of products from outdoor raw material storage sites to the storm water drainage system or watercourse by minimizing exposure of the products to storm water.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: soils, aggregates, asphalt and concrete products, mulches, road abrasives, salt, wood products

Best Management Practices:

1. Store materials away from areas that might drain into the storm water drainage system or other watercourse. Route stormwater run-on away from material storage areas through grading or sloping of the site, where feasible.

2. Cover the storage areas with a canopy or roof that is designed to direct run-on away from the storage area, where feasible.

3. Cover (tarp) dry materials that are not under a roof or canopy to prevent water intrusion during the winter season, where practical.

4. Protect storm drain inlets with sand bags, geotextile dams, filtration socks, berms, hay bales, etc. (See: 3-A-2 Erosion Repair & Control; Appendix B-8 & B-9)

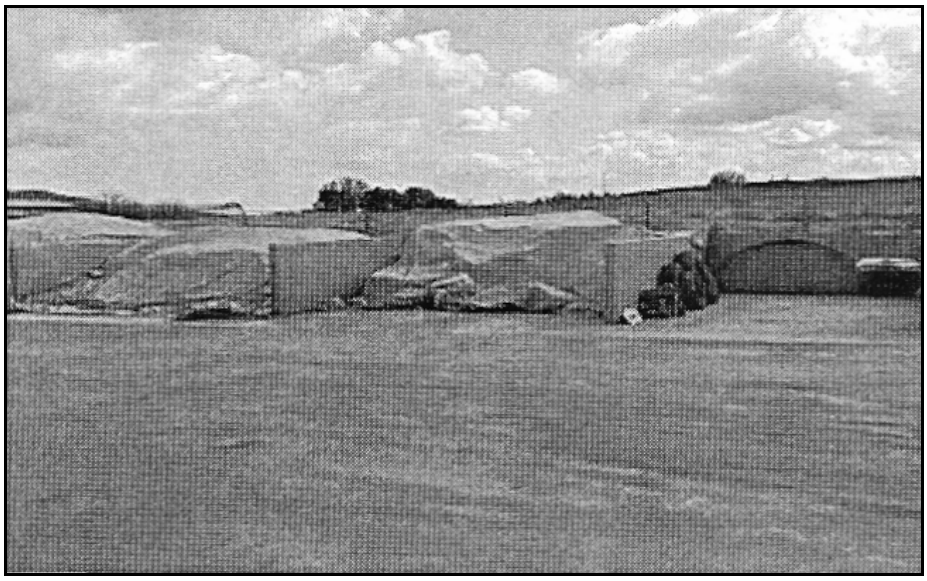
5. Promote good housekeeping procedures, including sweeping of surfaces where material is blown or washed from the storage area, keeping materials covered, and keeping storage containers in good condition. (See: 6-A Facility Housekeeping Practices)

6. Inspect storage areas regularly.

Permits Possibly Needed:

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for the site
- Comply with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit for each site (3/03)

OUTDOOR STORAGE OF RAW MATERIALS 6-D-4



Note water repellent coverings on storage piles

Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

OUTDOOR LOADING/ UNLOADING OF MATERIALS 6-D-5

Description: This BMP describes procedures and practices for the loading and unloading of materials in a manner which minimizes the discharge of the materials to the storm water drainage system or watercourses.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: pesticides, fertilizers, cleaning products, petroleum products, asphalt, concrete, paint products, hazardous materials (acids, lime, glues, adhesives, solvents, and curing compounds)

Best Management Practices:

1. Conduct outdoor loading and unloading on paved surfaces, where feasible.

2. Store an ample supply of spill clean-up materials in readily accessible locations in the vicinity of the loading/unloading area.

3. Limit exposure of the materials to precipitation. (See: 6-D-4)

4. Regularly check loading and unloading equipment for leaks before and after use.

5. Contain any leaks that occur during the transfer of materials.

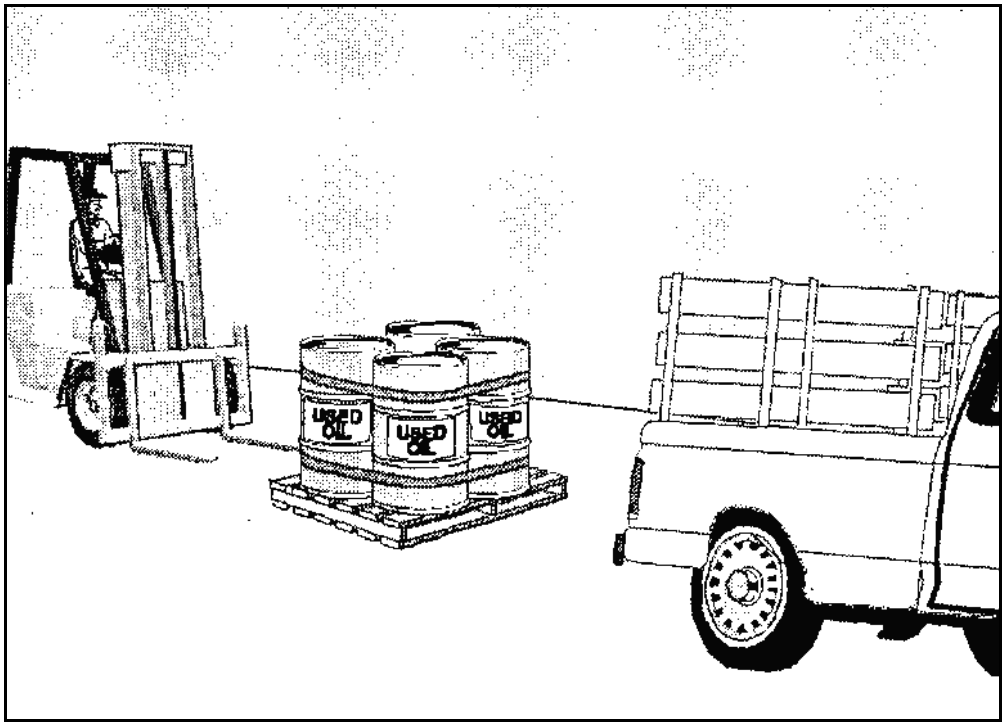
6. If practical, place drip pans under hoses when making connections and during liquid material transfer. Promptly remove drip pan after use.

7. Inspect loading/unloading areas before and after precipitation events, and as needed during other times to promote good housekeeping.

8. Repair and replace perimeter controls, containment structures, and covers as needed to keep them properly functioning.

Permits Possibly Needed:
- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan
- Comply with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit for each site (3/03)

OUTDOOR LOADING/ UNLOADING OF MATERIALS 6-D-5



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

ABOVE GROUND TANK LEAK & SPILL CONTROL 6-D-6

Description: Maintenance facilities may use above ground storage tanks for storage of bulk quantities of liquids. Often the liquids stored are potentially harmful to the environment. This BMP is intended to reduce the discharge of potential pollutants to the storm water drainage system or watercourses from above ground storage tanks by installing safeguards against accidental releases. Most tanks are now double walled for added protection.

Environmental Concerns:

- Discharge of the following materials into the storm water discharge system or watercourses: fuel, oil, paint, herbicides, asphaltic emulsion

Best Management Practices:

1. Control any spills immediately. For example, soak up wet spills using an absorbent material or dry mop. Place absorbent material collected in a waste container and dispose of the contents according to approved waste disposal procedures.

2. If a large spill or rupture should occur, call 911 and contact the Road Supervisor and the local Hazmat Manager. It may be necessary to use a private clean-up company or a Hazmat team for clean-up. [See also: 8-C Accident Clean-Up]

3. Block all storm drain inlets during a spill, and unblock after clean-up is completed.

4. Keep an appropriate spill kit near above ground tanks. Such a kit includes an ample supply of clean-up materials (absorbent materials, shovel, rags, and plastic bags). Update and replenish the spill kit as changes occur in the types of materials stored.

5. Inspect existing above ground storage tanks, secondary containment, and associated valves and piping for external corrosion, structural failure, and loose connections.

6. When required, review appropriate Spills Prevention Countermeasures and Control (SPCC) plan for the Maintenance facility.

7. Inspect or test rainwater in secondary containment prior to releasing.

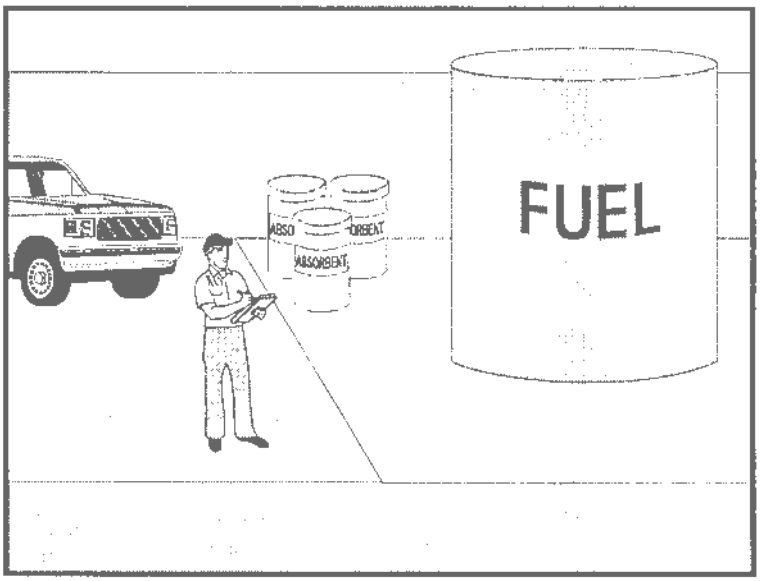
8. After releasing rainwater from secondary containment, ensure that drain valve is closed.

Permits Possibly Needed:

- Comply with County Spill Prevention Control and Countermeasure (SPCC) Plan for site and Hazmat Plan protocols
- Comply with RWQCB General Industrial Storm Water Management Plan and Storm Water Permit for each site (3/03)

ABOVE GROUND TANK LEAK & SPILL CONTROL

6-D-6



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

SAFER ALTERNATIVE PRODUCTS 6-D-7

Description: A variety of products that may be harmful to the environment if they come in contact with surface waters are used in maintenance facilities and activities. In some cases, a harmful product may be replaced with one less harmful which serves the same purpose. The less harmful product is referred to as a safer alternative product. The primary purpose of using safer alternative products is to reduce the potential for discharging toxic products to storm water drainage systems or watercourses. However, some alternative products may not be available, effective, or cost-effective in every situation.

Environmental Concerns:

- Discharge of the following materials into the storm water drainage system or watercourses: automotive products, cleaning products, paint products, pesticides, fertilizers, building products

Best Management Practices:

1. When safer alternative products exist for cleaning products, paints, pesticides, automotive products, and fertilizers, *use* where practical and effective.

2. Supervisors responsible for ordering products should select products based on the guidelines below:

   a) Automotive products - In some cases, less toxic alternatives are not available for all automotive products (e.g., lubricants, coolants, hydraulic fluids), but there are less toxic alternatives to car polishes, degreasers, and windshield washer solutions.

   b) Cleaning products - Vegetable-based or citrus-based soaps and asphalt release agents are available to replace petroleum-based soaps/detergents.

   c) Paint products – Water-based paints, wood preservatives, stains, and finishes are available.

   d) Pesticides/Herbicides – Specific alternative products or methods exist to control most insects, fungi, and weeds. Use "general use" (non-restricted use) herbicides.

   e) Fertilizers – Compost and soil amendments are natural alternatives to chemical fertilizers.

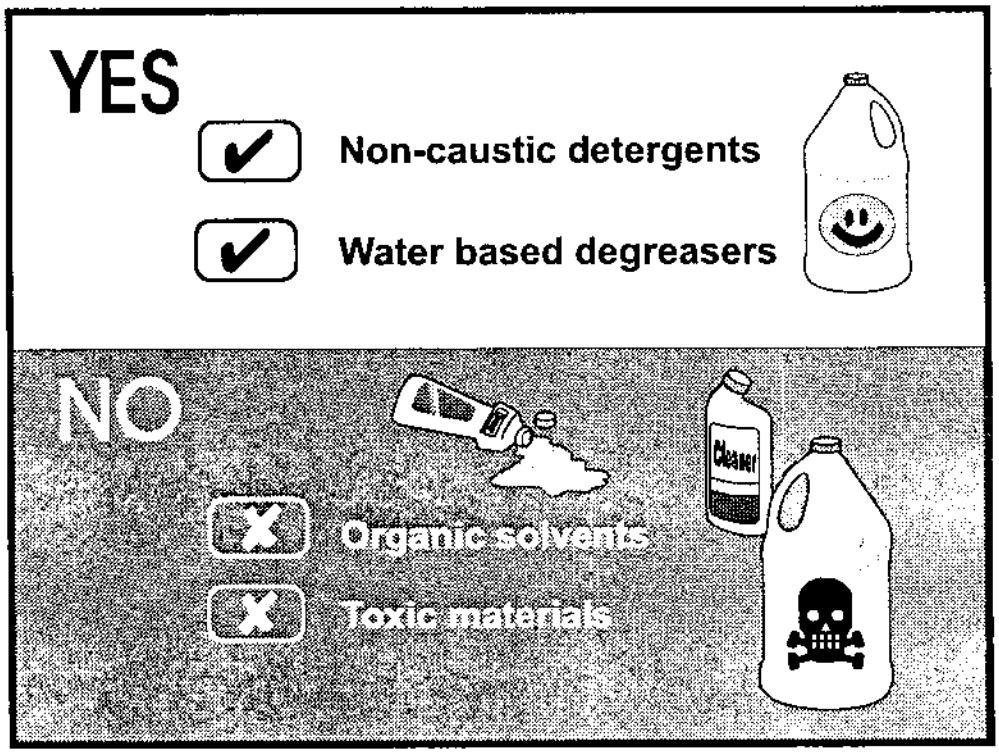
   f) Building products – Pressure-treated wood posts are alternatives to wood posts treated with creosote.

3. Use training to create awareness among employees regarding the use of safer alternatives.

4. Even safer alternative products can result in the discharge of harmful materials to storm water drainage systems or watercourses. Use safer alternative products in strict accordance

with manufacturers' recommendations. (See: 6-A Facility Housekeeping Practices; 6-D-1 Waste Minimization, Handling, and Disposal)

Permits Possibly Needed: None



Source: Caltrans Storm Water Quality Handbook – Maintenance Staff Guide (1998)

CHAPTER 7
MAINTAINING THE BRIDGES

The main purpose of this manual is to maintain a high level of water quality while maintaining our county roads, bridges, and other county facilities. Due to their close proximity to streams, bridges have a high potential to discharge pollutants directly into aquatic habitat. Special care should be taken while cleaning, maintaining, repairing, and controlling vegetation on county bridges.

The goals of this chapter are:

- Maintain public safety and open roads for the traveling public
- Prevent or minimize delivery of sediment and chemicals to streams
- Protect aquatic and riparian habitat

7-A Bridge Maintenance

7-B Bridge Repair & Drift Removal

7-A BRIDGE MAINTENANCE

Introduction:

Bridge maintenance includes cleaning and other routine maintenance activities such as painting, patching, and vegetation control. During any of these maintenance activities, attempt to keep all substances out of the water by blocking drains, capturing debris, and transporting the waste to a safe storage site.

7-A-1 Bridge Cleaning and Maintenance

7-A-2 Bridge Vegetation Management

BRIDGE CLEANING AND MAINTENANCE 7-A-1

Description: Maintenance and replacement of bridge structures includes washing, painting, scraping and patching of curbs, rails, deck joints, on wood, concrete and steel bridge components. Cleaning is done with hand and power tools, such as a high-pressure wash. Washing removes water-soluble surface contaminants, existing coatings, rust and oil and grease and care must be taken with the disposal of washwater and debris. Of special concern is the complete containment of existing paint residue containing lead, which is a toxic heavy metal pollutant that accumulates in animal tissues. Bridge repainting tends to be needed mostly in coastal areas where salt air causes corrosion of the steel surfaces when paint is not maintained. Severely corroded areas of a bridge will need abrasive spot blasting and priming before painting.

Environmental Concerns:

- Discharge of the following materials into the stream or storm water drainage system: epoxies, lead-based paint, metal grindings, concrete grindings and cuttings, expansion joint filler, concrete mix water, and concrete rinse water.
- Impacts on bats, swallows and other protected species, especially during nesting season.

Best Management Practices:

1. Take adequate measures in maintenance activities to ensure that paint and other hazardous material do not enter waters of the State or the riparian area.

2. Keep non-hazardous materials and debris from falling from the structure into the water or the riparian area. Remove any material that falls into the water in the least destructive way possible, or leave in place if this would be less destructive to fisheries habitat, according to CDFG biologist. Coordinate with CDFG biologist for presence of listed salmonids or their redds below bridge locations.

3. Temporarily block deck drains over streams and scuppers over streams when pressure washing, sandblasting, or scraping structures, to route water off deck and into a safe collection facility. Allow no washed material to be deposited in riparian area. Stage the operation to capture and collect as much debris as possible. Transport the waste back to a Maintenance facility or approved storage site.

4. Remove large debris from bridge decks with sweeper or shovel. Scrape other material by hand before being collected or removed, prior to pressure washing.

5. Develop practices to eliminate drainage systems that drain directly to streams where physically and economically possible.

6. Collect broken or damaged treated bridge pier fender posts and bring them back to a Maintenance facility. Dispose of the posts according to approved waste disposal practices.

7. Coordinate with CDFG on the appropriate timing for performing bridge cleaning or maintenance with regard to bats and swallows. Seek and apply approved methods, such as netting and other measures, to preclude future nesting on the bridge.

8. Follow these guidelines for bridge washing:
   a) Perform during high water event or when turbidity induced by bridge cleaning is not detectable ¼ mile downstream.
   b) Use cold-water pressure washing to prevent the removal of lead-based paint.
   c) Do not use any soaps or detergents.
   d) Place a tarp containment system under the working platform and sidewalk to capture any paint chips, dirt, lead-contaminated cleaning debris, and pressure washing water.
   e) Contain and dispose of filtered wash water and all cleaning debris off site.
   f) To avoid harming swallows and bats using the bridge for habitat:
      i) Avoid washing tight areas (e.g. cracks, crevices) where bats may be present.
      ii) If bats are observed, cease washing operations.
      iii) If birds are building nests, laying eggs, or tending young, no washing will occur.
      iv) Consider adding netting to the bridge to keep swallows from building nests.
      v) If any of the above criteria cannot be met, the local CDFG office must be contacted and the individual bridge will be discussed.

9. Follow these guidelines for bridge painting:
   a. Transport paint and materials to and from work sites in containers with positive locking lids. Secure paint containers to the transport vehicle using approved methods (e.g., Ropes and straps). When using conventional spray equipment, monitor weather and wind direction to ensure that paint is not entering drain inlets, the storm water drainage system, or watercourses.
   b. Do not transfer or load paint near drain inlets, the storm water drainage system, riparian areas, or watercourses.
   c. Use canvas or plastic tarps under the work area to capture excess paint or paint chips. Transfer material captured by the canvas or tarps into a waste container for disposal at a maintenance facility.
   d. Collect all paint equipment wash water and return it to a maintenance facility. If possible, dispose of the equipment washwater in waste water evaporation trays at the facility. After the liquid evaporates, dispose of the remaining paint solids according to approved waste disposal procedures.
   e. If waste water evaporation trays are not available, consult the County Hazmat manager for proper disposal.
   f. Develop an emergency spill management plan for each bridge painting project. See: 8-C Accident Clean-up

Permits Possibly Needed:

- Waste discharge permit for potential discharge of paint (especially if lead-based) and other hazardous materials may be required by RWQCB. Report of Waste Discharge must first be

submitted to Regional Board. Before beginning project, a Water Pollution Control Plan must be submitted describing the BMPs to be used.

- Storm Water Management Plan and Storm Water Permit (3/03) may be require BMPs.
- Maintenance of an existing bridge facility is categorically exempt from CEQA (14 CCR Section 15301).
- Notify CDFG about any potential waste discharge, salmonid habitat, and bat and swallow issues.
- Swallow species most often found on bridges are not listed ESA or CESA species but are protected under the Migratory Bird Treaty Act, which makes it unlawful to "take" the bird or its nest or eggs. Consult with US Fish and Wildlife Service. Violators may be fined up to $10,000, and may face up to 6 months imprisonment for misdemeanor violations of the Act.

BRIDGE VEGETATION MANAGEMENT 7-A-2

Description: This topic includes vegetation management around existing bridges. The primary purpose of bridge vegetation management is to maintain sight distance. Bridge vegetation management must also maintain access to the bridge structure for structure maintenance, fire safety, and to maintain the integrity of the structure.

Environmental Concerns:

- Excessive removal of riparian trees could affect stream habitat
- Excessive removal of vegetation could cause soil erosion, leading to discharge of sediment into stream or storm water discharge system.
- Noise may disturb bats and/or nesting swallows.

Best Management Practices:

1. Normally remove only brush to 20 feet on either side and under all maintained bridges for access or repair. (In some instances, road access under or adjacent to the structure will be outside the 20 foot buffer).

2. Remove only the amount of brush necessary to perform the activity.

3. When removing mature trees (over 12-inch diameter) in riparian areas, replant two native or appropriate seedling/cuttings for every tree removed. Ensure that the replanted trees will not pose future threat to County structures. Leave downed trees in the riparian area for large woody debris (LWD) recruitment into the stream channel.

4. Ensure no herbicide spraying or runoff of spray occurs on bridge and related structures located over streams or adjacent to riparian areas or wetlands.

Permits Possibly Needed:

- Comply with County Tree Ordinance

7-B BRIDGE REPAIR & DRIFT REMOVAL

Introduction:

Bridge repair and drift removal both entail work within active flowing streams. Any in-water work requires pre-project coordination with CDFG and RWQCB except in the case of an emergency. It is essential that temporary or permanent impacts, such as removal of large woody debris or the addition of riprap, will not have adverse effects on riparian habitat.

7-B-1 Bridge Repair

7-B-2 Drift Removal

BRIDGE REPAIR 7-B-1

Description: This activity includes repair of bridges and large culverts (over six feet diameter). In-water bridge repair can include repair or replacement of riprap, drainage features, and catch basins and replacement of structural members. Bridge structural repairs that require in-water work will be coordinated with permitting agencies to minimize impacts. In-water work may include permanent impacts, such as placing riprap, or temporary impacts, such as installing falsework or stream access.

Environmental Concerns:

- Discharge of sediment, debris, concrete, paint, or chemicals into the stream or storm water drainage system
- Damage to or loss of riparian vegetation from excessive riprap, disposal of refuse material, or heavy equipment
- Impacts on bats, swallows, and other protected species

Best Management Practices:

1. Consider use of bioengineering solutions in bridge repair work that requires installation of riprap, where practicable. "Practicable" use areas includes areas unshaded by bridge elements, above the full bank stage where success is probable and safety of the bridge structure is assured, and where the flow capacity is not diminished.

2. Ensure that the active flowing stream will not come into contact with fresh, plastic concrete. Where and when necessary, divert water away from concrete work areas during structural repairs of bridges and culverts as noted in #7 below. (SEE: 4-F Temporary Stream Diversions)

3. When repairing drainage features, make every attempt (within the engineering solution) to incorporate fish passage solutions and enhancements, such as adding streambed roughness (by adding cobble), in coordination with CDFG.

4. Perform any in-water work within time frames negotiated with the agencies.

5. Place all refuse material above the bank outside of the 100 year flood plain and away from waterways, riparian areas and wetlands. Dispose of material in locations and manners identified in the local disposal plan. (See also: 5-A Spoil Disposal)

6. Provide stable, appropriate concrete truck chute clean-out area and require the contractor to use it to keep material from being deposited in watercourses and riparian areas. (See: 3-B-1 Surface Work – BMPs for Concrete Mixing on Site)

7. Use cofferdams or other water diversion structures for structural repairs as appropriate. Do not place during spawning and egg incubation stages of local salmonids unless an emergency (See: 8-A Emergency Maintenance) . Use during the dry season and only after the area has

been cleared of residing fish species. (See: 4-F Temporary Stream Diversions and Appendix B-8)

8. Contain saw chips where feasible.

9. Avoid use of creosote or "Penta" treated wood for permanent structures.

10. Minimize impacts to riparian vegetation and replace disturbed areas with native plants. (See: Chapter 12-D Sources of Materials; Appendix B-4.5 Planting & B-4.8 Seeding)

11. If existing bridge has a non-erodible sill, check with CDFG to see if fish passage (adult or juvenile) is a problem. If passage is a problem and the sill is avoidable, seek to remove sill or replace with a bridge designed to function without a sill. If a non-erodible sill is unavoidable, provide a suitable fish passage structure. Channel instability may require the fish structure to be monitored and adjusted as channel conditions change. (See: Appendix B-6 Fish Ladders)

12. Seek to have temporary bridge structures (such as Big R, or Bailey bridges) available within the county that could be used to temporarily replace a washed-out bridge in an emergency. (See: 8-A Emergency Maintenance)

Permits Possibly Needed:

- DFG 1601 Streambed Alteration Agreement for in channel work and work that could "result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake".
- CWA 404 permit for work within "waters of the U.S." from US Army Corps of Engineers (COE).
- CWA 401 Water Quality Certification permit or Waiver (if 404 permit required) from RWQCB.
- Replacement bridges designed using federal funds must meet requirements recommended by FHWA and Caltrans to avoid significant impacts to the environment and flood risk (23 CFR Ch.1, 650.103)
- Emergencies: Pre-project permits are not required before emergency bridge repair work can begin. However, agencies must be notified within 14 days after the repair project has begun. (SEE: Chapter 8 – Working with Emergencies)

DRIFT REMOVAL 7-B-2

Description: Drift removal involves either using boats to maneuver the drift, hydraulic tongs to reach over the side of structure and dislodge the material, or pulling the drift from the side of the bridge (bank) and cutting it into pieces.

Environmental Concerns:

- Reduction of instream habitat quality due to removal of excessive large woody debris (LWD) from stream system.
- Damage to or loss of riparian vegetation by removal equipment.

Best Management Practices:

1. Cut material only when necessary and turn drift to allow it to flow through and under the structure, where doing so would not endanger any other crossing structures downstream.

2. Repair and restore riparian areas temporarily impacted by machinery during drift removal. Long-term access for drift removal will be coordinated with CDFG. (See: Appendix B-4 Erosion Control)

3. Perform all work within the flowing channel of any aquatic system during the appropriate in-water work window for that system, or as negotiated with CDFG (except when there is imminent danger to life, limb, or structure).

4. Minimize channel disturbance by using, where possible, specialized equipment, such as a crane with clam shell bucket to remove debris.

Permits Possibly Needed:

- CDFG 1601 Streambed Alteration Agreement if the project may "substantially change the bed, channel, or bank of any river, stream or lake".

- Emergencies: Pre-project permits are not required before emergency work can begin. However, agencies must be notified within 14 days after the repair project has begun. (SEE: Chapter 8 – Working with Emergencies)

CHAPTER 8
WORKING WITH AN EMERGENCY

To keep county roads always open and safe to the traveling public, crews must deal with emergency situations which can block roads, wash out bridges, or cause spills. The intent of this chapter is to help the road crew deal with these emergency scenarios in ways that will also protect water quality and stream habitat.

Primary goals for this chapter are:

- Maintain public safety and open roads
- Prevent or minimize delivery of sediment and chemicals to streams
- Protect aquatic and riparian habitat

8-A Emergency Maintenance – General

8-B Slide and Settlement Repair

8-C Accident Clean-Up

8-A EMERGENCY MAINTENANCE – GENERAL

Description: This action includes fixing damage to roadways, the roadside and structures (bridges) caused by storms, floods, and other activities. Failure to perform these activities may result in immediate threat to life, limb, or structures. Typical activities include: routine storm damage patrol, debris removal, emergency opening of road, and repairs to roadbed, slopes, and drainage facilities. After a major flood, for example, it may take several days to identify the extent of county road-related problems. While one cannot control the timing or location of where emergency situations will occur, the county can plan for various emergency scenarios involving county roads and the need for stream protection.

Regulatory Definitions of "Emergency":
COE regulations: "A situation which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process the application under standard."
ESA rules: "A situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property." (50 CFR 402.05)
California Environmental Quality Act: "A sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property or essential public services. Emergency includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage." (CEQA 15359)

Environmental Concerns:

- Discharge of sediment, organic material, and other potential pollutants to the stream or storm water drainage system

Best Management Practices:

1. Provide quick response and first inspection, and notify appropriate agencies in a timely manner (see list under Permits below).

2. Avoid additional impacts to wetlands, riparian areas or streams where possible.

3. Ensure appropriate training of county road staff in emergency response measures, including hazardous materials handling.

4. Provide adequate erosion control or bank stabilization necessary to keep material from entering watercourses. Include bioengineering and fish friendly designs in such emergency remedial actions, where practicable for road or bridge stability and public safety (See: Appendix B-4 Erosion Control)

8-A EMERGENCY MAINTENANCE – GENERAL

5. Seek to have temporary bridge structures (such as Big R, or Bailey bridges) available within the county that could be used to temporarily replace a washed-out bridge in an emergency.

6. For flood debris removal at bridges, see: 7-A – Drift Removal

7. Ensure that any needed excavation of excess material in a stream channel above and below a bridge or a stream culvert is done only to the original baselevel of the streambed, not below it. If too much is removed, a new channel is created causing headcuts to migrate upstream within the floodplain and altering the ability of the floodplain to store fine sediment. This practice is particularly critical where roads cross forested floodplains and floodplain fans where sediment is stored at the mouth of small ephemeral tributary canyons.

8. When an emergency situation is significantly impacting, or could impact, a stream system (e.g., the natural flow of a watercourse is disrupted by a large flood or landslide), seek the advice of appropriate experts prior to performing the permanent repair work. Relevant expertise includes professional hydrologists, geologists, geomorphologists, geotechnical engineers, and fishery biologists.

9. Perform any additional remedial work that may be required by the permitting agencies as a condition of the post-project permits.

Permits Possibly Needed:

- DFG regulations (Fish & Game Code Section 1601(f)): Project proponents are not required to notify DFG or obtain a Streambed Alteration Agreement before commencing the following emergency work under these conditions: 1) immediate emergency work necessary to protect life or property; 2) immediate emergency repairs to public service facilities under specified circumstances; 3) emergency projects undertaken, carried out, or approved by a public agency to maintain, repair, or restore an existing highway, as defined, within the existing right-of-way of the highway, damaged as a result of fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide, within one year of the damage. Work needed in the vicinity above and below a highway may be conducted outside of the existing right-of-way, if it is needed to stop ongoing or recurring mudslides, landslides, or erosion that pose an immediate threat to the highway or to restore those roadways damaged by mudslides, landslides, or erosion to their predamage condition and functionality. This exception does not exempt any project undertaken, carried out, or approved by a public agency to expand or widen a highway damaged by fire, flood, storm, earthquake, land subsidence, gradual earth movement, or landslide.

- NOTE: CEQA (Sect. 15269) has similar wording for emergency work.

- Instream work requires that DFG be given written notification of emergency work within 14 days **after** work begins.

8-A EMERGENCY MAINTENANCE – GENERAL

- Instream work requires COE pre-project notification. A post-project 404 permit must be applied for. Nationwide Permit #3 authorizes the repair, rehabilitation, or replacement of those structures destroyed by storms, floods, fire or other discrete events, provided the repair is begun (or under contract to begin) within 2 years of the date of their destruction or damage.

- Instream work requires a RWQCB post-project 401 permit, where a 404 permit is required.

- Work potentially impacting stream habitat with ESA-listed species requires NMFS pre-project notification if federal funding is being used or federal permits are required (ESA Section 7 - emergency consultation). A sheet with the following information can be faxed to the Arcata or Santa Rosa office, "Attention: ESA Section 7 Emergency Consultation":

  - ✓ County & department name
  - ✓ Road Name & Number
  - ✓ Mile post number
  - ✓ Adjacent stream name
  - ✓ Emergency: describe cause & extent
  - ✓ Brief description of proposed action
  - ✓ Contact Person name with: phone / fax / e-mail

8-B SLIDE AND SETTLEMENT REPAIR

Description: This action includes repair of settlements and slides by placing fill and removing material. Emergency settlement and slide repairs are done primarily when a road is in danger of collapse and to forestall an emergency.

Repair of minor slides and slip-outs includes: cleaning up or backfilling minor slides, slip-outs, or other minor damage to the roadside, the removal of materials (soil, rock, boulders) that have been deposited on the roadway by wind, water, or minor landslides, placing dikes or otherwise controlling drainage at minor slides and slip-outs, filling and repairing minor erosion damage to cut and fill slopes, and clearing the roadside of downed or damaged vegetation.

Environmental Concerns:

- Discharge of sediment, organic debris, asphalt, and other potential pollutants into the stream or storm water drainage system
- Stream habitat damage from heavy equipment use instream or in the riparian zone

Best Management Practices:

1. Follow actions for Emergency Maintenance – General (8-A) and for Erosion Repair & Control (Chapter 3-A-2; Appendix B-4, B-7).

2. Locate and identify watercourses, drain inlets, and drainage ditches downstream of the area where minor slides and slip-outs are being repaired and cleared.

3. Protect watercourses, drain inlets, and drainage ditches from discharges of sediment or organic material. For example, install temporary sediment barriers such as rock filter berms or sandbag barriers. [See: Appendix B-9]

4. Avoid sidecasting of debris material at the site to prevent the discharge of any pollutants into the stream system. Obtaining immediate passage of emergency vehicles may require some sidecasting in some road areas where identified safe disposal sites cannot be reached quickly, but minimize such practice.

5. Identify and plan for slide debris disposal sites in anticipated slide areas as part of local spoil disposal plans. [See: Chapter 5: Disposing the Spoil]

6. Stockpile material initially removed from roadways away from drain inlets, drainage ditches, or watercourses, whenever feasible. Install temporary sediment barriers around stockpiled materials in the winter rainy season after the clean-up and repair of the minor slide and slip-out is completed. [See: Chapter 5: Disposing the Spoil]

7. When clearing the roadside of downed or damaged vegetation, avoid placing the vegetation near drain inlets, or in watercourses or drainage ditches. Leave any large woody debris (LWD) in the adjacent riparian area if it does not pose any threats to downstream structures.

8-B SLIDE AND SETTLEMENT REPAIR

8. Apply a temporary ground cover of protective mulch to protect the soil surface of the disturbed site from rain and wind erosion, when possible. [See: 3-A-2 Erosion Repair & Control; Appendix B-4]

9. Set up the work area in such a way that vehicles will not track materials in or out, where possible.

Permits Possibly Needed:

- Work affecting stream habitat with ESA-listed species requires that NMFS be contacted prior to any emergency repairs if possible, or as soon as practially possible after, for any emergency project using federal funding. [See 8-A Permits for details]

- Instream work requires DFG 1601 written notification within 14 days from start of emergency project.

- Instream work requires COE post-project 404 permit

- Instream work requires RWQCB post-project 401 permit

8-C ACCIDENT CLEAN-UP

Description: This action includes removal of accident debris, including response to hazardous spills. The accident may be due to: a) county activity, or b) activity by non-county entity or individual, which the county is assisting in cleaning up. Emergency clean-up practices address the isolation, containment, identification, hazard assessment, proper removal, and disposal of spilled substances on highway rights-of-way. Proper containment and clean-up of spilled material, especially material that is spreading rapidly, will reduce the discharge of potential pollutants into watercourses.

Upon knowledge of an incident, County Maintenance's prioritized responsibilities consist of: 1) maintenance of public safety; 2) ensuring through County Environmental Health, County Sheriff, contractors, or other responsible parties, that the appropriate cleanup is properly performed as identified in local accident response procedures.

Environmental Concerns:

- Discharge of hazardous materials, powder or granular materials, liquid materials, or vehicle fluids, into the watercourse or storm water drainage system
- Potential for spilled product entering a creek or stream to contaminate entire downstream course, killing or harming aquatic animal and plant life
- Remote locations of many county roads significantly limit time response time to a major spill into the stream system, reducing the effectiveness of potential remedial measures

Limitations:

- County Road Maintenance actions will be based upon the information available at the time of the emergency. Primary responsibility is to prevent damage, notify the response team, and follow the Incident Commander's instructions.
- The County does not have legal responsibility for clean-up outside of the operating right-of-way in cases where the spill is generated by a third party.

Best Management Practices:

1. Follow County Spill Contingency Plan or Emergency Operations Plan, if none available. Identify key spill response sites around the county, in cooperation with other emergency response agencies, where roads are near to streams and carry truck traffic with potential for spills. Include such plans as an Appendix to this manual.

2. Ensure sufficient, proper and regular training of county road staff in spill contingency measures, especially with hazardous materials. [See: 11-A Training the Staff]

3. Provide proper emergency spill response equipment (such as kits, river booms, oil skimmer) at all maintenance yards and other strategic spill response sites.

4. For spills on roadways:
   a) Contain spill so it does not enter flowing waters of the stream system, including the storm drain system along the roads.

b) Ensure that each county road project site contains spill clean-up/ emergency response kits with sufficient materials to contain at least a small to moderate spill (1-50 gallons).
c) Minimize further tracking of spilled material.

4. For drain inlet protection:
   a) Look to see where the flow of the spill would go.
   b) Identify drain inlets and outlets and watercourses, both upstream and downstream.
   c) Where safe to do so, protect downstream drainage systems and watercourses from spilled material by covering or blocking storm drain inlets. For example, cover storm drain inlets with sand bags, plastic bags filled with native material, or absorbent booms or other appropriate devices. Remove covers/ blocks once clean-up is completed.

5. Work closely with DFG's Office of Spill Prevention and Response (OSPR) in developing appropriate training, equipment and strategy for dealing effectively with any potential stream spills.

Useful References:

DFG Pollution Response Manual (1998) & Spill Responses Training Manual, DFG - Office of Spill Prevention & Response (OSPR), Sacramento

Upper Sacramento Spill Contingency Plan (Resources Agency & DFG) – based on experience of the toxic "Cantara Spill" caused by Southern Pacific Railroad derailment in 1991

Deer Creek Canyon Highway 32 Contingency Spill Plan and Assessment (2000) – prepared by Deer Creek Watershed Conservancy, Tehama County

Permits Possibly Needed:

- Hazardous material in the storm water drainage system: Notification process is most important with hazardous spills. (See sample Notification Checklist from Humboldt County, Div. of Environmental Health). To notify as soon as possible:
  - ✓ County Sheriff – for dispatch and if substance is off-highway in unincorporated area
  - ✓ County Division of Environmental Health – for all incidents
  - ✓ CDFG - if substance is in or near a waterway or affects wildlife – 1-888-334-2258 (CalTIP number)
  - ✓ CDFG – OSPR – Oil and gas spill reporting at 1-888-334-2258
  - ✓ RWQCB – if substance is in or near a waterway (Co. Environmental Health is responsible for notifying)
  - ✓ Local Hazardous Materials Response Team (HMRT) – in the event of a significant hazardous materials incident, Level II or greater, the HMRT shall be requested immediately by on-scene personnel.
  - ✓ State Office of Emergency Services Warning Center – for all incidents – (800) 852-7550 or Oils Spills at 1-800-OILS-911
  - ✓ California Highway Patrol – if substance is on a roadway or State Highway

8-C ACCIDENT CLEAN-UP

- ✓ Coast Guard Marine Safety Office – if spill is near coast, off shore, or in a bay, call 1-800-424-8802 (National Response Center)
- ✓ US EPA – if substance is in other than navigable waters and response is beyond the capabilities of local and state resources – (800) 424-8802 National Response Center
- ✓ NMFS – if potential for contamination of stream with listed salmon or steelhead
- ✓ Landowner(s) of site where spill occurred, if adjacent to county road.

- Fines are likely for those responsible for accidental spills:

  DFG: "Water pollution from these unpermitted sources is unlawful: petroleum, acid, coal or oil tar, lampblack, aniline, asphalt, bitumen, or residuary product of petroleum, or carbonaceous material or substance;… or any substance or material deleterious to fish, plant life, or bird life." Civil penalty of not more than $25,000 for each violation is possible. (Fish & Game Code Section 5650)

CHAPTER 9
DEALING WITH SNOW & ICE

Snow removal and ice control work includes all work in connection with snow removal, snow hauling and disposal, maintaining drainage systems in the winter months, and applying sand, de-icing, and anti-icing chemicals. Proper snow and ice control will reduce the discharge of de-icing agents, anti-icing agents, and sediment to watercourses.

Primary goals for this chapter are:

- Maintain public safety and open roads
- Prevent or minimize delivery of sediment and chemicals to streams

9-A Snow and Ice Removal

9-B De-icing/Anti-icing and Sanding

9-A SNOW & ICE REMOVAL

Introduction:

It is important to keep dirty snow and ice out of watercourses since water quality can be degraded from the sand and de-icing chemicals entrained in the ice. Containing the snow and ice at disposal areas and planning ahead all lead to cleaner streams and healthier fish.

9-A-1 Snow and Ice Removal

SNOW & ICE REMOVAL 9-A-1

Description: Snow/ice removal consists of plowing snow and ice from bridges, roadways, and shoulders. Activities also include the truck haul of snow to disposal areas, opening drains covered by snow and ice, and opening roads that are normally closed for the winter season.

Environmental Concerns:

- Discharge of sediment (sand and cinders) and deicing agents (salt, CMA) into watercourses or the storm water drainage system.
- Discharge of fuel or oil from leaking snow removal equipment into watercourses.

Best Management Practices:

1. Develop winter management and operation plans that identify critical areas, with levels of service for roads and methods for maintaining levels of service during winter weather.

2. Inspect snow and ice control vehicles and equipment for fuel and oil leaks prior to using. [See: 6-C Maintenance Yard: Vehicle & Equipment Maintenance]

3. Where possible, avoid blowing or pushing ice, snow, abrasives, or other debris into watercourses, the storm water drainage system, or where a storm water drainage system inlet can be blocked.

4. Stop sidecast sweeping within 50 feet of structures over water, where possible.

5. Clean inlets prior to first rain as feasible. [See: 3-D Winterizing Roads]

6. Modify blade angles or blower hoppers in sensitive areas.

Permits Possibly Required:

None required

9-B DE-ICING, ANTI-ICING & SANDING

Introduction:

These practices include applying anti-icing agents to the road in advance to prevent ice from bonding to the surface, as well as applying de-icing agents after ice has formed to "de-ice" the road surface. De-icing agents typically include sand, salts, while anti-icing agents include magnesium chloride and potassium acetate. Anti-icing is the preferred practice, when feasible. It is important to keep these agents out of watercourses to protect water quality.

9-B-1 Sanding

9-B-2 De-icing and Anti-icing Chemicals

SANDING 9-B-1

Description: Sanding activities put sand on road and bridge surfaces to provide for safer driving surfaces. Winter weather will determine the rates of application for sand. The County should recycle sanding material into shoulders. It has been estimated that anywhere from 10-50% of the sand applied is re-used or trapped. The majority of the sand is removed from the road by plows, up to 60 feet off the road. The County should capture sand around bridges, and near streams where possible.

Environmental Concerns:

- Discharge of sediment (sand and cinders) into the watercourses or storm water drainage system.
- Adding fine sediment to salmon spawning gravels or rearing habitat, which can reduce the chance of survival for eggs and juveniles.
- Impact of particulates from sand and cinders on air quality.

Best Management Practices:

1. Place barriers in site-specific locations along streams or direct drainages to route sanding/anti-icing material away from watercourses, where appropriate and practical. [See: Appendix B-8 Water & Runoff Diversions]

2. Identify and create facilities to capture sanding material where appropriate.

3. Reduce quantity of sand applied where appropriate.

4. Where necessary, sweep after storms to remove sand and cinders. [See: Appendix B-9.9 Sweeping]

5. Use road abrasives that have been washed, or screened, or graded to reduce silt and clay to insignificant levels.

6. Where possible, store sand in covered stockpiles in area where frozen crust will not form on the stockpile. [See: 6-D-4 Outdoor Storage of Raw Materials]

Permits Possibly Required:

None required

DE-ICING & ANTI-ICING CHEMICALS 9-B-2

Description: Magnesium chloride, potassium acetate, and calcium magnesium acetate (CMA) are applied as anti-icers to prevent water from bonding to the pavement. Salts (sodium chloride, calcium chloride, and potassium chloride) are applied as de-icing agents once ice has formed. Winter weather will determine rates of application for sand and anti-icers.

Environmental Concerns:

- Discharge of de-icing agents into the watercourse or storm water drainage system.
- Chemical depletion of oxygen in stagnant water (by CMA) or increase of conductivity in quality of stream water (by salts).
- Salt damage to trees adjacent to a road or in a location affected by runoff.

Best Management Practices:

1. Minimize the application rates of sand where sand could wash off into the streamcourse.

2. Use anti-icing products on bridges and roads where permitted and during freezing fog in lieu of sanding, when optimum conditions exist, where adjacent water bodies support a 100:1 dilution factor, or where there is a vegetative buffer between the road and water body and there is no standing, shallow water.

3. Seek use of alternative de-icing agents that are environmentally friendly.

4. Calibrate spreaders routinely. Do not over-apply de-icing agents.

5. Maintain accurate records of the locations for salt application and quantities of salt used. Follow recommended salt application rates.

6. Wash equipment used in the application of de-icing agents at a wash area that discharges to a sanitary sewer system or water recovery system using detergents.
   [See: 6-C-3 Maintenance Yard: Pressure Washing]

7. Store de-icing agents in covered areas, bunkers, or storage buildings. Do not store de-icing chemical where they will come in contact with storm water runoff. [See: 6-D Maintenance Yard: Material Use & Storage]

8. See ODOT video, "CMA: A Valuable Tool for Winter Operations" (18 min.).

Permits Possibly Required:

- Chemical use may be addressed as part of the County's Storm Water Management Plan and Permit, if needed.

CHAPTER 10
MONITORING THE PRACTICES

This section addresses the need to evaluate the success of the manual's practices in protecting water quality, fish, and stream habitat. A practical approach is proposed to fit the realities of time, funds, and capabilities of County staff. Self-monitoring by the County is the most economical and effective in order to identify and rectify problems. The County Road Erosion Inventory of 2001-02 is one method being used of developing baseline information on existing and potential water quality problem sources. Documentation of problems also needs to be shared with agencies responsible for protecting water quality and fish habitat. Manual review and updating procedures are also recommended in this chapter. Adaptive management is the term used to describe this process of learning from experience, or using the feedback from monitoring to change or add BMPs if needed.

The goal for this chapter is to document whether the BMPs in this manual:

- Prevent or minimize delivery of sediment and chemicals to streams
- Prevent or minimize the interruption of normal runoff into streams
- Protect aquatic and riparian habitat
- Restore access for fish movement at stream crossings

10-A Documentation & Reporting

10-B Monitoring

10-B-1 BMP Implementation Monitoring
10-B-2 BMP Effectiveness Monitoring
10-B-3 Photopoint Monitoring
10-B-4 Project Monitoring

10-C Manual Review & Updating

10-A DOCUMENTATION & REPORTING

Description: This section is about the documentation of water quality or stream habitat problems and any identified problems which are related, or possibly related, to county road maintenance practices or accidents. Results from selective self-monitoring of the implementation and effectiveness of BMPs (see: 10-B) can be summarized in a simple format.

1. Annual Report: Develop an annual report by January of each year to summarize the County's self-evaluation of the effectiveness of its road maintenance BMPs and this manual in protecting water quality and stream habitat. The intent is to provide a fairly simple process for documentation that can be used internally by the county and can be shared with the other counties and agencies (see (e) below) in the region. Suggested contents include the following items:

a) Investigations of possible water quality and ESA-related problems from maintenance activities identified by County Road staff, other agencies, or members of the public. (See #2 below.)

b) Modifications of, or improvements to, any Best Management Practices in this manual, including summaries of challenges or successes in applications.

c) Compliance reviews, performance assessments, and the results of selective monitoring activities of maintenance actions.

d) Investigations of illicit discharges to County rights of way or drainages.

e) Overall summary of contacts and coordination with California Dept. of Fish and Game, National Marine Fisheries Service, and North Coast RWQCB on specific issues.

f) Outline of future work & monitoring activities planned for the next year, in tables or spreadsheets.

2. Problem Review Documentation:

a) Document any problems identified by County Road staff, agencies, or members of the public on impacts to water quality or stream habitat possibly caused by maintenance activities as a standard operating procedure. The documentation will include the basis of the perceived problem, results of the investigation, and resolution of issue, or recommendations.
   - Problems to be reviewed can represent a very wide spectrum of issues, ranging all the way from complaints with no factual basis to problems that result in significant changes in department operations.

b) Develop an Environmental Problem Report Form (1 page) for Maintenance Practices. Maintain all reports in a file at the relevant District and Headquarters offices.

10-B MONITORING

Description: Monitoring is a formal process for evaluating the effectiveness of the BMPs in this Maintenance Manual in protecting, maintaining, and enhancing water quality and stream habitat, particularly for listed salmon and steelhead. The intent of the process is to make adjustments to road maintenance practices as needed. However, it is not practical for the county to monitor every practice or every site.

Types and Purposes of Monitoring

Implementation Monitoring**:** This type of monitoring assesses whether the BMP activities recommended in this manual were carried out as planned. Typically this is carried out as an administrative review and does not involve any water quality or habitat measurements. The intent is to provide immediate feedback to the managers on whether the BMP process is being carried out as intended. However, the results cannot be linked back to water quality or aquatic habitat as none of these measurements are being made.

Effectiveness Monitoring: Effectiveness monitoring is used to evaluate whether the specified activities had the desired effect, specifically a particular BMP. Evaluating individual BMPs may require detailed and specialized measurements best made at the site of, or immediately adjacent to, the management practice. Effectiveness monitoring often occurs outside of the stream channel and riparian area, even though the objective of a particular practice is intended to protect the quality of the aquatic habitat. In contrast, monitoring the overall effectiveness of BMPs is usually done in the stream channel and it may be difficult to relate these measurements to the effectiveness of individual BMPs.

Project Monitoring: The impact of a particular activity or project, such as a culvert replacement, is assessed through this type of monitoring. Data are usually taken upstream and downstream of, or before and after, the particular project. Since such comparisons may partly evaluate the overall effectiveness of BMPs used to mitigate any environmental impacts associated with the project, project monitoring could be considered a type of effectiveness monitoring. Often project monitoring is required as a condition of grant funding for projects by state and federal agencies.

Policies:

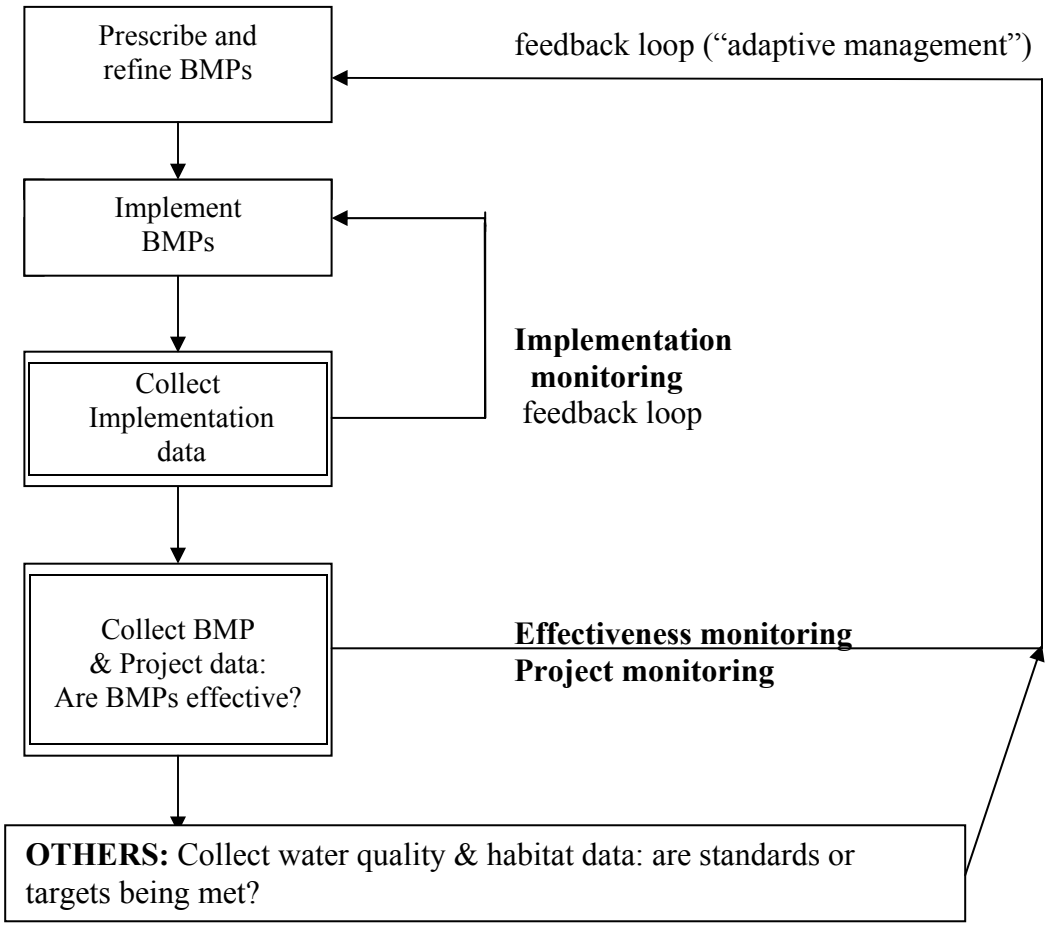
1. Monitor the Implementation and Effectiveness of the manual's Best Management Practices (BMPs) as needed in the course of developing necessary documentation, as well as responding to specific issues.

2. Commit to doing selective monitoring of county road maintenance activities related to this manual, depending upon available resources. An internal audit of road department activities by another county department is also an option.

3. Participate in inter-agency or partnership research programs, as appropriate, that monitor the effectiveness or impacts of the agency's maintenance activities on stream habitat or water quality. Share research results with others in the region.

4. Continue to network with other counties, agencies, and municipalities about effective monitoring of non-point source pollution from roads that are similar to county roads.

Monitoring for Feedback by County Road Departments



Possible Sources of Instream Monitoring Data Collected by Others:

- Local Resource Conservation Districts (RCDs)
- Local watershed councils
- Local water districts and agencies
- California Dept. of Fish and Game (DFG)
- California Dept. of Water Resources (DWR)
- North Coast Regional Water Quality Control Board
- U.S. Forest Service / Bureau of Land Management (BLM)
- U.S. Fish & Wildlife Service

10-B-1 IMPLEMENTATION MONITORING

Description: This type of monitoring assesses whether the BMP activities recommended in this manual were carried out as planned. Typically it is carried out as an administrative review and does not involve any water quality or habitat measurements. Since it is not practical to measure every practice, practices are reviewed selectively.

Method:

Selective monitoring can be done in many ways, such as by selecting: 1) all practices on several dates; 2) all practices within a certain category (such as 5-A Spoil Disposal) over a period of time; 3) randomly selected practices within randomly selected categories on randomly selected dates; or 4) some other combination.

Potential data to be collected at an on-site review of selected BMPs include answers to the following:

A) Were each of the practices implemented as recommended in the manual? _____

Ratings to be used:
1 = Exceeds BMP recommendation
2 = Meets BMP recommendation
3 = Minor departure from BMP
4 = Major departure from BMP
NA = criteria not applicable at this site

B) List the possible reasons why the implementation departed from the BMP, and describe:

- ❑ Emergency conditions
- ❑ Safety concern
- ❑ Lack of adequate equipment or materials
- ❑ Lack of adequate personnel
- ❑ Lack of training
- ❑ Unaware of BMP
- ❑ BMP was not practical (list why_____)
- ❑ Off-site problem
- ❑ Other_____

C) Can any of the BMP procedures being implemented be improved? Please describe new or improved BMP procedures. (Attach additional comments or drawings as necessary)

10-B-2 EFFECTIVENESS MONITORING

Description: Effectiveness monitoring is used to evaluate whether the specified activities or a particular BMP had the desired effect, such as provide fish passage, or prevent erosion and sedimentation. Evaluating individual BMPs may require detailed and specialized measurements best made at the site of, or immediately adjacent to, the management practice. Some of this monitoring can be done by county staff, while some aspects may best be done by others specializing in field monitoring. It is assumed that routine instream monitoring will not usually be done by County road staff for the purposes of this manual, unless special funding and appropriate expertise are provided. The focus of BMP effectiveness will be on direct evaluation of upslope conditions and potential for water quality and habitat impairment. Instream data routinely collected by others will be sought and used as an indirect indicator of BMP effectiveness.

Baseline conditions for county roads in the region were evaluated for erosion and fish passage problems in 2000-02. These sites can be re-evaluated after projects are completed or other BMPs have taken place, as the baseline data are readily available.

Method:

Effectiveness monitoring can be done in many ways, such as by selecting: 1) all practices on several dates, such as before and during storms; 2) all practices within a certain category (such as 5-A Spoil Disposal) over a period of time; 3) randomly selected practices within randomly selected categories on randomly selected dates; or 4) some other combination. The Five Counties need to be able to compare the results of their separate BMP monitoring efforts. The two options described below are intended to help primarily answer the question, "*Is the potential reduced for sediment or chemical delivery to the streams due to road maintenance by the use of this BMP*?"

Option A:

1) Use County erosion (DIRT) inventory process, plus any sites previously missed, to systematically reevaluate selected high and medium priority sediment delivery sites after remedial work is done or BMP is implemented. Purpose would be to estimate the effectiveness of areas where BMPs have attempted to correct the identified problem. Comparisons would be made of estimated pre- and post-treatment sediment delivery rates. Include blank Data Inventory Sheet in Appendix. Road Managers should maintain a data inventory sheet for each site identified as a sediment delivery site in order to track current condition, replacement history, and effectiveness of implemented BMP at each site.
2) Use Culvert Inventory process by fishery biologist to systematically re-evaluate fish passage effectiveness following culvert replacement or improvement BMPs. "Did this culvert replacement or improvement BMP help provide adequate fish passage?"

Option B: Visual evaluations of the following problem indicators, if relevant to the BMP and the evaluation site, can be completed with minimal time and training. Use Photopoint Monitoring (10-B-3) to depict each of these estimates, where relevant.

1. **Road surface**
   a. **Rilling**
      - Little or no evidence

- ❑ Some present, but occur on < 10% of road length, or where present do not leave road surface
- ❑ >10% of surface length has rills 2" deep and 20' in length that continue off road surface

2. Road cuts or fills

a. Rilling

- ❑ No evidence
- ❑ Rills present but do not extend > slope length below toe
- ❑ Rills present and extend > slope length below toe

3. Sediment to channels

- ❑ No evidence of transport to watercourse or storm water drainage system
- ❑ Sediment deposited near but not in channel
- ❑ Sediment deposited in channel (estimate amount below)
  - ❑ <10 cu.yds.
  - ❑ 10-500 cu.yds.
  - ❑ 500-1,000 cu.yds.
  - ❑ 1,000-5,000 cu.yds.
  - ❑ >5,000 cu.yds.

4. Slope failures: A) Cut slope B) Fill slope C) Hillside

- ❑ Less than 10 cu.yd. of material moved
- ❑ More than or equal to 10 cu.yd. of material moved but not into channel
- ❑ More than or equal to 10 cu.yd. of material moved into channel

5. Debris

- ❑ No debris from project in channel or near watercourse
- ❑ Debris near watercourse but not in it
- ❑ Debris in watercourse or storm water drainage system

6. Road drainage – cross drains (not stream crossings)

a) Plugging

- ❑ No evidence of sediment or debris restricting flow
- ❑ Sediment and/or debris is accumulating, but <30% of inlet or outlet blocked
- ❑ Sediment and/or debris is blocking >30% of inlet or outlet

b) Scour at outlet

- ❑ No evidence of scour
- ❑ Scour evident, but does not extend >20' below outlet
- ❑ Scour evident > 20' below outlet

7. Stream crossing – Culvert

Stream is __perennial ___intermittent ___ephemeral

a) Diversion potential

- ❑ Crossing is configured to pass flows without diversion if culvert fails
- ❑ If culvert fails, flow will be diverted out of channel and down roadway

b) Plugging
- ❑ No evidence of sediment or debris restricting flow
- ❑ Sediment and/or debris is accumulating, but <30% of inlet or outlet blocked
- ❑ Sediment and/or debris is blocking >30% of inlet or outlet

c) Scour at outlet
- ❑ No evidence of scour
- ❑ Scour evident, but extends less than 2 channel widths below outlet; and no undercutting of crossing fill
- ❑ Scour evident that extends more than 2 channel widths below outlet, or scour is undercutting crossing fill

8. Evidence (or risk) of chemical/ hazardous discharge
- ❑ No evidence of discharge outside bermed containment areas
- ❑ Evidence of discharge outside containment area has > 50' slope length to nearest channel, or to ditch that drains to a stream channel
- ❑ Evidence of discharge outside containment area and within 50' of a channel, or to a ditch that drains to a stream channel.

9. Complaints by staff, other agencies, or public of practice
- ❑ No verbal or written complaints
- ❑ Verbal or written complaints received

10. Sediment removed from channel system [Name watershed:_____] due to County Maintenance operations:
a. Culvert cleaning
b. Ditch cleaning
c. Landslide clearing
d. Other
   - ❑ < 10 cu. yds
   - ❑ 10-500 cu. yds.
   - ❑ 501-1,000 cu yds
   - ❑ 1,001-5,000 cu yds
   - ❑ > 5,000 cu yds

11. [Other]

If poor effectiveness is evident, comment on:
1) possible causes (e.g., site sensitivity, inadequate BMP, major storm event);
2) the degree and duration of effects on water quality or habitat

10-B-3 PHOTOPOINT MONITORING

Description: Photopoint monitoring means taking a series of photographs from the same point. This method is especially recommended for monitoring sediment delivery because it captures a complete inventory or baseline through a quick and repeatable process. By documenting through successive photos, the implementation and effectiveness of sediment control measures can also be monitored. In addition, photopoints can be used to evaluate the effect of practices on riparian conditions and fish passage in culverts and under bridges.

Methods:

1. **Camera**: Either a 35 mm color or digital color camera is recommended. A digital camera is preferred for the ease of sharing and storing photos electronically. Use the same camera to the extent possible for each photo throughout the duration of the monitoring.

2. Permanently mark designated photopoint sites with a fence post, ground marker, or some other suitable object. The marker should be made of durable material that can withstand climatic conditions over a long period of time. Once markers are established, their locations and the dates of the photographs should be recorded on the form following. A Geographic Positioning System (GPS) unit may be helpful to identify location if the resolution of the equipment is within about 10 feet.

3. **Monitoring site location and map**. Include any general information about marker location on or near the road or facility on the description. Direction in which to photograph should be given by a compass heading from the photopoint. Any obvious landmarks should also be recorded, particularly "witness points" (a point from which a photopoint can be seen). Record the same type of information for the second and third photopoints if needed for the site. Space is provided on the form for notes about these locations. [SEE: "Sediment Delivery Photopoint Monitoring Record" form]

    a) For stream sediment load or erosion monitoring, take pictures of these views:
        i) Long views from bridge or other elevated position;
        ii) Medium views of stream with a person for scale;
        iii) Close views of streambed with ruler or other common object for scale;
        iv) Time series: Views above and below BMP site during high runoff

4. **Photograph documentation.** Record detailed information on each photograph taken: date/time, photographer, photopoint number, camera/lens/film speed, film roll# /frame#, and other observations of details specific to that particular year or condition, such as changes in weather conditions and management practices. Storm events are opportune times to capture evidence of any erosion and sediment delivery problems. Effective photopoint monitoring requires consistency in taking photographs from year to year. Such consistency can be maintained by following these suggestions:

    a) Use a date-back camera that records at least the date on the photograph. Be familiar with where the date is positioned so the date can be put in a darker area of the photograph.
    b) When taking the photographs, carefully follow the information provided for each photopoint. This includes using a similar camera, lens, and film.
    c) Take the photographs during the same season every year and at the same time of day.

d) Use a staff gage to provide scale in the photograph. The gage should be at least 6 feet long and have 1-foot increments visibly marked. It can be made from PVC, wood, or other materials on hand.

5. **Document Storage.** Store the photographic record and photographs with other important records. Each successive year's photographs can be documented and filed with the appropriate record. Make sure digital photos are stored on both back-up disks and on hard copy.

For more information:

California Association of Resource Conservation Districts. 2001. Guidelines for Citizen Monitors. Wild on Watersheds Program. Sacramento. [Free @ (916)447-7237]

Lewis, D., Tate, K. and J. Harper. 2000. Sediment delivery inventory and monitoring: A method for water quality monitoring in rangeland watersheds. UC Cooperative Extension Publication 8014. California Rangelands Research and Information Center, U.C. Davis. [Free @ (530) 752-1720]

10-B-4 PROJECT MONITORING

Description: The impact of a particular activity or project, such as a culvert replacement, is assessed through this type of monitoring. Data are usually taken upstream and downstream of, or before and after, the particular project. Since such comparisons may partly evaluate the overall effectiveness of BMPs used to mitigate any environmental impacts associated with the project, project monitoring could be considered a type of effectiveness monitoring. Often project monitoring is required as a condition of state and federal grant funding for projects

Methods:

1) If a proposed project requires financing through outside grant funding, first check on the monitoring requirements of the granting agency to get a realistic estimate of what types of monitoring will be expected as a result of this grant.

2) Incorporate the cost of project monitoring into the total project budget estimate.

3) Before signing the project contract, be sure that the required monitoring tasks can be accomplished within the known budget and with the available expertise.

4) Implement the project monitoring requirements of the funding agency or agencies.

5) Document the before, during and after phases of the project through Photopoint Monitoring (see 10-B-3).

6) If a project includes a BMP or multiple BMPs in this manual, use the final monitoring report as one evaluation of the BMP's effectiveness. Share the results with the Five Counties' effort.

References:

California Dept. of Fish and Game. 2002. "Project Evaluation and Monitoring" In: California Salmonid Stream Habitat Restoration Manual. 4th Edition. Sacramento. [//www.dfg.ca.gov/nafwb]

10-C MANUAL REVIEW & UPDATING

Description: This County Road Maintenance Manual for Water Quality and Habitat Protection is a work-in-progress. As such, it will require periodic review and updating in order to keep it relevant, effective and practical for the users.

Methods:

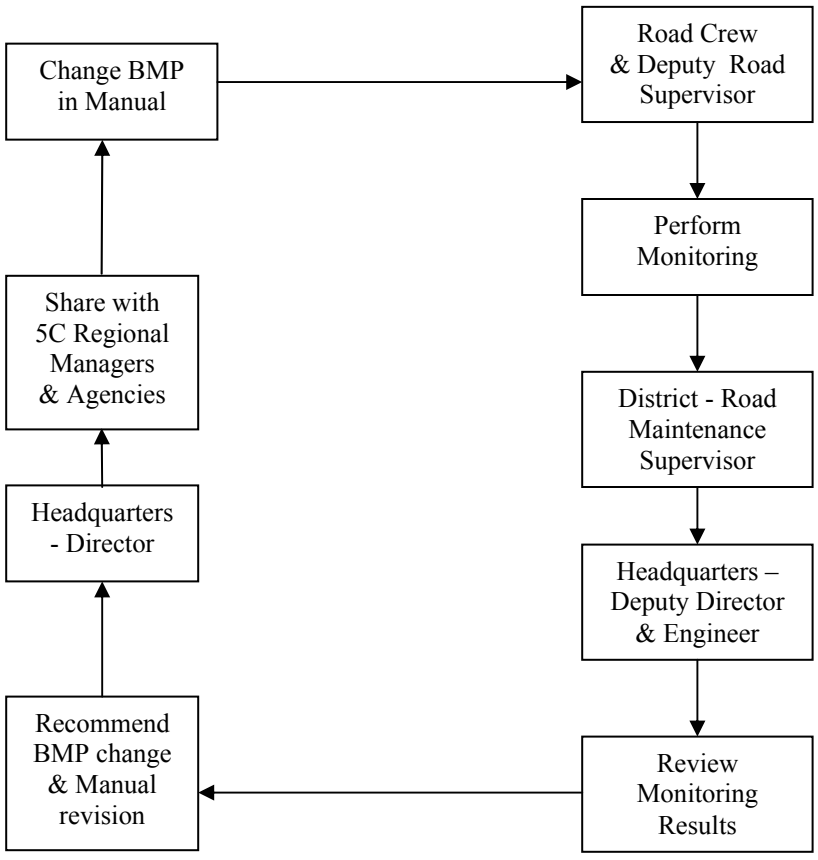
1. Use the Maintenance Manager team meetings and the annual field visits to identify and announce any modifications to the Best Management Practices identified in this document. Present new technologies and design standards at the team meetings.

2. Evaluate at least every five (5) years the need to rewrite this manual. Base changes on the number of substantive changes needed and new technologies to be incorporated.

3. Continue the periodic Regional Meetings and the annual 'Road, Salmon & Water Quality Workshop' of the five northwestern counties to be forums for discussing and evaluating the progress and effectiveness of the practices within this manual.

4. Provide proposed changes to the permit-issuing agencies prior to incorporation.

Manual Evaluation Feedback Process



CHAPTER 11
TRAINING THE STAFF

County road maintenance crews and managers need initial special training when first hired, and they also need to regularly update their skills. Learning new and better methods in protecting water quality and stream habitat while maintaining roads should be a required part of any County training program. This section describes the training program elements, a suggested training schedule, potential certifications, and training resources (videos, newsletters, magazines, manuals, websites, workshops). As a reward for exceptional service, an annual award is proposed to publicly acknowledge those employees (an individual or crew) who have contributed significantly to helping protect clean water and fish-friendly streams while keeping the roads open and safe to the traveling public.

The goal for this chapter is to ensure sufficient training of county road employees in order to:

- Prevent or minimize delivery of sediment and chemicals to streams
- Prevent or minimize the interruption of normal
- Protect aquatic and riparian habitat
- Restore access for fish movement at stream crossings

11-A Training Program

11-B Training Resources

11-C Annual Award

11-A TRAINING PROGRAM

Description: A training program helps County road maintenance personnel be responsible for understanding and correctly implementing the Best Management Practices (BMPs) for the maintenance activities described in this guide. It is one of the most critical elements of the regional and county road maintenance program.

Program Elements

The County, in conjunction with other counties and Caltrans, will provide an outreach and training program for its maintenance personnel on environmental issues. Training will include both classroom and hands-on field application sessions. Some of the training can be handled within the county and held at local sites, other types may be held elsewhere within the region to share expertise and technical advice, while specialized educational sessions may be located outside of the region. Certain elements of the Training Program are already officially on-going in the region, as noted by the asterisk (*) below. To be cost-effective, existing training materials and courses will be used if possible. When needed, supplemental funding will be sought to prepare additional training tools.

Training Program Elements for road crews, supervisors, engineers, and managers include:

A. Internal Employee Training
- New employee orientation
- Monthly /Quarterly Manager Team & Safety Meetings
- Hazardous materials training *
- Training video sessions (See: 11-B Training Resources)
- Field-based training

B. Regional Training
- Manual Implementation Training Workshops / Modules:
  - Watershed & Fish Basics: Chapter 1
  - Legal & Permit Basics: ESA and Clean Water Act: Chapter 2
  - BMP training: Chapters 3 through 9, such as:
    - Fish Passage at Road Crossings *
    - Water Drafting BMPs
    - Maintenance Yard Practices
    - Vegetation Management
    - Bridge Maintenance Practices
  - Monitoring Basics: Chapter 10
- Annual "Roads, Salmon and Water Quality Workshop for Northwestern Five Counties" *
- "Training the Trainer" workshops (so more training can be handled locally)

C. Regional Coordination Meetings & Forums
- Resource agency coordination meetings
- Five County Regional Manager quarterly meetings *

D. External Training by Others
- Participation in professional symposiums / conferences
- Participation in Continuing Education short courses or workshops
- Other appropriate courses and materials as later identified

- Relevant certification programs (see below)

County Road Department managers will ensure this Training Program occurs by following these policies:

1. Provide a sufficient budget for road maintenance training, seeking supplemental funding sources if needed.
2. Maintain employee training records and give credit for training efforts.
3. Designate a Training Coordinator (may be same person as Safety Coordinator) for the Maintenance staff.
4. Promote the protection of water quality and salmon habitat as a legitimate and important function of each employee's job. (SEE: 11-C Annual Award)
5. Work with the Five County Regional Training Committee in developing a training curriculum to assist road maintenance employees in the consistent and effective implementation of this Manual.
6. Document participation in each training event and summarize in an annual report to the Five County Regional Training Committee.
7. Measure the change in awareness of topics through certain indicators, such as a before and after training session questionnaires.

Schedule

Annual Sessions:

- "Roads, Salmon, and Water Quality Workshop for Northwestern Five Counties" : Policy and Technical Workshop Sessions *

Quarterly Sessions:

- Regional Five County Road Maintenance Manager policy meetings to discuss ESA and CWA-related policy issues, such as: *
  - Update on listed species & policies
  - Manual Implementation & Updates by Training Committee:
    - Identify and document thresholds for making changes in maintenance actions
    - Updated and/or new BMPs along with equipment that becomes available
    - Product use and evaluation
    - Recognizing when permits are needed
    - Develop process on filling out requests for permits
    - Develop planning for BMPs
    - Development of performance measures to evaluate progress

Monthly Sessions**:**

- Road Crew Safety Meetings to include discussion of ESA and CWA-related operational issues by Maintenance Supervisors and other maintenance personnel so ESA and CWA issues can continue to be incorporated into the daily delivery of the maintenance program.
- Note: OSHA and Hazmat procedures already require monthly staff meetings on their topics, so CWA & ESA topics can be added to these sessions

Possible Certifications:

- **Certified Professional in Erosion and Sediment Control (CPESC):** The International Erosion Control Association (IECA) and the Soil & Water Conservation Society co-sponsor this certification program. It is designed to provide certification for those with adequate erosion and sediment control qualifications and experience. For information, call (800) 455-4322 or see website: www.erosioncontrol.net

- **Watershed Training Certificate**: The U.S. Environmental Protection Agency (EPA) offers an on-line program. A certificate is granted following the successful completion of a series of 15 specific on-line watershed training modules (10 required, 5 elective). www.epa.gov/owow/watershed/wacademy/acad2000.html

- **"Road Scholar" Certificate:** A proposed new certification program based on the annual Five Counties' "Roads, Salmon and Water Quality Workshop" on county road maintenance practices.

11-B TRAINING RESOURCES

Description: Examples of various training tools are provided. Self-help materials include videos, manuals, journals and newsletters, and websites. Training workshops, short courses, and conferences offered by others are also included.

Videos

[Note: Trinity County Planning Dept. has a copy of each of these.]

Bouquet River Association. 2000. "Looking for Answers: Developing Partnerships for the Control of Sediment Runoff from Rural Roads". (24 min.) Elizabethtown, NY. [(518) 873-3688]. $15.00.

California Assoc. of Resource Conservation Districts. 1997. "We All Live in the Watershed". (5:18 min.) Sacramento CA. [(916) 447-7237]. $5.00

Oregon Dept. of Transportation. 1998?. "The Road to Recovery: Transportation-Related Activities and Impacts on Salmon". Photo & Video Services, Salem OR. [(503)986-3702]. $11.00.

Oregon Dept. of Transportation. 1999?. "Calcium Magnesium Acetate: A Valuable Tool for Winter Operations". Photo & Video Services, Salem OR. [(503)986-3702]. $11.00.

Oregon Sea Grant. 1999. "Life Cycle of the Salmon". (5:30 min.) Oregon State Univ., Corvallis, OR. [(541)737-2716]. $11.00.

Oregon State University Extension Service. 1999. "Life on the Edge: Improving Riparian Function". (12 min.). VTP 033. Corvallis, OR. [(541)737-2513]. $19.95.

Siskiyou Resource Conservation District. 1995. "The French Creek Watershed Story". (17:00 min.). Etna CA. [(530)467-3975]. $20.00.

USDA Forest Service. 2002. "Road Maintenance Practices." Water/Road Interaction Technology Series. San Dimas Technology and Development Center. San Dimas, CA. 5 video set. [(909) 599-1267] Free!

Journals, Magazines, Newsletters

Critter Crossings. Federal Highway Administration. Periodic on-line newsletter "linking habitats and reducing roadkill". E-mail: environment.fhwa@fhwa.dot.gov
Website: www.fhwa.dot.gov/environment/wildlifecrossings

Erosion Control . International Erosion Control Association. Bi-monthly trade magazine. P.O. Box 774904, Steamboat Springs, CO 80477-4904. [(970)879-3010; e-mail: ecinfo@ieca.org Website: www.erosioncontrol.net] $36.00 per year.

11-B TRAINING RESOURCES

Land and Water. Land and Water, Inc.. Bi-monthly trade magazine. [(515)576-3191; landandwater@dodgenet.com; Website: www.landandwater.com] $20.00 /year.

Maintenance Storm Water Pollution Prevention Bulletin. Caltrans Storm Water Program. Monthly on-line newsletter. [For info: (916) 653-2975.] Website: www.dot.ca.gov/hq/env/stormwater/index.htm

Watershed Management Council's Networker. Technical newsletter (2-4x/year) on various watershed management topics. [Voice mail (510)273-9066 or www.watershed.org/wmc] $20.00 per year.

Watershed Protection Techniques. A periodic bulletin on urban watershed restoration and protection tools. Center for Watershed Protection. [(410)461-8323; e-mail: center@cwp.org] $48.00 per 4 issues.

Manuals

Association of Bay Area Governments (ABAG). 1995. Manual of Standards for Erosion & Sediment Control Measures. 2nd Edition. Oakland, CA. 422 p. [(510)464-7900; $54.13 with S/H & tax]

----------. 1986. Erosion and Sediment Control Handbook. Oakland, CA. 454 p. [(510)464-7900; $85 with S/H]

California Dept. of Fish and Game (DFG). 2002. California Salmonid Stream Habitat Restoration Manual. 4th edition. Sacramento CA. [(916) 327-8840]

Choctawhatchee, Pea and Yellow Rivers Watershed Management Authority. 2000. Recommended Practices Manual: A Guideline for Maintenance and Service of Unpaved Roads. 59 p. [www.epa.gov/owow/nps/unpavedroads.html]

FishXing Development Team. 2000. "FishXing: an interactive CD-ROM." USDA, Forest Service, Humboldt State Univ., Fed. Hwy. Admin. Free. [See website below]

Tri-County ESA Response Effort. 2000. Regional Road Maintenance – Endangered Species Act Program Guidelines. Regional Road Maintenance Technical Working Group. King County, Washington. [www.metrokc.gov/roadcon/bmp/pdfguide.htm]

USDA Forest Service. 2000. Water/Road Interaction Technology Series. San Dimas Technology and Development Center. San Dimas, CA. Free. [(909)599-1267 x246]

Websites with Relevant Information

California Dept. of Fish & Game www.dfg.ca.gov/nafwb/index.html

11-B TRAINING RESOURCES

California Dept. of Transportation www.dot.ca.gov

Center for Watershed Protection www.cwp.org

Federal Highway Administration www.fhwa.dot.gov

International Erosion Control Association www.ieca.org

King County (Washington) – Regional Road Maintenance ESA Program
www.metrokc.gov/roadcon/bmp/pdfguide.htm

Oregon Dept. of Transportation www.odot.state.or.us

Oregon Road/Stream Crossing Restoration Guide
www.nwr.noaa.gov/1salmon/salmesa/4ddocs/orfishps.htm

Transportation Research Board //nationalacademies.org/transportation/

U.S Environmental Protection Agency www.epa.gov/ow
Office of Water

U.S. Forest Service Fish Crossing software www.stream.fs.fed.us/fishxing

Washington Dept. of Transportation www.wa.gov/wdot

Washington Dept. of Fish and Wildlife Fish Passage Technical Assistance
www.wa.gov/wdfw/hab/engineer/habeng.htm

Watershed Management Council www.watershed.org/wmc

References – See Section 12-C

Workshops / Short Courses / Conferences

CalTrans: Local Technical Assistance Program (LTAP) www.dot.ca.gov

International Erosion Control Association. Workshops and short courses. P.O. Box 774904, Steamboat Springs, CO 80477-4904. (970)879-3010. //www.ieca.org
e-mail: ecinfo@ieca.org

Pacific Watershed Associates. Special workshops on road maintenance practices and inventorying methods. P.O. Box 4433, Arcata CA 95519. (707)839-5130. E-mail: pwa@northcoast.com

11-B TRAINING RESOURCES

University of California, Davis Extension. Short courses on erosion control, environmental regulations. 1-800-752-0881 or www.universityextension.ucdavis.edu

University of California, Berkeley: Institute of Transportation Studies (ITS)/ Technology Transfer Program.
"Roadway Drainage Techniques: The Road Show" workshop:
http://www.its.berkeley.edu/techtransfer/training/group/rdt.html
"Maintenance and Inspection Practice for Local Bridges" training class.
www.its.berkeley.edu/techtransfer/training/

Washington State University. Annual "Road and Street Maintenance Supervisors' Conferences". 1-800-942-4978 or www.eus.wsu.edu/c&i

Watershed Management Council. Conferences, field tours, short courses, and workshops. (510)273-9066 or www.watershed.org/wmc

11-C ANNUAL AWARD

Description: Exceptional service by county employees in protecting water quality and stream habitat while maintaining county roads and public safety needs to be officially recognized. An annual recognition award, such as a "Clean Water Award", from the County to one or more employees is proposed.

Proposed Policy:

1. Encourage and support all of its personnel in complying with the Manual.

2. Perform Implementation Monitoring as described in Section 10-B-1 of the Manual. Records shall be kept of the results, noting not just the problems but also the crews and individual members who seem to be doing exceptional work.

3. Establish and promote an Annual Clean Water Award (or similar name) that recognizes individuals (or a road crew) for performing exceptional service in maintaining roads, water quality and stream habitat.

4. The Award shall be made publicly at an annual fun event, with publicity in the internal county agency news and in the local media. A wall plaque with the recipient's name shall be presented to the winner, as well as having the person's name engraved on a master plaque displayed in a prominent location in the County DPW/DOT main office(s).

5. Record of the recognition shall be included in the person's personnel file.

CHAPTER 12
INFORMATION SOURCES

This chapter presents sources for:

- what an abbreviation stands for,
- what a word means,
- where to read up more on these topics, and
- how to get some of the needed supplies.

12-A Acronyms / Abbreviations

12-B Glossary

12-C References

12-D Sources of Materials

12-A ACRONYMS

Here is a list of the "alphabet soup" of agencies, laws, programs, and materials that may need translation.

ABAG	Association of Bay Area Governments
AC	Asphalt – concrete
BA	Biological Assessment (under ESA)
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion (under ESA)
CAL-EPA	California Environmental Protection Agency
CC	California Coastal Commission
CDF	California Dept. of Forestry and Fire Protection
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CMA	Calcium Magnesium Acetate (for ice control)
CMP	Corrugated Metal Pipe culvert
COE	Corps of Engineers (U.S. Army)
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DFG	California Dept. of Fish and Game
DOT	Department of Transportation (county, state or federal)
EIR	Environmental Impact Report (under CEQA)
EIS	Environmental Impact Statement (under NEPA)
EPA	U.S. Environmental Protection Agency
ERFO	Emergency Relief for Federally Owned Roads
ESA	Endangered Species Act
FHWA	Federal Highway Administration
HBRR	Highway Bridge Rehabilitation or Replacement
HCP	Habitat Conservation Plan
LCP	Local Coastal Plan
LOP	Limited Operating Period
LWD	Large Woody Debris
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resource Conservation Service
ODOT	Oregon Dept. of Transportation
RWQCB	California Regional Water Quality Control Board
SHPO	State Historic Preservation Office
SLC	State Lands Commission
SMARA	Surface Mining and Reclamation Act (California)
SPCC	Spill Prevention Control and Countermeasure plan
STIP	State Transportation Improvement Project
SWP	Storm Water Permit
SWRCB	State Water Resources Control Board

12-A ACRONYMS

TMDL	Total Maximum Daily Load (under Clean Water Act)
USA	Underground Service Alert
USDOT	U.S Dept. of Transportation
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

12-B GLOSSARY

Abandoned road – A road which is no longer maintained. An abandoned road may or may not still be driveable and may or may not be overgrown with vegetation. [See also R*oad abandonment*.]

Accelerated erosion – Erosion which has been caused directly or indirectly by human activities or land management. Typically thought of as erosion which is not "natural" or that which is in excess of that which would have naturally occurred.

Active channel width - See *Ordinary High Water Mark*. Term used by California DFG in its "Culvert Criteria for Fish Passage".

Active road – A road that is part of the overall road network that needs to be actively inspected and maintained.

Adaptive management – Learning from experience by adapting management practices through the feedback received through monitoring.

Alevin – A juvenile salmonid fish in the early phase, recently emerging from the egg and still carrying a yolk sac.

Anadromous fish – ("*a-nad'-ro-mus*" ; to run upward) - fish that are born and rear in freshwater, move to the ocean to grow and mature, and return to freshwater to reproduce. Salmon, steelhead, and lamprey eel are examples.

Angle of repose – The steepest slope angle at which a material will freely stand without failing or sliding downslope. For material without cohesion, such as sand, the angle is about 33 degrees. It is steeper for cohesive materials. Slopes which are steeper than the angle of repose are likely to be unstable.

Armoring – Protective coverings or structures used to dissipate the erosive energy of water. Aprons and rip-rap are types of armoring.

Bankfull discharge – the stream discharge that just fills the stream to its banks, and which usually occurs approximately every one to two years on average.

Bearing surface – The driving surface of the road. Road rocking is a common method of increasing the load bearing capacity of the road surface if the subgrade soils are relatively weak.

Berm – A curb or dike constructed to control water and prevent roadway runoff waters from discharging onto roadside slopes and/or to provide material for subsequent road maintenance.

Best Management Practices (BMPs) – A technique, or series of techniques, which is the best known practice available to be effective in protecting water quality and stream habitat.

Borrow site – Locations on the landscape where sand, gravel, and/or rock is excavated for use in road construction activities elsewhere in the watershed.

Buffer strip – An area or strip of land adjacent to a stream containing relatively undisturbed vegetation that acts as a filter or buffer for erosion and runoff from upslope roads or other land management activities.

12-B GLOSSARY

Check dam (straw bale) – A temporary structure used to contain eroded soil from leaving a disturbed or construction site. Straw bale dams quickly decompose and will usually not provide sediment storage or protection for more than a single season.

Chinook salmon – An anadromous fish species also known as "king salmon".

CMP – Corrugated metal pipe culvert, often used synonymously with culvert. Metal culverts are typically made from galvanized steel or aluminum.

Coho salmon – An anadromous fish species also known as "silver salmon".

Controllable – Erosion that would reasonably respond to cost-effective mitigation.

Cross-drain – A culvert, rolling dip, water bar, or outslope area that drains water across a road from an inboard ditch or water collection area. Cross-road drains are more substantial and deeper than conventional waterbars used to drain forest and ranch roads, and are steeper and more abrupt than rolling dips. Well constructed cross-drains will often be deep enough to prevent vehicular access to an area and are typically installed on roads which are being closed permanently or for several years. Cross-road drains are typically constructed (excavated) using a tractor, an hydraulic excavator, or a backhoe.

Culvert – A transverse drain, usually a metal pipe, set beneath the road surface which drains water from the inside of the road to the outside of the road. Culverts are used to drain ditches, springs, and streams across the road alignment.

Cutslope (cutbank) – The artificial face or slope cut into soils or rock along the inside of a road.

Danger tree – Trees or snags, on or near the highway, that are found to be weakened, unsound, undermined, leaning, or exposed so they may fall across the road. When permission to remove the trees cannot be obtained, it is necessary to trim and do whatever else is reasonable to alleviate the hazard.

Debris flow – A rapidly moving mass of rock fragments, soil and mud, with more than half of the particles being larger than sand size. In contrast to debris slides, debris flows are usually saturated with water.

Debris slide – A slow to rapid slide, involving downslope translation of relatively dry and predominantly unconsolidated materials, with more than half of the particles being larger than sand size.

Debris torrent – Rapid movement of a large quantity of materials (wood and sediment) down a stream channel during storms or floods. This action generally occurs in smaller, steep stream channels and results in scouring of the streambed.

Dewatering – The temporary diversion of water away from a work site to protect water quality and allow progression of work. Diversion is accomplished with coffer dams, pipes, or other means. Water is removed from the work site only, and not the entire stream or body of water.

Ditch relief culvert – A drainage structure or facility which will move water from an inside road ditch to an outside area, beyond the outer edge of the road fill.

12-B GLOSSARY

Diversion potential - Road stream crossing that has the potential to divert flow from a plugged culvert down the length of the road surface, rather than directly across the culvert fill and into its natural drainage channel. This potential carries the risk of causing soil erosion and sediment delivery.

Downspout – A flume or trough attached to a culvert outlet to transport water beyond the erosive road fill to a stable, armored catchment area in order to prevent erosion. Culverts that are placed at the base of the road fill discharge directly into the natural channel or hillslope and usually do not require a downspout.

Drainage basin – See: *Watershed*.

Drainage structure – A structure installed to control, divert or to cross over water, including but not limited to culverts, bridges, ditch drains, fords, waterbreaks, outsloping, and rolling dips.

Drop inlet – A vertical riser on a culvert inlet, usually of the same diameter as the culvert, and often slotted to allow water to flow into the culvert as streamflow rises around the outside. Drop inlets are often used on stream or ditch relief culverts where sediment or debris would otherwise threaten to plug a traditional horizontal inlet.

Emergency – "A situation which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process the application under standard." (COE Regulations);**"A situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property." (ESA rules, 50 CFR 402.05);** "A sudden, unexpected occurrence, involving a clear and imminent danger, demanding immediate action to prevent or mitigate loss of, or damage to, life, health, property or essential public services. Emergency includes such occurrences as fire, flood, earthquake, or other soil or geologic movements, as well as such occurrences as riot, accident, or sabotage." (CEQA 15359).

Emergency road maintenance – See: *Storm maintenance*.

Endangered Species – Any species which is in danger of extinction throughout all or a significant portion of its range; an official designation of the California and/or Federal Endangered Species Acts.

Endhauling – The removal and transportation of excavated material to prevent sidecast, and the storage of the material in a stable location where it cannot enter stream channels. Endhauling is usually accomplished using dump trucks, but on larger jobs may be performed by mobile scrapers.

Energy dissipator – A device or material (often rocks) used to reduce the energy of flowing water, typically used at and below culvert outlets and other drainage structures to prevent erosion.

Ephemeral streams - Streams that contain running water only sporadically, such as during and following storm events.

Equipment limitation / equipment exclusion – The terms used when the use of heavy equipment is to be limited or prohibited, respectively, for the protection of water quality, the beneficial uses of water, or aquatic habitat.

Erodible soils – Soils which are relatively prone to erosion by rain drop impact and surface runoff. Granular, noncohesive soils (such as soils derived from sand dunes or from decomposed granite (DG)) are known to be especially erodible.

Erosion – The wearing away of land surface primarily by wind or water. Erosion occurs naturally as a result of weather or runoff, but can be intensified by clearing, grading, or excavation of the land surface. Erosion usually refers to processes of surface erosion (rain drop erosion, rilling, gullying, and ravelling) and not to mass soil movement (landsliding).

Erosion control - The act of controlling on-going erosion caused by rain drop impact, rilling, gullying, ravelling, and other surface processes.

Erosion prevention – Preventing erosion before it has occurred. Erosion prevention is typically less expensive and more effective than erosion control.

Erosion-proof – The act of performing erosion control and erosion prevention activities which will protect a road, including its drainage structures and fills, from serious erosion during a large storm and flood.

Excess material – See *Spoil.*

Fail-safe – A term used to describe a stream crossing that has no diversion potential.

Fail soft – A fail-safe stream crossing where the dip or change in road grade occurs over the hinge line between the fill and the natural ground surface. With the road dip or low point in this location, overflow from a plugged culvert will likely result in the least possible amount of erosion. Roads which dip deeply as they cross a stream channel have smaller fills which can be eroded when culvert plugging occurs.

Fillslope – That part of a road fill between the outside edge of the road and the base of the fill, where it meets the natural ground surface.

Fill – The material that is placed in low areas, compacted, and built up to form the roadbed surface.

Filter fabric (geotextile) – A synthetic fabric manufactured and designed for use in, among others, subsurface and surface drainage applications. Filter fabric is especially useful in maintaining a separation between coarse aggregate and finer native soil particles. It comes in a number of different types (with different specifications and uses) and is used in a number of different road building settings. Manufacturer's specifications should always be consulted before using a fabric for drainage or other engineering applications.

Filter strip – See *Buffer*.

Filter windrow – A row of slash and woody debris laid and pressed down along the base of a road fill or sidecast slope to contain soil eroded from the hillslope. Filter windrows are often used to contain erosion from fillslopes and sidecast areas where a road approaches and crosses a stream channel.

Flared inlet – A culvert inlet which is flared or widened to increase its capacity and reduce the chance of inlet plugging and damage. Mitred inlets, usually made by cutting a normal culvert at an angle, are also

used on ditch relief culverts to decrease inlet erosion and improve culvert efficiency. Flared inlets are attached to the normal culvert inlet using a band or bolts.

Floodplain – The land area that is covered by water from the overflow of stream channels when their banks are full. The '100-year floodplain' represents the area potentially inundated for an unusual but possible flood event with the probability of occurring once every 100 years on the average.

Fluvial geomorphology – the study of water-shaped landforms. See also *Geomorphology.*

Ford (wet) – A rock, concrete or other hardened structure built on the bed of a live stream which allows vehicle passage during low flow periods.

Ford (dry) - A rock, concrete or other hardened structure built on the bed of a swale, gully or usually dry stream which allows vehicle passage during periods of low or no flow.

French drain – A trench with covered drain rock used to provide subsurface ground water transport from a wet area and discharge it in a safe and stable location. French drains are often lined with filter fabric to keep soil from plugging the drain.

Fry – A juvenile salmonid fish, between the alevin and the smolt phase, in fresh water.

Full bench road – Road construction technique where the road bench cut width equals the road running surface width and no fill is used.

Full fill road – Road construction technique in which no bench cut is made into the hillslope and the road prism is made entirely from imported fill. The ground surface must still be prepared (grubbed and bared) for the fill to bind to the underlying substrate.

Geomorphology - the study of the physical features of the surface of the earth, including their form, nature, origin, and development. See also *Fluvial geomorphology*.

Geotextile – See *Filter fabric*.

Grade-break – The location of a reversal in the slope (grade) of the road from climbing to falling, or from falling to climbing.

Grading – The act of excavating and moving soil along the road alignment to an established grade-line during road construction or reconstruction. Grading also refers to the mechanical smoothing of the road bed to maintain a free-draining, smooth travelling surface.

Ground cover – Matter that covers the soil surface, such as low growing plants, rock and rock fragments, and debris such as leaves and twigs.

Groundwater – The standing body of water beneath the surface of the ground, consisting largely of surface water that has seeped down into the earth.

Gully – An erosion channel formed by concentrated surface runoff which generally has a cross sectional area larger than one square foot (1' deep by `1 wide). Gullies often form where road surface or ditch runoff is directed onto unprotected slopes.

12-B GLOSSARY

Habitat – The place where a plant or animal (including fish and other aquatic life) naturally or normally lives and grows.

Hazard Tree - Trees or snags on or near the highway that are found to be weakened, unsound, undermined, leaning, or exposed so they may fall across the highway, impair sight while driving, or damage structures.

Hazardous waste - A waste, or combination of wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics, may either cause or significantly contribute to an increase in serious irreversible illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Possesses at least one of four characteristics (ignitiability, corrosivity, reactivity, or toxicity), or appears on special EPA or state lists. Regulated under the federal Resource Conservation and Recovery Act and the California Health and Safety Code.

Headcut – The vertical break in slope at the uphill end (head) of a gully. Headcuts migrate uphill and elongate the gully.

Headwater swale – The swale or dip in the natural topography that is upslope from a stream, at its headwaters. There may or may not be any evidence of overland or surface flow of water in the headwater swale.

Hillslope – Sediment erosion site associated with areas above the riparian area.

Horizontal drains – Drains installed in cut slopes and beneath fills to remove subsurface water and guard against slides in problem areas. Typically, they consist of perforated metal or plastic pipes in drill holes that have been bored horizontally into the aquifer or water-bearing formation.

Hydrological connectivity – Degree to which water from a source site or unstable area is conveyed to the network of the natural watercourse of concern.

Hydrologically connected road - Any road segment that, during a design runoff event, has a continuous surface flowpath between any part of the road prism and a natural stream channel..

Hydrologically invisible – [Absence of hydrological connectivity. (?)]

Hydro-seeding (hydraulic seeding) – An erosion control technique for applying a slurry of seed, fertilizer and mulch by hydraulically spraying the mixture on the ground surface. Hydro-seeding is typically performed on slopes that are too steep for dry seeding.

Inactive road – A road needed only infrequently, for fire control or other intermittent management activities. These roads remain largely unused for most of the year, or for several years in succession, but have drainage structures intact and require regular inspection and maintenance.

Inboard ditch – The drainage ditch on the inside of the road, usually at the foot of a cutbank.

Infiltration – The movement of water through the soil surface of the soil.

12-B GLOSSARY

Inner gorge – A stream reach bounded by steep valley walls that terminate upslope into a more gently topography. Common in areas of rapid stream downcutting or uplift.

Insloped road – Road surface that is sloped in toward the cutbank. Insloped roads usually have an inboard ditch that collects runoff from the road surface and cutbank.

Intermittent stream – Any nonpermanent flowing drainage feature having a definable channel and evidence of scour and deposition. Intermittent streams flow in response to rainfall, and then for some period after the cessation of rainfall (being fed by groundwater discharge).

Landslide – The downslope movement of a mass of earth caused by gravity. Includes but is not limited to debris slides, torrents, rock falls, debris avalanches, and creep. It does not include dry ravel or surface erosion by running water. It may be caused by natural erosional processes, by natural disturbances (e.g., earthquakes or fire events) or human disturbances (e.g., mining or road construction).

LWD – Large woody debris; portions of downed trees that collect in the stream and provide channel structure and habitat for aquatic animals.

Maintained road – A road which is regularly inspected and whose cutslopes, road surface, drainage structures and fillslopes are maintained to prevent erosion and deterioration.

Maintenance activities – Routine maintenance activities that may require clearing, grading, or excavation to maintain original line and grade, hydraulic capacity, or original purpose of the facility.

Maintenance facilities – Facilities under County ownership or control that contain such areas as fueling areas, waste storage or disposal facilities, wash racks, equipment or vehicle storage, and materials storage areas.

Mass wasting – Downslope movement of soil mass under force of gravity; often used synonymously with "landslide".

Mature tree - A tree with width greater than a 12-inch (30cm) diameter at breast height (dbh).

Mitigate – To offset or lessen real or potential negative environmental impacts or effects through the application of additional controls or actions.

Mulch – Material placed or spread on the surface of the ground to protect it from raindrop, rill and gully erosion. Mulches include wood chips, rock, straw, wood fiber, and a variety of other natural and synthetic materials.

Nonpoint source discharge – Discharge from a diffuse pollution source, that is one without a single point of origin or not introduced into a receiving stream from a specific outlet like a pipe.

Oil waste – Oil of any kind or in any form, including but not limited to petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged soil.

Ordinary High Water Mark – "That line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes

in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area." [33 CFR 328.3(e)]

Organic matter – Material that is derived from living organisms, such as plants.

Outboard fill – The outside road edge fill material, usually generated by side cast road construction. This fill often comprises up to half the running surface width.

Outboard berm – A mounded earthen curb along the outboard edge of the road usually generated by periodic grading of the road. Berms trap water on the road.

Outfall – The discharge from a CMP, quantified by the vertical distance from the CMP outlet to its catchment basin.

Out-migration – The life cycle phase of anadromous salmonid fish, where juveniles move downstream from fresh water to the estuary and then the ocean for their salt water phase.

Outsloped road – Road surface that is sloped out away from the cutbank toward the road's fillslope. Outsloped roads may or may not have an inboard ditch.

Outsloping – The act of converting an insloped road to an outsloped road. Outsloping can also refer to the act of excavating the fill along the outside of the road and placing and grading it against the cutbank, thereby creating an outsloped surface where the roadbed once existed.

Partial bench – A partial bench road is one in which the road bed is part bench and part fill, somewhere between full bench and a full fill road.

Peak flow (flood flow) – The highest amount of stream or river flow occurring in a year or from a single storm event.

Perennial stream – A stream that typically has running water on a year-round basis.

Permanent road – A road which is planned and constructed to be part of a permanent all-season transportation system. These roads have a surface which is suitable of use throughout the entire winter period and have drainage structures, if any, at watercourse crossings which will accommodate the 50-year flood flow. Permanent roads receive regular and storm-period inspection and maintenance.

Permeable fill – See *Drainage blanket.*

Photopoint – Established point on the landscape used to conduct photographic monitoring.

Put-to-bed - The process of actively abandoning a road by eliminating all conceivable risks of sediment production until the road is again needed in future years. "Putting-to- bed" or road closure involves completely removing stream crossing fills and associated drainage structures and eliminating the risk of sediment production from roads. (See *Road closure.*)

Range finder – A hand-held field instrument used to measure distances less than about 1000 feet.

12-B GLOSSARY

Ratio (slope) – A way of expressing slope gradient as a ration of horizontal distance to vertical rise, such as 3:1 (3 feet horizontal for every 1 foot vertical rise of fall).

Ravel (dry ravel) – Soil particles dislodging and rolling down a slope under the influence of gravity. Ravel occurs most rapidly when a cohesionless soil on a steep slope dries out. Ravelling is dramatically increased when frost acts on the exposed soil. Ravel on some steep, bare cutbanks can quickly fill ditches and supply sediment that is then eroded and moved to nearby ditch relief culverts or streams by concentrated ditch flow.

Rearing – The phase of a life cycle for a salmonid fish, where juveniles emerge from eggs and grow to large enough size to become adults or migrate to the ocean (for anadromous forms).

Redd – The nest depression, constructed by spawning salmonid fish in stream gravels, in which the eggs are laid.

Rill – A small erosion channel formed by concentrated surface runoff that is less than one square foot in cross sectional area. It typically forms where rainfall and surface runoff is concentrated on fillslopes, cutbanks, and ditches. Larger channels are called gullies.

Rip-rap – The large rock or other suitable material placed on the ground or along streambanks as an armoring device to prevent or reduce erosion.

Riparian – The banks and other lands adjacent to lakes, watercourse, estuaries, and wet areas. Often refers to water-loving vegetation along the water's edge.

River run rock – Aggregate (gravel) that is excavated from a river bed. It is usually well rounded and, unless screened, also contains sand.

Road abandonment – In the past, road abandonment was synonymous with blocking the road and letting it grow over with vegetation. Today, proper road abandonment involves a series of proactive steps and activities that essentially erosion-proof a road alignment so that further maintenance will not be needed and significant erosion will not occur. (See also: *Road closure*)

Road closure – Also called "proactive road abandonment", it is a method of closing a road so that regular maintenance is no longer needed and future erosion is largely prevented. The goal of road closure is to leave the road so that little or no maintenance is required for stability while the road is unused. Road closure usually involves erosion-proofing techniques including removing stream crossing fills, removing unstable road and landing fills, installing cross road drains for permanent road surface drainage and other erosion prevention and erosion control measures as needed. Proper road closure is not accomplished by blocking a road and walking away from it to let "nature reclaim the road". (See also: *Road abandonment*)

Road failure – Damage to the roadbed (usually caused by a road bed slump, fill failure, stream crossing washout or major gully) which prevents vehicular passage, but does not usually mean minor cutbank or fill sloughing incidental to road settling.

Road fill excavation – Excavation and removal of unstable or potentially unstable fill and/or sidecast spoil from the outer edge of a road prism. Road fill excavations are performed as a preventive measure to guard against landsliding of unstable material into downslope stream channels.

Road grade – The slope of a road along its alignment.

Road maintenance – The actions taken to prevent erosion and/or the deterioration of a road, including the cutbank, the road surface, the fillslope and all drainage structures. Road maintenance activities include such tasks as grading, ditch cleaning, brushing and culvert cleaning.

Road network – The pattern of all the roads in an ownership, watershed, hillside or other defined area. The road network typically includes main trunk roads, secondary roads, and spur roads (in logging areas).

Road reconstruction – Repair or upgrading of those pre-existing roads that are to be restored or improved to make them useable for traffic. Reconstruction typically refers to road rebuilding when one or more road failures have occurred. (See: *Road failure*)

Road runoff – Surface runoff that collects on and is drained from the road surface, usually as a direct response to rainfall.

Rock armor – Coarse rock that is placed to protect a soil surface, usually from erosion caused by flowing or falling water. Rock armor is one type of material used for energy dissipation at culvert outfalls.

Rock pit – A large outcrop of bedrock that has been developed for aggregate uses, such as road surfacing material and/or larger rock armor. A borrow pit is an excavation from which material is removed for use in another location. (See also: *Borrow site*)

Rolling dip – Shallow, rounded dip in the road where road grade reverses for a short distance and surface runoff is directed in the dip or trough to the outside or inside of the road. Rolling dips are drainage facilities constructed to remain effective while allowing passage of motor vehicles at reduced road speed.

Runoff – Rainfall or snowmelt which flows overland across the surface or hillslopes and along roads and trails.

Rust line – The upper limit of rust inside a CMP which reflects the depth of sustained high water flows through the pipe.

Salmon, Chinook – A salmonid species, also called King Salmon in California.

Salmon, Coho – A salmonid fish species, also called Silver Salmon in California.

Salmonid – A species of fish that is a member of the salmon and trout family.

Sanitary sewer system – Underground pipes that carry off only domestic and industrial waste, not storm water.

Sediment – Organic or inorganic material that is carried or suspended in water and that settles out to form deposits in the storm drain system or receiving waters.

Sediment delivery – Material (usually referring to sediment) which is delivered to a stream channel. Sediment delivery often refers to the percent of material eroded from a site which actually gets delivered to a stream channel (as opposed to that which is stored on the hillslope).

12-B GLOSSARY

Sheet erosion – The loss of thin layers of soil across a large surface area.

Shotgun culvert – A CMP that protrudes from the road fill with no down spout. The falling water often causes substantial erosion in the catchment area.

Sidecast – The excess earthen material pushed or dumped over the side of roads.

Silt fence – A constructed barrier used to contain soil eroded from a construction site. The barrier is made from filter fabric stretched between fence posts placed on contour along a slope.

Slope ratio – See *Ratio*

Slope stability - The resistance of a natural or artificial slope or other inclined surface to failure by landsliding (mass movement).

Slump – An episodic, fast to very slow mass movement process involving the rotation of a block of hillslope or road along a broadly concave slip surface, often referred to as a rotational slide.

Smolt – A juvenile salmonid fish in the later phase of transitioning from fresh water to salt water, before migrating to the ocean.

Spawning – The phase of adult salmonid fish where redds (nests) are made and eggs are laid in gravels of streams.

Species of Special Concern – A designation used by California (CSC) and federal (FSC) agencies to refer to those species of animals (and sometimes plants) that have declining population levels, limited ranges, and/or continuing threats that have made them vulnerable to extinction. They may soon reach the point where they meet criteria for listing as threatened or endangered under the State and/or Federal Endangered Species Acts. No special legal protections are associated with this designation alone.

Spoil disposal site – The location where spoil material (woody debris and excavated soils) can be placed without the threat of accelerated erosion or of initiating slope instability. Stable spoil disposal sites include the cut portion of closed roads, the inside portion of turnouts, and flat or low gradient natural benches.

Spoil (spoil materials) – Material (soil and organic debris) that is not used or needed as a functional part of the road or a landing. Spoil material is generated during road construction, reconstruction, and maintenance activities.

Spur road – A side road off a main trunk road or a secondary road. Most spur roads are dead-end.

Steelhead – The anadromous form of the rainbow trout. Aside from their sea-going habits and large size at spawning, there is little to distinguish them from rainbow trout that are resident in the same streams that steelhead use for spawning.

Storm maintenance (emergency road maintenance) – Road inspection and maintenance that is performed during periods of high rainfall and runoff when drainage structures are most likely to plug, malfunction or fail.

12-B GLOSSARY

Storm water – Rainfall runoff, snow melt runoff, surface runoff and drainage.

Storm water drainage system – Streets, gutters, conduits, artificial drains, channels and watercourses, or other facilities that are owned, operated, maintained, and used for the purpose of collecting, storing, transporting, or disposing of storm water.

Stream – A natural configuration in the land surface that transports water in a perennial, intermittent, or ephemeral circumstance.

Stream Class – A category of a watercourse based on the its *beneficial* use (based on California Board of Forestry regulations, 2000):

Class I Watercourse: A stream (or lake) that is used for a domestic water supply (including springs) on the site and/or within 100 feet downstream of the operations area; and/or fish always or seasonally present onsite, including habitat to sustain fish migration and spawning. (It typically flows year round, but may flow seasonally.)

Class II Watercourse: A stream (or lake) that has fish always or seasonally present offsite within 1000 feet downstream, and/or aquatic habitat for nonfish aquatic species; excludes Class III waters that are tributary to Class I waters. (These streams may flow year round or seasonally; many springs and wetlands are also included.)

Class III Watercourse: A stream channel (or lake) with no aquatic life present but showing evidence of being capable of sediment transport to Class I or II waters under normal high water flow conditions.

Class IV Watercourse: Man-made watercourses, usually downstream, for established domestic, agricultural, hydroelectric supply or other beneficial use.

Stream crossing – The location where a road crosses a stream channel. Drainage structures used in stream crossings include bridges, fords, culverts and a variety of temporary crossings.

Stream crossing excavation – The excavation of the fill material that was used to build (fill) a stream crossing, specifically a culverted crossing, a log crossing, or a temporary crossing. A stable steam crossing excavation must be dug down to the level of the original stream bed, with side slopes graded (excavated) back to a stable angle (usually 50% or less, depending on soil characteristics).

Subdrainage (subsurface drainage) – The flow of water beneath the surface of the ground. Along roads, specific construction techniques can be used to make sure subsurface drainage is not impeded by the road bed or road fill.

Surface erosion – The detachment and transport of soil particles by wind, water or gravity. Surface erosion can occur as the loss of soil in a uniform layer (sheet erosion), in many rills, gullies, or by dry ravel.

Surface runoff – Precipitation, snow-melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of non-point source pollutants.

Surfacing (surface course) – The top layer of the road surface, also called the wear course. Rock aggregate and paving are two types of surfacing used to weather-proof the road for winter use.

12-B GLOSSARY

Swale – A channel-like linear depression or low spot on a hillslope which rarely carries runoff except during extreme rainfall events. Some swales may no longer carry surface runoff under the present climatic conditions.

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (as defined by the federal Endangered Species Act); to hunt, pursue, catch, capture, or kill, or to attempt to do any of these things (as defined by the California Endangered Species Act).

Threatened Species – Any species which is likely to become an endangered species within the foreseable future throughout all or a significant portion of its range; an official designation under the California and/or Federal Endangered Species Acts.

Through-cut (Double cut) – A road section that has a cutbank on each side of the road, both higher than the road elevation. This condition channels water down the road and usually creates an erosion source until a drainage opportunity occurs at a single cutbank section.

Through-fill – A road which is entirely composed of fill material and which has a berm along both sides of the road, thereby intentionally containing road surface runoff on the road and directing it to a single discharge point, usually a fabricated metal berm-drain. Through-fills are typically found at sensitive stream crossings where the fill is bermed on both sides of the road.

Total Maximum Daily Load (TMDL) – A process under the federal Clean Water Act that provides a tool for implementing State water quality standards and is based on the relationship between pollution sources and instream water quality conditions.

Trash rack – A debris grid built just over or upstream from a culvert inlet to trap floating woody debris before it plugs the culvert inlet.

Turbidity – Water that is cloudy or muddy usually due to sediment.

Unstable areas – Areas characterized by mass movement features or unstable soils, or by some or all of the following: hummocky topography consisting of rolling bumpy ground, frequent benches, and depressions; short irregular surface drainages which begin and end on the slope; visible tension cracks and head wall scarps; irregular slopes which may be slightly concave in upper half and convex in lower half as a result of previous slope failure; evidence of impaired ground water movement resulting in local zones of saturation including sag ponds with standing water, springs, or patches of wet ground; hydrophytic (wet site) vegetation; leaning, jackstrawed or split trees; pistol-butted trees with excessive sweep in areas of hummocky topography.

Unstable soils – These soils are indicated by the following characteristics: 1) unconsolidated, non-cohesive soils (coarser textured than loam) and colluvial debris including sands and gravels, rock fragments, or weathered granitics (e.g., decomposed granite or "DG"). Such soils are usually associated with a risk of shallow-seated landslides on slopes of 65% or more, having non-cohesive soils less than 5 feet deep in an area where precipitation exceeds 4 inches in 24 hours in a 5-year recurrence interval. 2) increase and decrease in volume as moisture content changes. During dry weather, these materials become hard and rock-like exhibiting a network of polygonal shrinkage cracks and a blocky structure resulting from dessication. Some cracks may be greater than 5 feet in depth. When wet, these materials are very sticky, dingy, shiny and easily molded.

12-B GLOSSARY

Washed out stream crossing – A stream crossing fill that has been partially or completely eroded and "washed" downstream. Washouts usually occur when a culvert plugs and streamflow backs up and flows over the roadbed during flood events.

Waters of the U.S. – In nontidal waters, this federal legal jurisdiction extends: a) to the ordinary high water mark in the absence of adjacent wetlands; b) beyond the ordinary high water mark to the limit of the adjacent wetlands when present; c) to the limit of the wetland when only wetlands exist.

Watercourse – Surface water bodies including streams, lakes, bays, estuaries, lagoons, reservoirs, and ponds. The term includes any well defined channel with distinguishable bed and bank showing evidence of having contained flowing water indicated by deposit of rock, sand or gravel.

Water quality – The chemical and biological characteristics of stream and lake water.

Watershed – The area or drainage basin contributing water, organic matter, dissolved nutrients and sediments to a stream or lake.

Wetlands – Areas that are inundated by surface water or ground water with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that require saturated or seasonally saturated soil conditions for growth and reproduction (Executive Order 11990). Wetlands generally include, but are not limited to, marshes, bogs and similar areas.

Winterize – To perform erosion prevention and erosion control work on a road in preparation for winter rains and flood flows.

Sources: Weaver & Hagans (1994); CalTrans (1998); Downie et al. (1998); Lewis et al. (2000); ODOT (1999); various state and federal statutes and regulations.

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Trinity County. 2002b. "List of County Road Migration Barrier Sites." Prepared by Ross Taylor and Assoc. for Trinity Co. Natural Resources Div., Weaverville CA.

USDA Forest Service (USFS). 1992. Best Management Practices Evaluation Program: A User's Guide. Region 5, San Francisco.

USDA Forest Service. 1999. Roads Analysis: Informing Decisions about Managing the National Forest Transportation System. Misc. Report FS-643. Washington, D.C. 222 p.

USDA Forest Service. 2000. Water/Road Interaction Technology Series. San Dimas Technology and Demonstration Center. San Dimas CA.

Washington Dept. of Transportation (WSDOT). 2000. Maintenance Manual for Water Quality and Habitat Protection. May 2000. Olympia , WA. 99 p.

Weaver, W.E. and D.K. Hagans. 1994. Handbook for Forest and Ranch Roads: A Guide for Planning, Designing, Constructing, Reconstructing, Maintaining and Closing Wildland Roads. Mendocino Co. Resource Conservation District, Ukiah , CA. 161 p.

Weaver, W.E. and D.K. Hagans. 1996. "Sediment Treatments and Road Restoration: Protecting and Restoring Watersheds from Sediment-Related Impacts." Chapter 4 In: Healing the Watershed – A Guide to the Restoration of Watersheds and Native Fish in the West. Pacific Rivers Council. pp. 109-140.

Weaver, W.E. and D.K. Hagans. 1999. "Storm-Proofing Forest Roads." pp. 230-245 In: *Proceedings of Inter. Mountain Logging and 10th Pacific Northwest Skyline Symposium*. Oregon State Univ. Dept. of Forest Engineering. Corvallis OR.

Weaver, W.E. and D.K. Hagans. 1999. "Sediment Source Assessments and Sediment Control Planning for County Road Systems." Pacific Watershed Associates. Prepared for Five County Planning Process. Arcata CA. 15 p.

12-D SUPPLIES

The following products are provided for information only. The County does not endorse or encourage the use of any particular product or make any claims as to their effectiveness in preventing or controlling erosion or spills.

Erosion Control Materials

California Straw Works: (916) 453-1456 or www.strawwattles.com
Forestry Suppliers: (800) 543-4203 or www.forestry-suppliers,com
International Erosion Control Association: www.erosioncontrol.net
Salix Applied Earthcare: (800) 403-0474 or www.erosiondraw.com or www.biodraw.com

Revegetation Materials

AlbrightSeeds**:** www.albrightseed.com
California Dept. of Forestry (CDF) Nursery: (530) 753-2441
California Native Plant Sources: members.aol.com/gstigall/calret.htm
ConservaSeed: (916) 775-1676
Cornflower Farms: (916) 689-1015
Forestry Suppliers: (800) 543-4203 or www.forestry-suppliers,com
Freshwater Farms: www.freshwaterfarms.com
Granite Seed: www.graniteseed.com
North Coast Native Nursery: (707) 769-1213
Pacific Coast Seed: (925) 373-4417
S&S Seeds: (805) 684-0436 or www.ss-seeds.com & www.wildflowerseed.com
Terra Tech: (800) 321-1037 or www.terratech.net

Safety & Spill Clean-up Materials

Foss Environmental: www.fossenv.com
Global Industrial Equipment: (800) 645-1232
Lab Safety Supply: (800) 356-0783 or www.labsafety.com

Vegetation Management Materials

Forestry Suppliers: (800) 543-4203 or www.forestry-suppliers,com

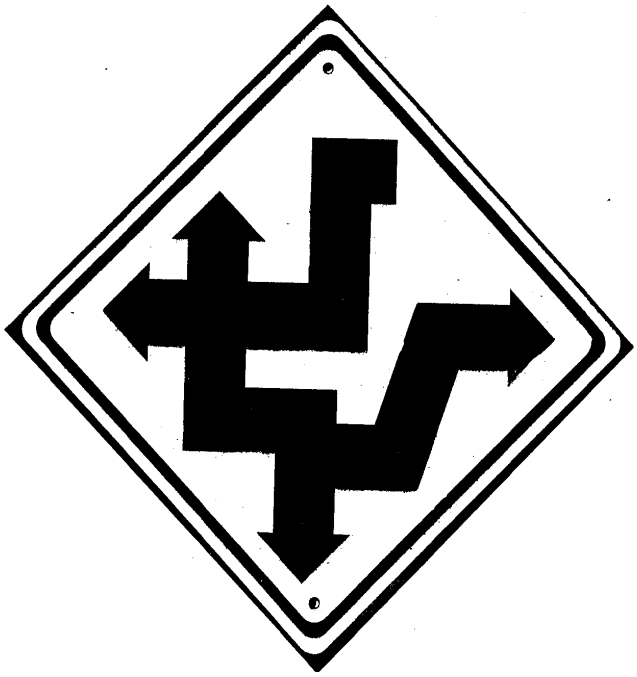
APPENDIX A

GETTING THE PERMITS

This appendix provides more detail to the information provided in Chapter 2 – Following the Rules. The intent is for the two sections to complement one another. Both should be consulted during the permit process for road maintenance activities.

A-1 **Permit Flow Charts**

A-2 **Directory of Agencies**



A-1 PERMIT FLOW CHARTS

Permit flow charts provide an overview of how the permit process usually works. (Of course, there are always exceptions to the rules.)

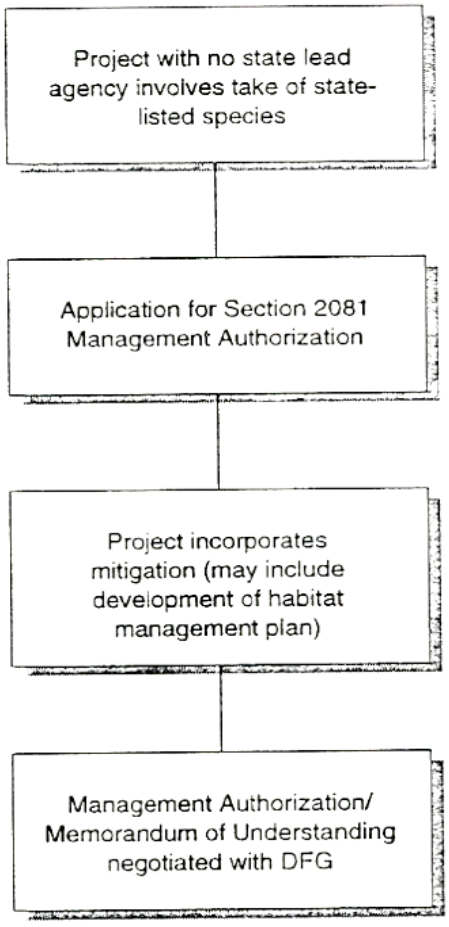
"Permit" Name *In alphabetical order*	**Responsible Agency**
1. **California Endangered Species Act – CESA** • Section 2081	DFG
2. **California Environmental Quality Act – CEQA**	Lead Agency
3. **Clean Water Act – CWA Section 401**	RWQCB
4. **CWA Section 402 – Stormwater Permit**	SWRCB & RWQCB
5. **CWA Section 404** • Individual Permit Process • Nationwide Permit Process	USACE
6. **Federal Endangered Species Act - ESA** • Section 7 Consultation • Section 10 Incidental Take Permit	NMFS – Salmon & Steelhead USFWS – Other species
7. **Fish & Game Code Section 1601** Streambed Alteration Agreement	DFG

NOTE: These charts reflect the currently available procedures, which can and do change over time. Please consult the agency for the most recent procedure.

A-1 PERMIT FLOW CHARTS

CALIFORNIA ENDANGERED SPECIES ACT
SECTION 2081

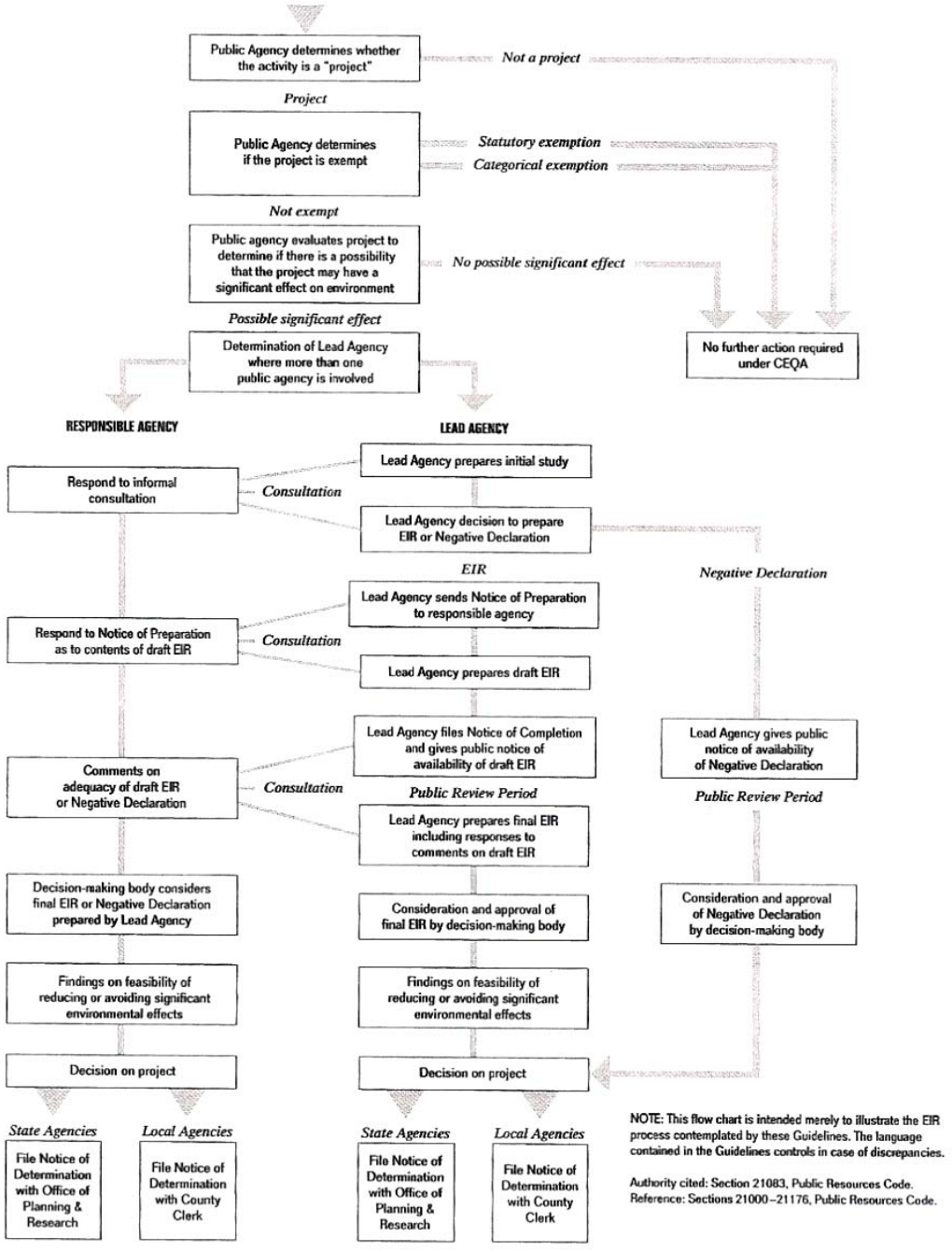
California Dept. of Fish and Game



Source: USFWS (1997). Handbook of Regulatory Compliance for the Anadromous Fish Restoration Program. Prepared by Jones & Stokes Assoc., Stockton CA.

A-1 PERMIT FLOW CHARTS

CALIFORNIA ENVIRONMENTAL QUALITY ACT - CEQA

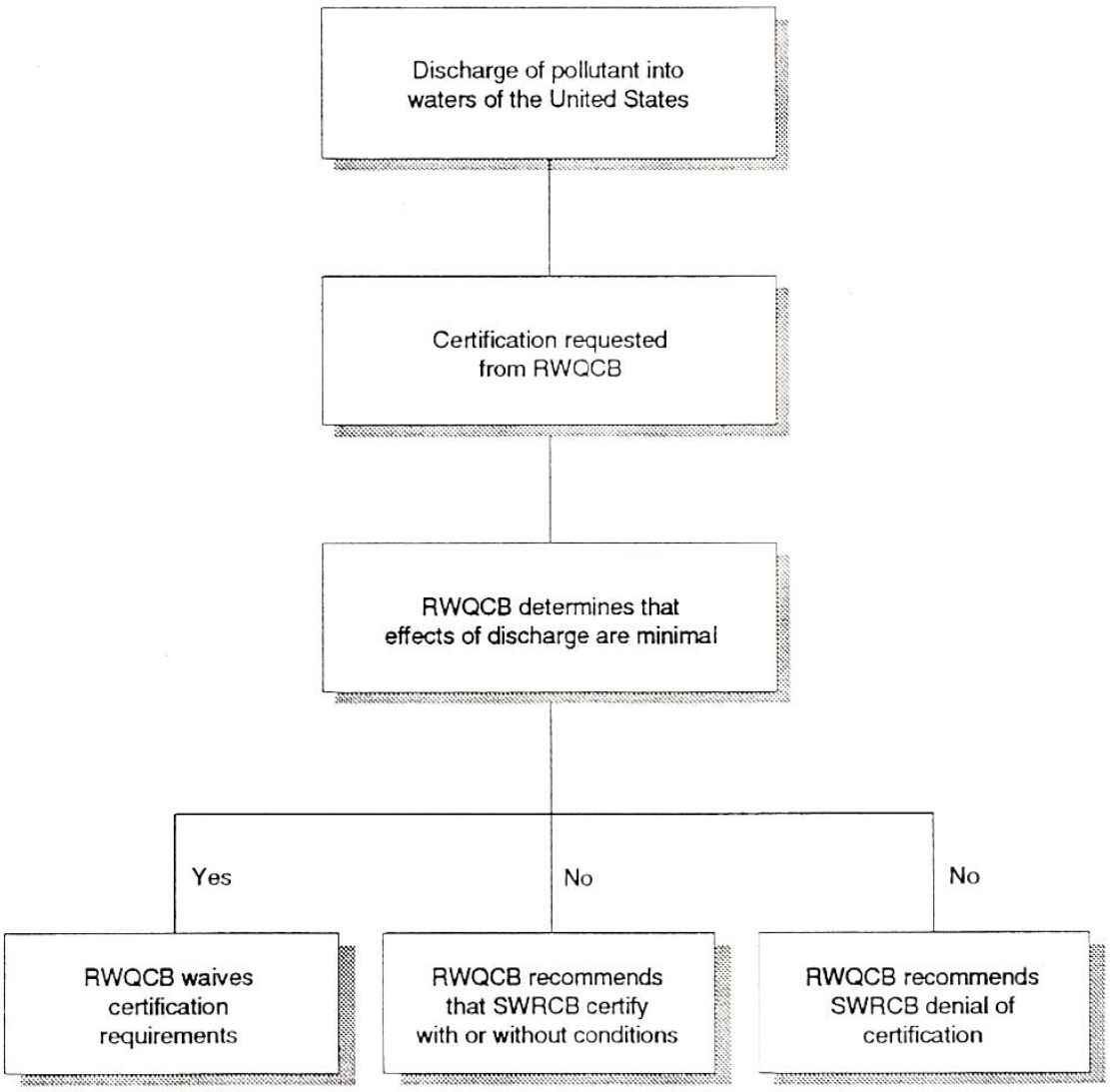


Source: Remy, M.H. et al. (1999). Guide to the California Environmental Quality Act. Solano Press Books. Pt. Arena CA. p. 693. Reproduced by permission of the publisher.

A-1 PERMIT FLOW CHARTS

CLEAN WATER ACT – SECTION 401
Certification

Regional Water Quality Control Board / State Water Resources Control Board



Source: USFWS (1997). Handbook of Regulatory Compliance for the Anadromous Fish Restoration Program. Prepared by Jones & Stokes Assoc., Stockton CA.

A-1 PERMIT FLOW CHARTS

CLEAN WATER ACT – SECTION 402
Stormwater Permit

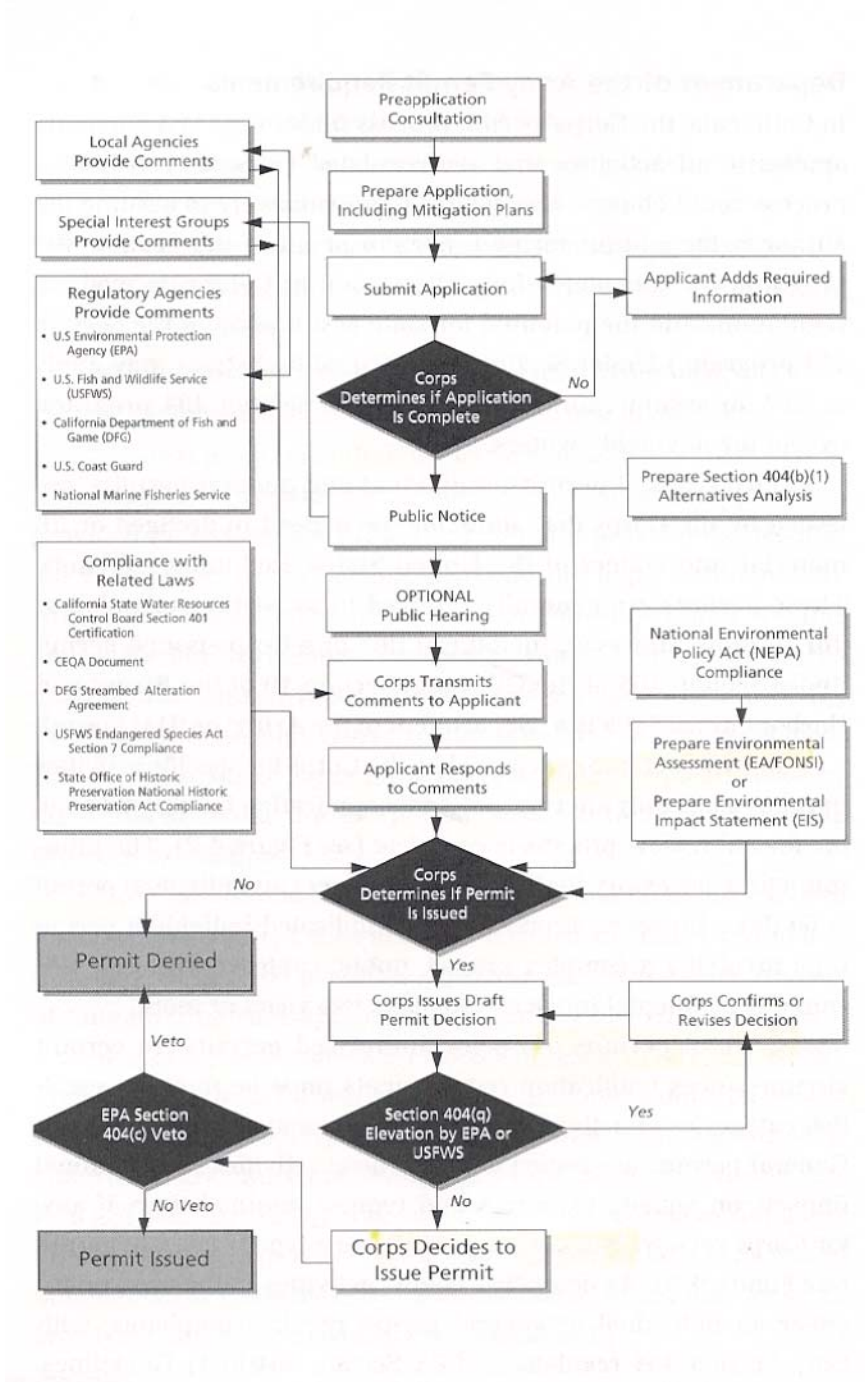
State Water Resources Control Board /
Regional Water Quality Control Board

[NO FLOW CHART AVAILABLE]

A-1 PERMIT FLOW CHARTS

CLEAN WATER ACT – SECTION 404 – INDIVIDUAL PERMIT PROCESS

U.S Army Corps of Engineers



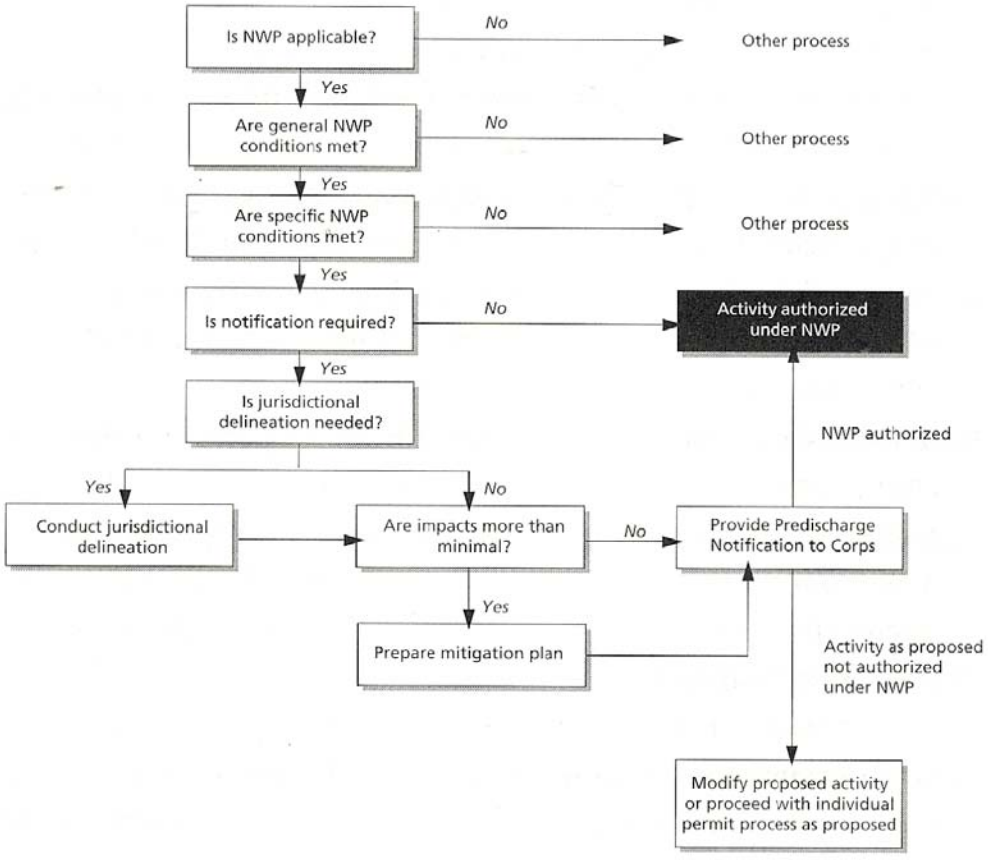
Source: Cylinder, P.D. et al. (1995). Wetlands Regulation: A Complete Guide to Federal and California Programs. Solano Press. p. 50. Reproduced by permission of the publisher.

A-1 PERMIT FLOW CHARTS

CLEAN WATER ACT – SECTION 404

NATIONWIDE PERMIT PROCESS (NWP)

U.S Army Corps of Engineers

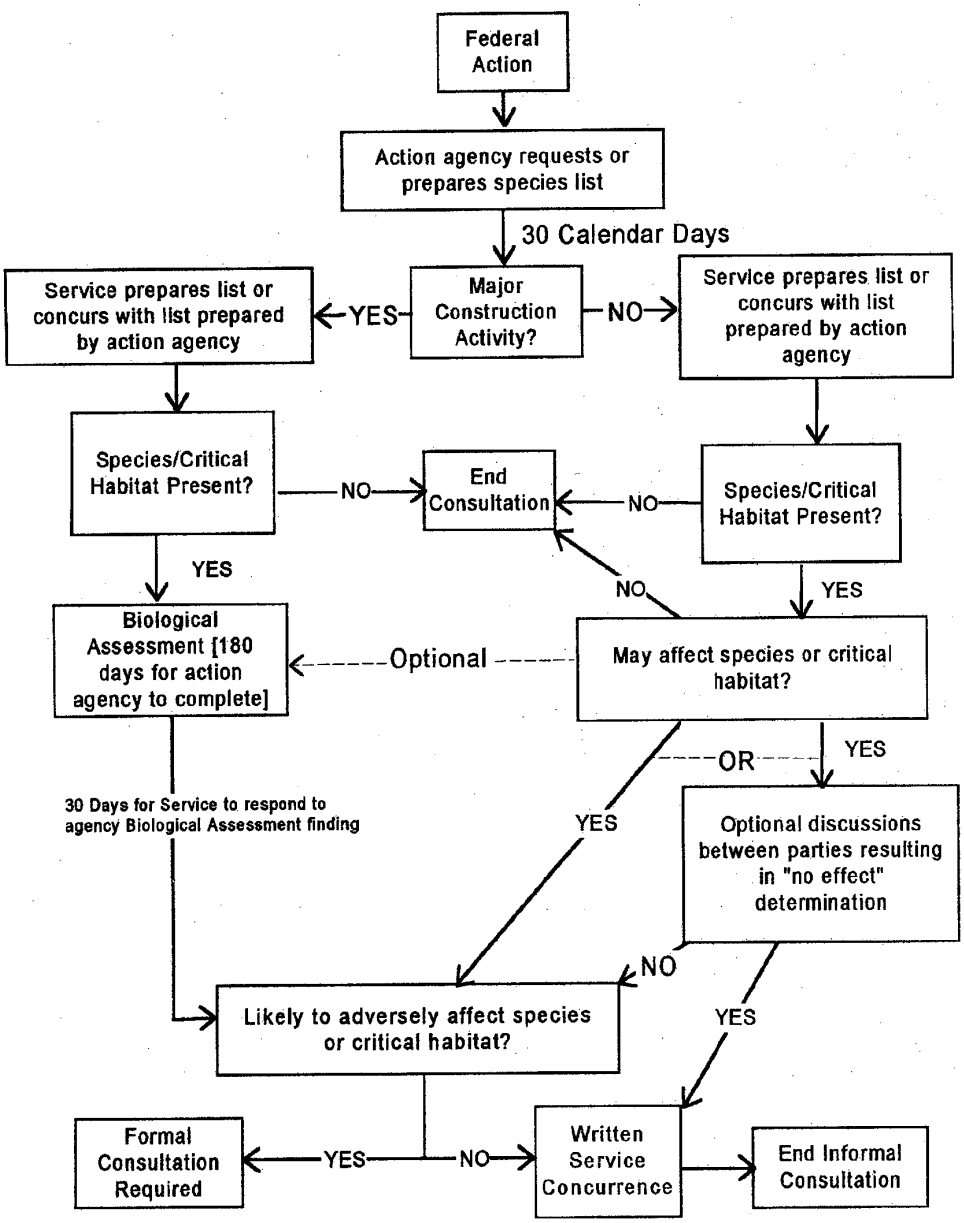


Source: Cylinder, P.D. et al. (1995). Wetlands Regulation: A Complete Guide to Federal and California Programs. Solano Press. p. 51. Reproduced by permission of the publisher.

A-1 PERMIT FLOW CHARTS

FEDERAL ENDANGERED SPECIES ACT (ESA) SECTION 7 CONSULTATION - INFORMAL

National Marine Fisheries Service / U.S. Fish and Wildlife Service

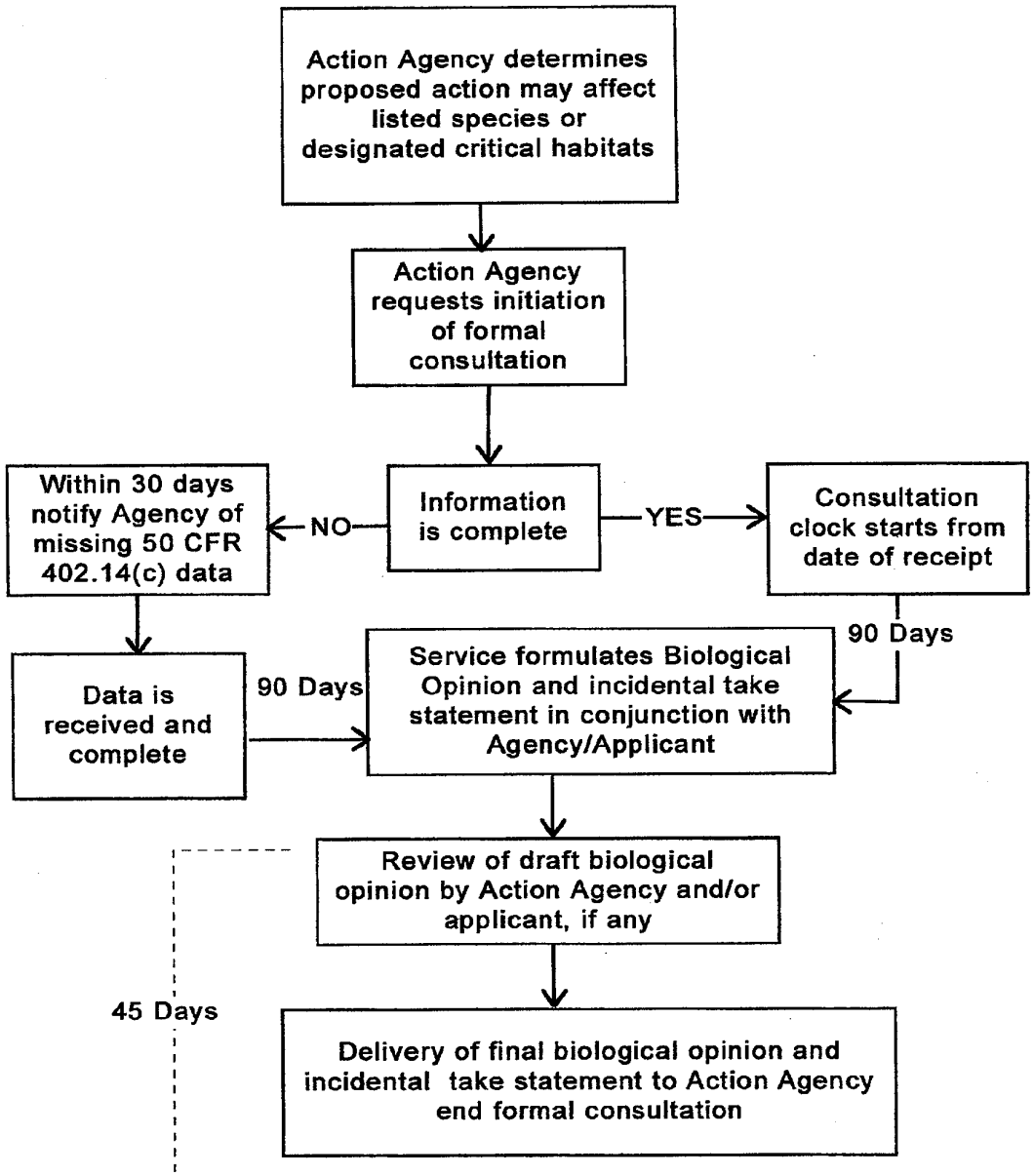


Source: USFWS & NMFS. 1998. Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conferences. Final.

A-1 PERMIT FLOW CHARTS

FEDERAL ENDANGERED SPECIES ACT (ESA) SECTION 7 CONSULTATION - FORMAL

National Marine Fisheries Service / U.S. Fish and Wildlife Service

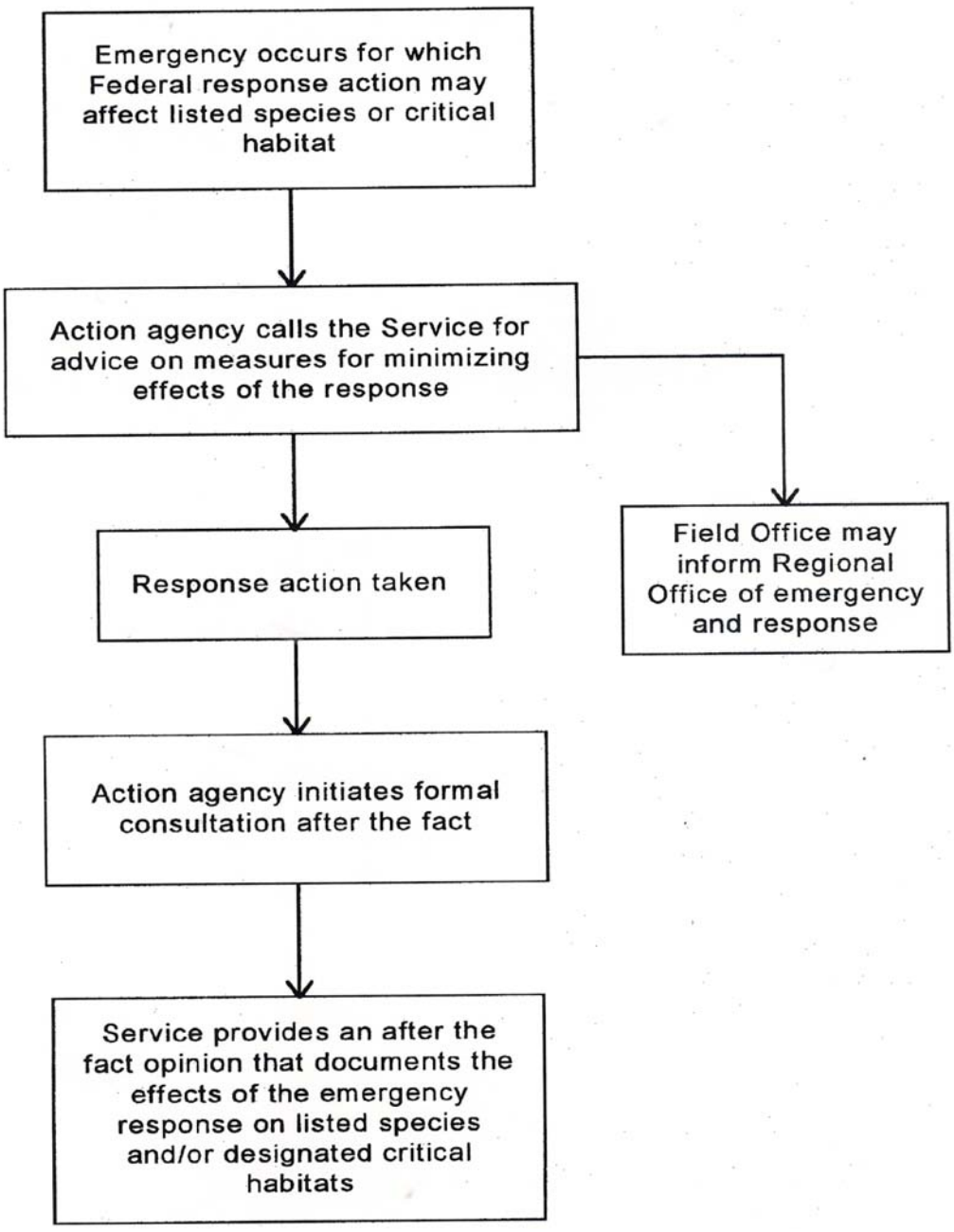


Source: USFWS & NMFS. 1998. Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conferences. Final.

A-1 PERMIT FLOW CHARTS

FEDERAL ENDANGERED SPECIES ACT (ESA) SECTION 7 CONSULTATION - EMERGENCY

National Marine Fisheries Service / U.S. Fish and Wildlife Service

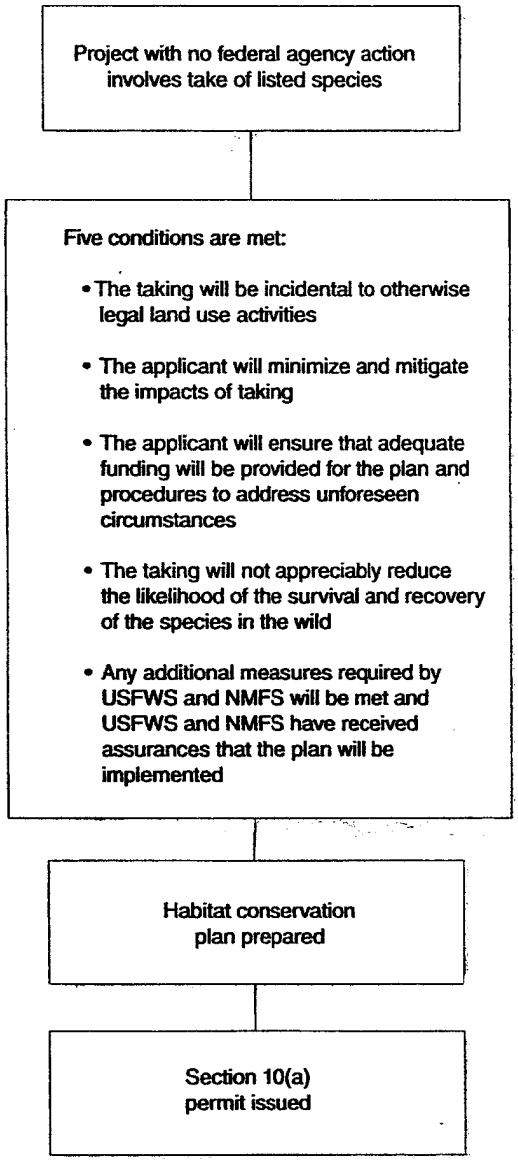


Source: USFWS & NMFS. 1998. Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conferences. Final.

A-1 PERMIT FLOW CHARTS

FEDERAL ENDANGERED SPECIES ACT
SECTION 10 TAKE PERMIT

National Marine Fisheries Service / U.S. Fish and Wildlife Service

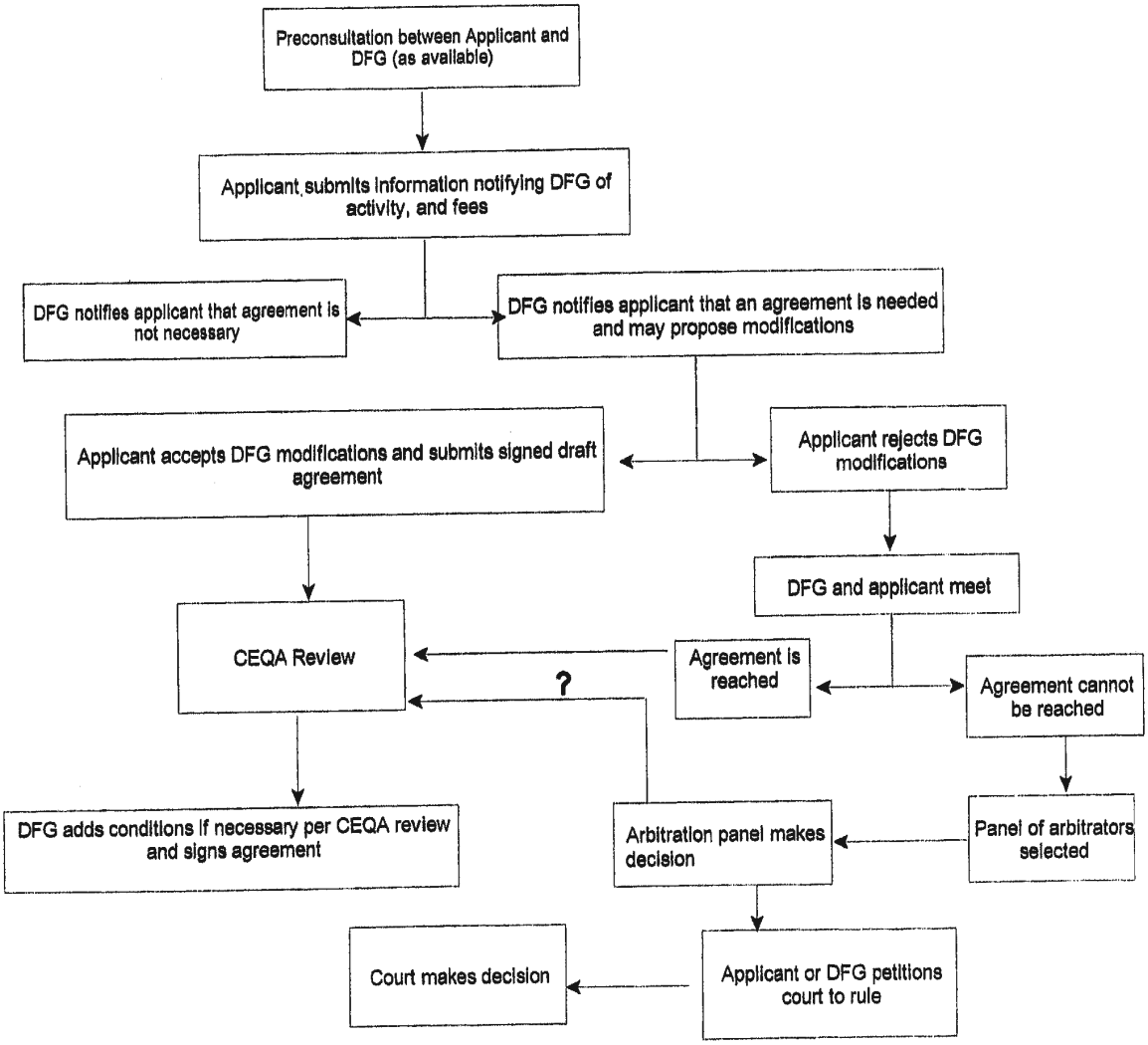


Source: USFWS. (1997). Handbook of Regulatory Compliance for the Anadromous Fish Restoration Program. Prepared by Jones & Stokes. Stockton, CA. p. 4-37.

A-1 PERMIT FLOW CHARTS

FISH AND GAME CODE SECTION 1601 - STREAMBED ALTERATION AGREEMENT

California Department of Fish and Game



Source: Calif. Dept. of Fish and Game. (2000).
"Lake & Streambed Alteration Agreement Process." Sacramento. p. 41

A-2 DIRECTORY OF AGENCIES

All state and federal agencies that may be involved in permitting or review of certain road maintenance activities are listed in this directory. Names of individuals are not included as they tend to change too frequently. Contacts for headquarters, regional, and local offices are listed where available.

- **California State Agencies**
- **Federal Agencies**

A-2 DIRECTORY OF AGENCIES

CALIFORNIA STATE AGENCIES

AIR RESOURCES BOARD (ARB)
2020 L St.,
Sacramento, CA 95814
Information: (916) 322-2990; Office of the Ombudsman (916) 323-8711
Regulatory Assistance Section: (916) 322-3984

Basin 1 North Coast Unified Air Quality Management District (AQMD)
2389 Myrtle Ave.
Eureka, CA 95001
(707) 443-3093

Mendocino County Air Quality Management District (AQMD)
306 E. Gobbi St.
Ukiah CA 95482
(707) 463-4354

Siskiyou County Air Pollution Control District (APCD)
525 South Foothill
Yreka, CA 96097
(530) 841-4029

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY (CAL/EPA)
555 Capitol Mall, Suite 525
Sacramento, CA 95814
(916) 327-1848 (Help Desk) (916) 468-1786 (Permit Assistance Centers)
Website: *//www.calepa.ca.gov/*

COASTAL COMMISSION
45 Fremont St., Suite 2000
San Francisco, CA 94105
(415) 904-5260 FAX (415) 904-5400
Website: //www.coastal.ca.gov/web

North Coast Area Office (Del Norte, Humboldt, and Mendocino counties)
P.O. Box 4908
Eureka CA 95502-4908
(707)445-7833 FAX (707)445-7877

DEPARTMENT OF CONSERVATION
Office of Mine Reclamation
801 K St., MS 09-06

Sacramento, CA 95814-3529
(916) 323-9198
Website: //www.consrv.ca.gov/omr/

DEPARTMENT OF FISH AND GAME (DFG)

Headquarters Website: www.dfg.ca.gov

Wildlife Protection Division
1416 Ninth St.
Sacramento, CA 95814
(916) 653-4094

Native Anadromous Fish & Watershed Restoration Branch
1807 – 13th St., Suite 104
Sacramento, CA 95814
(916) 327-8840 FAX 327-8854

Office of Oil Spill Prevention and Response (OSPR)
P.O. Box 944209, Sacramento CA 94244-2090
(916) 445-9338 Info 24-hour Hotline: (916) 445-0045
Dr. Kim McCleneghan (916) 322-9210

Region 1 – Northern California- North Coast Region

601 Locust St.
Redding, CA 96001
Information: (530) 225-2300 FAX: (530) 225-2381

619 Second St.
Eureka CA 95501
(707)445-6493 FAX (707)445-6664

Region 3 – Central Coast Region (includes Mendocino County)

P.O. Box 47 (mailing), Yountville, CA 94599
7329 Silverado Trail, Napa CA 94558 (street address)
Information: (707) 944-5500 FAX: (707) 944-5563

DEPT. OF TRANSPORTATION (CALTRANS)

District 1 (North Coast – Del Norte, Humboldt, Mendocino counties)
1656 Union St.
Eureka, CA 95501
(707) 445-6444

District 2 (Northeastern – Siskiyou and Trinity counties)
1657 Riverside Dr.
Redding, CA 96001
(530) 225-3260

Environmental Division
650 Howe Ave., Suite 400
Sacramento, CA 95825
(916) 263-3370 Website:

REGIONAL WATER QUALITY CONTROL BOARD (RWQCB)

NORTH COAST REGION
5550 Skylane Blvd., Suite A
Santa Rosa, CA 95403
(707) 576-2220 FAX: (707) 523-0135
Website: //www.swrcb.ca.gov/rwqcb1/

CENTRAL VALLEY REGION
415 Knollcrest Dr.
Redding, CA 96002
(530) 224-4845
Website: //www.swrcb.ca.gov/rwqcb5/

RESOURCES AGENCY
1416 Ninth St.,
Sacramento, CA 95814
(916) 653-5656 FAX: (916) 653-8102
Website: //resources.ca.gov/

STATE LANDS COMMISSION (SLC)
Land Management Division
100 Howe Ave., Suite 100 South
Sacramento CA 95825
(916) 574-1900 FAX: (916)574-1945
Website: //www.slc.ca.gov

STATE WATER RESOURCES CONTROL BOARD (SWRCB)
Division of Water Quality
Attn: Storm Water Permit Unit
P.O. Box 1977 (901 P St.)
Sacramento, CA 95812-1977
(916) 657-0757 FAX: (916) 657-1011
Website: //www.swrcb.ca.gov

A-2 DIRECTORY OF AGENCIES

FEDERAL AGENCIES

NATIONAL MARINE FISHERIES SERVICE (NMFS)

Protected Species Management Division or Habitat Division
777 Sonoma Ave., Room 325
Santa Rosa, CA 95405
(707) 575-6050 FAX (707) 578-3435

Arcata Field Office
1655 Heindon Rd.
Arcata, CA 95521
(707) 822-7201

Southwest Regional Office
501 West Ocean Blvd., #4200
Long Beach, CA 90802-4213
(562) 980-4000 FAX (562) 980-
Website: //www.swr.ucsd.edu/

U.S. ARMY CORPS OF ENGINEERS (COE)

San Francisco District
Regulatory Branch
333 Market St.
San Francisco, CA 94105-2197
North Section (includes Mendocino & Trinity counties) - (415) 977-8439

Eureka Field Office (Del Norte, Humboldt, Siskiyou counties)
P.O. Box 4863
Eureka, CA 95502-4863
(707) 443-0855

Website: //www.spn.usace.army.mil/regulatory/

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Region 9
Water Management Division
75 Hawthorne St.
San Francisco, CA 94105-3901
(415) 744-1305 FAX (415) 744-1078
Website: //www.epa.gov/ow

North Coast Office
1695 Heindon Rd.
Arcata CA 95521
(707) 825-2311

A-2 DIRECTORY OF AGENCIES

U.S. FISH AND WILDLIFE SERVICE (USFWS)

Sacramento Fish & Wildlife Office
Endangered Species / or Ecological Services Divisions
2800 Cottage Way, W-2605
Sacramento, CA 95825
(916) 414-6600 FAX (916) 414-6712

Arcata Fish and Wildlife Office
1655 Heindon Rd.
Arcata, CA 95521
(707) 822-7201
Website: //www.ccfwo.r1.fws.gov/

U.S. FOREST SERVICE (USFS)

Klamath National Forest
1312 Fairlane
Yreka CA 96097
(530) 842-6131

Mendocino National Forest
825 N. Humboldt Ave.
Willows CA 95988
(530) 934-3316

Shasta-Trinity National Forests
2400 Washington Ave.
Redding CA 96001
(530) 244-2978

Six Rivers National Forest
1330 Bayshore
Eureka CA 95501
(707) 442-1721

California USFS Website: ***//www.r5.fs.us***

NATIONAL PARK SERVICE (NPS)

650 Capitol Mall, Suite 8-300
Sacramento, CA 95814
(916) 930-3615

A-2 DIRECTORY OF AGENCIES

FEDERAL AGENCIES WITH RESPONSIBILITY FOR NATIONAL WILD & SCENIC RIVER MANAGEMENT: NORTH COAST RIVERS

CALIFORNIA 2a(ii) WSR
River Descriptions/Agency Responsibility

River	Segment	Mileage	Agency
Eel	NF – Soldier Basin to Forest Boundary (FB Six Rivers National Forest)	15	USFS (SRNF)
	NF – FB to confluence with Main Stem (includes Round Valley Indian Reservation lands)	24	NPS
	MF – Headwaters to FB (Confluence with Black Butte Creek and MF Eel).	18	USFS (MNF)
	MF – Confluence of Black Butte Creek to confluence with Main Stem (includes ½ mile of Round Valley Indian Reservation)	30	BLM
	Main Stem –(legal description) to southern BLM boundary	13	NPS
	Main Stem – South BLM boundary to confluence with Outlet Creek	13	BLM
	Main Stem – Confluence of Outlet Creek to Mouth	120	NPS
	SF – Headwaters (Section 4 Creek) to confluence with Rattlesnake Creek adjacent to Hwy 101 (Leggett)	23	BLM
	SF – Confluence with Rattlesnake Creek to Main Stem	62	NPS
	Van Duzen – Headwaters to confluence with Main Stem (segment end pt.s not clear	40	NPS
Trinity	Main Stem – Lewiston Lake to FB/confluence with NF Trinity R	17	BLM
	Main Stem – East FB to W. FB (Shasta-Trinity NF) (mileage of New River trib not included)	33.2	USFS (STNF)
	Main Stem – East FB to W FB (6 Rivers)	15	USFS (SRNF)
	Main Stem – FB, crossing Yurok land to Hoopa Indian land boundary	1	NPS
	Main Stem – Hoopa Indian land boundary to confluence with Klamath	2	NPS
	New River – Headwaters to confluence with main stem Trinity R	21	USFS (STNF)
	SF – Forest Glen to West FB (Shasta-Trinity NF)	37.2	USFS (STNF)
	SF – East FB (6 Rivers) to confluence with Main Stem of Trinity	19	USFS (SRNF)
	NF Trinity – Headwaters to Main Stem Trinity	15	USFS (STNF)

A-2 DIRECTORY OF AGENCIES

CALIFORNIA 2a(ii) WSR
River Descriptions/Agency Responsibility
(Continued)

River	Segment	Mileage	Agency
Klamath	Iron Gate to FB	12.5	USFS (KNF)
	East FB to Confluence with Dillon Creek– mileage of 2 tribs (Scott and Salmon) not included.	87.1	USFS (KNF)
	Confluence with Dillon Creek to west Forest Boundary of the Klamath N.F.	19.9	USFS (SRNF)
Scott	Scott River from Shackleford Creek to confluence with Klamath River	23.3	USFS (KNF)
Salmon	Main Stem Salmon River from forks of Salmon to the confluence with Nordheimer Creek	4.6	USFS (KNF)
Salmon	Main Stem Salmon River from confluence with Nordheimer Creek to Confluence with Klamath River	14.6	USFS (SRNF)
	SF Salmon R from <1984 wilderness boundary to Forks of Salmon	16.4	USFS (KNF)
	NF Salmon R from < 1984 wilderness boundary to confluence with Salmon R	28.5	USFS (KNF)
Wooley Creek	Wooley Creek from < 1984 wilderness boundary to confluence with Salmon R	7.9	USFS (SRNF)
	Klamath R - East FB to W. FB (Six Rivers National Forest)	20	USFS (SRNF)
	FB to confluence with Trinity R (Hoopa & Yurok Indian land boundaries unclear	2	NPS
	Confluence with Trinity R to Klamath Glen (Hoopa & Yurok Indian land boundaries unclear)	31	NPS
	Klamath Glenn to mouth (Includes REWD)	4	NPS
Smith	Endpoints unclear – generally from W. FB Note: 296 miles of Smith R were federally designated in 1990, superceding the 2(a)(ii) designation – It continues to be administered by Six Rivers NF.	29	NPS

KNF =Klamath National Forest; MNF = Mendocino National Forest; TNF = Shasta Trinity National Forest ; SRNF = Six Rivers National Forest; NPS = National Park Service; BLM = Bureau of Land Management
Note: The Six Rivers NF. administers work on the Ukonom District of the Klamath NF
Note: Do not use this river list as a reference guide for accurate segment mileages. Some of the segments have been measured by informal means and may not reflect the official distances listed in their legislation.

APPENDIX B

BEST MANAGEMENT PRACTICES - STANDARD DESIGNS & PROCEDURES

This appendix includes standard designs and procedures for many of the structural and physical Best Management Practices (BMPs) that are referred to in the Manual (Chapters 3 through 9). The best drawings and procedures were gleaned from a variety of manuals, guidelines, handbooks, and other references. Users of these designs are encouraged to refer to the original source for more detailed specifications of the particular BMP.

B-1 TABLE OF CONTENTS

B-1 TABLE OF CONTENTS

B-2 USEFUL REFERENCES

1. Association of Bay Area Governments (ABAG). 1995. Manual of Standards for Erosion & Sediment Control Measures. 2nd edition. Oakland CA. [(510)464-7900; //www.abag.ca.gov]

2. California Dept. of Fish and Game (CDFG). 1998. California Salmonid Stream Habitat Restoration Manual. By Gary Flosi, et al. Inland Fisheries Div., 3rd edition. Sacramento, CA. [(916)654-5997]

3. Furniss, M., et al. 2000. FishXing: An interactive CDROM. FishXing Development Team and Humboldt State Univ. Courseware Development Center. Arcata CA.

4. Humboldt County. 2000. "Ordinance for Grading, Excavation, Erosion and Sedimentation Control." July Draft. Prepared by Oscar Larson Assoc., Eureka CA.

5. King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Prepared by the Regional Road Maintenance Technical Working Group. Final Draft. Seattle, WA. [//www.metrokc.gov/roadcon/bmp/pdfguide.htm]

6. McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta Resource Conservation District (RCD). Redding CA. 187 p.

7. Robison, E., A. Mirati, and M. Allen. 1999. Oregon Road/Stream Crossing Restoration Guide. Advanced Fish Passage Training Version. Salem OR. [//www.4sos.org/wssupport/ws_rest/OregonRestGuide/index.html]

8. Salix Applied Earthcare. *Erosion Draw 3.0* / *BioDraw 1.0*. Redding CA. [(530) 247-1600; //www.salixaec.com]

9. USDA Forest Service (USFS). 2000. Water/Road Interaction Technology Series: "Diversion Potential at Road-Stream Crossings"; "Response of Road-Stream Crossings to Large Flood Events in Washington, Oregon, and Northern California" By M. Furniss et al., Technology and Development Program. San Dimas, CA. [(909)599-1267]

10. USDA Natural Resources Conservation Service. 1996. *Watershed Technology Electronic Catalog*. [//www.wcc.nrcs.usda.gov/wtec/wtec.html]

11. USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook – Streambank and Shoreline Protection. Part 650, Chapter 16. [local NRCS office]

12. Washington Dept. of Fish and Wildlife. 1999. Fish Passage Design at Road Culverts: A design manual for fish passage at road crossings. Olympia WA. [//dfw.wa.gov]

13. Weaver, W.E. and D.K. Hagans. 1994. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District, Ukiah CA. [(707)468-9223]

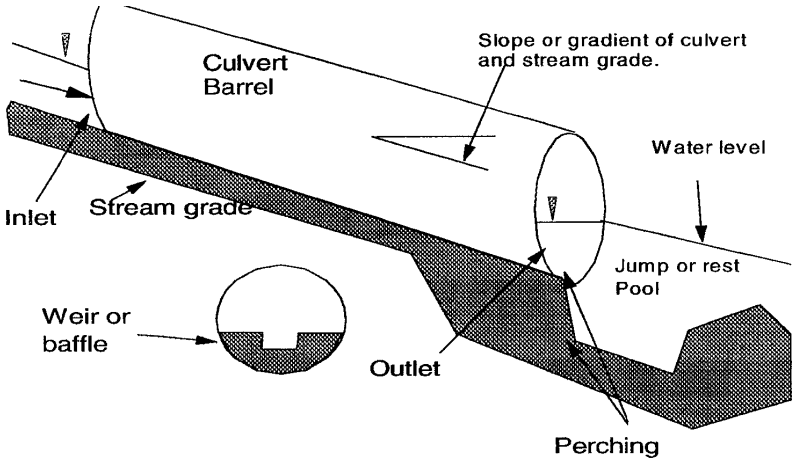
B-3 CULVERT BMP DESIGNS

These designs for practices at or within culverts are for the purposes of:

- Erosion control
- Fish passage improvement
- Water runoff control
- Sediment control

List of Culvert BMP Designs:	**Design #**
Culvert Hydraulics - Definition of Terms Diagram	B-3.1
Plugging Hazards Diagram	B-3.2
Back-Flooding Weirs	B-3.3
Baffles – Fish Passage	
When to Use & Types	B-3.4
Washington Baffles	B-3.5
Ditch Relief Culvert	B-3.6
Energy Dissipator	B-3.7
Culvert Inlet Sediment Trap	B-3.8

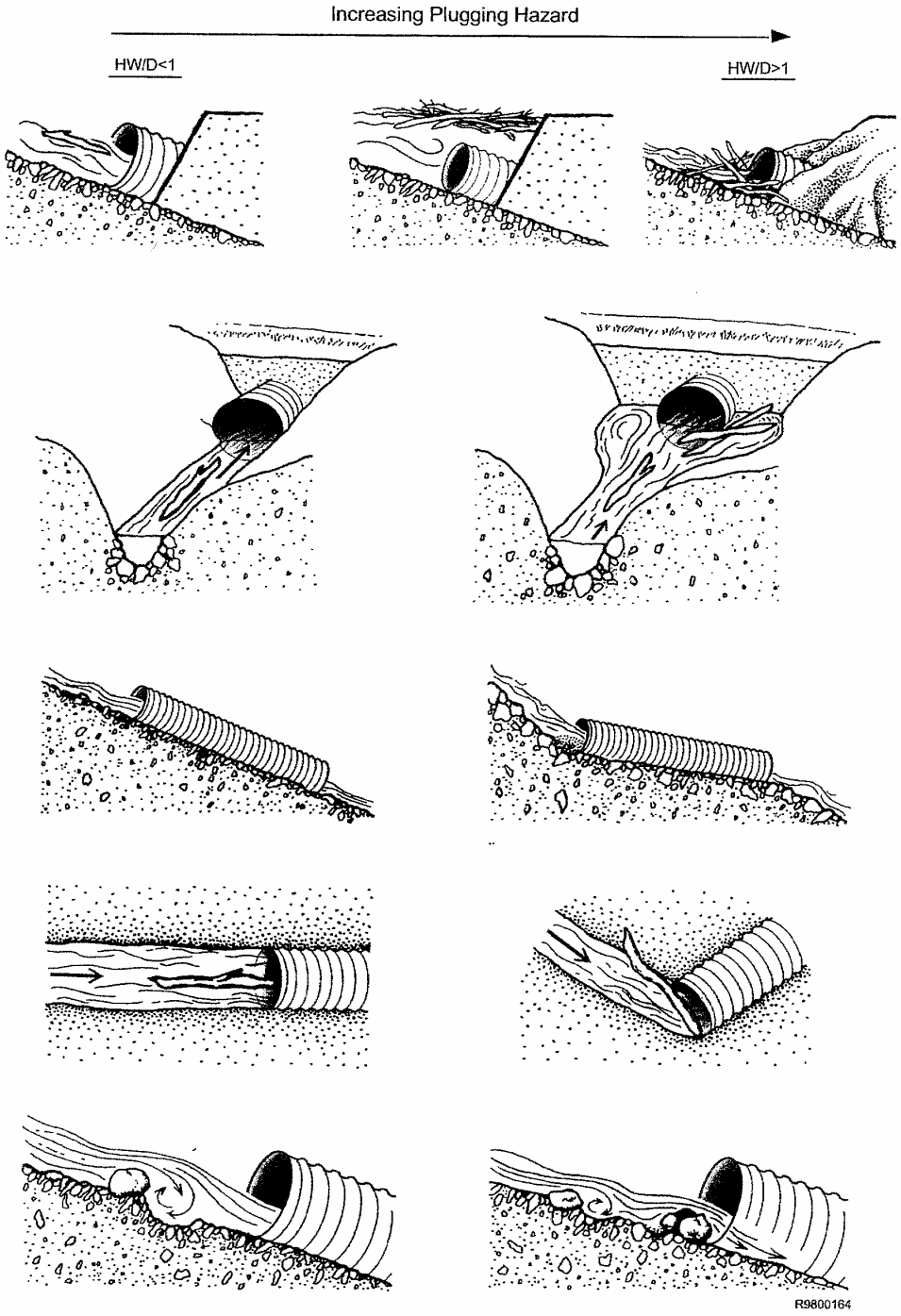
Culvert Hydraulics B-3.1
Definition of Terms



Perched Outlet: A condition in which a culvert's outlet is suspended over the immediate downstream pool, requiring fish to leap into a culvert (DFG).

Source: Robison, E., A. Mirati, and M. Allen. 1999. Oregon Road/Stream Crossing Restoration Guide. Advanced Fish Passage Training Version. Salem OR.

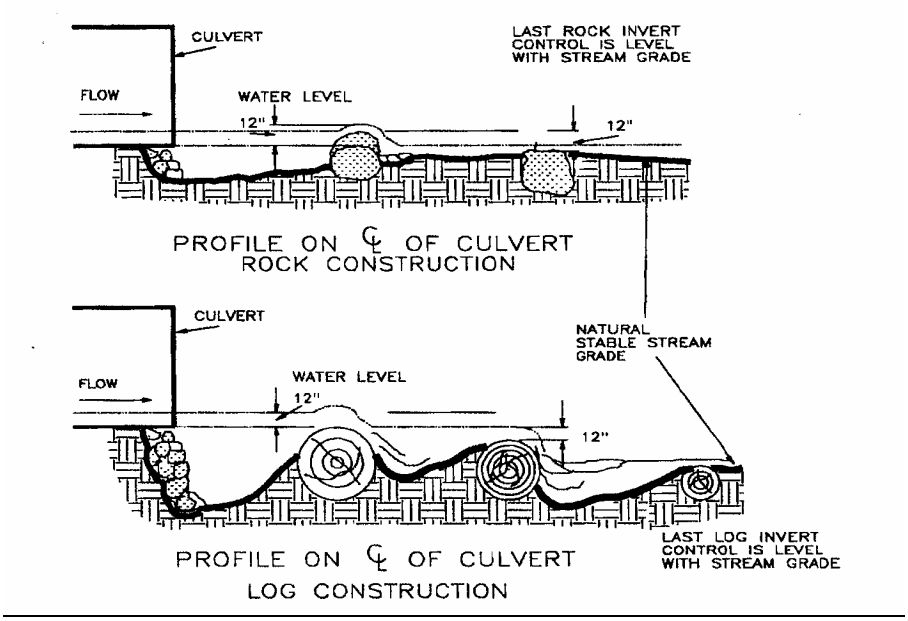
Culvert Plugging Hazards B-3.2



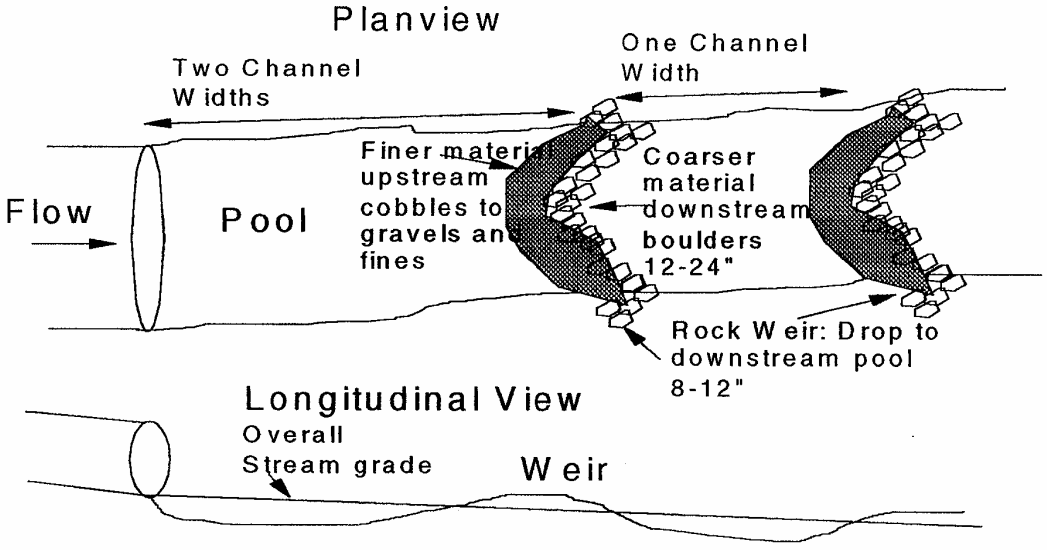
Source: USDA Forest Service (USFS). 2000. Water/Road Interaction Technology Series: "Diversion Potential at Road-Stream Crossings", By M. Furniss et al., Technology and Development Program. San Dimas, CA.

Back-Flooding Weirs B-3.3

When to use: When culvert is not installed with at least ¼ of its diameter at or below stream grade. Purpose is to help pass adult and juvenile fish where a jump barrier was created by scour at the downstream end of culverts.



Source: California Dept. of Fish and Game (CDFG). 1998. California Salmonid Stream Habitat Restoration Manual. By Gary Flosi, et al. Inland Fisheries Div., 3rd edition.



Source: Robison, E., A. Mirati, and M. Allen. 1999. Oregon Road/Stream Crossing Restoration Guide. Advanced Fish Passage Training Version. Salem OR.

Baffles: When to Use & Types B-3.4

Definition: A feature added to a culvert to increase the hydraulic roughness of the culvert and therefore reduce the average cross-section velocity. The purpose is to improve fish passage, mainly for adults.

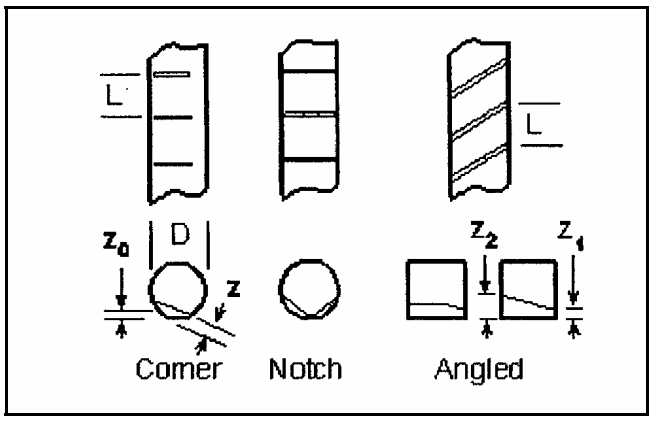
When to Use: To provide for adult fish passage in an existing culvert in a low gradient stream with good habitat upstream, and where funding is not available to replace with a bridge or open bottomed culvert. Cost and maintenance usually make this choice a last resort.

When Not to Use: Baffles within a culvert are not a desired solution to meeting velocity criteria and are not appropriate for new culvert installations. Baffles should not be installed in culverts with: 1) less than 5 feet of headroom; 2) high gradient streams (>3.5% slope) with large bedload and debris moving through. Culverts with baffles are more prone to clog with debris and sediment. Baffles can rip out and damage the culvert or cause it to fail.

Baffle Styles: The figure below depicts 2 styles for round culverts and 1 for box culverts. They are all designed with a continuous alignment of notches along one wall rather than alternating back and forth. This design allows less resistance to high flows and an uninterrupted line of fish passage along one or both sides. This feature is particularly important for weak fish which would be forced to cross the high velocity zone at every baffle in an alternating baffle design.

Two details of angled baffles are shown for box culverts; the continuously sloped baffle is generally used for juvenile passage situations and in culverts 6 feet wide and less. The notch baffle style is especially useful in large culverts and can be applied to slopes of 2.5-3.5%. Corner baffles generally apply to culverts with slopes from 1.0-2.5%.

To avoid reducing the culvert capacity, the upstream baffle should be placed at least one culvert diameter downstream of the inlet and should be high enough to ensure subcritical flow at the inlet at the high design flow. A modification of the culvert, such as a mitered end or wingwalls, may also be required to improve its hydraulic efficiency.



Source: Washington Dept. of Fish and Wildlife. 1999. Fish Passage Design at Road Culverts: A design manual for fish passage at road crossings. Olympia WA.

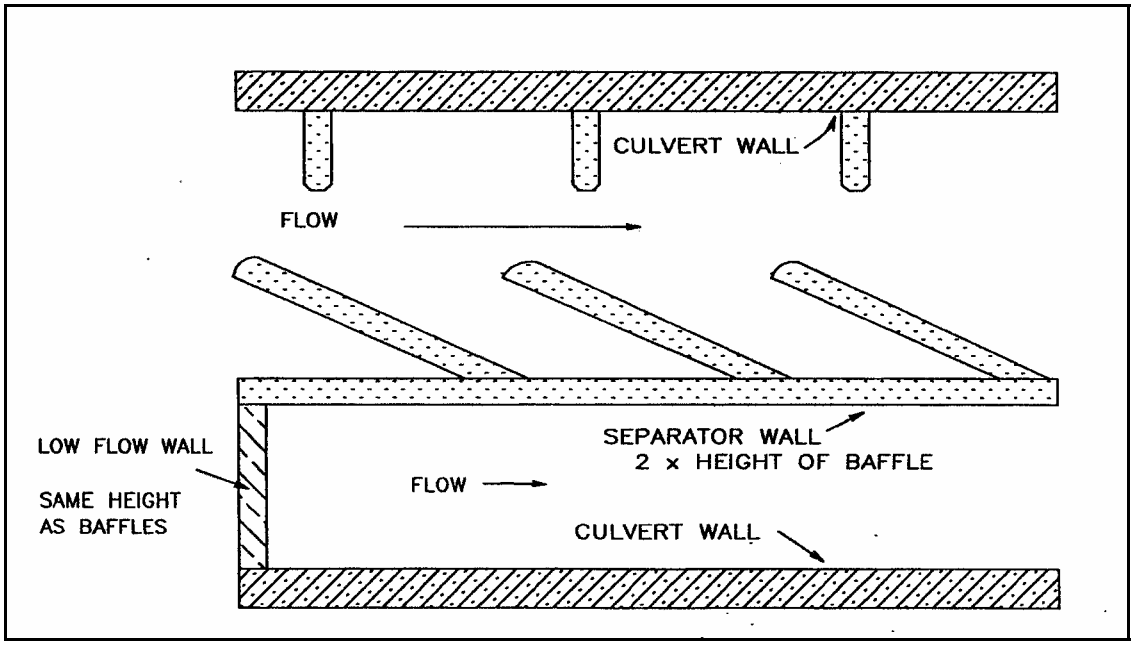


Figure 1. Washington Baffles with a separator wall – for culverts > 7 ft. width. (CDFG 1998)

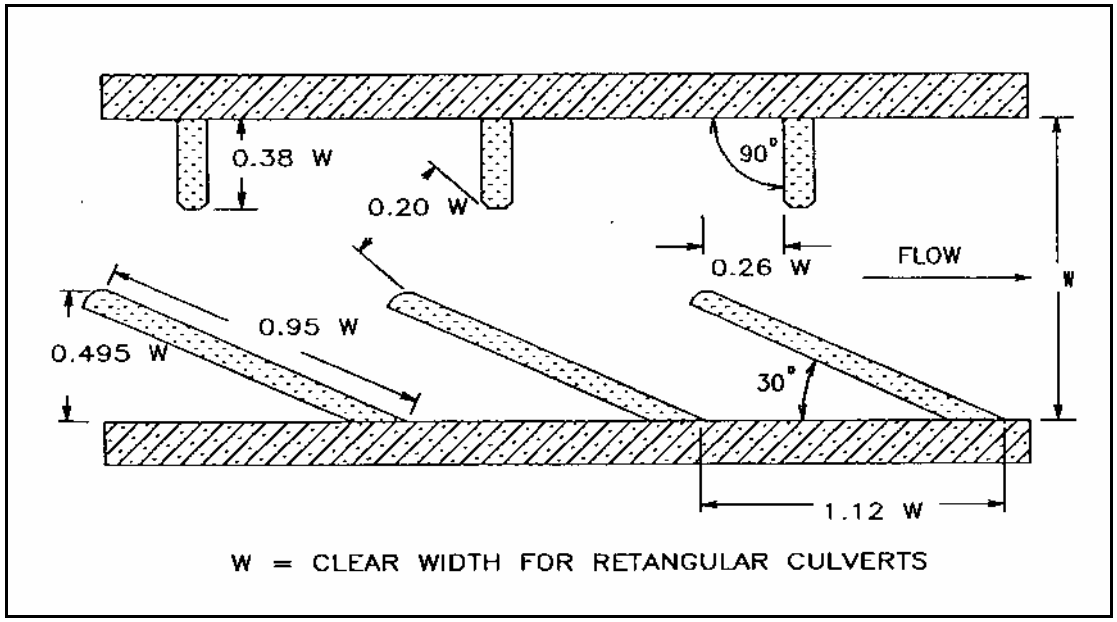


Figure 2. Washington baffles. (CDFG 1998)

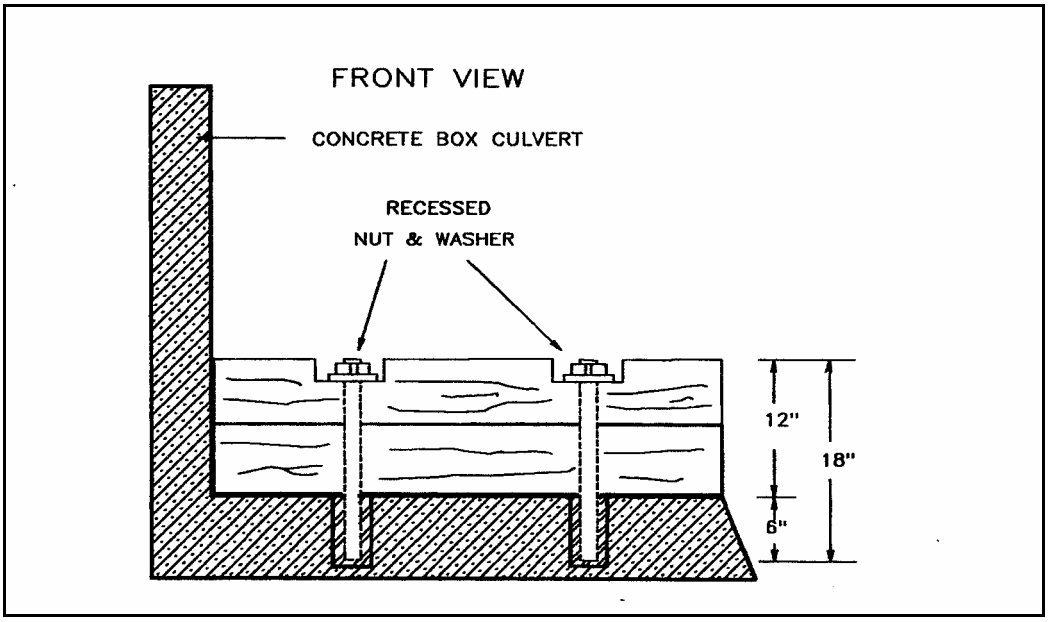


Figure 3. Redwood Washington baffle construction. (CDFG 1998)

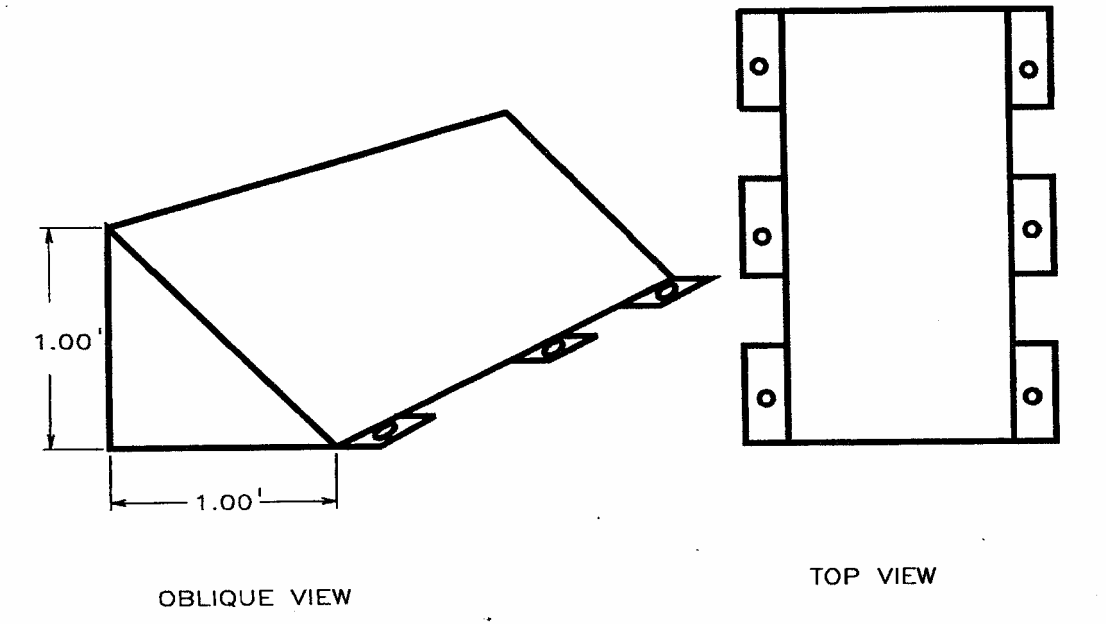


Figure 4. Steel Washington baffle. (CDFG 1998)

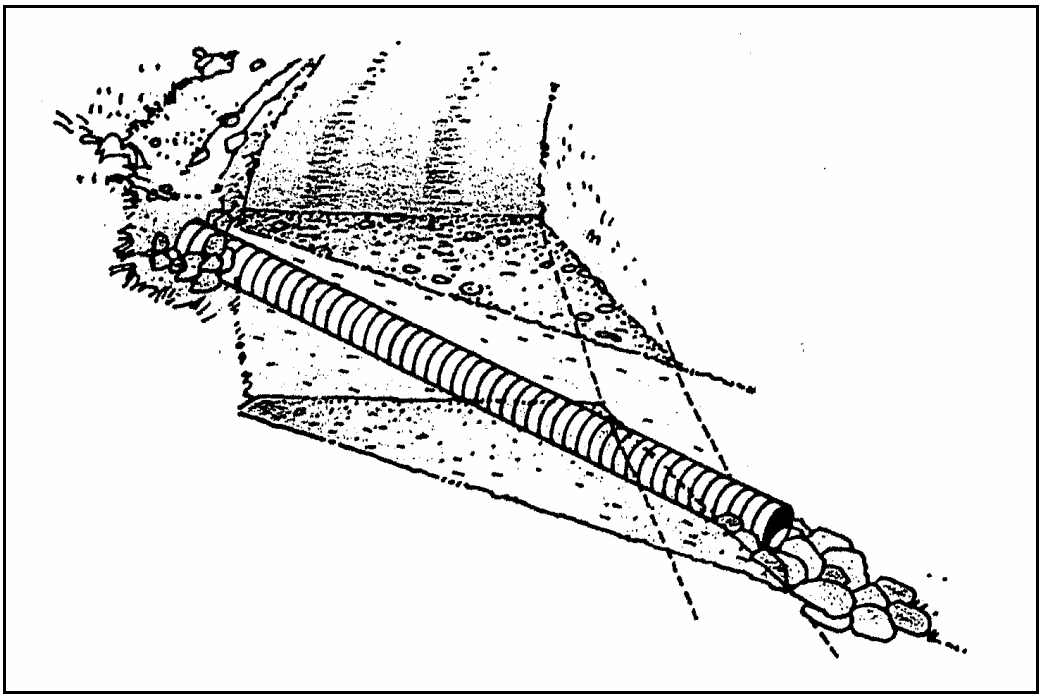
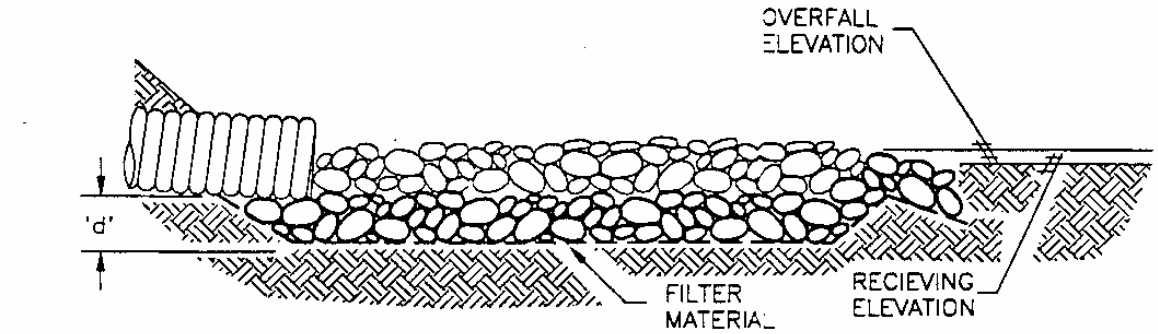


Figure 1. Like stream crossing culverts, ditch relief culverts should be installed at the base of the road fill, with armoring at the inlet and some type of energy dissipation at the outfall. If the culvert is placed higher in the fill, a downspout should be used to carry flow from the outlet downslope past the base of the fill.

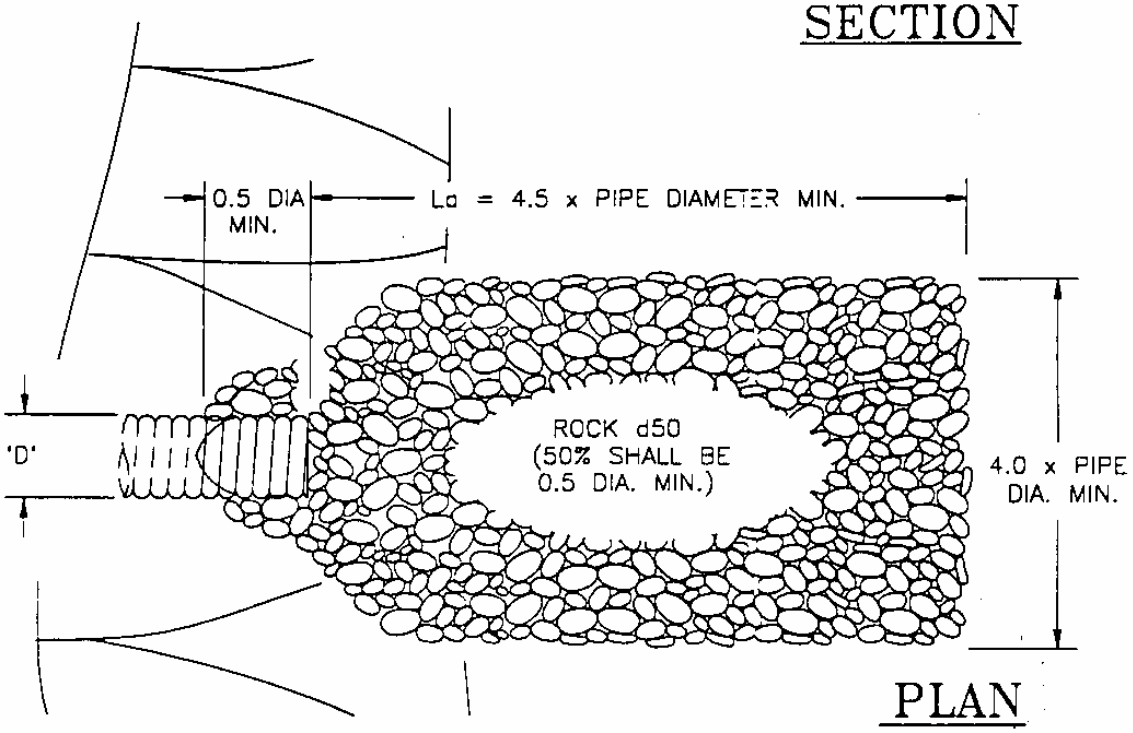
Source: Weaver, W.E. and D.K. Hagans. 1994. Handbook for Forest and Ranch Roads. Mendocino County Resource Conservation District, Ukiah CA.

Energy Dissipator B-3.7



THICKNESS (d) = 1.5 x MAX ROCK DIAMETER (6" MIN.)

SECTION



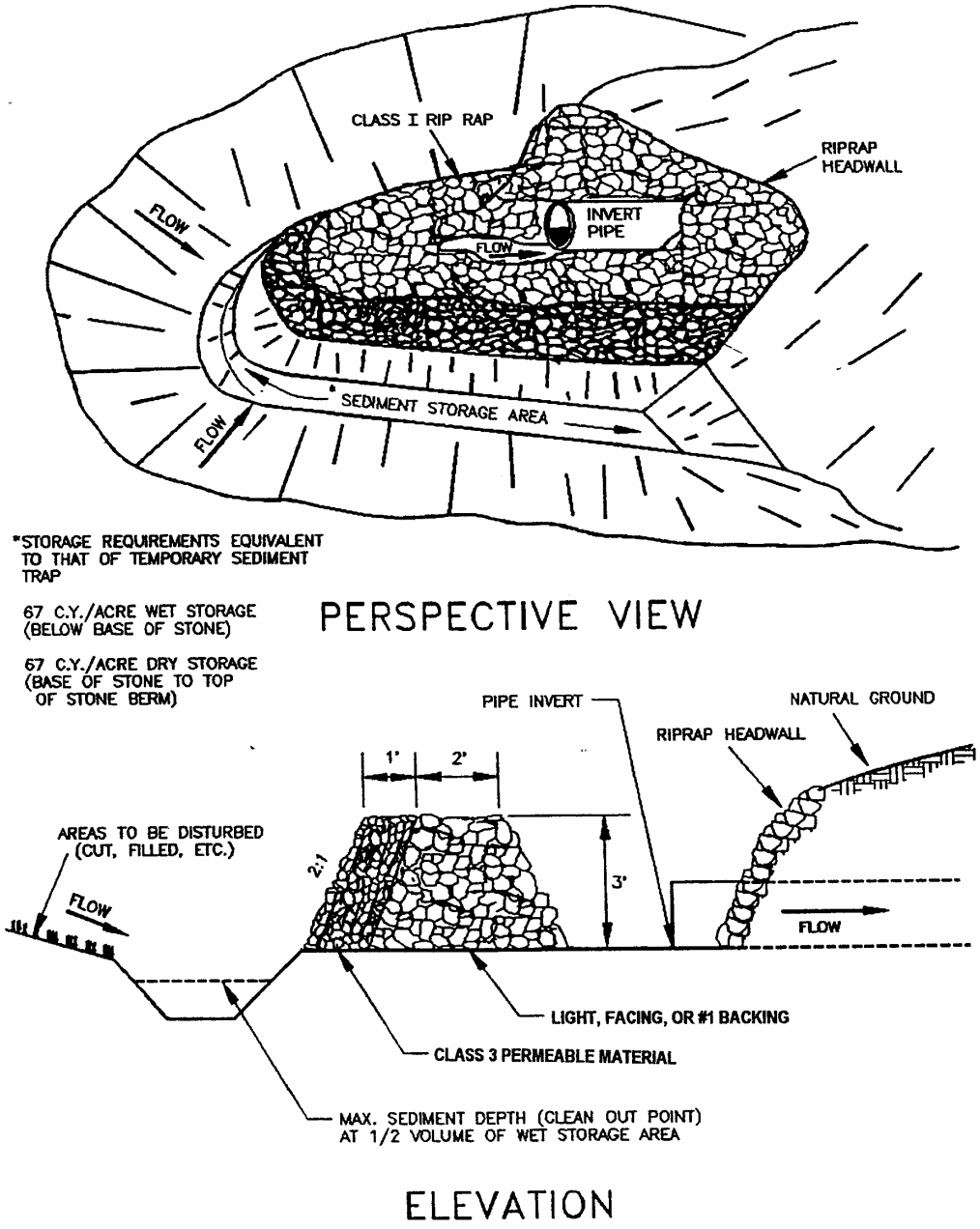
PLAN

NOTES:

1. 'La' = LENGTH OF APRON. DISTANCE 'La' SHALL BE OF SUFFICIENT LENGTH TO DISSIPATE ENERGY. APRON SHALL BE SET AT A ZERO GRADE AND ALIGNED STRAIGHT.
2. FILTER MATERIAL SHALL BE FILTER FABRIC OR 6" THICK (MIN.) GRADED GRAVEL LAYER.

Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta Resource Conservation District (RCD). Redding CA. 187 p.

Culvert Inlet Sediment Trap B-3.8



Source: Association of Bay Area Governments (ABAG). 1995. Manual of Standards for Erosion & Sediment Control Measures. 2nd edition. Oakland CA.

B-4 EROSION CONTROL – UPSLOPE

EROSION CONTROL BLANKETS B-4.1
GEOTEXTILE FABRICS

Description: Soil stabilization can be done through the installation of a protective blanket (covering) or mat on a prepared planting area, steep slope, or channel.

Purpose: The purpose is to resist the forces of soil erosion during storm events, reinforce steep slopes, and help promote vegetation establishment as a mulch substitute. These blankets can be made out of short-term biodegradable to control temporary erosion or long-term non-biodegradable materials for permanent reinforcement for vegetation during high flow or runoff events.

Other terms include Rolled Erosion Control Products, Erosion Control Netting, Turf Reinforcement Mats, and Geotextiles or Geosynthetics.

Types of Materials:

Biodegradable Products: Natural fibers

- Coconut Fiber or coir
- Jute
- Straw
- Wood fiber (excelsior)

Non-biodegradable Products: Synthetic fibers and filaments

- Nylon (polyamides)
- Propylene and Ethylene (polyolefins)
- PVC (polyvinylchloride)

Composites: A degradable filler between a temporary layer of netting and a permanent layer of a synthetic "matrix".

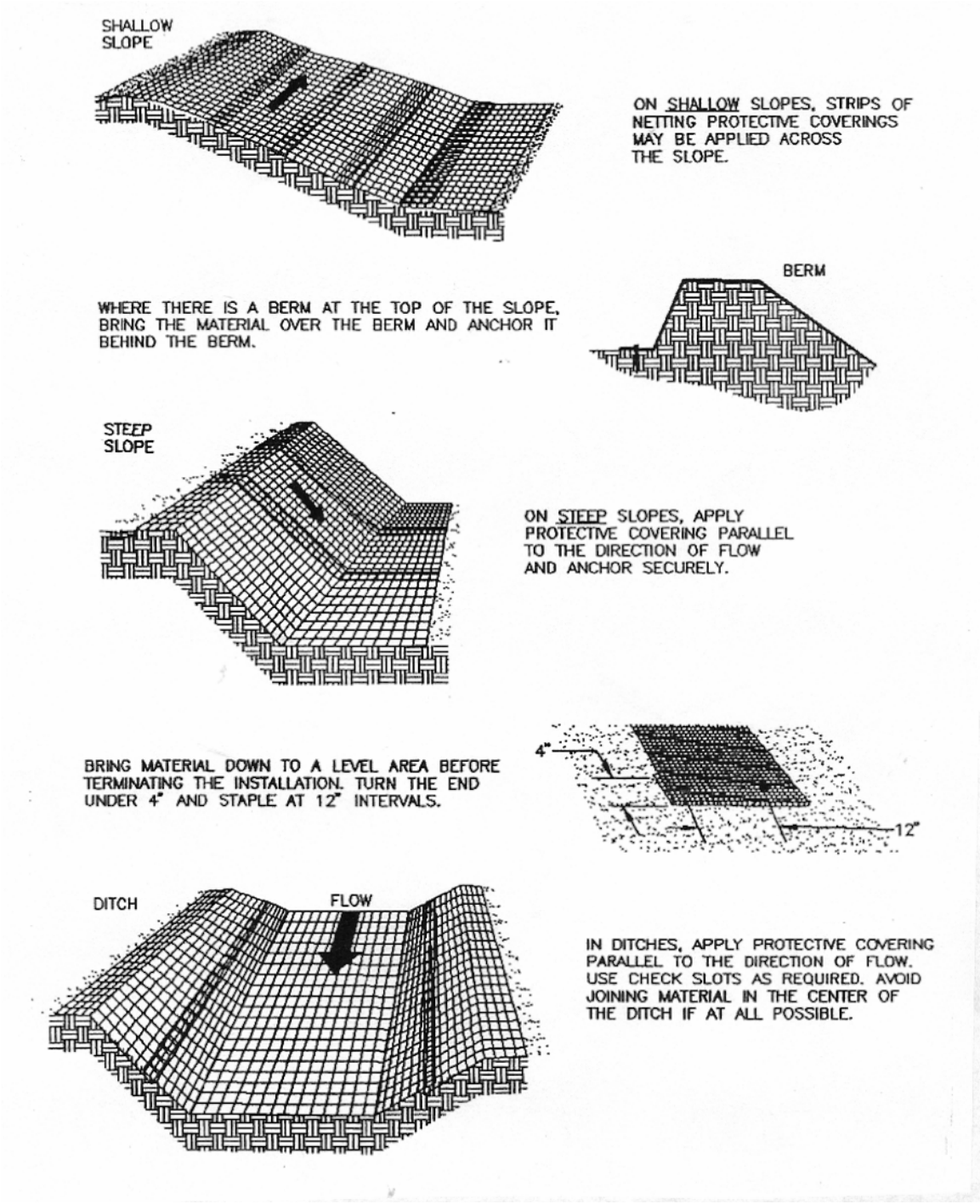
Filter Fabric: A permeable material made with synthetic fibers. It may be woven or non-woven fabric and is usually packaged in roll form.

- Woven filter fabric should only be used for soil separation, road reinforcement and soil separation.
- Non-woven filter fabric should only be used for drainage filtration but may be used under unpaved roads in certain circumstances.

For guidance in selection, refer to NRCS Design Note 24, *Guide to Use of Geotextile*, available at a local NRCS office.

EROSION CONTROL BLANKETS B-4.2
PLACEMENT & INSTALLATION

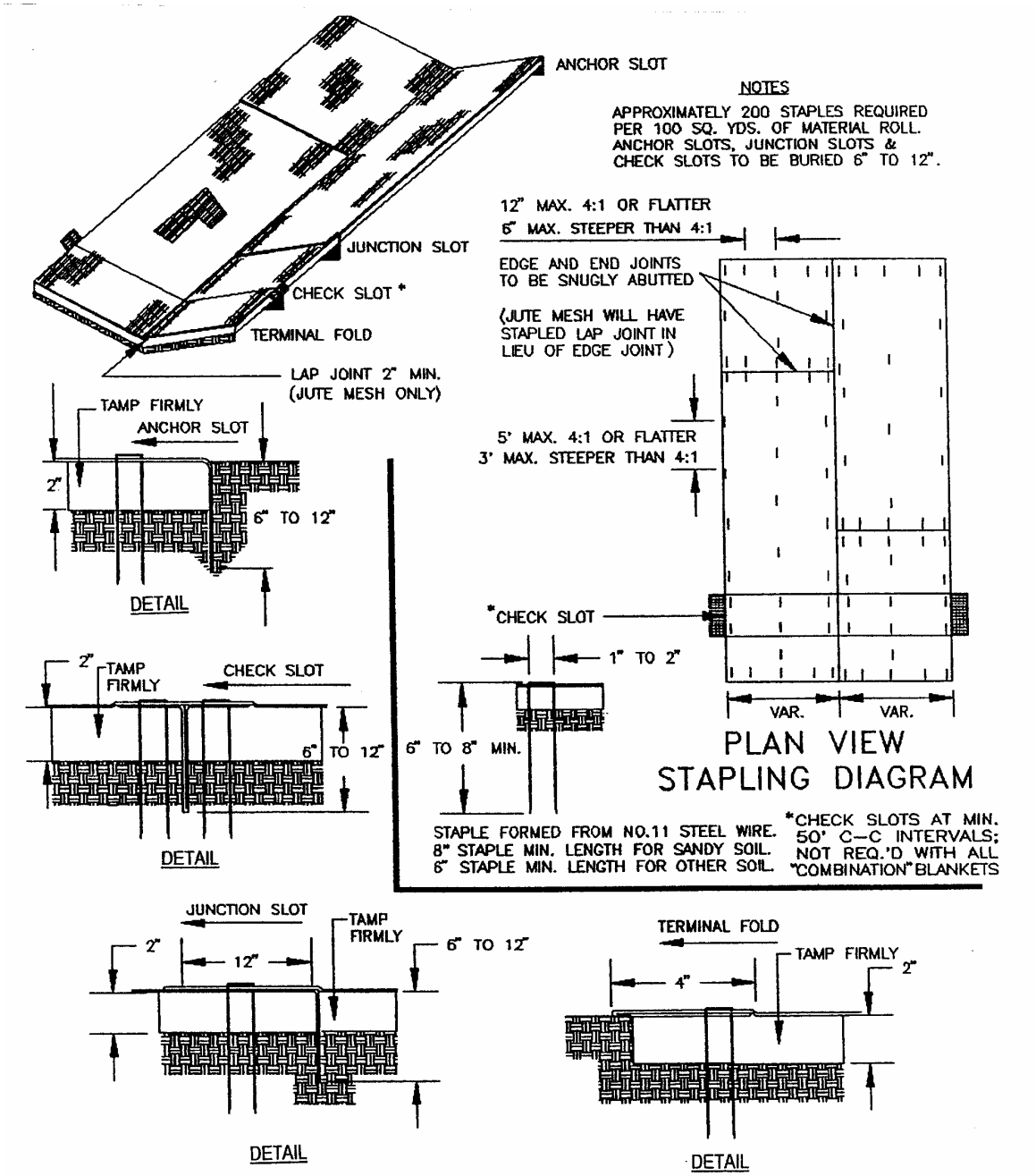
Figure 1. Placement of Biodegradable Blankets



(Source: ABAG. 1995. Manual of Standards for Erosion & Sediment Control Measures.Oakland CA.)

EROSION CONTROL BLANKETS B-4.2
PLACEMENT & INSTALLATION

Figure 2. Installation of Biodegradable Blankets

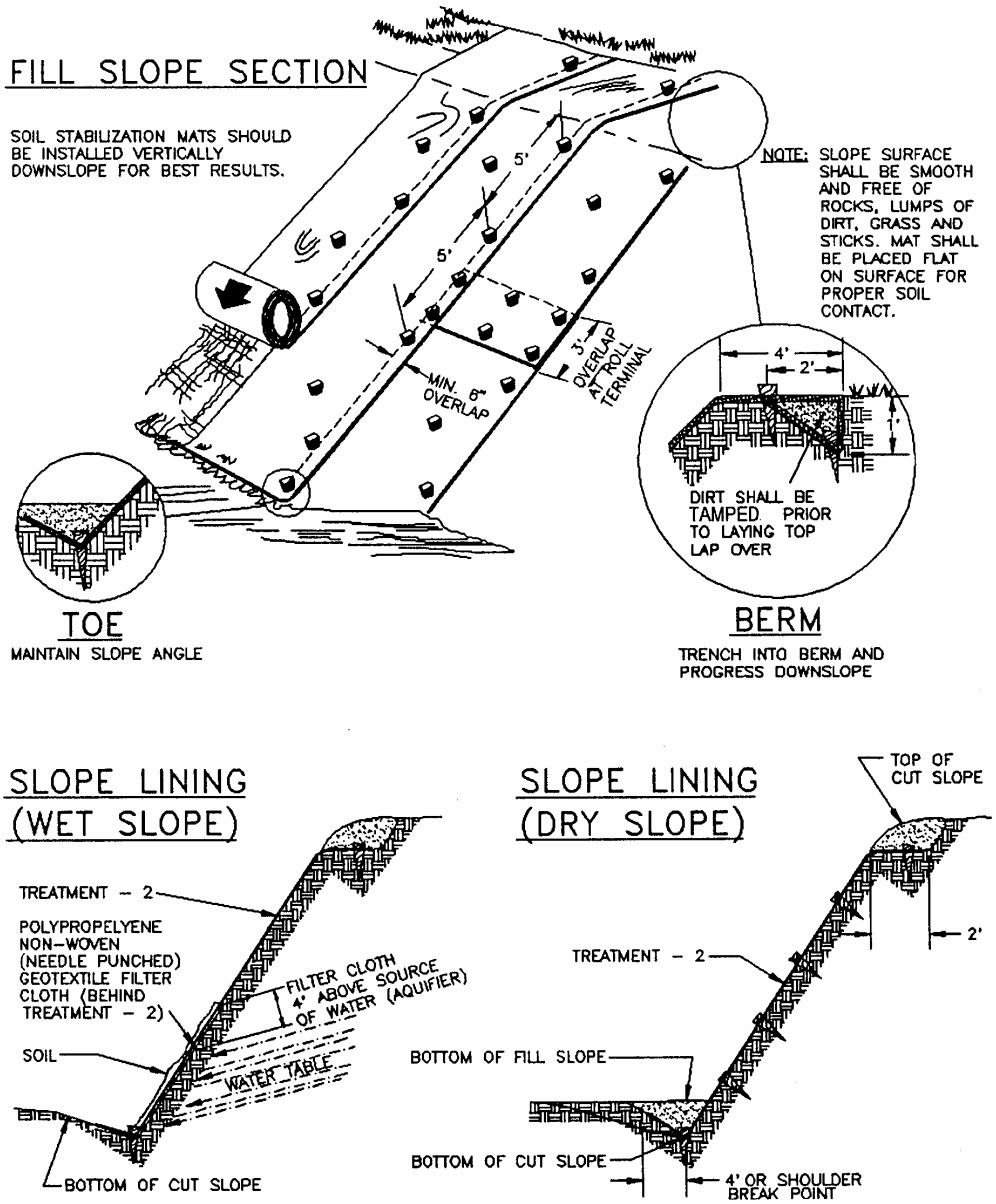


NOTE: Follow Manufacturer's recommended installation procedures.

Source: ABAG. 1995. Manual of Standards for Erosion & Sediment Control Measures.Oakland CA.

EROSION CONTROL BLANKETS B-4.2 PLACEMENT & INSTALLATION

Figure 3. Placement of Non-biodegradable Blankets



(Source: ABAG. 1995. Manual of Standards for Erosion & Sediment Control Measures.Oakland CA.)

Figure 4. Anchoring of Blankets

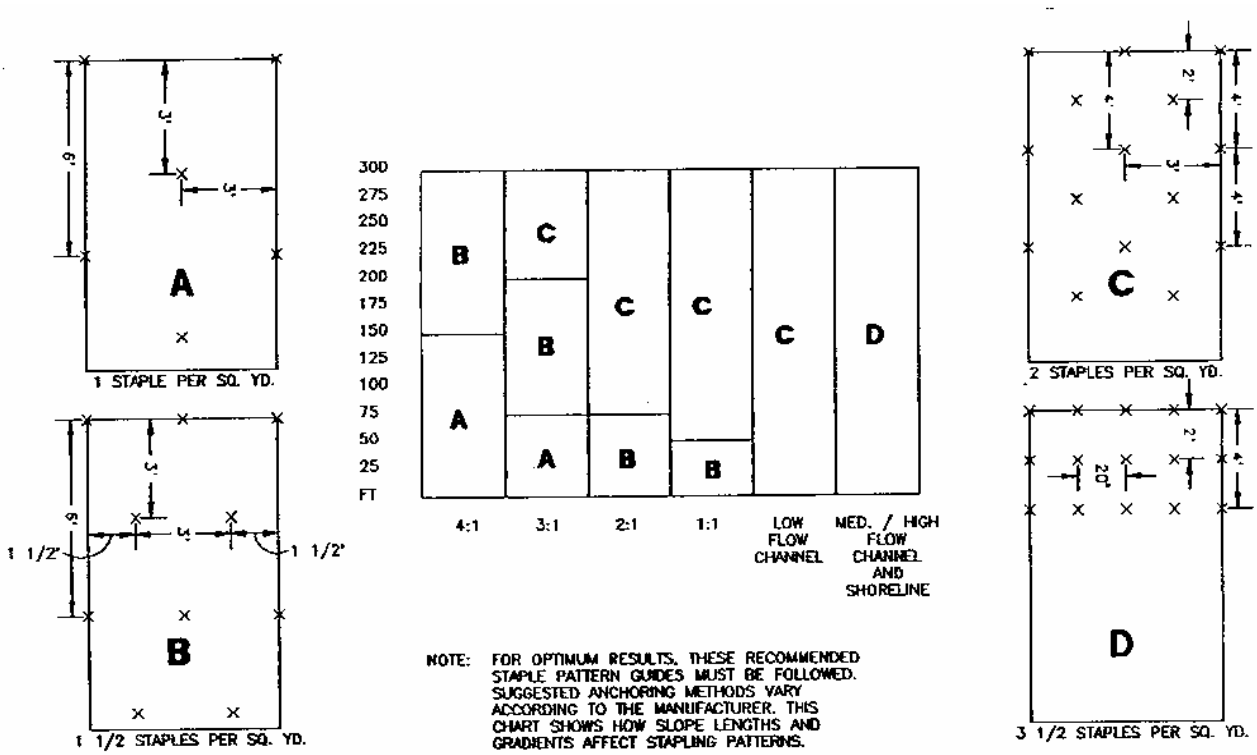
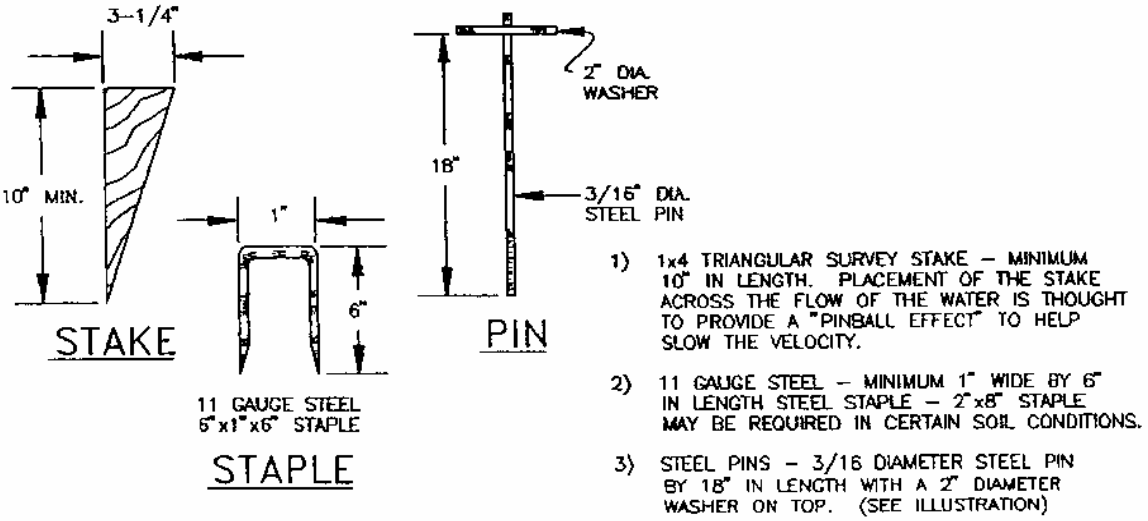


Figure 5. Installation Anchors

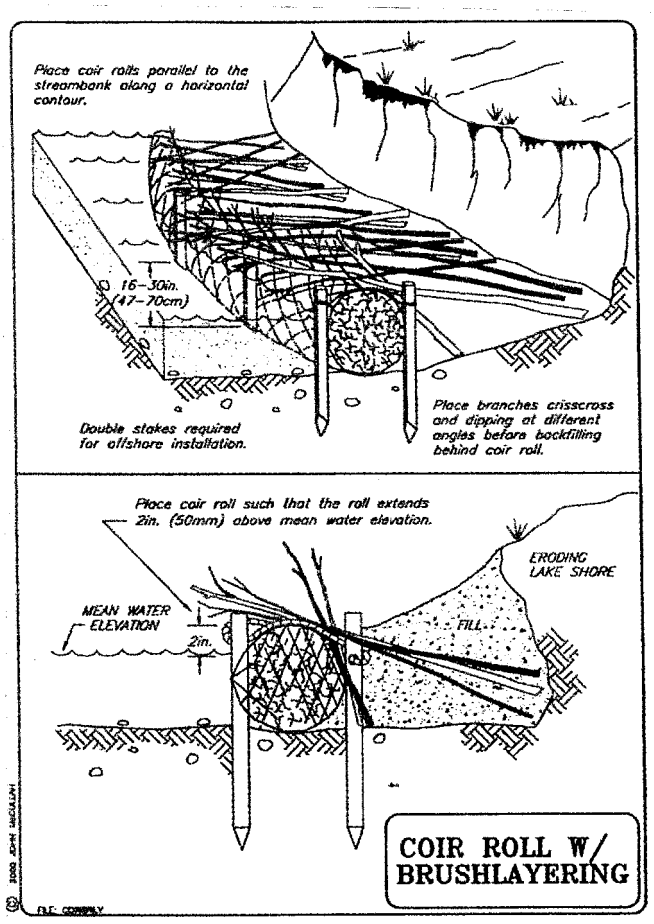


(Source: ABAG. 1995. Manual of Standards for Erosion & Sediment Control Measures.Oakland CA.)

Possible Uses:

- Temporary check dams in ditches
- Temporary spoil stockpile protection
- Drop inlet protection
- Temporary interceptor dike and swale
- Streambank stabilization with brushlayering

Figure 1. Coir Roll with Streambank Brushlayering



Sources: Sloan, R. 2001. "Coir rolls with brushlayering for successful streambank and shoreline stabilization." *Erosion Control* (March/April): p. 80. Drawing copyrighted by John McCullah. King County. 2000. Regional Road Maintenance ESA Program Guidelines. Seattle WA.

MULCHING B-4.4

Description: Mulching is the application of straw, wood chips, or other suitable materials on the soil surface applied manually or by machine. Plant-made materials will eventually decompose (biodegrade).

Purpose:
- Helping as a temporary, short-term practice
- Reducing erosion by protecting the soil surface from raindrop impact
- Decreasing surface water or wind velocity impacts
- Fostering the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

How to Use:
- Apply over areas already seeded or planted to provide soil protection and insulation.
- Cover soil sufficiently to allow seeds to germinate but thicker where seeding germination is not an issue.
- Nets and matting may be used in combination with mulch, and can help keep mulch from blowing away.
- Various types and sizes of mulch are available.
- Apply additional mulch where erosion or scouring occurs.
- Repair if a tear in the cover netting or matting occurs.
- Inspect weekly during construction or immediately after rainstorms.

When NOT to Use:
- On slopes steeper than 2 horizontal to 1 vertical
- In watercourses and streams
- In ditches where water flow is continuous.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle WA. p. 2.103.

PLANTING B-4.5

Description: This practice includes the planting of appropriate species of trees or shrubs on bare slopes (such as the road cut or fill slope), along a ditch or channel, or adjacent to streams.

Purpose:

- Helping provide long-term stabilization of slopes through the plants' roots and leaf litter
- Providing shade and riparian cover near streams to provide better aquatic habitat. Trees may eventually contribute large woody debris (LWD) to the stream for instream benefits.

What to Do:

- Correct choice of plant species and proper planting technique are critical to good plant survival.
- Obtain container–grown or bare-root stock of native species found in the vicinity of the planting site from a nursery in the region. Large quantities (>100 plants of 1 species) may need to be special ordered (grown under contract) with the nursery at least 6-12 months in advance.
- For moist areas, an option is to collect willow sprigs from a grove of willows near the area when dormant: sprigs should be at least ½ inch in diameter and 18 inches long, with 2-3 inches diameter and 3-4 feet long being the best.
- Handle seedlings carefully and ensure they are kept sufficiently watered (soil mixture is damp, not dry or soggy) and shaded until site is ready to plant. In cool, damp weather, seedlings are vulnerable to mold. Plant willow sprigs same day as cut.
- Clear away loose organic material, such as leaves and grasses, from the planting spot to expose mineral soil.
- Dig hole with shovel or hoedad to be deep and wide enough for the roots to be fully extended. Fill hole, being sure soil falls around roots, and tamp soil firmly around base of plant with heel. Willow sprigs need to be 75-80% buried into the soil.
- Add slow-release fertilizer tablet into hole, especially on poor soils.
- Water site - if possible – immediately after planting and weekly during dry periods of the first year. An attachment from a water truck can be used to hand irrigate near roads.

What NOT to Do:

- Plant in the summer months and where watering is not available.
- Plant trees within the safety clear zone areas that could become hazards.
- Plant willow sprigs upside down (avoid this by making sure buds are pointing up)

Sources: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle WA. ; CDFG. 1998. California Salmonid Stream Habitat Restoration Manual.

PLASTIC COVERING B-4.6

Purpose:

- Covering exposed areas needing immediate temporary protection from soil erosion that cannot be covered by mulching
- Helping protect bare soil areas during winter months before grass seed can germinate
- Covering steep slopes, construction sites, and on stockpiles where surface runoff can be controlled from the plastic covered area.

How to Use:

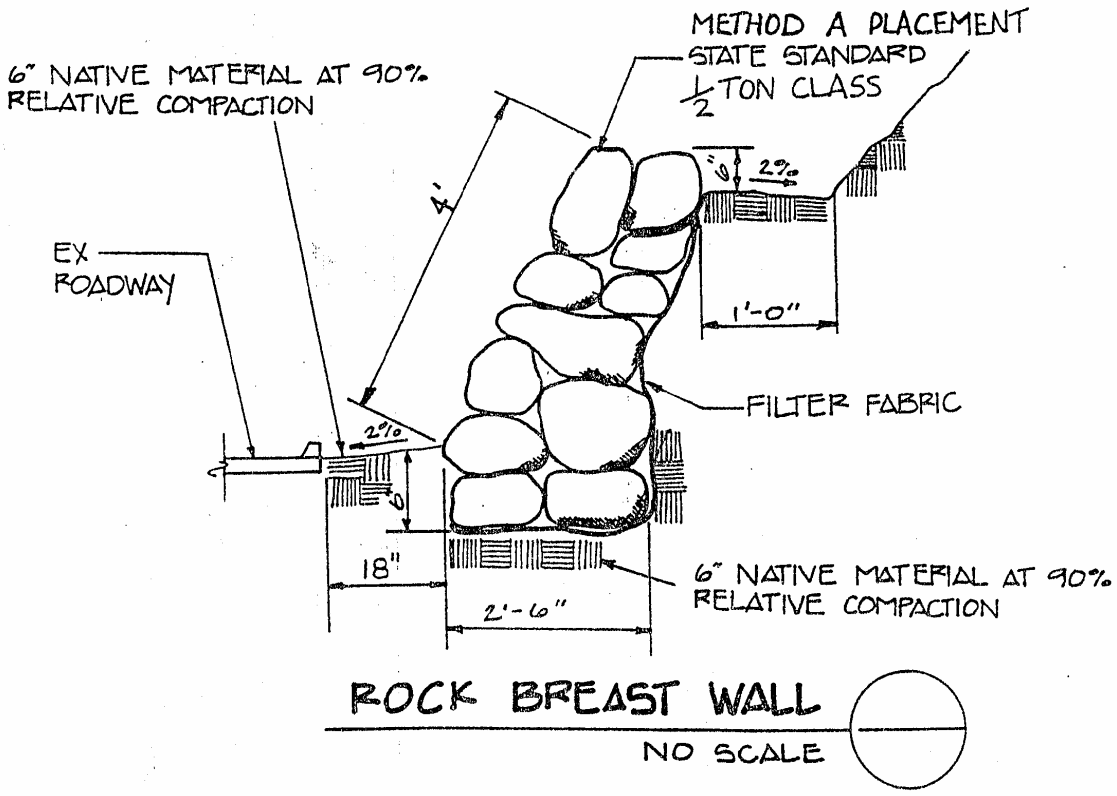
- Secure plastic by staking or using weight (e.g., sandbag or tires) to prevent movement. Rebar must not be used as a staking mechanism
- Key plastic covering in at the top of the slope.
- Apply additional BMPs, such as a berm or sediment control, to control surface water runoff from plastic.
- Inspect weekly and make any needed repairs or replacements.
- Remove plastic when area has stabilized or there is no longer the potential for sediment runoff from the site.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

ROCK BREAST WALL B-4.7

Description: A rock breast wall is a low retaining wall (usually 10 feet or less in height) constructed against the base of a slope. The wall is usually built by stacking rocks atop one another in a single, one-rock width course.

Purpose: To defend the toe of the slope and to prevent slope damage by erosion, especially piping and spring sapping as a result of seepage exiting from the face of the slope.



Source: Caltrans – Lake Tahoe district office (1994).

SEEDING B-4.8

Description: This practice spreads grass and forb seeds on disturbed or bare soil by the dry method (e.g., hand broadcasting, a hand -seeding device, blower) or hydraulic method (slurry mix of seed, fertilizer, water and mulch applied under pressure).

Purpose: To establish vegetative cover on exposed soil areas that will help decrease soil erosion. Seeding can be done for temporary or permanent purposes.

What to Do:

- Prepare site by removing weeds and debris, then loosening and roughening seedbed with a rake to 2-4" deep, if possible. Follow by raking smooth to a depth of ½ inch.
- Select seed mix carefully. Species or variety selection should be based on:
  - Performance (high survival rate) under local climate conditions
  - Protection of native grass communities
  - No tendency to spread (be "non-invasive") or become a weed if an exotic
  - Need for annual (short-term) and/ or perennial (long-term) mix of species
  - Commercial availability of seed (see Chapter 12-D Supplies).
  - Examples of Effective Native Seed Mixes: (a) Blue wildrye, California Brome, Idaho fescue, Squirreltail – for hot, dry sites; (b) Slender hairgrass, tufted hairgrass, red fescue, and California meadow barley – for moist sites
- Spread seed at appropriate time of year (Sept. 1- Oct. 15 best) and application rates (ranging from 15-80 lbs/acre). A hand-seeding device can apply more uniformly than hand broadcasting. Hydromulch may be better for applying to steeper slopes.
- Apply a slow-release fertilizer (such as ammonium phosphate 16-20-0) at recommended rate (e.g., 100 lb/acre). Re-apply in the second growing season to get full establishment.
- Rake lightly after seeding to cover seeds with a ½ to 1 inch layer of soil.
- Cover with certified weed-free (see County Agriculture Commissioner) straw (rye, barley, rice) mulch as needed to protect the surface during germination. [Note: "Organic" straw mulch is not the same thing and may contain many weed seeds.] Application rate varies at 2,000 -3,000 lbs/acre. See B-4.4 Mulching
- Only use tackifiers on very steep slopes, if needed to hold down mulch. Be sure the type selected is non-toxic (e.g., not the asphalt-type).
- Irrigate if rainfall is insufficient to keep soil moist during seed germination and establishment.
- Re-seed if established grass cover is inadequate after one growing season.

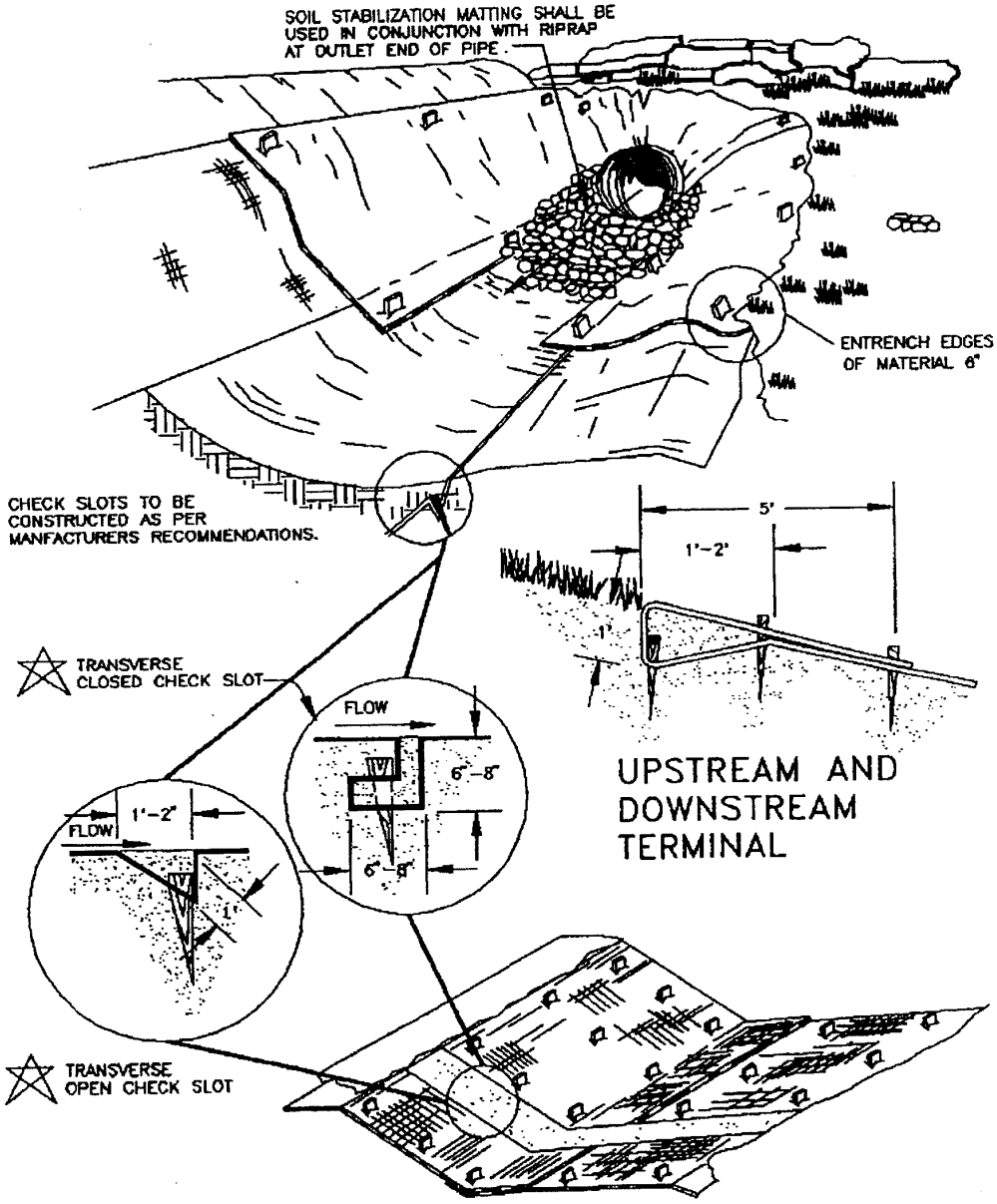
What NOT to Do:

- Do not cause more harm than good by introducing new invasive weeds into an area that can compete with the native grasses.
- Do not skimp on the amount of mulch during the first year of seed establishment.

Sources: Trinity County RCD, Native Grass mixes; McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta.; King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.;; Klamath National Forest, Seeding Specifications.

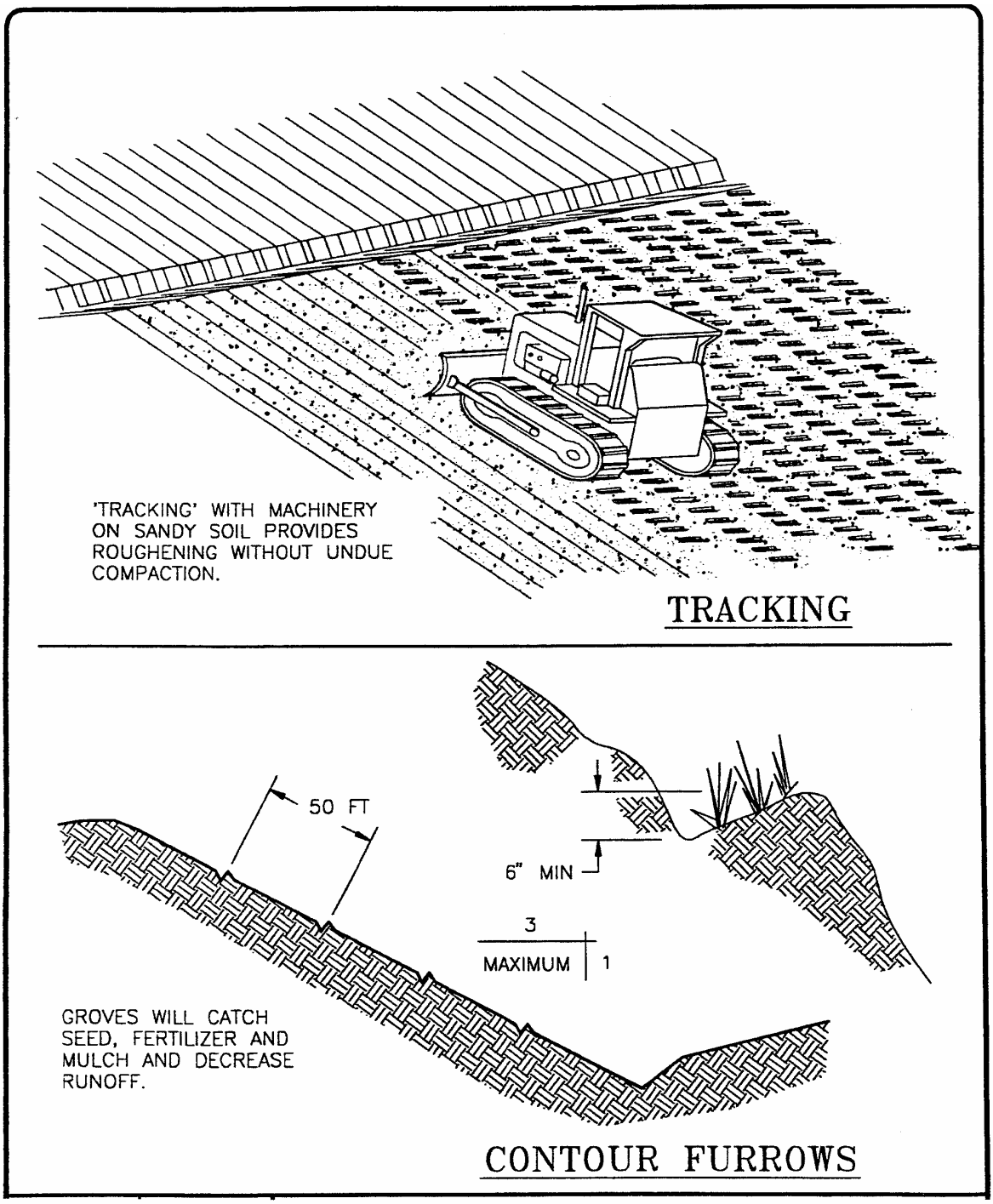
SILT MAT B-4.9

Purpose: To capture sediment and prevent erosion at culvert discharge points where there are no high flow rates.



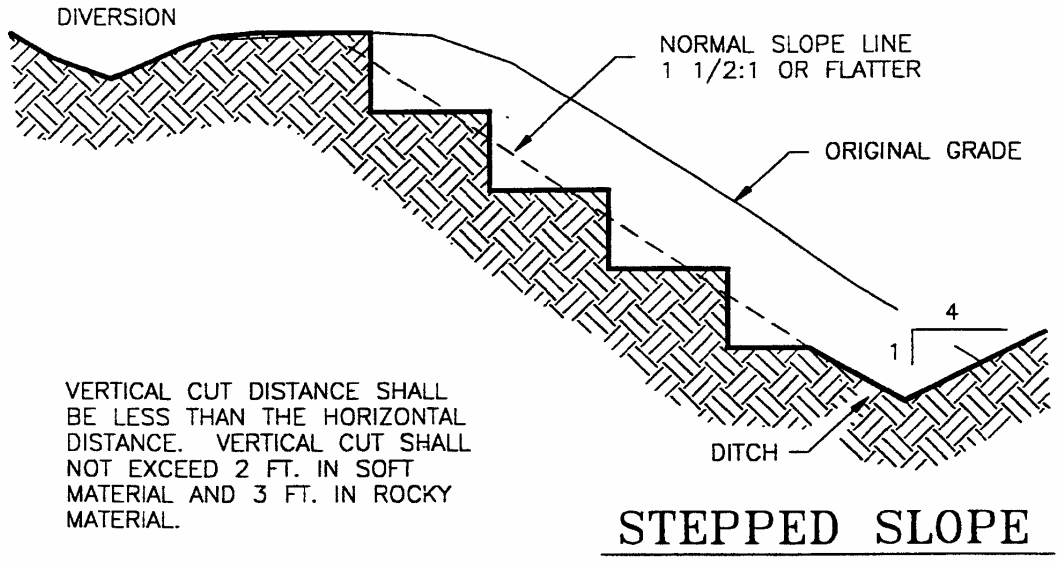
Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

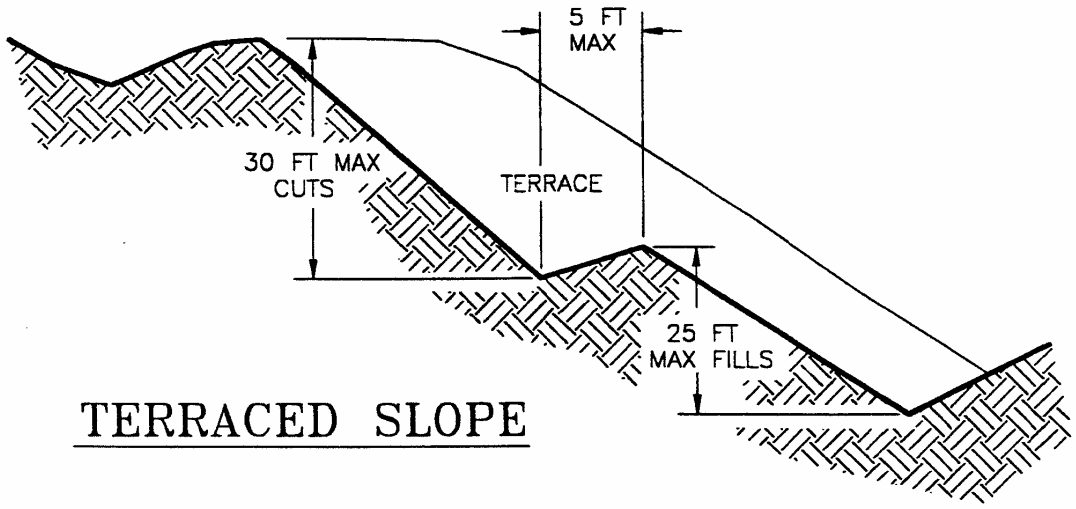
SLOPE TREATMENTS: B-4.10
SURFACE ROUGHENING & TRACKING



Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Western Shasta RCD.

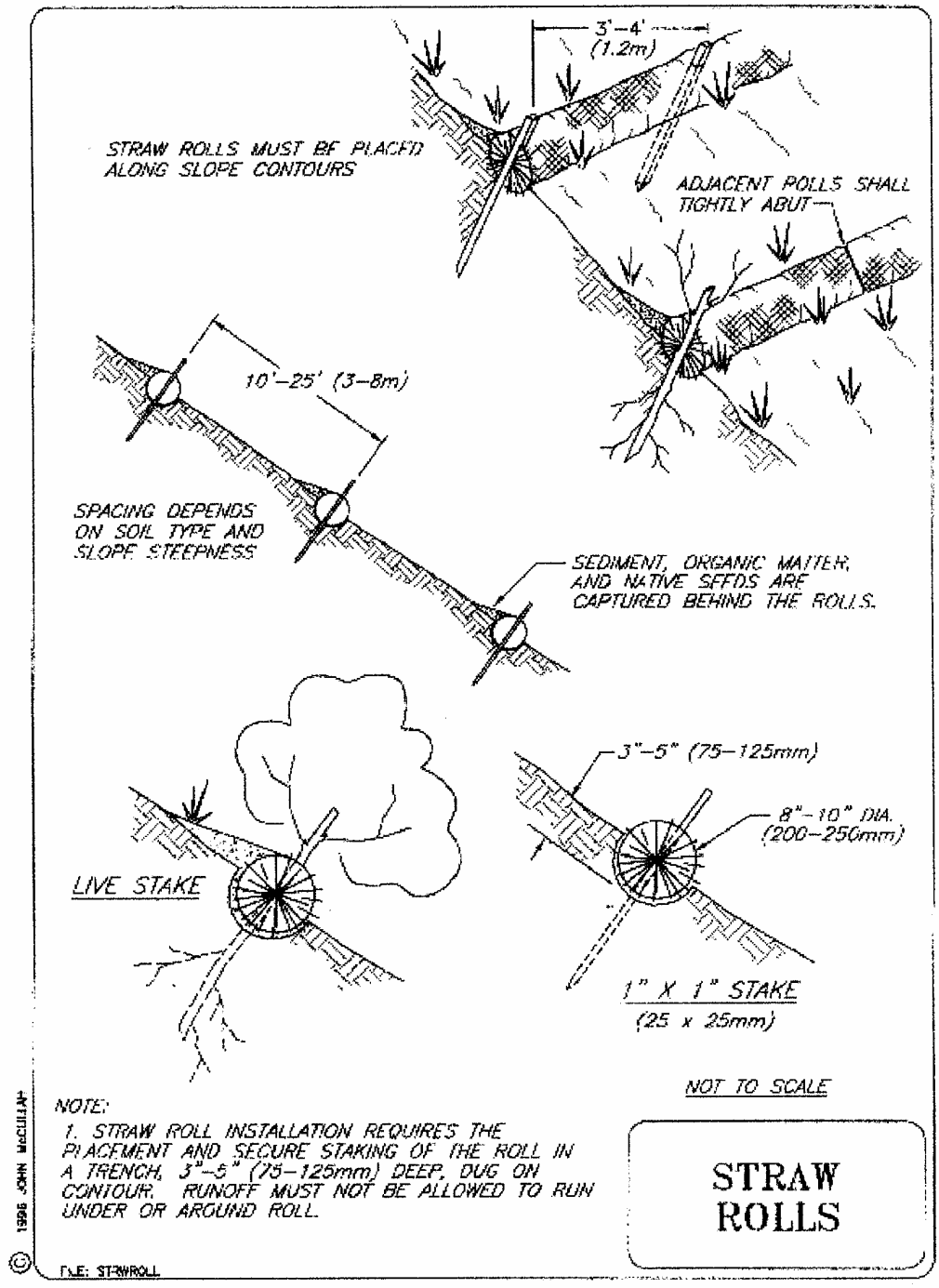
SLOPE TREATMENTS: B-4.11
STEPPED OR TERRACED SLOPE





Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Western Shasta RCD.

STRAW LOG OR ROLL B-4.12



Sources: John McCullah copyright. Found at: //www.strawwattle.com Or //www.earth-savers.com

B-5 FISH EXCLUSION

Description: Road maintenance activities may require work within streams that contain salmonids. Some of these activities require the site to be temporarily dewatered with the fish removed, relocated upstream of the work area, and excluded from the work site until work is completed. See also: Chapter 4-F Temporary Stream Diversions

Purpose: BMPs are used to minimize or reduce deleterious impacts to aquatic resources for the dewatering action. Fish exclusion from the work site prior to dewatering must be done in accordance with the protocols set forth in the "Incidental Taking Permit" from the National Marine Fisheries Service (NMFS) and the California Dept. of Fish and Game (for state-listed species). Fish exclusion is done only under the supervision of a qualified fishery biologist with such a permit.

When Fish Exclusion May be Needed:

- **Stream Crossings:** Repair, maintenance, cleaning, installation or replacement / upgrade of stream crossing facilities such as pipes, arch pipes, culverts, fish ladders, weirs, sediment pools, and bridges.
- **Bridge Maintenance:** Repair, replacement, and maintenance of bridge components such as the superstructure, footings, piers, supports, abutments, and ramps.
- **Watercourses and Streams:** Repair, replacement, installation, and maintenance tasks such as structural repair/ replacement, slope stabilization, sediment removal, vegetation management, debris removal, or habitat maintenance / improvements.

Sequence of Fish Exclusion Procedures:

1. Isolate the area (block nets).
2. Remove as many fish as possible using seine or dip nets.
3. Gradually dewater work area.
4. Remove as many remaining fish as possible using dip nets, and relocate upstream.
5. Electroshock, if required by permit, to avoid any stranding.
6. Keep records of fish exclusion activities.

What to Do:

- Consult with a qualified fishery biologist with an Incidental Taking Permit from NMFS and CDFG. A copy of the permit must be in possession of the person(s) authorized to collect the fish at the time of the fish exclusion activity.
- Obtain any needed training from the qualified fishery biologist.
- Only assist the supervising fishery biologist in the officially approved "incidental take permit" procedures when requested.
- Help clean fish screens twice a day of leaves and debris, and report any dead fish to the supervising biologist.

What NOT to Do:

- Do not "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" a threatened or endangered species (i.e., "take") without the above procedure.

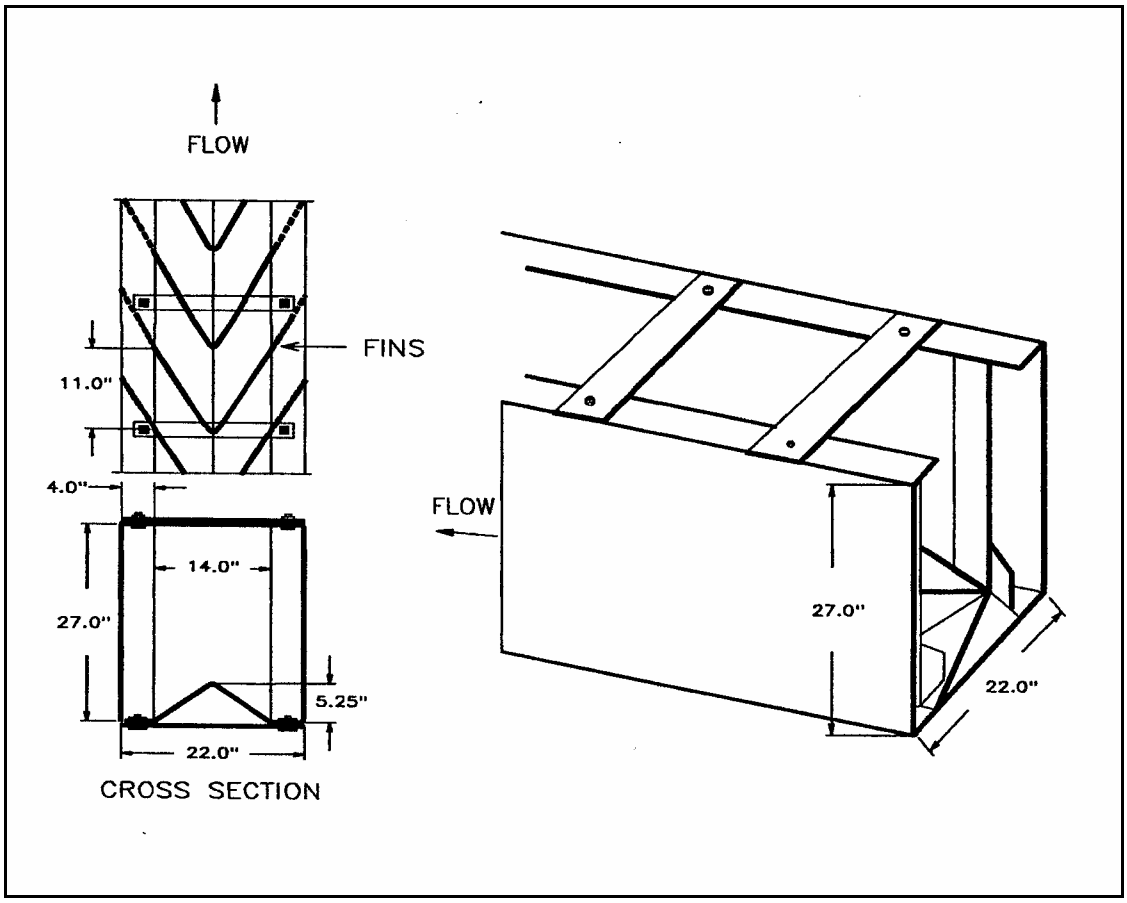
Sources: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA; Jan Smith, Trinity County DOT; Ross Taylor, Ross Taylor & Associates, Arcata CA.

B-6 FISH LADDERS

List of BMP Designs	Design #
Alaskan Steep-pass	B-6.1
Denil Fishway	B-6.2
Step-and-Pool Fishway	B-6.3

FISH LADDER: ALASKAN STEEP-PASS

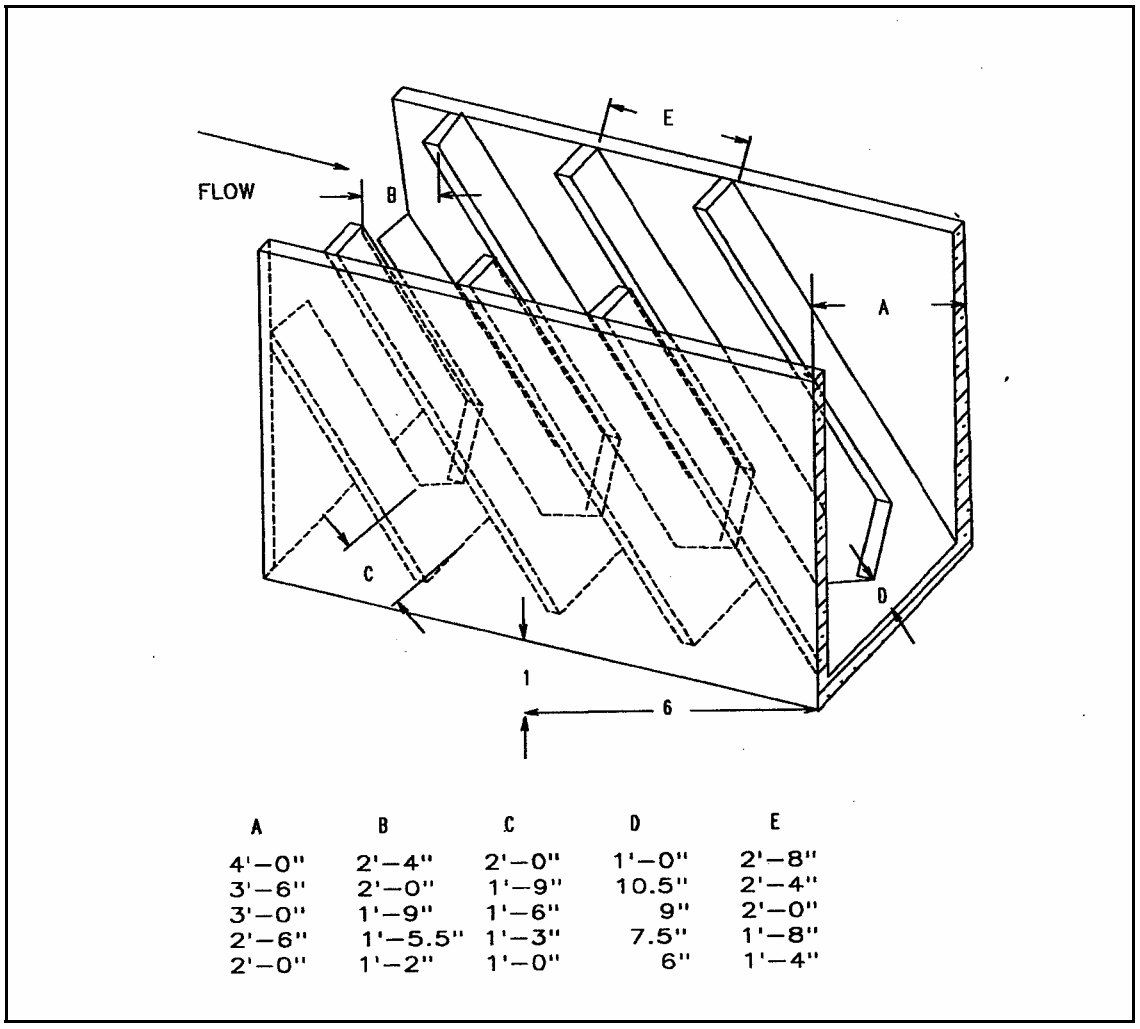
B-6.1



Source: California Dept. of Fish and Game (CDFG). 1998. California Salmonid Stream Habitat Restoration Manual. By Gary Flosi, et al. , 3rd edition. Sacramento, CA.

FISH LADDER: DENIL FISHWAY

B-6.2

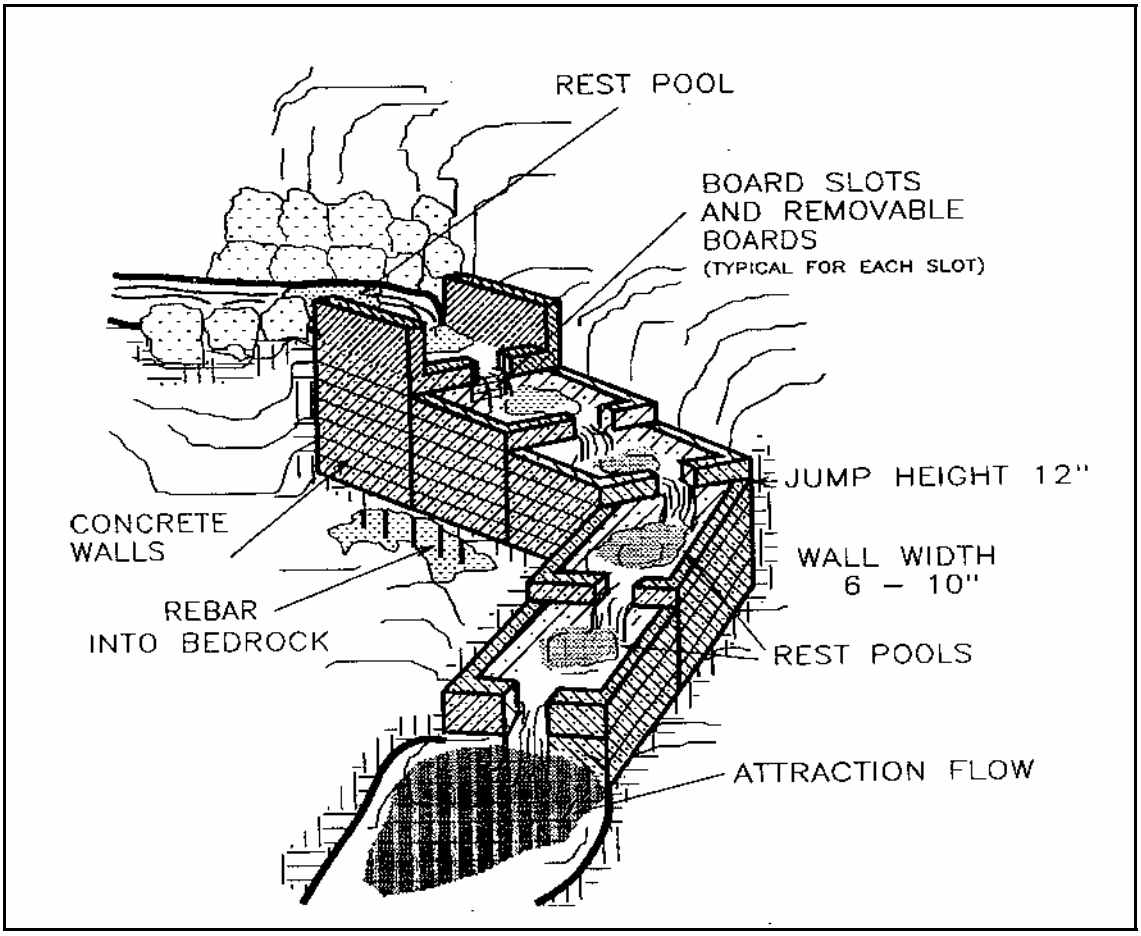


A	B	C	D	E
4'–0"	2'–4"	2'–0"	1'–0"	2'–8"
3'–6"	2'–0"	1'–9"	10.5"	2'–4"
3'–0"	1'–9"	1'–6"	9"	2'–0"
2'–6"	1'–5.5"	1'–3"	7.5"	1'–8"
2'–0"	1'–2"	1'–0"	6"	1'–4"

Source: California Dept. of Fish and Game (CDFG). 1998. California Salmonid Stream Habitat Restoration Manual. By Gary Flosi, et al. , 3rd edition. Sacramento, CA.

FISH LADDER: STEP-AND-POOL FISHWAY

B-6.3

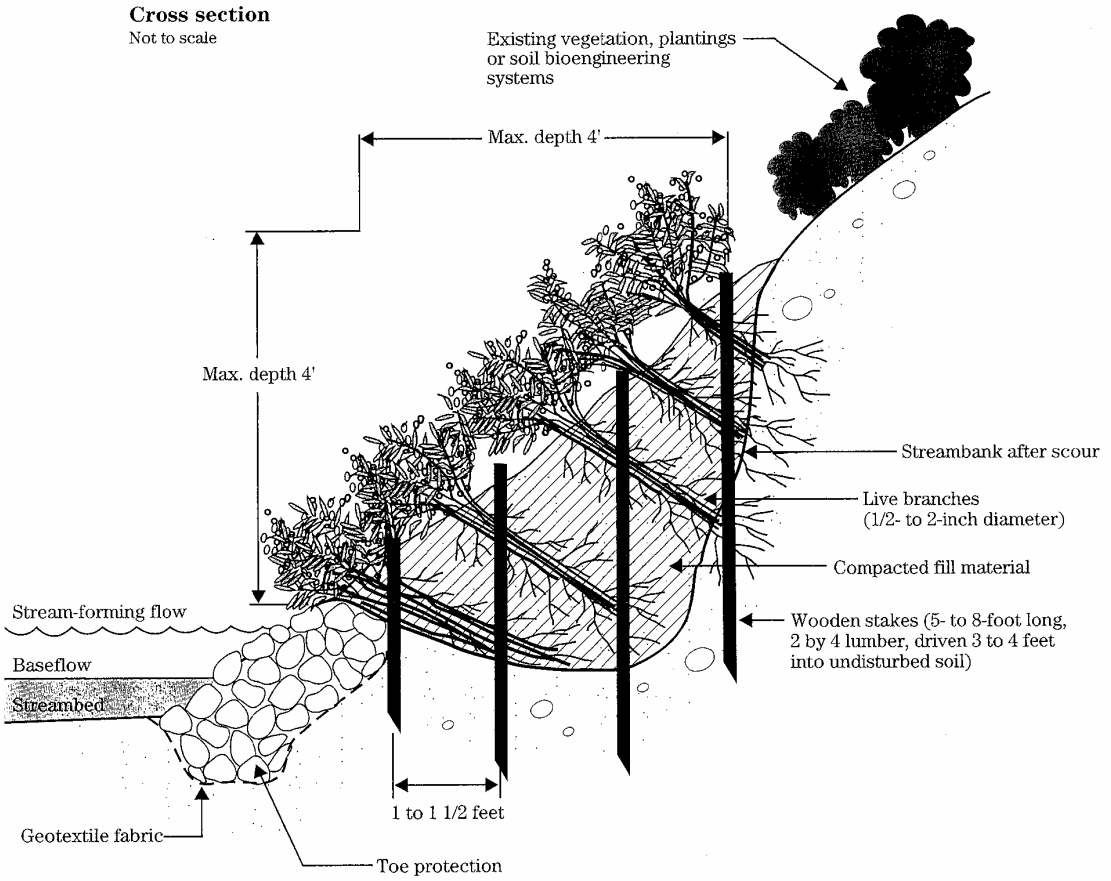


Source: California Dept. of Fish and Game (CDFG). 1998. California Salmonid Stream Habitat Restoration Manual. By Gary Flosi, et al. , 3rd edition. Sacramento, CA.

B-7 STREAMBANK PROTECTION / CHANNEL IMPROVEMENT

BIOENGINEERING: BRANCHPACKING

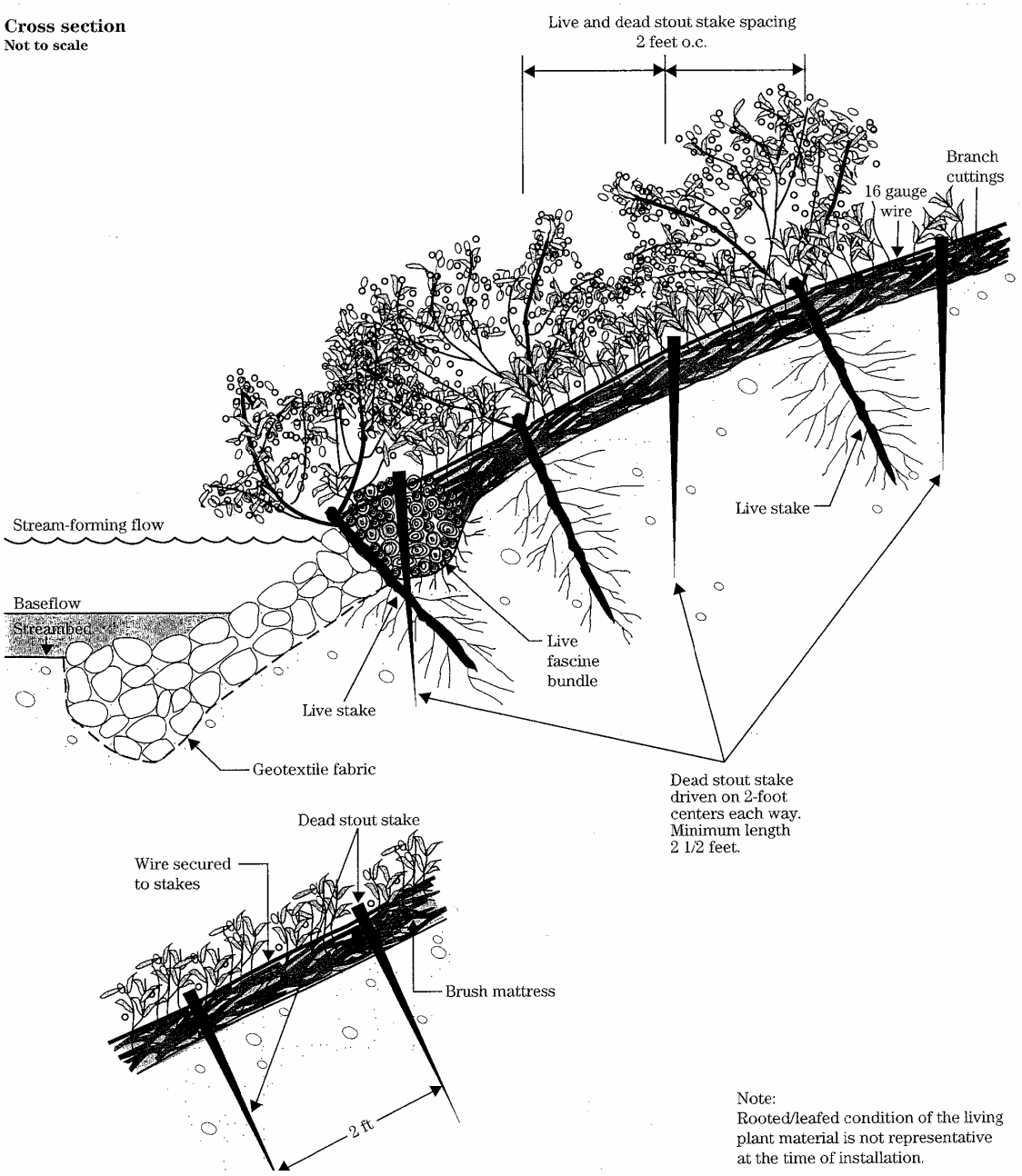
B-7.1



Note: CDFG encourages planting to below bankfull elevation and the addition of large woody debris (see B-7.4).

Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook – Streambank and Shoreline Protection. Part 650, Chapter 16.

BIOENGINEERING: B-7.2
BRUSHMATTRESS

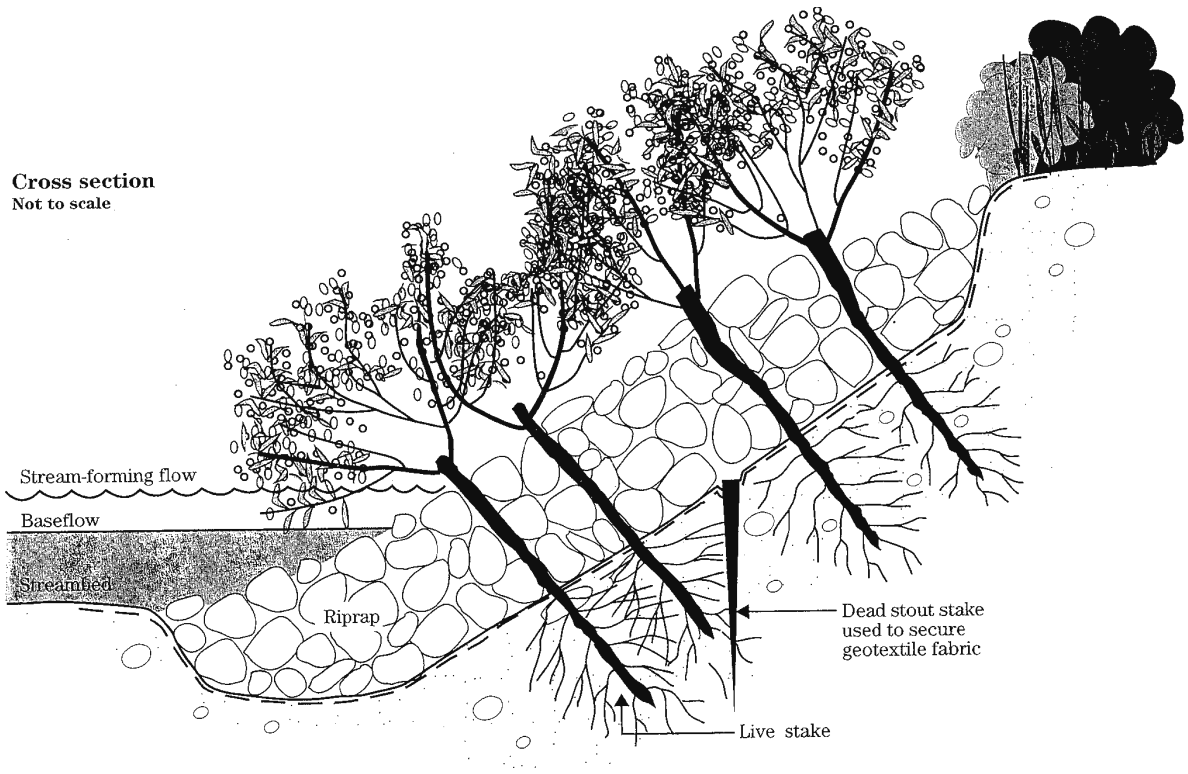


Note: CDFG encourages planting to below bankfull elevation and the addition of large woody debris (see B-7.4).

Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook – Streambank and Shoreline Protection. Part 650, Chapter 16.

BIOENGINEERING: JOINT PLANTING

B-7.3



Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook – Streambank and Shoreline Protection. Part 650, Chapter 16.

BIOENGINEERING: B-7.4
LARGE WOODY DEBRIS - LWD

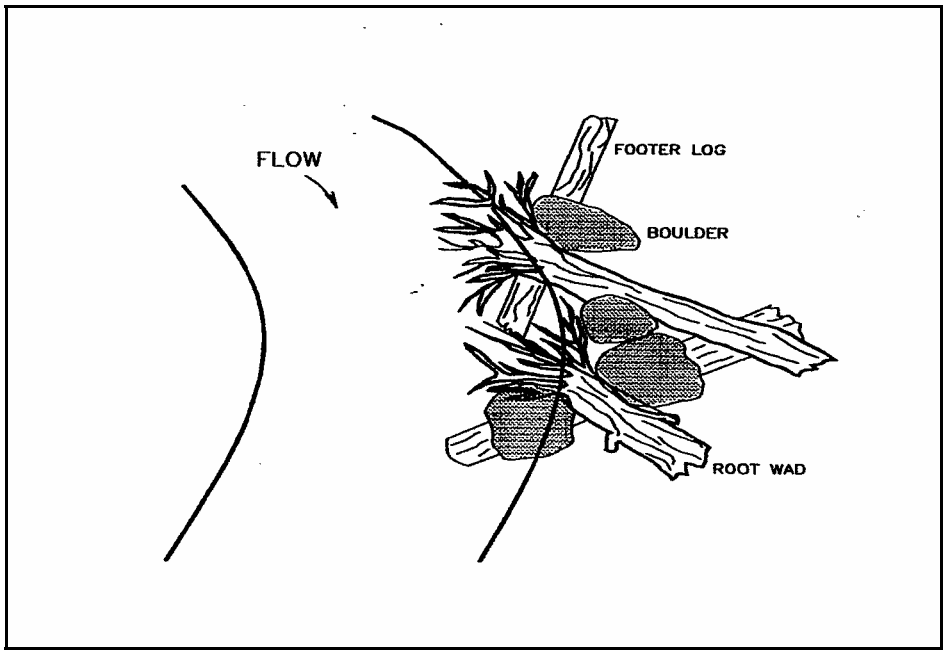


Figure 1. Native material revetment – Plan View. (After Rosgen, 1993)

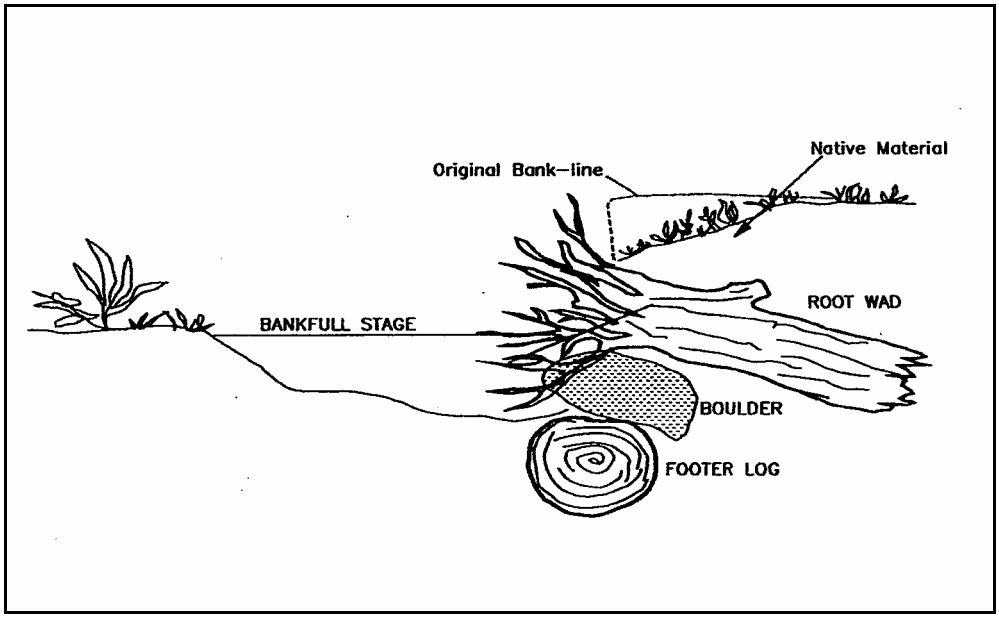
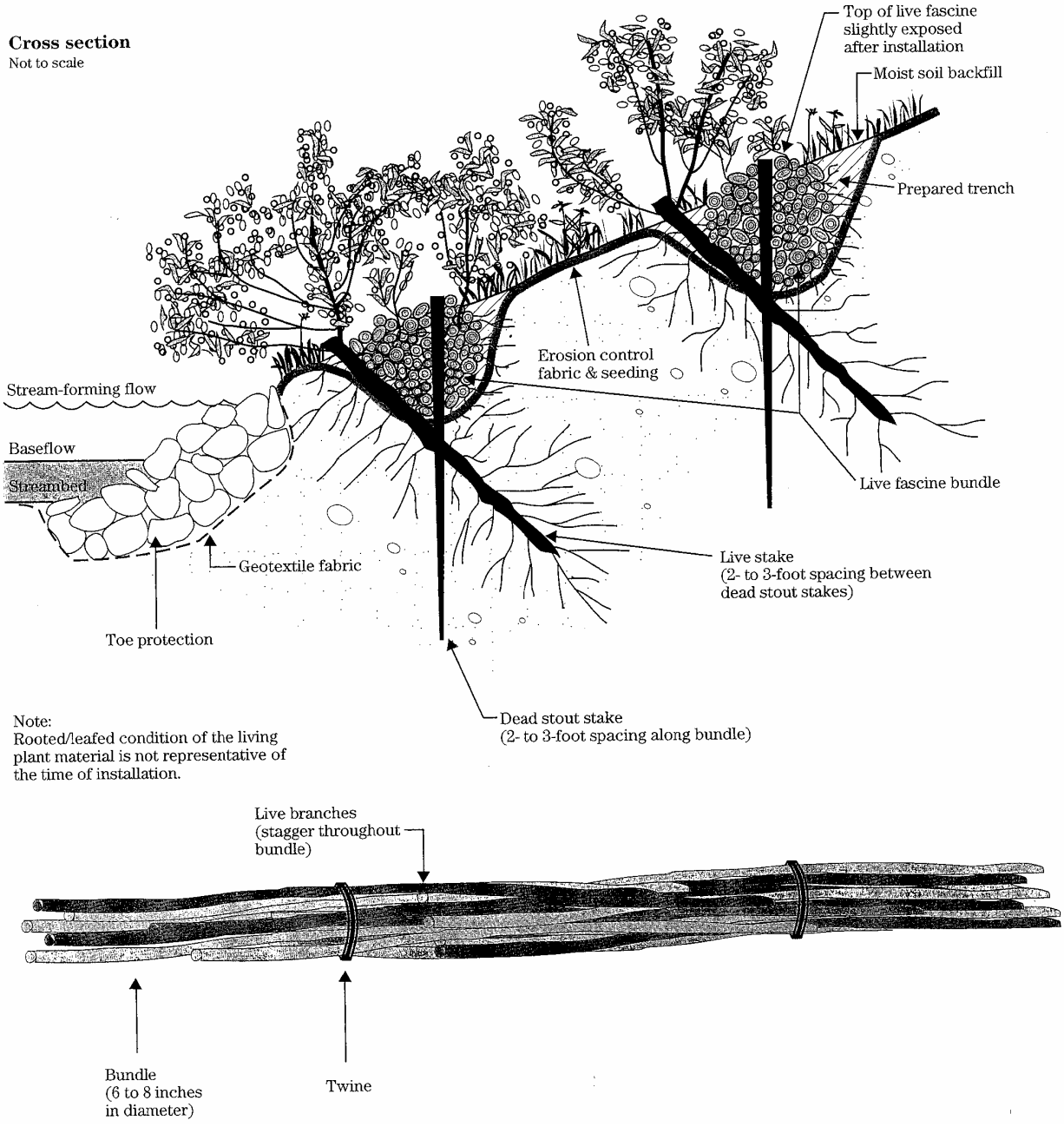


Figure 2. Native material revetment – Side View. (After Rosgen, 1993).

Source: California Dept. of Fish and Game (CDFG). 1998. California Salmonid Stream Habitat Restoration Manual. By Gary Flosi, et al. 3rd edition. Sacramento, CA.

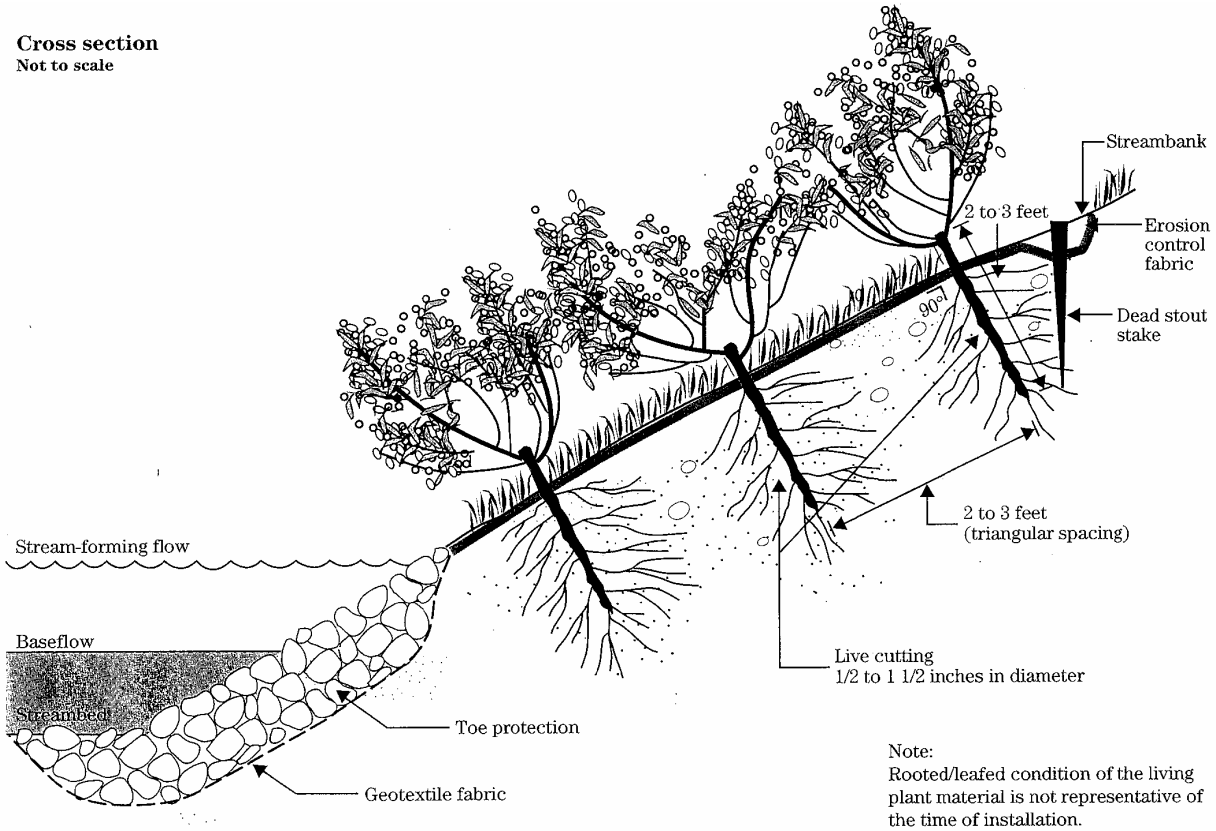
BIOENGINEERING: LIVE FASCINE

B-7.5



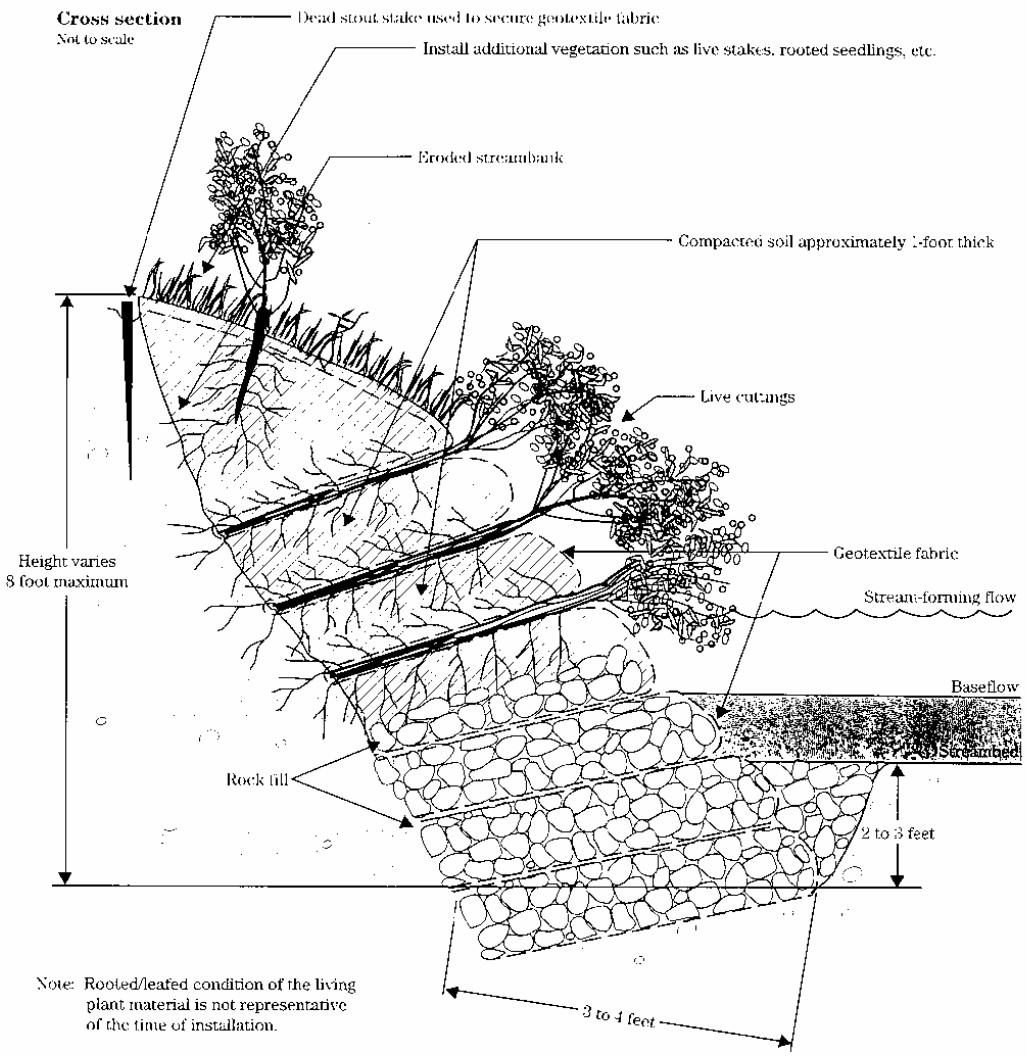
Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook – Streambank and Shoreline Protection. Part 650, Chapter 16.

BIOENGINEERING: B-7.6
LIVE STAKE



Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook Streambank and Shoreline Protection. Part 650, Chapter 16.

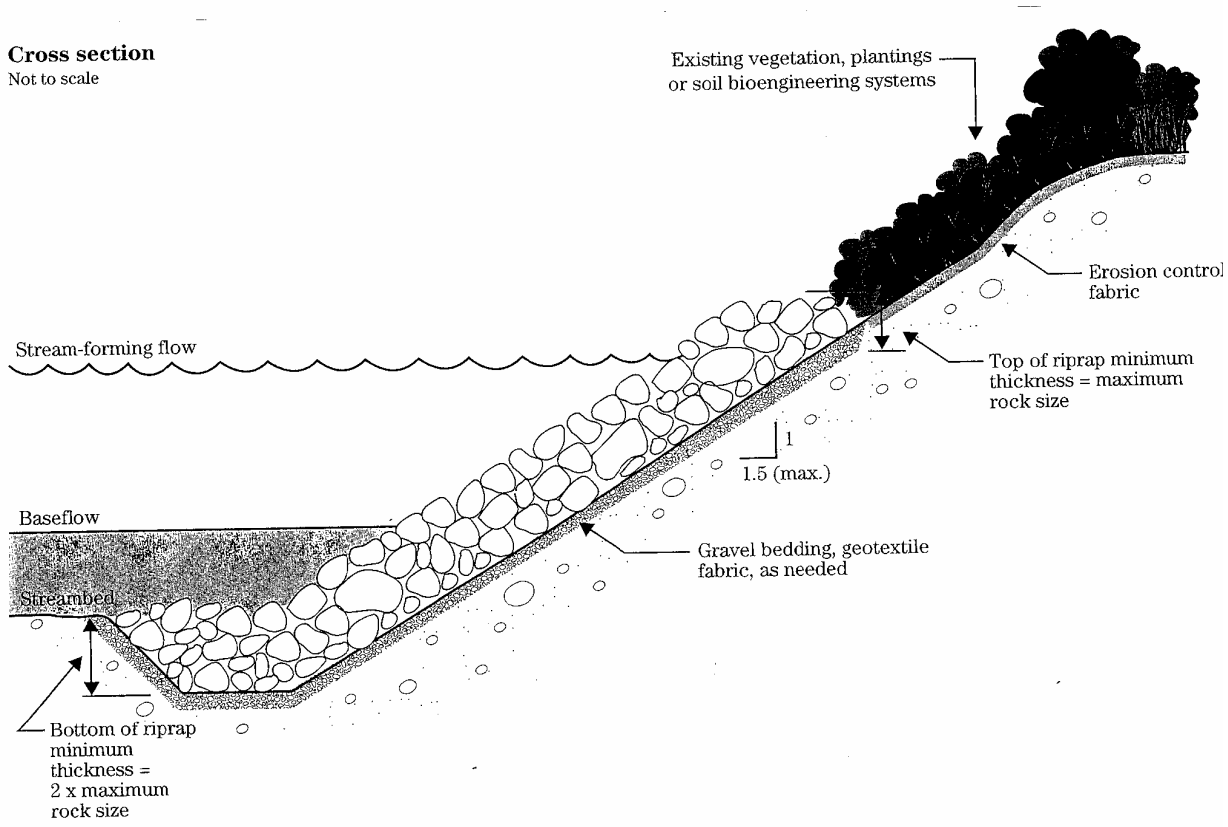
BIOENGINEERING: VEGETATED GEOGRID B-7.7



Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook Streambank and Shoreline Protection. Part 650, Chapter 16.

ROCK RIPRAP DESIGN DETAILS

B-7.8



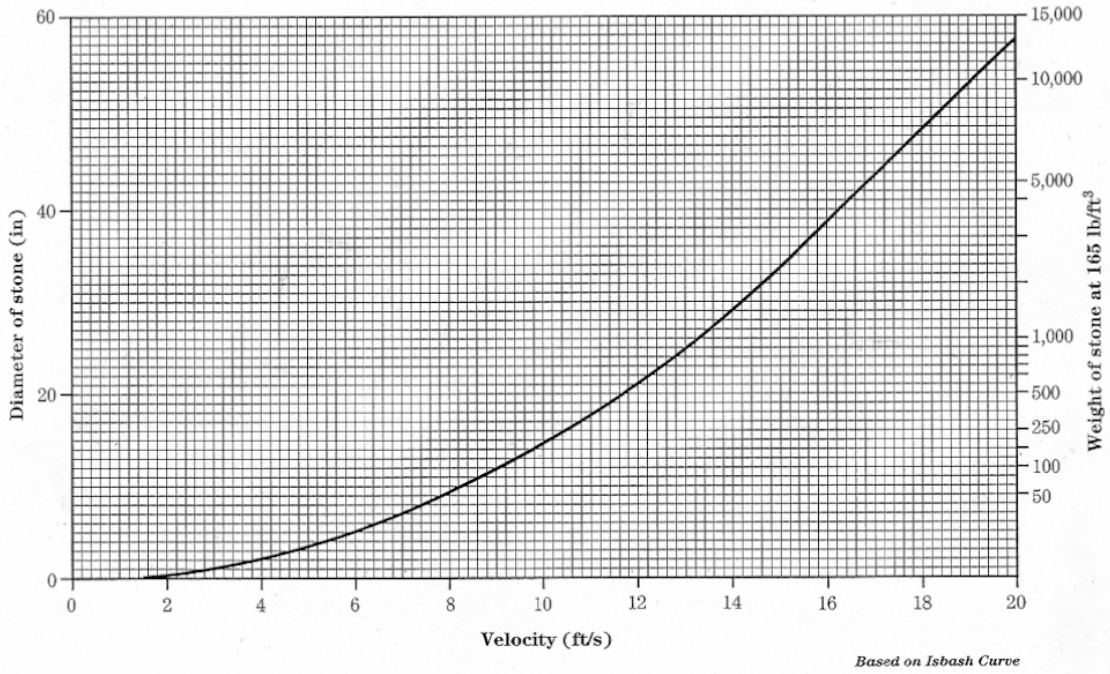
Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook Streambank and Shoreline Protection. Part 650, Chapter 16.

From NRCS Manual:

Isbash Curve

The Isbash Curve, because of its widespread acceptance and ease of use, is a direct reprint from the previous chapter 16, Engineering Field Manual. The curve was developed from empirical data to determine a rock size for a given velocity. See figure 16A–1. The user can read the D_{100} rock size (100 percent of riprap ≤ this size) directly from the graph in terms of weight (pounds) or dimension (inches). Less experienced users should use this method for quick estimates or comparison with other methods before determining a final design.

Figure 16A–1 Rock size based on Isbash Curve



Procedure

1. Determine the design velocity.
2. Use velocity and fig. 16A-1 (Isbash Curve) to determine basic rock size.
3. Basic rock size is the D_{100} size.

Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook Streambank and Shoreline Protection. Part 650, Chapter 16, Appendix 16A.

Figure 16A–2 Rock size based on Far West States (FWS)-Lane method

$D_s = \frac{3.5}{CK} w D S$ $D_s = D_{75}$ size rock in inches

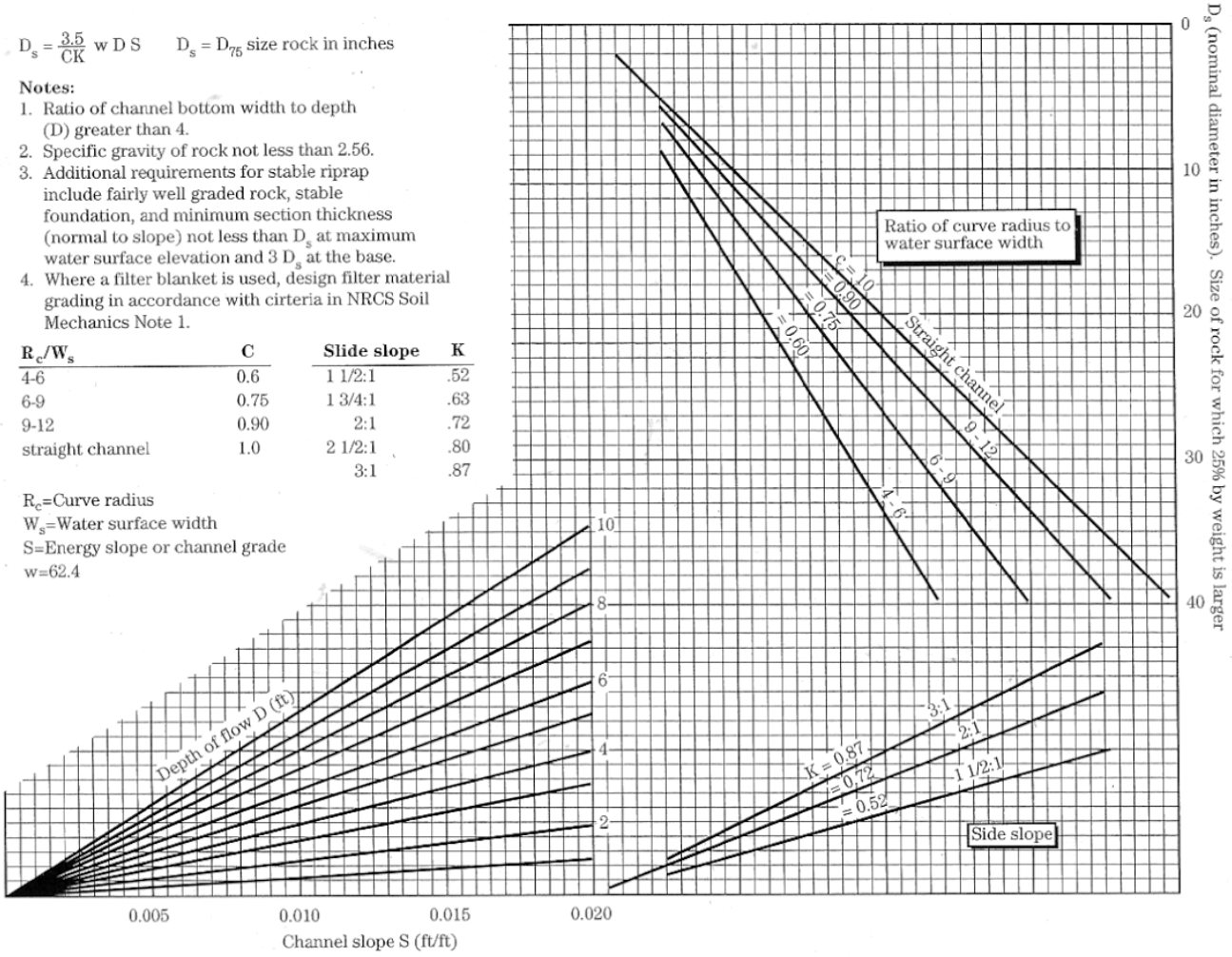
Notes:

1. Ratio of channel bottom width to depth (D) greater than 4.
2. Specific gravity of rock not less than 2.56.
3. Additional requirements for stable riprap include fairly well graded rock, stable foundation, and minimum section thickness (normal to slope) not less than D_s at maximum water surface elevation and 3 D_s at the base.
4. Where a filter blanket is used, design filter material grading in accordance with cirteria in NRCS Soil Mechanics Note 1.

R_c/W_s	C
4-6	0.6
6-9	0.75
9-12	0.90
straight channel	1.0

Slide slope	K
1 1/2:1	.52
1 3/4:1	.63
2:1	.72
2 1/2:1	.80
3:1	.87

R_c=Curve radius
W_s=Water surface width
S=Energy slope or channel grade
w=62.4



Procedure

1. Determine the average channel grade or energy slope.
2. Enter fig. 16A-2 with energy slope, flow depth, and site physical characteristics to determine basic rock size.
3. Basic rock size is the D_{75} size.

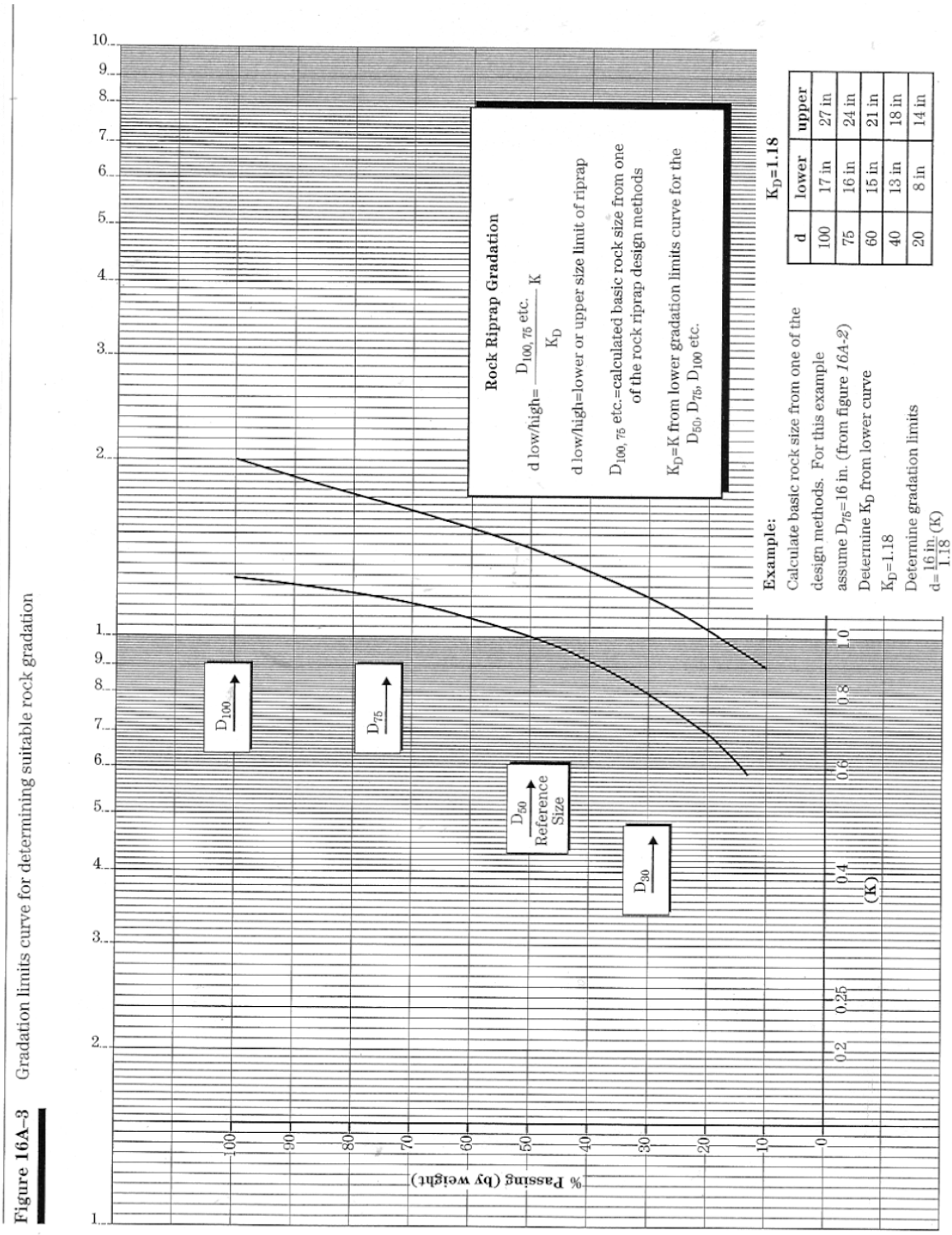
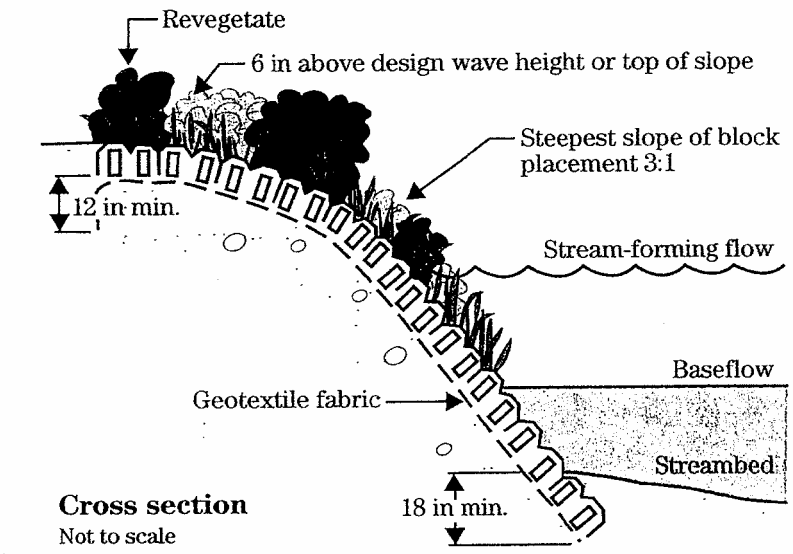


Figure 16A–3 Gradation limits curve for determining suitable rock gradation

CONCRETE CELLULAR BLOCK B-7.10



Source: USDA Natural Resources Conservation Service. 1996. Engineering Field Handbook Streambank and Shoreline Protection. Part 650, Chapter 16.

STREAMBED GRAVEL B-7.11

Description: Streambed gravel is sediment-free, non-angular (smooth) gravel of variable sizes used for habitat protection and maintenance, or sometimes in culvert replacements (which may be in watercourses or streams).

Purpose:
- Providing a natural substrate for fish
- Minimizing siltation in ditches and /or stormwater facilities

What to do:
- Place gravel in accordance with applicable design and permit conditions.
- Check gravel gradation to ensure it meets design specifications.
- If gravel has excessive fines, wash rock off-site (at a location where washed water cannot enter watercourses, streams or wetlands) until it runs clear.
- Haul material in clean truck bed.
- Dump cleaned rock onto tarped area on-site.
- Place a cover and berm around clean rock stockpiles. Re-wash rock before using if it becomes dirty.

What NOT to do:
- Use gravel that does not meet design specifications.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

B-8 WATER & RUNOFF DIVERSIONS

List of BMP Designs	Design #
Aqua Barrier	B-8.1
Coffer Dam	B-8.2
Dewatering	B-8.3
Diversion Berm	B-8.4
Diversion Channel	B-8.5
Rolling Dip	B-8.6
Sandbag	B-8.7
Slope Drain - Temporary	B-8.8
Slope Drain – Overside	B-8.9
Stream Bypass	B-8.10

AQUA BARRIER B-8.1

Description: An aqua barrier is a manufactured vinyl tube filled with water to provide a temporary / portable dam or barrier positioned to contain or divert the movement of water. It is a type of cofferdam.

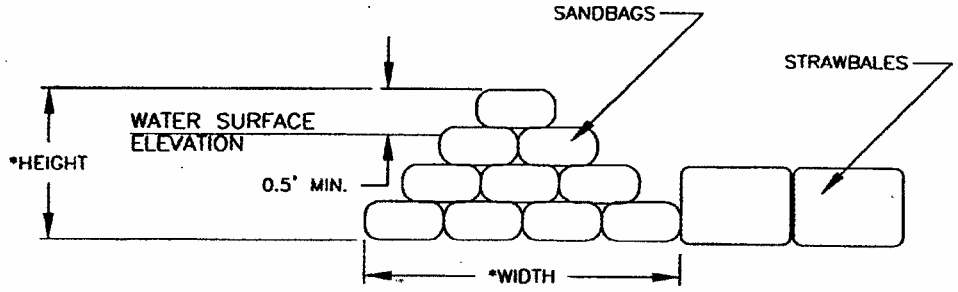
Purpose:
- Providing a dry construction area in a stream or waterway.
- Providing a bypass for a stream or waterway.
- Creating a temporary reservoir for water storage.
- Excluding waters from work area under and around bridges or piers.

What to Do:
- Use in accordance with the permit requirements.
- Refer to Fish Exclusion procedures (B-5).
- Follow manufacturer's recommendations and guidelines for installation and safety measures.
- Wear knives so workers can deflate in an emergency.
- Keep a repair kit on site in case of small punctures.
- Remove any visible rocks or sharp objects before installing barrier.
- Barriers can be used on dry ground, or in standing or flowing water.
- If needed, join multiple aqua barriers with connections.
- Inspect several times daily and make any needed repairs immediately.
- Allow to dry before rolling up for storage.

What NOT to Do:
- Do not cross more than 2/3 of the main flow of any salmonid-bearing water at the time of the year when any life stage of the fish is expected to be present.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

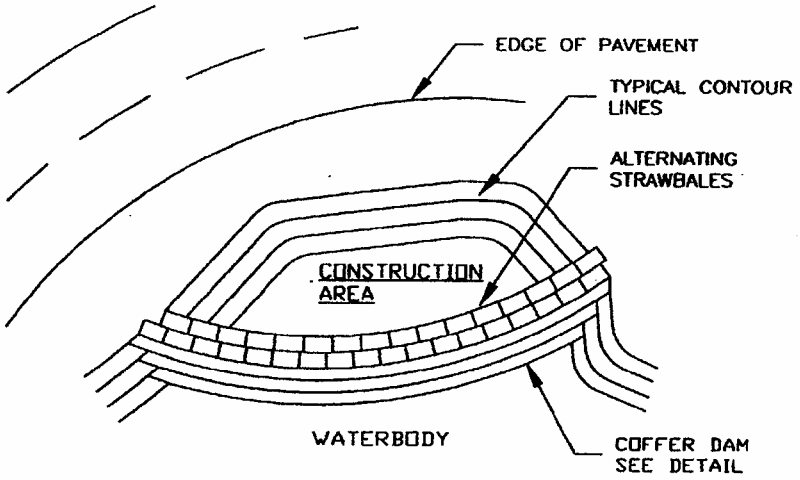
COFFERDAM B-8.2



* HEIGHT AND WIDTH OF COFFER DAM SHALL BE DETERMINED BY THE WATER SURFACE ELEVATION AT THE TIME OF CONSTRUCTION.

NOTES:

1. SANDBAGS SHALL BE USED IN ACCCORDANCE WITH APPLICABLE PERMITS.
2. INSTALL COFFER DAM AND DEWATER SITE PRIOR TO CONSTRUCTION
3. PROVIDE ADEQUATE FREEBOARD.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

DEWATERING B-8.3

Description: Dewatering can be used to keep water from a work area by using any or all of the following: pump, barrier, vactor, or bypass culvert.

Purpose:
- Allowing work to be performed in dry conditions
- Reducing the transport of soil particles by flowing water
- Reducing the liquefaction of soils.
- Used in ditches, watercourses, streams, channels, swales, and excavations.

What to Do:
- Determine if the project will require continuous dewatering.
- Schedule pumping, monitoring, and maintenance activities accordingly.
- Dewatering must be used in accordance with applicable design and permit conditions.
- Refer to "Fish Exclusion" procedures in B-5.
- Install dewatering devices.
- Install site-specific barrier before dewatering to prevent exterior water from entering construction area.
- Ensure water discharged from the site is not allowed to cause erosion.
- Dewatered water must be discharged to:
  - A containment device
  - A sanitary sewage system
  - Other BMPs to remove sediment before reintroducing to watercourse.
- Inspect daily and make any required repairs immediately.
- Check for erosion at discharge and repair or move as necessary.
- Provide adequate fuel supply and backup pumps in the event of a mechanical failure.

What NOT to Do:
- Do not use where flows are greater than pump capacity.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

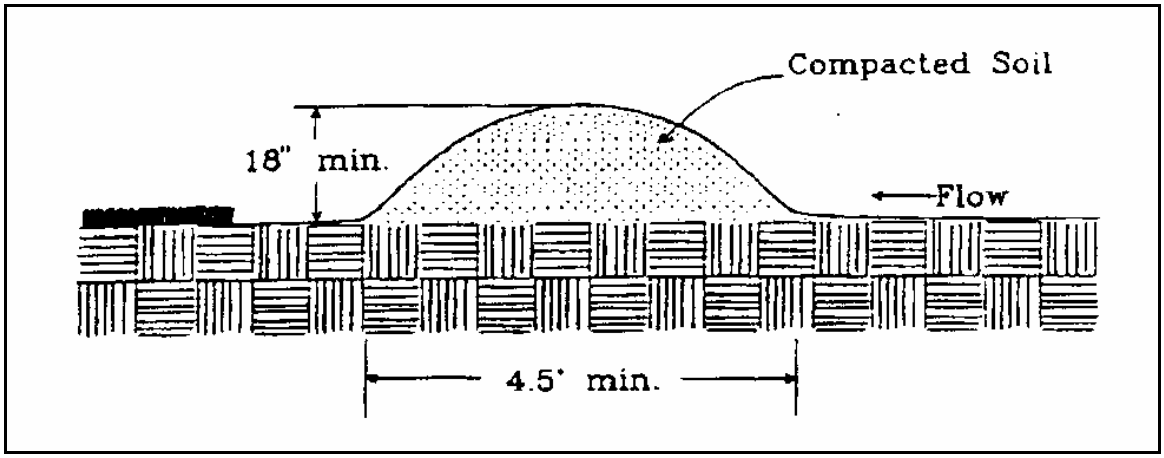
DIVERSION BERM B-8.4

Description: A diversion berm is a temporary ridge of compacted soil constructed at the top or base of a disturbed slope. These structures generally have a life expectancy of 18 months or less.

Purpose:
- Diverting storm runoff from upslope drainage areas away from unprotected disturbed areas and toward a stabilized outlet.
- Diverting sediment-laden runoff from a disturbed area to a sediment-containment facility such as a sediment trap or a sediment basin.

What to Do:
- Install as a first step in the land-disturbing activity.
- Compact adequately to prevent failure.
- Have a minimum freeboard of 0.3 feet.
- Apply temporary seeding and mulch following construction of the berm.
- Clear plastic may be used as an additional erosion control method (B-4.9).
- Inspect daily and make any required repairs.
- When no longer needed, remove sediment build-up and the berm. Revegetate area disturbed by berm removal (if applicable).

What NOT to Do:
- Do not use if water flow is likely to erode the berm.
- Do not use if there is indequate space for construction.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

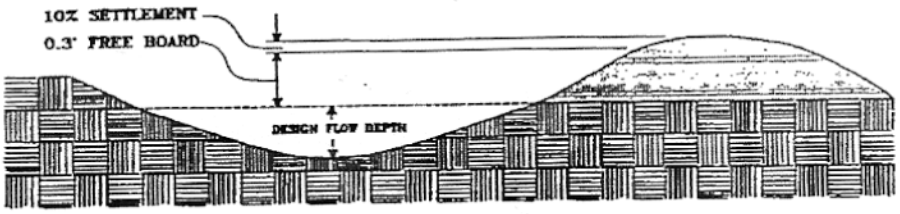
DIVERSION CHANNEL B-8.5

Purpose:

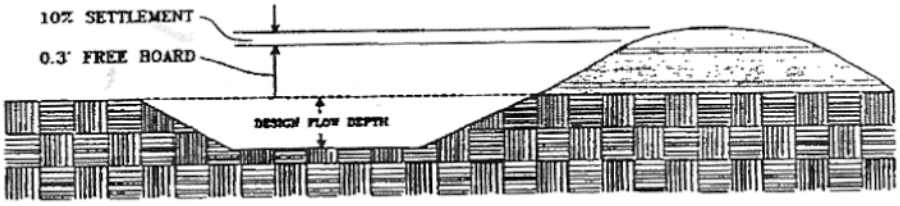
- Reducing slope length
- Intercepting and diverting stormwater runoff to stabilized outlets at non-erosive velocities
- Intercepting sheet flow
- Decreasing down slope sheet flow velocity

What Not to Do:

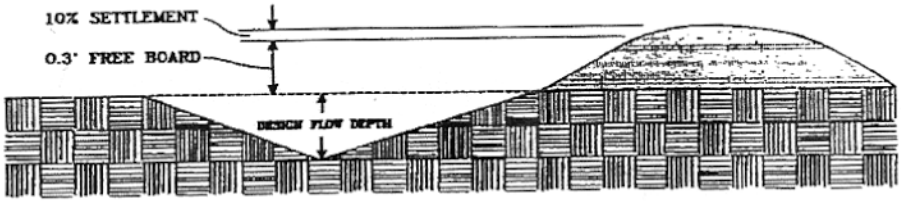
- Do not use if the downslope is greater than 2 horizontal to 1 vertical.
- Do not use if water flow is likely to erode the channel.



TYPICAL PARABOLIC DIVERSION



TYPICAL TRAPEZOIDAL DIVERSION



TYPICAL VEE-SHAPED DIVERSION

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

ROLLING DIP B-8.6

Description: Rolling dips are breaks in the grade of a road. The dips are sloped either into the inside ditch or to the outside of the road edge to drain and disperse road surface runoff. Rolling dips are most frequently used on outsloped roads.

Purpose:

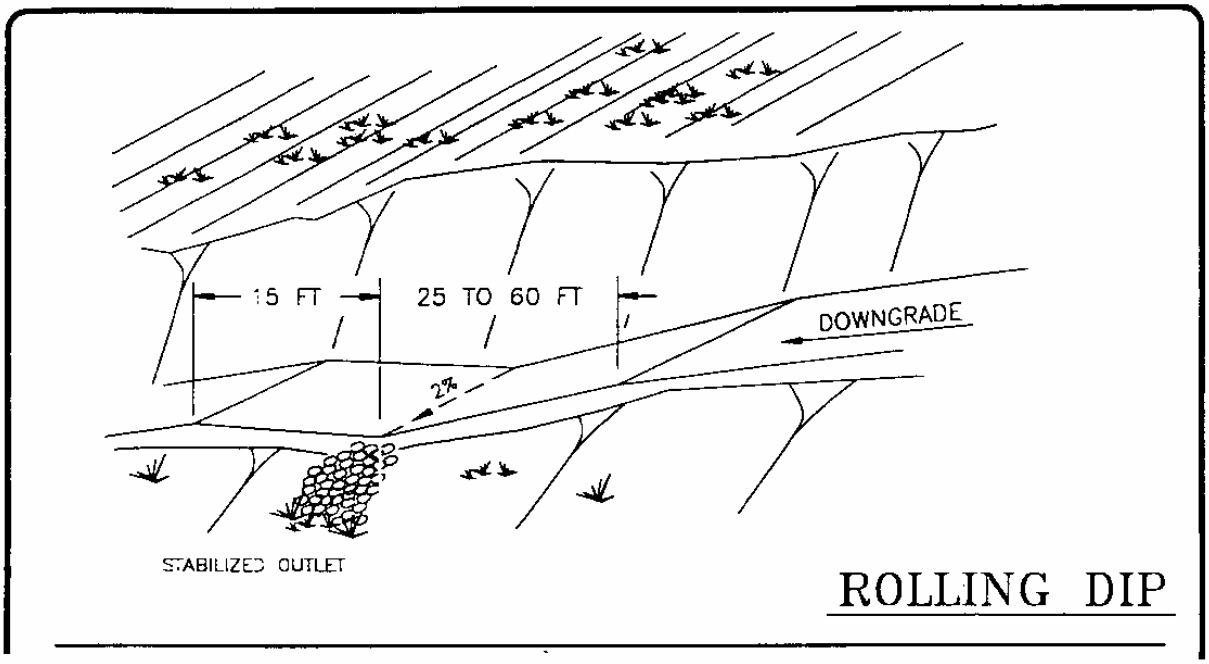
- Draining and dispersing road surface runoff to prevent rilling and surface erosion.
- Improving surface drainage on existing roads with low volume traffic and lower speeds.

What to Do:

- Excavate the entire rolling dip into the roadbed; do not create any fill.
- Angle the axis of a rolling dip about 30 degrees to the road alignment.
- Make sure that the down-road side of the dip has a higher slope than the original grade below it, to ensure that runoff cannot continue down the road surface.
- As a road becomes steeper, make dips deeper and place at a steeper angle to adequately capture and divert road runoff.

What NOT to Do:

- Grader operators should not fill the depressions with soil or cut deeply into the lower part of the rising section, which would remove the important grade change.



Sources: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.; Weaver, W.E. and D.K. Hagans. 1994. Handbook for Forest and Ranch Roads. Mendocino County RCD, Ukiah CA.

SANDBAG B-8.7

Description: A sandbag is a pre-manufactured cloth or plastic bag (polypropylene) filled with sand or gravel. Sandbags can be used to keep water from the work area, for settling and reduction in water velocity and erosive forces.

Purpose:
- Serving as a cofferdam
- Providing filtering for sediment (when used with clean pea gravel)
- Decreasing water velocity, such as in a ditch
- Protecting areas from flooding

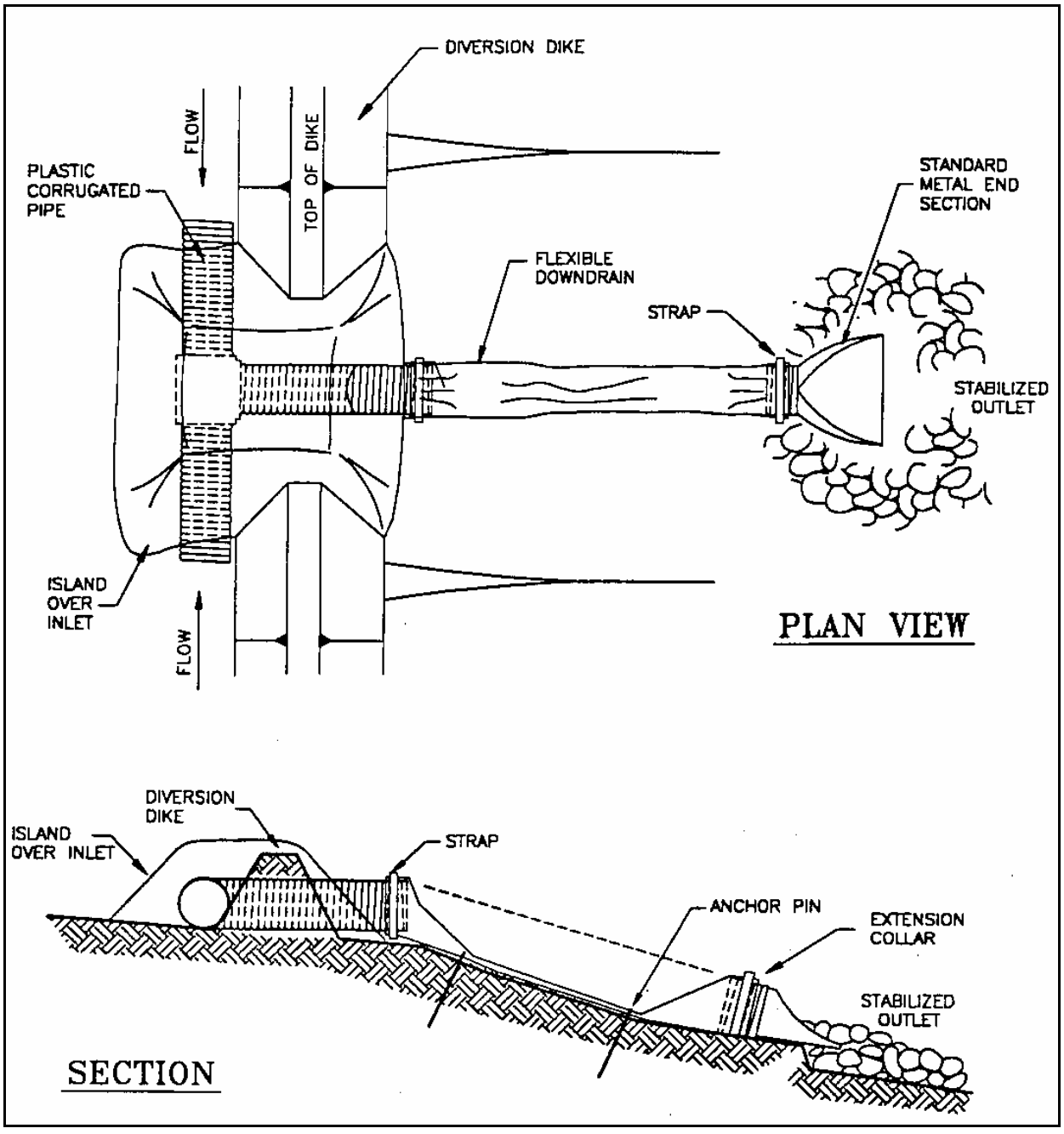
What to Do:
- Apply in accordance with permit requirements
- Refer to Fish Exclusion procedures in B-5
- If sandbag filling is used as streambed gravel, it must be washed before filling bags and appropriately sized according to design or permit conditions. Wash rock off-site (at a location where washed water can not enter watercourses, streams or wetlands) until water runs clear.
- Secure ends of sandbags to ensure material does not scatter.
- When used as a barrier, stack bags tightly together and in alternating, brick-layer fashion.
- Inspect daily during workweek and replace any damaged sandbags.
- Remove sediment when deposits reach ½ the height of the bags.
- Release contents of gravel-filled bags on site, in streams, when so stated in the specific permit conditions. Remove bags from job site.

What NOT to Do:
- Do not use when permit conditions state not to.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle, WA.

SLOPE DRAIN - TEMPORARY

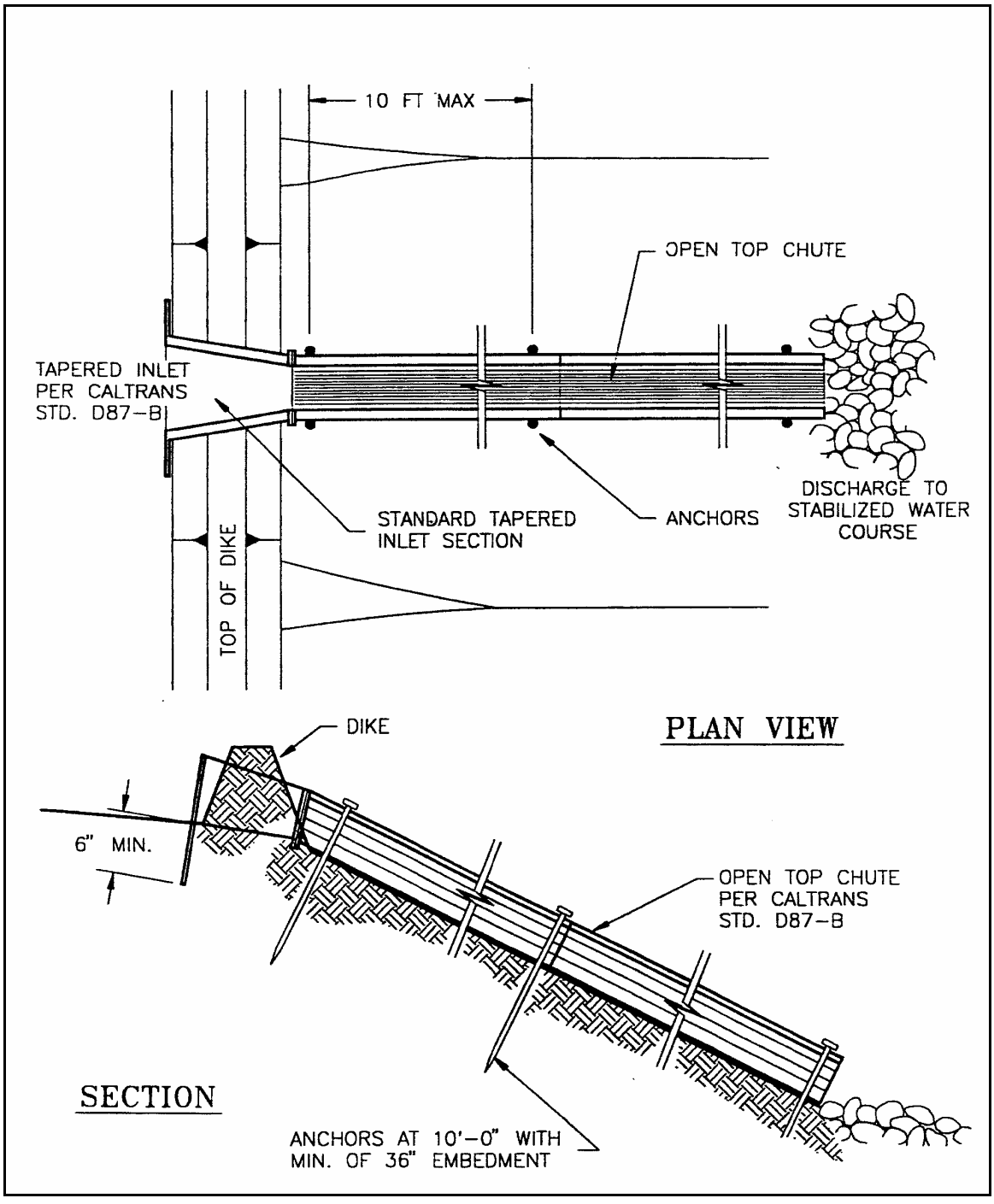
B-8.8



Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.

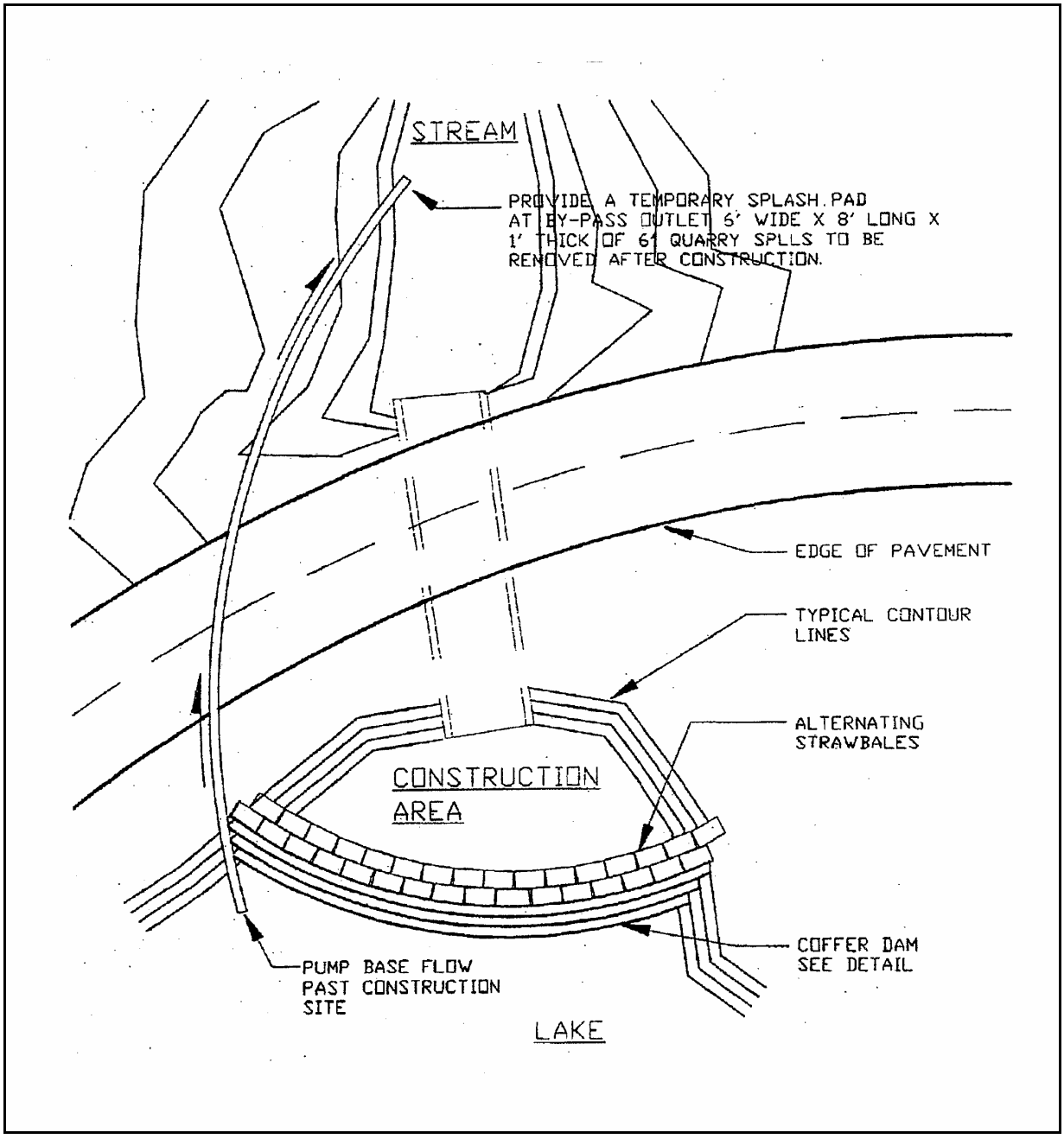
SLOPE DRAIN - OVERSIDE

B-8.9



Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.

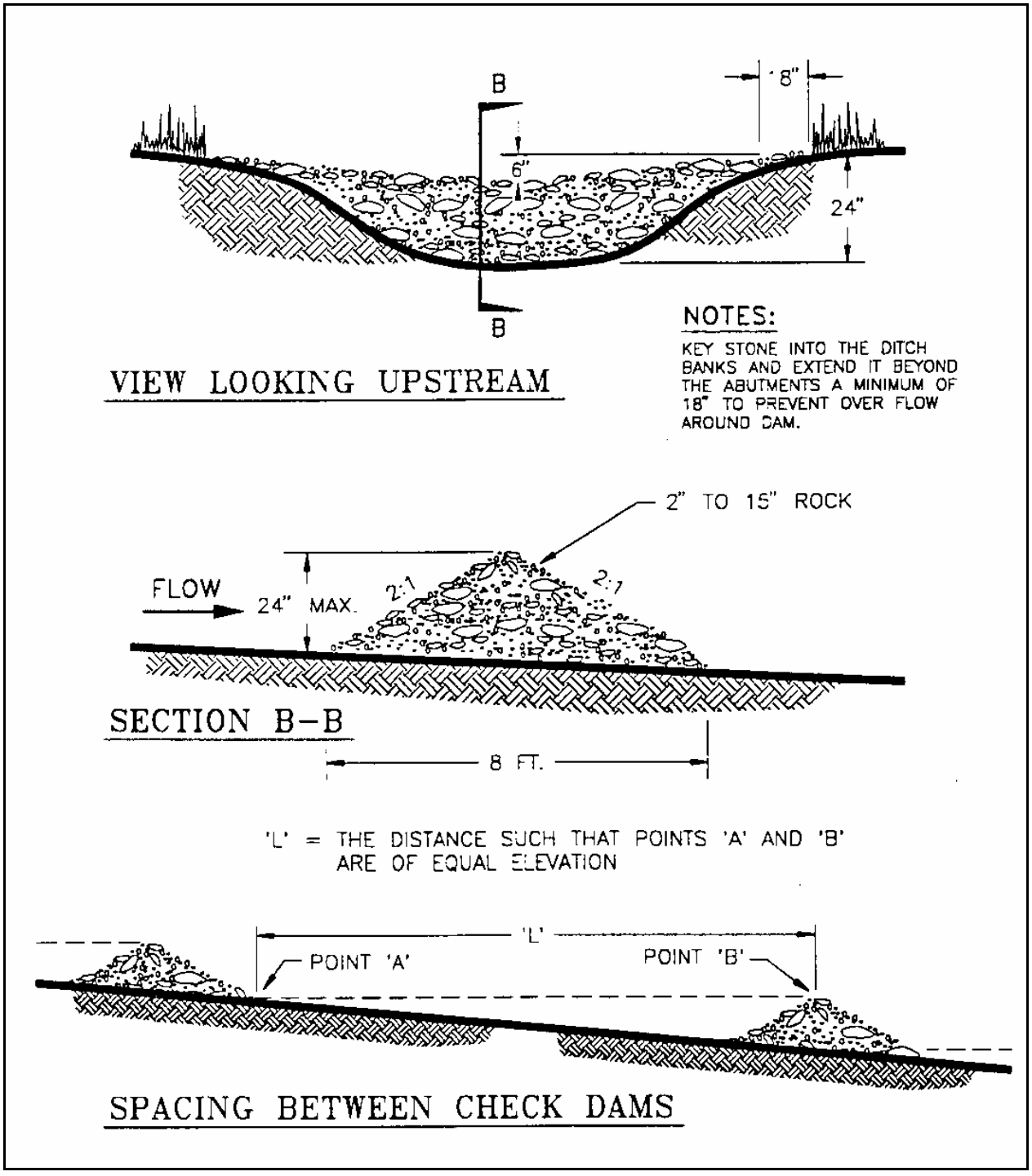
STREAM BYPASS B-8.10



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

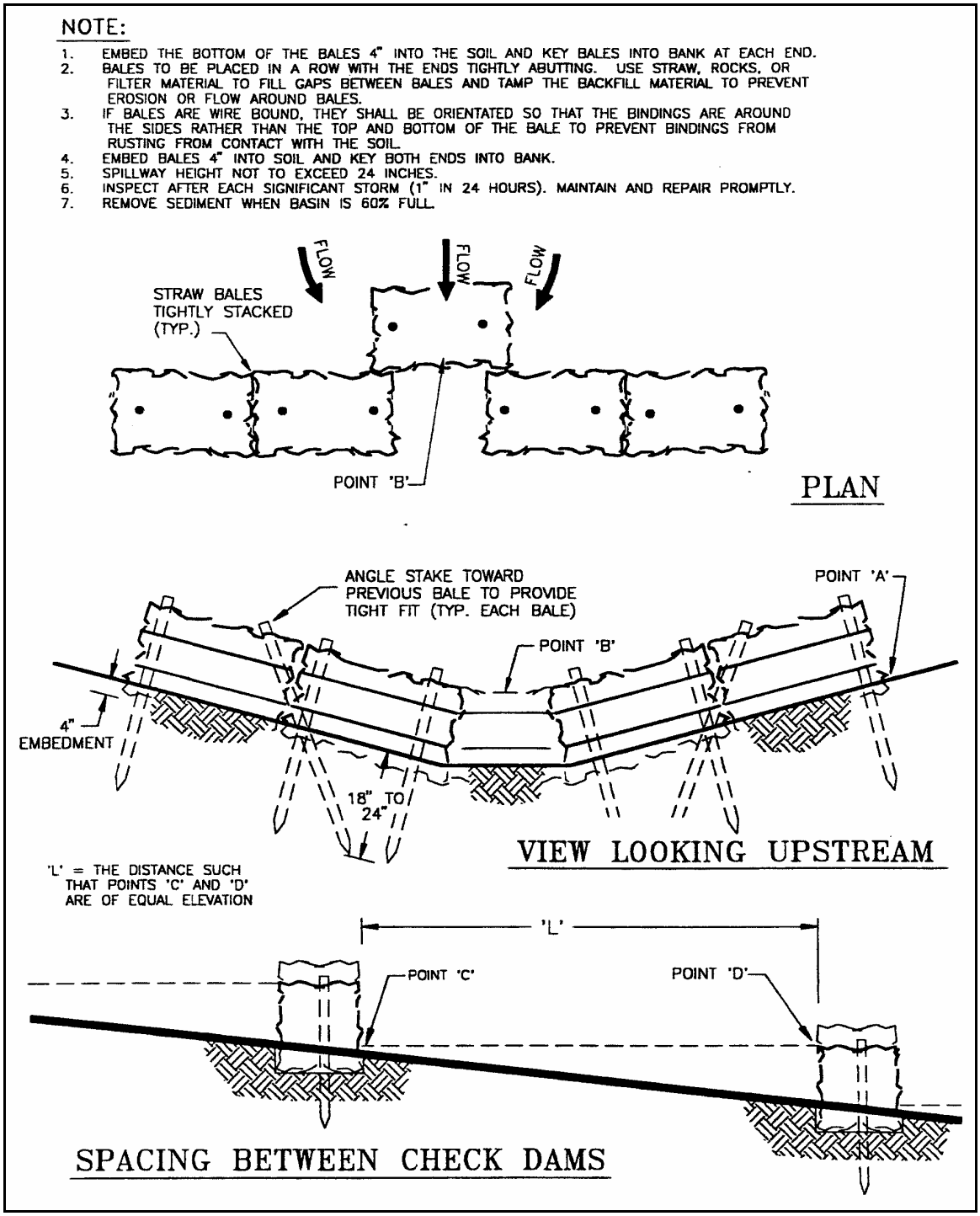
B-9 WATER QUALITY PROTECTION & SEDIMENT CONTROL

CHECK DAM –ROCK B-9.1



Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.

CHECK DAM – STRAW BALE B-9.2

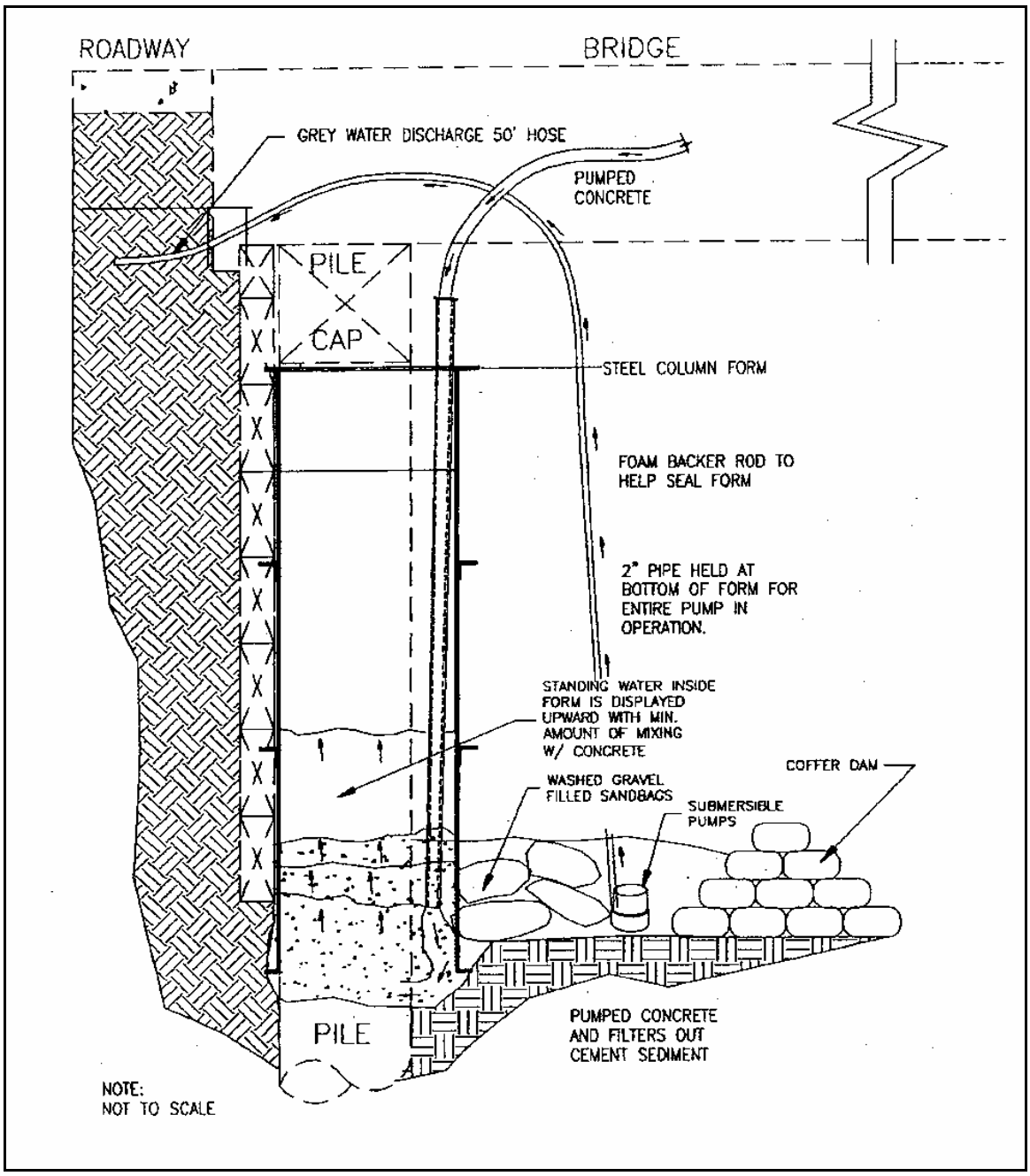


Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.

CONCRETE CONTAINMENT B-9.3

Purpose:

- Preventing uncured concrete and chemicals from leaving the work site and entering the adjacent body of water
- Used when dewatering is not possible for bridge repair work

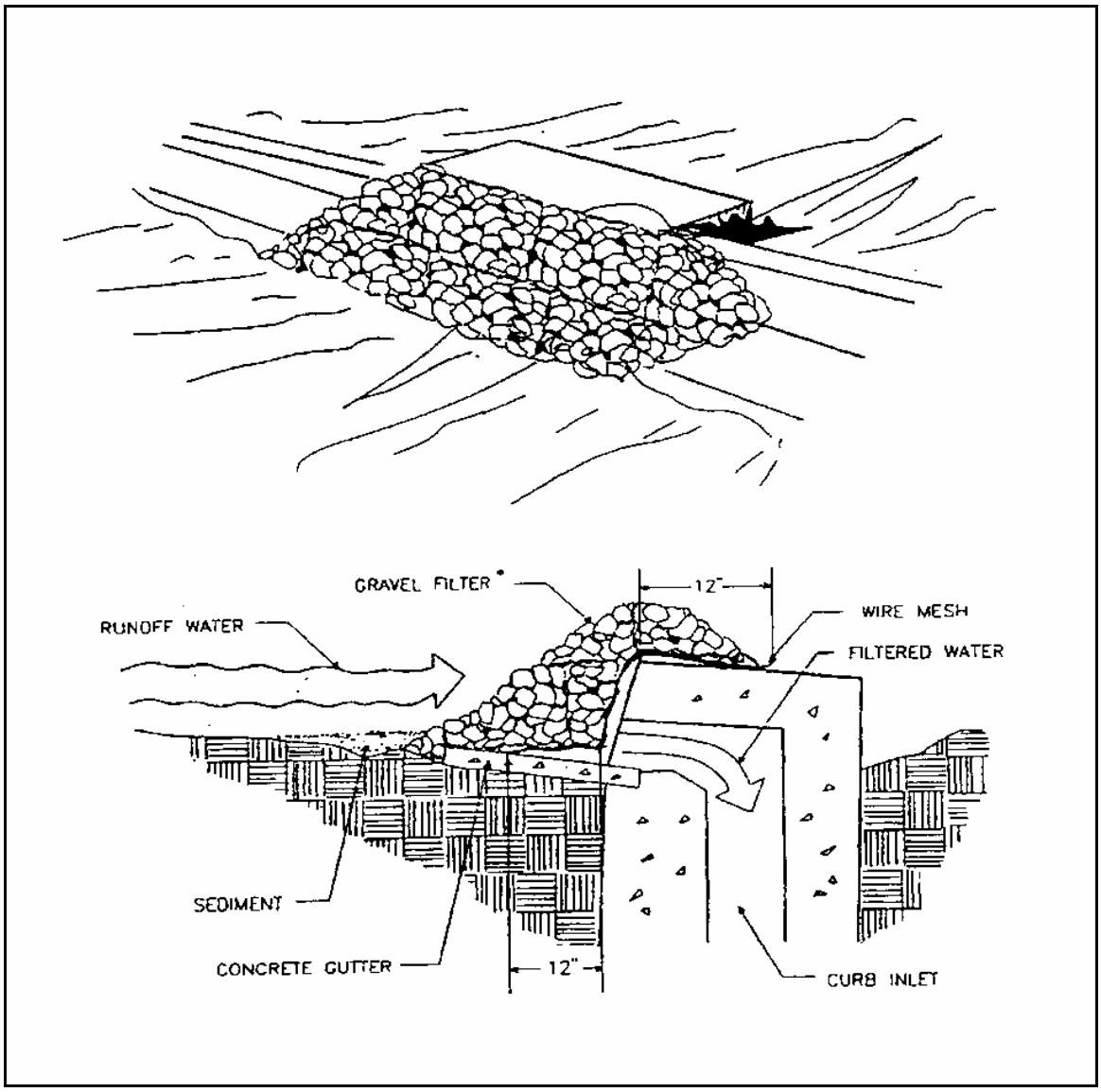


Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

CURB OR DROP INLET SEDIMENT TRAP

B-9.4

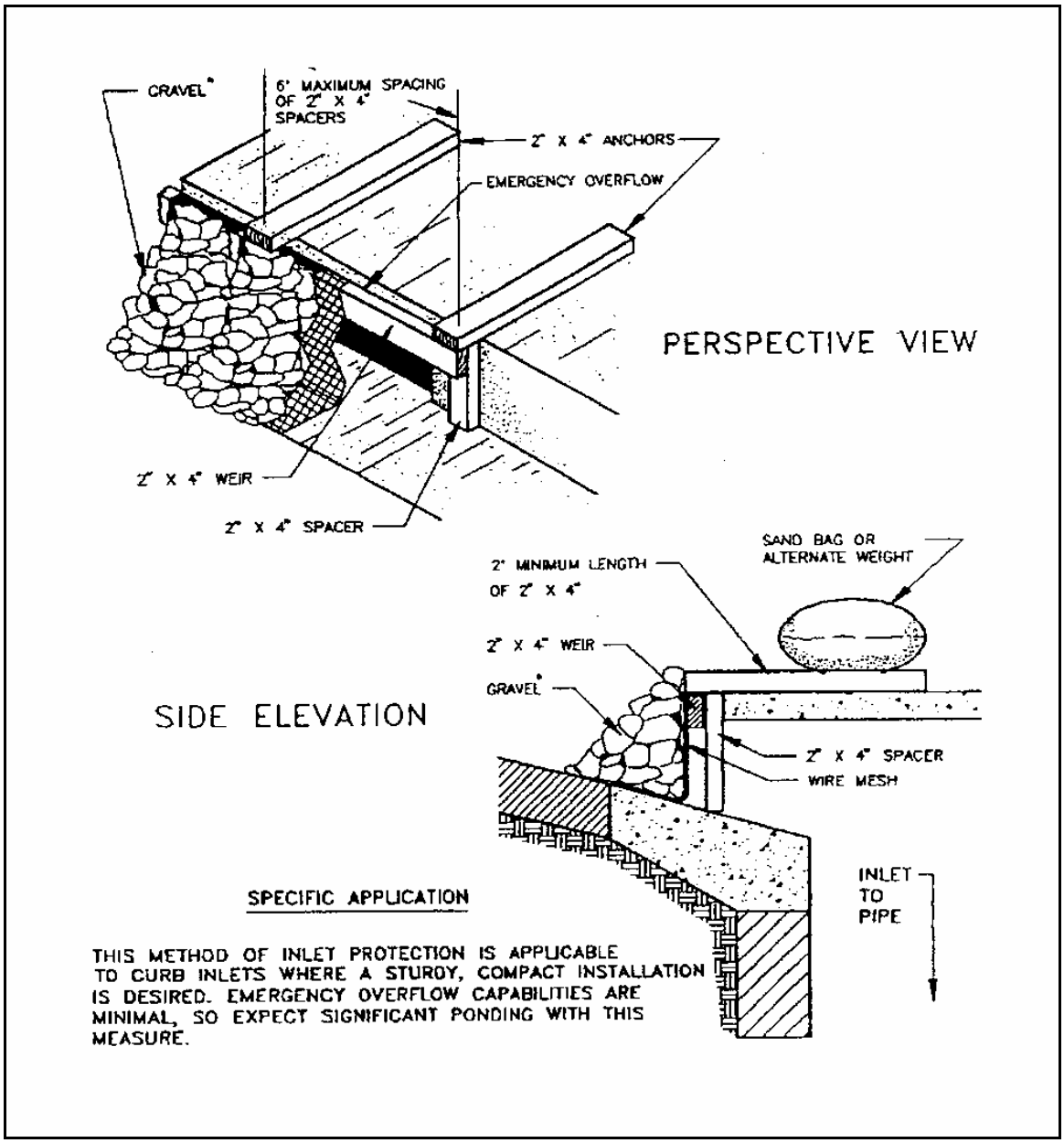
Figure 1. Design A - Curb inlet sediment trap detail



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

CURB OR DROP INLET SEDIMENT TRAP B-9.4

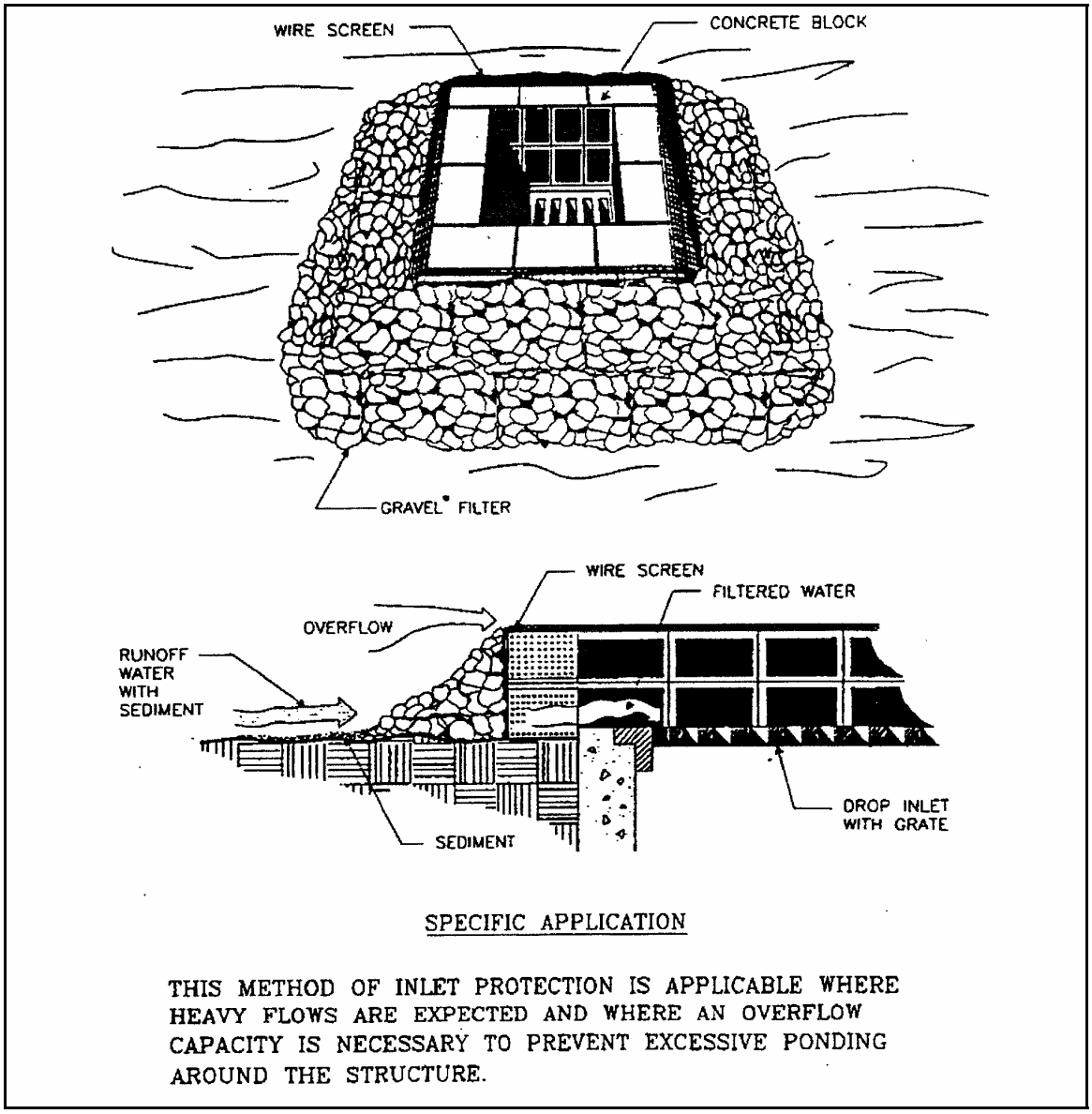
Figure 2. Design B – For curb inlets where a sturdy, compact installation is required.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

CURB OR DROP INLET SEDIMENT TRAP B-9.4

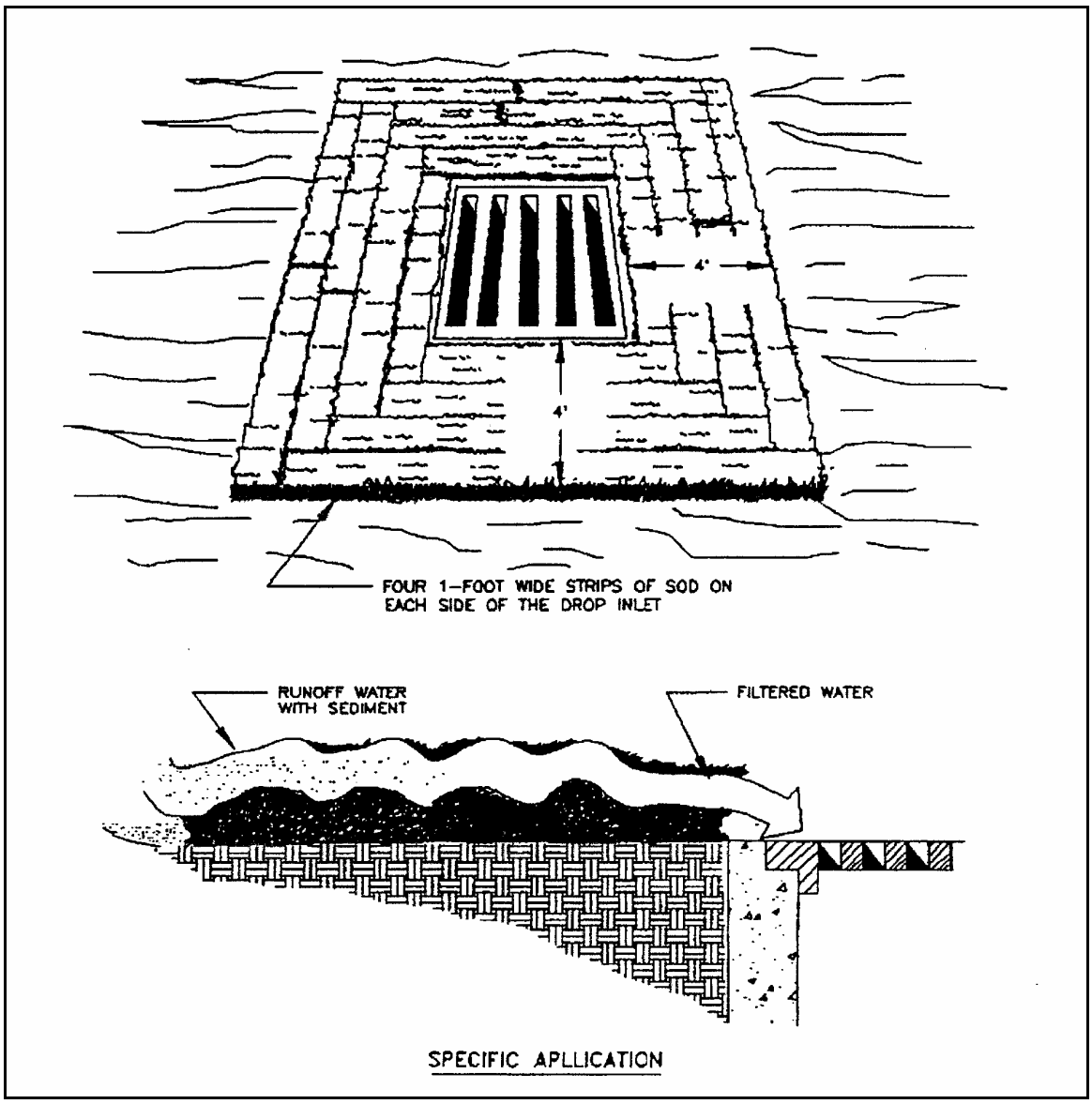
Figure 3. Design C - Block and gravel drop inlet with sediment filter.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

CURB OR DROP INLET SEDIMENT TRAP B-9.4

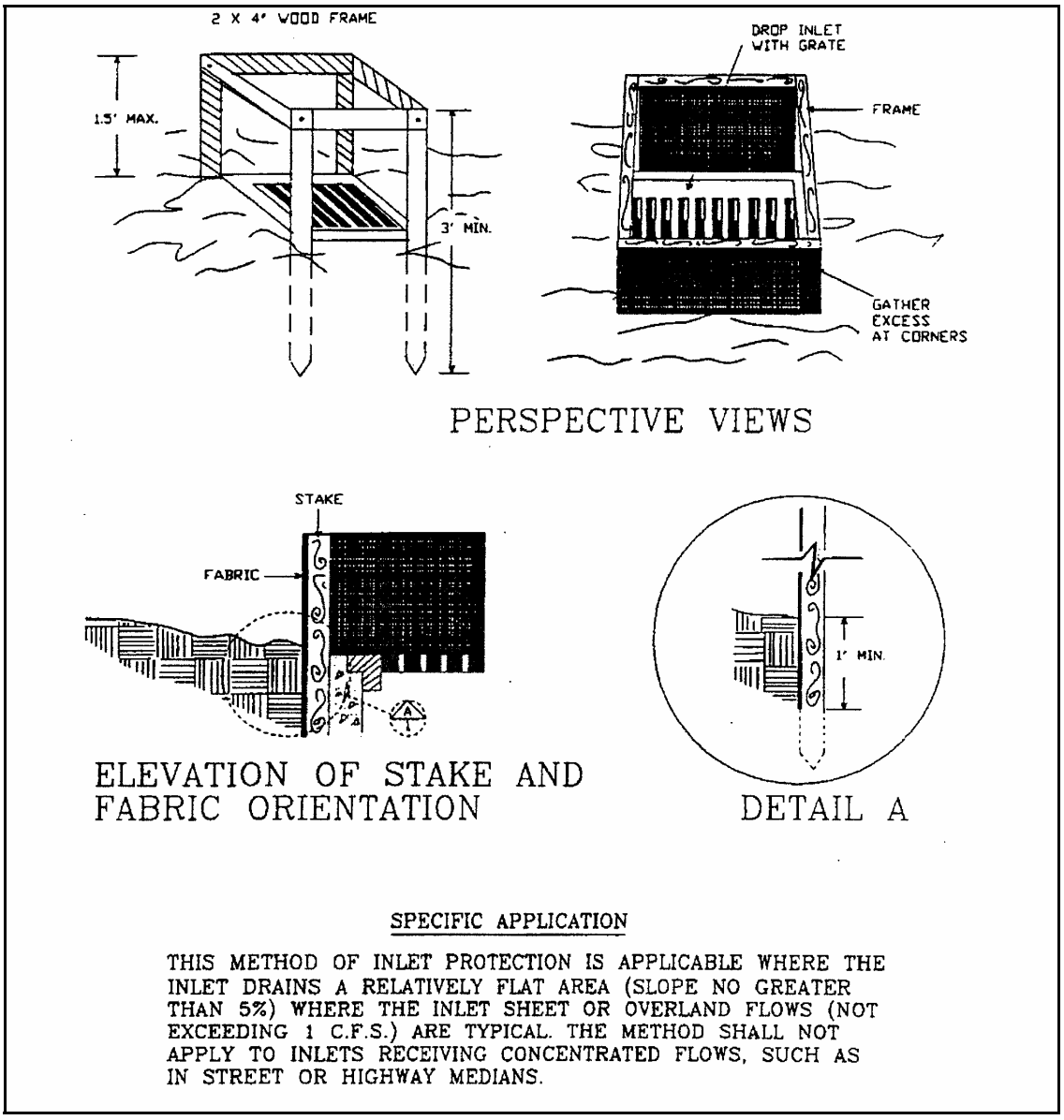
Figure 4. Design D – Drop inlet with Sod sediment filter.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

CURB OR DROP INLET SEDIMENT TRAP B-9.4

Figure 5. Design E – Silt Fence drop inlet protection.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

SEDIMENTATION SUMP B-9.5

Description: Sedimentation sumps provide a sump within the flow line of ditches, swales, or channels to allow soil particles to collect and settle.

Purpose:

- Collecting soil particles by settlement in areas where water quantity or velocities are transporting sediment and impacting structures or habitat.

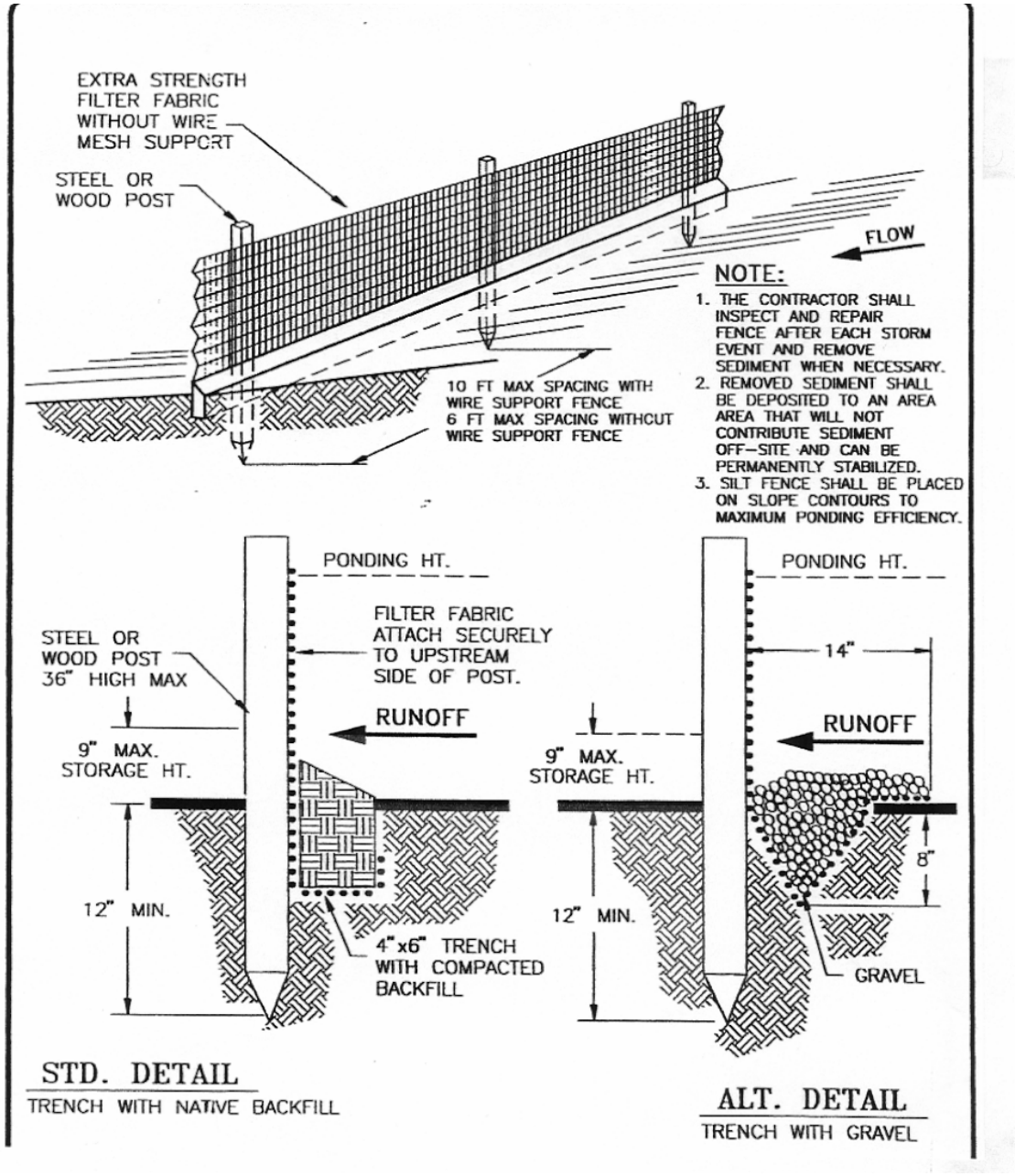
What to Do:

- Place rim of structure at flow line elevation.
- Size structures based on the quantity of sediment and space availability within the transport facility.
- Place structures with other BMPs, such as ditch linings.
- Locate structures in transport facilities where they can collect sediment prior to pipe crossings into streams, wetlands, sensitive areas, or structures that easily plug with sediment.
- Monitor after rainfall events to determine the needed cleaning schedule and frequency.
- Clean when needed using vactor truck (used in cleaning of catch basins), if affordable.

What NOT to Do:

- Do not use to remove excessive fines.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.



Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.

SILTATION POND / SETTLING TANK B-9.7

Description: A siltation pond, or settling tank, is a temporary containment structure or area for silt-laden water to be initially discharged. After sufficient settling, the water may be discharged to a sanitary sewer, storm drainage system, or other BMP.

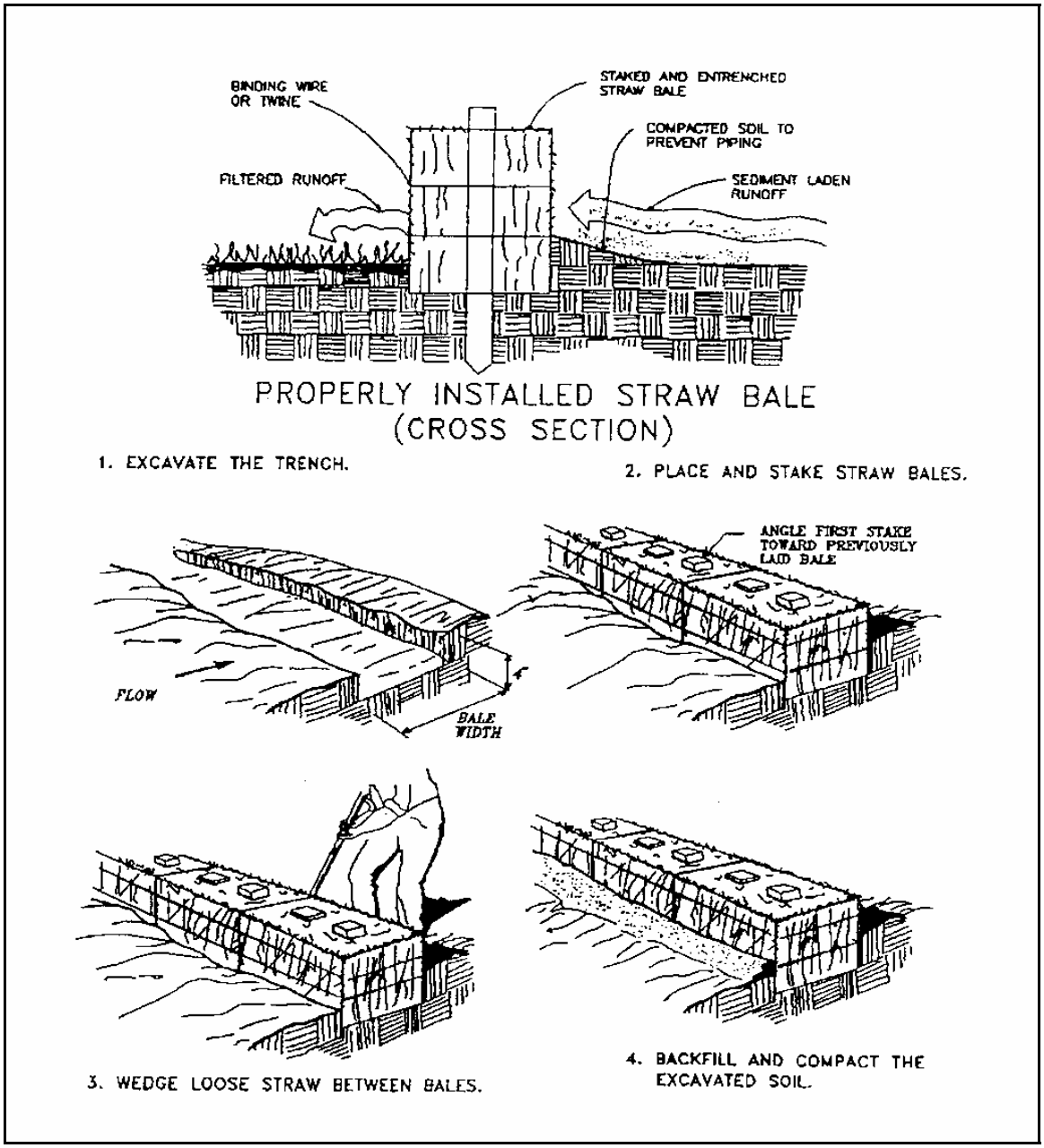
Purpose:
- Allowing soil particles to settle before being discharged off-site
- Containing water-borne soil particle on site
- Controlling the flow of water through a control structure, such as a tee fitting, an oil–water separator, or an orifice.

What to Do:
- Install according to applicable permit requirements.
- Be sure that the quality of the water discharged from siltation pond / settling tank meets the permit requirements at the point of discharge.
- Check site to determine if there is adequate space for pond excavation.
- Use portable tanks where ponds cannot be constructed.
- Design siltation pond according to surface water design standards.
- Have geologist review soil types to ensure compatible filtration. Use line where soils are incompatible with filtration.
- Inspect daily during workweek, particularly the filtering and control devices. Repair structure and replace devices to ensure that the structure functions as designed.
- When pond/tank is no longer needed, follow engineer's recommendation for its removal. Remaining sediment shall be removed and disposed of according to permit conditions.
- Revegetate area that was disturbed by the pond /tank, if needed.

What NOT to Do:
- Do not use in soils that are not compatible for filtration, unless a liner is used.
- Do not use if there is inadequate space to process the volume of sediment-laden water.

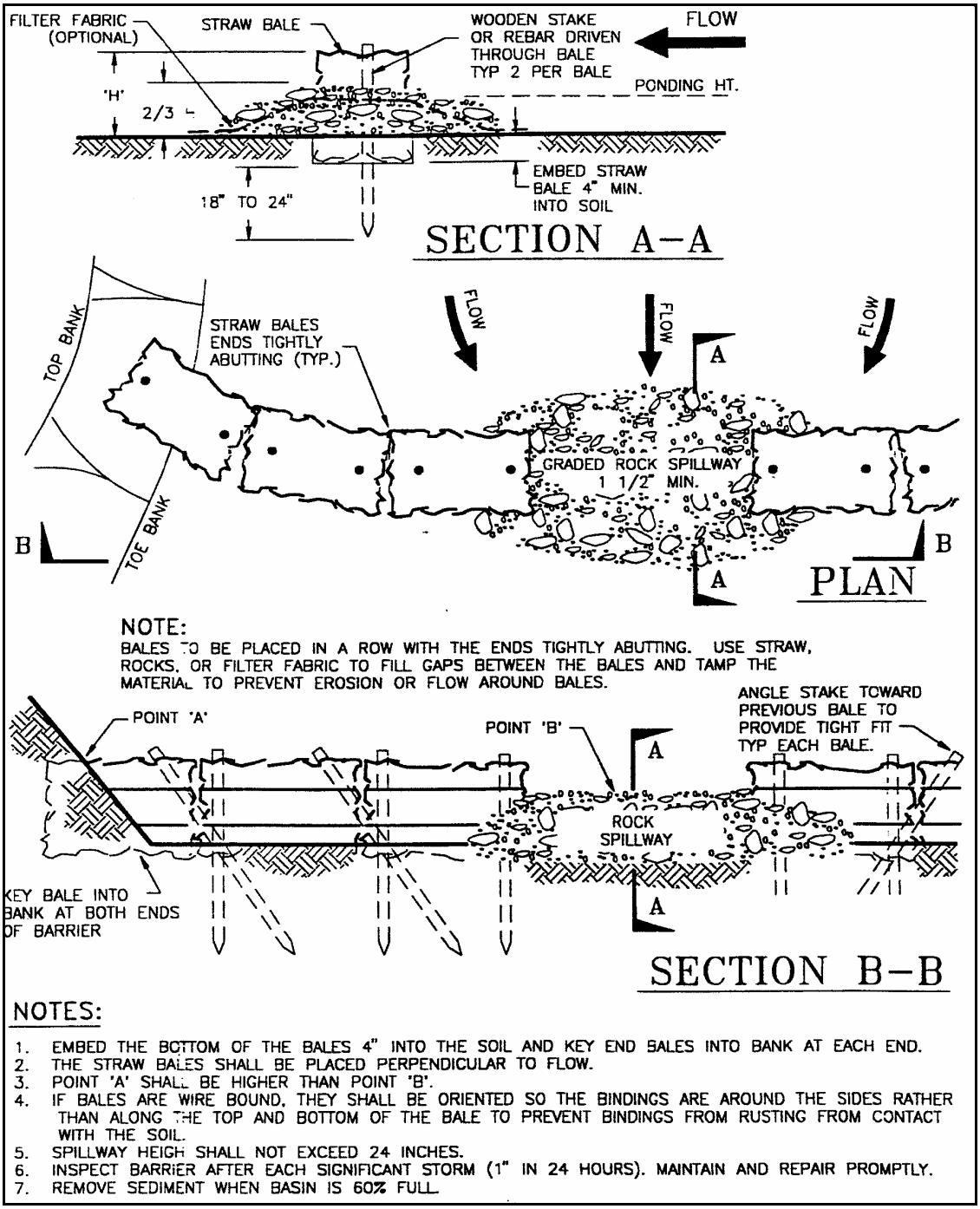
Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

Figure 1. Properly installed straw bale and construction of straw bale barrier.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

Figure 2. Semi-pervious straw bale sediment barrier, with sand and gravel spillway.



NOTES:

1. EMBED THE BOTTOM OF THE BALES 4" INTO THE SOIL AND KEY END BALES INTO BANK AT EACH END.
2. THE STRAW BALES SHALL BE PLACED PERPENDICULAR TO FLOW.
3. POINT 'A' SHALL BE HIGHER THAN POINT 'B'.
4. IF BALES ARE WIRE BOUND, THEY SHALL BE ORIENTED SO THE BINDINGS ARE AROUND THE SIDES RATHER THAN ALONG THE TOP AND BOTTOM OF THE BALE TO PREVENT BINDINGS FROM RUSTING FROM CONTACT WITH THE SOIL.
5. SPILLWAY HEIGH SHALL NOT EXCEED 24 INCHES.
6. INSPECT BARRIER AFTER EACH SIGNIFICANT STORM (1" IN 24 HOURS). MAINTAIN AND REPAIR PROMPTLY.
7. REMOVE SEDIMENT WHEN BASIN IS 60% FULL.

Source: McCullah, J. 1992. Erosion and Sediment Control Standards Design Manual – County of Shasta. Prepared for the Western Shasta RCD. Redding CA. 187 p.

SWEEPING B-9.9

Description: Sweeping is done by hand or mechanical means. A sweeper is a vehicle with brushes and /or a vacuum system and a water spray system used on the roadways to remove debris and soil particles.

Purpose:

- Removing soil particles and debris before entering the drainage systems, watercourses, or streams
- Suppressing dust on roadways and at construction sites
- Removing snow sand after snow and ice control operations

What to Do:

- Use pickup brooms in sensitive areas.
- Always use water with mechanical brooms.
- Schedule snow sand removal as part of the snow and ice emergency response.
- Dispose of collected material at permitted facilities.
- Do not pick up suspicious debris but instead call appropriate agency.

Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

TURBIDITY CURTAIN B-9.10

Description: A turbidity curtain is a pre-manufactured floating geotextile structure which minimizes turbidity transport from a disturbed area adjacent to or within a body of water. This device allows for settling of suspended solids and/or reducing water velocity.

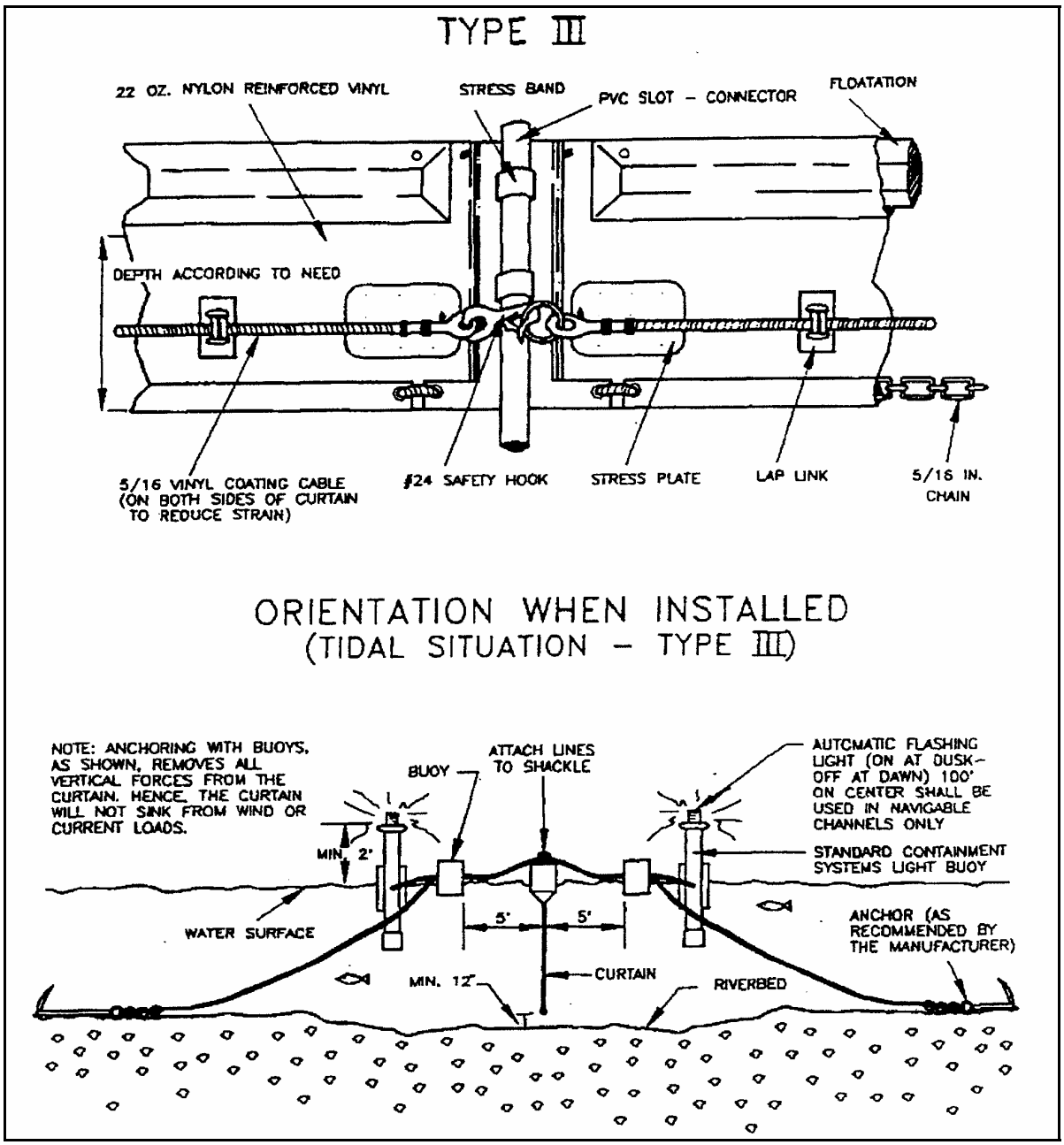
Purpose:
- Minimizing the mixing of turbid water with adjacent clean water
- Containing soil particles during construction and/or repair activities

What to Do:
- Install according to manufacturer's recommendations and guidelines and follow applicable permit requirements.
- Choose the appropriate height of the turbidity curtain. Units are preassembled in 50 foot lengths and are used by connecting the number of units required.
- Add a suitable weight or anchoring system to the bottom of the curtain.
- Remove curtain in such a manner as to minimize turbidity. Remaining soil particles shall be sufficiently settled before removing the curtain.
- Ensure that water discharged from turbidity curtain meets permit requirements at point of discharge.

What NOT to Do:
- Do not place across the main flow of a significant body of water.
- Do not cross more than 2/3 of the main flow of any salmonid-bearing water at the time of the year when any life history stage of salmonids are expected to be present.
- Do not use where flow volume or water velocity inhibits its function.
- Do not use for any purpose other than retaining silt.

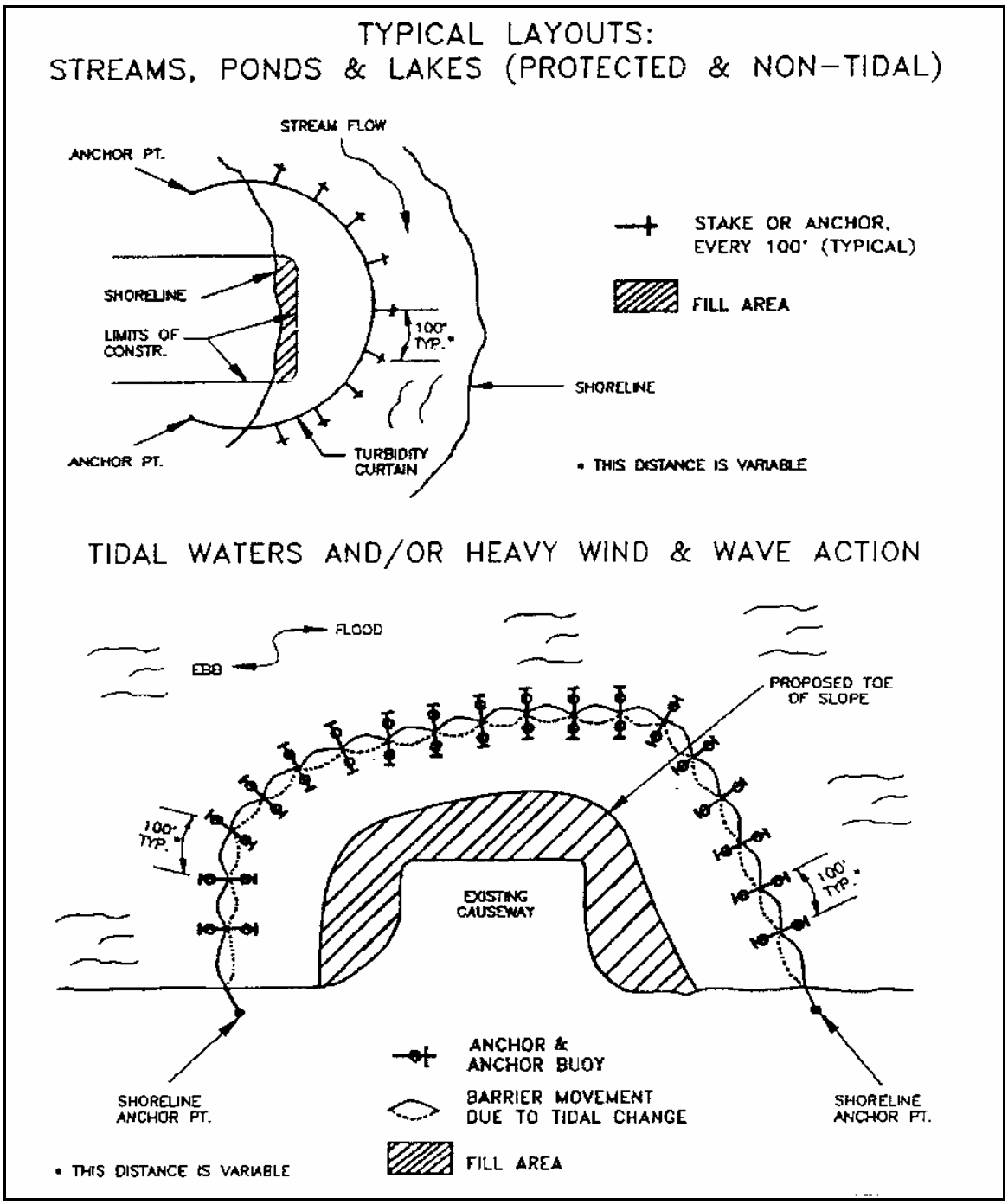
Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines. Seattle WA.

Figure 1. Turbidity Curtain – Type III, including tidal situation.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

Figure 2. Two typical layouts of a turbidity curtain.



Source: King County. 2000. Regional Road Maintenance Endangered Species Act Program Guidelines.

APPENDIX C

FISH PASSAGE GUIDELINES

C-1 NMFS Fish Passage Guidelines

Download from NMFS website:
http://swr.nmfs.noaa.gov/hcd/NMFSSCG.pdf

C-2 DFG Culvert Criteria for Fish Passage

Download chapter from 4th edition (2002 version) of California Salmonid Stream Habitat Manual from CDFG website:
http://www.dfg.ca.gov/nafwb/pubs/

APPENDIX D

WATER DRAFTING GUIDELINES

D-1 NMFS Water Drafting Specifications

D-2 DFG Guidelines for Temporary Water Drafting: Preliminary Draft

D-1 NMFS - WATER DRAFTING

WATER-DRAFTING SPECIFICATIONS

National Marine Fish Service
Southwest Region

August 2001

AWater-drafting@ is a short-duration, small-pump operation that withdraws water from streams or impoundments to fill conventional tank trucks or trailers. Usually, this water is used to control road dust, or for wildfire management.[1] Short term water drafting is also used to temporarily de-water a construction site, or to temporarily divert water around a construction site.

The specifications below are given primarily for the protection of juvenile anadromous salmonids, in waters where they are known to exist; but they also may be applied to protect a host of other aquatic organisms as well. The issue of sufficient in-stream flow for life support of the aquatic ecosystem should be addressed by a local Fish & Game biologist. Temporal and cumulative effects should be considered on a watershed scale. While we give some guidelines in that area, the actual impact of water drafting on stream ecology should be assessed and monitored at the local level by qualified personnel.

The main focus of this guidance is the construction, operation, and maintenance of a fish screen module(s) that must be installed at the in-stream end of the drafting hose to protect small salmon and steelhead fry from being entrained in the hose, or impinged on the surface of the screen. The specifications are based on the critical Aapproach velocity@ at the screen surface[2], and a recognition that many temporary screens will not be outfitted with automatic cleaning devices to remove debris buildup. Since it is difficult to measure water velocities in the field, only the construction, pumping capacities, and operations are specified. Variances from these specifications may be considered, but only on a case-by-case basis.

Operating Guidelines

[1] In case of emergency wildfire, where human life is in danger, the operator may disregard the screening requirement if a suitable screen is not immediately accessible.

[2] Approach velocity is the horizontal velocity vector component, typically measured at a distance of 3 inches from the screen face.

D-1 NMFS - WATER DRAFTING

1. Operations are restricted to one hour after sunrise to one hour before sunset.[3]
2. Pumping rate shall not exceed 350 gallons per minute.
3. The pumping rate shall not exceed ten percent of the stream flow.[4]
4. Seek streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools.
5. Pumping shall be terminated when the tank is full. The effect of single pumping operations, or multiple pumping operations at the same location, shall not result in obvious draw-down of either upstream or downstream pools.
6. Each pumping operation shall use a fish screen. The screen face should be oriented parallel to flow for best screening performance. The screen shall be designed and used such that it can be submerged with at least one-screen-height-clearance above and below the screen.
7. Operators shall keep a log on the truck containing the following information: *Operator=s Name, Date, Time, Pump Rate, Filling Time, Screen Cleaned (Y or N), Screen Condition, Comments*. These guidelines should be included as instructions in a logbook with serially numbered pages. This assures each truck operator easy access to this information.

Screen Construction Criteria

1. Surface Area

The total (unobstructed) surface area of the screen shall be at least 2.5 square feet, based on the upper limit of pumping of 350 gpm[5]. Larger surface areas are recommended where debris buildup is anticipated, and where stream depth is adequate to keep the screen submerged at approximately mid-depth.

2. Screen Mesh

Screen Mesh must be in good repair and present a sealed, positive barrier- effectively preventing entry of the Adesign fish@ into the intake. The design fish in this case is a immature (20-30mm) salmon or steelhead fry.

The screen mesh size shall be:
Round openings - maximum 3/32 inch diameter (.09 inch)
Square openings - maximum 3/32 inch diagonal (.09 inch)
Slotted openings - maximum 1/16 inch width (.07 inch)

3. Screen Design

[3] Restricting operations to daylight-only prevents the use of lights that will attract fish to the drafting pool

[4] Restricting drafting to ten percent of the stream flow provides adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Ten percent of flow may be estimated by pump operators.

[5] If larger pumping volumes are needed, or if the pumping application is continuous, refer to http://swr.nmfs.noaa.gov/habitat.htm and review addendum for small pump intakes.

D-1 NMFS - WATER DRAFTING

Water drafting screens may be off-the-shelf products, but they are often custom-made devices appropriate to the scale and duration of pumping operation. To keep the screen supported and correctly positioned in the water column, adjustable support legs are advised. Screen geometry can be configured either as rectangular or cylindrical, i.e.- as a shallow Abox-shape@ or tubular. The intake structure shall be designed to promote uniform velocity distribution at all external mesh surfaces. This can be accomplished with a simple internal baffle device that distributes the flow evenly across the entire surface of the screen. In order to accomplish this, the designer needs to understand the hydraulic characteristics of these devices. There is a tendency for most of the intake water to enter the screen near the hose end, so a typical internal baffle would consist of a pipe (or a manifolded set of pipes) which have variable porosity holes at predetermined spacing. We recommend starting near the hose end with approximately 5-10% average open area, and gradually increasing the porosity toward the length of the screen. At a point where screen length exceeds three times the diameter of the suction hose, the baffling effect tends to diminish rapidly. At this point the baffle porosity may approach 100%. A successful baffle system will functionally distribute flow to all areas of the screen. A poorly designed screen may result in high-velocity Ahot spots,@ which could lead to fish impingement on the screen face. Hydraulic testing of prototype screen designs is recommended where the application is on-going and extensive.

4. Screen Structure
The screen frame must be strong enough to withstand the hydraulic forces it will experience. However, structural frames, braces, and other elements that block the flow, change flow direction, or otherwise decrease the screen surface area should be minimized.

5. Screen Cleaning
The screen shall be cleaned as often as necessary to prevent approach velocity from exceeding 0.33 feet per second. Operators should withdraw the screen and clean it after each use, or as necessary to keep screen face free of debris. Pumping should stop for screen cleaning when approximately fifteen percent or more of the screen area is occluded by debris. A suitable brush shall be on board the truck for this cleaning operation.

If the operator notes (a) impingement of any juvenile fish on the screen face or (b) entrainment of any fish through the screen mesh, he/she should stop operations and notify the Department of Fish & Game and/or NMFS hydraulic engineering staff :

National Marine Fisheries Service
Engineering Section
777 Sonoma Avenue, Suite 325
Santa Rosa, CA. 95404
(707) 575-6050

_____

Rebecca Lent, Ph.D.
Regional Administrator

D-2 DFG - WATER DRAFTING: Preliminary Draft

DRAFT

STATE OF CALIFORNIA
Resources Agency
Department of Fish and Game

Guidelines for Temporary Water Drafting from Watersheds
Supporting Anadromous Salmonids;
Special Application for Timber Harvest Activities

by

Richard Macedo

Timberland Resources Program
Central Coast Region

November 16, 2001

Preliminary Draft - Subject to Revision

D-2 DFG - WATER DRAFTING: Preliminary Draft

The purpose of this paper is to provide concise and updated criteria for protecting anadromous salmonids from impacts associated with water drafting. Criteria in this report are directed at anyone responsible for operating, permitting or overseeing small, temporary water diversion projects associated with timber harvest activities in coastal timberlands supporting salmon, steelhead or other important aquatic resources. Information in this report may not be applicable to water diversion projects in other locations. Criteria in this paper may change as a result of improved biological knowledge and/or changes associated with state or federal regulation.

Laws and policies governing the Department of Fish and Game (Department) in this matter include Section 1600 et seq. and Section 6100 of the Fish and Game Code, Section 703 of the Fish and Game Code (specifically the policies identified as "Salmon", "Steelhead Rainbow Trout", "Endangered and Threatened Species", "Water", and the "Joint Policy Statement on Coho Salmon" between the California State Board of Forestry and the California Fish and Game Commission). Fish and Game Code Section 1600 et seq. requires that the Department enter into an agreement with a person proposing to, among other actions, substantially divert or obstruct the natural flow of a river, stream, or lake. This includes water drafting. Applications can be obtained from a Department office.

Streams and rivers are used as water sources for timber harvest operations in coastal California. Water is used by itself or in combination with additives to minimize dust and improve running conditions on unpaved roads. Watering roads for dust abatement is often an enforceable condition for approved timber harvest plans. In addition to roads, water may be used in conjunction with controlled burns, wildfire suppression and watering for revegetation projects.

The typical water drafting system for a timber harvest operation involves a truck outfitted with a three to four thousand gallon storage tank, a truck-mounted centrifugal pump and an extendable intake hose. Pools are often targeted for diversion sites because they have sufficient volume to permit high diversion rates. Operators often pump at or near maximum rates to limit down time, thereby maximizing the amount of road surface that can be watered in a given period. To prevent damage to the pump, operators avoid entraining rocks or air during pumping. Typically, an operator will back next to or pull alongside a pool, position a hose with the intake end near the bottom of a pool and commence pumping. Depending on the size and condition of the pump, an operator may fill a four thousand gallon water truck in 10 to 20 minutes. For most systems, the drafting rate can be adjusted.

The following three variables should be considered when designing a small, portable water drafting operation; 1) screen size, 2) approach velocity and 3) diversion rate. The following criteria for screen size, approach velocity and diversion rate are designed to protect fry-size salmonids from water diversion activities in California's timberlands. Use of these criteria may protect other species which occupy the same streams and lakes.

<u>Screen Mesh Size</u>:

Openings in perforated plate and woven wire screens shall not exceed 3/32 inches (2.38 millimeters). Slot opening in wedge wire screens shall not exceed 1.75 mm.

To prevent entrainment of fish during water diversion, the pump intake shall be fitted with screen made of woven mesh, perforated plate, wedge wire, or other durable fabric. The screen medium shall be able to withstand forces related to pumping and be of sufficient size to prevent small fish from entering the intake and being pumped along with diverted water.

Approach Velocity:

The velocity of water across the screen surface shall not exceed 0.33 feet/second at any point on the screen surface. To achieve this standard, the screen shall be kept clean and free of accumulated algae, leaves or other debris which could block portions of the screen surface and increase approach velocities at any point on the screen. The screen shall be supported above the bed of the streams so that no part of the screen surface is obstructed. Water truck operators shall move drafting hoses with attached screens in and out of the water after each drafting operation. The screen should be brushed clean and inspected each time it is placed into the water. This practice will usually prevent screens from accumulating significant amounts of debris and essentially replicate the function of a self-cleaning screen. Where a stationary pump is used, the screen should be checked frequently to ensure it is kept clean and free of debris. For screens where regular cleaning cannot be guaranteed, the approach velocity across the screen surface shall not exceed 0.0825 feet/second at any point on the screen.

Diversion Rate:

Water drafting may cause adverse impacts to juvenile salmonids if flow in source streams is reduced to insufficient levels. For these cases, a specific water drafting plan shall be developed. Concerns over impacts caused by reduced flows and the subsequent need for a water drafting plan may not be necessary if the proposed water diversion conforms to all of the following standards:

a. Flow in the source stream during water drafting will remain at 2.0 $feet^3$/second or greater, and

b. If diverting from a pool, reduction in pool volume will not exceed 10 percent, and

c. Diversion rate will not exceed 10 percent of the surface flow from the source stream, and

d. Instantaneous diversion rate is less than 350 gallons per minute (0.78 $feet^3$/second)

For water diversion projects that will not meet criteria a through d above, a water drafting plan shall be prepared and approved by the Department through an Agreement pursuant to Section 1600 et seq. of the Fish and Game Code. This plan shall include the following:

D-2 DFG - WATER DRAFTING: Preliminary Draft

1. Determine the instantaneous flow reduction and duration of reduction from the source stream.

2. Disclose potential impacts associated with both the instantaneous flow reduction and cumulative flow reduction and total volume removed from the source stream.

3. Identify proposed recommendations for minimizing adverse impacts such as a reduced hose diameter, decrease in pumping rates, use of alternative sites and/or restrict number of water withdraws from one location.

4. Require operators to maintain a water diversion log which records the date, time, pump rate, filling time, screen cleaning and inspection, and bypass flow from the source stream.

5. Conduct a pre-operations briefing with personnel who will be operating water drafting equipment and charged with compliance of the water diversion plan.

Additional Considerations:

While outside the scope of this report, standards for protecting anadromous salmonids may also be sufficient for protecting other species of fish, amphibians, reptiles and invertebrates. These considerations should be made on a case-by-case and species-by-species bases.

In certain situations and at specific sites, the requirement for screen and approach velocity criteria may be disregarded if an approved watering hole or sump is constructed adjacent to a stream or river. Large gravel bars adjacent to streams may be appropriate sites for constructing temporary water drafting holes. Unaltered sections of the gravel bar which lie between the watering hole and the flowing stream may provide the functional equivalent of a screen. In addition, approach velocities along the gravel bar must meet Department standards (e.g. < 0.33 feet/second for fry-size fish). Construction and use of these watering holes will be restricted to summer periods when storms and increasing stream flows are uncommon. Pursuant to Section 1600 et seq. of the Fish and Game Code, construction and use of watering holes will likely require a Lake and Streambed Alteration Agreement.

<u>Example for Calculating Surface Area for Intake Screens</u>:

The purpose of this example is to outline steps for calculating the appropriate screen surface area necessary to meet Department guidelines for approach velocities.

Scenario:

A water drafting operation will use a 4,000 gallon truck to divert water from a small stream which supports fry-size salmon and steelhead. At the maximum rate, the truck can be filled in 15 minutes. Calculate the surface area of screen necessary to comply with Department guidelines for approach velocities not to exceed 0.33 feet/second.

D-2 DFG - WATER DRAFTING: Preliminary Draft

Step 1:

Calculate diversion rate in gallons per minute (gpm) with the pump running at full capacity.

$$\frac{\text{4,000 gallons}}{\text{15 minutes}} = 266.7 \text{ gpm}$$

Step 2:

Convert diversion rate from gpm to feet^3/second (cfs). Note, to covert gpm to cfs, multiple the gpm figure by 0.00223.

266.7 gpm X 0.00223 = 0.59 cfs

Step 3:

Using the maximum acceptable approach velocity of 0.33 feet/second, calculate how much surface area of screen is needed for a diversion rate of 0.59 cfs.

$$\frac{0.59 \text{ feet}^3/\text{second}}{0.33 \text{ feet/second}} = 1.79 \text{ feet}^2 \text{ (square feet)}$$

Answer: For this example, a screen surface area of 1.79 square feet or larger will satisfy the Department's standard for approach velocity.