STATEWIDE STORM WATER QUALITY PRACTICE GUIDELINES

CTSW-RT-02-009

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LIST OF TABLES

LIST OF FIGURES

ES.1 OVERVIEW

The Statewide Storm Water Quality Practice Guidelines (Guidelines) describe each approved Best Management Practice (BMP) included in the Statewide Storm Water Management Plan (SWMP) for statewide application. This document provides California Department of Transportation (Department) staff with instructions on implementing each approved storm water management practice or BMP. The document is also intended to facilitate communication with regulators and other interested parties. The Guidelines instructions will be included in specifications, policy manuals, employee handbooks and/or training materials, and will focus on specific Department groups or divisions. In general, this document provides guidance, but is not a substitute for fundamental engineering knowledge, experience, and the application of sound engineering judgment. Because the discipline of storm water quality management is rapidly evolving, the Department anticipates frequent updates/revisions to this document, in consultation with the State Water Resources Control Board (SWRCB) staff. These Guidelines, which have been revised for consistency with the approved Statewide SWMP, consist of the following sections:

- Section 1 - Overview
- Section 2 - Maintenance BMPs (Category IA);
- Section 3 - Design Pollution Prevention BMPs (Category IB);
- Section 4 - Construction Site BMPs (Category II); and
- Section 5 - Treatment BMPs (Category III).

ES.2 MAINTENANCE BMPS (CATEGORY IA)

Section 2, Maintenance BMPs, are pollution prevention BMPs designed to reduce the discharge of pollutants associated with maintenance activities. Maintenance BMPs apply to ongoing maintenance of existing roadways and other facilities owned or operated by the Department.

A comprehensive assessment of maintenance activities was performed to ensure that potential sources of pollutants were identified. Maintenance activities and subtasks were itemized, and potential pollutant sources (e.g., spills or erosion) associated with each subtask were listed. Next, the potential pollutants were identified (e.g., asphalt might be spilled or sediment could be eroded). Finally, BMPs were identified that correspond to the sources and types of pollutants.

The process for selecting maintenance BMPs is described in Section B.2 of the SWMP. A brief description of each maintenance activity with key subtasks is provided. After describing the activity, the potential sources of pollutants and pollutants are identified.

Section 2 of these Guidelines includes a series of tables that identify the subtasks, potential sources of pollutants, likely pollutants and BMPs appropriate for each Caltrans maintenance

activity. Personnel performing maintenance activities can determine which BMPs should be applied for each activity by consulting these tables.

For some activities, maintenance personnel may select from a variety of BMPs for storm water pollution prevention. For example, during cleanup or repair of minor slides and slipouts, several sediment controls are available that may adequately contain sediment. Personnel will need to select one or a combination of the available control methods to address the sediment they encounter at the site. Also, individual BMPs identified on the tables will not necessarily be applicable to all projects involving the activity. For example, not all projects will have on-site fueling operations, but those that do should be required to perform those operations in a manner consistent with the intent of the BMP descriptions that follow the tables.

ES.3 DESIGN BMPs (CATEGORY IB)

Section 3, Design BMPs, describes the BMPs that are used during the planning and design phases of projects, which are then incorporated into the design of new facilities and reconstruction or expansion of existing facilities. Some BMPs have both permanent and temporary applications, and may also have application to several different temporary categories. The pollution prevention BMPs that are to be incorporated, as appropriate, into the design of new facilities and reconstruction or expansion of existing facilities, are as follows:

- Consideration of Downstream Effects of Potentially Increased Flows;
- Preservation of Existing Vegetation;
- Concentrated Flow Conveyance Systems; and
- Slope/Surface Protection Systems.

ES.4 CONSTRUCTION SITE BMPs (CATEGORY II)

Section 4, Construction Site BMPs, describes those BMPs reviewed for potential use during the construction phase of Department projects. Construction Site BMPs are best conventional technology/best available technology (BCT\BAT)-based temporary control practices required by the section of the State of California NPDES General Permit defining construction activity storm water management. Construction Site BMPs include the following categories:

- Soil Stabilization Practices;
- Sediment Control Practices;
- Wind Erosion Control;
- Tracking Control Practices;
- Non-Storm Water Control; and
- Waste Management and Materials Pollution Control.

This section also discusses procedures for BMP inspections, temporary soil stabilization and sediment control implementation guidance, and guidance for implementation of BMPs.

ES.5 TREATMENT BMPs (CATEGORY III)

Section 5, Treatment BMPs, defines and describes Treatment BMPs, identifies BMP selection procedures, and provides information for determining the volume of water that must be treated by BMPs. Existing or proposed storm drain systems discharging directly or indirectly to a surface water body require Treatment BMPs. In the experience of the Department, Treatment BMPs are considered constructable, maintainable, and effective at removing pollutants. However, site specific circumstances exist where these BMPs may not produce water that fully achieves specific effluent quality requirements. Furthermore, the construction of certain Treatment BMPs may not be feasible under all site conditions. Feasibility considerations include technical and cost issues, among others. The following Treatment BMP categories have been approved by the Department:

- Biofiltration: Swales and Strips;
- Infiltration Basins;
- Detention Devices;
- Traction Sand Traps; and
- Dry Weather Flow Diversions.

1.1 OVERVIEW

These Statewide Storm Water Quality Practice Guidelines (Guidelines) provide a description of each approved Best Management Practice (BMP) included in the Statewide Storm Water Management Plan (SWMP) for statewide application.

This section is intended to provide Caltrans staff with details of the implementation expectations associated with each approved storm water management practice or BMP. These implementation details will be subsequently incorporated into various specifications, policy manuals, employee handbooks and/or training materials. In almost all cases, the BMPs will be subdivided and regrouped to focus on specific target audiences.

This compilation of details within one document is seen as appropriate for facilitating productive dialog with regulators and other interested parties.

Caltrans anticipates frequent updates/revisions to this appendix. These updates will be accomplished in consultation with the State Water Resources Control Board (SWRCB) staff.

The Guidelines are organized as follows:

- Section 2 describes the Maintenance BMPs (Category IA);
- Section 3 describes the Design Pollution Prevention BMPs (Category IB);
- Section 4 describes the Construction Site BMPs (Category II); and
- Section 5 describes Treatment BMPs (Category III)

These Guidelines have been revised for consistency with the approved Statewide SWMP.

2.1 MAINTENANCE BMPs (CATEGORY IA)

Caltrans performs a variety of maintenance activities on highways throughout California to maintain a safe and usable condition for the motoring public. In contrast to construction projects, maintenance activities are performed by a small crew in a short duration (most require no more than one day), and minimal soil is disturbed (generally less than 0.4 ha [1 acre]). This section of the Guidelines describes the storm water pollution prevention BMPs that are used at maintenance activity sites and at maintenance facilities. Maintenance activity sites are located along the state's highways and right-of-ways. The practices described in this section may be used for purposes other than storm water pollution prevention, but those uses are not described in these Guidelines.

This section describes those BMPs considered during maintenance activities. These BMPs shall be considered for implementation on an activity-by-activity basis. Caltrans Maintenance Managers provide supervision to the Maintenance Superintendents, who ensure the maintenance BMPs are implemented within their jurisdictions. Maintenance Supervisors have on-site responsibility for BMP implementation and maintenance.

Section 1.3.4 of the Statewide SWMP defines emergency conditions under which the protection of public health, safety and property takes precedence over the BMPs in these Guidelines. Maintenance personnel are frequently tasked with responding to emergency situations where some elements of the Guidelines cannot be applied for the duration of the emergency. The RWQCBs are the primary agencies responsible for inspection and enforcement of the storm water program. Maintenance Managers and Storm Water Coordinators are encouraged to work directly with the appropriate RWQCB to foster a more effective program.

The terms "may", "should" and "shall" are used throughout these Guidelines. These terms are used consistently with other Caltrans maintenance guidance documents. They are defined as follows:

- May: Maintenance staff have the flexibility to use or not use the guidance provided based on their best professional judgment.
- Should: Maintenance staff will follow the guidance provided unless there is a strong justification for doing otherwise. Maintenance staff need to document the justification for not implementing a BMP.
- Shall: Maintenance staff must follow the provided guidance.

2.2 MAINTENANCE ACTIVITY TABLES

This section introduces a series of tables that have been prepared for each maintenance activity provided in this section. The purpose of these tables is to identify the subtasks, potential sources of pollutants, likely pollutants and BMPs appropriate for each Caltrans maintenance activity. Personnel performing maintenance activities can determine which BMPs should be applied for each activity by consulting these tables.

For some activities, maintenance personnel may select from a variety of BMPs for storm water pollution prevention. For example, during cleanup or repair of minor slides and slipouts, several sediment controls are available that may adequately contain sediment. Personnel will need to select one or a combination of the available control methods to address the sediment they encounter at the site. Also, individual BMPs identified on the tables will not necessarily be applicable to all projects involving the activity. For example, not all projects will have on-site fueling operations, but those that do should be required to perform those operations in a manner consistent with the intent of the BMP descriptions that follow the tables.

TABLE 2-1: FAMILY – A1
ASPHALT CEMENT[1]
CRACK AND JOINT GRINDING/SEALING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks Excess Emulsion	Asphalt Release Agents Fuel Hydraulic Fluid Emulsion	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Crack and Joint Cleaning (compressor)	Blowing Sediment	Sediment	Sweeping and Vacuuming (2.29)
Material Application (asphaltic emulsion or rubberized sealant)	Leaks Spills	Emulsion Rubberized Sealant	Liquid Waste Management (2.13.6) Material Use (2.14.2) Paving Operations Procedures (2.16) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)
Sand Application	Excess Sand	Sand	Stockpile Management (2.17) Sweeping and Vacuuming (2.29)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-2: FAMILY – A2
ASPHALT PAVING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Cleaning Asphalt Release Agent	Fuel Oil Asphalt Release Agents	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Pre- and Post-Sweeping	Excess Water Dust Generated During Sweeping Handling Removed Material	Non-Storm Water Sediment	Solid Waste Management (2.13.2) Stockpile Management (2.17) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Asphalt Material Use Application	Spill	Asphalt	Material Use (2.14.2) Water Conservation Practices (2.18)
Binder Application (Jack Coat)	Emulsion Kettle Leaks Spills Loading Excess Material Excess Water from Cleaning	Asphalt Cleaning Agents Non-Storm Water	Material Use (2.14.2) Paving Operations Procedures (2.16) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Pavement Application	Excess Cured Material Spills Excess Asphalt Release Agent	Asphalt Asphalt Release Agent Sediment	Material Use (2.14.2) Paving Operations Procedures (2.16) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)
Compaction Roller Operation	Excess Water	Non-Storm Water	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Evaporative Cooling	Excess Water	Sediment Non-Storm Water	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-3: FAMILY – A3 STRUCTURAL PAVEMENT FAILURE (DIGOUTS)[1]
PAVEMENT GRINDING AND PAVING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Equipment Cleaning Leaks	Fuel Asphalt Release Agent Hydraulic Fluid Oil	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Asphalt Removal	Excess Water Dust and Grindings Generated	Non-Storm Water Sediment	Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Storage, Hauling and Disposal	Spills of Grindings Removed Materials	Aggregate Material Asphalt Grindings	Solid Waste Management (2.13.2) Stockpile Management (2.17)
Pre- and Post-sweeping	Excess Water Dust Generated from Sweeping Handling Removed Material	Non-Storm Water	Solid Waste Management (2.13.2) Stockpile Management (2.17) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Binder Application (Tack Coat)	Emulsion Kettle Leaks/Spills Excess Material Loading Excess Water from Cleaning	Asphalt Binder Cleaning Agents Non-Storm Water Concrete	Concrete Waste Management (2.13.7) Material Use (2.14.2) Paving Operations Procedures (2.16) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Asphalt Material Use Application	Asphalt Material Spills	Asphalt Non-Storm Water Binders	Material Use (2.14.2) Water Conservation Practices (2.18)
Pavement Application	Excess Cured Material Spills Excess Asphalt Release Agent	Asphalt Sediment Asphalt Release Agent	Material Use (2.14.2) Paving Operations Procedures (2.16) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)
Compaction Roller Operation	Excess Water	Sediment Non-Storm Water	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)

TABLE 2-3: FAMILY – A3 STRUCTURAL PAVEMENT FAILURE (DIGOUTS)[1]
PAVEMENT GRINDING AND PAVING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
Evaporative Cooling	Excess Water	Sediment Non-Storm Water	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-4: FAMILY – A4
EMERGENCY POTHOLE REPAIRS[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Safer Alternative Products (2.21)
Material Application	Excess Material	Pothole Material	Material Use (2.14.2)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)

1 EMERGENCY POTHOLE REPAIRS ARE NOT RESTRICTED BY RAIN EVENTS OR STORM PREDICTIONS.

TABLE 2-5: FAMILY – A5
SEALING OPERATIONS[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Equipment Cleaning Leaks Spills	Fuel Oil Asphalt Release Agent Hydraulic Fluid	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Pre- and Post-sweeping	Dust Generated from Sweeping Excess Water	Sediment Non-Storm Water	Material Use (2.14.2) Solid Waste Management (2.13.2) Stockpile Management (2.17) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Material Application	Leaks Spills Excess Application	Asphalt Emulsion	Material Use (2.14.2) Paving Operations Procedures (2.16) Safer Alternative Products (2.21) Storm Drain Inlet Protection (2.5)
Sand or Aggregate Application	Excess Application	Aggregate Sand Asphalt	Stockpile Management (2.17) Sweeping and Vacuuming (2.29)
Compaction Roller Application	Material Tracking	Sediment	Sweeping and Vacuuming (2.29)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-6: FAMILY – B1
PORTLAND CEMENT CRACK AND JOINT SEALING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Equipment Cleaning Leaks	Release Agents Fuel Hydraulic Fluid Oil	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Crack and Joint Cleaning (compressor)	Blowing Sediment	Sediment	Sweeping and Vacuuming (2.29)
Material Use (emulsion) and Sealant Application (asphaltic or rubberized)	Leaks Spills Excess Sealant	Asphaltic Emulsion Rubberized Sealant	Liquid Waste Management (2.13.6) Material Use (2.14.2) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)
Sand Application	Excess Sand	Sand	Sweeping and Vacuuming (2.29)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-7: FAMILY – B2
MUDJACKING AND DRILLING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Drilling	Drilling Slurry Leaks Excess Water	Sediment Hydraulic Fluid Non-Storm Water Concrete	Concrete Waste Management (2.13.7) Liquid Waste Management (2.13.6) Solid Waste Management (2.13.2) Water Conservation Practices (2.18)
Material Use, Mixing and Pumping	Spills Leaks Excess Material Excess Water Concrete Washout	Slurry Hydraulic Fluid Non-Storm Water Concrete	Concrete Waste Management (2.13.7) Material Use (2.14.2) Spill Prevention and Control (2.13.1) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-8: FAMILY – B3
CONCRETE SLAB AND SPALL REPAIR[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning Concrete Washout	Concrete Sediment Fuel Oil	Concrete Waste Management (2.13.7) Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Slab Repair and Cleaning (compressor, jackhammer, saw)	Removed Material Sawcut Slurry Excess Water	Sediment Concrete Non-Storm Water	Concrete Waste Management (2.13.7) Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Hauling and Disposal	Removed Material	Sediment Concrete	Concrete Waste Management (2.13.7) Solid Waste Management (2.13.2) Stockpile Management (2.17)
Material Use (concrete), Mixing and Repair	Spills Leaks Excess Water	Concrete Slurry Non-Storm Water	Material Use (2.14.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Curing	Excess Water Application	Non-Storm Water	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)

1 CONCRETE SLAB REPAIR SHALL NOT BE PREFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS. CONCRETE SPALL REPAIR IS AN EMERGENCY EVENT THAT IS NOT RESTRICTED BY RAIN EVENTS OR STORM PREDICTIONS.

TABLE 2–9: FAMILY – C1
SHOULDER GRADING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning(2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Compaction	Excess Water	Non-Storm Water Sediment	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.14)
Material Import and Fill	Spills Leaks Excess Material Excess Water Asphalt Grindings	Sediment Aggregate Non-Storm Water Asphalt Grindings	Compaction (2.7.1) Material Use (2.14.2) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Stockpile Management (2.17) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Sweeping	Excess Water Residual Material	Non-Storm Water Sediment	Stockpile Management (2.17) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-10: FAMILY – C2a
NONLANDSCAPED CHEMICAL VEGETATION CONTROL[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Mix and Load Equipment Operation	Spills Leaks Excess Water	Pesticide Non-Storm Water	Chemical Vegetation Control (2.25) Material Use (2.14.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.14)
Chemical Application	Improper Application Spills Leaks	Pesticide	Chemical Vegetation Control (2.25) Preservation of Existing Vegetation (2.8) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-11: FAMILY – C2b
NONLANDSCAPED MECHANICAL VEGETATION CONTROL/MOWING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Mowing	Mowed Vegetation	Clippings	Preservation Of Existing Vegetation (2.8) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1)

TABLE 2-12: FAMILY – C3
NONLANDSCAPED TREE AND SHRUB PRUNING
BRUSH CHIPPING
TREE AND SHRUB REMOVAL

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Leaks Spills	Sewage	Sanitary/Septic Waste Management (2.13.5)
Chipping, Pruning and Removal	Clippings	Clippings Sawdust Wood Mulch Wood	Preservation of Existing Vegetation (2.8) Spill Prevention and Control (2.13.1) Stockpile Management (2.17) Storm Drain Inlet Protection (2.5)
Hauling and Disposal	Leaks Clippings	Clippings Wood Mulch Wood	Solid Waste Management (2.13.2)

TABLE 2-13: FAMILY – C5
DRAINAGE DITCH AND CHANNEL MAINTENANCE

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Baseline Storm Water Drainage Facilities Inspection and Cleaning (2.22.1) Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Cleaning Operation (backhoe, excavator and loader)	Disturbed Soil Leaks Litter	Sediment Hydraulic Fluid Litter and Debris	Check Dam (2.4.5) Clear-Water Diversion (2.9) Fiber Rolls (2.4.4) Hydroseeding/Handseeding (2.7.4) Liquid Waste Management (2.13.6) Preservation of Existing Vegetation (2.8) Riprap (2.7.8) Sandbag or Gravel Bag Barrier (2.4.2) Sediment Trap (2.4.6) Storm Drain Inlet Protection (2.5) Straw Bale Barrier (2.4.3)
Headwall or Apron Repair or Replacement	Removed Material Mixing	Concrete	Concrete Waste Management (2.13.7)
Stockpiling and Disposal	Removed Material	Sediment	Contaminated Soil Management (2.13.4) Solid Waste Management (2.13.2) Stabilized Activity Entrance/Exit (2.12.1) Tire Inspection and Sediment Removal (2.12.2)
Import Fill	Spill	Sediment	Compaction (2.7.1) Geotextiles, Mats/Plastic Covers and Erosion Control Blankets (2.7.7) Hydroseeding/Handseeding (2.7.4) Material Use (2.14.2) Stockpile Management (2.17)

TABLE 2-14: FAMILY – C6
DRAIN AND CULVERT MAINTENANCE

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Cleaning Operation (backhoe and Vactor™)	Disturbed Soil Leaks Excess Water Litter	Sediment Hydraulic Fluid Non-Storm Water Litter and Debris	Baseline Storm Water Drainage Facilities Inspection and Cleaning (2.22.1) Compaction (2.7.1) Enhanced Storm Drain Inlet Inspection and Cleaning Program[1] (2.22.2) Fiber Rolls (2.4.4) Hydroseeding/Handseeding (2.7.4) Liquid Waste Management (2.13.6) Preservation of Existing Vegetation (2.8) Sandbag or Gravel Bag Barrier (2.4.2) Sediment Trap (2.4.6) Straw Bale Barrier (2.4.3) Water Conservation Practices (2.18)
Headwall or Apron Repair or Replacement	Removed Material Mixing	Concrete	Concrete Waste Management (2.13.7) Solid Waste Management (2.13.2)
Stockpile and Disposal	Sediment In Runoff	Sediment	Contaminated Soil Management (2.13.4) Solid Waste Management (2.13.2) Stabilized Activity Entrance/Exit (2.12.1) Stockpile Management (2.17) Tire Inspection and Sediment Removal (2.12.2)

1 SEE BMP DESCRIPTION TO DETERMINE WHETHER THE ACTIVITY IS IN AN AREA WHERE THIS BMP APPLIES.

TABLE 2-15 FAMILY – C9
CURB AND SIDEWALK REPAIR[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Concrete Waste Management (2.13.7) Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Slab Repair and Cleaning (compressor, jackhammer, saw)	Removed Material Sawcut Slurry Concrete Washout Excess Water	Sediment Concrete Non-Storm Water	Concrete Waste Management (2.13.7) Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Hauling and Disposal	Removed Material	Concrete Sediment	Concrete Waste Management (2.13.7) Solid Waste Management (2.13.2) Stockpile Management (2.17) Storm Drain Inlet Protection (2.5)
Material Use (concrete), Mixing and Repair	Spills Leaks Excess Water Concrete Washout	Slurry Non-Storm Water Concrete	Material Use (2.14.2) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Curing	Excess Water Application	Non-Storm Water	Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-16: FAMILY – D3
SWEEPING OPERATIONS

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Sweeping	Excess Water Materials Collected	Non-Storm Water Sediment	Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Stockpiling and Disposal	Residual Material Leaks	Sediment Fluids	Liquid Waste Management (2.13.6) Solid Waste Management (2.13.2) Stockpile Management (2.17)

TABLE 2-17: FAMILY – D4
LITTER AND DEBRIS REMOVAL

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Anti-Litter Signs (2.24.2) Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Portable Toilet	Leaks Spills	Sewage	Sanitary/Septic Waste Management (2.13.5)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Manual Collection, Sweeping and Vacuuming	Spills Leaks Litter Excess Water	Litter and Debris Non-Storm Water	Litter and Debris (2.24.1) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Consolidation and Disposal	Spills	Litter and Debris	Solid Waste Management (2.13.2)

TABLE 2-18: FAMILY – D5
EMERGENCY RESPONSE AND CLEANUP PRACTICES

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Portable Toilet	Leaks Spills	Sewage	Sanitary/Septic Waste Management (2.10.5)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Cleanup	Spills	TBD[1] Materials Sediment Debris Fuel Hydraulic Fluid Oil	Contaminated Soil Management (2.13.4) Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Material Use (2.14.2) Preservation of Existing Vegetation (2.8) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Stabilized Activity Entrance/Exit (2.12.1) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Tire Inspection and Sediment Removal (2.12.2) Water Conservation Practices (2.18)
Hauling and Disposal	Tracking Spills Leaks	Sediment Debris Materials	Contaminated Soil Management (2.13.4) Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Solid Waste Management (2.13.2) Stabilized Activity Entrance/Exit (2.12.1) Tire Inspection and Sediment Removal (2.12.2)

1 UNKNOWN MATERIAL RELEASE (MATERIAL TO BE DETERMINED).

TABLE 2-19: FAMILY – D6
GRAFFITI REMOVAL

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Painting	Spills Leaks	Paint	Liquid Waste Management (2.13.6) Material Use (2.14.2) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)
Paint Removal (hydroblasting, sandblasting, soda blasting and washing)	Blast Material Excess Water	Non-Storm Water Sediment Grit	Material Use (2.14.2) Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)

TABLE 2-20: FAMILY – E1a
CHEMICAL VEGETATION CONTROL[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Mix and Load Equipment Operation	Spills Leaks Excess Water	Pesticide Non-Storm Water	Chemical Vegetation Control (2.25) Material Use (2.14.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Chemical Application	Improper Application Spills Leaks	Pesticide	Chemical Vegetation Control (2.25) Preservation of Existing Vegetation (2.8) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-21: FAMILY – E1b
MANUAL VEGETATION CONTROL

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Portable Toilet	Leaks Spills	Sewage	Sanitary/Septic Waste Management (2.13.5)
Vegetation Removal Hand-Held Equipment Operation (may be small gas-power equipment))	Fuel Spills Fuel Leaks Removed Vegetation	Fuel Vegetation Debris	Preservation of Existing Vegetation (2.8) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)

TABLE 2-22: FAMILY – E1c
LANDSCAPED MECHANICAL VEGETATION CONTROL/MOWING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Mowing	Mowed Vegetation	Clippings	Preservation of Existing Vegetation (2.8) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1)

TABLE 2-23:
LANDSCAPED TREE AND SHRUB PRUNING (E2b)
BRUSH CHIPPING (E2c)
TREE AND SHRUB REMOVAL (E2d)

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spills Cleaning	Sediment Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Leaks Spills	Sewage	Sanitary/Septic Waste Management (2.13.5)
Chipping, Pruning and Removal	Clippings	Clippings Sawdust Wood Mulch Wood	Preservation of Existing Vegetation (2.8) Spill Prevention and Control (2.13.1) Stockpile Management (2.17) Storm Drain Inlet Protection (2.5)
Hauling and Disposal	Leaks Clippings	Clippings Wood Mulch Wood	Solid Waste Management (2.13.2)

TABLE 2-24: FAMILY – E3a
IRRIGATION LINE REPAIRS

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Water Line Repair	Piping Repair Welding Excavated Soil Backfill Excess Water	PVC Glue Primer Non-Storm Water[1] Debris Sand Sediment	Compaction (2.7.1) Fiber Rolls (2.4.4) Hydroseeding/Handseeding (2.7.4) Material Use (2.14.2) Potable Water/Irrigation (2.19) Preservation of Existing Vegetation (2.8) Sandbag or Gravel Bag Barrier (2.4.2) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Straw Bale Barrier (2.4.3) Water Conservation Practices (2.18) Wood Mulch (2.7.2)

1 CONDITIONALLY EXEMPT.

TABLE 2-25: FAMILY – E3b
IRRIGATION (WATERING), POTABLE AND NONPOTABLE

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Irrigation	Excess Water	Non-Storm Water[1]	Potable Water/Irrigation (2.19) Water Conservation Practices (2.18)

1 CONDITIONALLY EXEMPT.

TABLE 2-26: FAMILY – F2
STORM DRAIN STENCILING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)

TABLE 2-27: FAMILY – F4
ROADSIDE SLOPE INSPECTION

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illicit Connection Detection, Reporting and Removal (2.22.3) Illegal Spill Discharge Control (2.22.4) Vegetated Slope Inspection (2.26)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)

TABLE 2-28: FAMILY – F4b
ROADSIDE STABILIZATION

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3) Vegetated Slope Inspection (2.26)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Slope Repair	Overspray to Hardscaped Surfaces	Binders Fertilizer Fiber Seed	Check Dam (2.4.5) Compaction (2.7.1) Fiber Rolls (2.4.4) Geotextiles, Mats/Plastic Covers and Erosion Control Blankets (2.7.7) Hydraulic Mulch (2.7.3) Hydroseeding/Handseeding (2.7.4) Material Use (2.14.2) Preservation of Existing Vegetation (2.8) Safer Alternative Products (2.21) Sandbag or Gravel Bag Barrier (2.4.2) Sediment Trap (2.4.6) Silt Fence (2.4.1) Soil Binders (2.7.5) Spill Prevention and Control (2.13.1) Stabilized Activity Entrance/Exit (2.12.1) Stockpile Management (2.17) Storm Drain Inlet Protection (2.5) Straw Bale Barrier (2.4.3) Straw Mulch (2.7.6) Sweeping and Vacuuming (2.29) Tire Inspection and Sediment Removal (2.12.2) Water Conservation Practices (2.18) Wind Erosion Controls (2.11) Wood Mulch (2.7.2)

TABLE 2-29: FAMILY – F7a
STORM WATER TREATMENT DEVICES

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Treatment System Maintenance	System Cleaning	Contaminated or Uncontaminated Sediment Litter	Vegetated Treatment Systems (2.23.1) Contaminated Soil Management (2.13.4) Detention Devices (2.23.3) Infiltration Basins (2.23.2) Litter and Debris (2.24.1) Solid Waste Management (2.13.2) Stabilized Activity Entrance/Exit (2.12.1) Tire Inspection and Sediment Removal (2.12.2) Traction Sand Trap Devices (2.23.4)

TABLE 2-30: FAMILY – F7b
TRACTION SAND TRAP DEVICES

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)

TABLE 2-31: FAMILY – G1-3
PUBLIC FACILITIES

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Maintenance Facility Housekeeping Practices (2.30) Material Delivery and Storage (2.14.1) Scheduling and Planning (2.3) Spill Prevention and Control (2.13.1)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Trash Removal	Litter Trash Pickup	Litter Trash	Litter and Debris (2.24.1) Solid Waste Management (2.13.2)
Restrooms/RV Dump Station Use/ Maintenance	Use of Facilities Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5) Storm Drain Inlet Protection (2.5)
Landscaping and Grounds Maintenance	Excess Irrigation Chemical Vegetation Control Erosion	Non-Storm Water Pesticides Sediment	Concrete Waste Management (2.13.7) Material Use (2.14.2) Potable Water/Irrigation (2.19) Preservation of Existing Vegetation (2.8) Safer Alternative Products (2.21) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Graffiti/Vandalism Repair	Illegal Dumping Spills Leaks Graffiti Removal	Sand Blast Grit Paint	Anti-Litter Signs (2.24.2) Illegal Spill Discharge Control (2.22.4) Liquid Waste Management (2.13.6) Material Use (2.14.2) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5) Storm Drain Stenciling (2.20)

TABLE 2-32: FAMILY – H2
WELDING AND GRINDING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Grinding	Grinding	Removed Paint Sediment Grit	Hazardous Waste Management (2.13.3) Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5)
Welding	Welding Rods	Solder	Material Use (2.14.2) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Storm Drain Inlet Protection (2.5)

TABLE 2-33: FAMILY – H7a
SANDBLASTING, WET BLAST WITH SAND INJECTION AND HYDROBLASTING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Sandblasting	Material Removal	Paint Sediment Grit	Fiber Rolls (2.4.4) Hazardous Waste Management (2.13.3) Material Use (2.14.2) Safer Alternative Products (2.21) Sandbag or Gravel Bag Barrier (2.4.2) Sediment Trap (2.4.6) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Straw Bale Barrier (2.4.3) Sweeping and Vacuuming (2.29)
Hydroblasting	Material Removal Excess Water	Grit Non-Storm Water	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)

TABLE 2-34: FAMILY – H7b
PAINTING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Painting	Spills Leaks Overspray	Paint	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Material Use (2.14.2) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-35: FAMILY – H9a
BRIDGE REPAIRS

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Scheduling and Planning (2.3) Spill Prevention and Control (2.13.1)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Pavement Repair	See Structural Pavement Failure (Digouts) (Table 2-3) See Concrete Slab and Spall Repair (Table 2-8)		
Welding and Grinding	See Welding and Grinding (Table 2-32)		

TABLE 2-36: FAMILY – H9b
DRAW BRIDGE MAINTENANCE

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Portable Toilet	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
Rotating Span and Lifting Span Maintenance	Spills Leaks	Lubricants Hydraulic Fluid	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Material Use (2.14.2) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1)

TABLE 2-37: FAMILY – J1
PUMP STATION CLEANING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Maintenance Facility Housekeeping Practices (2.30) Scheduling and Planning (2.3)
Equipment Operation Vactor™ Trash Pump	Leaks Cleaning	Sediment Litter and Debris Hydraulic Fluid	Stabilized Activity Entrance/Exit (2.12.1) Sweeping and Vacuuming (2.29) Tire Inspections and Sediment Removal (2.12.2) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3) Water Conservation Practices (2.18)
Consolidation and Disposal	Stockpile Removed Material	Sediment Litter and Debris	Contaminated Soil Management (2.13.4) Liquid Waste Management (2.13.6) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Stockpile Management (2.17)

TABLE 2-36: FAMILY – J2
TUBE AND TUNNEL MAINTENANCE AND REPAIR

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3) Spill Prevention and Control (2.13.1) Water Conservation Practice (2.18)
Equipment Operations	Spills Leaks	Hydraulic Fluid Fuel Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Tunnel Washing	Excess Water	Non-Storm Water Cleaning Agent	Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Water Conservation Practices (2.18)
Tunnel Pavement Repair	See Structural Pavement Failure (Digouts) (Table 2-3) See Concrete Slab and Spall Repair (Table 2-8)		
Tunnel Wall Repair	Cement and Grout Spills Excess Water	Cement Grout Non-Storm Water	Concrete Waste Management (2.13.7) Liquid Waste Management (2.13.6) Material Use (2.14.2) Solid Waste Management (2.13.2) Water Conservation Practices (2.18)

TABLE 2-39: FAMILY – K6
SAWCUTTING FOR LOOP INSTALLATION

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3) Water Conservation Practices (2.18)
Equipment Operation	Leaks Spills Cleaning	Concrete Fuel Hydraulic Fluid Oil	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Sawcutting Operation	Sawcutting Slurry Waste	Concrete Slurry	Liquid Waste Management (2.13.6) Storm Drain Inlet Protection (2.5)
Sweeping, Hauling and Disposal	Removed Material Excess Water	Slurry Non-Storm Water	Concrete Waste Management (2.13.7) Solid Waste Management (2.13.2) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)
Pavement Repair (epoxy sealant)	Excess Sealant	Sealant	Material Use (2.14.2)

TABLE 2-40: FAMILY – M1a and M2a
THERMOPLASTIC STRIPING AND MARKING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3) Spill Prevention and Control (2.13.1)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Sandblasting or Grinding Operation	Removed Material Excess Sand	Plastic Sand Grit	Material Use (2.14.2) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29)
Hauling and Disposal	Removed Material	Plastic Sand Grit	Hazardous Waste Management (2.13.3) Solid Waste Management (2.13.2)
Striping Application	Spills Leaks	Plastic	Material Use (2.14.2) Safer Alternative Protection (2.21) Solid Waste Management (2.13.2) Spill Prevention Control (2.13.1)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-41: FAMILY – M1b and M2b
PAINT STRIPING AND MARKING[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Painting	Spills Leaks Overspray	Paint	Liquid Waste Management (2.13.6) Material Use (2.14.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)
Pre-sweeping	Dust Generated During Sweeping Handling Removed Material Excess Water	Sediment Non-Storm Water	Solid Waste Management (2.13.2) Stockpile Management (2.17) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-42: FAMILY – M3
RAISED/RECESSED PAVEMENT MARKER APPLICATION AND REMOVAL[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spill Leaks	Oil Fuel Hydraulic Fluid	Spill Prevention and Control (2.13.1) Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Raised Marker Truck Application	Excess Application	Epoxy	Material Use (2.14.2) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1)

1 ACTIVITY SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-43: FAMILY – M4
SIGN REPAIR AND MAINTENANCE

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Leaks Spill Cleaning	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Posthole Drilling	Excess Material	Debris Sediment	Compaction (2.7.1) Material Use (2.14.2)
Hauling and Disposal	Waste Material	Debris Sediment	Solid Waste Management (2.13.2)

TABLE 2-44: FAMILY – M7
MEDIAN BARRIER AND GUARD RAIL REPAIR

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Guard Rail Truck	Leaks	Hydraulic Fluid Fuel Oil	Compaction (2.7.1) Stabilized Activity Entrance/Exit (2.12.1) Sweeping and Vacuuming (2.29) Tire Inspection and Sediment Removal (2.12.2)
Concrete Mixing	Concrete Washout Excess Water	Concrete Non-Storm Water	Concrete Waste Management (2.13.7) Water Conservation Practices (2.18)
Material Hauling and Disposal	Removed Material	Debris	Solid Waste Management (2.13.2) Stabilized Activity Entrance/Exit (2.12.1) Sweeping and Vacuuming (2.29) Tire Inspection and Sediment Removal (2.12.2)

TABLE 2-45: FAMILY – M8
EMERGENCY VEHICLE ENERGY ATTENUATOR REPAIR

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Attenuator Repair Hauling and Disposal	Damaged Attenuator Sand Released Water Released	Debris Sand Non-Storm Water	Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5) Sweeping and Vacuuming (2.29) Water Conservation Practices (2.18)

TABLE 2-46: FAMILY – R1
SNOW REMOVAL[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Snow Removal Operation	Snow Removed	Sediment De-Icing Agents	Safer Alternative Products (2.21) Snow Removal and De-Icing Agents (2.27)

1 CONSIDERED AN EMERGENCY OPERATION DUE TO INSUFFICIENT FORECAST OF EXTENT, DURATION, SEVERITY AND LOCATION OF HAZARD PRESENTED TO THE PUBLIC.

TABLE 2-47: FAMILY – R2
ICE CONTROL[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Abrasive Application	Abrasives	Sand Cinder	Material Use (2.14.2) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Sweeping and Vacuuming (2.29)
Ice Control	Excess Application	De-Icing Agents	Safer Alternative Products (2.21) Snow Removal and De-Icing Agent (2.27) Spill Prevention and Control (2.13.1)

1 CONSIDERED AN EMERGENCY OPERATION DUE TO INSUFFICIENT FORECAST OF EXTENT, DURATION, SEVERITY AND LOCATION OF HAZARD PRESENTED TO THE PUBLIC.

TABLE 2-48: FAMILY – S3
MINOR SLIDES AND SLIPOUTS CLEANUP/REPAIR

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Abrasive Application	Abrasives	Sand Cinder	Material Use (2.14.2) Safer Alternative Products (2.21) Spill Prevention and Control (2.13.1) Sweeping and Vacuuming (2.29)
Ice Control	Excess Application	De-Icing Agents	Safer Alternative Products (2.21) Snow Removal and De-Icing Agent (2.27) Spill Prevention and Control (2.13.1)
General			Illegal Spill Discharge Control (2.22.4) Illicit Connection Detection, Reporting and Removal (2.22.3) Scheduling and Planning (2.3)

TABLE 2-49: FAMILY – T5b
BUILDING AND GROUNDS MAINTENANCE

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Maintenance Facility Housekeeping Practices (2.30) Material Delivery and Storage (2.14.1) Material Use (2.14.2) Safer Alternatives Products (2.21) Scheduling and Planning (2.3) Spill Prevention and Control (2.13.1)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Litter/Trash Pickup	Litter Trash Pickup	Litter Trash	Litter and Debris (2.24.1) Solid Waste Management (2.13.2)
Restrooms/RV Dump Station Use/ Maintenance	Spills Leaks	Sewage	Sanitary/Septic Waste Management (2.13.5)
General			Illegal Spill Discharge Control (2.22.4) Maintenance Facility Housekeeping Practices (2.30) Material Delivery and Storage (2.14.1) Material Use (2.14.2) Safer Alternatives Products (2.21) Scheduling and Planning (2.3) Spill Prevention and Control (2.13.1)

TABLE 2-50: FAMILY – T7a
STORAGE OF HAZARDOUS MATERIALS (WORKING STOCK)

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Management of Hazardous Material	Spills Leaks	Pesticides Fuel Oil Paints Solvents Asphalt Byproducts Cement Epoxy Resins	Material Delivery and Storage (2.14.1) Spill Prevention and Control (2.13.1)

TABLE 2-51: FAMILY – T7c
MATERIAL STORAGE CONTROL (HAZARDOUS WASTE)

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)

TABLE 2-52: FAMILY – T7d
OUTDOOR STORAGE OF RAW MATERIALS

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Safer Alternative Products (2.21) Scheduling and Planning (2.3)
Equipment Operation	Spills Leaks	Fuel Oil Hydraulic Fluid	Vehicle and Equipment Cleaning (2.15.1) Vehicle and Equipment Fueling (2.15.2) Vehicle and Equipment Maintenance (2.15.3)
Raw Material Storage	Spills Leaks	Sand De-Icing Agents Wet Weather Asphaltic Material	Maintenance Facility Housekeeping Practices (2.30) Material Delivery and Storage (2.14.1) Spill Prevention and Control (2.13.1) Stockpile Management (2.17)

TABLE 2-53: FAMILY – T9a
VEHICLE AND EQUIPMENT FUELING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
Vehicle and Equipment Refueling	Spills Leaks	Fuel	Illegal Spill Discharge Control (2.22.4) Material Delivery and Storage (2.14.1) Spill Prevention and Control (2.13.1) Vehicle and Equipment Fueling (2.15.2)

TABLE 2-54: FAMILY – T9b
VEHICLE AND EQUIPMENT CLEANING

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
Vehicle and Equipment Washing Operation	Washing Activity Excess Water	Sediment Oil Cleaning Agent Non-Storm Water	Illegal Spill Discharge Control (2.22.4) Liquid Waste Management (2.13.6) Material Use (2.14.2) Water Conservation Practices (2.18)

TABLE 2-55: FAMILY – T9c
VEHICLE AND EQUIPMENT MAINTENANCE AND REPAIR[1]

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
Vehicle and Equipment Maintenance Operation	Spills Leaks	Fuel Oil Hydraulic Fluid Lead-Acid Batteries Spent Antifreeze Used Oil Filters	Hazardous Waste Management (2.13.3) Illegal Spill Discharge Control (2.22.4) Liquid Waste Management (2.13.6) Maintenance Facility Housekeeping Practices (2.30) Safer Alternative Products (2.21) Solid Waste Management (2.13.2) Spill Prevention and Control (2.13.1) Vehicle and Equipment Maintenance (2.15.3)

1 OUTDOOR VEHICLE AND EQUIPMENT MAINTENANCE SHALL NOT BE PERFORMED DURING RAIN EVENTS OR WHEN STORMS ARE PREDICTED UNLESS REQUIRED BY EMERGENCY CONDITIONS.

TABLE 2-56: FAMILY – T9d
ABOVEGROUND AND UNDERGROUND TANK LEAK AND SPILL CONTROL

Subtask	Potential Source of Pollutants	Potential Pollutant of Concern	BMP Options (Section Number)
General			Illegal Spill Discharge Control (2.22.4) Scheduling and Planning (2.3)
Tank Operation and Maintenance	Spill Leaks	Fuel Oil Emulsions	Hazardous Waste Management (2.13.3) Liquid Waste Management (2.13.6) Maintenance Facility Housekeeping Practices (2.30) Material Delivery and Storage (2.14.1) Spill Prevention and Control (2.13.1) Storm Drain Inlet Protection (2.5)

2.3 SCHEDULING AND PLANNING

Description:

This BMP involves scheduling and planning of all activities (at maintenance facilities or maintenance activity sites) in a manner that considers the use of BMPs. Planning is needed to reduce the exposure of potential pollutants to wind, rain, runoff and vehicle tracking. Planning is important when working in the vicinity of a drainage system or water body. Caltrans Regional Work Plans identify sensitive water bodies where even higher levels of protection are needed. This BMP also includes the scheduling of maintenance activities and control practices to minimize potential water quality impacts during rainfall events.

Appropriate Applications:

Except for emergency conditions, the following activities shall not be performed during rain events or when storms are predicted:

- Asphalt cement crack and joint grinding/sealing;
- Asphalt paving;
- Structural pavement failure (digouts);
- Pavement grinding and paving;
- Sealing operations;
- Concrete slab repair (concrete spall repair is allowed);
- Portland cement crack and joint sealing;
- Mudjacking and drilling;
- Shoulder grading (should not be performed if runoff is visible);
- Nonlandscaped chemical vegetation control;
- Curb and sidewalk repair;
- Chemical vegetation control;
- Painting;
- Thermoplastic striping and marking;
- Paint striping and marking;
- Raised/recessed pavement marker application and removal; and
- Outdoor vehicle and equipment maintenance.

Maintenance activities should be scheduled to minimize land disturbance during the rainy season.

Implementation:

- During the rainy season and prior to forecast storm events, avoid scheduling maintenance activities that could adversely affect storm water quality.
- Establish the appropriate planting time when introducing vegetation. If it is necessary to vegetate disturbed soil at other times of the year, then perform more frequent inspections and maintenance. Apply other BMPs (e.g., Section 2.7.2 Wood Mulch or Section 2.7.6 Straw Mulch) if the vegetation is not successfully established.

Maintenance:

- Verify that work is progressing in accordance with the schedule. If the schedule changes, revise BMPs as necessary.
- Inspect vegetation and perform maintenance to ensure it is established.

2.4 SEDIMENT CONTROL

Sediment control includes those practices that intercept, slow or detain the flow of storm water and allow sediment to settle and be trapped. These practices can consist of installing linear sediment barriers (e.g., Section 2.4.1 Silt Fences, Section 2.4.2 Sandbag or Gravel Bag Barriers and Section 2.4.3 Straw Bale Barriers), Fiber Rolls (Section 2.4.4) or Check Dams (Section 2.4.5) to break up slope length or flow. Sediment barriers are typically placed below the toe of exposed and/or erodible slopes, downslope of exposed soil areas, around stockpiles, and at other appropriate locations along the perimeter of disturbed soil areas. All sediment barriers require periodic inspection and maintenance.

2.4.1 Silt Fence

Description:

A silt fence is a linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves a disturbed soil area. Silt fences are more difficult to construct and maintain than most other sediment control options. This limits their use for short-term maintenance activities.

Appropriate Applications:

- Silt fences may be used for temporary stockpiles.
- For cleanup/repair of minor slides and slipouts, silt fences may be placed below the toe of exposed and erodible slopes or downslope of exposed soil areas to address long-term erosion concerns.
- Silt fences may be used as a temporary measure during roadside stabilization activities.
- Silt fences may also be considered when performing work in the vicinity of sensitive water bodies.
- Silt fences cannot be used under extremely muddy or rocky conditions where the fence cannot be properly anchored.
- Silt fences should be constructed with a setback of at least 1m (1.09 yds) from the toe of a slope or stockpile. Where a silt fence cannot have a 1 meter setback due to specific site conditions, the silt fence may be constructed as far from the toe of the slope as practicable.

Implementation:

- Silt fences should be constructed with a setback of at least 1 meter (1.09 yds) from the toe of a slope or stockpile. Where a silt fence cannot have a 1-meter setback due to specific site conditions, the silt fence may be constructed as far from the toe of the slope as practicable.
- A conceptual silt fence is shown in Figure 2-1. The notes on the figure provide guidance for the proper installation of silt fences.

Maintenance:

- Inspect silt fences to ensure they are functioning properly.
- Repair undercut silt fences. Repair or replace split, torn, slumping or weathered fabric.

- Remove sediment prior to accumulation reaching one-third of the fence height. Consideration should be given to incorporating removed sediment into the maintenance activity site.
- Remove a silt fence when it is no longer needed. Fill postholes and anchorage trench and remove sediment accumulation to conform to existing grade.

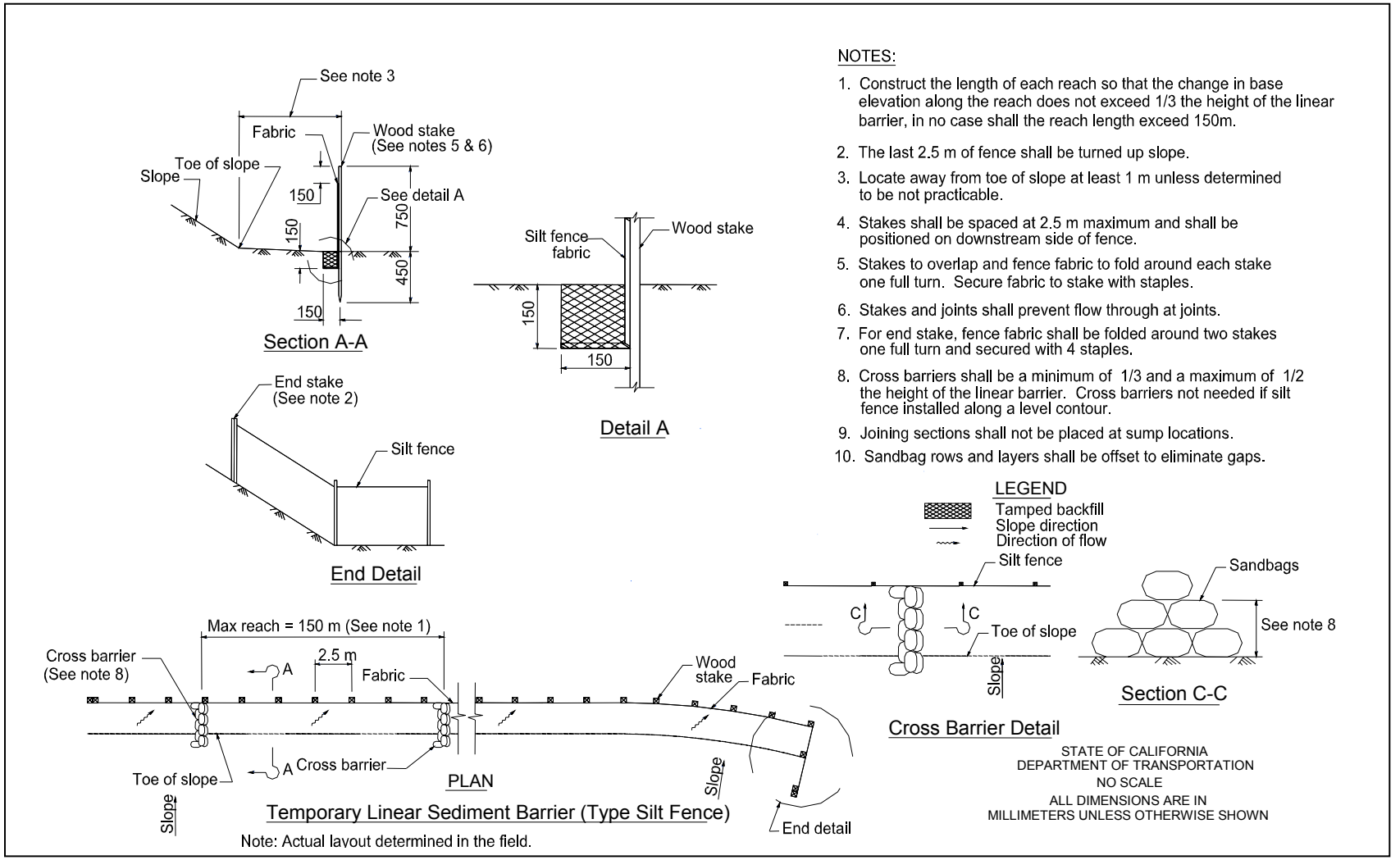


Figure 2-1
Conceptual Temporary Linear Sediment Barrier (Silt Fence)

2.4.2 Sandbag or Gravel Bag Barrier

Description:

A sandbag or gravel bag barrier is a linear sediment barrier consisting of stacked sand- or gravel-filled bags designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sandbag and gravel bag barriers allow sediment to settle from runoff before water leaves a disturbed soil area. Sandbag or gravel bag barriers may also be used to divert the flow of water (see Section 2.6.2 Ditches, Berms, Dikes and Swales). Gravel bag barriers may be preferred because the gravel is easier to contain if the bag fails.

Appropriate Applications:

- Sandbag and gravel bag barriers are a temporary measure used to divert water and intercept sediment. They may be used during Drain and Culvert Maintenance, Drainage Ditch and Channel Maintenance, Irrigation Line Repairs, Roadside Stabilization, Sandblasting, Wet Blast with Sand Injection and Hydroblasting, Minor Slides and Slipouts Cleanup/Repair and Building and Grounds Maintenance. Other BMPs are preferred if the barrier is required for more than a few months.
- Sandbag and gravel bag barriers should be placed below the toe of slopes with exposed and erodible soil.
- Sandbag or gravel bag barriers may be placed around stockpiles at maintenance activity sites or maintenance facilities.
- They may also be used to protect drain inlets and ditch lines during maintenance activities at maintenance activity sites or maintenance facilities.
- Due to their density, sandbags are preferable to divert flows or to prevent flows from entering a storm water conveyance system or watercourse. Gravel bags are better suited for filtration purposes.

Implementation:

- Sandbag or gravel bag materials:
  - Bag material should be canvas, polypropylene, polyethylene, burlap or polyamide woven fabric.
  - Fill material should consist of clean coarse sand or gravel.
- A conceptual sandbag barrier is shown in Figure 2-2. Notes on the figure provide guidance for implementation.

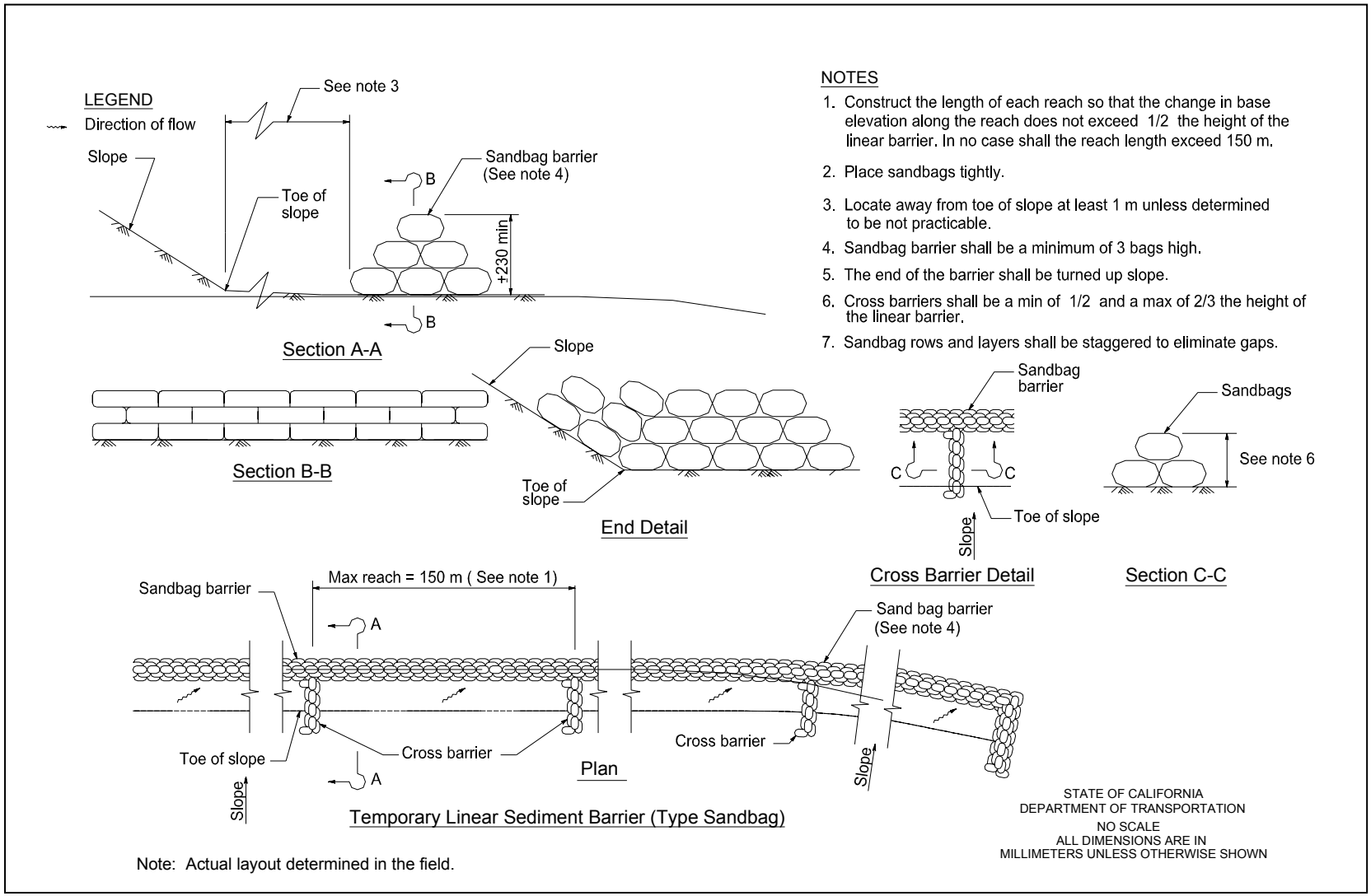


Figure 2-2
Conceptual Temporary Linear Sediment Barrier (Sandbag)

Maintenance:

- Inspect sandbags and gravel bags to ensure the sediment barrier is functioning properly.
- Reshape or replace sandbags and gravel bags as needed.
- Repair washouts or other damage as needed.
- Consideration should be given to incorporating removed sediment into the maintenance activity site.
- Remove sandbags and gravel bags when no longer needed. Remove sediment accumulation, clean the maintenance activity site of debris, regrade if necessary and stabilize the area.

2.4.3 Straw Bale Barrier

Description:

A straw bale barrier is a linear sediment barrier consisting of straw bales designed to intercept and slow the flow of and filter sediment-laden sheet flow runoff. Straw bale barriers allow sediment to settle from runoff before water leaves a disturbed soil area. Straw bale barriers are readily available and suitable for many short-term applications in maintenance activities. Straw bale barriers have the disadvantages of being bulky and heavy when wet.

Appropriate Applications:

- Straw bale barriers are best suited for short-term applications and should not be placed into areas receiving concentrated flow.
- Straw bale barriers are typically placed below the toe of exposed and erodible slopes, downslope of disturbed soil areas (e.g., Minor Slides and Slipouts Cleanup/Repair).
- Straw bale barriers may be placed around stockpiles at maintenance activity sites or at maintenance facilities.
- Straw bale barriers may also be used to protect drain inlets and ditch lines at maintenance activity sites or maintenance facilities during maintenance activities.

Implementation:

- A conceptual straw bale barrier is shown in Figure 2-3. The notes on the figure are useful guidance for the placement and anchoring of larger barriers.

Maintenance:

- Repair or replace damaged straw bales as needed.
- Repair washouts or other damage as needed.
- Consideration should be given to incorporating removed sediment into the maintenance activity site.
- Remove straw bales when no longer needed. Remove or redistribute accumulated sediment to grade and stabilize the area.

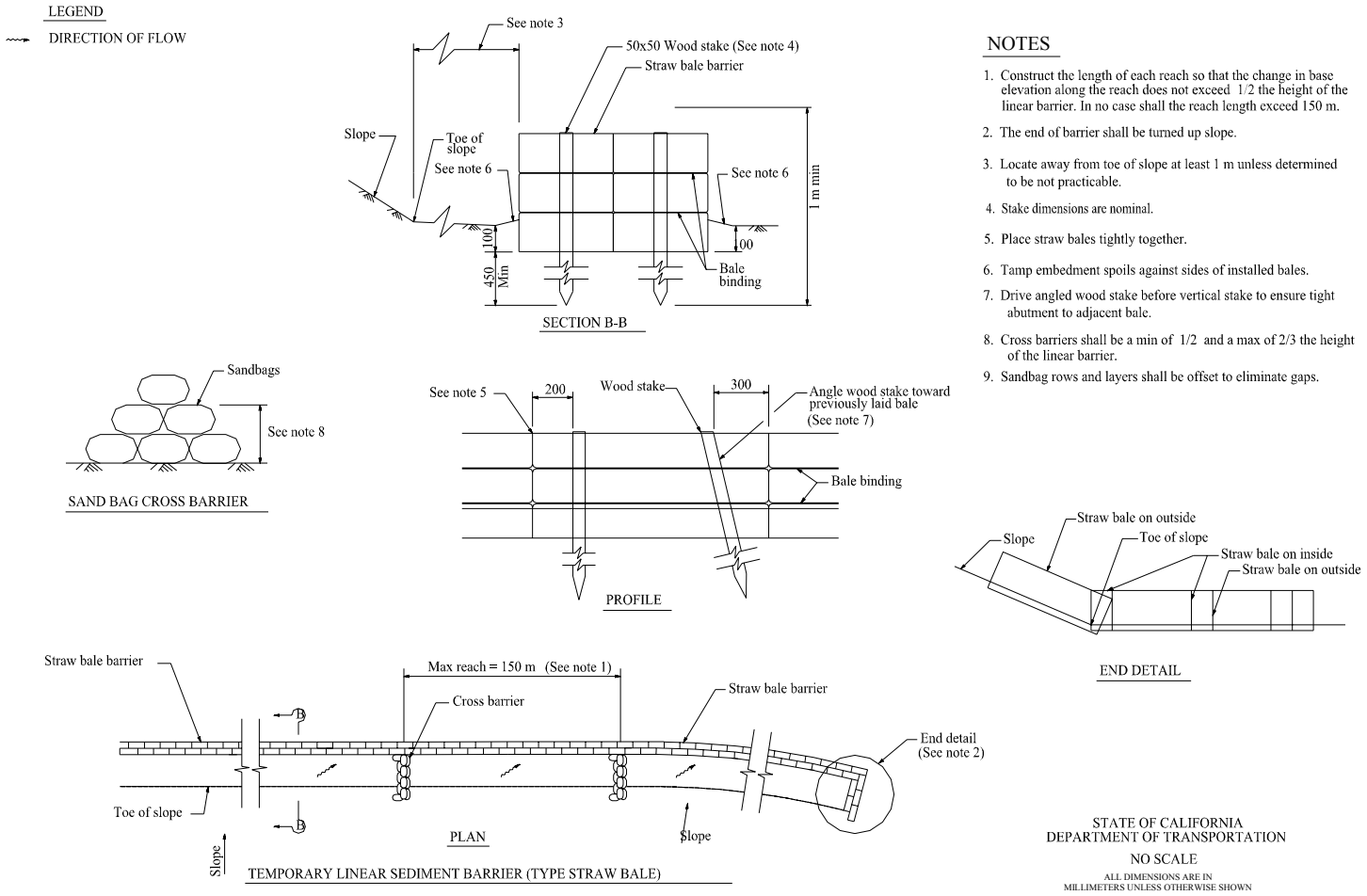


Figure 2-3
Conceptual Temporary Linear Sediment Barrier (Straw Bale)

2.4.4 Fiber Rolls

Description:

A fiber roll consists of commercially available straw (straw wattles), native grasses, flax or similar materials that are rolled or bound into a tight tubular roll and placed on the face of slopes at regular intervals. Fiber rolls intercept runoff, reduce flow velocity, release the runoff as sheet flow and provide some removal of sediment from the runoff. Fiber rolls are preferred at activity sites where the rolls may be left in place for assimilation into the site.

Appropriate Applications:

- Fiber rolls may be used for Minor Slides and Slipouts Cleanup/Repair.
- Fiber rolls may be used along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- Fiber rolls provide some sediment control.

Implementation:

- Fiber roll materials are either:
  - Prefabricated rolls; or
  - Rolled tubes of erosion control blanket.
- Assembly of field-rolled fiber roll:
  - Roll length of erosion control blanket into a tube.
  - Bind roll at each end (may be bound along length of roll with jute-type twine).
- Installation:
  - Install fiber rolls on level contours in a shallow trench.
  - Stake fiber rolls securely.
- A conceptual fiber roll installation is shown in Figure 2-4. The notes on the figure are useful guidance for the installation of fiber rolls.

Maintenance:

- Replace or repair split, torn, unraveling or slumping fiber rolls.
- Fiber rolls should be inspected for sediment accumulation that can render the fiber roll ineffective. Normally, removed sediment may be disposed of in accordance with

the Department's solid waste management practices. However, if the sediment exhibits characteristics such as odor, color and texture that are not similar to the surrounding native soil, an unknown material may be present. Notify the District HazMat Manager immediately.

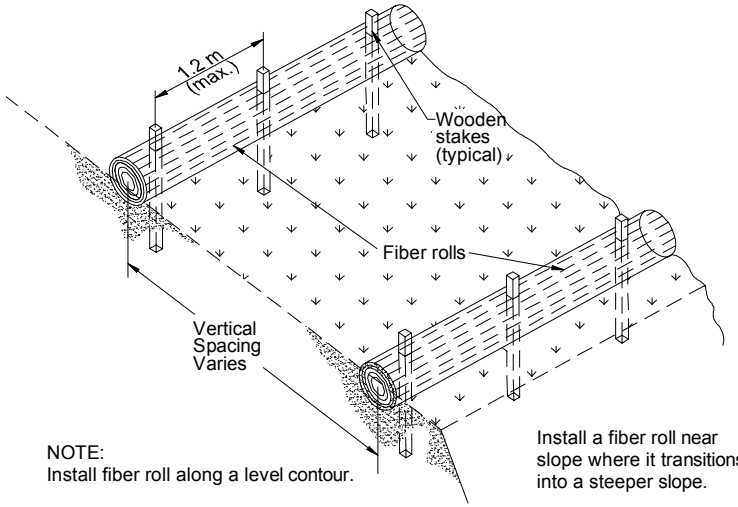


Figure 2-4
Conceptual Fiber Roll Installation

2.4.5 Check Dam

Description:

A check dam is a small, temporary device constructed of rock, fiber rolls, gravel bags or sandbags placed across a natural or man-made channel or drainage ditch. Restricting the flow velocity in the ditch line reduces erosion of the drainage ditch.

Appropriate Applications:

- Check dams shall not be installed in watercourses without required regulatory permits.
- Check dams are primarily considered for use during emergency situations (Minor Slides and Slipouts Cleanup/Repair).
- Check dams may be used when working in areas receiving concentrated flow (see Section 2.9 Clear-Water Diversion).
- Check dams may be installed in small open or steep channels.

Implementation:

- Check dams should be placed at a distance and height to allow small pools to form behind them.
- A conceptual rock check dam is shown in Figure 2-5. The notes on the figure provide guidance for the implementation of check dams.

Maintenance:

- Remove sediment prior to accumulation reaching one-third of the check dam height and consider incorporating removed sediment into the maintenance activity site.
- Remove the check dam when no longer needed.

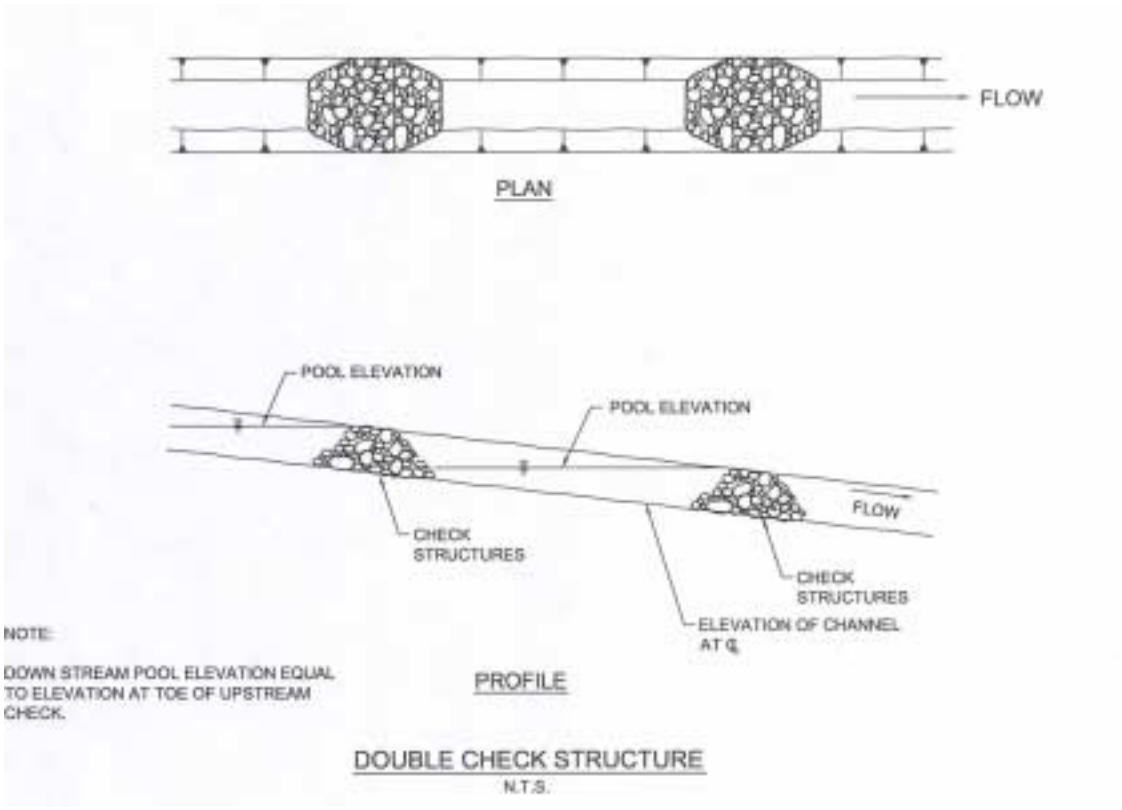


Figure 2-5
Conceptual Rock Check Dam

2.4.6 Sediment Trap

Description:

A sediment trap is a basin formed by excavating or constructing an earthen embankment across a ditch line or low drainage area (see Figure 2-6). A sediment trap is appropriate for long-term application at a maintenance activity site.

Appropriate Applications:

- Sediment traps may be used where the contributing drainage area is less than 2 ha (5 acres). Traps should be placed where sediment-laden storm water may enter a storm water drainage system or watercourse.
- Sediment traps may be used for Minor Slides and Slipouts Cleanup/Repair.
- Sediment traps shall not to be located in waterways.

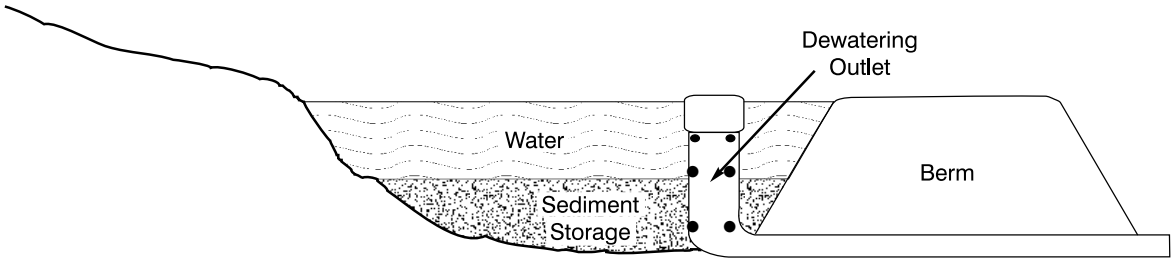
Implementation:

- Traps should be situated according to the following criteria: (1) by excavating a suitable area, such as a low embankment constructed across a swale; (2) where failure would not cause loss of life or property damage; and (3) to provide access for maintenance, including sediment removal and temporary storage of sediment in a protected area.
- Sediment traps should be adequately sized to allow settling of sediment.
- Trap inlets should be located to maximize the travel distance to the trap outlet. Rock or vegetation may be used to protect the trap outlets against erosion (see Section 2.7.8 Riprap).
- To dewater the trap, the outlet may be constructed in one of the following two ways: (1) use a small diameter riser pipe with dewatering holes encased in gravel; or (2) construct a crushed stone outlet section of the embankment at the low point of the trap.

Maintenance:

- Check sediment trap for seepage and structural soundness.
- Check outlet structure and spillway for any damage or obstructions. Repair damages and remove obstructions as needed.
- Check outlet area for erosion and stabilize if required.
- Remove sediment prior to accumulating one-third the volume of the trap.
- Properly dispose of sediment and debris removed from the trap as follows:

- Dispose of debris in accordance with Section 2.13.2 Solid Waste Management.
- Incorporate sediment into the maintenance activity site or manage in accordance with Section 2.13.2 Solid Waste Management.



Note: Actual layout determined in the field
Design of drainage structures shall be in accordance with State of California, Department of Transportation, Standard Plans Section D.

Figure 2-6
Conceptual Sediment Trap

2.5 STORM DRAIN INLET PROTECTION

Description:

This control practice is used in two ways: (1) to detain and/or to filter sediment-laden storm water runoff and (2) to prevent unpermitted non-storm water discharges into storm water drainage systems or watercourses.

Appropriate Applications:

This BMP may be implemented during the following activities:

- Asphalt Rehabilitation and Paving activities (A Family);
- Rigid Pavement activities (B Family);
- Drainage maintenance activities (C Family);
- Maintenance of Traction Sand Traps (F Family);
- Public Facilities activities (G Family);
- Welding or Grinding (H Family);
- Sawcutting for Loop Installation (K Family);
- Paint Striping/Marking (M Family);
- Minor Slides and Slipouts Cleanup/Repair (S Family);
- Vehicle and Equipment Maintenance and Repair (if required in the field) (T Family); and
- Aboveground and Underground Tank Leak and Spill Control (T Family).

- Storm drain inlet protection should be considered for activities where sediment-laden storm water may enter a drain inlet.
- Use this BMP only where ponding of water will not encroach into highway traffic or onto erodible surfaces or slopes.

Implementation:

- Impermeable covers should be used to prevent the unauthorized discharge of non-storm water.
- Storm drain inlets may be temporarily covered with spill pads and/or mats during maintenance activities.
- Storm drain inlets may also be protected by surrounding an inlet with one or a combination of the following:
  - Silt fence (storm water only);

- Fiber rolls (storm water only);
- Straw bale barrier (storm water only);
- Polyurethane barrier (storm water or non-storm water);
- Rubber barrier (storm water or non-storm water);
- Sandbag or gravel bag barrier (gravel or aggregate preferred for storm water only); or
- Excavated culvert inlet sediment trap (storm water only).

Maintenance:

- Make sure silt fence stakes are securely driven into the ground. Replace damaged stakes.
- Repair fabric as needed. Replace or clean fabric prior to fabric becoming clogged with sediment.
- Check sandbags for proper installation. Replace damaged bags as needed.
- Remove sediment prior to accumulation reaching one-third of the fence height or before the volume of the basin has been reduced by one-half. Sediment removed shall be disposed of in accordance with Section 2.13.2 Solid Waste Management BMP or incorporated in the maintenance activity site.
- Remove all inlet protection when no longer needed.

2.6 CONCENTRATED FLOW CONVEYANCE CONTROLS

2.6.1 Overside/Slope Drains

Description:

An overside/slope drain is a pipe used to intercept and direct surface runoff into a stabilized watercourse, a trapping device or a stabilized area. Overside/slope drains are typically used to intercept and direct surface flow away from slope areas to protect slopes. Overside/slope drains installed during maintenance efforts may be temporary. Maintenance staff may receive assistance from engineering for long-term installations or where installation is difficult.

Appropriate Applications:

- Slope drains may be used at sites where slopes have been eroded by surface runoff (Minor Slides and Slipouts Cleanup/Repair).
- Severe erosion may result if overside/slope drains fail (overside/slope drains shall be inspected and maintained).

Implementation:

- When installing overside/slope drains:
  - Limit drainage area per pipe. For areas larger than 4 ha (10 acre), use a lined channel or a series of pipes.
  - Use ditches, berms, dikes and swales to direct surface runoff into the overside/slope drain.
  - Secure the drain to the slope surface.
- Consider the following for installing overside/slope drains:
  - Install perpendicular to slope contours.
  - Protect area around inlet. Protect outlet with riprap or other energy dissipation device. For high-energy discharges, reinforce riprap with concrete or use reinforced concrete device.
  - Compact soil around and under entrance, outlet and along length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.

Maintenance:

- Regularly inspect overside/slope drains and maintain drains to ensure they are secured to the slope.

- Check outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventive measures are implemented.
- Check slope drain for accumulation of debris and sediment. Clean drains to maintain their capacity.

2.6.2 Ditches, Berms, Dikes and Swales

Description:

Ditches, berms, dikes and swales are temporary or permanent measures used to intercept and direct surface runoff to an overside/slope drain or stabilized watercourse.

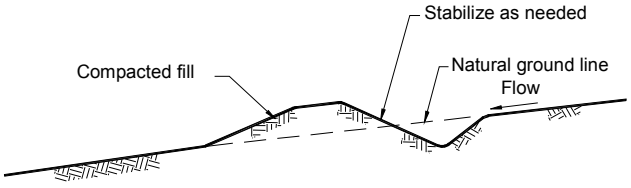
Appropriate Applications:

Ditches, berms, dikes and swales may be implemented for the following purposes:

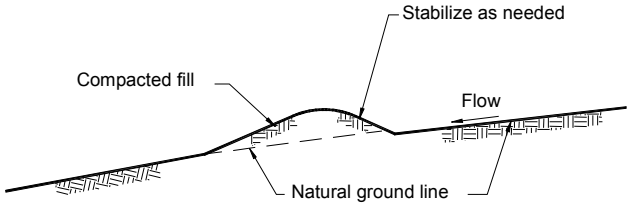
- To convey flow around maintenance activities;
- To divert flow away from maintenance stockpiles;
- At the top of slopes to divert run-on from adjacent slopes and areas;
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows;
- At other locations to convey runoff to overside/drains, stabilized watercourses, storm water drainage system inlets (catch basins), pipes and channels;
- To intercept runoff from paved surfaces; and
- Along roadways and facilities subject to flood drainage.

Implementation:

- Evaluate risks due to erosion, overtopping, flow backups or washout.
- Consider outlet protection where localized scour is anticipated.
- Examine the site for run-on from off-site sources.
- Conveyances should be lined if high flow velocity is anticipated. Consider use of riprap, engineering fabric, asphalt concrete or concrete.
- Conceptual ditches, berms, dikes and swales are shown in Figure 2-6.



Conceptual Diversion Ditch/Drainage Swale
Not to Scale



Conceptual Diversion Dike/Berm
Not to Scale

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Figure 2-7
Conceptual Ditches, Berms, Dikes and Swales

2.6.3 Temporary Diversion Ditches

Description:

These are temporary measures used to intercept and direct surface runoff to an overside (or slope) drain or stabilized watercourse.

Appropriate Applications:

Temporary diversion ditches may be implemented for one or more of the following purposes:

- To convey flow around maintenance activities (most commonly during Minor Slides and Slipouts Cleanup/Repair);
- To divert flow away from maintenance stockpiles;
- At the top of slopes to divert run-on from adjacent slopes and areas;
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows;
- At other locations to convey runoff to overside drains, stabilized watercourses, storm water drainage system inlets (catch basins), pipes and channels; and
- To intercept runoff from paved surfaces.

Implementation:

- Evaluate risks due to erosion, overtopping, flow backups or washout.
- Consider protection where localized scour is anticipated.
- Examine the site for run-on from off-site sources.
- Conveyances should be lined if high flow velocity is anticipated. Consider use of riprap, engineering fabric, asphalt concrete or concrete.

2.7 SOIL STABILIZATION

Disturbed soil areas should be inspected and evaluated for soil stabilization/revegetation to reduce erosion. At the completion of maintenance activities, disturbed soil areas should be stabilized. Stabilization is also required for Minor Slides and Slipouts Cleanup/Repair. Follow-up inspections should be performed to ensure that soil stabilization was successfully implemented.

Soil stabilization consists of preparing the soil surface and applying one of the following BMPs, or combination thereof, to disturbed soil areas or erodible slopes:

- Section 2.7.1 Compaction
- Section 2.7.2 Wood Mulch
- Section 2.7.3 Hydraulic Mulch;
- Section 2.7.4 Hydroseeding/Handseeding;
- Section 2.7.5 Soil Binders;
- Section 2.7.6 Straw Mulch;
- Section 2.7.7 Geotextiles, Mats/Plastic Covers and Erosion Control Blankets; and
- Section 2.7.8 Riprap (Rock Slope Protection)

In some instances, disturbed soil areas may contain seed that will naturally germinate under the right conditions. Maintenance staff may elect to allow natural germination to occur, but these areas must be inspected and otherwise repaired if vegetation does not sprout. Temporary sediment control BMPs will need to be implemented to avoid erosion from these areas while the vegetation is being established.

2.7.1 Compaction

Description:

Soil may be compacted to reduce the potential for erosion and transport of sediment to drainage systems or watercourse. When asphalt grindings are used near water bodies, the material shall be compacted.

Appropriate Applications:

- Compaction is not an alternative to restoring vegetation. Compaction is restricted to areas where vegetation is undesirable or is not sustainable.
- Compaction is appropriate for unpaved shoulder areas following shoulder grading activities, guard rail post installation and sign post installation.

Implementation:

- The effect of runoff from the compacted soil on nearby surface water should be considered.
- The area should be evenly graded or leveled prior to compaction.
- Compaction should not be performed while storm water runoff is observed.
- Compaction should be performed as soon as possible after grading or soil disturbance.
- Compaction may be combined with other BMPs (see Section 2.7.2 Wood Mulch and Section 2.7.6 Straw Mulch).

Maintenance:

- Compacted areas shall be inspected to identify any evidence of erosion upon the completion of maintenance activities.

2.7.2 Wood Mulch

Description:

Wood mulch consists of applying chipped material or commercially available wood mulch products to reduce the potential for eroding the underlying soil. Wood mulch is readily available and has an attractive appearance. Wood mulch may be chosen over other stabilization measures to reduce germination of noxious weeds and the need for vegetation control measures.

Appropriate Applications:

- Wood mulch is appropriate for landscaping applications (Building and Grounds Maintenance).
- Wood mulch may be considered as an option for the Roadside Stabilization Activity (see Section 2.26 Vegetated Slope Inspection).
- Wood mulch may also be considered as an option during Irrigation Line Repairs.
- Wood mulch should not be applied to steep slopes or placed into drainage paths that could receive concentrated flow. Wood mulch is prone to displacement under these conditions.

Implementation:

- Contact the District Landscape Specialist, District Erosion Control Specialist or Landscape Architect for the appropriate application rates. Use the recommended application rate.
- Wood mulch may be applied by hand, with blowers or with chippers.
- Avoid application onto hardscaped areas.

Maintenance

- Periodically inspect areas where mulch has been applied.

2.7.3 Hydraulic Mulch

Description:

Hydraulic mulch is applied to disturbed soil areas that require protection. Hydraulic mulch consists of applying a mixture of natural or recycled fiber and a tackifier with hydro-mulching equipment. The mulch stabilizes the soil, reduces wind and water erosion and provides protection to seeds increasing survivability (see Section 2.6.3 Hydroseeding/Handseeding). It may be used as a temporary repair measure following maintenance activities (to be followed by other soil stabilization BMPs).

Appropriate Applications:

- Hydraulic mulch may be applied to steeper slopes than wood mulch.
- Hydraulic mulch can be applied to areas that receive more concentrated flow where wood mulch would be washed away.
- Hydraulic mulch may be an appropriate measure for Minor Slides and Slipouts Cleanup/Repair.

Implementation:

- Contact the District Landscape Specialist, District Erosion Control Specialist or Landscape Architect for the appropriate application rates. Use the recommended application rate.
- Hydro-mulching equipment is used to apply hydraulic mulch.
- Avoid mulch over-spray onto hardscaped areas.

2.7.4 Hydroseeding/Handseeding

Description:

Hydroseeding/Handseeding is a permanent soil stabilization method. Hydroseeding consists of applying a mixture of fiber, seed, fertilizer and stabilizing emulsion with hydro-mulching equipment. Other methods of seeding may also be used, including spreading by hand broadcasting or with a mechanical handspreader. Replacement planting is also covered under this BMP.

Appropriate Applications:

- Hydroseeding/handseeding may be used on erodible surfaces which require protection (e.g., Minor Slides and Slipouts Cleanup/Repair).

Implementation:

- Hydroseeding can be accomplished using a multiple-step or one-step process.
- Avoid over-spray onto hardscaped areas.
- Seed should be uniformly applied.
- Seed should be "scratched in" or covered with straw or soil (see Section 2.7.6 Straw Mulch).
- Contact the District Landscape Specialist or Landscape Architect for the appropriate seed type and application rate. The recommended seed type and application rate for the site conditions should be used.

Maintenance:

Seeded or planted areas should be inspected for failures and revegetated, fertilized or mulched.

2.7.5 Soil Binders

Description:

Soil binders consist of applying and maintaining polymeric or lignin sulfonate soil stabilizers or emulsions.

Appropriate Applications:

Soil binders may be applied to disturbed soil areas or soil stockpiles requiring short-term protection.

A variety of soil binders are available for use. Prior to use, the manufacturers' specifications should be reviewed and compared to the site-specific conditions. In selecting a soil binder, the following criteria should be considered:

- Availability of product;
- Ease of cleanup;
- Degradability (how the product degrades and what its by-products are);
- Length of drying time;
- Erosion control effectiveness;
- Longevity;
- Mode of application and availability of application equipment; and
- Water quality impact.

Implementation:

- Apply soil binders per manufacturer's specifications.
- Soil binders shall be nontoxic to plant and animal life.
- Soil binders shall not be applied to frozen soil or areas with standing water.
- Soil binders should not be applied during or immediately before rainfall.
- Avoid over-spray onto hardscaped areas.

Maintenance:

Check protected areas to ensure proper coverage and re-apply soil binder as needed, or implement additional BMPs.

2.7.6 Straw Mulch

Description:

The application of straw mulch consists of placing of a uniform layer of straw. It may be attached by wetting, with an organic tackifier or by mechanical means. It is effective for short-term applications and may be combined with other BMPs (e.g., Section 2.7.4 Hydroseeding/Handseeding).

Appropriate Applications:

- Straw mulch may be an appropriate temporary measure for responding to Minor Slides and Slipouts Cleanup/Repair.
- Straw mulch may be applied as a short-term measure to disturbed soil areas. It can be used in this manner for Building and Grounds Maintenance.
- Straw mulch may be used for Roadside Stabilization (see Section 2.26 Vegetated Slope Inspection).
- Straw mulch may also be used in combination with permanent seeding strategies (Section 2.7.4 Hydroseeding/Handseeding) to enhance plant establishment.
- Straw mulch can be applied to steeper slopes than wood mulch.

Implementation:

- Straw mulch should be derived from native grass, oat, wheat, rice or barley.
- Straw mulch with organic tackifier should not be applied during or immediately before rainfall.
- Avoid placing straw mulch onto hardscaped areas.

Maintenance:

- Straw mulch should be periodically inspected and maintained until permanent stabilization measures or repairs are successful.

2.7.7 Geotextiles, Mats/Plastic Covers and Erosion Control Blankets

Description:

This BMP involves the placement of geotextiles, mats, chainlink fencing, plastic covers or alternative erosion control products to stabilize disturbed soil areas. These measures may be temporary or permanent.

Appropriate Applications:

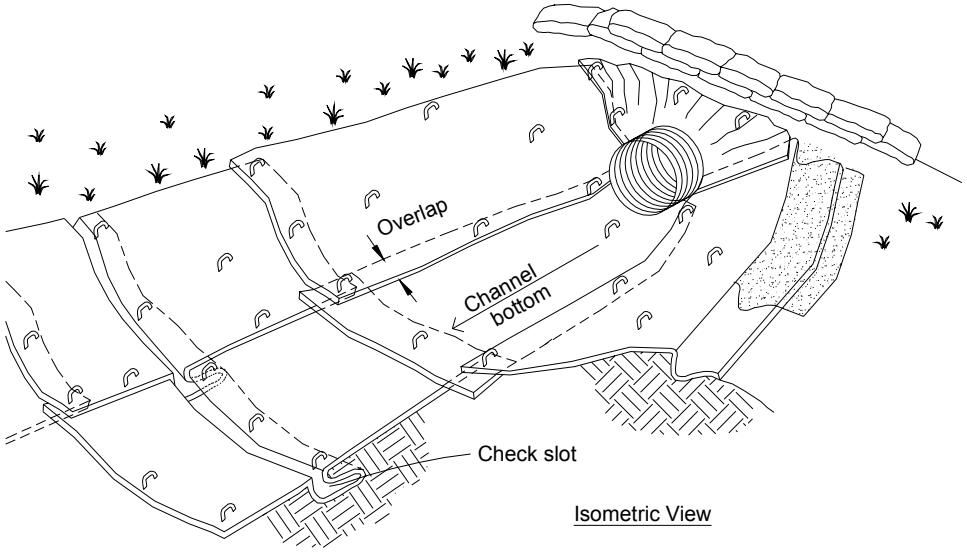
- These measures are used where disturbed soils may be particularly difficult to stabilize, including steep slopes, slopes where erosion hazard is high and slopes where mulch must be anchored. They may be used for Slides and Slipouts Cleanup/Repair or Roadside Stabilization (see Section 2.26 Vegetated Slope Inspection).
- Geotextiles, mats/plastic covers and erosion control blankets may also be used for disturbed soil areas where plants are slow to develop or where it is not the appropriate planting season.
- Geotextiles and mats/plastic covers may also be used in areas receiving concentrated flow.

Implementation:

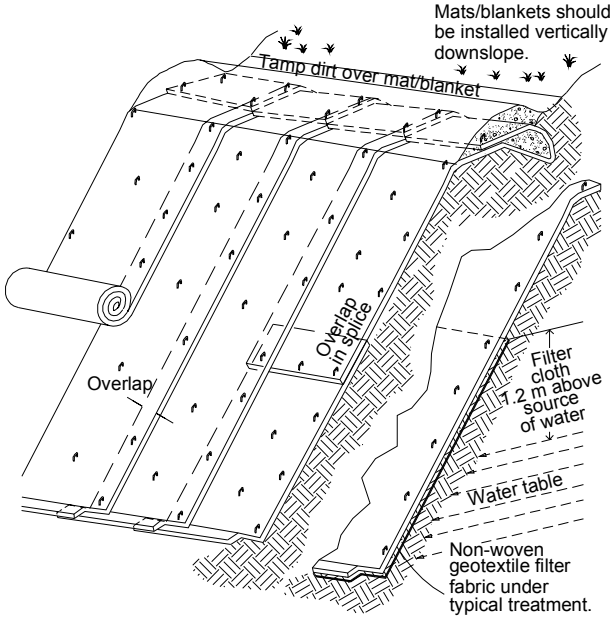
- These measures may be designed with input from geotechnical engineering or hydrology (especially if they are intended as permanent measures).
- Geotextiles, mats/plastic covers and erosion control blankets must be secured to the slope.
- Illustrations of conceptual geotextiles, mats/plastic covers and erosion control blankets are shown in Figure 2-8.

Maintenance:

- Inspect for erosion and undermining. Ensure the controls are secured to the slope until permanent soil stabilization has been successfully attained.
- If washout or breaks occur, repair the damage to the slope or channel whenever possible and re-install the material.



Isometric View



Wet Slope Lining
Not to Scale

Note: Actual layout determined in the field.

Figure 2-8
Conceptual Geotextiles, Mats/Plastic Covers and Erosion Control Blankets

2.7.8 Riprap (Rock Slope Protection)

Description:

Riprap is placed in locations that receive concentrated flows including ditches, channels, slides and slipouts to prevent scour or reduce the energy of storm water flows.

Appropriate Applications:

- Riprap may be used as a temporary measure when working in channels (Drainage Ditch and Channel Maintenance).
- Riprap can be used as a temporary or permanent measure for Slides and Slipouts Cleanup/Repair.
- Riprap may be used as a velocity dissipation measure on slopes and near pipe outlets or on the banks of channels to reduce erosion.

Implementation:

- Install riprap or grouted riprap.

Maintenance:

- Inspect riprap periodically and restore as necessary.
- Check for scour beneath riprap and repair damage as needed.

2.8 PRESERVATION OF EXISTING VEGETATION

Description:

Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits. For activities involving the removal of vegetation, the limits of disturbance should be defined to minimize adverse effects on vegetation outside the working area.

Appropriate Applications:

- Vegetation should be preserved during the following activities:
  - Shoulder Grading;
  - Drain and Culvert Maintenance;
  - Drainage Ditch and Channel Maintenance;
  - Chemical Vegetation Control;
  - Manual Vegetation Control;
  - Mechanical Vegetation Control (Mowing);
  - Tree and Shrub Pruning;
  - Tree and Shrub Removal;
  - Public Facilities;
  - Minor Slides and Slipouts Cleanup/Repair; and
  - Buildings and Grounds Maintenance.
- Preserve existing vegetation where no maintenance activity is planned or where activities will occur at a later date. Preserve existing vegetation to the maximum extent practicable.

Implementation:

The following general steps should be taken to preserve existing vegetation:

- Ensure that the limits of disturbance are identified. Vegetation disturbed outside these limits should be replaced if damaged (see Section 2.7.4 Hydroseeding/Handseeding).
- Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs. Follow existing contours to reduce cutting and filling.
- Minimize the number of access and egress points and locate them to reduce damage to existing vegetation.

- Maintenance materials and equipment storage and parking areas should be located where they will not cause root compaction.
- Keep equipment away from trees to prevent trunk damage and root damage.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Avoid placing soil around trunks of trees.

2.9 CLEAR-WATER DIVERSION

Description:

Clear-water diversion consists of a system of structures and measures that intercept clear water, transport it around a maintenance activity site and discharge it downstream with minimal water quality degradation. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains and drainage and interceptor swales.

Appropriate Applications:

- Clear-water diversions would most likely be implemented during Minor Slides and Slipouts Cleanup/Repair.
- It is possible that a clear-water diversion may be implemented when working on a ditch line or channel.

Implementation:

- Clear-water diversions shall not be performed without required regulatory permits.
- Stationary equipment (such as motors and pumps) located within or adjacent to a water body should be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained or placed in operation, sufficient water shall at all times be allowed to pass downstream to maintain aquatic life downstream.
- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations.
- Remove diversions when the maintenance activity is completed.

2.10 WORK IN A WATER BODY

Description:

Maintenance activities occasionally require equipment or personnel to enter a stream, river, channel, wetland or other water body. This BMP describes measures that are required for maintenance activities in water bodies.

Appropriate Applications:

- Although working in a water body is not routine, Minor Slides and Slipouts Cleanup/Repair, Drainage Ditch and Channel Maintenance, Bridge Repairs and Draw Bridge Maintenance could require work in a water body.

Implementation

- Maintenance equipment shall not enter a water body without the required regulatory permits (*e.g*., Army Corps of Engineers Clean Water Act Section 404 permit, California Department of Fish and Game Code Section 1601 Agreement, SWRCB Clean Water Act Section 401Water Quality Certification). The Maintenance Storm Water Coordinator should be contacted to identify the appropriate permits.
- Evaluate alternatives to performing work in the water body.
- Tires shall be cleaned before entering a water body.
- Heavy equipment driven into a water body to accomplish work should be clean of petroleum residue.
- Water levels should be below the gear boxes of the equipment in use, or equipment lubricants and fuels should be sealed such that inundation by water shall not result in leaks.

2.11 WIND EROSION CONTROL

Description:

Wind erosion control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisances. Covering of small stockpiles is an alternative to applying water or other dust palliatives. This BMP may be combined with Section 2.4 Sediment Controls.

Appropriate Applications:

- Wind erosion controls should be implemented for stockpiles of loose materials.
- This practice is also implemented on disturbed soils subject to wind erosion (including Shoulder Grading, Roadside Stabilization and Minor Slides and Slipouts Cleanup/Repair).

Implementation:

- Evaluate suspending work under windy conditions when loose materials are prone to erosion.
- All distribution equipment shall be equipped with a positive means of shutoff.
- At least one mobile unit should be available to apply water or dust palliative to the maintenance activity site.
- Only potable and nonpotable (uncontaminated) water shall be used. Reclaimed wastewater or otherwise contaminated water shall not be used.
- Materials applied as temporary soil stabilizers may also provide wind erosion control benefits (see Section 2.7 Soil Stabilization).
- Do not apply excess water. Non-storm water discharges are prohibited.

Maintenance:

Inspect protected areas to ensure proper coverage.

2.12 SEDIMENT TRACKING CONTROL

Sediment tracking controls are implemented to avoid tracking sediment from maintenance activity sites or maintenance facilities onto public roads or the highway. These controls include:

- Tire Inspection and Sediment Removal.

The Sweeping and Vacuuming BMP (see Section 2.29) may also be applied as a tracking control. At least one of these BMPs should be implemented when off-road maintenance activities are likely to introduce sediment onto the highway. For extended maintenance activities or site conditions where considerable material tracking will occur, a combination of these BMPs should be considered.

2.12.1 Stabilized Activity Entrance/Exit

Description:

This temporary control practice is a defined point of entrance/exit to a maintenance site that is stabilized to reduce the tracking of mud and soil onto public roads by maintenance vehicles.

Appropriate Applications:

- Use at maintenance activity sites where sediment may be tracked onto public roads by maintenance vehicles.

Implementation:

- Limit the points of entrance/exit to the maintenance activity site.
- Stabilize entrance/exits with wood chips, straw, rock aggregate, commercially available manufactured steel-ribbed plate or other suitable material.

Maintenance:

- Inspect entrance/exit for functionality.
- Replace or supplement rock aggregate as needed.
- Periodically clean steel-ribbed plates.
- Incorporate removed sediment or soil back into the maintenance activity site.

2.12.2 Tire Inspection and Sediment Removal

Description:

Tires are inspected and sediment is removed to reduce tracking of sediment onto public roads or the highway.

Appropriate Actions:

- Tires should be inspected after the completion of off-road activities. Sediment should be removed as needed.

Implementation:

- Inspect tires prior to entering the roadway after off-road work.
- Use dry cleanup techniques to remove rock and sediment from tires prior to leaving the worksite.

2.13 WASTE MANAGEMENT

Waste management consists of implementing procedural and structural BMPs for handling, storing and disposing of wastes generated by a maintenance activity to prevent the release of waste materials into storm water discharges. Waste management includes the following BMPs:

- Section 2.13.1 Spill Prevention and Control;
- Section 2.13.2 Solid Waste Management;
- Section 2.13.3 Hazardous Waste Management;
- Section 2.13.4 Contaminated Soil Management;
- Section 2.13.5 Sanitary/Septic Waste Management;
- Section 2.13.6 Liquid Waste Management; and
- Section 2.13.7 Concrete Waste Management.

These controls shall be implemented for all applicable activities, material usage and site conditions.

2.13.1 Spill Prevention and Control

Description:

Spill prevention and control procedures and practices are implemented to prevent and control spills in a manner that minimizes or prevents discharge to storm water drainage systems or watercourses at maintenance activity sites and maintenance facilities (see Section 2.14.2 Material Use for additional materials handling procedures).

Appropriate Applications:

- These controls apply at maintenance activity sites and at maintenance facilities.
- Spill prevention and control procedures are implemented wherever non-hazardous chemicals and/or hazardous substances are stored or used. Substances may include, but are not limited to, soil stabilizers, dust palliatives, pesticides, growth inhibitors, fertilizers, paints, de-icing chemicals, fuels, lubricants and other petroleum distillates.
- To the extent that the clean up work can be accomplished safely, wastes shall be contained and cleaned up immediately.

Implementation:

- If a spill or leak occurs in the containment area, accumulated rainwater shall be evaluated to determine appropriate disposal method.
  - If accumulated rainwater is hazardous, dispose of in accordance with the Section 2.13.3 Hazardous Waste Management BMP.
  - If accumulated rainwater is chemically contaminated, but nonhazardous, dispose of in accordance with the Section 2.13.6 Liquid Waste Management BMP.
- To the extent that cleanup activities and safety are not compromised, spills shall be covered and protected from storm water run-on during rainfall.
- Dry cleanup methods should be used when possible.
- Used cleanup materials, contaminated materials and recovered spill material that is no longer suitable for its intended purpose shall be disposed in accordance with the Section 2.13.3 Hazardous Waste Management BMP or Section 2.13.2 Solid Waste Management BMP, depending on waste characteristics.
- Contaminated water used for cleaning and decontamination shall not be allowed to enter storm water drainage systems or watercourses.
- Waste storage areas shall be kept clean, well organized and equipped with cleanup supplies that are appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners shall be repaired or replaced as needed to maintain proper function.

- Tarps and similar control measures should be used to prevent spills or material drift from being deposited into watercourses (e.g., during bridge maintenance).

Maintenance:

- The spill response plan shall be available for maintenance staff in the facility supervisor's office or in a designated area for facility reference documents.
- Verify that spill control cleanup materials are located near material storage, unloading and use areas.
- Update spill prevention and control plans and stock appropriate cleanup materials whenever changes occur in the types of chemicals stored on site.

2.13.2 Solid Waste Management

Description:

Solid waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants to drainage systems or watercourses associated with the stockpiling or removal of maintenance activity wastes.

Appropriate Applications:

Solid waste management practices are implemented during maintenance activities that generate solid wastes. These solid wastes include, but are not limited to:

- Maintenance wastes, including brick, mortar, asphalt concrete, Portland cement, concrete, timber, steel and metal scraps, pipe and electrical cuttings, nonhazardous equipment parts, styrofoam, grindings, sandblast grit and other materials used to transport and package maintenance materials;
- Highway planting wastes, including vegetative material, plant containers and packaging materials; and
- Litter and debris, including food containers, beverage cans, coffee cups, paper bags and plastic wrappers.

Implementation:

- Use dry cleanup techniques (e.g., vacuuming, sweeping, dry rags) to remove solid waste from the maintenance activity site when practicable. Use another technique only when dry cleanup techniques are not practicable, such as having to wet for dust control for safety or air quality reasons.
- Recycle, reuse or properly dispose of solid waste.
- Storm water run-on shall be prevented from contacting stored solid waste through the use of ditches, berms, dikes and swales (see Section 2.6 Concentrated Flow Conveyance Controls BMPs).
- Solid waste storage areas at maintenance facilities should be located away from drainage facilities and watercourses and shall not be located in areas prone to flooding or ponding.
- Reuse of asphalt grindings shall be in accordance with the California Department of Fish and Game MOU.
- Reused asphalt grindings shall be compacted when the material is placed near water bodies. (see Section 2.7.1 Compaction)

Maintenance:

- Periodically inspect the solid waste storage areas and review the disposal procedures.
- Repair or replace damaged or missing BMPs.

2.13.3 Hazardous Waste Management

Description:

Hazardous waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants at maintenance activity sites and maintenance facilities to storm water drainage systems or watercourses.

Appropriate Applications:

Hazardous waste management practices are implemented during maintenance activities and at maintenance facilities that generate or store hazardous waste from the use of petroleum products, asphalt products, concrete curing compounds, pesticides, acids, paints, solvents, wood preservatives, stains, roofing tar and any other materials considered a hazardous waste.

Implementation:

- At the Department's Maintenance Facilities, hazardous waste shall be stored in sealed containers constructed of a compatible material and shall be properly labeled in accordance with the Department's *Maintenance Hazardous Waste Manual*; Chapter 2 *Hazardous Waste Storage*.
- All hazardous waste shall be stored, transported and disposed in accordance with federal, state and local regulations.
- Refer to the Department's *Maintenance Hazardous Waste Manual*. For example, the Hazardous Waste Manual includes the following: Chapter 2 *Hazardous Waste Storage*; Chapter 3 *Disposal of Hazardous Waste*; and Appendix E Section D5.07 *Cleanup and Transport Requirements for Government Agencies*.
- Maintenance staff are to follow label instructions regarding the proper handling, mixing and application of materials which could generate hazardous waste and a discharge to waterways.
- Maintenance staff shall implement good housekeeping procedures and exercise care and caution when handling hazardous materials capable of generating wastes that could create a contaminated water discharge. For example: Paint brushes and equipment for water- and oil-based paints shall be cleaned within a contained area and associated waste shall not be allowed to contaminate site soils, watercourses or storm water drainage systems; containers shall not be overfilled.
- The District HazMat Manager is the Maintenance Division lead for Maintenance HazMat activities. Maintenance staff shall contact the HazMat Manager immediately if wastes are generated or encountered within the Department's Right-of-Way requiring special HazMat handling procedures.

Maintenance:

Periodically inspect the maintenance facility storage site to ensure all requirements are met and to review storage, disposal, and transport procedures.

2.13.4 Contaminated Soil Management

Description:

These are procedures and practices to minimize or eliminate the discharges of pollutants from contaminated soil/sediment to storm water drainage systems or watercourses.

Appropriate Applications:

Contaminated soil/sediment generated during emergency response or other maintenance activities should be collected and managed for treatment or disposal.

Implementation:

- Work with the local regulatory agencies to develop options for treatment, reuse and/or disposal of contaminated soil. Disposal of contaminated soil shall be in accordance with the Section 2.13.2 Solid Waste Management BMP or Section 2.13.3 Hazardous Waste Management BMP, depending on soil characteristics.
- Avoid stockpiling contaminated soils or hazardous material.
- Do not stockpile in or near storm water drainage systems or watercourses.
- If temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps; and/or
  - Install a berm or barrier around the stockpile to prevent runoff from leaving the area.

Maintenance:

Temporary stockpiles of contaminated soil should be inspected regularly and controls shall be repaired as needed.

2.13.5 Sanitary/Septic Waste Management

Description:

Sanitary/septic waste management procedures and practices are designed to minimize or eliminate the discharge of sanitary/septic waste materials to storm drain systems or watercourses.

Appropriate Applications:

Sanitary/septic waste management practices are implemented for all maintenance activities that use portable sanitary/septic waste systems.

Implementation:

- Sanitary facilities shall be located away from drainage facilities and watercourses. When subjected to risk of high winds, sanitary facilities shall be secured to prevent overturning.
- Wastewater shall not be discharged (unless the discharge is to a permitted leach field or pond) or buried within the highway right-of-way.

Maintenance:

- Sanitary/septic waste should be discharged to a sanitary sewer or managed by a licensed hauler.
- Sanitary/septic waste storage and the disposal procedures should be managed to prevent non-storm water discharge.

2.13.6 Liquid Waste Management

Description:

Liquid waste management procedures and practices are designed to prevent the discharge of pollutants to storm water drainage systems or watercourses as a result of the creation, collection or disposal of nonhazardous materials that may be unauthorized non-storm water discharges.

Appropriate Applications:

- Liquid waste management is applicable to maintenance activities that generate nonhazardous byproducts, residuals or wastes, including drilling slurries and drilling fluids; grease-free and oil-free wastewater and rinse water; dredging; and other non–storm water liquid discharges.
- Unpermitted non-storm water discharges are prohibited.

Implementation:

- Non-storm water discharges to drainage paths, drain systems and watercourses are prohibited.
- Drilling and saw cutting fluids:
  - Stick-down berms may be used to improve containment.
  - Fluids may be collected by vacuum or other methods.
  - Collected fluids shall be contained and recycled, evaporated or discharged to the sanitary sewer system with approval from the publicly-owned treatment works (POTW).
  - Fluids shall not be discharged to storm water drainage systems or watercourses.
- Vactor™ liquid wastes:
  a) A visual inspection of water drainage facilities shall be preformed prior to cleaning. Caltrans operators are trained to visually inspect for petroleum products, odors, discoloration and other physical evidence of contamination. If chemical contamination is suspected, the operators will stop work and notify the Maintenance Supervisor. The Supervisor will follow existing Caltrans Hazardous Materials Spills procedures and coordinate removal of the contamination with the District Maintenance Hazardous Materials Coordinator.
  b) Liquid waste collected in the Vactor™ trucks may be evaporated or discharged to a Regional Water Quality Control Board approved temporary decanting location in the District. The Maintenance Supervisor shall ensure Vactor™ crews are aware of approved decanting procedures and the approved decanting location.

- Tunnel cleaning:
  - Discharge to storm water drainage systems or watercourses from tunnel maintenance is prohibited.
  - Nonhazardous spent solvents shall be captured and reused, recycled or disposed in accordance with federal, state and local requirements.
  - Refer to the Section 2.14 Materials Handling BMP for appropriate handling and storage of liquids at maintenance activity sites.
  - Refer to the Section 2.13.7 Concrete Waste Management BMPs for appropriate management of concrete waste.

Maintenance:

- At the completion of the task, remove deposited solids from containment areas and capturing devices.
- Check containment areas and capturing devices for damage and repair.

2.13.7 Concrete Waste Management

Description:

Concrete waste management procedures and practices are designed to ensure that concrete wastes are properly handled and eliminate the discharge of concrete waste to storm water drainage systems or watercourses.

Appropriate Applications:

Concrete waste can be generated in various maintenance activities including Curb and Sidewalk Repair, Mudjacking and Drilling, Drain and Culvert Maintenance, Drainage Ditch and Channel Maintenance, Public Facilities, Sawcutting for Loop Installation, Sign Repair and Maintenance, Median Barrier and Guard Rail Repair, and Building and Grounds Maintenance.

Implementation:

- Contracts for concrete providers require contractors to appropriately manage any concrete waste and prohibit non-storm water discharges generated at the job site.
- The Department's *Standard Specifications Section 7-1.01G Water Pollution* requires compliance to applicable statutes relating to the prevention or abatement of water pollution.
- Portland cement concrete waste shall not be allowed to enter storm water drainage or watercourses.
- Concrete waste from grout pumping operations shall be contained.
- Concrete residue should be collected by vacuum or shovel for proper disposal. Concrete debris may be disposed of through on-site burial consistent with the requirements of Caltrans Standard Specification 15-3.02.
- Liquid waste can be contained in a bucket or drum with a tight-fitting lid for transport and approved off-site disposal. Plastic bags may be used if nothing else is available. Avoid breaking the bags by double-bagging and filling the bags to about one-fifth of their capacity. Allow solids to settle and recycle or dispose of in accordance with the Section 2.13.2 Solid Waste Management BMP. The liquid waste may be evaporated. Decanted liquid waste shall be discharged to sanitary sewer only with the POTW's approval. Decanted liquid waste may also be removed for disposal as hazardous waste. Refer to the Hazardous Waste Management BMP (Section 2.13.3).
- A temporary concrete washout facility may be constructed at the maintenance activity area. Below-grade concrete washout facilities are preferred. Above-grade facilities are used if excavation is not practical. Designated washout areas should be located at least 15 meters (50 feet) away from drainage facilities.

- Below-grade facilities consist of a pit excavated away from watercourses. Above-grade washout facilities should be bermed using sandbags or straw bales. Local requirements or other environmental restrictions should be reviewed prior to placing concrete waste on the ground.

Maintenance:

The supervisor or the designee shall monitor the concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure that concrete waste is collected and disposed of properly.

2.14 MATERIALS HANDLING

Materials handling consists of implementing procedural and structural BMPs for handling, storing and using maintenance materials in a manner that prevents the release of those materials into storm water.

2.14.1 Material Delivery and Storage

Description:

Material delivery and storage procedures and practices are designed for the proper handling and storage of materials at the maintenance facility. These procedures and practices minimize or eliminate the discharge of these materials to storm water drainage systems or watercourses.

Appropriate Applications:

- These procedures are implemented at maintenance facilities involved in the delivery and storage of aggregate, pesticides, fertilizers, detergents, plaster, petroleum products, asphalt and concrete components, hazardous chemicals, concrete compounds or other materials that may be detrimental if released to storm water drainage systems or watercourses.
- Refer to Section 2.14.2 Material Use for procedures that apply to any materials that are assembled for use at a maintenance activity site.

Implementation:

- Containment facilities shall provide for a spill containment volume equal to 110% of the largest container in the facility.
- Containment facilities shall be impervious to the materials stored there.
- Containment facilities should be maintained free of rainwater and spills.
- Rainwater in containment facilities should be inspected prior to discharge. Drain valves should remain closed except to release clean rainwater.
- Personnel at maintenance facilities shall be trained to ensure that materials are properly handled and stored.
- Separation should be provided between stored containers to allow for spill cleanup and emergency response cleanup.
- To provide protection from rain, bagged and boxed materials stored outdoors shall be stored on pallets throughout the rainy season.
- To provide protection from rain, bagged and boxed materials shall be covered prior to rain events.
- Storage areas shall be kept clean, well organized and equipped with cleanup supplies for the materials being stored. Perimeter controls, containment structures, covers and liners shall be repaired or replaced as needed.

Maintenance:

- Check to ensure that designated storage areas are kept clean and well organized.
- Repair and/or replace perimeter controls, containment structures and covers as needed to keep them functioning properly.

2.14.2 Material Use

Description:

Material use procedures and practices are used at maintenance facilities and maintenance activity sites to prevent the discharge of materials to storm water drainage systems or watercourses.

Appropriate Applications:

These procedures are implemented at maintenance facilities and at maintenance activity sites where pesticides, fertilizers, detergents, plaster, petroleum products, asphalt and concrete components, hazardous chemicals, concrete compounds and other material that may be detrimental if released to the environment are used or prepared.

Implementation:

- Contract agreements with haulers who supply materials to maintenance activity sites should require them to supply materials in accordance with the requirements of this BMP.
- Latex paint and paint cans, used brushes, rags, absorbent materials and drop cloths shall be disposed of in accordance with federal, state and local requirements.
- Do not remove the original product label from a container as it contains important spill cleanup and disposal information. Make copies of the label information or material safety data sheet if needed. Use all of the product before disposing of the container. Appropriately label all secondary containers.
- Mix paint indoors or in a containment area. Do not clean paint brushes or rinse paint containers where rinsate may discharge into a street, gutter, storm water drainage systems or watercourses. Rinsate from latex paint cleaning may be recycled or discharged to the sanitary sewer. Empty paint cans shall be dry prior to disposal as solid waste. See Section 2.13.6 Liquid Waste Management and Section 2.13.3 Hazardous Waste Management.
- Paint should be loaded into spray equipment at a maintenance facility. Nearby drain inlets should be protected at maintenance facilities and at maintenance activity site.
- Use materials only where and when needed to complete the maintenance activity. Consider the use of safer alternative materials (See Section 2.21) when possible. Reduce or eliminate use of hazardous materials on site when possible.
- Keep a supply of spill cleanup material near material use areas. Train employees in spill cleanup procedures.
- Secure loads and cover loose materials in open-bed trucks during hauling to activity sites.

- Truck beds should be inspected after the completion of material delivery to avoid depositing materials on the roadway.
- Use proper loading and unloading techniques to prevent spills.

2.15 VEHICLE AND EQUIPMENT OPERATIONS

Vehicle and equipment operations, procedures and practices are designed to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning, fueling and maintenance operations to storm water drainage systems or watercourses.

2.15.1 Vehicle and Equipment Cleaning

Description:

Discharges to storm water drainage systems or watercourses from vehicle and equipment cleaning are prohibited. Vehicle and equipment cleaning procedures and practices are used to eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm water drainage systems or watercourses.

Appropriate Applications:

- These procedures apply whenever vehicle and equipment cleaning is performed.
- Waste generated during concrete washout must be managed in accordance with the Section 2.13.7 Concrete Waste Management BMP. Non-storm water discharges of concrete washout are prohibited.

Implementation:

- Contractual provisions require contractors to use cleaning practices consistent with the requirements of this BMP when working at maintenance activity sites.
- When using solvents for cleaning vehicles and equipment, used solvents and by-products shall be captured and reused, recycled or disposed of according to the requirements of the Section 2.13.6 Liquid Waste Management BMP or Section 2.13.3 Hazardous Waste Management BMP, depending on waste characteristics. Minimize use of solvents.
- When possible, truck beds should be cleaned using a dry cleanup technique (sweep up or shovel out).
- Vehicle and equipment washing shall occur only at designated pre-wash areas, facility wash racks or other designated areas:
  - Whether at pre-wash areas at the maintenance facility or the field, vehicle and equipment wash water shall be discharged to a sanitary sewer. If no connection to the sanitary sewer available, wash water should be contained for percolation (if preapproved by the RWQCB) or evaporative drying away from storm drain inlets or watercourses.
  - Facility wash racks shall discharge to a sanitary sewer, recycle system or other approved discharge system and shall not discharge to the storm water drainage systems or watercourses.
  - Concrete washout areas are described under Section 2.13.7 Concrete Waste Management.
- Minimize water use to reduce potential for unpermitted non-storm water discharges (e.g., provide a positive shutoff type of hose nozzle).

- Post signs for pre-wash and wash areas that identify the allowable cleaning methods for the location and discharge prohibitions.

Maintenance:

- Regularly inspect and maintain the designated pre-wash areas, facility wash racks, designated cleaning areas, wash pads, clarifiers, oil-water separators, sumps and sediment traps.

2.15.2 Vehicle and Equipment Fueling

Description:

Vehicle and equipment fueling procedures and practices are designed to minimize or eliminate the discharge of fuel spills and leaks into storm water drainage systems or watercourses during equipment fueling and the bulk delivery of fuel.

Appropriate Applications:

These procedures apply at all maintenance sites where vehicle and equipment fueling occurs.

Implementation:

Bulk Fuel Delivery

- All aboveground and underground storage tanks shall be equipped with automatic overfill shutoff valves.
- Implement Section 2.13.1 Spill Prevention and Control BMP to prevent spillage.

Fueling Area Maintenance

- Label drains at fuel dispensing areas to indicate if they discharge to the storm drain or to the sewer.
- Storm drain inlets may be temporarily covered with spill pads and/or mats during fueling operations.
- Absorbent spill cleanup materials or drip pans shall be stored in fueling and maintenance areas and used materials shall be disposed in accordance with the Section 2.13.3 Hazardous Waste Management BMP.
- Immediately clean up leaks and drips.
- Hosing off the fueling area is prohibited. Dry shop clean up practices should be used.
- Manage wastes to reduce adverse impacts on storm water quality (see Section 2.13.2 Solid Waste Management and Section 2.13.3 Hazardous Waste Management). Fueling areas should be kept free of litter and debris that might become contaminated with petroleum products.
- Maintain and implement a current spill response plan for fueling operations.

Refueling Practices

- Nozzles used at dedicated fueling areas shall be equipped with an automatic shutoff.
- Warnings against “topping off” fuel tanks should be posted at fuel dispensers.

- Fueling operations shall not be left unattended.
- Fueling in the field shall not be performed near unprotected drainage facilities or watercourses. See Section 2.13.1 Spill Prevention and Control BMP for pollution prevention and response requirements.

Maintenance:

- Inspect fueling facilities daily and correct deficiencies.
- Keep a supply of spill cleanup materials on site.

2.15.3 Vehicle and Equipment Maintenance

Description:

Vehicle and equipment maintenance procedures and practices are designed to minimize or eliminate the discharge of pollutants to storm water drainage systems or watercourses from vehicle and equipment maintenance.

Appropriate Applications:

- These procedures are applied where equipment and vehicles are stored or repaired.
- These procedures should be implemented to avoid prohibited discharges to the storm water drainage system of fuel, oil, hydraulic fluid, brake fluid, antifreeze and wiper fluid.

Implementation:

Indoor Maintenance

- Maintenance should be performed in covered or indoor maintenance areas where potential pollutants cannot be introduced into storm water drainage systems.

Field or Outdoor Maintenance

- Drip pans or absorbent materials shall be used during vehicle and equipment maintenance work that involves fluids.
- See Section 2.13.1 Spill Prevention and Control BMP for pollution prevention and response measures.
- The Section 2.13.4 Contaminated Soil Management BMP should be used to address any contaminated soil resulting from vehicle or equipment repair.
- Use dry methods (e.g., dry rags, vacuuming or sweeping) for cleaning associated with maintenance in outdoor areas.

General Maintenance (in the field or in the yard)

- Vehicles and equipment shall be inspected for leaks on each day of use. Leaks should be repaired immediately; problematic vehicles or equipment shall be removed from the maintenance activity site.
- All parts washing should be performed in designated areas. Do not wash parts where wash waste cannot be captured. Use self-contained sinks or tanks when working with solvents.
- Non-storm water discharges into storm water drainage systems or watercourses are prohibited.

- Wastes should be collected and reused, recycled, removed or disposed of in accordance with the Section 2.13.3 Hazardous Waste Management BMP.

Maintenance:

- Inspect areas following field maintenance areas to ensure there is no residual contamination that might impact storm water quality. Clean areas as needed using dry methods, (e.g., sweeping or vacuuming).
- Maintain waste fluid containers in leak-proof condition.
- Inspect equipment for damaged hoses and leaky gaskets. Repair or replace as necessary.

2.16 PAVING OPERATIONS PROCEDURES

Description:

Paving operations procedures are designed to minimize pollution of storm water runoff during paving operations.

Appropriate Applications:

These procedures are implemented where paving, surfacing, resurfacing or saw cutting may pollute storm water runoff or discharge to storm water drainage systems or watercourses.

Implementation:

- Protect drainage inlet structures and manholes during paving operations including when seal coat, tack coat, slurry seal or fog seal is applied.
- Seal coat, tack coat, slurry seal or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.
- When using asphalt release agents (e.g., citrus, soy-based or diesel) for cleaning and coating of equipment and tools, all products and by-products shall be captured and reused, recycled or disposed in accordance with the requirements of the Section 2.13.3 Hazardous Waste Management BMP. Asphalt release agents shall not be discharged to the storm water drainage systems or watercourses.
- Clean pavers over absorbent pads, drip pans, plastic sheeting or other materials to collect residual cleaning wastes. Dispose of removed material in accordance with the Section 2.13.3 Hazardous Waste Management BMP.
- Pick up and reuse, recycle or dispose of cured material in accordance with the Section 2.13.2 Solid Waste Management BMP.
- Prevent water used to clean emulsion kettles from discharging into storm water drainage systems or watercourses. Recycle products where possible to avoid discharge.
- Diesel fuel used in kettle cleaning shall be contained and reused, recycled or disposed of in accordance with the Section 2.13.3 Hazardous Waste Management BMP.

Maintenance:

Maintain machinery regularly to minimize leaks and drips.

2.17 STOCKPILE MANAGEMENT

Description:

Stockpile management procedures and practices are designed to reduce or eliminate pollution of storm water from stockpiles of vegetative wastes and paving materials.

Appropriate Applications:

- Stockpile management procedures are used for stockpiles of contaminated and uncontaminated soil.
- Stockpile management procedures are used for the stockpiling of vegetative waste and paving materials.
- Stockpile management procedures are used for materials removed from drains, ditches and culverts.
- Stockpile management procedures are used for waste piles.
- Stockpile management procedures are used for any other material or waste that could impact storm water quality.

Implementation:

- Do not locate stockpiles in areas of concentrated flows of storm water, drainage systems, inlets or watercourses.
- Do not locate stockpiles adjacent to sensitive water bodies.
- Divert storm water run-on away from stockpiles. See Section 2.6.2, Ditches, Berms, Dikes and Swales.
- Wind erosion control practices shall be implemented on stockpile material. See Section 2.11, Wind Erosion Control BMP.
- Manage stockpiles of contaminated soil in accordance with the Section 2.13.4, Contaminated Soil Management BMP.
- Minor slides/slipouts usually occur during major storms. Stockpiles should be removed as soon as practicable and materials should be placed so that waterways are not impacted (see Section 2.4 Sediment Control).
- During rain events, stockpiles of "cold mix" asphalt (i.e., pre-mixed aggregate and asphalt binder) shall be covered. Any deviation from this BMP for "cold mix" shall be coordinated with the RWQCB.
- During rain events, soil stockpiles shall be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier.

- During rain events, stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base or aggregate subbase shall be covered or protected with a temporary perimeter sediment barrier.

Maintenance:

Repair and/or replace perimeter controls and covers as necessary to keep them functioning properly.

2.18 WATER CONSERVATION PRACTICES

Description:

Water conservation practices minimize water use during a maintenance activity to avoid causing erosion and/or the transport of pollutants into the drainage system and watercourses. Non-storm water discharges to storm water drainage systems and watercourses are prohibited unless the discharge is authorized by a separate National Pollutant Discharge Elimination System (NPDES) permit, exempted or conditionally exempt as provided in the Caltrans Statewide Storm Water Permit.

Appropriate Applications:

- All maintenance activities should practice water conservation.
- Unpermitted non-storm water discharges are prohibited.

Implementation:

- Keep water application equipment in good working condition.
- Avoid using water to clean maintenance areas. Use dry cleanup methods where practical. Sweep paved areas.
- Use the minimum amount of water needed to complete each maintenance activity.

Maintenance:

- Repair water supply and distribution equipment to minimize the loss of water.

2.19 POTABLE WATER/IRRIGATION

Description:

In accordance with Table 5-2 of the Statewide SWMP, some non-storm water discharges are conditionally exempt by the Permit. The conditionally exempt non-storm water discharges include irrigation water, potable water sources and water from line and hydrant flushing. This BMP is intended to reduce the possibility for the discharge of potential pollutants associated with conditionally exempt discharges from irrigation systems, planned and unplanned discharges from potable water sources and water line or hydrant flushing.

Appropriate Applications:

This BMP should be implemented on a site-specific basis whenever the above activities or discharges occur.

Implementation:

- When possible, flushed water should be applied for landscaping purposes.
- Shut off the water source to isolate a broken line, sprinkler or valve as soon as possible to minimize the loss of water.
- Repair broken water lines as soon as possible.
- Protect downstream storm water drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.
- Manage irrigation systems to ensure the appropriate amount of water is used and runoff is minimized.

2.20 STORM DRAIN STENCILING

Description:

Stenciled messages at storm drain inlets are intended to educate the public about storm water runoff pollution. Where required, warnings prohibiting discharges to storm drains should be placed near inlet structures.

Appropriate Applications:

Storm drain stenciling is approved for park-and-ride lots, safety roadside rest areas, vista points, commercial vehicle enforcement facilities and along roads and highways legally accessible by the public in developed communities with a population greater than 10,000 or that traverse through cities, towns and communities with populations of 10,000 or more, or less if the area is covered by a MS4 permit. Stenciling is not required in areas where pedestrians are prohibited.

Implementation:

Warnings to discourage illegal discharges should be stenciled onto or adjacent to drain inlets where appropriate. The goal is to increase public awareness of how rainfall runoff can carry litter, automotive fluids, motor oil and other contaminants into waterways.

Maintenance:

Stenciling should be inspected and replaced when unreadable.

2.21 SAFER ALTERNATIVE PRODUCTS

Description:

A variety of products that may be harmful to the environment if they come into contact with surface waters are used in maintenance facilities and activities. In some cases, a less harmful product that serves the same purpose can replace a harmful product. 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 the discharge of toxic products to drainage paths, storm water drainage systems or watercourses.

Appropriate Applications:

Safer alternative products should be considered for all maintenance activities. For example, when safer alternative products exist for cleaning products, paints, herbicides, automotive products and fertilizers, they should be used where practical and effective. Alternative products may not be available, effective or cost effective in every situation.

Implementation:

- Create awareness among employees regarding the benefits of safer alternative products.
- Safer alternative product awareness will be incorporated into the Maintenance Division storm water staff training program. For example the use of lower phosphate detergents where applicable at facilities and the use of water based cleaners versus halogenated solvents (cleaning fluids).
- The materials used on Maintenance projects shall conform to approved materials in the current *State of California, Department of Transportation, Standard Specifications*. The Department's Translab has an established testing protocol for product review and testing before a material becoming a standard material for use. For example, the Standard Specifications include approved asphalt mixtures and thermoplastic striping materials.
- The use of a safer alternative product may still result in the discharge of harmful materials to drainage paths, storm water drainage systems or watercourses. All products are to be used in accordance with manufacturers' recommendations.

2.22 DRAINAGE FACILITIES

These BMPs address the maintenance of drainage facilities to reduce the potential for pollutant discharge. Drainage Facilities BMPs include Baseline Storm Water Drainage Facilities Inspection and Cleaning (Section 2.22.1), Enhanced Storm Drain Inlet Inspection and Cleaning Program (Section 2.22.2), Illicit Connection Detection, Reporting and Removal (Section 2.22.3) and Illegal Spill Discharge Control (Section 2.22.4).

2.22.1 Baseline Storm Water Drainage Facilities Inspection and Cleaning

Description:

Culverts, ditches, gutters, underdrains, horizontal drains and downdrains require inspection and cleaning to prevent flooding and to provide for sufficient hydraulic capacity.

Appropriate Applications:

These procedures are applicable to maintenance personnel who conduct storm water drainage system facilities inspection and cleaning. BMP implementation will depend on traffic, weather, available resources, safety conditions and access to storm water drainage systems.

Implementation:

- Inspect culverts, ditches, gutters, underdrains, horizontal drains, downdrains and outlets annually and as needed during the winter season to determine if cleaning is required or if damage has occurred.
- Clean culverts to maintain sufficient hydraulic capacity of the culvert.
- Inspect ditches and gutters to maintain sufficient hydraulic capacity. Schedule routine ditch-cleaning activities designed to maintain sufficient hydraulic capacity of ditches prior to the rainy season.
- When cleaning drainage ditches below cut slopes or steep slopes, avoid cutting the toe of the slope. This can also prevent damage to the ditch.
- Water used and the material generated during drainage facility cleaning should be collected and managed per the requirements of the Section 2.13.2 Solid Waste Management and Section 2.13.6 Liquid Waste Management BMPs.
- Where waterways are affected, coordinate maintenance activities with the appropriate regulatory agency.
- The Maintenance Supervisors in charge of the activity will provide Vactor™ operators with written instructions identifying pre-approved decanting sites.
- Maintenance Supervisors will work with the District Maintenance Storm Water Coordinator in establishing approved decanting sites for Vactor™ waste.

2.22.2 Enhanced Storm Drain Inlet Inspection and Cleaning Program

Description:

Caltrans will implement an annual storm drain inlet inspection and cleaning program in the metropolitan areas of San Diego, Orange, Los Angeles and Ventura Counties.

Appropriate Applications:

Within the target counties, an annual inspection and cleaning program should be implemented. This program will not address left shoulder, median or ramp inlets that require lane closures for access. Right shoulder inlets and other inlets that do not require lane closures should be inspected and the impact of litter and debris from these inlets should be assessed in the Monitoring and Research Program. Inspection and cleaning activities should be reported annually by county, route and postmile.

Implementation:

- Inspect drain inlets annually in the target counties to determine if cleaning is required or if damage has occurred.
- Clean inlets with 12 inches or more of accumulated material.
- Maintain records and a database of inspection and cleaning information.

2.22.3 Illicit Connection Detection, Reporting and Removal

Description:

This procedure directs maintenance staff to detect and report illicit connections and illegal discharges into Caltrans storm water drainage systems. Illicit connections are connections to Caltrans drainage systems that have not been approved by Caltrans.

This management practice is directed at continuous or recurring discharges through direct connections to storm water drainage systems or as run-on from adjacent properties.

Appropriate Applications:

Detecting and reporting illicit connections applies to all field activities performed by maintenance staff. If an illicit connection is discovered, it shall be reported.

Implementation:

- Maintenance personnel, as part of their routine inspections and maintenance work, shall report all observed suspected illicit connections to the District Maintenance Storm Water Coordinator, who will forward these observations to the NPDES Storm Water Coordinator.
- All public-initiated calls should be directed to the District's Public Affairs Officer. Calls regarding illicit connections should be logged and routed to the NPDES Storm Water Coordinator.
- Response and permitting or removal of illegal connections will be in accordance with Section 1.3.3 of the Statewide SWMP.

2.22.4 Illegal Spill Discharge Control

Description:

This procedure calls for maintenance field staff who detect illegal dumping, discharges and spills of pollutants on Caltrans properties and facilities to report them.

This BMP is directed at incidents involving dumping, discharges or spills that affect storm water.

Appropriate Applications:

- Any spills or dumped materials that are observed by maintenance personnel shall be reported.

Implementation:

- Maintenance supervisors and field personnel shall report to the Maintenance Storm Water Coordinator any observed illegal dumping or discharges as part of their routine inspections and maintenance work.
- Spill cleanup will be handled in accordance with the legal authority presented in Section 2.6 of the SWMP.

2.23 TREATMENT SYSTEM MAINTENANCE

The treatment systems represent the approved treatment BMPs that were identified as technically and fiscally feasible in reducing constituents of concern to improve water quality. See Guidelines, Section 5, for more details. The treatment systems include Vegetated Treatment Systems (Section 2.23.1), Infiltration Basins (Section 2.23.2), Detention Devices (Section 2.23.3) and Traction Sand Traps (Section 2.23.4).

Prior to intrusive maintenance at any BMP, maintenance personnel should check with a District biologist to ensure there are no endangered species, threatened species or species of special concern within the BMP maintenance area. For applicable areas, emergent habitat could attract endangered or threatened species, or species of concern whose residence would prevent necessary maintenance. If BMP function will not be impaired, remove habitat or discourage attraction as recommended by District Environmental.

2.23.1 Vegetated Treatment Systems (Biofiltration Swales and Strips)

Description:

These measures are intended to maintain established swales as effective devices for treating runoff discharges. These requirements for inspection and maintenance will allow the devices to continue to function as designed for water quality purposes.

Appropriate Application:

The BMP maintenance activities described in Table 2-57 apply to personnel that inspect and maintain vegetative treatment systems. Chemical vegetative control measures will not be used on vegetated treatment BMPs except where Caltrans is directed by the California Department of Food and Agriculture to treat the BMPs for invasive weeds. Fire control strips up to 2.4 meters (8 feet) wide may be maintained through pesticide applications adjacent to biofiltration swales. The areas used for fire control will not be considered as part of the treatment system. Caltrans will report the use of chemicals in its Annual Report.

Implementation:

Field measurements of maintenance indicators are made by visual observation. Frequencies provided are for the minimum required level of service. Greater maintenance frequencies may be required depending on the particular site and level of traffic.

TABLE 2-57: VEGETATED TREATMENT SYSTEMS MAINTENANCE

Maintenance Indicator	Measurement Frequency	Maintenance Activity
Presence of overgrowth or woody species.	Inspect two times per year.	Mow grass, grass-lined swales and strips to an average height of no less than 100 mm (4 inches).
Debris/trash present in inlet or outlet structures.	Inspect two times per year.	Remove and dispose trash and debris to permit free flow. Frequency of litter pickup is established on Litter Frequency Map.
Bare areas as a result of excessive erosion or sedimentation and/or. ponding/vector problems.	Inspect ditches and channels two times per year for shape and serviceability to detect conditions that may cause scour, undermining, washout or other damage to the highway or facilities by water or wave action.	Repair deficiencies promptly. Clean, reshape and revegetate lined ditches and channels when needed. Maintenance activities are preferably conducted in the summer prior to winter rainfalls.

2.23.2 Infiltration Basins

Description:

These measures are intended to maintain infiltration basins as effective devices for treating runoff discharges. These requirements for inspection and maintenance will allow the devices to continue to function as designed for water quality purposes.

Appropriate Applications:

The BMP maintenance activities described in Table 2-58 apply to personnel who inspect and maintain infiltration devices.

Implementation:

Field measurements of maintenance indicators are made by visual observation.

TABLE 2-58: INFILTRATION BASIN MAINTENANCE

Maintenance Indicator	Measurement Frequency	Maintenance Activity
Sediment volume exceeds design capacity.	Inspect annually.	Remove accumulated sediment.
Debris/trash present.	Inspect during routine trash collection.	Remove and dispose trash and debris.
Standing water 72 hours after a storm event.	Inspect 72 hours after one significant storm per year.	• Drain facility, if possible. • Notify engineer to consider: - Remove sediment, scarify invert and regrade if necessary. If unable to achieve acceptable infiltration rate or implement alternative solution then move to decommission. If standing water can not be removed than notify vector control authority[1].
Borrows, holes, or mounds.	Inspect annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.
General maintenance items. Inlet/outlet structural integrity, side slopes or other features damaged, significant erosion, graffiti or vandalism, etc.	Inspect semi-annually.	Take corrective action prior to wet season. Consult engineer if immediate solution is not evident.

TABLE 2-58: INFILTRATION BASIN MAINTENANCE

Maintenance Indicator	Measurement Frequency	Maintenance Activity
Evidence of erosion.	Inspect before rainy season.	Reseed/revegetate barren spots as appropriate for the area. Scarify surface if needed. If after two applications (2 seasons) of reseeding/revegetating growth is still unsuccessful, consider installation of an erosion blanket or equivalent protection over eroding areas. No erosion blanket should be installed in the basin invert.
Average plant height is greater than 12 inches.	Inspect once during wet season and once during dry season.	Cut or remove vegetation and clippings as appropriate.

1 MONITORING AND ABATEMENT OF VECTORS MAY BE DONE THROUGH AGREEMENT WITH THE LOCAL VECTOR CONTROL AUTHORITY.

2.23.3 Detention Devices

Description:

These measures are intended to maintain effective detention devices for treating runoff discharges. These requirements for inspection and maintenance will allow the devices to continue to function as designed for water quality purposes.

Appropriate Application:

The BMP maintenance activities described in Table 2-59 apply to personnel who inspect and maintain detention devices.

Implementation:

Field measurements of maintenance indicators are made by visual observation.

TABLE 2-59: DETENTION DEVICE MAINTENANCE

Maintenance Indicator	Measurement Frequency	Maintenance Activity
Sediment volume exceeds design capacity.	Inspect annually.	Remove accumulated sediment.
Trash/debris present.	Inspect during routine trash collection.	Remove and dispose trash and debris.
Standing water 72 hours after a storm event.	Inspect 72 hours after one significant storm per year.	• Drain facility. • Check and unclog clogged orifice. Notify engineer, if immediate solution is not evident.
Borrows, holes, or mounds.	Inspect annually and after vegetation trimming.	Where burrows cause seepage, erosion and leakage, backfill firmly.
General maintenance items: Inlet/outlet structural integrity, side slopes or other features damaged, significant erosion, graffiti or vandalism, etc.	Inspect semi-annually.	Take corrective action prior to wet season. Consult engineer if immediate solution is not evident.
Evidence of erosion.	Inspect before rainy season.	Reseed/revegetate barren spots as appropriate for the area. Scarify surface if needed. If after two applications (2 seasons) of reseeding/revegetating growth is still unsuccessful, consider installation of an erosion blanket or equivalent protection over eroding areas. No erosion blanket should be installed in the basin invert. Contact environmental or landscape architect for appropriate seed mix.
Average plant height is greater than 12 inches.	Inspect once during wet season and once during dry season.	Cut or remove vegetation and clippings as appropriate.

2.23.4 Traction Sand Trap Devices

Description:

This BMP is intended to maintain sand trap devices as effective devices for treating runoff discharges. These requirements for regular inspection and maintenance will allow the devices to continue to function as designed.

Appropriate Applications:

The BMP maintenance activities described in Table 2-60 apply to personnel who inspect and maintain traction sand trap devices.

Implementation:

Field measurements of maintenance indicators are made by visual observation.

TABLE 2-60: TRACTION SAND TRAP DEVICE MAINTENANCE

Maintenance Indicator	Measurement Frequency	Maintenance Activity
Sediment volume exceeds design capacity.	Inspect annually and after significant storms.	Remove accumulated sediment.
Standing water 72 hours after a storm event.	Inspect 72 hours after one significant storm per year.	• Drain facility, if possible. • Notify engineer to consider: - Remove sediment and restore infiltration capacity. - If unable to achieve acceptable infiltration rate or implement alternative solution then move to decommission. - If standing water can not be removed then notify vector control authority[1].
General maintenance items: Inlet/outlet structural integrity, damaged structures, graffiti or vandalism, etc.	Inspect semi-annually.	Take corrective action prior to wet season. Consult engineer if immediate solution is not evident.

1 MONITORING AND ABATEMENT OF VECTORS MAY BE DONE THROUGH AGREEMENT WITH THE LOCAL VECTOR CONTROL AUTHORITY.

2.24 LITTER AND DEBRIS REMOVAL

Litter and debris removal consists of removing and properly disposing of litter and implementing procedures to discourage littering to reduce the discharge of potential pollutants. Litter and Debris Removal BMPs include Litter and Debris (Section 2.24.1) and Anti-Litter Signs (Section 2.24.2).

2.24.1 Litter and Debris

Description:

These measures are intended to reduce the discharge of litter to storm water drainage systems or watercourses.

Appropriate Applications:

This BMP should be implemented on a site-specific basis whenever litter and debris removal activities are performed. The frequency of removal is dependent on the availability of resources, safety considerations and rate of accumulation.

Implementation:

- Remove litter and debris from drainage grates, trash racks and ditch lines to reduce discharge to the storm water drainage systems and watercourses.
- Secure or cover transported materials, equipment and supplies to and from maintenance activity sites to prevent spillage to the roadway.

2.24.2 Anti-Litter Signs

Description:

Caltrans conducts a signage program that warns against dumping and littering (e.g., "No Dumping" and "$1,000 Fine for Littering"). These signs are placed along highways where littering violations are frequent. The purpose of this program is to discourage littering by educating motorists about the fine for littering.

The Care for California Program displays signs showing an image of trash being placed into a garbage can. These signs encourage positive behavior.

Appropriate Applications:

Anti-litter signs may be placed:

- Along corridors that receive an unsightly amount of litter.
- Along freeways, safety roadside rest areas, vista points and park-and-ride facilities.

Implementation:

Maintenance Supervisors travel highways in their assigned section to observe overall conditions and assess the need for litter removal and installation of anti-litter signs. Anti-litter signs can be requested when litter removal becomes a concern.

2.25 CHEMICAL VEGETATION CONTROL

Description:

This practice is intended to reduce the potential for the discharge of pollutants generated during chemical vegetation control. This method of vegetation control uses herbicides to eliminate and prevent weed growth. The purpose is to control weed growth that may threaten the growth and health of preferred vegetation that may become a fire hazard or raise other safety concerns.

Appropriate Applications:

The BMPs should be implemented on a site-specific basis whenever chemical vegetation control activities are performed. Chemical vegetative control measures will not be used on vegetated treatment BMPs except where Caltrans is directed by the California Department of Food and Agriculture to treat the BMPs for invasive weeds. Caltrans will report the use of these required chemicals in its Annual Report.

Implementation:

- Caltrans has an Integrated Vegetation Management Plan that integrates physical, chemical, mechanical, cultural and biological methods to provide the most effective pest management approach.
- Caltrans follows an approved list of chemicals developed by Maintenance Headquarters that is generally more restrictive than herbicide use options available to other agencies and the public.
- The Caltrans goal is to reduce chemical usage.
- To achieve effective vegetation control through chemical application, maintenance personnel should consider the following: (1) use of the correct herbicide, (2) seasonal timing of applications, (3) timing in relation to expected precipitation events, (4) proximity to water bodies, (5) speed of travel when applying herbicides and (6) proper agitation of the spray tank.
- Apply herbicides in compliance with federal, state and local pesticide use regulations.
- Apply herbicides only as specified on the "Pesticide Use Recommendation" and the label.
- Activities should be approved by a licensed Agricultural Pest Control Adviser.
- Apply herbicides as recommended by the District Annual Vegetation Control Plan.
- Minimize the use of herbicides in or near storm water drainage systems or watercourses.
- Calibrate the spray rig to ensure accurate application of herbicides.

- Avoid using overhead irrigation for as long as the chemical manufacturer recommends after applying herbicides.
- Do not spray chemicals when rainfall causing runoff is forecast within 12 hours.
- Herbicide use should be documented and summarized in the Annual Report.

2.26 VEGETATED SLOPE INSPECTION

Description:

Districts have established Maintenance Inspection/Slope Stabilization Teams to review vegetated slopes. The program will identify problematic slopes for repair to reduce erosion.

Appropriate Application:

Slope and unpaved areas should be inspected on a five-year cycle.

Implementation:

The following general steps should be taken to evaluate slopes and re-establish vegetation:

- Minor slides and slipouts requiring a Maintenance Division response shall be inspected and evaluated at the time of response field activities.
- Areas should be inspected for erosion on a five-year cycle.
- Areas with recurring problems should be inspected on an as-needed basis.
- Slope repairs that are within the abilities of the Maintenance Inspection/Slope Stabilization Team should be repaired by that team.
- Each District will establish a multi-disciplinary team to review problem slopes.
- Problem slopes with erosion concerns that cannot be repaired by the Maintenance Inspection/Slope Stabilization Team should be reported to the multi-disciplinary team. These projects should be forwarded to the State Highway Operation and Protection Program for possible funding and repair.
- A standard Maintenance Division reporting format for scheduling, inspection findings and repairs has been developed for the program.
- *The Preliminary Maintenance Slope Inspection Form* (number CT-MAINT-NPDE-S005) is to be used and is available electronically from the Department's Headquarters Maintenance Division.

2.27 SNOW REMOVAL AND DE-ICING AGENTS

Description:

This BMP is intended to reduce the discharge of potential pollutants generated during ice control activities. Ice control activities include:

- The mechanical spreading of abrasives and de-icing agents;
- The mechanical removal of snow from the travel way;
- Opening of drains covered by snow and ice; and
- Opening of roads that are normally allowed to close for the winter season.

Appropriate Applications:

- This BMP provides guidance to maintenance personnel who are involved in snow and ice removal activities. The use or nonuse of de-icing agents is based on driver safety, traffic delay, geographic location, weather and total cost.
- In areas of the state where significant amounts of abrasives are required, the sweeping frequency should be increased to remove accumulated abrasives.

Implementation:

- Calibrate spreader to avoid the over-application of de-icing agents or abrasives. Use no more than is necessary for snow and ice control. Consider using alternative de-icing agents where runoff from roads discharges directly to sensitive watercourses.
- Maintain accurate records of the locations of de-icing agents and abrasives application and the quantities of de-icing agents and abrasives used.
- Store de-icing agents (e.g., salt) in appropriate areas, bunkers or storage buildings. Do not store de-icing agents where they will come into contact with storm water runoff.
- Avoid blowing, pushing or dumping snow into the watercourse.

2.28 STORM WATER DEWATERING OPERATIONS (TEMPORARY PUMPING OPERATIONS)

Description:

These practices are implemented where storm water is pumped. This BMP addresses discharge from portable pumps used by maintenance personnel during repairs and to prevent damage to the highway.

Appropriate Applications:

These practices are implemented where storm water is pumped as part of a maintenance activity. Note that per Section 5 of the Statewide SWMP, some discharges are exempt or conditionally exempt.

Implementation:

- Ensure that dewatering discharges do not cause erosion at the discharge point.
- Pumping systems should be equipped with screens on the intake.
- Intakes should be located to reduce the pumping of sediment. Pumping areas near the storm water surface often contain less sediment than areas near the bottom.
- Sediment Control BMPs may be installed at intake or outlet locations to trap excessive sediment.

2.29 SWEEPING AND VACUUMING

Description:

Sweeping and vacuuming are performed to remove litter, debris and de-icing abrasives from paved roads and shoulders. Sweeping to reduce track-out generally involves manual sweeping or use of small equipment, but does not exclude the use of sweepers should the need arise (e.g., for slides and slipouts).

Appropriate Applications:

- Sweeping and vacuuming operations are appropriate for removing de-icing abrasives, material from small slides, litter and debris.
- Sweeping and vacuuming may be implemented anywhere sediment is tracked from off-road maintenance activity sites onto public or private paved roads typically at the points of egress.

Implementation:

Highway Sweeping:

- Do not sweep up any unknown substance that may be potentially hazardous. If a substance is known to be hazardous, suspected of being hazardous or cannot be identified, notify the District Maintenance HazMat Manager immediately. If an illegally dumped substance within the Department's Right of Way has the potential of entering a municipal drain system, the immediate supervisor and the District Storm Water Coordinator must be notified so that the downstream municipality can be contacted.
- Adjust brooms to maximize the efficiency of sweeping operations.
- Do not load hoppers beyond their capacity.
- Dispose of waste to a landfill or approved site in accordance with local regulations and Section 2.13.2, Solid Waste Management BMP. There is to be no dumping on site, especially during the rainy season or during unseasonal storm events to abate wash out. Clean materials may be incorporated into the maintenance activity area.

Tracking Control:

- Substantially visible sediment shall be swept or vacuumed from the maintenance activity site.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the maintenance activity site.
- Washing and rinsing of equipment shall be performed in designated areas and the resulting runoff shall not be discharged to the storm drain system.

2.30 MAINTENANCE 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 eliminate the potential for discharge of pollutants to drainage paths, storm water drainage systems or watercourses by promoting efficient and safe storage, use and cleanup of potentially harmful materials.

Appropriate Applications:

Proper housekeeping practices apply to all maintenance personnel who participate in activities that have a potential to generate pollutants that could discharge to storm water drainage systems or watercourses.

Implementation:

- Maintain clean, orderly material and equipment storage areas. Provide covers for materials as needed.
- Use the 'first in first out' policy for material storage and control. Avoid ordering more materials than can be stored properly or used in a reasonable timeframe.
- Properly reuse, recycle or dispose of empty containers, excess materials, equipment and parts that are not likely to be used. All solid wastes shall be managed per the requirements of the Section 2.13.2 Solid Waste Management BMP.
- Maintain equipment and buildings to avoid peeling paint, rust and degradation. Request funding for major repairs.
- Sweep or vacuum maintenance facility floors and pavement.
- If mopping is used to clean floors or pavement, contain the mop water and dispose of it to the sanitary sewer system according to the following guidelines:
  - Do not dispose of mop water into the parking lot, street, gutter or drain inlet; and
  - 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.
- Secure and close lids on waste receptacles and bins when not in use.
- Clean up spills promptly. See Section 2.13.1, Spill Prevention and Control BMP.
- Use drip pans or absorbent material under leaking vehicles and equipment to capture fluids.
- If it is necessary to use a hose for cleaning, wash water shall not be discharged to the storm water drainage systems or watercourses.

- Minimize the possibility of storm water pollution from outdoor waste receptacles by doing at least one of the following:
  - Use only watertight waste receptacle(s) and keep the lid(s) closed;
  - Grade and pave the waste receptacle area to prevent run-on of storm water;
  - Install a roof over the waste receptacle area;
  - Install a low containment berm around the waste receptacle area; or
  - Use and maintain drip pans under waste receptacles.

3.1 DESIGN POLLUTION PREVENTION BMPs (CATEGORY IB)

This section lists and describes those BMPs that are considered during the planning and design phases of projects. Permanent measures are those that provide storm water quality management after construction is completed. Some BMPs have both permanent and temporary applications, and may also have applications to several different temporary categories. The pollution prevention BMPs that are to be incorporated, as appropriate, into the design of new facilities and reconstruction or expansion of existing facilities are listed in Table 3-1.

TABLE 3-1: DESIGN POLLUTION PREVENTION BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow
Preservation of Existing Vegetation
Concentrated Flow Conveyance Systems
Ditches, Berms, Dikes and Swales
Overside Drains
Flared Culvert End Sections
Outlet Protection/Velocity Dissipation Devices
Slope/Surface Protection Systems
Vegetated Surfaces
Hard Surfaces

For all Caltrans projects, Caltrans will:

- Maximize vegetation-covered soil areas of a project. These areas are treatment zones known as biofiltration strips (overland flow areas) and biofiltration swales (vegetated ditches); and
- Evaluate treatment BMPs that may be incorporated into a project. In this evaluation Caltrans at a minimum will:
  - Evaluate the potential impacts to downstream hydrology and aquatic life and habitat that could be caused by the project (can reference environmental documents if needed).
  - Evaluate and consider approved design pollution prevention BMPs for all projects determined to have the potential to cause downstream impacts.
  - Evaluate and consider approved treatment BMPs at each project based on site-by-site conditions.
  - Document the feasible treatment opportunities of each approved BMP for every project.
  - Incorporate the appropriate treatment BMPs into the project.

Section 4.4.1 of the SWMP presents additional information on the process by which Caltrans will implement treatment BMPs into the project delivery process.

3.2 REQUIRED MINIMUM DESIGN ELEMENTS FOR STORM WATER CONTROL

All projects must incorporate certain minimum design elements with respect to water quality concerns. These design goals include the following:

1. *Minimize Impervious Surfaces:* The intent of this goal is to reduce the volume of runoff (see Section 3.3).
2. *Prevent Downstream Erosion:* Storm water drainage systems will be designed to avoid causing or contributing to downstream erosion.
3. *Stabilize Disturbed Soil Areas:* Disturbed soil areas will be appropriately stabilized as discussed in Section 4.
4. *Maximize Vegetated Surfaces Consistent with Existing Caltrans Policies:* Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from storm water.

In addition, project design staff will implement the appropriate pollution prevention BMPs described in the following sections.

3.3 DESIGN POLLUTION PREVENTION BMPs (CATEGORY IB)

3.3.1 Consideration of Downstream Effects Related to Potentially Increased Flow

Description:

Total paved area is kept to a practical minimum to limit maintenance costs and impervious area (to minimize runoff).

Appropriate Applications:

During the design of both new and reconstructed facilities, Caltrans may include new road surfaces or additional surface paving to enhance the operational safety and functionality of the facility.

Implementation:

Changes in the velocity or volume of runoff, the sediment load or other hydraulic changes from stream encroachments, crossings or realignment may affect downstream channel stability. If these changes result in an increased potential for downstream effects in channels, Caltrans will consider the following:

- Modifications to channel lining materials (both natural and man-made), including vegetation, geotextile mats, rock and riprap;
- Energy dissipation devices at culvert outlets;

- Smoothing the transition between culvert outlets/headwalls/wingwalls and channels to reduce turbulence and scour; and
- Incorporating retention or detention facilities into designs to reduce peak discharges.

Caltrans will implement appropriate measures to ensure that runoff from Caltrans facilities will not significantly increase downstream effects.

3.3.2 Preservation of Existing Vegetation

Description:

Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits.

Appropriate Applications:

Caltrans will preserve existing vegetation at areas on a site where no construction activity is planned or will occur at a later date.

Implementation:

The following general steps should be taken to preserve existing vegetation:

- Identify and delineate in contract documents all vegetation to be retained and mark in the field prior to the start of adjacent soil-disturbing activities.
- Mark areas to be preserved with orange polypropylene temporary fencing.
- Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling.
- When removing vegetation, consider impacts (increased exposure or wind damage) to the adjacent vegetation that will be preserved.

3.3.3 Concentrated Flow Conveyance Systems

Concentrated flow conveyance systems consist of permanent design measures that are used alone or in combination to intercept and divert surface flows, and convey and discharge concentrated flows with a minimum of soil erosion, both on-site and downstream (off-site). Temporary controls for storm water run-on and conveyance of concentrated flows are discussed in Section 4.3.3 of the Guidelines.

Ditches, Berms, Dikes and Swales

Description:

These are permanent devices typically used to intercept and direct surface runoff to an overside (or slope) drain or stabilized watercourse.

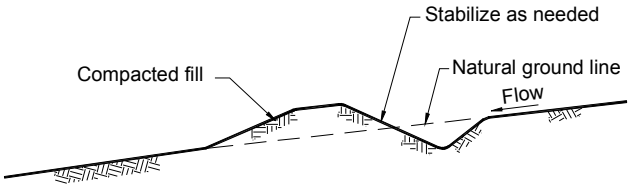
Appropriate Applications:

Ditches, berms, dikes and swales are typically implemented:

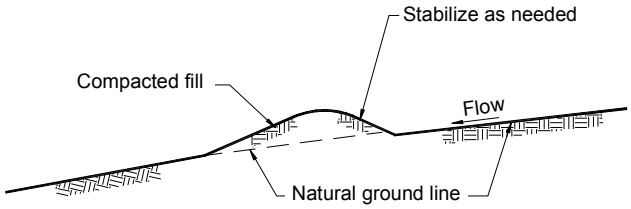
- At the top of slopes to divert run-on from adjacent slopes and areas;
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows;
- At other locations to convey runoff to overside drains, stabilized watercourses, and storm water drainage system inlets (catch basins), pipes and channels;
- To intercept runoff from paved surfaces; or
- Along roadways and facilities subject to flood drainage.

Implementation:

- Select design flow and safety factors based on careful evaluation of risks due to erosion, overtopping, flow backups or washout.
- Consider outlet protection where localized scour is anticipated.
- Examine the site for run-on from off-site sources.
- Consider order of work provisions to install and utilize permanent dikes, swales and ditches early in the construction process.
- Conveyances must be lined when velocities exceed allowable limits for soil. Consider use of riprap, engineering fabric, vegetation, asphalt concrete or concrete.
- Conceptual ditches, berms, dikes and swales are shown in Figure 3-1.



Conceptual Diversion Ditch/Drainage Swale
Not to Scale



Conceptual Diversion Dike/Berm
Not to Scale

Fig_3-1.DWG JAC 7/24/00

Figure 3-1
Conceptual Ditches, Berms, Dikes and Swales

Overside Drains

Description:

Overside drains are pipes, downdrains, flumes or asphalt concrete overside drains used to protect slopes against erosion by collecting surface runoff from the roadbed, the tops of cuts or from benches in cut or fill slopes, and conveying it down the slope to a stabilized drainage ditch or area.

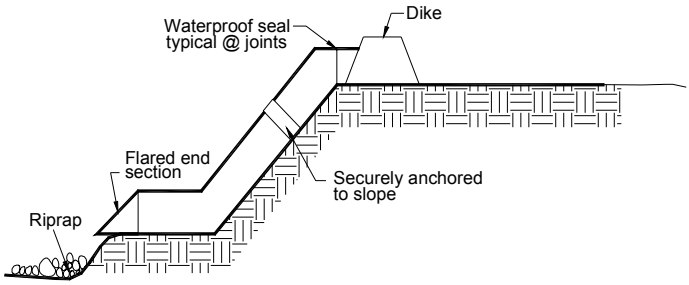
Appropriate Applications:

Overside drains are typically used at sites where slopes may be eroded by surface runoff.

Implementation:

- Pipe downdrains are metal pipes adaptable to any slope. They are recommended where side slopes are 1:4 or steeper.
- Flume downdrains are rectangular corrugated metal flumes with a tapered entrance. They are best adapted to slopes that are 1:2 or flatter.
- Pipe and flume downdrains shall be securely anchored to the slope.
- Paved spillways are recommended on side slopes flatter than 1:4. On steeper slopes, a more positive type of overside drain (such as a pipe downdrain) should be used.

- Drainage from benches in cut and fill slopes should be removed at intervals ranging from 100 to 150 meters.
- A conceptual overside drain is shown in Figure 3-2.



Note: Actual layout determined in the field

Figure 3-2
Conceptual Overside Drain

Flared Culvert End Sections

Description:

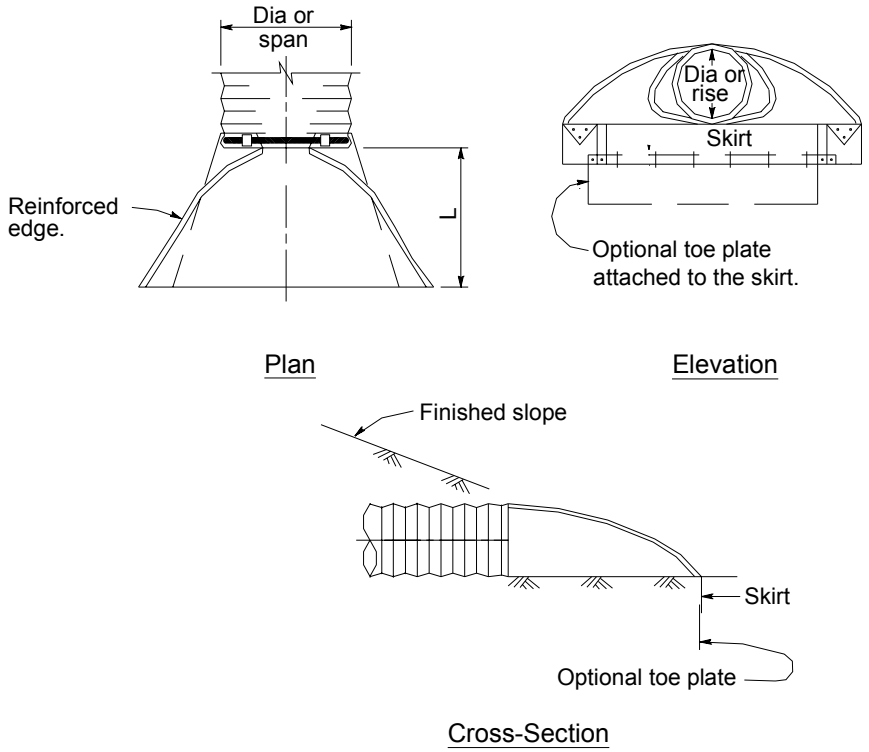
These are devices typically placed at inlets and outlets of pipes and channels to improve the hydraulic operation, retain the embankment near pipe conveyances, and to help prevent scour and minimize erosion at these inlets and outlets.

Appropriate Applications:

Use flared culvert end sections at outlets and inlets of slope drains and culverts.

Implementation:

- At outlets, use with other outlet protection/velocity dissipation devices.
- A conceptual flared culvert end section is shown in Figure 3-3.



Note: Actual layout determined by design.

Figure 3-3
Conceptual Flared Culvert End Section

Outlet Protection/Velocity Dissipation Devices

Description:

These devices are typically placed at pipe outlets to prevent scour and reduce the outlet velocity and/or energy of exiting storm water flows.

Appropriate Applications:

These devices are typically used at the outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, where localized scouring is anticipated.

Implementation:

- Install riprap, grouted riprap, or concrete apron at selected outlet.
- Apron length (L) is related to outlet flow rate and tailwater level.

- For proper operation of apron, align apron with receiving stream and keep straight throughout its length.
- A conceptual outlet protection/velocity dissipation device is shown in Figure 3-4.

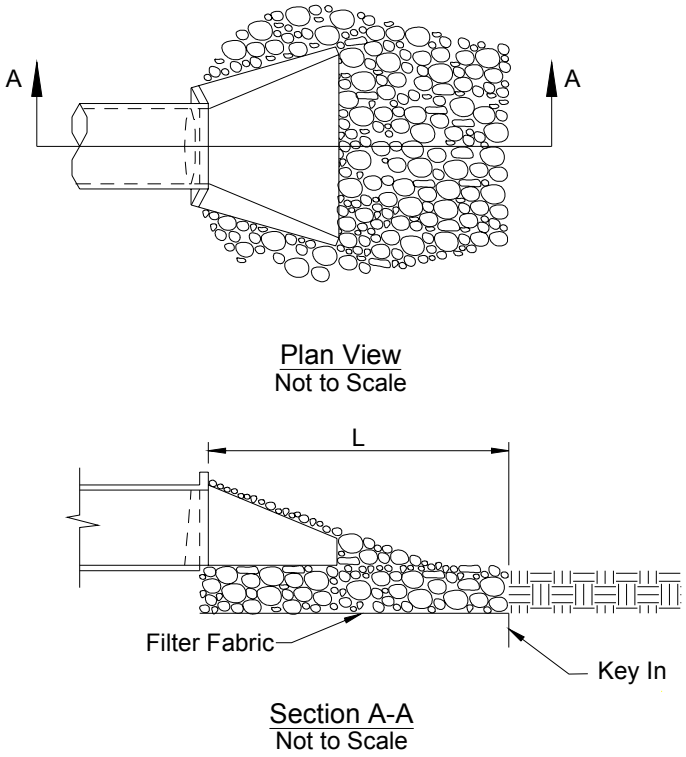


Figure 3-4
Conceptual Outlet Protection/
Velocity Dissipation Device

3.3.4 Slope/Surface Protection Systems

Surface protection consists of a system of permanent design measures that are used alone or in combination to minimize erosion from completed, disturbed surfaces. Vegetated surfaces may offer several advantages to paved surfaces, including lower runoff volumes and slower runoff velocities, increased times of concentration and lower cost. However, where site or slope-specific conditions would prevent adequate establishment and maintenance of a vegetative cover, hard surfacing should be considered.

Vegetated Surfaces

Description:

A vegetated surface is the establishment of a permanent perennial vegetative cover on areas that have been disturbed by construction. The purpose of a vegetated surface is to prevent erosion and remove pollutants in storm water and non-storm water runoff.

Appropriate Applications:

Vegetated surfaces should be established on areas of disturbed soil that are complete or nearly complete and that can support the selected vegetation.

Implementation:

Adhere to the following typical steps to implement vegetated surfaces:

- The site should first be evaluated to select the appropriate vegetation and planting strategy. The site evaluation should consider soil type and condition; site topography; climate and season; types of appropriate native and adapted vegetation suited to the site; and maintenance.
- Vegetated surfaces shall be designed to minimize overland and concentrated flow depths and velocities, and maximize contact time between water and vegetated surfaces. This will enhance infiltration and pollutant removal opportunities.
- When determined feasible, strip and stockpile topsoil and removed vegetation during construction. Use stockpiled materials in the surface preparation prior to seeding operations.
- Roughen the surface of the slope or area to be seeded.
- Typical application rates are 2 to 3 tons of seeds per acre.
- After planting seeds, apply protective mulch, erosion control blanket, or other protective cover.
- For optimal performance seed should be applied between 30 days prior to start of rainy season and 30 days after start of rainy season.
- In all cases, application of seed should be restricted to between 30 days prior to the rainy season and 30 days prior to the end of the rainy season.
- Long term maintenance of these vegetated surfaces are discussed in Section 2.7 of these Guidelines and in Section 5.3.4 of the Statewide SWMP.
- Slope Roughening/Terracing/Rounding
  - Roughening and terracing are techniques for creating furrows, terraces, serrations, stair-steps or track-marks on the soil surface to increase the effectiveness of

temporary and permanent soil stabilization practices. Slope rounding is a design technique to minimize the formation of concentrated flows.

- Use on embankment or cut slopes, prior to the application of temporary soil stabilization or permanent seeding.
- Slope roughening, terracing, and rounding should be implemented conceptually as shown in Figure 3-5.

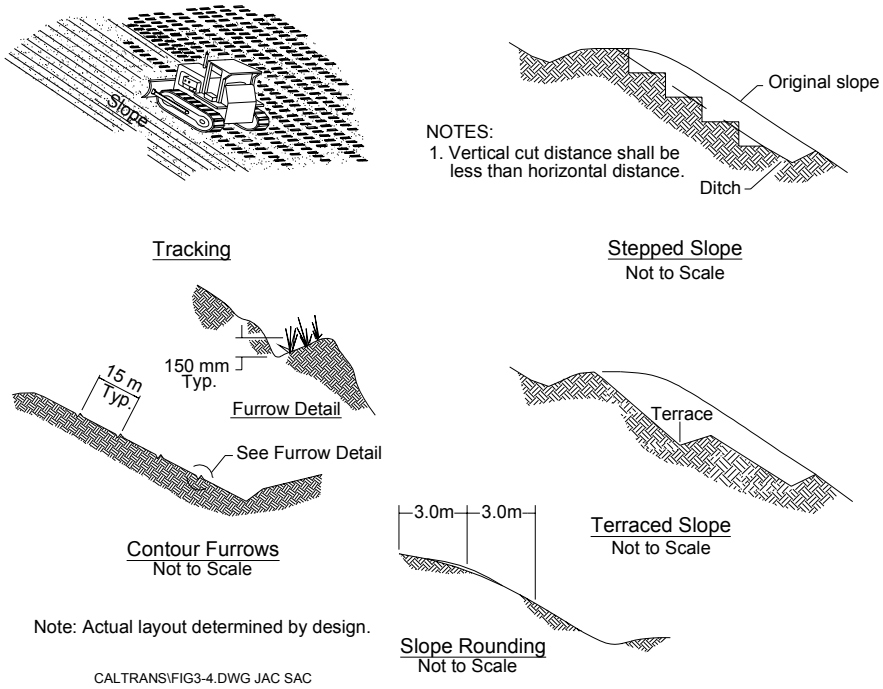


Figure 3-5
Conceptual Slope Roughening, Terracing and Rounding

Hard Surfaces

Description:

Hard surfaces consist of placing concrete, rock, or rock and mortar slope protection.

Appropriate Applications:

Apply on disturbed soil areas where vegetation would not provide adequate erosion protection. Hard surfaces are also considered where it is difficult to maintain vegetation.

Implementation:

- Rock Slope Protection
  - Rock slope protection consists of placing revetment-type rock courses.
  - Remove loose, sharp, or extraneous material from the slope to be treated.
  - Place underlayment fabric loosely over the surface so that the fabric conforms to the surface without damage. Equipment or vehicles should not be driven directly on the fabric.
  - Excavate a footing trench along the toe of the slope.
  - Local surface irregularities should not vary from the planned slope by more than 0.3 meters as measured at right angles to the slope.
- Rock and Mortar Slope Protection
  - If the rocks are to be grouted in place with concrete, the rocks should be cleaned of any adhering dirt or clay and then moistened. The concrete should be placed with buckets, chutes, tubes, pneumatic equipment, or other mechanical means and then spaded and rodded into place to ensure adequate penetration. After the concrete has been placed, the rocks should be thoroughly brushed so that their top surfaces are exposed.
- Concrete Slope Protection
  - Concrete slope protection consists of constructing Portland concrete cement or shotcrete slope paving under the ends of bridges and at other locations.
  - Foundation areas should be evenly graded and thoroughly compacted, with moisture sufficient to allow a firm foundation and to prevent absorption of water from the concrete or mortar. Work should be scheduled so that the work (including placing, finishing, and application of curing compound) between timber borders is started and completed in the same day. There should not be any construction joints between timber spacers.

4.1 CONSTRUCTION SITE BMPs (CATEGORY II)

This section lists and describes those BMPs considered during the construction of Caltrans projects. They are best conventional technology/best available technology (BCT\BAT)-based temporary control practices that are consistent with the BMPs and control practices required under the State of California NPDES General Permit for Storm Water Discharges Associated with Construction Activity. Temporary control practices include soil stabilization, sediment control, wind erosion control, tracking control, non–storm water control and waste management and materials pollution control.

Table 4-1 lists the construction site BMPs and their potential applications. BMP inspection requirements are identified in Section 4.2. Guidance and general principles for implementing soil stabilization and sediment control BMPs on disturbed soil areas are discussed in Section 4.3. Guidance for selecting and implementing wind erosion controls, tracking controls, non–storm water, and waste management and materials pollution controls are addressed in Section 4.4. BMPs are described in Section 4.5.

TABLE 4-1: CONSTRUCTION SITE STORM WATER POLLUTION PREVENTION BMPs AND APPLICATIONS

Best Management Practices	Page Number of This Section	Construction Site BMPs (Category II)					
		Soil Stabilization Practices	Sediment Control Practices	Wind Erosion Control	Tracking Control Practices	Non-Storm Water Control	Waste Management and Materials Pollution Control
Temporary Sediment Control	4-12						
Silt Fence	4-12		X				
Sandbag Barrier	4-14		X				
Straw Bale Barrier	4-16		X				
Fiber Rolls	4-18		X				
Gravel Bag Berm	4-19		X				
Check Dam	4-20		X				
Desilting Basin	4-22		X				
Sediment Trap	4-25		X				
Sediment Basin	4-26		X				
Temporary Soil Stabilization	4-27						
Hydraulic Mulch	4-27	X		X			
Hydroseeding	4-28	X		X			
Soil Binders	4-29	X		X			
Straw Mulch	4-30	X		X			
Geotextiles, Mats/Plastic Covers and Erosion Control Blankets	4-31	X		X			
Scheduling	4-33	X	X	X	X	X	X
Preservation of Existing Vegetation	4-33	X	X	X			
Temporary Concentrated Flow Conveyance Controls	4-34						
Earth Dikes/Drainage Swales & Lined Ditches	4-34	X					

TABLE 4-1: CONSTRUCTION SITE STORM WATER POLLUTION PREVENTION BMPs AND APPLICATIONS

Best Management Practices	Page Number of This Section	Construction Site BMPs (Category II)					
		Soil Stabilization Practices	Sediment Control Practices	Wind Erosion Control	Tracking Control Practices	Non-Storm Water Control	Waste Management and Materials Pollution Control
Outlet Protection/Velocity Dissipation Devices	4-36	X					
Slope Drains	4-38	X					
Temporary Stream Crossing	4-39	X					
Clear Water Diversion	4-41	X				X	
Wind Erosion Control	4-43			X			
Sediment Tracking Control	4-44						
Street Sweeping and Vacuuming	4-44				X		
Stabilized Construction Roadway	4-44	X		X	X		
Entrance/Outlet Tire Wash	4-45				X		
Waste Management	4-46						
Spill Prevention and Control	4-47						X
Solid Waste Management	4-48						X
Hazardous Waste Management	4-49						X
Contaminated Soil Management	4-50						X
Concrete Waste Management	4-53						X
Sanitary/Septic Waste Management	4-55						X
Liquid Waste Management	4-56						X
Materials Handling	4-56						
Material Delivery and Storage	4-57						X
Material Use	4-58						X
Vehicle and Equipment Operations	4-59						
Vehicle and Equipment Cleaning	4-59						X
Vehicle and Equipment Fueling	4-60						X
Vehicle and Equipment Maintenance	4-61						X
Paving Operations	4-62						X
Stockpile Management	4-63						X
Water Conservation Practices	4-64					X	
Potable Water/Irrigation	4-65			X			X
Dewatering Operations	4-66					X	
Illicit Connection/Illegal Discharge Detection and Reporting	4-76					X	
Storm Drain Inlet Protection ⁕	4-76		X				
Stabilized Construction Entrance / Exit ⁕	4-78				X		

⁕ See Section 4.6, Best Management Practices: Further Research Needed.

4.2 BMP INSPECTIONS

The temporary control practices deployed on construction sites will be regularly inspected. Improperly installed or damaged practices shall be corrected immediately or by a later date and time if requested by the contractor and approved by the Resident Engineer (RE) in writing, but not later than the onset of subsequent rain events. Inspections of the construction site for temporary control practices are conducted as follows:

- Prior to a forecast storm;
- After a rain event that causes runoff from the construction site; and
- At 24-hour intervals during extended rain events.

4.3 TEMPORARY SOIL STABILIZATION AND SEDIMENT CONTROL IMPLEMENTATION GUIDANCE

Storm water pollution control requirements are intended to be implemented on a year-round basis at an appropriate level. The requirements must be implemented in a proactive manner during all seasons while construction is ongoing. California has varied rainfall patterns throughout the state; therefore, the appropriate level of BMP implementation will also vary throughout the state. The temporary sediment controls and soil stabilization specified in this section are based on rainfall patterns (time frames, intensities, and amounts), general soil types, the seasons, slope inclinations and slope lengths. Appropriate water pollution control includes the implementation of an effective combination of both erosion and sediment controls.

This section describes both general principals and specific guidance for selecting and implementing soil stabilization and sediment control BMPs. Sections 4.3.1, 4.3.2, and 4.3.3 provide key principles for preventing erosion on construction sites. Section 4.3.4 provides specific guidance for selecting and implementing soil stabilization and sediment control BMPs to manage disturbed soil areas.

4.3.1 Scheduling

Construction scheduling shall consider the amount and duration of soil exposed to erosion by wind, rainfall, runoff and vehicle tracking and seek to minimize disturbed soil area in the rainy season. A schedule shall be prepared that shows the sequencing of construction activities with the installation of erosion and sediment control BMPs. See Section 4.5.3 of the Guidelines for BMP details.

4.3.2 Preservation of Existing Vegetation

Preserving existing vegetation to the maximum extent possible and for as long as possible on a construction site reduces or eliminates erosion in those areas. To facilitate this practice, on a year-round basis temporary fencing shall be provided prior to commencement of clearing and grubbing operations or other soil-disturbing activities in areas where no construction activity is

planned or construction will occur at a later date. See Section 4.5.4 of the Guidelines for BMP details.

4.3.3 Storm Water Run-on and Concentrated Flows

The diversion of storm water run-on and conveyance of concentrated flows must be considered in determining the appropriateness of the BMPs chosen. BMPs to divert or manage concentrated flows in a non-erodible fashion may be required on a project-by-project basis to divert off-site drainage through or around the construction site or to properly manage construction site storm water runoff. See Section 4.5.5 of the Guidelines for BMP details.

4.3.4 Disturbed Soil Area Management

These disturbed soil area management guidelines are based on rainfall patterns (time frames, intensities, and amounts), general soil types, the seasons, slope inclinations, and slope lengths. All of these factors are considered in developing the appropriate levels of soil stabilization and sediment control, and will be considered by the RE when directing specific site-by-site actions.

4.3.4.1 Definitions

Disturbed Soil Area

Disturbed soil areas (DSAs) are areas of exposed, erodible soil that are within the construction limits and that result from construction activities. The following are not considered DSAs:

- Areas where soil stabilization, erosion control, highway planting, or slope protection are applied and associated drainage facilities are in place and functional.
- Roadways, construction roads, access roads or contractor's yards that have been stabilized by the placement of compacted subbase or base material or paved surfacing.
- Areas where construction has been completed in conformance with the contract plans and permanent erosion control is in place and functional.

Erosion control is considered functional when a uniform vegetative cover equivalent to 70 percent of the native background vegetation coverage has been established or equivalent stabilization measures have been employed.

Active and Nonactive Areas

Active areas are construction areas where soil-disturbing activities have already occurred and continue to occur or will occur during the ensuing 21 days.

Nonactive areas are construction areas (formerly active areas) that will be idle for at least 21 days.

The RE will conduct a review of the existing active areas on a regular basis to determine if a nonactive status should be applied to some DSAs.

Slope Length and Benches

Slope length is measured or calculated along a continuous inclined surface. Each discrete slope is between one of the following: top to toe, top to bench, bench to bench, and bench to toe.

Benches are drainage facilities that intercept surface flow and convey the resulting concentrated flow away from a slope. For the purpose of determining slope lengths, fiber rolls or other appropriate BMPs (used for temporary sediment control) can be considered equivalent to a bench.

Rainy Season

The average rainfall in California varies greatly from region to region. To account for the various rainfall patterns (time frame, intensities, and amounts) the state is separated into several rainy seasons. Figure 4-1 is a map identifying the rainy seasons throughout the state. These rainy seasons are used to identify the appropriate level of soil stabilization and sediment control protection.

4.3.4.2 DSA Protection by Temporary Soil Stabilization and Sediment Controls

To account for rainfall patterns (time frames, intensities, and amounts) and to a lesser extent general soil type differences, the state has been divided into seven areas requiring common protection requirements. These rainfall areas are defined in Table 4-2. The specific temporary erosion and sediment control practices for DSA protection in each area are determined from Tables 4-3 and 4-4. Based on consultation with experts, the slope length and slope inclination are seen as the most important criteria for soil stabilization and sediment control requirements, as these factors have the largest potential impact on the erosion rate. As indicated on these tables, the temporary erosion and sediment controls at a construction site will increase with increasing slope inclination and length.

DSAs shall be protected as follows:

- Temporary control practices (as required in Table 4-3) shall be performed on nonactive DSAs within 14 days from the cessation of soil-disturbing activities or one day prior to the onset of precipitation, whichever occurs first.
- Temporary control practices for active DSAs (as required in Table 4-4) shall be performed prior to the onset of precipitation and throughout each day for which precipitation is forecasted.
- For nonactive DSAs, limit the erosive effects of storm water flow on slopes by implementing BMPs such as fiber rolls or gravel bag berms to break up the slope lengths as follows:

  - Slope inclination between 1:20 and 1:2: BMPs shall be placed on slopes 30m and greater at intervals no greater than 15m.
  - Slope inclination 1:2 or greater: BMPs shall be placed on slopes 15m and greater at intervals no greater than 7.5m.
- For nonactive DSAs, permanent erosion control shall be applied to areas deemed substantially complete during the project's defined seeding window.

The requirements are different for construction sites within District 6 within the Lahontan RWQCB jurisdiction, District 7 within the Lahontan RWQCB jurisdiction, District 8 within the Lahontan and Colorado River Basin RWQCB jurisdictions, District 9, and District 11 within the Colorado River Basin RWQCB jurisdiction). The soil stabilization and erosion control practices required for construction sites in these areas will be determined by the applicable RWQCB on a site-by-site basis. The following procedure is to be used to notify the applicable RWQCB for construction in these areas:

- Caltrans will notify the applicable RWQCB staff of construction sites in these areas at least 30 days prior to the start of construction.
- During the 30-day notification period, the RWQCB staff may request to review the SWPPP or meet with Caltrans to discuss the construction project.
- Within the 30-day notification period, the RWQCB may respond with specific soil stabilization and sediment control practices required for the site. If the RWQCB does not respond within the 30-day review period, then Caltrans can proceed with its construction activities as scheduled.
- Regardless of the action of the RWQCB, the RWQCB may inspect the site and take enforcement actions, if necessary, pending inspection findings.

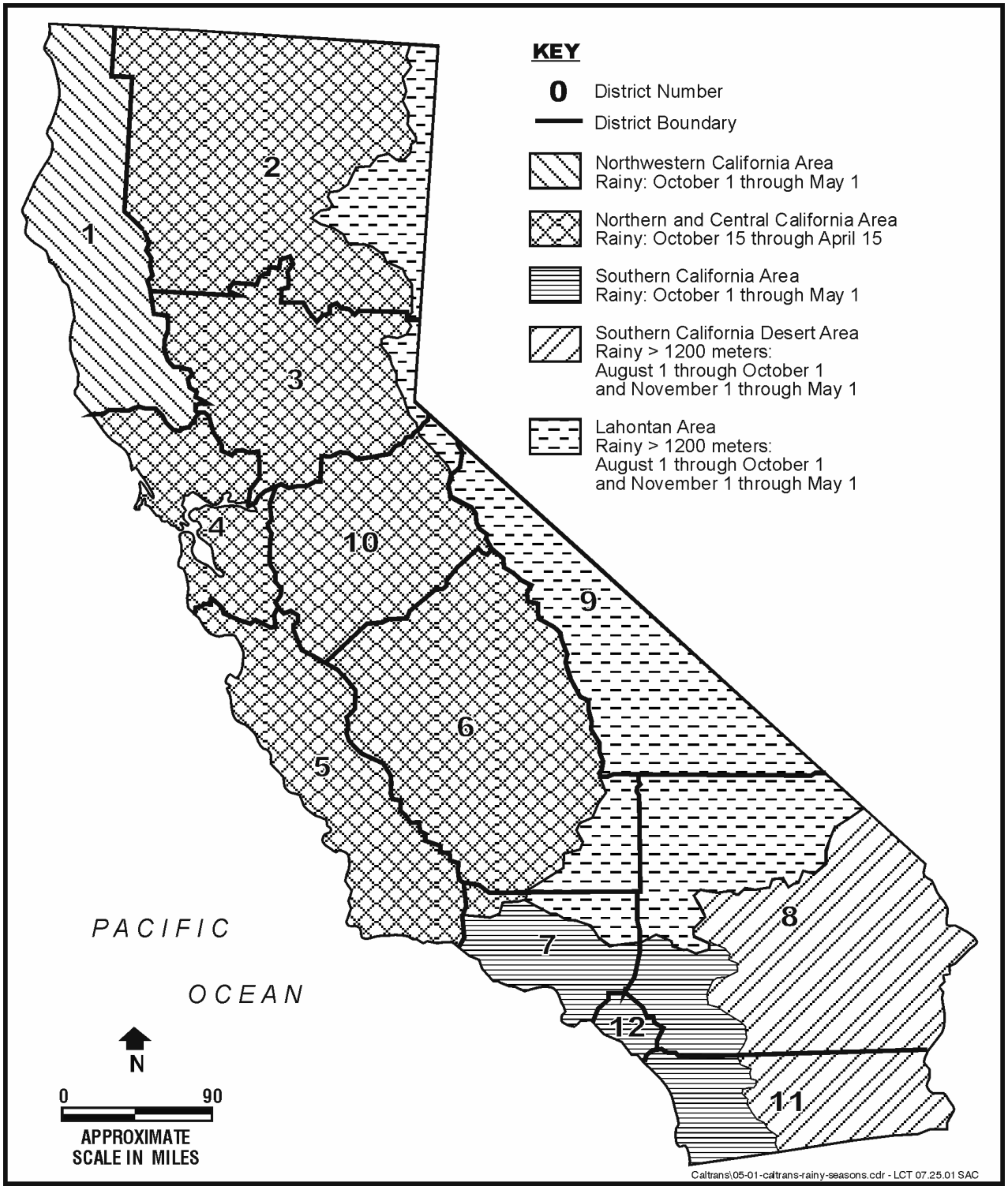


Figure 4-1
Designation Of Rainy Seasons

TABLE 4-2: RAINFALL AREA DEFINITIONS

AREA	DESCRIPTION	
	Applicability	**Elevation**
1[1]	District 1 in the following areas: all of Del Norte and Humboldt Counties within 20 miles of the coast in Mendocino County	≤1200m
2[1]	District 1 (except within Area 1) District 2 within the North Coast, Central Valley and Lahontan RWQCB jurisdictions Districts 3, 4 and 5	<250 m
3[1]	District 1 (except within Area 1) District 2 within the North Coast, Central Valley and Lahontan RWQCB jurisdictions Districts 3, 4 and 5	250m–1200m
4[1]	District 6 within the Central Valley RWQCB jurisdiction District 7 - within the Central Coast, Los Angeles, and Central Valley RWQCB jurisdictions District 8 within the Santa Ana and San Diego RWQCB jurisdictions District 10 District 11 within the San Diego RWQCB jurisdiction District 12	<500m
5[1]	District 6 within the Central Valley RWQCB jurisdiction District 7 within the Central Coast, Los Angeles, and Central Valley RWQCB jurisdictions District 8 within the Santa Ana and San Diego RWQCB jurisdictions District 10 District 11 within the San Diego RWQCB jurisdiction District 12	500m–1200m
6[1]	Statewide	>1200m

[1] See Tables 4-3 and 4-4 for practices in Rainfall Areas 1-6.

TABLE 4-3: RECOMMENDED COMBINATION OF TEMPORARY SOIL STABILIZATION,TEMPORARY SEDIMENT CONTROLS AND BARRIERS [6] [7]

NONACTIVE DISTURBED SOIL AREAS						
SEASON	RAINFALL AREA(S)	TEMPORARY BMP	SLOPE (V:H) [1]			
			≤ 1:20	> 1:20 ≤ 1:4	> 1:4 ≤ 1:2	> 1:2
RAINY [2]	1 & 6	SOIL STABILIZATION [5]	X	X	X	X
		SEDIMENT BARRIER [5]	X	X	X	X
		DESILTING BASIN [3]		X	X	X
	2, 3, 4 & 5	SOIL STABILIZATION [5]	X	X	X	X
		SEDIMENT BARRIER		X	X	X
		DESILTING BASIN				
NON-RAINY	1	SOIL STABILIZATION [5]	X [4]	X [4]	X	X
		SEDIMENT BARRIER		X [4]	X	X
		DESILTING BASIN				
	2 & 4	SOIL STABILIZATION				
		SEDIMENT BARRIER				
		DESILTING BASIN				
	3 & 5	SOIL STABILIZATION				
		SEDIMENT BARRIER				X
		DESILTING BASIN				
	6	SOIL STABILIZATION [5]	X [4]	X [4]	X	X
		SEDIMENT BARRIER		X [4]	X	X
		DESILTING BASIN [3]				X

1. Unless otherwise noted, the temporary BMP is required for the slope inclinations indicated on slope lengths greater than 3 meters.
2. The maximum slope length is 30 meters for slope inclinations between 1:20 and 1:2 and 15 meters for steeper slopes.
3. Required in addition to the temporary sediment barrier, where feasible. Feasibility will depend on site-specific factors such as available right-of-way within the project limits, topography, soil type, disturbed soil area within watershed, and climate conditions.
4. Implementation of controls not required except at least 24 hours prior to all predicted rain events.
5. The indicated temporary BMP is required on all slope lengths.
6. Sediment controls and barriers include all temporary sediment control construction BMPs identified in Appendix B.4 of the SWMP and Section 4 of these Guidelines. Linear barrier systems are equivalent to what are referred to in the General Construction Permit as perimeter controls. The intent is to provide a barrier to prevent the transport of sediment at the downslope edge of disturbed soil areas.
7. Permanent erosion control seeding shall be applied during the defined seeding window to all nonactive areas deemed substantially complete.

TABLE 4-4: RECOMMENDED COMBINATION OF TEMPORARY SOIL STABILIZATION, TEMPORARY SEDIMENT CONTROLS AND BARRIERS [6]

ACTIVE DISTURBED SOIL AREAS [3]					
SEASON	RAINFALL AREA(S)	TEMPORARY BMP	SLOPE (V:H) [1]		
			≤ 1:20	> 1:20 ≤ 1:2	> 1:2
RAINY	1 & 6	SOIL STABILIZATION		X	X
		SEDIMENT BARRIER [4]	X	X	X
		DESILTING BASIN [2]		X	X
	2, 4 & 5	SOIL STABILIZATION			
		SEDIMENT BARRIER		X	X
		DESILTING BASIN [2]			X [5]
	3	SOIL STABILIZATION			X [5]
		SEDIMENT BARRIER		X	X
		DESILTING BASIN [2]			X [5]
NON-RAINY	1	SOIL STABILIZATION			
		SEDIMENT BARRIER		X	X
		DESILTING BASIN [2]			X [5]
	2, 3, 4, & 5	SOIL STABILIZATION			
		SEDIMENT BARRIER			
		DESILTING BASIN			
	6	SOIL STABILIZATION			
		SEDIMENT BARRIER		X	X
		DESILTING BASIN [2]			X

1. Unless otherwise noted, the BMP is required for the slope inclinations indicated on slope lengths greater than 3 meters.
2. Required in addition to the temporary sediment barrier, where feasible. Feasibility will depend on site-specific factors such as available right-of-way within the project limits, topography, soil type, disturbed soil area within watershed, and climate conditions.
3. Implementation of controls not required except prior to predicted rain.
4. The indicated temporary BMP is required on all slope lengths.
5. The indicated temporary BMP is required on slope lengths greater than 15 meters.
6. Sediment controls and barriers include all temporary sediment control construction BMPs identified in Appendix B.4 of the SWMP and Section 4 of these Guidelines. Linear barrier systems are equivalent to what are referred to in the General Construction Permit as perimeter controls. The intent is to provide a barrier to prevent the transport of sediment at the downslope edge of disturbed soil areas.

The practices described herein are typical of those that will be implemented on a project-by-project basis. However, it is important to note that there will be instances where project and site conditions require deviation from the BMPs and the descriptions described in these Guidelines. For instance, the proposed implementation of desilting basins is a new commitment that has not been incorporated into existing designs. In addition, the nature of linear projects and constrained rights-of-way inherent to Caltrans work may prohibit the use of desilting basins at some locations on certain projects and on some projects altogether. Implementation of desilting basins will be considered on a project-by-project basis. Caltrans is committed to refining the desilting basin implementation criteria during the term of this Permit while implementing the desilting basins on projects as practicable.

4.3.4.3 Stockpile Management

Soil stabilization and sediment control requirements as they apply to stockpiles of various materials are presented in Section 4.5.14 of the Guidelines.

4.4 GUIDANCE FOR IMPLEMENTATION OF OTHER BMPs

4.4.1 Mobile Operations

Mobile operations common to the construction of a project include asphalt recycling, concrete mixing, crushing and the storage of materials. BMPs shall be implemented, as appropriate, to control the individual situations these mobile operations can create. Section 4.5 of the Guidelines provides guidance on implementation of BMPs related to the specific activity being conducted.

4.4.2 Wind Erosion Controls

Wind erosion controls shall be considered for all disturbed soils on the project site that are subject to wind erosion and when significant wind and dry conditions are anticipated during construction of the project. See Section 4.5.8 of the Guidelines for BMP details.

4.4.3 Tracking Controls

Tracking controls shall be implemented as needed to reduce the tracking of sediment and debris from the construction site. At a minimum, entrances/exits shall be inspected daily and controls implemented as needed. See Section 4.5.9 of the Guidelines for BMP details.

4.4.4 Non-Storm Water and Waste Management and Materials Pollution Controls

The objective of the non-storm water and waste management and materials pollution controls is to reduce the discharge of materials other than storm water to the storm water drainage system or to receiving waters. These controls shall be implemented for all applicable activities, material usage, and site conditions. Section 4.5 of the Guidelines provides guidance on implementation of BMPs related to the specific activity being conducted.

4.5 BEST MANAGEMENT PRACTICES

Temporary construction BMPs are approved for implementation on Caltrans construction projects as appropriate.

4.5.1 Temporary Sediment Control

Temporary sediment control practices include those practices that intercept and slow or detain the flow of storm water to allow sediment to settle and be trapped. These practices can consist of installing temporary linear sediment barriers (such as silt fences, fiber rolls, sandbag barriers, and straw bale barriers); providing fiber rolls, gravel bag berms, or check dams to break up slope length or flow; or constructing a temporary desilting basin, sediment trap, or sediment basin. Linear sediment barriers are typically placed below the toe of exposed and erodible slopes, downslope of exposed soil areas, around temporary soil stockpiles and at other appropriate locations along the site perimeter. Temporary sediment control practices and appropriate applications are described below.

Silt Fence

Description:

> A silt fence is a temporary linear sediment barrier of permeable fabric designed to intercept and slow the flow of sediment-laden sheet flow runoff. Silt fences allow sediment to settle from runoff before water leaves a construction site.

Appropriate Applications:

- Silt fences are typically placed below the toe of exposed and erodible slopes, downslope of exposed soil areas or around temporary soil stockpiles.
- Silt fences shall be constructed with a set-back of at least 1m from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.

Implementation:

- Silt fences shall be implemented in conformance with the criteria presented in Section 4.3.4.
- A conceptual silt fence is shown in Figure 4-2.

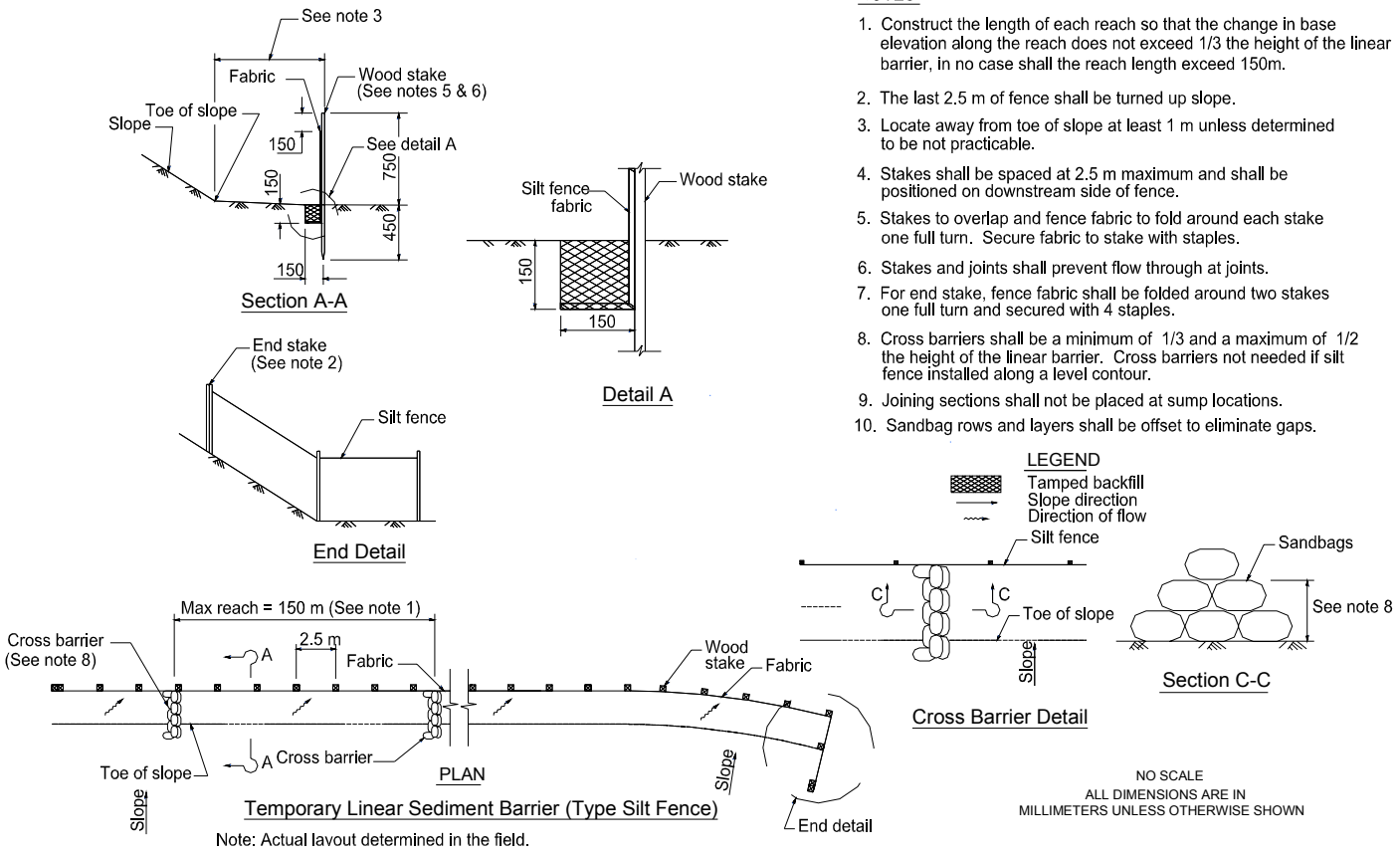


Figure 4-2
Conceptual Temporary Linear Sediment Barrier (Silt Fence)

Maintenance:

- Repair undercut silt fences. Repair or replace split, torn, slumping or weathered fabric.
- Remove sediment when accumulation reaches one-third of the fence height. Sediments removed shall be disposed of properly.
- Remove a silt fence when it is no longer needed. Fill and compact post holes and anchorage trench, remove sediment accumulation and grade fence alignment to blend with adjacent ground.

Sandbag Barrier

Description:

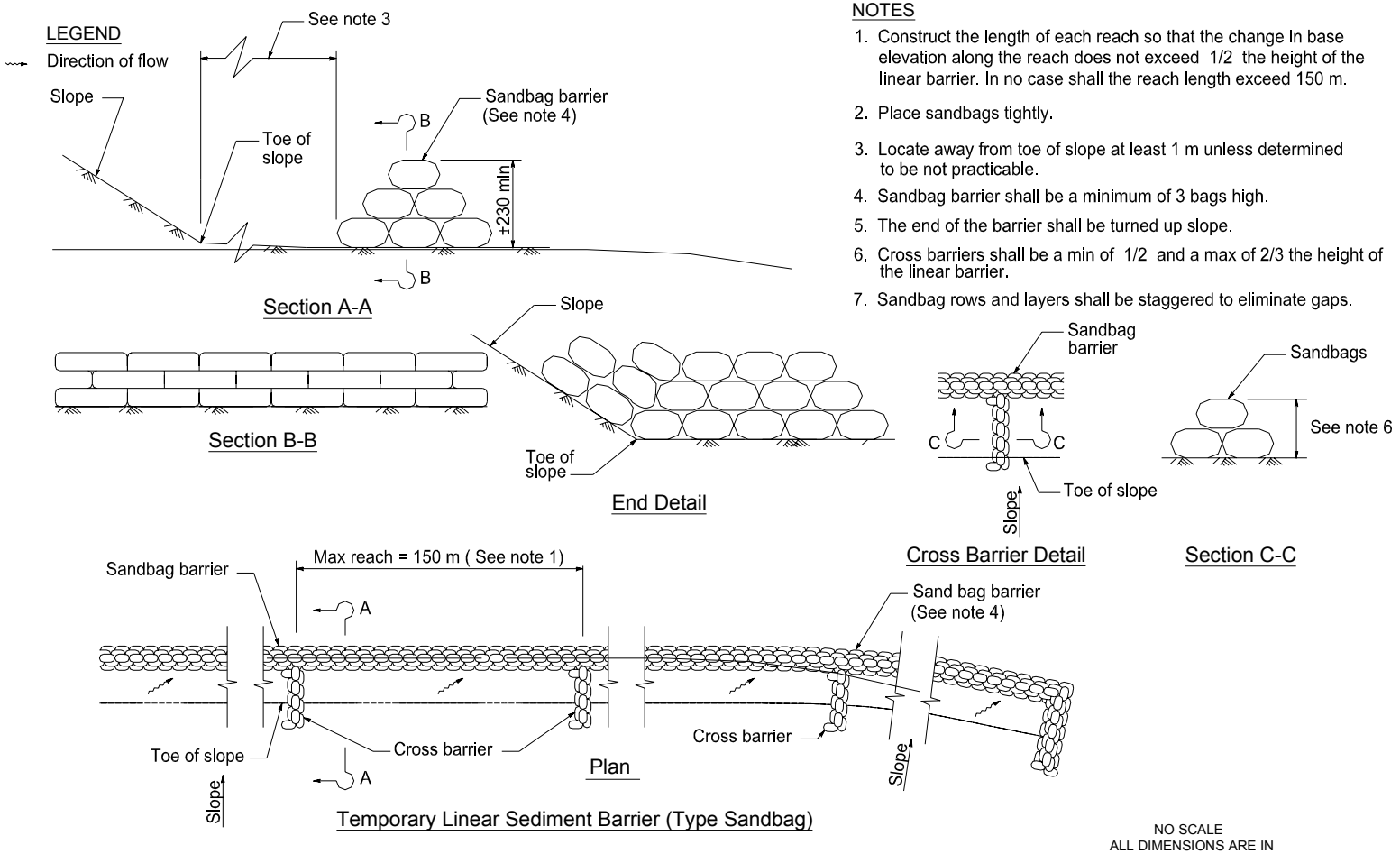
A sandbag barrier is a temporary linear sediment barrier consisting of stacked sandbags designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sandbag barriers allow sediment to settle from runoff before water leaves a construction site.

Appropriate Applications:

- Sandbag barriers are typically placed below the toe of exposed and erodible slopes, downslope of exposed soil areas or around temporary soil stockpiles.
- Sandbag barriers shall be constructed with a set-back of at least 1m from the toe of a slope. Where it is determined to be not practicable due to specific site conditions, the sandbag barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the PE.

Implementation:

- Sandbag materials:
  - Bag material shall be either polypropylene, polyethylene, or polyamide woven fabric.
  - Fill material shall be noncohesive coarse sand/or gravel free from deleterious material.
- Sandbag barriers shall be implemented in conformance with the criteria presented in Section 4.3.4.
- A conceptual sandbag barrier is shown in Figure 4-3.



NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 150 m.
2. Place sandbags tightly.
3. Locate away from toe of slope at least 1 m unless determined to be not practicable.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.

NO SCALE
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

Note: Actual layout determined in the field.

Figure 4-3
Conceptual Temporary Linear Sediment Barrier (Sandbag)

Maintenance:

- Reshape or replace sandbags as needed.
- Repair washouts or other damages as needed.
- Remove sediment when accumulation reaches one-third of the barrier height. Sediments removed shall be disposed of properly.
- Remove sandbags when no longer needed. Remove sediment accumulation, clean, regrade and stabilize the area.

Straw Bale Barrier

Description:

A straw bale barrier is a temporary linear sediment barrier consisting of straw bales designed to intercept and slow the flow of sediment-laden sheet flow runoff. Straw bale barriers allow sediment to settle from runoff before water leaves a construction site.

Appropriate Applications:

- Straw bale barriers are typically placed below the toe of exposed and erodible slopes, downslope of exposed soil areas or around temporary soil stockpiles.
- Straw bale barriers shall be constructed with a set-back of at least 1m from the toe of a slope. Where it is determined to be not practicable due to specific site conditions, the straw bale barrier may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practicable.
- This BMP may be implemented on a project-by-project basis in addition to other BMPs when determined necessary and feasible by the PE.

Implementation:

- Straw bale barriers shall be implemented in conformance with the criteria presented in Section 4.3.4.
- A conceptual straw bale barrier is shown in Figure 4-4.

Maintenance:

- Repair or replace damaged straw bales as needed.
- Repair washouts or other damage as needed.

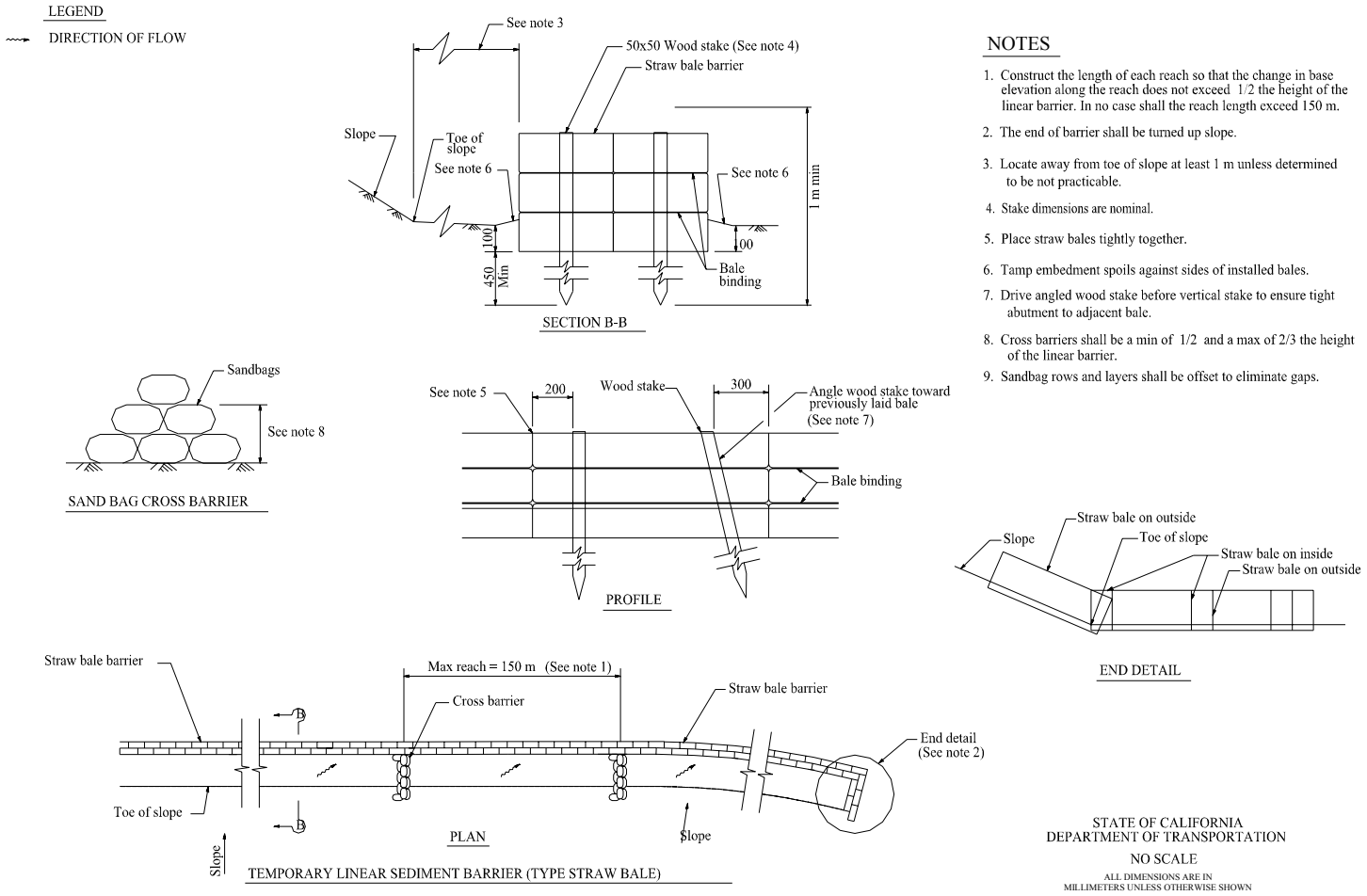


Figure 4-4
Conceptual Temporary Linear Sediment Barrier (Straw Bale)

- Remove sediment when accumulation reaches one-third of the barrier height. Sediments removed shall be disposed properly.
- Remove straw bales when no longer needed. Regrade and stabilize the area.

Fiber Rolls

Description:

A fiber roll consists of straw, flax, or other similar materials that are rolled or bound into a tight tubular roll and placed on the face of slopes at regular intervals to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide some removal of sediment from the runoff.

Appropriate Applications:

- Fiber rolls shall be implemented in conformance with the criteria presented in Section 4.3.4.
- May be used along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
  - Slope inclination between 1:20 and 1:2: BMPs shall be placed on slopes 30m and greater at intervals no greater than 15m; and
  - Slope inclination 1:2 or greater: BMPs shall be placed on slopes 15m and greater at intervals no greater than 7.5m.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.

Implementation:

- Fiber roll materials are either:
  - Prefabricated rolls; or
  - Rolled tubes of erosion control blanket.
- Assembly of field-rolled fiber roll
  - Roll length of erosion control blanket into a tube.
  - Bind roll at each end and along length of roll with jute-type twine.
- Installation
  - Install fiber rolls on level contours.
  - Stake fiber rolls into a trench.
- A conceptual fiber roll installation is shown in Figure 4-5.

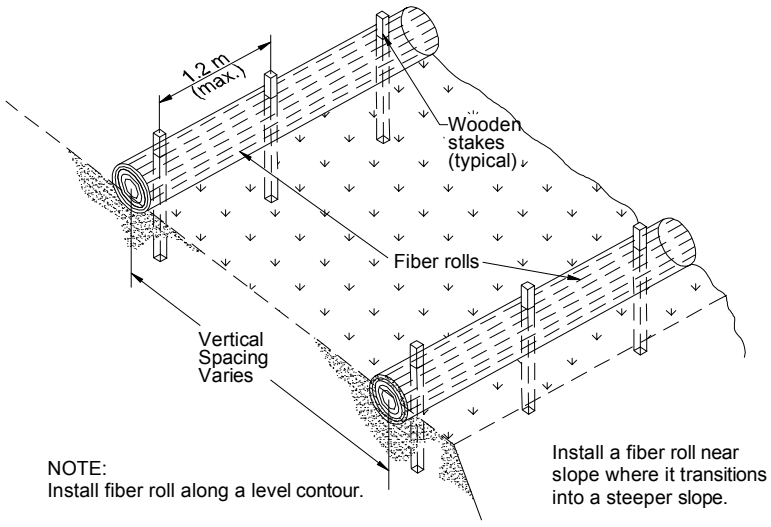


Figure 4-5
Conceptual Fiber Roll Installation

Maintenance:

Repair or replace split, torn, unraveling, or slumping fiber rolls.

Gravel Bag Berm

Description:

A gravel bag berm consists of a single row of gravel bags that are installed end to end to form a barrier across a slope to intercept runoff, reduce its flow velocity, release the runoff as sheet flow and provide some removal of sediment from the runoff.

Appropriate Applications:

- Gravel bag berms shall be implemented in conformance with the criteria presented in Section 4.3.4.
- May be used along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
  - Slope inclination between 1:20 and 1:2: BMPs shall be placed on slopes 30m and greater at intervals no greater than 15m; and
  - Slope inclination 1:2 or greater: BMPs shall be placed on slopes 15m and greater at intervals no greater than 7.5m.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.

- Although gravel bag berms provide some sediment removal, this BMP is not to be used in place of a linear sediment barrier (i.e., a silt fence, sandbag barrier, or straw bale barrier).

Implementation:

- Gravel bag berm materials:
  - Bag material shall be either polypropylene, polyethyline, or polyamide woven fabric or burlap.
  - Fill material shall be one-half to one-inch of clean aggregate.
- Installation:
  - Install gravel bag berm on a level contour.
  - Tightly abut bags.

Maintenance:

- Reshape or replace gravel bags as needed.
- Repair washouts or other damages as needed.
- Remove sediment when accumulation reaches one-third of the berm height. Sediments removed shall be disposed of properly.
- Remove gravel bags when no longer needed. Remove sediment accumulation. Clean, regrade and stabilize the area.

Check Dam

Description:

A check dam is a small device constructed of rock or gravel bags placed across a natural or man-made channel or drainage ditch. Erosion of the drainage ditch is reduced by restricting the velocity of flow in the ditch.

Appropriate Applications:

Check dams may be installed in small open channels that drain 4 hectares (ha) or less, in steep channels where runoff velocities exceed 1.5 meters per second (m/s), during the establishment of grass linings in drainage ditches or channels, or in temporary ditches where the short length of service does not warrant the establishment of erosion-resistant lining.

- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Not to be used in live streams.

- Not appropriate in channels that drain areas greater than 4 ha (10 acres).
- Not to be placed in channels that are already grass lined.
- Not to be constructed from straw bales or a silt fence.

Implementation:

- Check dams shall be placed at a distance and height to allow small pools to form behind them.
- For multiple check dam installation, backwater from downstream check dam shall reach the toe of the upstream dam.
- High flows (typically, a two-year storm or larger) shall safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams shall be removed when the grass has matured sufficiently to protect the ditch or swale.
- A sump shall be provided immediately upstream of the check dam for the purpose of capturing excessive sediment.
- A conceptual rock check dam is shown in Figure 4-6.

Maintenance:

- Remove sediment when depth reaches one-third of the check dam height.

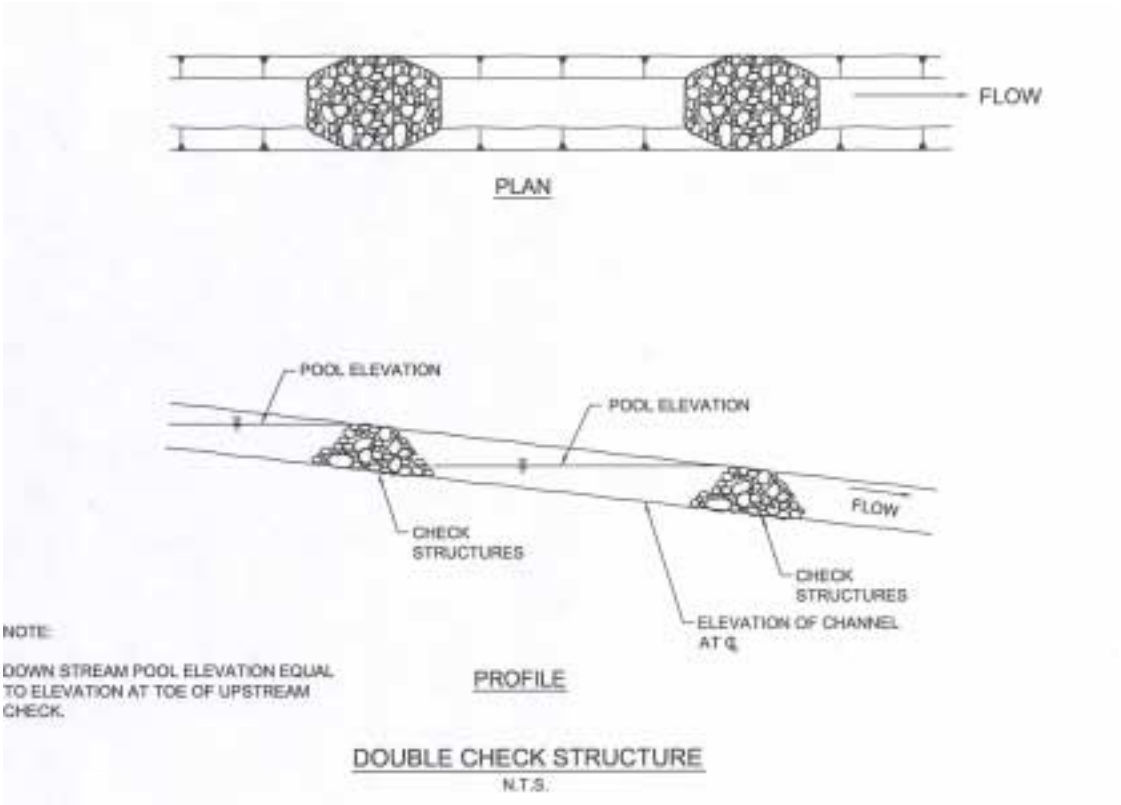


Figure 4-6
Conceptual Rock Check Dam

Desilting Basin

Description:

A desilting basin is a temporary basin formed by excavation and/or constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out during infiltration or before the runoff is discharged.

Appropriate Applications:

Desilting basins are designed to accommodate size limitations typically associated with linear construction activities. Desilting basins shall be considered for use on construction projects with disturbed areas where sediment-laden water may enter drainage systems or watercourses.

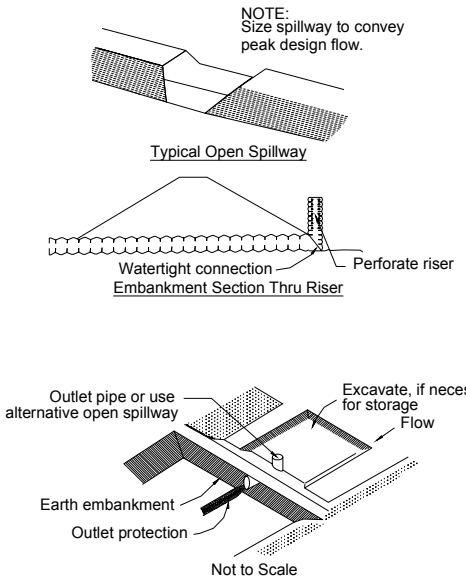
Implementation:

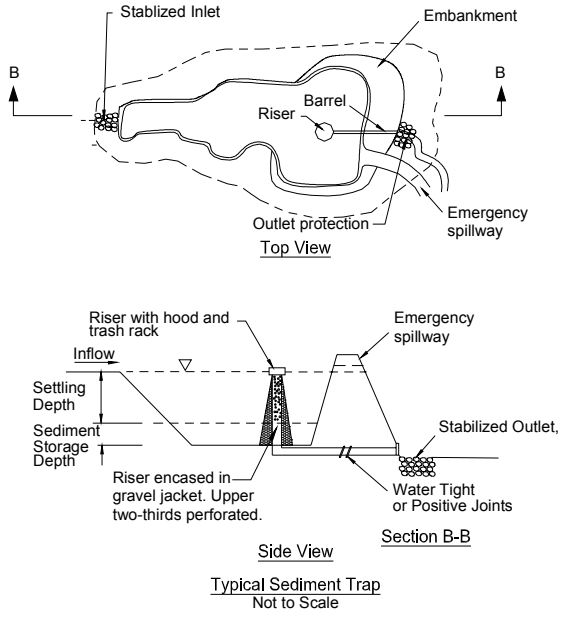
- Temporary desilting basins shall be implemented in conformance with the criteria presented in Section 4.3.4.

- The typical design will capture particles with a diameter of 0.02 mm or greater, as well as a fraction of particles between 0.01 mm and 0.02 mm. The General Permit requires capture of particles 0.01 mm and greater; therefore, a desilting basin should not be considered a standalone BMP and must be used in conjunction with other appropriate sediment and erosion control devices.
- Non-storm water discharges and runoff from undisturbed areas should not be routed to the basin to avoid compromising the basin's design capacity and treatment efficiency.
- Desilting basins will be designed to have a capacity equivalent to 100 cubic meters of storage (as measured from the bottom of the basin to the principal outlet) per hectare of contributory area.
- The length of the basin should be more than twice the width of the basin. The length shall be determined by measuring the distance between the inlet and the outlet. The depth must not be less than one meter nor greater than 1.5 meters.
- Inlets should be a type of diffusing device that will prevent erosion of the basin bottom or bank and reduce resuspension of particles, such as energy dissipaters at the bottom of a paved rundown.
- Outlets should be capable of slowly releasing the design capture volume over the design drainage time. The design should reduce clogging and provide ease of maintenance. An example of an appropriate outlet would be a perforated riser. Outlets shall also be equipped with an emergency spillway.
- Limit the contributing area to the desilting basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the desilting basin.
- Avoid dewatering of groundwater to the desilting basin during the rainy season. Insignificant quantities of accumulated precipitation may be dewatered to the desilting basin unless precipitation is forecasted within 24 hours.
- Basins will be designed to drain within 72 hours following storm events.
- Temporary desilting basins must be fenced if safety is a concern.
- Conceptual temporary desilting basins are shown in Figure 4-7.

Maintenance

- Check basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Remove sediments when storage zone is one-third full.





Note: Actual layout determined in the field.

Figure 4-7
Conceptual Temporary Desilting Basins

Sediment Trap

Description:

A sediment trap is a small temporary containment area which allows sediment in collected storm water to settle out during infiltration or before the runoff is discharged through a rock spillway. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Appropriate Applications:

Sediment traps may be used on construction projects where the contributing drainage area is less than 2 ha (5 acres). Traps would be placed where sediment-laden storm water may enter a storm drain or watercourse.

- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Requires large surface areas to permit infiltration and settling of sediment.
- Not appropriate for drainage areas greater than 2 ha (5 ac).
- Not to be located in live streams.

Implementation:

- Traps shall be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Areas under embankments, structural works, and sediment traps shall be cleared and stripped of vegetation.
- Trap inlets shall be located to maximize the travel distance to the trap outlet. Use rock or vegetation to protect the trap outlets against erosion.
- To dewater the trap, water that doesn't infiltrate will be pumped out and treated using the methods described in Section 4.5.17.

Maintenance:

- Check trap banks for seepage and structural soundness.
- Check rock spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check outlet area for erosion and stabilize if required.

- Remove accumulated sediment when its volume reaches one-third the volume of the trap.
- Properly dispose of sediment and debris removed from the trap.

Sediment Basin

Description:

A sediment basin is a temporary basin designed with a controlled release structure. Sediment basins are designed with a rock spillway and are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Appropriate Applications:

- Sediment basins shall be designed in accordance with Section A of the State of California NPDES General Permit for Storm Water Discharges Associated with Construction Activities where sediment basins are the only control measure proposed for the site;
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Requires large surface areas to permit settling of sediment.
- Not to be located in live streams.

Implementation:

- Areas under sediment basin embankments shall be cleared and stripped of vegetation.
- Basin inlets shall be located to maximize the travel distance to the basin outlet. Use rock or vegetation to protect the basin outlets against erosion.
- To dewater the basin, the outlet shall be constructed in one of the following two ways: (1) use corrugated metal or reinforced concrete riser pipe with dewatering holes encased in gravel; or (2) construct a crushed stone outlet section of the embankment at the low point of the basin.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- Basins will be designed to drain within 72 hours following storm events.
- Temporary sediment basins must be fenced if safety is a concern.

Maintenance:

- Check basin banks for seepage and structural soundness.
- Check outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check outlet area for erosion and stabilize if required.
- Remove accumulated sediment when its volume reaches one-third the volume of the trap. Properly dispose of sediment and debris removed from the trap.

4.5.2 Temporary Soil Stabilization

Temporary soil stabilization consists of preparing the soil surface and applying one of the following BMPs, or combination thereof, to disturbed soil areas:

- Hydraulic mulch;
- Hydroseeding;
- Soil binder;
- Straw mulch; or
- Geotextiles, mats/plastic covers and erosion control blankets.

Temporary soil stabilization is appropriate for application to disturbed soil areas of construction projects. Temporary soil stabilization shall be implemented in conformance with the criteria presented in Section 4.3.4.

Hydraulic Mulch

Description:

Hydraulic mulch is an erosion control measure that consists of applying a mixture of shredded wood fiber and tackifier with hydro-mulching equipment.

Appropriate Applications:

Hydraulic mulch is typically applied to disturbed areas requiring temporary protection until permanent vegetation is established or disturbed areas that must be re-disturbed following an extended period of inactivity. Avoid use in areas where the mulch would be incompatible with future earthwork activities and would have to be removed.

Implementation:

- Typical application rates are 1,500 pounds per acre.
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking should only be used where rolling is impractical.
- Avoid mulch over-spray onto the traveled way, sidewalks, lined drainage channels, or existing vegetation.

Maintenance:

Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked. Repair any damaged ground cover and re-mulch exposed areas of soil.

Hydroseeding

Description:

Hydroseeding typically consists of applying a mixture of wood or paper fiber, seed, fertilizer and stabilizing emulsion with hydro-mulch equipment.

Appropriate Applications:

Hydroseeding is typically applied on disturbed areas requiring temporary protection until permanent vegetation is established or disturbed areas that must be re-disturbed following an extended period of inactivity.

Implementation:

- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydroseeding must be used in conjunction with mulching (i.e., straw mulch).
- Avoid use in areas where the BMP would be incompatible with future earthwork activities and would have to be removed.
- Prior to application, roughen embankment and fill areas.
- Hydroseeding can be accomplished using a multiple-step or one-step process. The multiple-step process ensures maximum direct contact of the seeds to soil. When the one-step process is used to apply the mixture of wood fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Avoid mulch over-spray onto the traveled way, sidewalks, lined drainage channels, or existing vegetation.

Maintenance:

All seeded areas shall be checked for failures and re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates. Any temporary revegetation efforts that do not provide adequate cover within 30 days of planting must be revegetated within 40 days of the initial installation.

Soil Binders

Description:

Soil binders consist of applying and maintaining polymeric or lignin sulfonate soil stabilizers or emulsions.

Appropriate Applications:

Soil binders are typically applied to disturbed areas requiring short-term temporary protection. Because soil binders can often be incorporated into the work, they may be a good choice for areas where grading activities will soon resume.

There are a wide variety of soil binders available for use, with a wide variety of application limitations. The manufacturers specifications shall be reviewed and compared to the site-specific conditions. In selecting a soil binder, the following criteria should be considered:

- Availability of product;
- Ease of cleanup;
- Installed cost;
- Degradability (how the product degrades and what its by-products are);
- Length of drying time;
- Erosion control effectiveness;
- Longevity;
- Mode of application and availability of application equipment;
- Residual impact on future construction activities; and
- Water quality impact.

Implementation:

- Prior to application, roughen embankment and fill areas. Track walking should only be used where rolling is impractical. Pre-wet the soil if called for by the manufacturer's specifications.

- Apply soil binders per manufacturer's specifications.
- Soil binders shall be nontoxic to plant and animal life and shall not stain paved or painted surfaces.
- Soil binders shall not be applied to frozen soil, areas with standing water, or when the air temperature is below 4º C (39.2°F) during the curing period.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders shall not be applied during or immediately before rainfall.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, or and/or vegetation.

Maintenance:

Check protected areas to ensure proper coverage and re-apply soil binder as needed.

Straw Mulch

Description:

Straw mulch consists of the placing of a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a stabilizing emulsion.

Appropriate Applications:

Straw mulch is typically used for soil stabilization as a temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetation is established. Straw mulch is also typically used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Implementation:

- Typical application rates are a minimum of 4,000 pounds per acre.
- Avoid use in areas where the straw mulch would be incompatible with future earthwork activities and would have to be removed.
- Straw mulch shall be derived from wheat, rice or barley.
- If stabilizing emulsion will be used to anchor the straw mulch in lieu of incorporation, roughen embankment and fill areas before placing the straw mulch by rolling with a crimping or punching-type roller or by track walking. Track walking should only be used where rolling is impractical.
- Straw mulch with emulsion shall not be applied during or immediately before rainfall.
- Avoid placing straw mulch onto the traveled way, sidewalks, lined drainage channels, or existing vegetation.

Maintenance:

Maintain an unbroken, temporary mulched ground cover while DSAs are nonactive. Repair any damaged ground cover and re-mulch exposed areas.

Geotextiles, Mats/Plastic Covers and Erosion Control Blankets

Description:

This BMP involves the placement of geotextiles, mats, plastic covers or erosion control blankets to stabilize disturbed soil areas.

Appropriate Applications:

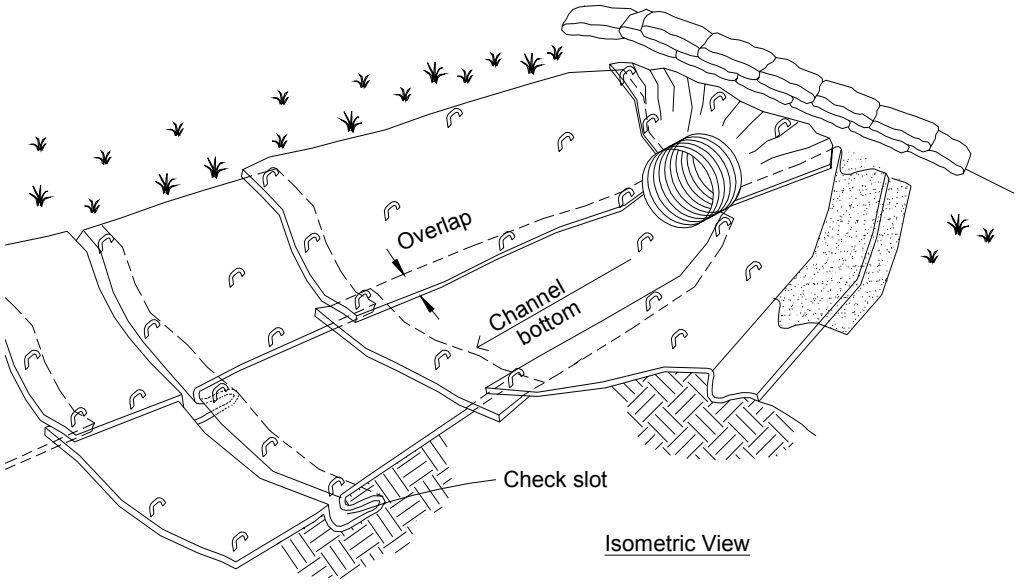
These measures are typically used where disturbed soils may be particularly difficult to stabilize, including steep slopes (greater than 1:3 [vertical:horizontal]), slopes where erosion hazard is high, slopes where mulch must be anchored, disturbed areas where plants are slow to develop, channels with flows exceeding approximately 1.0 m/s and in channels to be vegetated.

Implementation:

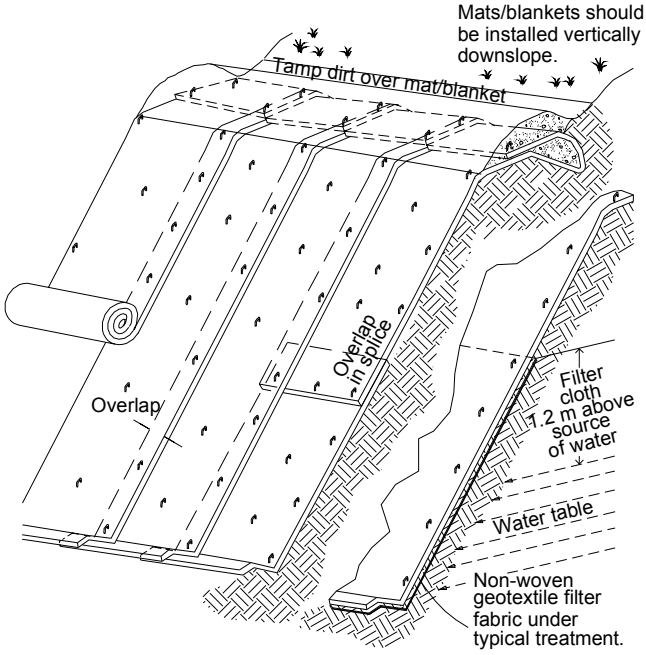
Illustrations of conceptual geotextiles, mats/plastic covers, and erosion control blankets are shown in Figure 4-8.

Maintenance:

- Check for erosion and undermining. Any failures shall be repaired immediately.
- If washout or breakages occur, re-install the material after repairing the damage to the slope or channel.



Isometric View



Wet Slope Lining
Not to Scale

Note: Actual layout determined in the field.

Figure 4-8
Conceptual Geotextiles, Mats/Plastic Covers and Erosion Control Blankets

4.5.3 Scheduling

Scheduling

Description:

This BMP involves a schedule for every project that considers sequencing of construction activities with the installation of erosion and sediment control measures. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff and vehicle tracking and to perform the construction activities and control practices in accordance with the planned schedule.

Appropriate Applications:

Construction sequencing shall typically be scheduled to minimize land disturbance for all projects during the winter season.

Implementation:

- Consider scheduling work items such as clearing and grubbing, grading and excavation to minimize the active construction area during the rainy season.
- Minimize soil-disturbing activities during the rainy season.
- Consider scheduling when establishing permanent vegetation (appropriate planting time for specified vegetation).

Maintenance:

- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- When changes are warranted, amend the sequence scheduling in advance to maintain sediment control.

4.5.4 Preservation of Existing Vegetation

Description:

Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits.

Appropriate Applications:

- Preserve existing vegetation at areas on a site where no construction activity is planned or where it will occur at a later date.
- As described in Section 4.3.2, on a year-round basis temporary fencing shall be provided prior to the commencement of clearing and grubbing operations or other

soil-disturbing activities in areas where no construction activity is planned or will occur at a later date.

Implementation:

The following general steps shall be taken to preserve existing vegetation:

- Mark areas to be preserved with orange polypropylene temporary fencing.
- Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling.
- Construction materials and equipment storage and parking areas shall be located where they will not cause root compaction.
- Keep equipment away from trees to prevent trunk damage and root damage.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Disturbed vegetation outside the active area shall be replaced using the appropriate soil stabilization measures.

Maintenance:

Ensure that the limits of disturbance are clearly marked. Irrigation or maintenance of existing vegetation shall conform to the requirements in the landscaping plans.

4.5.5 Temporary Concentrated Flow Conveyance Controls

Temporary concentrated flow conveyance controls consist of a system of measures that are used alone or in combination to intercept, divert, convey and discharge concentrated flows with a minimum of soil erosion, both on-site and downstream (off-site). Temporary concentrated flow conveyance controls may be required to direct run-on around or through a project in a non-erodible fashion.

Earth Dikes/Drainage Swales and Lined Ditches

Description:

These are structures that intercept, divert and convey concentrated surface runoff, generally sheet flow, to prevent erosion.

Appropriate Applications:

These structures may be used to convey surface runoff down sloping land; to intercept and divert runoff to avoid sheet flow over sloped surfaces; and to direct runoff towards a stabilized watercourse, drainage pipe or channel. Also, these structures may be used below steep grades where runoff begins to concentrate and along roadways and facility improvements subject to flood drainage.

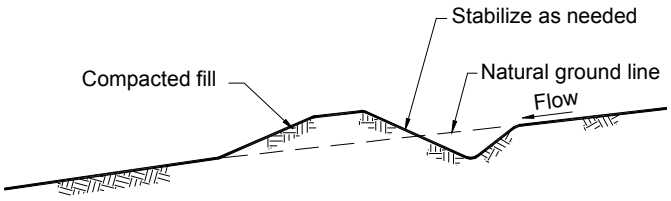
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- These structures are not suitable as sediment-trapping devices.

Implementation:

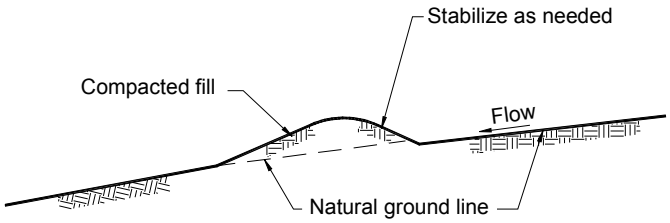
- Care must be applied to correctly size and locate earth dikes, drainage swales and lined ditches. Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- When possible, install and utilize permanent dikes, swales and ditches early in the construction process.
- Provide stabilized outlets.
- A conceptual diversion ditch/drainage swale and a conceptual diversion berm/earth dike are shown in Figure 4-9.

Maintenance:

- Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.
- Check the channel lining, embankments, and bed for erosion and accumulating debris and sediment buildup. Remove debris and repair linings and embankments as required.



Conceptual Diversion Ditch/Drainage Swale
Not to Scale



Conceptual Diversion Dike/Berm
Not to Scale

Figure 4-9
Conceptual Diversion Ditch/Drainage Swale and Diversion Berm/Earth Dike

Outlet Protection/Velocity Dissipation Devices

Description:

These devices are placed at pipe outlets to prevent scour and reduce the velocity and/or energy of exiting storm water flows.

Appropriate Applications:

- These devices may be used at the outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels. Also, these devices may be used at outlets located at the bottom of mild-to-steep slopes; outlets subject to short, intense flows of water; discharge outlets that carry continuous flows of water; and points where lined conveyances discharge to unlined conveyances.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.

Implementation:

- Install riprap, grouted riprap, or concrete apron at selected outlets.
- Apron length is related to outlet flow rate and tailwater level.
- For proper operation of apron:
  - Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
  - If size of apron riprap is large, protect underlying filter fabric with a gravel blanket.
- Outlets on slopes steeper than 10 percent shall have protection.
- A conceptual outlet protection/velocity dissipation device is shown in Figure 4-10.

Maintenance:

- Check apron for displacement of the riprap and/or damage to the underlying fabric. Repair fabric and replace the riprap that has washed away.
- Check for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.
- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

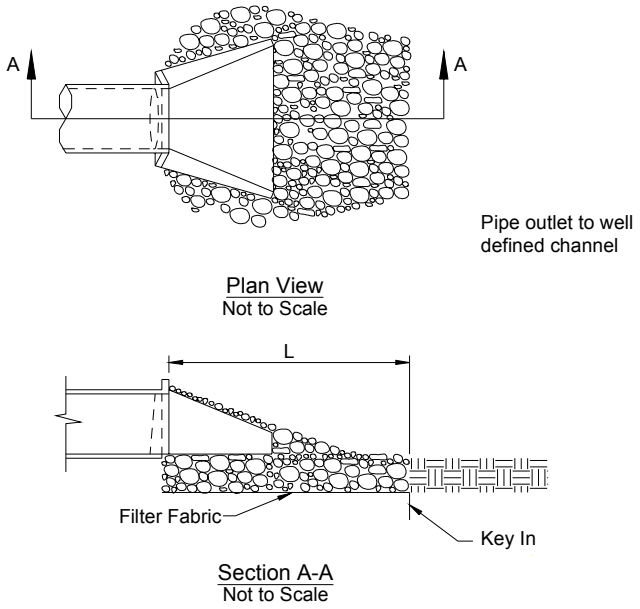


Figure 4-10
Conceptual Outlet Protection/ Velocity Dissipation Device

Slope Drains

Description:

A slope drain is a pipe used to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area. Slope drains are typically used with lined ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

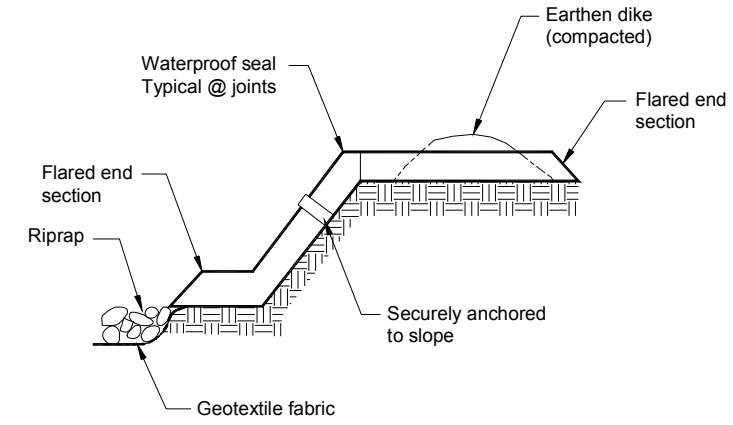
Appropriate Applications:

Slope drains may be used at construction sites where slopes may be eroded by surface runoff.

- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Severe erosion may result when slope drains fail by either over-topping, piping, or pipe separation.

Implementation:

- When designing slope drains:
  - Limit drainage area per pipe to 4 ha (10 ac). For larger areas, use a lined channel or a series of pipes.
  - Use interceptor dikes to direct surface runoff into the slope drain.
  - Can be placed on or buried underneath the slope surface.
- Consider the following for installing slope drains:
  - Install perpendicular to slope contours.
  - Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
  - Compact soil around and under entrance, outlet and along length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.
  - A conceptual slope drain is shown in Figure 4-11.



Note: Actual layout determined in the field.

Figure 4-11
Conceptual Slope Drain

Maintenance:

- Check outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventive measures are implemented.
- Check slope drainage for accumulations of debris and sediment.

4.5.6 Temporary Stream Crossing

Description:

A temporary stream crossing is a structure placed across a waterway that allows vehicles to cross the waterway during construction without entering the water, eliminating erosion and downstream sedimentation caused by the vehicles.

Appropriate Applications:

Temporary stream crossings are typically installed at sites where appropriate permits have been secured (1601 Agreements, 404 Permits, and 401 Certifications), where construction equipment or vehicles need to frequently cross a waterway, when alternate access routes impose significant constraints, when crossing perennial streams or waterways causes significant erosion or where construction activities will not last longer than one year.

Implementation:

- Vehicles and equipment shall not be driven, operated, fueled, cleaned, maintained, or stored in the wet or dry portions of a water body where wetland vegetation, riparian vegetation or aquatic organisms may be destroyed, except as authorized by the RE, as necessary to complete the work.
- Temporary water body crossings and encroachments shall be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments shall be clean, rounded river cobble.
- The exterior of vehicles and equipment that will encroach on water bodies within the project shall be maintained free of grease, oil, fuel, and residues.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation shall be replaced with the appropriate soil stabilization measures.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble shall be removed upon completion of project activities.
- Any temporary artificial obstruction placed within flowing water shall only be built from material, such as clean gravel or sand bags, that will cause little or no siltation.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.
- Conceptual temporary stream crossings are shown in Figure 4-12.

Maintenance:

- Check for blockage and silt buildup in the channel. Remove silt behind fords, in culverts and under bridges.
- Check for erosion of abutments, channel scour, riprap displacement or piping of soil.
- Replace aggregate from inlets and outlets of culverts.
- Remove temporary crossing promptly when it is no longer needed.

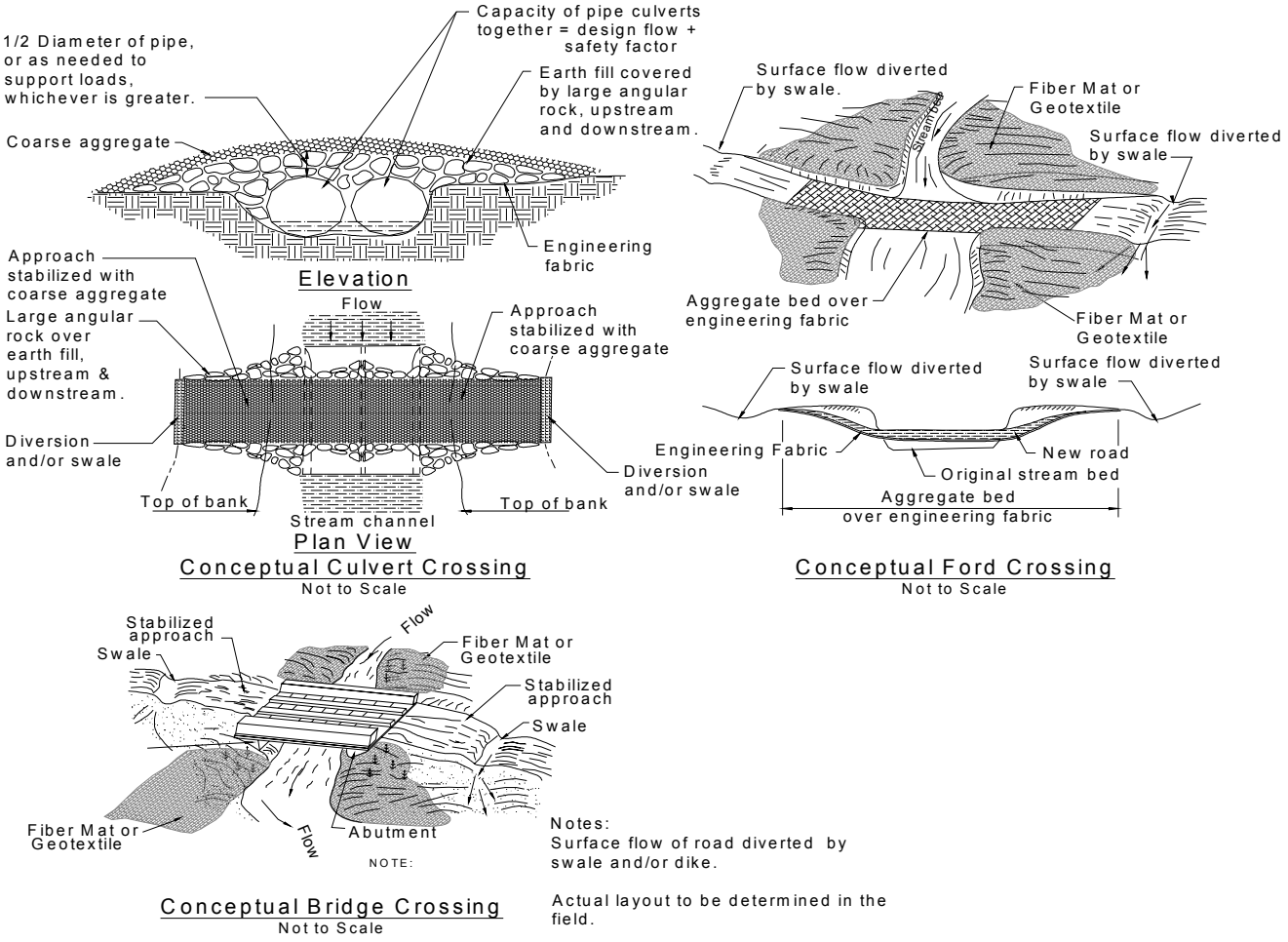


Figure 4-12
Conceptual Temporary Stream Crossings

4.5.7 Clear Water Diversion

Description:

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a project site, transport it around the site and discharge it downstream with minimal water quality degradation for either the project construction operations or the construction of the diversion. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, drainage and interceptor swales.

Appropriate Applications:

A clear water diversion is typically implemented where appropriate permits (1601 Agreement) have been secured and work must be performed in a live stream or water body.

Implementation:

- Heavy equipment driven in wet portions of a water body to accomplish work shall be completely clean of petroleum residue, and water levels shall be below the gear boxes of the equipment in use or equipment lubricants and fuels shall be sealed such that inundation by water shall not result in leaks.
- Mechanical equipment operated in the water shall not be submerged to a point above any axle of said mechanical equipment.
- Excavation equipment buckets may reach out into the water for the purpose of removing or placing fill materials. Only the bucket of an excavator/backhoe may operate in water-covered portions of a water body. The main body of the crane/excavator/backhoe shall not enter water-covered portions of a water body, except as necessary to cross the stream to access the work site.
- Stationary equipment (such as motors and pumps) located within or adjacent to a water body shall be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained or placed in operation, sufficient water shall at all times be allowed to pass downstream to maintain aquatic life downstream.
- The exterior of vehicles and equipment that will encroach on water body within the project shall be maintained free of grease, oil, fuel and residues.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation shall be replaced with the appropriate soil stabilization measures.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble shall be removed upon completion of project activities.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.

Maintenance:

Check embankments and diversion for damage to the linings, accumulating debris, sediment buildup and adequacy of the slope protection. Remove debris and repair linings and slope protection as required.

4.5.8 Wind Erosion Control

Description:

Wind erosion control consists of applying water, other dust palliatives or covering material as necessary to prevent or alleviate dust nuisance. Dust control shall be applied in accordance with Caltrans standard practices. Covering of small stockpiles or areas is an alternative to applying water or other dust palliatives.

Appropriate Applications:

This practice is typically implemented on all exposed soils subject to wind erosion.

Implementation:

- Water shall be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment shall be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit shall be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge shall meet California Department of Health Services water reclamation criteria and the RWQCB requirements. Nonpotable water shall not be conveyed in tanks or drain pipes that will be used to convey potable water, and there shall be no connection between potable and nonpotable supplies. Nonpotable tanks, pipes, and other conveyances shall be marked "NONPOTABLE WATER – DO NOT DRINK."
- Materials applied as temporary soil stabilizers will also provide wind erosion control benefits.

Maintenance:

Check areas protected to ensure proper coverage. See specific wind erosion control BMP or implement requirements of Section 10 of the Caltrans Standard Specifications as appropriate.

4.5.9 Sediment Tracking Control

Street Sweeping and Vacuuming

Description:

The purpose of street sweeping and vacuuming is to remove tracked sediment so that the sediment does not enter a storm drain or watercourse.

Appropriate Applications:

Street sweeping and vacuuming is typically implemented anywhere sediment is tracked from the project site onto public or private paved roads (typically points of egress).

Maintenance:

- Substantially visible sediment tracking shall be swept or vacuumed on a daily basis.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project area.

Stabilized Construction Roadway

Description:

A stabilized construction roadway is a temporary access road connecting existing public roads to a remote construction area. It is designed for the control of dust and erosion created by vehicular tracking.

Appropriate Applications:

This measure applies to construction roadways and short-term detour roads, during wet weather conditions when mud tracking is a problem, and during dry weather conditions, when dust is a problem. This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.

Implementation:

- Properly grade roadway to prevent runoff from leaving construction site.
- Stabilize roadway using aggregate, asphalt concrete or concrete based on site conditions.
- If aggregate is selected, place aggregate over geotextile fabric.

Maintenance:

- Check for damage and repair as needed.
- Keep all temporary roadway ditches clear.

Entrance/Outlet Tire Wash

Description:

A tire wash is an area located at stabilized construction roadway egress points to remove sediment from tires and undercarriages and to prevent sediment from being transported onto public roadways.

Appropriate Applications:

Entrance/outlet tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Requires a supply of wash water.
- Requires a turnout or doublewide exit to avoid having entering vehicles drive through the wash area.

Implementation:

- Incorporate with a stabilized construction roadway.
- Construct on level ground when possible, on a pad of coarse aggregate.
- Wash rack shall be designed for anticipated traffic loads.
- Provide a drainage ditch that will convey the runoff from the wash area to a sediment-trapping device.
- Ditch shall be of sufficient grade, width, and depth to carry the wash runoff.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- A conceptual entrance/outlet tire wash is shown in Figure 4-13.
- Use of constructed or prefabricated steel plate with ribs for entrance/exit access (without washing) is allowed with written approval of the Resident Engineer.

Maintenance:

Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.

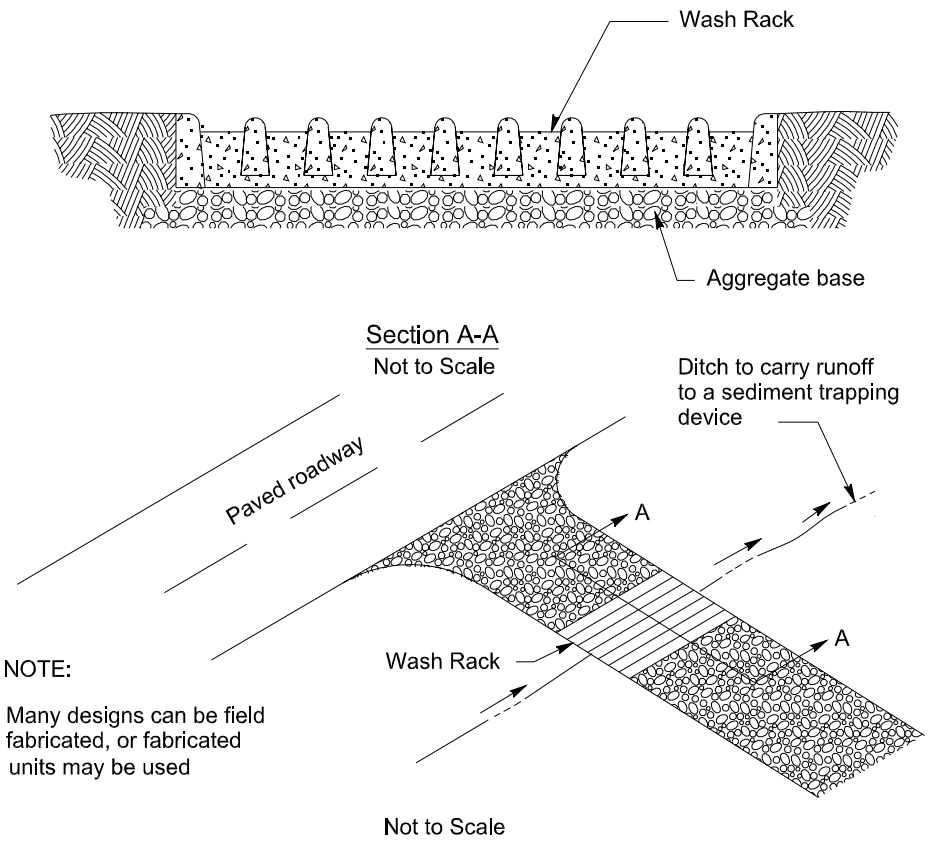


Figure 4-13
Conceptual Entrance/Outlet Tire Wash

4.5.10 Waste Management

Waste management consists of implementing procedural and structural BMPs for handling, storing, and disposing of wastes generated by a construction project to prevent the release of waste materials into storm water discharges. Waste management includes the following BMPs:

- Spill Prevention and Control;
- Solid Waste Management;
- Hazardous Waste Management;
- Contaminated Soil Management;
- Concrete Waste Management;

- Sanitary/Septic Waste Management; and
- Liquid Waste Management.

These controls shall be implemented for all applicable activities, material usage and site conditions.

Spill Prevention and Control

Description:

Spill prevention and control procedures and practices are typically implemented to prevent and control spills in a manner that minimizes or prevents the discharge of spilled material to drainage systems or watercourses.

Appropriate Applications:

Spill prevention and control procedures are typically implemented wherever chemicals and/or hazardous substances are stored. Substances may include, but are not limited to, soil stabilizers, dust palliatives, herbicides, growth inhibitors, fertilizers, de-icing chemicals, fuels, lubricants and other petroleum distillates. To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under Title 40 of the Code of Federal Regulations (CFR) Parts 110, 117, and 302, and sanitary and septic wastes shall be contained and cleaned up immediately.

Implementation:

- To the extent that this action does not compromise cleanup activities, spills shall be covered and protected from storm water run-on during rainfall.
- Spills shall not be buried or washed with water.
- Used cleanup materials, contaminated materials and recovered spill material that is no longer suitable for its intended purpose shall be stored and disposed of in conformance with these special provisions.
- Water used for cleaning and decontamination shall not be allowed to enter storm drains or watercourses.
- Water overflow or minor water spillage shall be contained and shall not be allowed to discharge into drainage facilities or water courses.
- Proper storage, cleanup and spill reporting instructions for hazardous materials stored or used on a project site shall be posted at all times in an open, conspicuous and accessible location.
- Waste storage areas shall be kept clean, well organized and equipped with ample cleanup supplies that are appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.

Maintenance:

- Verify that spill control cleanup materials are located near material storage, unloading, and use areas.
- Update spill prevention and control plans and stock appropriate cleanup materials whenever changes occur in the types of chemicals stored on-site.

Solid Waste Management

Description:

Solid waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants to drainage systems or watercourses as a result of the creation, stockpiling or removal of construction site wastes.

Appropriate Applications:

Solid waste management practices are typically implemented on construction projects that generate solid wastes. These solid wastes include but are not limited to:

- Construction wastes, including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, nonhazardous equipment parts, styrofoam and other materials used to transport and package construction materials.
- Highway planting wastes, including vegetative material, plant containers and packaging materials; and
- Litter, including food containers, beverage cans, coffee cups, paper bags, plastic wrappers and smoking materials, including litter generated by the public.

Implementation:

- Littering on the project site shall be prohibited.
- Trash receptacles shall be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site shall be collected and placed in watertight dumpsters at least weekly.
- Full dumpsters shall be removed from the project site and the contents shall be disposed of properly.
- Storm water run-on shall be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas shall be located at least 15m from drainage facilities and watercourses and shall not be located in areas prone to flooding or ponding.

- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters shall be securely covered with tarps or plastic sheeting or protected in conformance with the applicable DSA protection section.
- Dumpster washout on the project site shall not be allowed.

Maintenance:

- A foreman and/or construction supervisor shall monitor on-site solid waste storage and disposal procedures.
- Keep the site clean of litter and debris.

Hazardous Waste Management

Description:

Hazardous waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants from construction site hazardous waste to storm drain systems or watercourses.

Appropriate Applications:

Hazardous waste management practices are typically implemented on construction projects that generate waste from the use of petroleum products, asphalt products, concrete curing compounds, pesticides, palliatives, acids, septic wastes, paints, solvents, wood preservatives, stains, roofing tar and any materials deemed a hazardous waste in California.

Implementation:

- Wastes shall be stored in sealed containers constructed of a suitable material and shall be labeled as required by Title 22 of the California Code of Regulations (CCR), Division 4.5 and 49 CFR Parts 172,173, 178, and 179.
- All hazardous waste shall be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR Parts 261–263.
- Waste containers shall be stored in temporary containment facilities.
    1. A temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
    2. A temporary containment facility shall be impervious to the materials stored there for a minimum contact time of 72 hours.
    3. A temporary containment facility shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and

spills shall be placed into drums after each rainfall. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids shall be sent to an approved disposal site.

4. Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
5. Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
6. Each temporary containment facility shall be covered during nonworking days and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums shall not be overfilled and wastes shall not be mixed.
- Unless watertight, containers of dry waste shall be stored on pallets.
- Waste shall be disposed of properly within 90 days of being generated.
- To minimize on-site storage, full containers of waste shall be disposed of properly and promptly in accordance with all applicable regulations. In no case shall hazardous waste storage exceed the requirements in Title 22 CCR, Section 66262.34.
- Paint brushes and equipment for water- and oil-based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, a watercourse or drainage system. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused shall be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials and drop cloths can be disposed of as solid waste.

Maintenance:

A foreman and/or construction supervisor shall monitor on-site hazardous waste storage and disposal procedures.

Contaminated Soil Management

Description:

These are procedures and practices to minimize or eliminate the discharges of pollutants from contaminated soil to drainage systems or watercourses.

Appropriate Applications:

Contaminated soil management is typically implemented on construction projects in highly urbanized or industrial areas where soil pollution may have occurred due to spills, illicit discharges or leaks from underground storage tanks. Contaminated soil management may also apply to highway widening projects in older areas where median and shoulder soils may have been contaminated by aerially deposited lead.

Implementation:

Identifying Contaminated Areas

- Contaminated soils are often identified during project planning and development. Known locations of contaminated soils are identified in the plans and specifications.

Education

- Prior to performing any excavation work at locations identified as containing material classified as hazardous, employees and subcontractors shall complete a safety training program that meets the requirements of 29 CFR 1910.120 and 8 CCR 5192.
- Employees and subcontractors shall be educated and instructed in the identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Meetings to discuss and reinforce disposal procedures shall be held or incorporated into regular safety meetings.

Handling Procedures for Material with Aerially Deposited Lead

- Materials from areas designated as containing aerially deposited lead may, if allowed by the contract, be excavated, transported and used in the construction of embankments and/or backfill.
- Excavation, transportation and placement operations shall result in no visible dust. Methods shall be employed to prevent spillage of lead-containing material during transport. Air quality shall be monitored during excavation of soils contaminated with lead.

Handling Procedures for Contaminated Soils

- To minimize on-site storage, contaminated soil shall be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22 CCR, Section 66265.250 to 66265.260.
- Test suspected soils at a Caltrans-approved certified laboratory.
- If the soil is contaminated, work with the local regulatory agencies to develop options for treatment and/or disposal. Avoid temporary stockpiling of contaminated soils or hazardous material.
- If temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps. Soil binders may also be used in lieu of tarping.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.

- Contaminated material and hazardous material on the exterior of a transport vehicle shall be removed and placed either into the current transport vehicle or the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and dispose of at an appropriate disposal site.
- Collect nonreusable protective equipment after use by any personnel and dispose of at an appropriate disposal site.
- Excavation, transport, and disposal of contaminated material and hazardous material shall be in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - United States Department of Transportation (USDOT);
  - United States Environmental Protection Agency (USEPA);
  - California Environmental Protection Agency (Cal/EPA);
  - California Division of Occupation Safety and Health Administration (Cal/OSHA); and
  - Local regulatory agencies.

Procedures for Underground Storage Tank Removals

- As directed by the RE, arrange to test any liquid or sludge found in the underground tank prior to its removal to determine if it contains hazardous material.
- After tank removal, take soil samples beneath the excavated tank and perform analysis as required by the local agency representatives.
- The underground storage tank, any liquid and/or sludge found within the tank, and all contaminated material and hazardous material removed during the tank removal shall be transported to disposal facilities permitted to accept such material.

Water Control

- Take all necessary precautions and preventive measures to prevent the flow of water, including groundwater, from entering hazardous material or underground storage tank excavations. Such preventative measures may consist of, but are not limited to, berms, cofferdams, grout curtains, freeze walls, seal course concrete or any combination thereof.

- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, shall be discharged to clean, closed top, watertight, transportable holding tanks, and disposed of in accordance with federal, state, and local laws.

Maintenance:

A foreman and/or construction supervisor shall monitor on-site contaminated soil storage and disposal procedures.

Concrete Waste Management

Description:

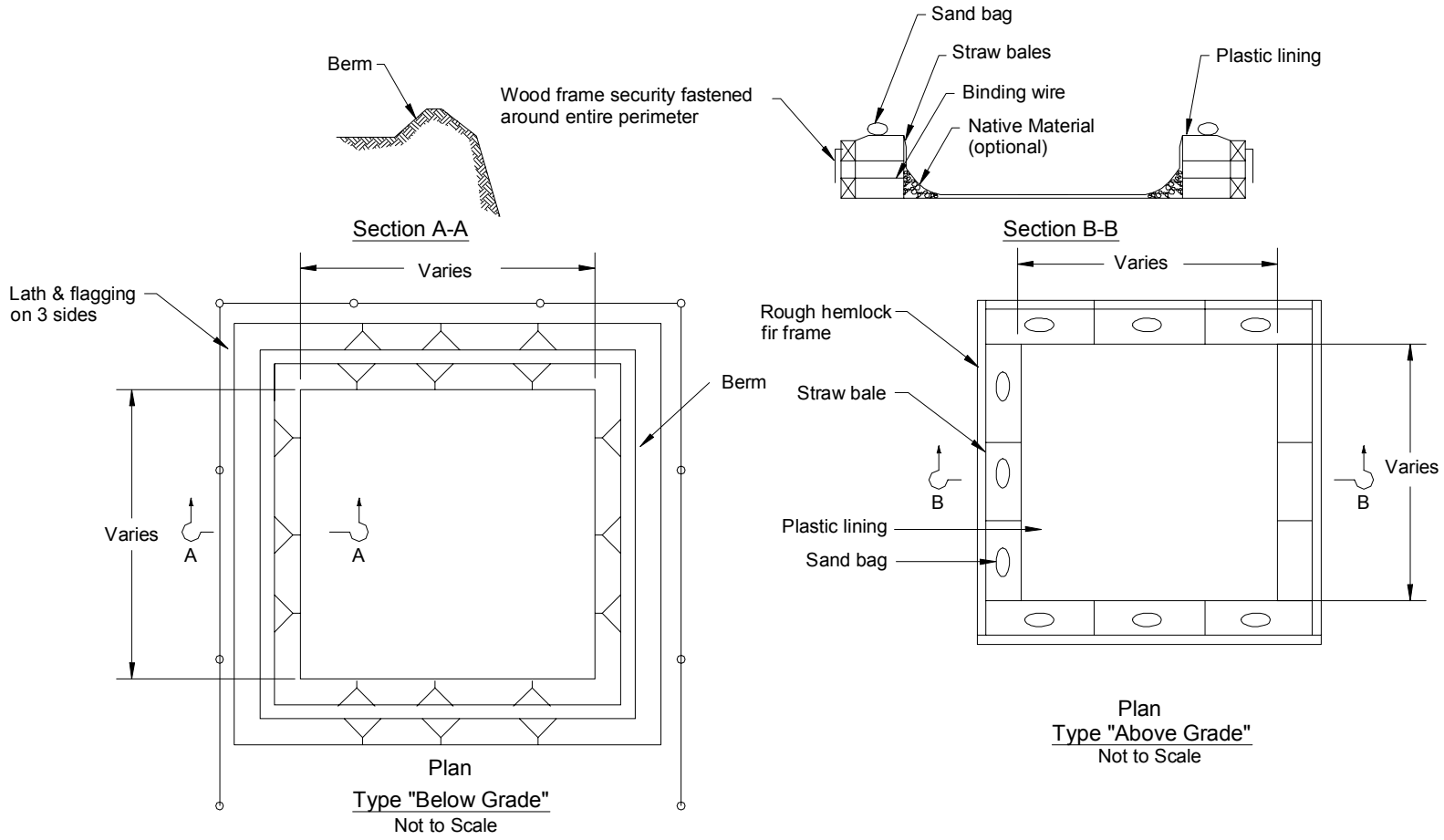
Concrete waste management procedures and practices are designed to minimize or eliminate the discharge of concrete waste materials to storm drain systems or watercourses.

Appropriate Applications:

Concrete waste management practices are typically implemented on construction projects where concrete is used as a construction material or where concrete dust and debris result from demolition activities.

Implementation:

- Portland cement concrete and asphalt concrete waste shall not be allowed to enter storm water drainages or watercourses.
- Portland cement concrete waste shall be collected and properly disposed of or placed in a temporary concrete washout facility as shown conceptually in Figure 4-14.
- Asphalt concrete waste shall be collected and properly disposed of.



Note: Actual layout determined in the field.

Figure 4-14
Conceptual Temporary Concrete Washout

- A sign shall be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.
- Below-grade concrete washout facilities are typical. Above-grade facilities are used if excavation is not practical.
- A foreman and/or construction supervisor shall monitor on-site concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.

Maintenance:

- A foreman and/or construction supervisor shall monitor on-site concrete waste storage and disposal procedures.

Sanitary/Septic Waste Management

Description:

Sanitary/septic waste management procedures and practices are designed to minimize or eliminate the discharge of construction site sanitary/septic waste materials to storm drain systems or watercourses.

Appropriate Applications:

Sanitary/septic waste management practices are typically implemented on all construction sites that use temporary or portable sanitary/septic waste systems.

Implementation:

- Temporary sanitary facilities shall be located away from drainage facilities and watercourses. When subjected to high winds or risk of high winds, as determined by the RE, temporary sanitary facilities shall be secured to prevent overturning.
- Wastewater shall not be discharged or buried within the highway right-of-way.

Maintenance:

A foreman and/or construction supervisor shall monitor on-site sanitary/septic waste storage and disposal procedures.

Liquid Waste Management

Description:

Liquid waste management procedures and practices are designed to prevent the discharge of pollutants to storm drain systems or water courses as a result of the creation, collection, or disposal of nonhazardous liquid.

Appropriate Applications:

Liquid waste management is typically applicable to construction projects that generate any of the following nonhazardous byproducts, residuals or wastes: drilling slurries and drilling fluids; grease-free and oil-free wastewater and rinse water; dredging; and other non–storm water liquid discharges not permitted by separate permits.

Implementation:

- Drilling residue and drilling fluids shall not be allowed to enter storm drains or watercourses and shall be properly disposed of.
- If an appropriate location is available, as determined by the RE, drilling residue and drilling fluids that are exempt under 23 CCR §2511(g) may be dried by infiltration and evaporation in a temporary concrete washout facility.
- See Section 4.5.11, Materials Handling, for appropriate handling and storage of liquid wastes.

Maintenance:

- Spot-check employees and subcontractors throughout the duration of construction to ensure appropriate practices are being implemented.
- Remove deposited solids in containment areas and capturing devices as needed and at the completion of the task.
- Check containment areas and capturing devices frequently for damage and repair as needed.

4.5.11 Materials Handling

Materials handling consists of implementing procedural and structural BMPs for handling, storing and using construction materials to prevent the release of those materials into storm water discharges.

These controls shall be implemented for all applicable activities, material usage and site conditions.

Material Delivery and Storage

Description:

Material delivery and storage procedures and practices are designed for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to storm water drainage systems or watercourses.

Appropriate Applications:

These procedures are typically implemented at all construction sites with delivery and storage of pesticides, fertilizers, detergents, plaster, petroleum products, asphalt and concrete components, hazardous chemicals, concrete compounds or other materials that may be detrimental if released to the environment.

Implementation:

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be placed in temporary containment facilities for storage.
    1. A temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
    2. A temporary containment facility shall be impervious to the materials stored there for a minimum contact time of 72 hours.
    3. A temporary containment facility shall be maintained free of accumulated rainwater and spills. In the event of soil spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as a hazardous waste unless testing determines to be non-hazardous. Non-hazardous liquids shall be sent to an approved disposal site.
    4. Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
    5. Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
    6. Throughout the rainy season, each temporary containment facility shall be covered during nonworking days and prior to rain events.
    7. Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.
- Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground.
- To provide protection from wind and rain, throughout the rainy season, bagged and boxed materials shall be covered during nonworking days and prior to rain events.
- Storage areas shall be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.

Maintenance:

- Check to ensure that designated storage areas are kept clean and well organized.
- Repair and/or replace perimeter controls, containment structures, and covers as needed to keep them functioning properly.

Material Use

Description:

Material use procedures and practices are designed for use of construction material in a manner that minimizes or eliminates the discharge of these materials to storm drain systems or watercourses.

Appropriate Applications:

These procedures are typically implemented at construction sites where pesticides, fertilizers, detergents, plaster, petroleum products, asphalt and concrete components, hazardous chemicals, concrete compounds and other material that may be detrimental if released to the environment are used or prepared on site.

Implementation:

- Latex paint and paint cans, used brushes, rags, absorbent materials and drop cloths, when thoroughly dry and no longer hazardous, may be disposed of with other construction debris.
- Do not remove the original product label from a container, as it contains important safety and disposal information. Use all of the product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paint brushes or rinse paint containers into a street, gutter, storm drain or watercourse. Dispose of any paint, thinners, residue or sludges that cannot be recycled as hazardous waste.
- For water-based paints, paint out brushes to the extent practical and rinse to a drain leading to a sanitary sewer, where permitted or into a concrete washout pit or temporary sediment trap. For oil-based paints, paint out brushes to the extent practical and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, nontreated lumber and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials on-site when practical.
- Do not over-apply fertilizers and pesticides. Prepare only the amount needed. Follow strictly the recommended usage instructions. Apply surface dressings in

smaller applications, as opposed to one large application, to allow time for them to work in and to avoid excess materials being carried off-site by runoff.

- Keep an ample supply of spill cleanup material near material use areas. Train employees in spill cleanup procedures.

Maintenance:

Spot-check employees and subcontractors throughout the duration of construction job to ensure appropriate practices are being implemented.

4.5.12 Vehicle and Equipment Operations

Vehicle and equipment operations procedures and practices are designed to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning, fueling and maintenance operations to storm water drainage systems or watercourses.

These controls shall be implemented for all applicable activities, material usage, and site conditions.

Vehicle and Equipment Cleaning

Description:

Vehicle and equipment cleaning procedures and practices are typically used to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drain systems or watercourses.

Appropriate Applications:

These procedures are typically applied on all construction sites where vehicle and equipment cleaning is performed.

Implementation:

- Onsite vehicle and equipment washing is discouraged.
- When using solvents for cleaning vehicles and equipment, used solvents and by-products must be captured and recycled or disposed according to the requirements of the Liquid Waste Management BMP or Hazardous Waste Management BMP, depending on waste characteristics. Minimize use of solvents.
- Truck beds used in thermoplastic striping are to be cleaned using a dry cleaning technique.
- When possible, truck beds should be cleaned using a dry cleaning technique (sweep up or shovel out).

- Vehicle washing shall occur only at designated pre-wash areas, facility wash racks or other designated areas:
  - Whether at pre-wash areas at the maintenance facility or the field, vehicle and equipment wash water shall be discharged to a sanitary sewer, or contained for percolation or evaporative drying away from storm drain inlets or watercourses. Apply sediment control BMPs if applicable.
  - Facility wash racks shall discharge to a sanitary sewer, recycle system or other approved discharge system and shall not discharge to the drainage system or watercourses.

Maintenance:

Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.

Vehicle and Equipment Fueling

Description:

Vehicle and equipment fueling procedures and practices are designed to minimize or eliminate the discharge of fuel spills and leaks into storm drain systems or watercourses.

Appropriate Applications:

These procedures are typically applied on all construction sites where vehicle and equipment fueling takes place.

Implementation:

- Drip pans shall be used during vehicle and equipment fueling unless the fueling is performed over an impermeable surface in a dedicated fueling area. Dedicated fueling areas shall be protected from storm water run-on and runoff and shall be located at least 15m from downstream drainage facilities or watercourses.
- Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shutoff to control drips.
- Fueling operations shall not be left unattended.
- Absorbent spill cleanup materials shall be available in fueling and maintenance areas and shall be disposed properly after use.
- Vehicles and equipment leaks shall be inspected and cleaned up on each day of use. Leaks shall be repaired immediately or problem vehicles or equipment shall be removed from the project site.

Maintenance:

- Keep an ample supply of spill cleanup material on-site.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup material.

Vehicle and Equipment Maintenance

Description:

Vehicle and equipment maintenance procedures and practices are designed to minimize or eliminate the discharge of pollutants to storm drain systems or watercourses from vehicle and equipment maintenance procedures.

Appropriate Applications:

These procedures are typically applied on all construction projects where an on-site yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Implementation:

- Drip pans shall be used during vehicle and equipment maintenance work that involves fluids unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area. Dedicated maintenance areas shall be protected from storm water run-on and runoff and shall be located at least 15m from downstream drainage facilities or watercourses.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.
- Vehicles and equipment leaks shall be inspected on each day of use. Leaks shall be repaired immediately or problem vehicles or equipment shall be removed from the project site.

Maintenance:

- Maintain waste fluid containers in leak-proof condition.
- Check equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

4.5.13 Paving Operations

Description:

Paving operations procedures are designed to minimize pollution of storm water runoff during paving operations.

Appropriate Applications:

These procedures are typically implemented where paving, surfacing, resurfacing, or sawcutting may pollute storm water runoff or discharge to storm drain systems or watercourses.

Implementation:

- Substances used to coat asphalt transport trucks and asphalt spreading equipment shall not contain soap and shall be nonfoaming and nontoxic.
- Drainage inlet structures and manholes shall be covered when seal coat, tack coat, slurry seal or fog seal is applied to adjacent surfaces. Seal coat, tack coat, slurry seal, or fog seal shall not be applied if rainfall or thunderstorms are predicted to occur during the application or curing period.
- Protect drainage inlet structures and maintenance holes during paving operations, including when seal coat, tack coat, slurry seal or fog seal is applied to adjacent surfaces.
- Seal coat, tack coat, slurry seal or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.
- When using asphalt release agents (e.g., citrus, soy-based or diesel) for cleaning and coating of equipment and tools, all products and by-products shall be captured and reused, recycled, or disposed in accordance with the requirements of the Hazardous Waste Management BMP.
- Scrape residual material out of equipment using dry methods.
- Clean pavers over absorbent pads, drip pans, plastic sheeting or other materials to collect the asphalt release agents. Dispose removed material in accordance with the Hazardous Waste Management BMP.
- Pick up and reuse, recycle, or dispose of cured material in accordance with the Solid Waste Management BMP.
- Prevent water used to clean emulsion kettles from discharging into drain inlets or watercourses. Diesel oil used in kettle cleaning shall be contained and reused, recycled, or disposed of in accordance with the Hazardous Waste Management BMP.

Maintenance:

- Maintain machinery regularly to minimize leaks and drips.
- Ensure that employees and subcontractors are implementing appropriate measures during paving operations.

4.5.14 Stockpile Management

Description:

Procedures and practices designed to reduce or eliminate pollution of storm water from stockpiles of soil and paving materials.

Appropriate Applications:

Typically implemented anywhere soil and paving materials are stockpiled.

Implementation:

- Protection of stockpiles is a year-round requirement.
- All stockpiles shall be located away from concentrated flows of storm water, drainage courses, and inlets.
- All stockpiles shall be protected from storm water run-on, using berms, dikes or other temporary diversion BMPs.
- Wind erosion control practices shall be implemented as appropriate on all stockpiled material. For specific information, see Section 4.5.8.
- Stockpiles of contaminated soil shall be managed in accordance with the Contaminated Soil Management BMP.
- Nonactive stockpiles of the identified materials shall be protected further as follows:
  - Soil stockpiles.
- During the rainy season, soil stockpiles shall be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- During the non-rainy season, soil stockpiles shall be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.
  - Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate subbase:
    - During the rainy season, the stockpiles shall be covered or protected with a temporary perimeter sediment barrier at all times.
    - During the non-rainy season, the stockpiles shall be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.
  - Stockpiles of "cold mix" asphalt (pre-mixed aggregate and asphalt binder):
    - During the rainy season, these stockpiles shall be placed on and covered with plastic or comparable material at all times.
    - During the dry season, these stockpiles shall be placed on and covered with plastic or comparable material prior to the onset of precipitation.

- Active stockpiles of the identified materials shall be protected further as follows:
  - All stockpiles shall be covered or protected with a temporary linear sediment barrier prior to the onset of precipitation.
  - Stockpiles of "cold mix" shall be covered with plastic or comparable material prior to the onset of precipitation.

Maintenance:

Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

4.5.15 Water Conservation Practices

Description:

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and/or the transport of pollutants off-site.

Appropriate Applications:

Water conservation practices are typically used on all construction sites where water is used.

Implementation:

- Keep water equipment in good working condition.
- Repair water leaks promptly.
- Discourage washing of equipment on the construction site.
- Avoid using water to clean construction areas. Sweep paved areas where practical.
- Direct construction water runoff to areas where it can soak into the ground.

Maintenance:

Repair water equipment as needed.

4.5.16 Potable Water/Irrigation

Description:

This BMP describes practices to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing and hydrant flushing.

Appropriate Applications:

This BMP should be implemented where the above activities or discharges occur at or enter a construction site.

Implementation:

- Where possible, direct water from off-site sources around or through a construction site in a way that minimizes contact with the construction site.
- When possible, the rinse water from the activity of flushing water lines should be reused for landscaping purposes.
- Shut off the water source from a broken line, sprinkler, or valve as soon as possible to prevent excess water flow.
- Schedule necessary repairs on broken water lines as soon as possible.
- Protect downstream storm water drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.
- If an irrigated area is within the construction limits, inspect the irrigation system to ensure that the appropriate amount of water is being used and runoff is minimized. 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.

4.5.17 Dewatering Operations

Dewatering Operations

Description:

Dewatering Operations are practices that manage the discharge of pollutants when non-storm water and accumulated precipitation must be removed from a work location so that construction work may be accomplished.

Appropriate Applications:

These practices are implemented for discharges of non-storm water from construction sites. Non-storm waters include, but are not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area.

Practices identified in this section are also appropriate for implementation when managing the removal of accumulated precipitation (storm water) from depressed areas at a construction site.

Implementation:

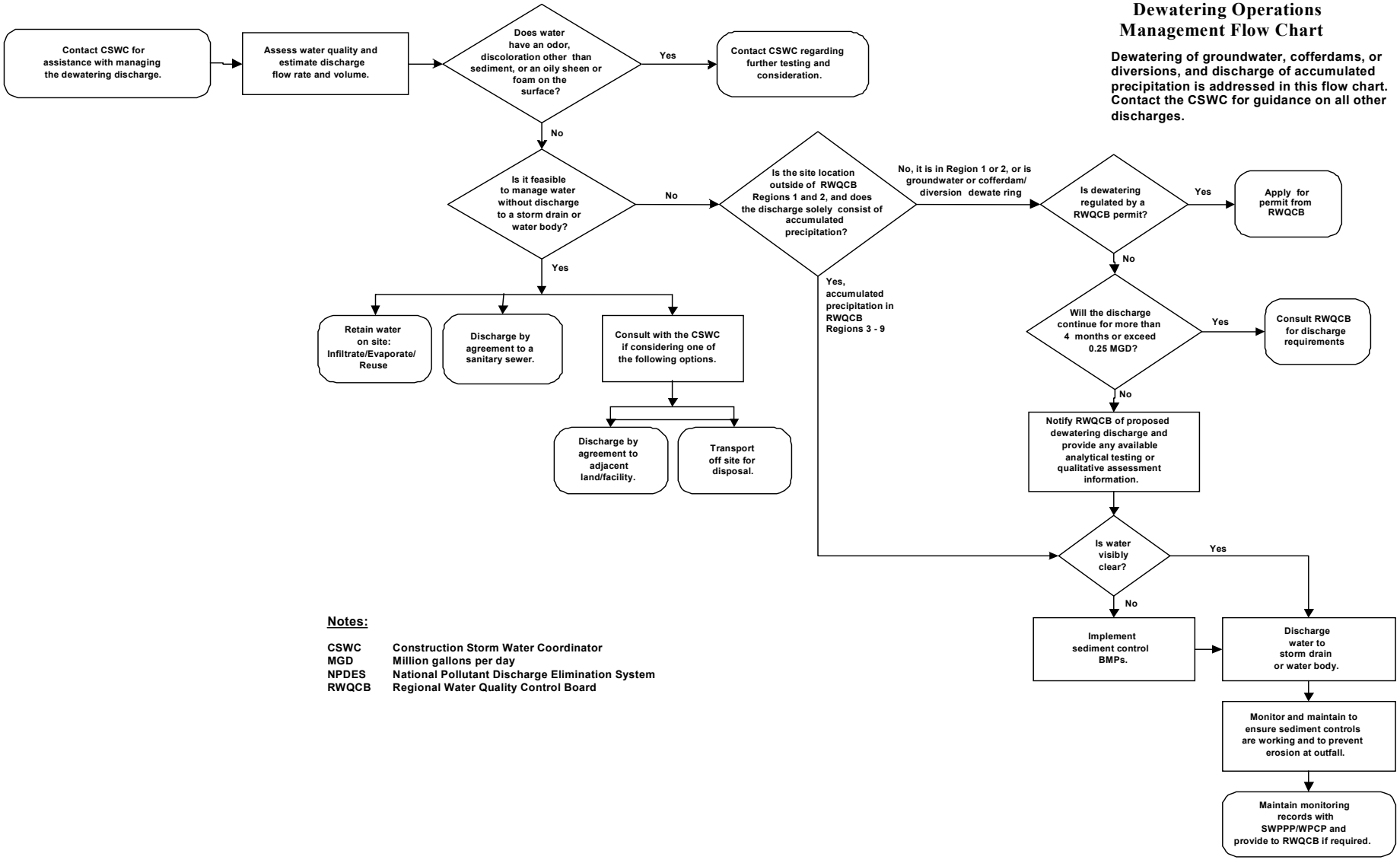
- Dewatering non-storm water cannot be discharged without prior notice and approval from the appropriate Regional Water Quality Control Board. This includes storm water that is co-mingled with groundwater or other non-storm water sources. Once the discharge is allowed, appropriate BMPs must be implemented to ensure the discharge complies with all permit requirements.
- The RWQCB may require a separate NPDES permit prior to the dewatering discharge of non-storm water. These permits will have specific testing, monitoring, and discharge requirements and can take significant time to obtain.
- Except in RWQCB Regions 1 and 2, the discharge of accumulated precipitation (storm water) to a water body or storm drain is subject to the requirements of Caltrans NPDES permit. RWQCB Regions 1 and 2, require notification and approval prior to any removal of water from construction sites. Sediment control and other appropriate BMPs must be employed when this water is discharged.
- The flow chart shown in Figure 4-15 shall be utilized to guide dewatering operations.
- The RE will coordinate monitoring and permit compliance.
- Discharges must comply with regional and watershed-specific discharge requirements.
- Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges must not cause erosion at the discharge point.

Maintenance:

- Inspect all BMPs implemented to comply with permit requirements frequently and repair or replace to ensure the BMPs function as designed.
- Accumulated sediment removed during the maintenance of a dewatering device may be either spread on site and stabilized or disposed of at a disposal site as approved by the RE.
- Accumulated sediment that is commingled with other pollutants must be disposed of in accordance with all applicable laws and regulations and as approved by the RE.

Figure 4-15
Dewatering Operations
Management Flow Chart

Dewatering of groundwater, cofferdams, or diversions, and discharge of accumulated precipitation is addressed in this flow chart. Contact the CSWC for guidance on all other discharges.



Notes:

CSWC	**Construction Storm Water Coordinator**
MGD	**Million gallons per day**
NPDES	**National Pollutant Discharge Elimination System**
RWQCB	**Regional Water Quality Control Board**

Sediment Treatment

A variety of methods can be used to treat water during dewatering operations from the construction site. Several devices are presented in this section that provide options to achieve sediment removal. The size of particles present in the sediment and Permit or receiving water limitations on sediment are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate.

Category 1: Constructed Settling Technologies

The devices discussed in this category are to be used exclusively for dewatering operations only.

Desilting Basin

Description:

A desilting basin is a temporary basin with a controlled release structure that is formed by excavation and/or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging.

Appropriate Applications:

Effective for the removal of trash, gravel, sand, and silt and some metals that settle out with the sediment.

Implementation:

- Excavation and construction of related facilities is required.
- Temporary desilting basins must be fenced if safety is a concern.
- Outlet protection is required to prevent erosion at the outfall location.
- A conceptual temporary desilting basin is shown in Figure 4-7.

Maintenance:

- Maintenance is required for safety fencing, vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Sediment Trap

Description:

A sediment trap is a temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging.

Appropriate Applications:

Effective for the removal of large and medium sized particles (sand and gravel) and some metals that settle out with the sediment.

Implementation:

- Excavation and construction of related facilities is required.
- Trap inlets shall be located to maximize the travel distance to the trap outlet.
- Use rock or vegetation to protect the trap outlets against erosion.

Maintenance:

- Maintenance is required for vegetation, embankment, inlet and outfall structures, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

Category 2: Mobile Settling Technologies

The devices discussed in this category are typical of tanks that can be used for sediment treatment of dewatering operations. A variety of vendors are available who supply these tanks.

Weir Tank

Description:

A weir tank separates water and waste by using weirs. The configuration of the weirs (over and under weirs) maximizes the residence time in the tank and determines the waste to be removed from the water, such as oil, grease, and sediments.

Appropriate Applications:

The tank removes trash, some settleable solids (gravel, sand, and silt), some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

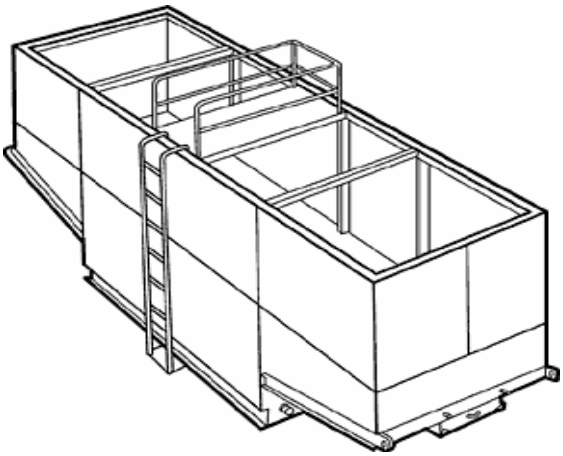
Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal must be by licensed waste disposal company.

Schematic Diagrams:



Weir Tanks

Dewatering Tank

Description:

A dewatering tank removes debris and sediment. Flow enters the tank through the top, passes through a fabric filter, and is discharged through the bottom of the tank. The filter separates the solids from the liquids.

Appropriate Applications:

The tank removes trash, gravel, sand, and silt, some visible oil and grease, and some metals (removed with sediment). To achieve high levels of flow, multiple tanks can be used in parallel. If additional treatment is desired, the tanks can be placed in series or as pre-treatment for other methods.

Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.
- Oil and grease disposal must be by licensed waste disposal company.

Schematic Diagrams:

Dewatering Tanks

Category 3: Basic Filtration Technologies

Gravity Bag Filter

Description:

A gravity bag filter, also referred to as a dewatering bag, is a square or rectangular bag made of non-woven geotextile fabric that collects sand, silt, and fines.

Appropriate Applications:

Effective for the removal of sediments (gravel, sand, and silt). Some metals are removed with the sediment.

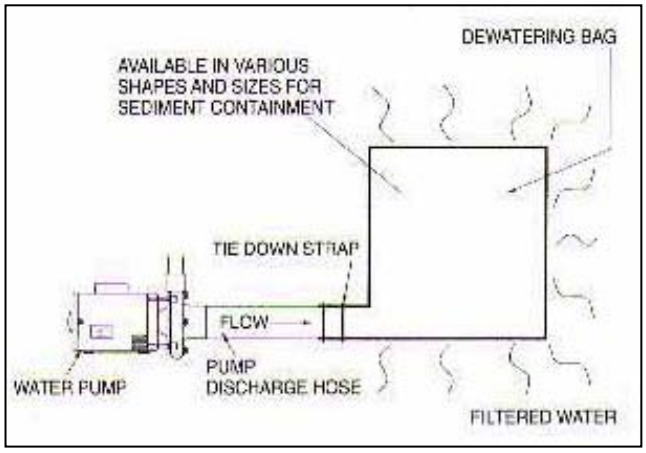
Implementation:

- Water is pumped into one side of the bag and seeps through the bottom and sides of the bag.
- A secondary barrier, such as a rock filter bed or straw/hay bale barrier, is placed beneath and beyond the edges of the bag to capture sediments that escape the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- The bag is disposed off-site, or on-site as directed by the Resident Engineer.

Schematic Diagrams:



Gravity Bag Filter

Category 4: Advanced Filtration Technologies

Sand Media Particulate Filter

Description:

Water is treated by passing it through canisters filled with sand media. Generally, sand filters provide a final level of treatment. They are often used as a secondary or higher level of treatment after a significant amount of sediment and other pollutants have been removed.

Appropriate Applications:

Effective for the removal of trash, gravel, sand, and silt and some metals, as well as the reduction of biochemical oxygen demand (BOD) and turbidity.

- Sand filters can be used for standalone treatment or in conjunction with bag and cartridge filtration if further treatment is required.
- Sand filters can also be used to provide additional treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

- The filters require monthly service to monitor and maintain the level the sand media.

Schematic Diagrams:

Sand Media Particulate Filters

Pressurized Bag Filter

Description:

A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header, allowing for the discharge of flow in series to an additional treatment unit. Vendors provide pressurized bag filters in a variety of configurations. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

Appropriate Applications:

Effective for the removal of sediment (sand and silt) and some metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Oil absorbent bags are available for hydrocarbon removal.

Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

The filter bags require replacement when the pressure differential exceeds the manufacturer's recommendation.

Schematic Diagrams:

Pressurized Bag Filter

Cartridge Filter

Description:

Cartridge filters provide a high degree of pollutant removal by utilizing a number of individual cartridges as part of a larger filtering unit. They are often used as a secondary or higher (polishing) level of treatment after a significant amount of sediment and other pollutants are removed. Units come with various cartridge configurations (for use in series with pressurized bag filters) or with a larger single cartridge filtration unit (with multiple filters within).

Appropriate Applications:

Effective for the removal of sediment (sand, silt, and some clays) and metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Hydrocarbons can effectively be removed with special resin cartridges.

Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

Implementation:

- The filters require delivery to the site and initial set up. The vendor can provide assistance.

Maintenance:

The cartridges require replacement when the pressure differential exceeds the manufacturer's recommendation.

Schematic Diagrams:

Cartridge Filter

4.5.18 Illicit Connection/Illegal Discharge Detection and Reporting

Description:

These procedures and practices are designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents to the RE.

Appropriate Applications:

Illicit connection/illegal discharge detection and reporting is typically applicable anytime an illicit connection is discovered or illegally discharged or dumped material is found on a construction site.

Implementation:

- The RE shall be notified of illicit connections and illegal dumping or discharge incidents at the time of discovery. The RE will notify the District Construction Storm Water Coordinator for reporting.

4.6 BMPs: FURTHER RESEARCH NEEDED

These are temporary construction BMPs that have been identified as needing further research and evaluation of the design and effectiveness. Although these BMPs have not yet been approved, they are available for use on an innovative basis on construction projects as determined by the RE. The RE will monitor such use as part of the BMP assessment process and report to the District Construction Storm Water Coordinator.

4.6.1 Storm Drain Inlet Protection

Description:

This temporary control practice is used to detain and/or to filter sediment-laden runoff to allow sediment to settle and/or to filter sediment prior to discharge of storm water into storm water drainage systems or watercourses.

Appropriate Applications:

- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Use where sediment-laden water has potential to enter an inlet.
- Use only where ponding will not encroach into highway traffic or onto erodible surfaces or slopes.
- Use where drainage area is 0.4 ha or less.
- Use shall not obstruct traffic or violate traffic safety requirements.

Implementation:

- Storm drain inlets shall be temporarily covered with spill pads and/or mats during construction or maintenance activities (i.e., cold planning and paving operations).
- Storm drain inlets may also be protected by surrounding an inlet with either:
  - Filter fabric fence;
  - Fiber rolls;
  - Gravel bag barrier;
  - Polyurethane barrier; or
  - Sandbag barrier.
- Excavated drainage or culvert inlet sediment trap surrounded by silt fence and lined with filter fabric.

Maintenance:

- Make sure filter fabric stakes are securely driven into the ground. Replace damaged stakes.
- Replace or clean fabric when the fabric becomes clogged with sediment. Repair fabric as needed.
- Check gravel bags for proper arrangement. Replace damaged bags as needed.

- Remove sediment when accumulation reaches one-third of the fence or barrier height or when the volume of the basin has been reduced by one-half. Sediments removed shall be disposed of properly.
- Remove all inlet protection when no longer needed. Clean and re-grade the area around the inlet and clean the inside of the storm drain inlet of sediment and debris.

4.6.2 Stabilized Construction Entrance/Exit

Description:

This temporary control practice is a defined point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Appropriate Applications:

- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary and feasible by the RE.
- Use at construction sites where dirt or mud is tracked onto public roads by construction vehicles.

Implementation:

- Limit the points of entrance/exit to the construction site.
- Properly grade each entrance/exit to prevent runoff from leaving the construction site.
- Stabilize each entrance/exit with aggregate or a constructed/manufactured steel-ribbed plate.
- If aggregate is selected for stabilization, place aggregate over geotextile fabric.

Maintenance:

Check for damage and repair as needed.

5.1 TREATMENT BMPs (CATEGORY III)

Where there is, or is proposed to be, a storm drain system discharging directly or indirectly to a surface water, the treatment BMPs listed in Table 5-1 will be considered.

TABLE 5-1: APPROVED TREATMENT BMPs (CATEGORY III)

Biofiltration: Swales and Strips
Infiltration Basins
Detention Devices
Traction Sand Traps
Dry Weather Flow Diversion
Linear Radial Device and Inclined Screen

The BMPs listed in Table 5-1 have been approved by Caltrans. In the experience of Caltrans, these BMPs have been found to be constructable, maintainable, and effective at removing pollutants. However, site specific circumstances exist where these BMPs may not produce water that fully achieves any particular effluent standard. Furthermore, it may not be feasible to construct these BMPs under all site conditions. Feasibility includes consideration of technical and cost issues, among others. Refer to Section 5.2.2 of this section for additional guidance on feasibility.

In general, this document provides guidance, but is not a substitute for fundamental engineering knowledge, experience, and the application of sound engineering judgment. Because storm water quality management is evolving rapidly, the guidance in this section will be amended or changed as conditions warrant. The designer must integrate this guidance with that provided in Caltrans policies and procedures.

5.1.1 Interim Project Delivery Categories

For the projects noted below, Caltrans will consider treatment BMPs by integrating the SWMP into the Caltrans existing project delivery process that begins with project feasibility studies and ends when construction is complete. At the present time, Caltrans has many projects in various phases of project delivery, and how Caltrans will implement treatment BMPs into new construction and major reconstruction projects will vary depending on the phase of a project. The process by which Caltrans will implement treatment BMPs into the project delivery process is summarized in Table 5-2.

Except for projects in Category C.1.a, described in Table 5-2, Caltrans will notify the appropriate RWQCB during the planning or design stages of projects noted below to provide RWQCB staff an opportunity to meet and discuss storm water quality issues and design pollution prevention and treatment BMPs for the proposed project.

Projects in Category C.1a, described in Table 5-2, are projects for which the environmental documents are final but for which treatment BMPs can be incorporated into the project without

reopening the environmental documents. For these projects, Caltrans will consult with the RWQCB within 180 days after the completion of construction to discuss storm water quality issues and design pollution prevention and treatment BMPs for the proposed project.

TABLE 5-2: PHASES OF PROJECT DELIVERY FOR NEW CONSTRUCTION AND MAJOR RECONSTRUCTION PROJECTS

Category	Project Delivery Status	Process to Incorporate Treatment BMPs	How BMPs Are Addressed and Funded
A	Beginning of Project Delivery Process prior to approval of the PSR	Storm water quality issues will be evaluated and treatment BMPs considered during the project alternatives and work plan development.	Cost of treatment BMPs will be programmed into the project.
B	PSR approved but environmental documents are not final	Treatment BMPs will be evaluated and, where feasible, incorporated into a project's design and addressed in the environmental documents.	Will incorporate BMPs and seek funding from the CTC. Caltrans will report to the SWRCB when the CTC has rejected Caltrans request for funding.
C	Environmental documents final		
C.1		1. Environmental documents are not reopened for any reason.	
C.1.a		a. Treatment BMPs can be incorporated into project without requiring the environmental documents to be reopened.	Will incorporate BMPs and seek funding from the CTC. Caltrans will report to the SWRCB when the CTC has rejected Caltrans request for funding.
C.1.b		b. Treatment BMPs cannot be incorporated into project without requiring the environmental documents to be reopened.	Project will be tagged for high priority retrofit to incorporate BMPs. Will seek funding from the CTC. Caltrans will report to the SWRCB if the CTC has rejected Caltrans request for funding.
C.2		2. Environmental documents are reopened for some other reason other than storm water.	Notify RWQCB; follow process identified in Category B above.

For all categories of project delivery described in Table 5-2, Caltrans will:

- Maximize vegetation-covered soil areas of a project subject to the criteria for strips and swales in Section 5.4. Strips and swales are considered treatment zones known as biofiltration strips (overland flow areas) and biofiltration swales (vegetated ditches); and
- Evaluate treatment BMPs that may be incorporated into a project. In this evaluation Caltrans at a minimum will:

- Consider the potential impacts to downstream hydrology and aquatic life and habitat that could be caused by the project (can reference environmental documents if needed).
- Evaluate and consider approved design pollution prevention BMPs for all projects determined to have the potential to cause downstream impacts.
- Evaluate and consider approved treatment BMPs for each project based on site-by-site conditions.
- Document the feasible opportunities of each approved treatment BMP for every project.
- Incorporate the appropriate treatment BMPs into the project.

For all project categories described in Table 5-2, if Caltrans rejects all of the five approved BMPs listed in Table 5-1 for a specific project, then Caltrans will consult with the appropriate RWQCB to determine if viable alternative BMPs could be incorporated into the project. Caltrans will meet with the RWQCB to review the project and discuss possible alternative BMPs or alternative design or siting location criteria. If no viable alternatives exist, Caltrans will document its findings in a technical report submitted to the RWQCB:

- At a **minimum of 180 days** prior to the start of construction for all project categories except Category C.1.a.
- **Within 90 days** subsequent to meeting with the RWQCB for project Category C.1.a.

5.1.2 New Construction and Major Reconstruction

New construction and major reconstruction projects are defined as follows: New construction and major reconstruction includes new routes, route realignments, route upgrades (i.e. from two lane conventional highway to four lane expressway or freeway), and other such projects involving large construction grading equipment and right-of-way acquisitions for whole parcels or wide swaths. New construction activity does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility, nor does it include emergency construction activities required to protect public health and safety.

Examples of projects that require the consideration of treatment BMPs to treat storm water runoff from the impervious and pervious project areas within the Caltrans right-of-way are:

- New highways;
- Upgrading from two to four lanes;
- New maintenance facility;
- New safety roadside rest area;
- New bridge;

- New weigh station;
- New vista point;
- New interchange; and
- New park and ride lot.

5.1.3 Requirements for MS4 Areas

Opportunities to install treatment BMPs must be considered for water quality improvements for systems in urban areas subject to a MS4 permit (incorporated areas with a population greater than 100,000) whenever a section of Caltrans R/W undergoes significant construction or reconstruction and in other instances in which installation of treatment BMPs is required by the RWQCB.

Urban areas regulated under a MS4 permit are:

- Santa Rosa
- Alameda County
- Contra Costa County in RWQCB 2
- Contra Costa County in RWQCB 5
- San Mateo County
- Santa Clara County
- Salinas
- Ventura County
- Los Angeles County in RWQCB 4
- City of Long Beach
- Orange County in RWQCB 8 and 9
- San Diego County
- Riverside County in RWQCB 8
- Riverside County in RWQCB 9
- San Bernardino County in RWQCB 8
- Coachella Valley
- Bakersfield
- Fresno
- Modesto
- Stockton
- Port of Stockton
- Sacramento County
- Vallejo
- Fairfield/Suisuin
- Lake Tahoe Basin

Significant construction or reconstruction projects are described in the Highway Design Manual (HDM) as Resurfacing, Restoration and Rehabilitation (RRR) projects. RRR projects involve highway widening or curve realignments, retrofit jobs that modify and upgrade an existing facility such as lane additions, curve realignments that involve large construction grading equipment, and sliver right-of-way acquisitions.

Examples of these projects include:

- Adding an auxiliary lane to an existing highway;
- Widening an existing bridge;
- Improving or reconfiguring an existing interchange; and
- Grade separations.

5.1.4 Excluded Projects

Projects that do not involve grading or changes to the existing drainage system are excluded from upgrades to storm water facilities and the need for treatment facilities. These projects may include:

- Maintenance;
- CAPM;
- Minor A&B;
- Retrofit sound walls;
- Ramp metering;
- Highway planting;
- Striping;
- Bridge scour;
- Bridge rail replacement;
- Bridge seismic retrofit;
- Freeway maintenance access;
- Signs and lighting;
- Traffic signals;
- Pedestrian over/under crossings;
- Railroad crossings;
- Changeable message signs; and
- Major damage restorations.

Procedures for determining which treatment BMPs should be considered at a given site are described in Section 5.2. Guidance in determining the appropriate Water Quality Volume (WQV) or Water Quality Flow (WQF) Rate is presented in Section 5.3. Section 5.4 contains descriptions of the approved BMPs and guidance for determining their feasibility at any particular site.

5.2 TREATMENT BMP SELECTION PROCEDURES

A procedure for consideration of approved treatment BMPs is described below. Section 5.2.2 contains guidance for site-specific determinations of BMP feasibility.

5.2.1 General BMP Selection

A flow chart illustrating the treatment BMP selection procedure for non-exempt projects is shown in Figure 5-1.

Biofiltration swales and strips are to be implemented at all sites to the extent practicable and to the extent that implementation is consistent with existing Caltrans policies. In practice this means maximizing the use of vegetation in the right-of-way. Further guidance can be found in Section 5.4.

Dry weather diversions may be feasible. If the criteria described in Section 5.4 are met at a particular site, a dry weather diversion should be considered for deployment.

The remaining treatment BMPs should be considered next. Infiltration basins should be considered first. If they are found to be feasible, funds for deployment should be requested from the funding authority. If infiltration is not feasible at a specific site, detention devices should be evaluated.

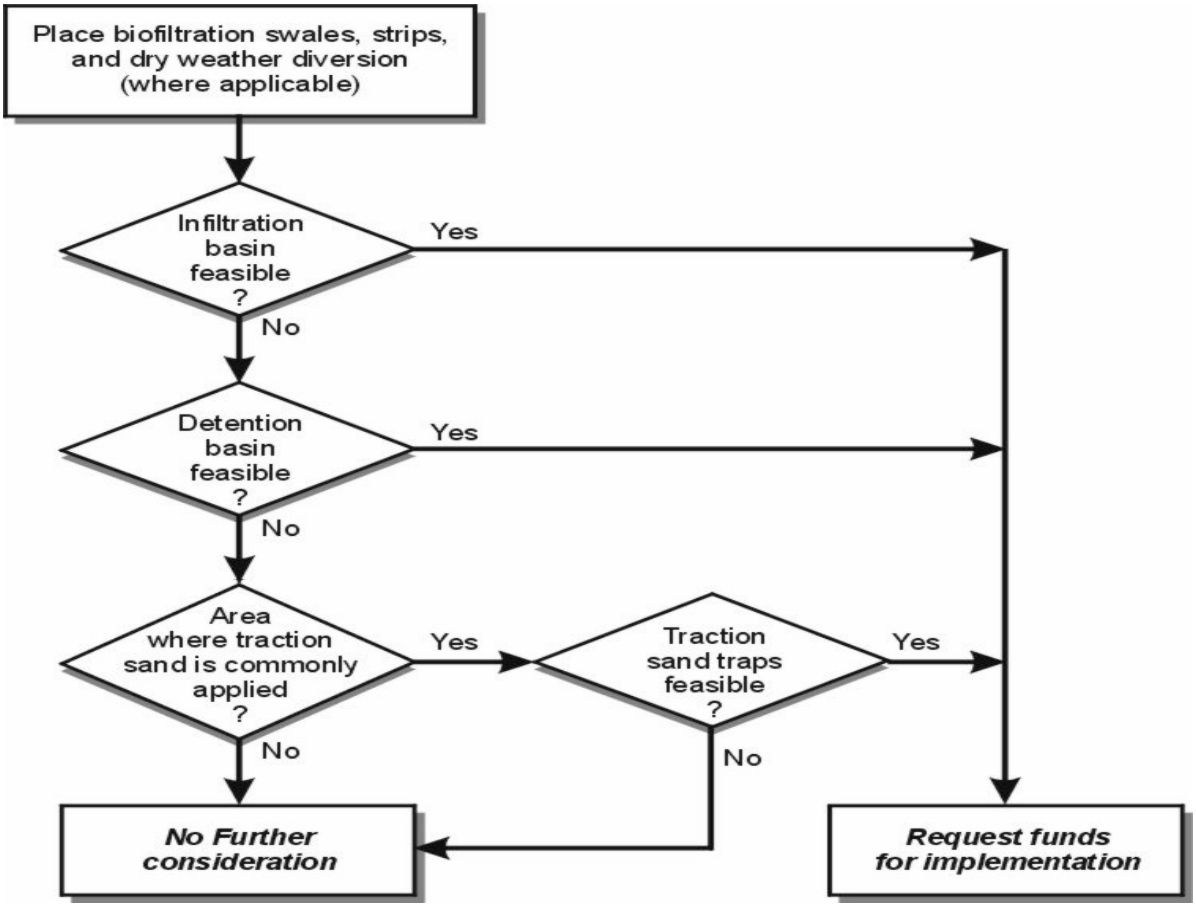


Figure 5-1
Decision Process for Selecting Treatment BMPs at Specific Sites

If detention devices are not feasible at a specific site, no other BMPs have been approved for consideration except in mountain regions where traction sand is commonly applied during winter snow storms. In these locations, the feasibility of traction sand traps should be evaluated. Where they are feasible, they should be considered. If they are not feasible, the RWQCB should be contacted and options discussed. Consideration should also be given to linking BMPs, where feasible. For instance, the overflow of some BMPs could be treated by a BMP such as a bioswale or an infiltration basin could be preceded by a traction sand trap. Combining BMPs in series or in parallel could enhance treatment in a cost effective manner, depending on the BMP and the site conditions.

5.2.2 Site-Specific Determination of Feasibility

Section B.1.2 of the SWMP provides general criteria used during the evaluation and approval of BMPs to be included in the list of approved BMPs. These criteria can also be used as a guide when considering project specific BMPs and include Relative Effectiveness, Technical Feasibility, Costs and Benefits, and Legal and Institutional Constraints.

General Criteria Applicable to All BMP Categories

Relative Effectiveness: A recommended BMP should generally demonstrate equal or greater pollution control benefits than a design without any BMP. Effectiveness may be assessed in terms of specific pollutants of concern (e.g., sediment or trash) or groups of pollutants. If there are no existing pollution or water quality control measures currently being implemented, then the recommended BMP will be considered effective by default.

Technical Feasibility: A recommended BMP must be technically feasible. Caltrans must be able to implement the BMP within the context of the state highway system. Feasibility also includes health and safety concerns. BMPs that substantially increase the risk to Caltrans workers or the public will be considered not feasible.

Costs and Benefits: The pollution control benefits must have a reasonable relationship to the costs. The costs and benefit analysis will consider the impacts to the waters of the State that are being mitigated or controlled through implementing the SWMP.

Legal and Institutional Constraints: The recommended BMP cannot compromise Caltrans compliance with other laws. For example, Caltrans must provide drainage under roadways at regular intervals to prevent water from accumulating upgradient and threatening the integrity of the roadbed and to limit encroachment of captured water on the traveled way. Caltrans cannot legally block historic drainage patterns or systems (e.g., runoff from farmland).

The first step in assessing feasibility is to gather the data needed to determine the size and estimate the cost of the BMP and whether or not the site characteristics, particularly the soil, are appropriate. A listing of the data needed can be found in Table 5-3.

TABLE 5-3: DATA NEEDS FOR TREATMENT BMPs

OUTFALL INVENTORY

TRIBUTARY DRAINAGE AREA TO OUTFALL (pavement surface plus R/W)

SITE HYDROLOGY: Design storms, runoff coefficients, etc., needed to meet Caltrans hydraulic design criteria

WATER QUALITY TREATMENT VOLUME CALCULATED FROM WATER QUALITY DESIGN STORM OBTAINED FROM:

a. SWMP Practice Guidelines (this document), or at http://www.stormwater.water-programs.com
b. Calculated by Project Engineer (see website above)

SITE PLANS AND ADJACENT LAND USES FROM AERIAL PHOTOGRAPHS, GIS DATA, ETC.

SITE SOIL CHARACTERISTICS:

a. Soil types (NRCS hydrologic soil classes)
b. Soil infiltration rates (on-site testing)
c. Local groundwater quality concerns (consult RWQCB)
d. Seasonal groundwater level (well data, USGS databases, etc.)
e. Site hydrogeology (from boring logs, lenses, hardpan, etc.)
f. Available system head

COSTS OF BMP MATERIALS, LABOR, AND EQUIPMENT

RWQCB	Regional Water Quality Control Board
USGS	U.S. Geological Survey
NRCS	Natural Resource Conservation Service (formerly Soil Conservation Service [SCS])

Next, determine the water quality volume (or for traction sand traps, the flow during the water quality design storm) that must be treated. (See Section 5.3 for guidance.)

Next, for all BMPs except GSRDs, calculate the size of the proposed BMP needed to treat the water quality volume (or flow). Guidance for making these calculations can be found in Section 5.4 and other sources. For GSRDs, the design process is different – the units are sized to convey the design peak flow while holding one year's worth of gross solids. Unless regional or site-specific data are available, the design gross solids loading should be 0.7 m^3/hectare/year (10 ft^3/acre/year).Next, use the procedure in Section 5.4, beginning with Infiltration Basins, to evaluate the appropriate BMP giving proper consideration given to recovery zones, setbacks from structures, hydraulic head, and maintenance access roads and ramps. In very small drainage areas, it may be impractical to construct a BMP to treat the resulting small water quality volume (or flow).

For projects where the WQV is less than 0.1 acre-foot, detention basins and infiltration basins are not cost effective.

Sites requiring extraordinary plumbing to collect and treat runoff (e.g., highway jacking or bridge deck collection systems) are considered infeasible due to their associated costs and need not be considered. Sites requiring extraordinary features or construction practices, such as retaining

walls and shoring, may also be infeasible due to their associated costs relative to the cost of the BMP itself.

Biofiltration strips and swales are to be implemented at all sites to the extent practicable, which means Caltrans should maximize the use of vegetation in the right-of-way.

Dry weather flow diversion should be considered only when all of the following conditions exist:

- Dry weather flow is persistent;
- A sanitary sewer is close by;
- The domestic wastewater treatment authority is willing to accept the flow; and
- Local health officials recommend the dry weather flow diversion.

Generally, BMPs otherwise appropriate for a site will be considered infeasible in certain instances. If a BMP is too large to fit at a site, it is considered infeasible. As described in Section 5.3, Caltrans and the RWQCB may, in some cases, agree to install a BMP that is smaller than what normal sizing procedures would dictate. Purchasing additional land for BMPs is generally not fiscally feasible. However, purchasing additional land to site infiltration basins can be considered, because of the high water quality benefits gained through the use of infiltration basins for storm water. Even in this case, however, only the purchase of undeveloped land can be fiscally justified. Where a minor piece of land is needed for placement of an infiltration basin, purchasing low intensity developed land (such as storage yards or parking lots) can be considered. The Department will include in its review process the potential for land acquisition or agreements with other resource agencies to allow for storm water spreading over existing vegetated areas outside of the Department's Right of Way if fiscally feasible.

5.3 PROJECT SIZING: WATER QUALITY DESIGN STORM DETERMINATION

"Design Storm" is the particular event which generates runoff rates or volumes which the drainage-related facilities are designed to handle. For water quality treatment purposes, the volume of water that must be treated is termed the WQV, and the flow rate to be treated is the WQF. Methods for determining the WQV have been established in the SWMP and are generally tied to an analysis of rainfall depths generated over 24-hour periods.

The water quality volume of treatment BMPs will be based on using any one of the following methods:

- Where they are established, sizing criteria from the RWQCB or local agency (whichever is more stringent) will be used;
- Where the RWQCB or local agency does not have an established sizing criterion, Caltrans will use one of the following methods listed in the SWMP (Appendix B):

- The maximized detention volume determined by the 85th percentile runoff capture ratio. This method is described in Chapter 5 of the *Urban Runoff Management WEF Manual of Practice No. 23,* 1998, published jointly by the Water Environment Federation and the American Society of Civil Engineers. Designers should note, however, that the information presented in the WEF manual cannot be directly applied to Caltrans facilities because it is based on large watersheds and oversimplified hydrologic data for California. A Web-based design tool, which uses data from more than 300 California rainfall stations, has been created for Caltrans use. It is available at http://stormwater.water-programs.com. A detailed description of the method can also be found in: Guo, C.Y., and B.R. Urbonas (1996), "Maximized Detention Volume Determined by Runoff Capture Ratio," *Journal of Water Resources Planning and Management,* v. 122, n. 1, pp. 33-39.
- The volume of annual runoff based on unit basin storage WQV to achieve 80 percent or more volume of treatment based on the sizing methods provided in the *California Storm Water Municipal Best Management Practice Handbooks,* published by the California Storm Water Quality Task Force, March 1993. A Web-based design tool has been created for Caltrans use. It is available at http://stormwater.water-programs.com.

- A volume established by Caltrans subject to the review and approval of the RWQCB when one of the following situations applies:
  - The site area is limited and cannot accommodate a treatment BMP sized according to the methods described in Options 1 or 2 above, or
  - Sizing a treatment BMP using the methods established in Options 1 or 2 above, in areas of the State with significant annual precipitation, results in excessively large treatment units.

The WQF is the primary design criteria to be used for filtering types of treatment control devices. As identified in the approved SWMP (Section B.5.3), the Department, the SWRCB and the nine RWQCBs worked cooperatively to establish the values.

The listed values of rainfall intensity would be used in the Rational Formula (Q=CiA) to generate runoff from areas which would flow to the filtering treatment device. The resulting runoff rate would be the design WQF to be used at any specific site.

The WQF should be used as the basis for developing current designs, but over time, both the Department and the Boards should review and assess the effectiveness of this criteria for possible revision. Also, where there are special circumstances or conditions, the project specific designer and the affected RWQCB should discuss the potential need for modification of the criteria on a case-by-case basis.

1. Region 1 (North Coast) – 0.22 inches/hour ("/hr) for Siskiyou and Modoc Counties, 0.27 "/hr for Trinity and Mendocino Counties and 0.36 "/hr for Del Norte, Humboldt and Sonoma Counties.

2. Region 2 (San Francisco) – 0.20 "/hr regionwide.
3. Region 3 (Central Coast) – 0.22 "/hr for Santa Cruz County, 0.20 "/hr for Santa Clara County, 0.18 "/hr for San Benito, Monterey and San Luis Obispo Counties and 0.26 "/hr for Santa Barbara County.
4. Region 4 (Los Angeles) – 0.20 "/hr regionwide.
5. Region 5 (Central Valley) – 0.16 "/hr for portions of Lassen and Modoc Counties within the Region, all areas of Region below 1,000' elevation north of and including Sacramento and Amador Counties and below 2,000' elevation south of Sacramento and Amador Counties, and all elevations on the west side of the Region (rain shadow side of the Coast Range). 0.20 "/hr for elevations in the Sierra Nevadas between 1,000' and 4,000' in the north and between 2,000' and 4,000' in the south. 0.24 "/hr for all elevations above 4,000' in the Sierra Nevadas.
6. Region 6 (Lahontan)-

    a) Where there are location specific requirements (Truckee River, East and West Forks Carson River, Mammoth Creek, and Lake Tahoe), the WQF will conform to the Basin Plan requirement for runoff from impervious areas. Where runoff from pervious areas contributes to the flow to the treatment device, the WQF value to be used will be as specified in the following two items.

    b) Other than as stated in item a), above, the WQF to be used for that portion of the Lahontan Region including Inyo County and areas southward will be 0.16 "/hr. The WQF to be used for pervious surface areas within the Mammoth Creek watershed above 7,000 feet will be 0.16 "/hr.

    c) For all other areas of the Lahontan Region other than as indicated in item a) above, the WQF to be used will be 0.20 "/hr. This includes pervious surface areas of the Truckee River, Carson River East and West Forks and Lake Tahoe Hydrologic units.

7. Region 7 (Colorado River) – 0.16 "/hr regionwide.
8. Region 8 (Santa Ana River) – 0.20 "/hr regionwide.
9. Region 9 (San Diego) – 0.20 "/hr regionwide.

5.4 DESCRIPTIONS OF TREATMENT BMPS

This section contains descriptions of treatment BMPs, guidance on appropriate applications and site-selection criteria, and a discussion of factors to be considered during preliminary design. This guidance is intended to assist design engineers in determining the physical size, shape, and location of treatment BMPs so that an assessment about their feasibility at particular sites can be made.

Biofiltration Swales and Strips (Vegetated Treatment Systems)

Description:

Biofiltration swales are vegetated channels that receive directed flow and convey storm water. Biofiltration strips, also known as vegetated buffer strips, are vegetated sections of land over which storm water flows as overland sheet flow.

Pollutants are removed by filtration through the grass, sedimentation, adsorption to soil particles, and infiltration through the soil. Swales and strips are mainly effective at removing debris and solid particles, although some dissolved constituents are removed by adsorption onto the soil.

Appropriate Applications and Siting Constraints:

Swales and strips should be considered wherever site conditions and climate allow vegetation to be established and where flow velocities are not high enough to cause scour. Even where strips cannot be sited to accept directed sheet flow, vegetated areas provide treatment of rainfall and reduce the overall impervious surface.

Factors Affecting Preliminary Design:

Interim criteria for the design of swales and strips include the requirements in Sections 3.1, 3.2, and 3.3 of the Guidelines. These sections direct engineers to "maximize vegetation-covered soil areas of a project," "minimize impervious surfaces" and "minimize overland and concentrated flow depths and velocities." Designers should also consider the following factors:

Swales have two design goals: 1) maximize treatment, 2) provide adequate hydraulic function for flood routing, adequate drainage and scour prevention. Treatment is maximized by designing the flow of water through the swale to be as shallow and long as site constraints allow. No minimum dimensions are required for treatment purposes, as this could exclude swales from consideration at some sites. Swales should also be sized as a conveyance system calculated according to Caltrans procedures for flood routing and scour. Design of swales is also subject to Caltrans procedures for clear recovery distances.

To maximize treatment efficiency, strips should be designed to be as long (in the direction of flow) and as flat as the site will allow. No minimum lengths or maximum slopes are required for treatment purposes. The area to be used for the strip should be free of gullies or rills that can concentrate overland flow and cause erosion.

Vegetation mixes appropriate for various climates and locations will be developed by District landscape staff. Table 5-4 summarizes preliminary design factors for biofiltration.

TABLE 5-4: SUMMARY OF BIOFILTRATION (STRIPS AND SWALES)

Description	Applications/Siting	Preliminary Design Factors
Swales are vegetated channels that receive and convey storm water. Strips are vegetated buffer strips over which storm water flows as sheet flow. Treatment Mechanisms: • Filtration through the grass • Sedimentation • Adsorption to soil particles • Infiltration Pollutants removed: • Debris and solid particles • Some dissolved constituents	• Site conditions and climate allow vegetation to be established • Flow velocities not high enough to cause scour	• Swales sized as a conveyance system (per Caltrans flood routing and scour procedures) • Swale water depth as shallow as the site will permit • Strips sized as long (in direction of flow) and flat as the site allows • Strips should be free of gullies or rills • Strips should be as wide as possible, subject to Caltrans drainage standards. • No minimum dimensions or slope restrictions for treatment purposes • Vegetation mix appropriate for climates and location

Infiltration Basins

Description:

Infiltration basins are depressions designed to hold runoff and infiltrate it directly to the soil rather than discharging it to receiving waters. A conceptual schematic illustration of an infiltration basin is shown in Figure 5-2.

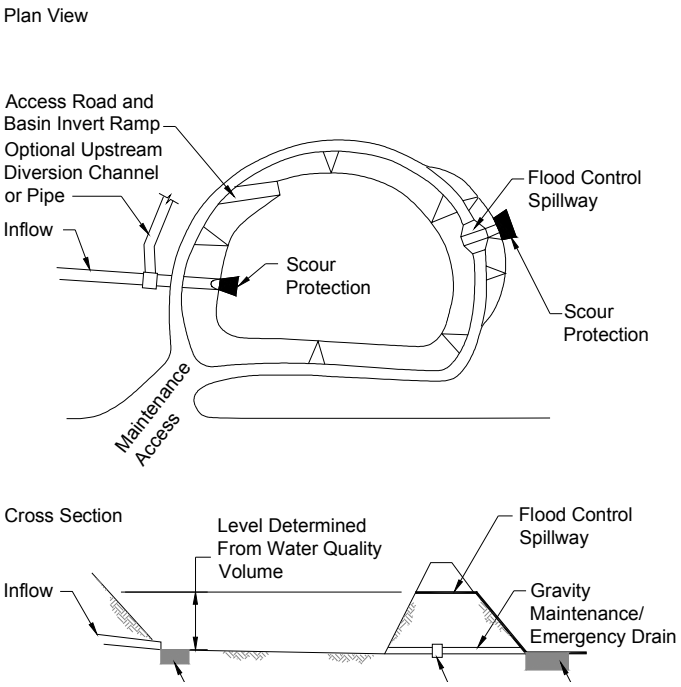


Figure 5-2
Example Conceptual Schematic of
Infiltration Basin Design
(Not a Standard Plan)

Appropriate Applications and Siting Constraints:

Infiltration basins should be considered wherever site conditions allow and the design water quality volume exceeds 0.1 acre-feet. Appropriate sites for infiltration basins have sufficient soil permeability (both vertical and horizontal), have a sufficiently low water table, do not present a threat to local groundwater quality and are at a sufficient elevation to allow gravity drainage (of the basin) for maintenance purposes. The Lahontan Regional Board staff has requested consideration of infiltration basins where pretreatment can be provided. Where pretreatment is not feasible, Caltrans will consult with the RWQCB to discuss available options.

The following steps are recommended for determining the feasibility of infiltration BMPs. The major components are Pre-screening, Site Screening, Site Investigation and Preliminary Design.

1. PRE-SCREENING FOR THE INFILTRATION BMP

Pre-screening for the infiltration BMP involves collecting site-specific information necessary to determine, in consultation with the RWQCB, whether infiltration is an appropriate storm water

treatment for the site. No field testing is anticipated during this phase. The steps involved in pre-screening include:

1. Information collection; and
2. Preliminary determination of infiltration appropriateness through consultation with RWQCB on the results.

The following sections describe the steps involved.

Information Collection

Some of the basic site-specific data required for the determination of the appropriateness of the infiltration BMP are found in the sources listed below. Additional data may be required for local conditions. Data collected by project engineering staff and Caltrans Storm Water Coordinators include, but may not be limited to:

- Outfall inventory data (if available), project alignment, right-of-way, annual average daily traffic (ADT), Caltrans outfall locations, and other basic project maps and data;
- Tributary drainage areas and surrounding land uses (from outfall inventory, as-builts, aerial photographs, GIS data from Caltrans and local planning agencies);
- Site surface hydrology data: tributary drainage area, runoff coefficients, drainage network, travel times, etc., needed to design facilities to Caltrans hydrologic/hydraulic criteria;
- Basin Plan groundwater beneficial uses and known impairments (RWQCB);
- Caltrans runoff quality data for appropriate Caltrans land use in catchment area (Caltrans Statewide Storm Water Quality Database at http://stormwater.water-programs.com , Caltrans Annual Research Summary report);
- Water quality treatment volume per Section 5.3;
- Site soil characteristics:
  - Indigenous soil types: NRCS soil maps and corresponding hydrologic soil classes;
  - Soil infiltration rates (estimated and from any existing on-site testing in the vicinity by others); and
  - Caltrans project grading plans or as-built plans (if retrofit), if available.
- Existing groundwater and hydrogeology information:
  - Maps of local aquifers underlying the alignment or location of the proposed Caltrans project;
  - Aquifer groundwater quality and seasonal groundwater levels: monitoring well data, U.S. Geological Survey (USGS), Department of Water Resources (DWR), and local public agency maps and databases;

  - Local groundwater quality concerns: Consult RWQCB, California Department of Health Services (DHS), local environmental/health department (city/county);
  - Site hydrogeology (from any existing boring logs: lenses, hardpan, etc.);
  - Known contaminated groundwater plumes (RWQCB); and
  - Groundwater rights data: adjudicated basins, other rights (RWQCB, DHS); and
- State Water Information Management System data for project area (SWRCB).

During the data collection process, the Caltrans Storm Water Coordinator should brief the RWQCB regarding the project for which the BMP is being considered, and request assistance in the data collection process as needed.

Preliminary Determination for Appropriateness of Infiltration

Once the data above have been collected and placed in the context of the alignment and/or location of the Caltrans facility being considered for infiltration BMPs, the project engineer and Storm Water Coordinator will use the data collected and follow the procedure outlined in Figure 5-3.

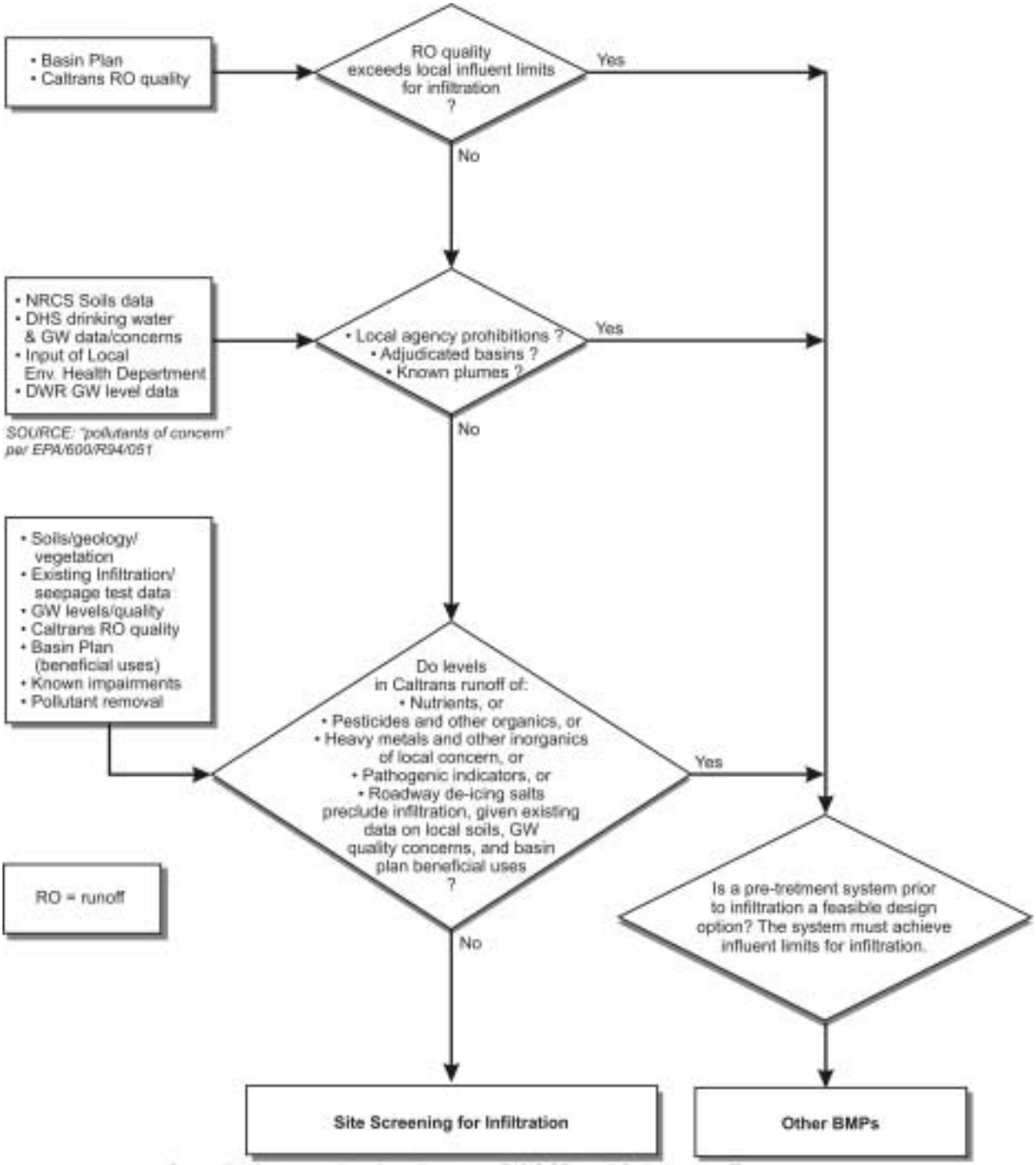


Figure 5-3
Pre-screening for the Infiltration BMP

Salient steps include:

1. Determine if local Basin Plan or other local ordinances provide influent limits on quality of water that can be infiltrated. Compare with Caltrans runoff quality, and determine if infiltration is permissible. If not, consider detention basins.
2. Determine if local agencies, public health authorities, legal restrictions, or other concerns preclude consideration of infiltration of storm water runoff. Consult with RWQCB and representatives of appropriate authorities as needed. If infiltration into the aquifer is not acceptable to local authorities, consider detention basins.
3. Estimate the quality of runoff from the Caltrans facility draining into the proposed infiltration basin using data from the Caltrans storm water database and annual research summaries.

   Compare the estimated Caltrans runoff water quality with available groundwater quality data, using receiving water objectives from the RWQCB Basin Plan for each groundwater beneficial use. Determine if the separation between the maximum anticipated seasonal high groundwater and the proposed basin invert is at least 3 m (10 ft). Tabulate the results and make a preliminary determination of the appropriateness of the infiltration BMP.
4. Caltrans project representative contacts the RWQCB Contact to review procedures followed, what information is available and what information is not available. Present the compiled data and the results of the preliminary determination to the RWQCB.
5. Caltrans and RWQCB will jointly review the data, and, if necessary, gather additional existing information if available data are deemed insufficient for a preliminary determination. Caltrans and RWQCB will then re-convene to make the determination on whether to proceed with infiltration. The Department will prepare written documentation regarding the determination to proceed or not to proceed with infiltration. Copies of the written documentation will be placed in the appropriate project file and also forwarded to the appropriate RWQCB.

If the determination is negative (infiltration *not* appropriate), consider detention basins. If determination is positive (infiltration potentially appropriate), proceed to infiltration site screening.

2. SITE SCREENING

Using data gathered in the pre-screening process, perform an initial desktop screening of sites to narrow the number of potential sites to those that can be considered for field investigations. As needed, collect additional information, and follow the procedures below:

- Estimate soil type (consider NRCS Hydrologic Soil Groups (HSG) A, B, or C only, as shown in Table 5-4) from soil maps and/or USDA soil survey tables and/or

background information; in areas where septic systems are in widespread use, the County Environmental Health Department should have information on appropriate soil types for infiltration of onsite wastewaters.

TABLE 5-5: TYPICAL INFILTRATION RATES FOR NRCS TYPE AND HSG CLASSIFICATIONS

NRCS Soil Type	HSG Classification	Infiltration Rate	
		cm/hr	(in/hr)
Sand	A	2.0	(8.0)
Loamy sand	A	5.1	(2.0)
Sandy loam	B	2.5	(1.0)
Loam	B	1.3*	(0.5)*
Silt loam	C	0.6	(0.25)
Sandy clay loam	C	0.4	(0.15)
Clay loam & silty clay loam	D	<0.2	(<0.09)
Clays	D	<0.1	(<0.05)

* Minimum rate for infiltration basins. Silt loams may also be acceptable (HSG C) if geotechnical investigations demonstrate adequate infiltration rates.

- Also review other key available data: percent silt and clay, presence of a restrictive layer, permeable layers interbedded with impermeable layers, and seasonal high water table. Other geotechnical considerations include location in seismic impact zones, unstable areas, such as landslides and Karst terrains, and those with soil liquefaction and differential settlement potential. Generally, sites should not be constructed in fill, or on any slope greater than 15 percent.
- The minimum acceptable spacing between the proposed infiltration basin invert and the seasonal high water table is 3 m (10 feet). If a separation of less than 3 m (10 feet) is proposed, the approval of the local RWQCB is required.
- Infiltration basins should not be sited in locations over previously identified contaminated groundwater plumes. Setback distance should be determined in coordination with the RWQCB.
- Estimate infiltration rate for maximum infiltration for soil type using Table 5-4.
- Estimate the area required for infiltration as follows:

$$A_{est} = 12 \cdot SF \cdot WQV / k_{est} \cdot t \qquad \text{(Eq. 1)}$$

Where:

A_{est}	=	estimated area of invert of basin, ft^2
12	=	conversion factor from inch to feet
SF	=	safety factor of 2.0
WQV	=	water quality volume calculated from the design storm, ft^3
k_{est}	=	estimated infiltration rate from Table 5-4, in/hr
t	=	draw-down time, 48 hours

- The infiltration basin should be located outside the 9 m (30 ft) clear recovery zone, 300 m (1,000 ft) from any municipal water supply well, 30 m (100 ft) from any private well, septic tank or drain field, and 60 m (200 ft) from a Holocene fault zone.

3. SITE INVESTIGATION

1. Obtain list of candidate sites (within R/W and outside R/W) that pass the screening process (from outfall inventory database(s), if available).
2. Perform site investigation to identify any: (a) Regulatory permit required, (b) major underground utility interference, (c) Transportation improvement plan conflicts, or (d) General plan land use data for tributary area.
3. If the parcel is outside of R/W, for planning to proceed, Caltrans must generate greater than 50% of the total tributary runoff. Otherwise discontinue investigation of parcel.
4. Assess the feasibility (degree of plumbing and available area) of directing runoff from additional tributary area to the site. (Additional Caltrans area has priority; other off-site areas are secondary). Consider potential downstream impacts from diversions and cost of diverting additional flow. Diversions of tributary area to unimproved conveyances (creeks/streams) is prohibited. Diversions to improved conveyances may be permitted if it can be demonstrated that the conveyance has sufficient capacity to accommodate the additional flow.
5. Investigate feasibility of infiltration using criteria above and procedure in Section 4: Procedure for preliminary infiltration basin site investigation. Recalculate and verify area requirements using the collected field data. Use Equation 1 above and the lowest measured infiltration rate to calculate area of basin.
6. If an infiltration basin is feasible, proceed to Section 5 Preliminary Design.

4. PROCEDURE FOR PRELIMINARY INFILTRATION BASIN SITE INVESTIGATION

The following scope of work defines the steps for infiltration basin feasibility studies. This scope of work provides for a level of investigation necessary to determine if an infiltration basin may be feasible on the subject site. The screening procedure is terminated if the site does not meet the criteria for any step, and assessment of the site continues for a detention basin.

The depth to groundwater must be known as the first step in feasibility because a high groundwater table can lead to infiltration failure and potential contamination of the groundwater table. The *in situ* infiltration rate at the basin invert must also be known to ensure that infiltration of the calculated water quality volume is possible within 48 hours. Due to the extreme variability of site conditions, field investigation is required to determine the depth to groundwater and *in situ* infiltration rate.

The scope of work comprises two phases:

- Initial Investigation; and
- Detailed Investigation as described below.

Initial Investigation

The initial investigation comprises two parts: A) Initial technical field screening and determination of groundwater elevations, and B) Geotechnical investigation for soil lithology and select chemical testing. To streamline the initial investigation phase, Part A will be performed first, followed by Part B if the Part A criterion of at least 3 m (10 ft) clearance for the groundwater elevation below the basin invert is satisfied and the engineer approves the site for further consideration. Consult the local RWQCB for approval of proposed groundwater separation less than 3 m (10 ft).

Part A Initial Technical Field Screening and Determination of Groundwater Elevation

An initial indication of the seasonal high groundwater water table elevation will be determined by using a piezometer, previous studies, or other accepted geotechnical means. The piezometer will be installed to a depth of at least 6 m (20 ft) below the proposed basin invert using the direct push or other suitable method. Groundwater levels will be observed for at least 24 hours after installation. As part of this task, an engineer will conduct a site reconnaissance to evaluate the site conditions. Site screening criteria in Section 2 should be considered.

A regional groundwater review will be performed based on the available data, including, but not necessarily limited to:

- Previously compiled databases on potential BMP sites (such as outfall inventory databases);
- Data and maps available from regional government databases, DWR, other local agencies and internal Caltrans sources;
- Local soil survey data from the NRCS and other sources;
- Soil lithology, infiltration rate and groundwater depth data from the county or other specialists that approve septic system installations in the local area;
- Information on local groundwater beneficial uses and groundwater quality issues from the RWQCBs and other water agencies; and
- Information on local groundwater-related drinking water issues from DHS.

The geotechnical professional will make a determination on a site-by-site basis, whether the groundwater elevation determined after 24 hours can be considered to be a reasonable indication of the seasonal high water table for the purposes of the evaluation of the groundwater depth criteria, described below. If such determination cannot be made reasonably based on the

available data, the site will be recommended for a longer period of water table elevation monitoring, as necessary.

If the initial seasonal high groundwater elevation indication is within 3 m (10 ft) of the invert of the proposed infiltration basin, the site will be eliminated from further consideration unless the local RWQCB requires installation of an infiltration basin with less than 3 m separation to groundwater, and that provides adequate groundwater protection. If there is not a reliable indication that the seasonal high water table is at least 3 m (10 ft) below the invert of the proposed infiltration basin (i.e., if there is reason to believe the water table may rise to within 3 m (10 ft) of the proposed invert), a more extensive groundwater table elevation investigation will be performed as outlined below in Part 2.C of the Detailed Investigation procedure described below. If the groundwater elevation at the site clearly exceeds 3 m (10 ft) from the proposed basin invert and all other criteria in the initial investigation are satisfied, a detailed groundwater elevation determination will not be required.

Part B Geotechnical Investigation for Soil Lithology and Select Chemical Testing

An initial soil investigation will be performed to adequately understand soil lithology and determine:

- If there are potential problems in the soil structure that would inhibit the rate or quantity of infiltration desired; or
- If there are potential adverse impacts that could result from locating the infiltration basin at the site to either structures, slopes or groundwater.

Geotechnical trenches (or at the option of the engineer, a boring may be used) will be dug using a backhoe at one or two locations within each site, depending on the site conditions. Clearance of the site for hazardous contaminants through the appropriate District should be done prior to drilling by the geotechnical professional conducting the work. Underground Service Alert (USA) clearance will also be obtained. The trenches will be at least 2 m (6 ft) long and 2 m (6 ft) deep below the proposed basin invert. The soil profiles will be carefully logged to determine variations in the subsurface profile. Of greatest importance is the presence of fine-grained materials such as silts and clays, which should be determined by direct measurement of particle size distribution. It is anticipated that two to four soil samples will be collected for determination of the soil particle size distribution at each site. Samples will be collected from the soil profiles at different horizons and transported to a laboratory for soil texture and chemical testing as described below:

- Soil textures that tend to promote infiltration include sands, loamy sands, sandy loams, and loams (and possibly some of the coarser silt loams) in the NRCS classification system, or GW, GM, SP, SW and GC, SC, SM, ML (unified soil classification), subject to clay and clay/silt percentages shown below and the judgement of the field engineer or soil scientist.

- The soil in the first 300 mm (12 inches) below the basin invert will be tested for organic content (OC), pH, and cation exchange capacity (CEC). Values that promote pollutant capture in the soil are: OC > 5 percent, pH in the range of 6-8, and CEC > 5 meq/100 g of soil. In general, the soil should not have more than 30 percent clay or more than 40 percent of clay and silt combined.

In addition, the trenches should be examined for other characteristics that may adversely affect infiltration. These include evidence of significant mottling (indicative of high groundwater), restrictive layer(s), and significant variation in soil types horizontally and vertically. A summary report will be prepared addressing the issues noted above, with recommendations on the suitability of the site for infiltration and the necessity of carrying out the next phase of the investigation. (All the site reports will ultimately be combined in a single report.) Caltrans will give the 'go/no go' instructions for the detailed investigation phase for the sites deemed acceptable from the initial investigation.

Detailed Investigation

If the site conditions still appear favorable to infiltration after the geotechnical review and soil investigations, a detailed field investigation will be undertaken, which includes Part A, Detailed Subsurface Soil Investigation, Part B, In-Hole Conductivity Testing, and Part C, Detailed Groundwater Elevation Determination.

Part A Detailed Subsurface Soil Investigation

Borings will be drilled to a maximum depth of 15 m (50 ft) (or refusal) for each detailed investigation location at the discretion of the geotechnical professional. Samples will be obtained at 1.5 m (5-ft) intervals for soil characterization and laboratory testing. Bulk samples will also be collected at shallow depths to verify information collected in Parts A and B of the Initial Investigation.

Part B In-hole Conductivity Testing

Infiltration rate tests or another method approved by the geotechnical engineer will be performed at the proposed basin invert. The tests will be located to measure infiltration rates in the bed of the proposed basin.

The minimum acceptable infiltration rate as measured in any of the test holes is 1.3 cm/hr (0.5 in/hr). If any test hole shows less than the minimum value, the site will be disqualified from further consideration. If the infiltration rate at the site is significantly greater than 6.4 cm/hr (2.5 in/hr), the RWQCB must be consulted, and the RWQCB must conclude that the groundwater quality will not be compromised, before approving the site for infiltration.

If the site is constructed in fill or partially in fill, it will be excluded from consideration unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed, rather than flocculated state, greatly impacting permeability.

The geotechnical investigation will be sufficient to develop a good understanding of how the storm water runoff will move in the soil (horizontally or vertically), and if there are any geological conditions that could inhibit the movement of water.

Part C Detailed Groundwater Elevation Determination

If a detailed investigation to determine the groundwater elevation is required per the guidance above and, in the opinion of the engineer, the seasonal high groundwater elevation may come within 3 m (10 ft) of proposed basin invert) at least one and possibly two (per the recommendation of the geotechnical engineer) groundwater monitoring wells will be installed. One well will be installed within the proposed basin footprint and the other, if needed, will be installed near the basin but downgradient by about 10 m (30 feet). The wells will be observed over a wet and dry season. This observation period will be extended to a second wet season (at the direction of Caltrans) if the first wet season produces rainfall less than 80% of the historical average. The minimum acceptable spacing between the proposed infiltration basin invert and the seasonal high water table, as measured at either of the two established monitoring wells, is 3 m (10 ft), unless, in coordination with the RWQCB, it can be demonstrated that the groundwater will not be adversely impacted. A geotechnical professional will oversee the detailed investigation and must also consider other potential factors that may influence the groundwater elevation, such as local or regional groundwater recharge projects, future urbanization or agriculture. The geotechnical professional shall also examine the soil borings for indications of previous high water.

A final geotechnical report, overseen by a geotechnical professional, summarizing the findings of the investigation will be prepared. The report will include all results from the initial as well as detailed investigation phases of the feasibility study.

5. PRELIMINARY DESIGN

Table 5-5 summarizes preliminary design factors for infiltration basins.

1. Obtain site topography (one-half meter contours, 1:500 scale). Extend topography 25 m beyond the site perimeter in all directions and along the drain line to the location of the outfall to the local receiving water.
2. Develop a conceptual grading plan for improvements showing basin, maintenance access, basin outlet and extent of R/W requirements to accommodate the improvements. The basin invert must not have a slope of greater than 3%.
3. Develop unit cost-based cost estimate to construct the infiltration basin. Include allowances for hazardous/unsuitable materials, traffic management, storm drain system improvements (as needed and determined by engineer).
4. Develop single paragraph assessments of: nonstandard design features, impact on utilities, hydrology (WQV, peak flow, land use), R/W total area needed, current

ownership), highway planting and lighting, permits, hazardous materials, environmental clearance and traffic management.

Figure 5-4 summarizes the BMP siting procedure for infiltration basins.

TABLE 5-6: SUMMARY OF INFILTRATION BASIN SITING AND DESIGN CRITERIA

Applications/Siting	Preliminary Design Factors
• > 3 m (w ft) to seasonally high water table (≥ 1.2 m [4 ft] if justified by adequate groundwater observations for a minimum of 1 year) • Soil infiltration rate ≥ 1.3 cm/hr (0.5 in/hr) • Clay content < 30%, and < 40% clay and silt combined • Sufficient horizontal hydraulic capacity • Infiltrated water is unlikely to affect the stability of downgradient structures, slopes, or embankments • Runoff quality is ≥ standards for infiltration to local groundwater • If pretreatment is required, only approved BMPs should be considered • Consult with RWQCB, water agencies, vector control authorities, and local utilities	• Maintenance access (road around basin and ramp to basin invert) • Optional upstream diversion channel or pipe, or downstream overflow structure • Flood control spillway • Scour protection on inflow and spillway • Size to capture the 24-hr water quality volume • Infiltrate water quality volume within 48 hours • Use ½ the measured infiltration rate to size the basin • > 3 m downgradient and 30 m (100 ft)upgradient from structural foundations • ≥ 30 m (100 ft) from drinking water wells • Emergency/maintenance gravity drain

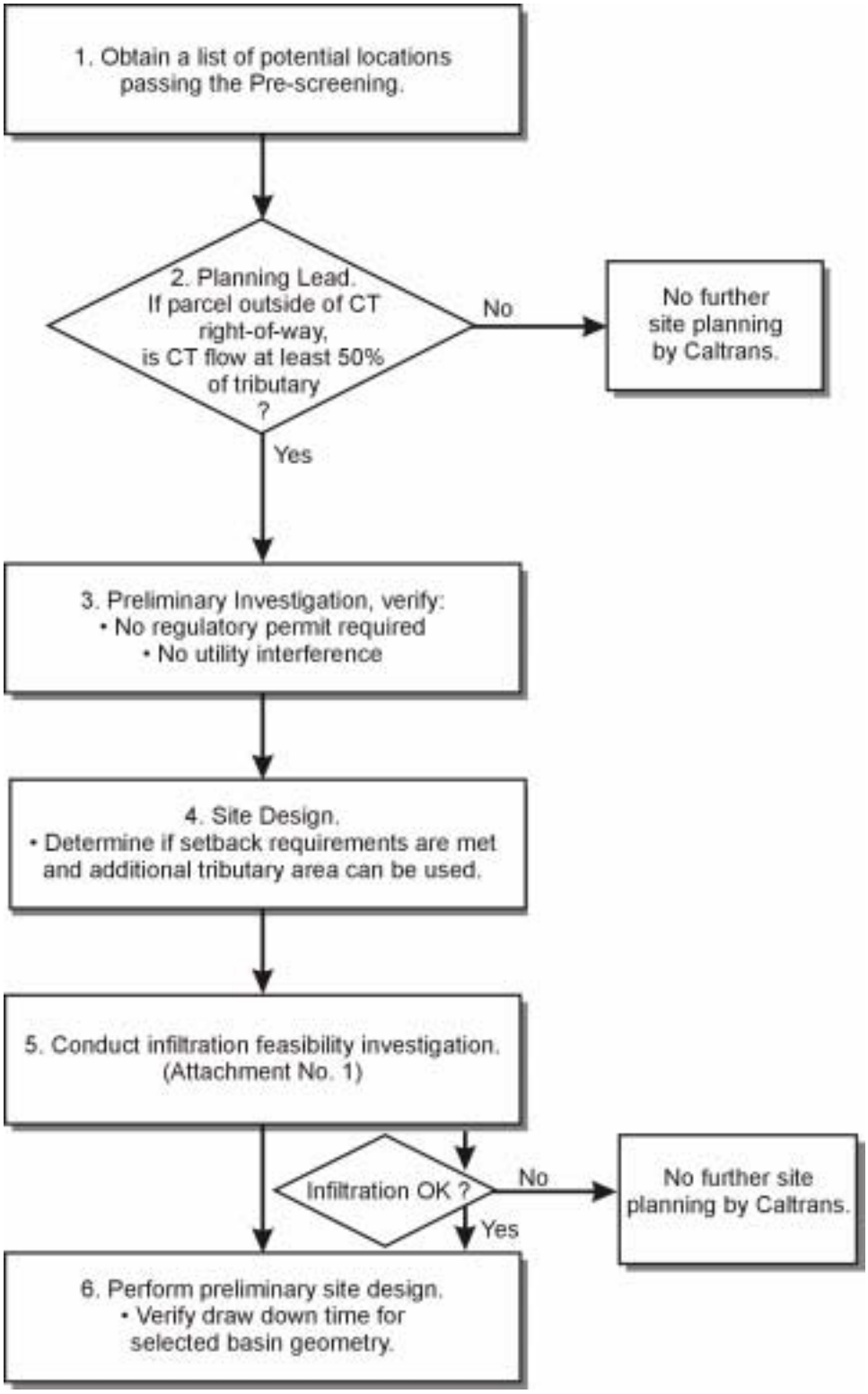


Figure 5-4
BMP Siting Procedure for Infiltration Basins

Detention Basins

Description:

Detention basins are impoundments where the water quality volume is temporarily detained under quiescent conditions, allowing sediment and particulates to settle out. A conceptual schematic of a detention basin is shown in Figure 5-5.

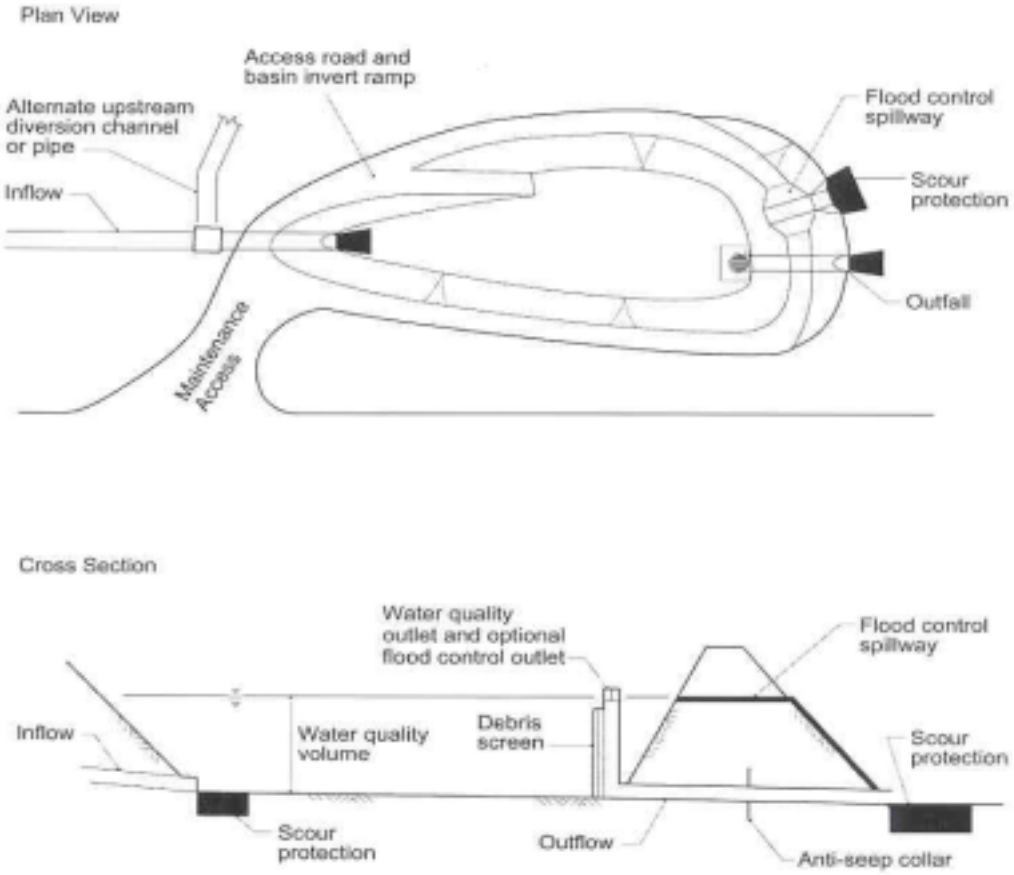


Figure 5-5
Example Conceptual Schematic of an Detention Basin (Not a Standard Plan)

Detention basins remove litter, settleable solids (debris), and total suspended solids (TSS) and pollutants, that are attached (adsorbed) to the settled particulate matter.

Appropriate Applications and Siting Constraints:

Detention basins should be considered for implementation wherever infiltration basins are not feasible, the water quality volume is at least 0.1 acre-feet, and site conditions allow.

One important siting requirement is that sufficient head is available so that water stored in the basin does not cause a backwater condition in the storm drain system, which would limit its capacity. A second siting requirement is that seasonally high groundwater be no higher than the bottom elevation of the basin for reasons described below. A minimum of two 13 mm (0.5 in) orifices sets a minimum drainage area depending on basin depth, runoff coefficient, drain time and water quality volume.

Factors Affecting Preliminary Design:

Detention basins should be designed with a volume equal to at least the water quality volume determined using the methods described in Section 5.3. The maximum water level in the detention device should not cause groundwater to occur under the roadway within 0.2 m (8 in) of the roadway subgrade. A flow-path-to-width ratio of at least 2:1 is recommended. This ratio can be accomplished by baffles or interior berms to accommodate the geometry of the site.

Liners are not generally required for detention basins. Infiltration is permissible if the infiltrated water does not surface in an undesirable place off-site or threaten the stability of a slope or embankment downgradient of the basin. To protect groundwater quality and to ensure dry conditions for maintenance of unlined basins, the distance between the basin invert and seasonally high groundwater should be at least 3 m (10 ft). Where the groundwater is higher than this, the basin side slopes and invert should be provided with an impermeable liner. In no case should the seasonally high groundwater be higher than the bottom elevation of the detention device to prevent uplift of tanks or liners.

Discharge should be accomplished through a water quality outlet. An example is shown in Figure 5-6. A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.

The water quality outlet should be designed to empty the device within 24 to 72 hours (also referred to as “drawdown time”). (The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.) Some methods for determining the WQV (specifically Options 2a and 2b in Section 5.3) involve an assumption of drawdown time. If these methods are used, the drawdown time used to design the outlet should be consistent with the value used to calculate the WQV. In Option 2a, any drawdown time between 24 and 72 hours can be used. In Option 2b, a 40-hour drawdown time is assumed. Because detention basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Public health and vector control authorities should be consulted to verify the acceptability of detention basins and to establish the maximum drawdown time allowed in order to avoid mosquito problems.

The inlet structure of the basin should be designed to divert the peak hydraulic flow (calculated according to Caltrans procedures for flood routing and scour) when the basin is full. Alternatively, an overflow structure sized according to these criteria can be provided in one of the downstream walls or berms. A third alternative is to include a flood control outlet in the top of the water quality outlet. In this case, an additional outlet (riser or spillway) should be supplied to prevent overtopping of the walls or berms. Entering flows should be distributed uniformly at low velocity to prevent re-suspension of settled materials and to encourage quiescent conditions.

The site must have sufficient area for a perimeter maintenance road and safe access to and from the site from local roads. Basin side slopes must be shallow enough to permit tracked vehicles to access the basin invert for maintenance. Alternatively, an access ramp should be provided. Preliminary design factors for detention basins are summarized in Table 5-7.

TABLE 5-7: SUMMARY OF DETENTION BASIN

Description	Applications/Siting	Preliminary Design Factors
Impoundments where the water quality volume is temporarily detained Treatment Mechanisms: • Sedimentation • Infiltration (if basin unlined) Pollutants removed: • Sediment and particulates • Litter • Sorbed pollutants (heavy metals, O&G)	• Sufficient head to prevent objectionable backwater condition in the storm drain system • Seasonally high groundwater below basin invert • Consult public health and vector control authorities • Minimum orifice size of 13 mm (0.5 in)	• Size to capture the water quality volume according to Section 5.3 • Flow-path-to-width ratio of at least 2:1 recommended • Maximum water level should not cause groundwater to occur under the roadway within 0.2 m of the roadway subgrade • Basin invert ≥ 3 m above seasonally high groundwater or else a impermeable liner is required • Scour protection on inflow, outfall and spillway • Maintenance access (road around basin and ramp to basin invert) • Upstream diversion channel or pipe, downstream overflow structure or flood control outlet • Discharge through a water quality outlet with debris screen (or equivalent) • Outlet design to empty basin within 24 to 72 hrs (consistent with basin sizing method, as appropriate) • Flows should enter at low velocity

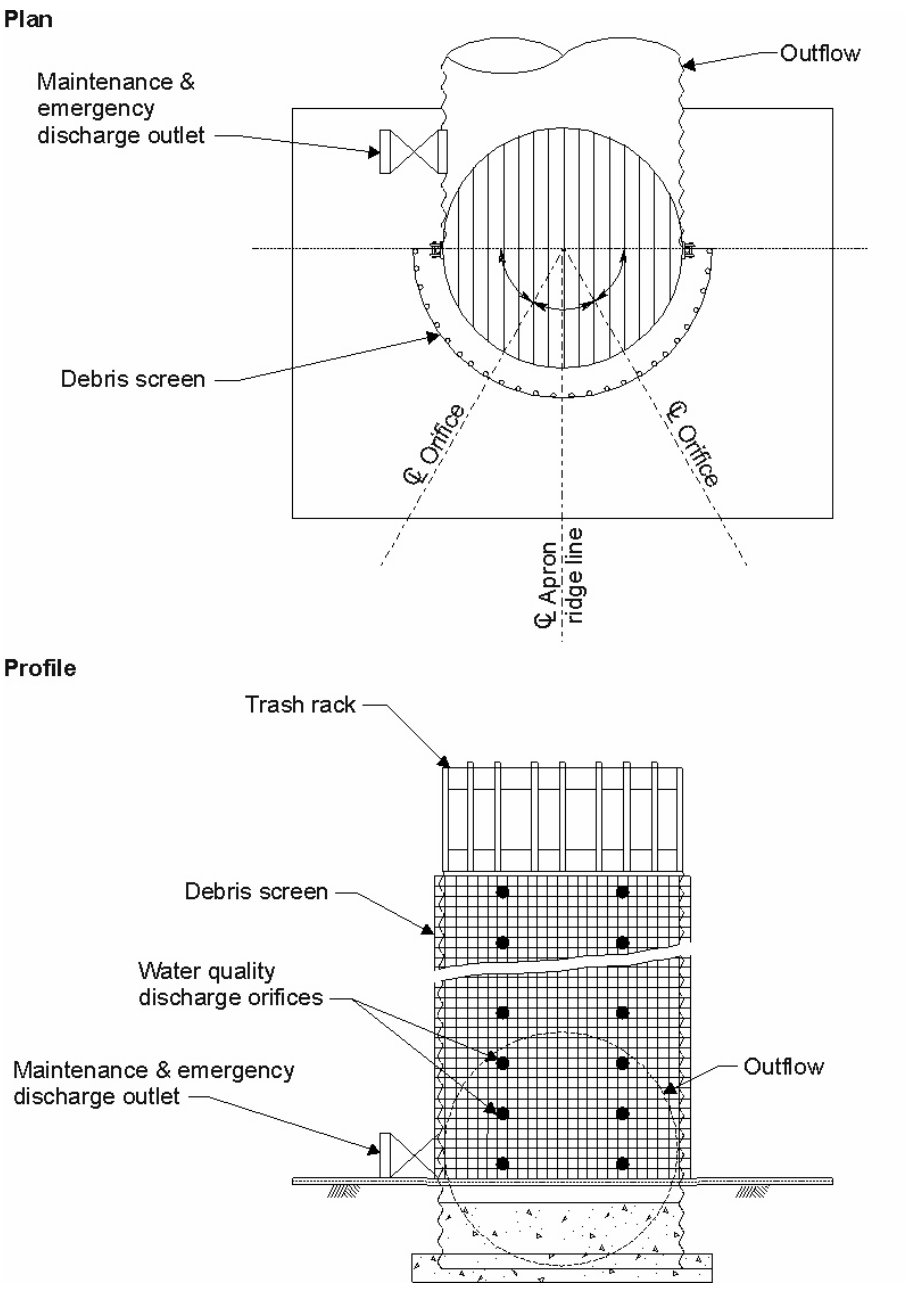


Figure 5-6
Example Schematic of Water Quality Outlet Structure
(Not a Standard Plan)

Traction Sand Traps

Description:

Traction sand traps are sedimentation devices that temporarily detain runoff and allow traction sand that was previously applied to snowy or icy roads to settle out. These traps may take the form of basins, tanks, or vaults.

Appropriate Applications and Siting Constraints:

Traction sand traps should be considered at sites where sand or other traction-enhancing substances are commonly applied to the roadway. If sand is used only rarely (less than once or twice a year), traction sand traps should not be considered for installation.

Traction sand traps should be considered only where detention basins are not feasible. The local RWQCB should be consulted to ensure that the traction sand trap is not classified as a regulated underground injection well.

Factors Affecting Preliminary Design:

Traction sand traps are designed to operate at the treatment design storm runoff flow (not volume) (flow-based runoff criteria are being reviewed by the SWRCB). Provisions should be made to divert the peak hydraulic flow (calculated according to Caltrans procedures for flood routing and scour).

In addition, sand traps should have sufficient volume to store the settled sand through the winter (or some other period of time chosen by the District) with enough depth over the stored sand to prevent scouring and to promote relatively calm pool conditions. A typical sand application rate is approximately 47 m^3/lane/km/yr (2,700 ft^3/lane/mile/yr or 100 yd^3/lane/mile/yr), although rates twice this value are not uncommon. Sand application varies by location, and information available in the District should be used when available. Sand recovery by sweeping varies from 0 (no sweeping) to 60 percent (aggressive sweeping), leaving 40 to 100 percent of the applied sand potentially available to be captured in traps. This value needs to be multiplied by a factor to account for losses of sand (by wind or removal with snow-blowing equipment) and gains of sediment (from erosion). This factor can range from 0.8 to 1.2. The pool above the stored sand should be large enough to provide a 1-minute hydraulic detention time (calculated by dividing the sand trap volume by the design flow rate).

Traction sand traps require a small hydraulic head for gravity flow operation. The inlet and outlet devices should be arranged or baffled to minimize short-circuiting of the flow through the device. Weep holes should be provided and the trap invert should be sufficiently high above groundwater (1 to 2 m) to allow for proper drainage. Traction sand traps that do not drain may create vector problems in the spring.

Traction sand traps require sufficient space and/or access ramps for maintenance by large equipment to remove the accumulated sand. Traps should also be located so that water is not introduced above the roadway subgrade should the trap become blocked or fail to drain. Preliminary design factors for traction sand traps are summarized in Table 5-8.

TABLE 5-8: SUMMARY OF TRACTION SAND TRAPS

Description	Applications/Siting	Preliminary Design Factors
Sedimentation devices that temporarily detain runoff and allow traction sand to settle out. May be basins, tanks, or vaults Treatment Mechanisms: • Sedimentation Pollutants removed: • Sand or other traction-enhancing substances	• Sites where sand or other traction-enhancing substances commonly applied to the roadway • Not considered where sand is used only rarely (less than once or twice a year) • Where detention basins are not feasible • Consult RWQCB to ensure device not classified as a regulated underground injection well • Locate device so water is not introduced above the roadway subgrade in case of blockage	• Design for treatment design storm runoff flow (not volume) • Divert peak hydraulic flow • Sufficient volume to store the settled sand through the winter and provide a calm pool without scour • Pool above the stored sand large enough to provide a 1-min hydraulic detention time • Sufficient hydraulic head for gravity flow • Inlet and outlet arrangement to minimize short-circuiting of the flow • Weep holes • Invert 1 to 2 m above groundwater • Maintenance space and/or access ramps for large equipment

Dry Weather Flow Diversion

Description:

Dry weather diversion devices direct flow through a pipe or channel to a local municipal sanitary sewer system for conveyance and treatment at a local wastewater treatment plant during dry weather.

Appropriate Applications and Siting Constraints:

Dry weather flow diversion should only be considered when all of the following conditions apply:

- Dry weather flow is persistent (i.e., present over a significant length of time at a relatively consistent flow rate);

- An opportunity for connecting to a sanitary sewer is reasonably close and would not involve excessive measures to implement (e.g., jacking under a freeway);
- The sanitary sewer authority is willing to accept the flow during the dry season; and
- Diversion is recommended by local health officials because of public use of the receiving water near the Caltrans facility.

Factors Affecting Preliminary Design:

Typically, a berm or wall is constructed across the dry weather flow drainage channel and the dry weather flows are diverted to a pipe or channel leading to the sanitary sewer. A gate, weir, or valve should be installed to stop the diversion during the wet season. Accordingly, the conveyance to the sanitary sewer should be sized for the dry weather flow only. Wet weather flow is diverted back to the storm water conveyance system.

If possible, a screen should be installed at the diversion to reduce the likelihood of clogging the diversion pipe or channel. Maintenance vehicle access should be provided, especially if a screen is installed. Preliminary design factors for dry weather flow diversions are summarized in Table 5-9.

TABLE 5-9: SUMMARY OF DRY WEATHER FLOW DIVERSION

Description	Applications/Siting	Preliminary Design Factors
Direct flow during dry weather to local municipal sanitary sewer and wastewater treatment plant Treatment Mechanisms: • Wastewater treatment plant Pollutants removed: • All constituents	Only when the conditions below apply: • Dry weather flow is persistent (consistent flow rate and significant length of time) • Reasonably close connection to a sanitary sewer • Connection would not involve excessive construction measures to implement • Sanitary sewer authority willing to accept dry weather flow • Recommended by local health officials (public use of receiving water near Caltrans facility)	• Berm or wall across channel to divert dry weather flow to the sanitary sewer • Gate, weir, or valve to stop diversion during wet season • Conveyance to sanitary sewer sized only for dry weather flow • Maintenance vehicle access