Caltrans

Storm Water Quality Handbook:
Project Planning and Design Guide

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Office of Storm Water Management - Design

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Tables

TABLE OF CONTENTS

List of Figures

TABLE OF CONTENTS

Appendices

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

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1.1 OVERVIEW

This Project Planning and Design Guide (PPDG) provides guidance on the process and procedures for evaluating project scope and site conditions to determine the need for and feasibility of incorporating Best Management Practices (BMPs) into projects, and also provides design guidance for incorporating those stormwater quality controls into projects during the planning and design phases. This document supersedes prior stormwater design guidance manuals and has been prepared in support of the Statewide Storm Water Management Plan (SWMP). The PPDG addresses key regulatory, policy and technical requirements by providing direction on the procedures to implement the stormwater BMPs into the design of all Caltrans projects.

The key objective of this PPDG is to provide the overall process for selecting and designing BMPs within the Caltrans planning and design processes and incorporating those BMPs into the appropriate documents. These documents include the Project Initiation Document (PID), the Project Approval/Environmental Document (PA/ED), and the Plans, Specifications and Estimates (PS&E). The planning and design approach described herein has been developed to fit within the appropriate Work Breakdown Structure (WBS) codes and activities identified in the Caltrans Project Development Procedures Manual (PDPM) updated March 2006) and the Guide to Project Delivery Workplan Standards, Release 8.0A. These documents can be found on the web at the following sites:

http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm

http://www.dot.ca.gov/hq/projmgmt/documents/wsg/workplan_standards_guide_8.0a.doc

Also, the Storm Water Data Report (SWDR), which summarizes the stormwater quality issues of a project, and its corresponding checklists are described in this manual. These documents are provided in Appendix E, and are used for guidance in evaluating BMPs considered during the PID, PA/ED, and PS&E processes.

This PPDG is organized as follows:

Section 1 – Introduction: Provides an overview of the BMP selection and design process, the history of the existing stormwater guidance documents, regulations and permits, SWMP implementation, design compliance monitoring and annual reporting requirements.

Section 2 – Best Management Practice Selection: Provides designers with background information and guidance necessary for the appropriate selection of permanent and temporary BMPs.

Section 3 – Design Program Responsibilities: Identifies specific staff responsibilities.

Section 4 – Permanent Treatment Consideration: Provides guidance for evaluating whether a project must consider incorporating Treatment BMPs based upon project-specific criteria.

Section 5 – Project Initiation Document Process: Describes the overall PID process, including the identification of stormwater quality issues, evaluation of potential BMPs, the estimating of

BMP costs, the preparation of a PID-level SWDR, and the development of a Preliminary Environmental Assessment Report (PEAR).

Section 6 – Project Approval/Environmental Document Process: Describes the overall PA/ED process, including the evaluation of potential stormwater quality impacts, the preparation of environmental and engineering studies for project alternatives, the selection of the preferred project alternative and its associated permanent BMPs, the development of a cost estimate, the completion of the PA/ED level SWDR, and the completion of a Project Report.

Section 7 – Plans, Specifications and Estimates Process: Describes the overall PS&E process, including the final design of the project, permanent BMPs, and temporary BMP strategy. Also describes the process for obtaining environmental permits, the steps necessary for completion of a PS&E level SWDR, and the completion of the PS&E package.

Section 8 – Final Project Development Procedures – Construction: Provides Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) information and Notification of Construction (NOC) information for the project construction phase.

Appendix A – Approved Design Pollution Prevention BMPs. Describes the Design Pollution Prevention BMPs that are considered during the planning and design phases of projects. These BMPs are then incorporated into the design of new facilities and the reconstruction or expansion of existing facilities.

Appendix B – Approved Treatment BMPs. Describes the Treatment BMPs that are considered during the planning and design phases of projects. Appendix B also identifies BMP selection procedures (the Targeted Design Constituent Approach).

Appendix C – Approved Construction Site BMPs. Describes and lists the Construction Site BMPs that should be considered for use during construction activities to reduce pollutants in stormwater discharges throughout construction.

Appendix D – Relevant Storm Water Documents and Web Sites. Provides a summary of the relevant stormwater related documents and their purpose, and the web sites that are referenced in this document.

Appendix E – Water Quality Summary Forms and Checklists. Provides Process Summary Forms for the PID, PA/ED and the PS&E processes, the Evaluation Documentation Form that correlates to Section 4, the SWDR that documents decisions made regarding stormwater quality, Checklist SW-1 that lists categories of pertinent information required for stormwater planning and design, Checklist SW-2 which provides a guide to collecting information relevant to project stormwater quality issues, Checklist SW-3 which provides direction to the designer during the project planning phase to avoid or reduce potential stormwater impacts, and Checklists DPP-1, T-1, and CS-1 which are used for guidance in selecting Design Pollution Prevention, Treatment BMPs and Construction Site BMPs.

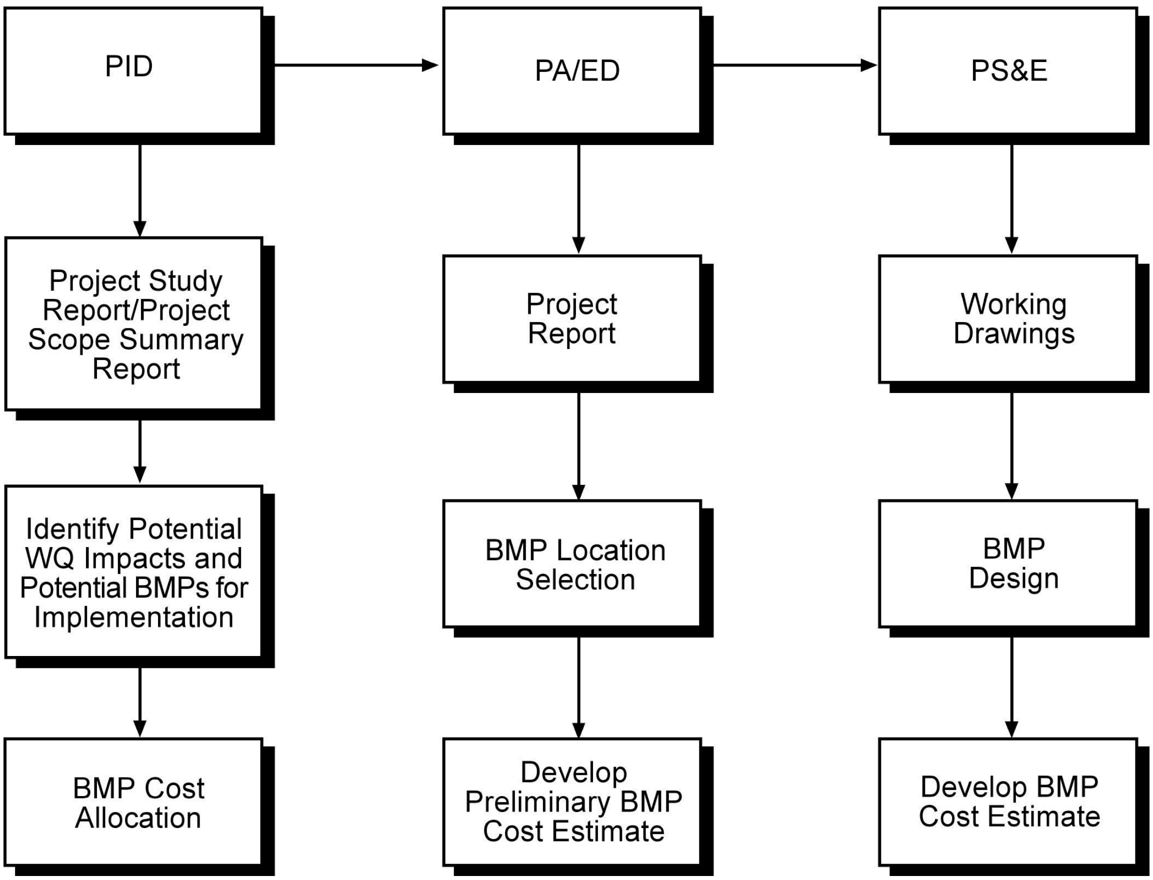
Appendix F – Cost Estimates. Provides guidance on how to estimate the cost of stormwater BMPs into the overall project cost.

Appendix G – Abbreviations, Acronyms, Definition of Terms and References.

1.2 BMP SELECTION AND DESIGN PROCESS

The overall process to select BMPs as part of each of the project phases, PID, PA/ED, and PS&E, is shown in Figure 1-1. This figure presents the procedure for BMP implementation throughout the design process from securing funds in the PID, to selecting the preferred BMP alternative in the PA/ED and preparing detailed design in the PS&E. Each phase of the project is individually described in Sections 5, 6 and 7 of this PPDG. Implementation activities generally follow the procedures presented in the PDPM.

Figure 1-1: Design Process Summary



It is important to note that this document provides minimum guidelines and that additional requirements may have to be incorporated on a project-by-project basis to comply with special requirements from a Regional Water Quality Control Board (RWQCB), specific District guidelines, environmental laws, or as a result of other studies. Other stormwater quality elements that designers may have to consider are included as a result of each District's Work Plan (DWP).

Special site conditions may warrant variations from the guidance provided herein. The Project Engineer (PE) is responsible for recognizing site conditions that warrant variations in procedures, and for securing appropriate approvals for these variations before proceeding with design.

1.3 STORM WATER GUIDANCE DOCUMENTS

In order to meet the demands of the stormwater management process in regards to controlling pollutant discharges and meeting permit requirements, several documents have been developed. Appendix D provides a list and a brief summary of these documents and their purposes.

1.4 REGULATIONS AND PERMITS

1.4.1 Federal Regulations

Federal regulations for controlling discharges of pollutants from municipal separate storm sewer systems (MS4s), construction sites, and industrial activities were incorporated into the National Pollutant Discharge Elimination System (NPDES) permit process by the 1987 amendments to the Clean Water Act (CWA) and by the subsequent 1990 promulgation of federal stormwater regulations issued by the U.S. Environmental Protection Agency (EPA). The EPA regulations require municipal, construction and industrial stormwater discharges to comply with an NPDES permit. In California, the EPA delegated its authority to the State Water Resources Control Board (SWRCB) to issue NPDES permits.

1.4.2 Caltrans NPDES Statewide Storm Water Permit

The SWRCB issued an NPDES Statewide Storm Water Permit (Caltrans Permit) to Caltrans in 1999 (Order No. 99-06-DWQ) (CAS000003), to regulate stormwater discharges from Caltrans facilities. The Caltrans Permit contains three basic requirements:

1. Caltrans must comply with the requirements of the Construction General Permit (General Permit) described in Section 1.4.3;
2. Caltrans must implement a year-round program in all parts of the State to effectively control stormwater and non-stormwater discharges; and
3. Caltrans stormwater discharges must meet water quality standards through implementation of permanent and temporary (construction) BMPs and other measures.

The Caltrans Permit regulates stormwater discharges from Caltrans rights of way during and after construction, as well as from existing facilities and operations. The Caltrans Permit gives RWQCBs the option to specify additional requirements they may consider necessary to meet water quality standards. Copies of the Caltrans Permit can be downloaded from the SWRCB web site, at http://www.swrcb.ca.gov/stormwtr/docs/caltranspmt.pdf.

Discharges from Caltrans rights of way that are not composed entirely of stormwater are prohibited unless the non-stormwater discharges are from a source authorized under the SWMP. Therefore, appropriate BMPs must be installed to remove pollutants to the Maximum Extent Practicable (MEP). The permit language is “Any discharge from Caltrans right-of-way or Caltrans properties, facilities, and activities within those rights of way that is not composed entirely of ‘Storm Water’ to waters of the United States is prohibited unless authorized pursuant to…this NPDES Permit.”

1.4.3 Construction General Permit

Recognizing the substantial administrative burden associated with permitting individual construction sites throughout California, the SWRCB elected to adopt a single statewide general permit for construction activities (General Permit) (Order No. 99-08-DWQ) (CAS000002) that applies to all stormwater discharges from land where clearing, grading, and excavation result in soil disturbance of at least one (1) acre or more. Construction activity that results in soil disturbances of less than one (1) acre is subject to this General Permit if the construction activity is part of a larger Common Plan of Development totaling one (1) acre or more of soil disturbing activities, or if there is the potential for significant water quality impairment resulting from the activity as determined by the RWQCB. The General Permit requires owners of land where construction activity occurs to develop a SWPPP (see Section 1.4.6).

In some areas of the state, the RWQCBs have issued permits directly to Caltrans Districts. The requirements for construction sites in these permits are generally similar and supersede the General Permit requirements. Copies of the General Permit can be downloaded from the SWRCB web site, at http://www.swrcb.ca.gov/stormwtr/construction.html.

1.4.4 Waste Discharge Requirements and Other Permits

In addition to implementing the Caltrans Permit, a RWQCB may issue separate Waste Discharge Requirements (WDRs) or additional permits. Some of the additional permits that may apply to Caltrans projects include, but are not limited to, the following:

- California General Construction Permit (see Section 1.4.3);
- Waste Discharge Requirements (WDR);
- Permit for Re-Use of Soil Containing Aerially Deposited Lead (ADL);
- 1601 and 1603 Permits from the California Department of Fish & Game;
- 404 Permit from the Army Corps of Engineers (ACOE);
- 401 Certification from the RWQCB; and
- Coastal Permits

An example of an additional permit requirement that may be applicable for a project would be work that involves the reuse of soils that contain aerially deposited lead. Caltrans has applied for and received variances from the California Department of Toxic Substances Control (DTSC) for the reuse of some soils that contain lead. Under the Caltrans Permit, the District will provide written notification to the RWQCB at least 30 days prior to advertisement for bids of projects that involve soils subject to this variance. This notification period will allow a determination by the RWQCB(s) of the need for development of Waste Discharge Requirements (WDRs) or written conditional approvals by RWQCB staff. Other situations that may require WDRs or permits include dewatering discharges, disposal of concrete wastes, etc.

1.4.5 Caltrans Statewide Storm Water Management Plan

The Caltrans Permit directs Caltrans to implement and maintain an effective SWMP. The SWMP is the Caltrans policy document that describes how Caltrans conducts its stormwater management activities (i.e., procedures and practices), provides descriptions of each of the major management program elements, discusses the processes used to evaluate and select appropriate

BMPs, and presents key implementation responsibilities and schedules. The SWMP also contains a list of the approved BMPs that have been evaluated and selected to manage stormwater discharges from Caltrans properties, facilities, and activities.

1.4.6 Storm Water Pollution Prevention Plan

Section A of the General Permit outlines the required contents of a SWPPP. A SWPPP is a document that addresses water pollution controls for a specific project during construction. The General Permit requires that all stormwater discharges associated with construction activities that result in soil disturbance of at least one (1) acre of total land area must comply with the provisions specified in the Caltrans Permit, including development and implementation of an effective SWPPP. Designers are required to include pertinent SWPPP related information in the project file. In some cases, the RWQCB may view two or more small projects (individually less than one [1] acre of soil disturbance, but together totaling one [1] acre or more) in the same corridor to be part of a larger Common Plan of Development, thus making the small projects subject to the requirements of the General Permit to develop and implement a SWPPP. The Project Manager (PM) should therefore be aware of other projects in the corridor.

At least 30 days prior to the start of construction, Caltrans will submit a Notification of Construction (NOC) to the appropriate RWQCB for all construction projects that disturb more than one (1) acre of soil. A project's SWPPP must include a copy of the NOC. The SWPPP is normally prepared by the contractor, and shall be approved by the Resident Engineer (RE) prior to commencement of soil-disturbing activities. When construction is complete and the construction site is stabilized, Caltrans will submit a Notice of Completion of Construction (NOCC) to the appropriate RWQCB.

1.4.7 Water Pollution Control Program

Generally, construction projects with a disturbed soil area of less than one (1) acre are not covered under the General Permit and do not require a SWPPP. The exceptions to this rule would be (i) in the case of a Common Plan of Development, or (ii) if the RWQCB requires a SWPPP for a smaller project based upon water quality concerns. For all projects that do not require preparation of a SWPPP, Caltrans requires that a Water Pollution Control Program (WPCP) be prepared. The WPCP is normally prepared by the contractor and shall be approved by the RE prior to commencement of soil-disturbing activities. Details on the preparation of the SWPPP or WPCP are found in the supplementary Storm Water Quality Handbook, "SWPPP and WPCP Preparation Manual, March 2003."

1.5 PERMIT AND SWMP IMPLEMENTATION

The Headquarters (HQ) Environmental Program coordinates implementation of the SWMP with each District or Region and with other HQ functional units including Design, Maintenance, and Construction. Each District is responsible for implementing the SWMP within the District and complying with the Caltrans Permit and General Permit requirements and any District- or Region-specific requirements. Program responsibility matrices have been developed specifically for each District or Region and are available from District/Regional Storm Water Coordinators.

1.5.1 District Work Plans

The Caltrans Permit requires the submittal of District Work Plans (DWPs) as part of the Annual report. Caltrans, in coordination with the SWRCB and the RWQCBs, has developed a standard format for the development and submittal of these DWPs. Each RWQCB is provided a copy of the DWPs relevant to their jurisdiction.

Caltrans will develop and submit DWPs to the SWRCB each year, as part of the Annual Report. The DWPs will also be forwarded to the appropriate RWQCB Executive. The DWPs describe activities that will be conducted by the Districts during the upcoming fiscal year to implement the SWMP. These work plans are organized as follows:

- Section 1 – Introduction;
- Section 2 –Personnel and Responsibilities;
- Section 3 – District Facilities and Water Bodies;
- Section 4 – Drinking Water Reservoirs and Recharge Facilities;
- Section 5 – Implementation.

The Districts will coordinate and meet with the appropriate RWQCBs to discuss the proposed DWPs at least 30 days prior to their submittal due date each year.

1.6 PROJECT DESIGN COMPLIANCE EVALUATION

Project Design Compliance Evaluation (PDCE) is a SWMP element that will be developed by the HQ Project Design Storm Water Advisory Team (PD-SWAT) and will be implemented by the Districts with the following objectives:

- Evaluate compliance of project planning and design activities with requirements of the Caltrans Permit and the approved SWMP;
- Identify activities needing improvement, changes or revisions;
- Report compliance status to Caltrans management, the SWRCB and the RWQCBs.

Currently, each District is responsible for implementing a design review process based on local requirements and project needs. Elements of each District’s compliance review program, and the implementation of that program, will be unique due to individual District organizational structures and staff responsibilities. The PDCE that will be implemented through the SWMP is intended to address this variability. It will be developed by the PD-SWAT, implemented through the Districts, and will require documentation and reporting of the review findings to HQ and in the Annual Report.

The key elements of the proposed PDCE are:

- Design Evaluation Selection Criteria;
- Compliance Review Method;

- Compliance Rating Criteria;
- Treatment BMP Evaluation;
- Feedback and Program Improvement

The results of the Project Design Evaluation Activities for each fiscal year will be provided in the Annual Report.

1.7 ANNUAL REPORTING REQUIREMENTS

The information to be included in the Annual Report will be first reviewed by the PD-SWAT as part of the process to annually update the SWMP. A summary of Design Compliance Monitoring activities will be provided in the Annual Report including:

- The design checklists used during the previous year;
- A new checklist for the upcoming year, if needed;
- A summary of the review findings; and
- A summary of lessons learned, trends, challenges encountered, and proposed program changes.

In protecting water quality, each RWQCB:

- Adopts a region-specific Water Quality Control Plan or Basin Plan that contains water quality standards specific to the region's waters;
- Issues waste discharge requirements (WDRs) and water quality monitoring and reporting programs that implement the SWRCB's statewide policy and regulations along with the region-specific water quality standards specified in its Basin Plan; and
- Implements enforceable orders against violations of statewide and region-specific requirements

2.1 INTRODUCTION

This section of the Project Planning and Design Guide (PPDG) provides designers with background information and guidance on the process and procedures for evaluating project scope and site conditions to determine the need for and feasibility of incorporating Best Management Practices (BMPs) into projects, and also provides guidance necessary for the appropriate selection of Best Management Practices (BMPs). The following sections describe how the designer can identify pollutants of concern, define BMP placement and use considerations, and describe the various approved BMPs that can be used by designers.

2.2 APPROVED BEST MANAGEMENT PRACTICES

The Caltrans Statewide Storm Water Management Plan (SWMP) identifies permanent and temporary BMPs that have been approved for statewide application. The BMPs fall into four categories as shown in Table 2-1:

Table 2-1: BMP Categories and Responsible Divisions

BMP	Description	Responsible Division for BMP Implementation
Design Pollution Prevention BMPs	Permanent soil stabilization systems, etc.	Division of Design
Treatment BMPs	Permanent treatment devices and facilities	Divisions of Design, Construction and Maintenance
Construction Site BMPs	Temporary soil stabilization and sediment control, non-stormwater management, and waste management	Divisions of Design and Construction
Maintenance BMPs	Litter pickup, toxic controls, street sweeping, etc.	Division of Maintenance

BMPs must be considered throughout the planning and design process. Both Design Pollution Prevention and Construction Site BMPs must be considered for every project. Treatment BMPs must be evaluated for all projects meeting the criteria presented in Section 4. Consideration for the implementation of BMPs must begin in the planning process, and continue through the design process.

The descriptions, appropriate applications, siting criteria, and design factors for the approved Design Pollution Prevention and Treatment BMPs are provided in Appendices A and B of this document. Additional information regarding the selection process for these BMPs is provided in Sections 2.4.1 and 2.4.2 of this manual.

2.2.1 Incorporation of Non-Approved Treatment Best Management Practices

Only BMPs that have been approved for statewide use should be incorporated into projects. If project conditions prohibit the use of approved BMPs, then the designer should consult with the District/Regional Storm Water Coordinator (either the National Pollutant Discharge Elimination System [NPDES] or Design Storm Water Coordinator). The District does have the option of proposing the incorporation of a non-approved BMP as a pilot project. The Storm Water

Advisory Teams (SWATs) and the appropriate Headquarters' (HQ) functional units must approve this proposal. The District's proposal for a pilot project should include the following information:

- Description of project (including why approved BMPs cannot be implemented);
- Description of proposed BMP (including anticipated costs and benefits);
- Anticipated life-cycle maintenance requirements;
- Monitoring Program;
- Evaluation criteria; and
- Commitment by the District to prepare a final report on the pilot technology.

If the SWATs and the HQ functional units approve the pilot project, the District would be allowed to incorporate the non-approved BMP into their project. It should be noted that a pilot technology is normally approved only for deployment in a limited quantity within a given project. Pilot technologies are not deployed in large numbers within a single project, or deployed within multiple projects unless these multiple deployments are required to evaluate a pilot technology's performance under varying site conditions. The purpose of the pilot project is to evaluate the feasibility of that particular pilot technology, with further deployment being dependent upon the outcome of the pilot project (reference SWMP, Section 4). This process applies to Design Pollution Prevention BMPs, Treatment BMPs, and Construction Site BMPs.

If it is found that a project cannot incorporate an approved Treatment BMP, and no pilot treatment technologies can be identified by the District or by HQ, then the Project Engineer (PE) shall prepare a technical report explaining why this is so. The Technical Data Report must be submitted to the Regional Water Quality Control Board (RWQCB) at a minimum of 60 days prior to PS&E submittal date of the project. This submittal should be made through the District/Regional NPDES Storm Water Coordinator.

2.3 IDENTIFICATION OF WATER QUALITY REQUIREMENTS FOR PROJECT PLANNING PURPOSES

The appropriate selection of BMPs requires the PE to have an understanding of the process used to identify water quality requirements and pollutants of concern for specific water bodies. The RWQCBs play an important role in identifying the pollutants of concern. Water quality standards, Clean Water Act Section 303(d) list, Total Maximum Daily Loads (TMDLs) and Basin Plans developed by the RWQCBs are important references for the identification of pollutants that need to be addressed.

The process of identifying water quality requirements includes close coordination with the District Environmental Unit. The PE should initiate the process of compiling information regarding water quality requirements as identified in the checklists provided in Appendix E, and should share this information with the Environmental Unit. The Environmental Unit and the PE shall exchange information necessary to (1) prepare documents regarding the assessment of water quality impacts, (2) determine whether Treatment BMPs should be considered, and (3) select and design BMPs, which is the responsibility of the PE. This information exchange continues to take place throughout the Project Initiation Document (PID), the Project Approval/Environmental Document (PA/ED) and the Plans, Specifications and Estimates (PS&E) processes. The Environmental Unit will use the shared information to prepare a Water Quality Assessment Technical Report (WQR), as determined by the Water Quality Impact Questionnaire (Appendix A of the Water Quality Assessment Guidelines (WQAG). The WQAG (Volume 5 of the Caltrans Standard Environmental Reference [website: http://www.dot.ca.gov/ser/]), WQAG Appendices and associated Templates for the WQR, provide direction on format, content, and methods for preparing WQRs, which are technical water quality assessment documents. The PE uses the information to complete the Storm Water Data Report (SWDR) as described in Appendix E.

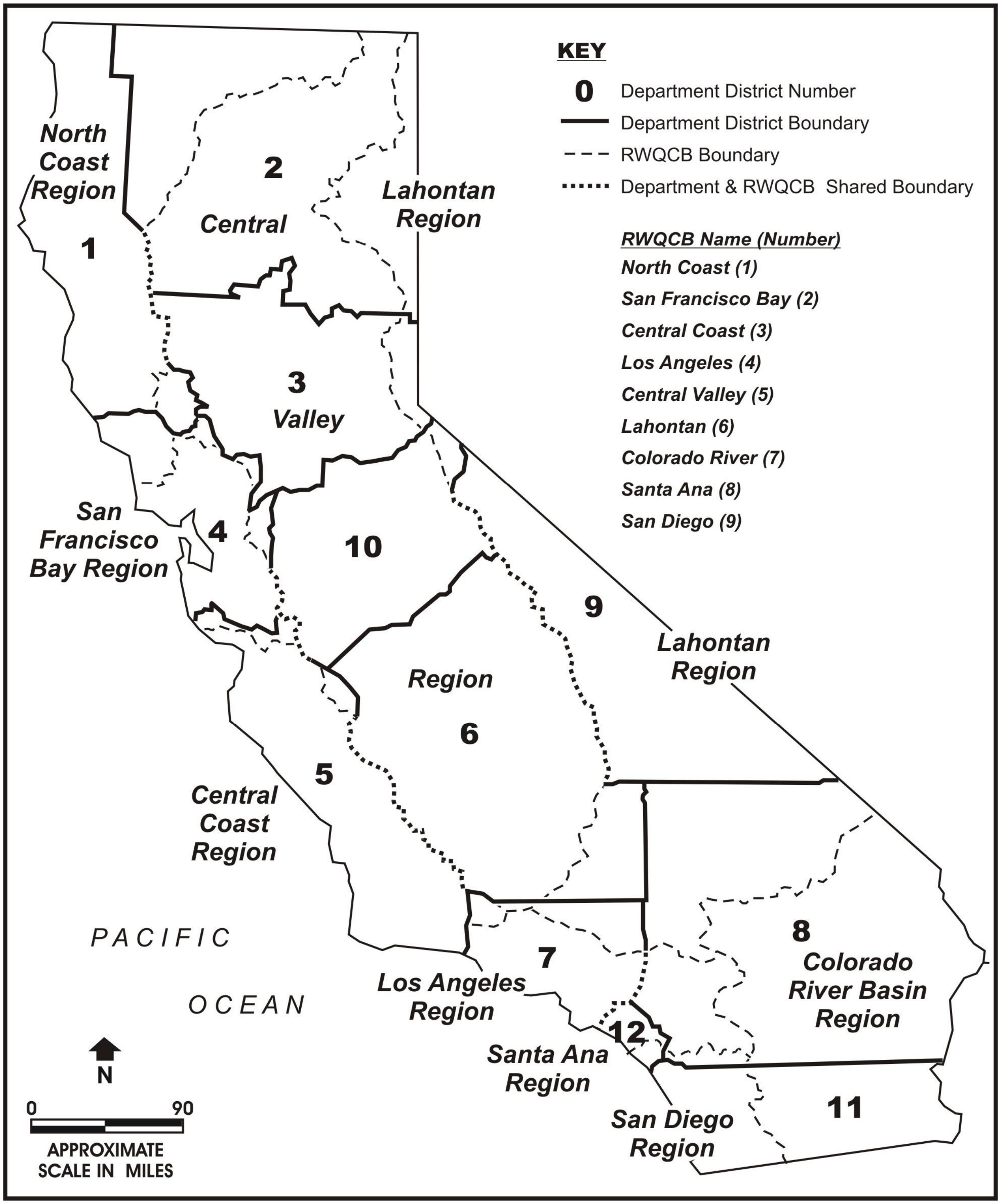
2.3.1 State Water Resources Control Board and Regional Water Quality Control Boards

The State Water Resources Control Board's (SWRCB's) mission is to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations. The **California Water Code** divides the state of California into nine RWQCBs, based on major drainage areas. Nine RWQCBs act to protect water quality within these regions. The nine regional boards and their offices are:

- Region 1- North Coast (Santa Rosa);
- Region 2- San Francisco Bay (Oakland);
- Region 3- Central Coast (San Luis Obispo);
- Region 4- Los Angeles (Los Angeles);
- Region 5- Central Valley (Redding);
- Region 5- Central Valley (Fresno);
- Region 5- Central Valley (Sacramento);
- Region 6- Lahontan (Victorville);
- Region 6- Lahontan (South Lake Tahoe);
- Region 7- Colorado River (Palm Desert);
- Region 8- Santa Ana River (Riverside); and
- Region 9- San Diego (San Diego).

Figure 2-1 is a map showing the RWQCB jurisdictions.

Figure 2-1: Map of California with RWQCB and District Boundaries



In protecting water quality, each RWQCB:

- Adopts a region-specific Water Quality Control Plan or Basin Plan that contains water quality standards specific to the region's waters;
- Issues waste discharge requirements (WDRs) and water quality monitoring and reporting programs that implement the SWRCB's statewide policy and regulations along with the region-specific water quality standards specified in its Basin Plan; and
- Implements enforceable orders against violations of statewide and region-specific requirements.

2.3.2 Resources for Identifying Pollution Control Requirements

Proper selection and design of BMPs requires an understanding of the applicable pollution control requirements. Designers should coordinate with the District/Regional Storm Water Coordinators to ensure that all relevant water quality requirements are identified. Water quality requirements come from a variety of sources, including:

- RWQCB Basin Plans;
- TMDLs and 303(d) lists; and
- Standard Urban Storm Water Mitigation Plans (SUSMPs).

The following sub-sections provide a brief description of these sources of pollution control requirements. While the designer normally obtains this information from the District/Regional Storm Water Coordinator, designers should be aware that Basin Plans, TMDLs, and SUSMPs can change over time and that it may be necessary to reconfirm the pollution control requirements at different stages in the design process.

2.3.2.1 Regional Water Quality Control Board Basin Plans

Each RWQCB has developed a Basin Plan to identify designated beneficial uses and water quality objectives for their jurisdictional regions. The Basin Plans are available online by accessing the SWRCB web site at www.swrcb.ca.gov and selecting the link for the appropriate RWQCB. Each individual RWQCB web page includes a link to access the corresponding Basin Plan.

A comprehensive database of all of the beneficial uses, water quality objectives and water quality data can also be accessed using the **Water Quality Planning Tool** available at www.stormwater.water-programs.com.

2.3.2.2 Total Maximum Daily Loads and 303(d) Lists

Section 303(d) of the 1972 Federal Water Pollution Control Act requires priority rankings for water bodies for which the beneficial uses are listed as impaired by pollution, and also requires the establishment of TMDLs to protect water quality of these impaired water bodies from specific pollutants. In response to this requirement, the U.S. Environmental Protection Agency

(EPA) has developed a 303(d) list for each state that identifies specific pollutants causing impairment of specific receiving waters. A water quality planning tool, including 303(d) list information, has been developed for Caltrans and is available at www.stormwater.water-programs.com. Projects discharging to receiving waters on the Clean Water Act 303(d) list and/or with TMDLs may have to comply with additional discharge criteria. Response to TMDL and/or 303(d) listed water body criteria should be coordinated with the District/Regional Storm Water Coordinator.

2.3.2.3 Standard Urban Storm Water Mitigation Plans

Projects in urban areas may be subject to additional water quality requirements or additional BMP requirements if there is an applicable SUSMP. These plans contain special local requirements and are currently applicable in Los Angeles, Ventura, and San Diego counties; however, other urban areas may develop SUSMPs in the future.

2.3.3 Storm Water Documents

The WQR and the Storm Water Data Report (SWDR) are the two project-specific Storm Water Documents prepared by a District. The District Environmental Unit prepares the WQR, while the Project Engineer (PE) prepares the SWDR. These documents are prepared concurrently, and require extensive coordination between the PE, the Environmental staff person preparing the WQR, and the District/Regional Storm Water Coordinator.

A WQR will identify applicable stormwater regulations and stormwater impacts to be addressed. The WQR also identifies the receiving water, evaluates the existing surface water quality, identifies potential project-related stormwater discharges, and evaluates the potential project-related stormwater impacts on the receiving water quality. The WQR is typically prepared by the Environmental Unit as support documentation during the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) environmental review phase of a project.

The SWDR documents decisions made regarding project compliance with the NPDES permit. The SWDR also may be used to provide key project information to environmental personnel responsible for preparing the WQR. The preliminary information in the SWDR prepared during the PID phase will be reviewed, updated, and confirmed by environmental personnel, and if required, will be revised in the SWDR prepared during the later phases of the project. The information contained in the SWDR and the WQR may be used to make more informed decisions regarding the selection of BMPs and/or recommended avoidance, minimization or mitigation measures to address water quality impacts for California Environmental Quality Act (CEQA) compliance.

2.3.4 Types of Pollutants

Selection of BMPs requires an understanding of the types of pollutants that the BMPs are designed to remove. Brief descriptions of commonly encountered pollutants are provided in the following sub-sections.

Table 2-2 provides a list of theses pollutants and the types of Treatment BMPs that can be used to reduce the discharge of these pollutants. To determine if the BMP addresses pollutants of concern and will meet pollution control requirements, use Section 15 of the *BMP Retrofit Pilot Program Final Report* (California Department of Transportation, January 2004) and consult with your District/Regional Storm Water Coordinator.

2.3.4.1 Total Suspended Solids

Solids can be present in the water column in a dissolved phase (Total Dissolved Solids [TDS]) or a suspended phase (Total Suspended Solids [TSS]). In general, suspended solids are considered a pollutant when they significantly exceed natural concentrations and have a detrimental effect on the beneficial uses designated for the receiving water.

Possible sources of TSS from Caltrans facilities include natural erosion, runoff from construction sites, and other operations where the surface of the ground is disturbed. In addition, increased runoff from new impervious surfaces can accelerate the process of channel erosion, which in turn can increase TSS (and TDS) in runoff.

2.3.4.2 Nutrients

Excessive inputs of nutrients such as phosphorus and nitrogen to receiving waters can over-stimulate the growth of aquatic plants to the detriment of other aquatic life and to some beneficial uses of the receiving water. Nutrients generally have more adverse effects in water bodies with slow flushing rates, such as slow moving streams and lakes. Also, nutrients attached to suspended solids in stormwater runoff can cause problems where they settle out downstream.

Sources of phosphorus that may be present in highway runoff include tree leaves, surfactants and emulsifiers, and natural sources such as the mineralized organic matter in soils. Phosphorus may be present in stormwater discharges as dissolved or particulate orthophosphate, polyphosphate, or organic phosphorous.

Potential sources of nitrogen in highway runoff include atmospheric fallout, nitrite discharges from automobile exhausts, fertilizer runoff, and natural sources such as mineralized soil organic matter. Nitrogen may be present in stormwater discharges as nitrate, nitrite, ammonia/ammonium, or organic nitrogen.

2.3.4.3 Pesticides

A pesticide is a chemical agent designed to control pest organisms. The most common forms of pesticides are organic chemicals designed to target insects (insecticides) or vascular plants (herbicides). Pesticides have been repeatedly detected in surface waters and precipitation in the United States. Water is one of the primary media in which pesticides are transported from targeted applications to other parts of the environment. As the use of pesticides has increased, concerns about the potential adverse effects of pesticides on the environment and human health have also increased.

Table 2-2: Pollutants of Concern and Applicable Treatment BMPs

	Biofiltration Systems	Infiltration Devices	Detention Devices	Dry Weather Flow Diversions[1]	Gross Solids Removal Devices	Multi-Chambered Treatment Train	Media Filters	Wet Basins	Traction Sand Traps
Total Suspended Solids	ü	ü	ü	ü		ü	ü	ü	ü
Nutrients		ü	ü [2]	ü			ü [3]	ü [4]	
Pesticides		ü		ü					
Particulate Metals	ü	ü	ü	ü		ü	ü	ü	
Dissolved Metals	ü	ü		ü			ü		
Pathogens		ü		ü				ü	
Litter	ü	ü	ü	ü	ü	ü	ü	ü	
Biochemical Oxygen Demand		ü		ü				ü	
Total Dissolved Solids		ü		ü					

[1] Dry Weather Flow Diversions address non-stormwater flows only.

[2] Phosphorus only.

[3] Phosphorus and Nitrogen for the Austin Sand Filter; Phosphorus only for the Delaware Sand Filter.

[4] Reductions observed for dry weather flow only.

2.3.4.4 Metals (Particulate and Dissolved)

Metals in stormwater runoff may be in a dissolved phase or a particulate form adsorbed to suspended solids. Some Treatment BMPs are effective for removing specific particulate metals, but not for removing dissolved metals.

Possible sources of metals in highway runoff include the combustion products from fossil fuels, the wearing of brake pads, and the corrosion of metals, paints and solder. Metals can also reach receiving waters through the natural weathering of rock and soil erosion.

2.3.4.5 Pathogens

Pathogenic microorganisms including viruses, bacteria, protozoa, and helminth worms are of concern in stormwater runoff. The direct measurement of specific pathogens in water is extremely difficult. For that reason, the coliform group of organisms is commonly used as an indicator of the potential presence of pathogens of fecal origin.

Sources of total and fecal coliforms in stormwater runoff are ubiquitous (e.g., soil particles, droppings of wild and domestic animals, etc.). Human sources could include illicit sewer connections and seepage from septic tanks.

2.3.4.6 Litter

Litter in stormwater is defined as manufactured objects made from paper, plastic, cardboard, glass, metal, etc. This definition does not include materials of natural origin such as gravel or vegetation. Litter is quantified by 24-hour air-dried volume and weight measurements. Litter within stormwater is considered to be a significant problem in the municipal areas of Southern California as evidenced by the current listing of many water bodies as impaired due to trash on the EPA 303(d) list. Litter in surface waters can inhibit the growth of aquatic vegetation, harm aquatic organisms by ingestion or entanglement, convey other pollutants, such as toxic substances, and cause aesthetic problems on shorelines.

2.3.4.7 Biochemical Oxygen Demand

The Biochemical Oxygen Demand (BOD) is a measure of quantity of oxygen required to biologically stabilize the organic matter present in a pollutant. Biochemical oxidation is a slow process, and theoretically takes an infinite time to reach 100% completion. Therefore, a 5-day BOD (BOD_5) test, wherein the oxidation reaches about 60 to 70% completion, is commonly used for practical purposes. The BOD_5 test measures the rate of oxygen required by microorganisms (i.e., a laboratory inoculation) to oxidize the biodegradable matter in a sample under controlled laboratory test conditions. High BOD values (usually the result of organic contamination) suggest that the dissolved oxygen levels in receiving water may be depleted.

2.3.4.8 Total Dissolved Solids

The TDS in water consist of inorganic and organic molecules and ions that are in solution. Elevated levels of dissolved solids can deleteriously affect surface water quality in a number of ways, most often because of the increased concentration (and perhaps increased number) of constituents that may be toxic to aquatic organisms.

2.3.5 Targeted Design Constituents

A Targeted Design Constituent (TDC) is a pollutant that has been identified during Departmental runoff characterization studies to be discharging with a load or concentration that commonly exceeds allowable standards and which is considered treatable by currently available Department-approved Treatment BMPs. The Targeted Design Constituent approach is the Department's statewide design guidance to address the "Primary Pollutants of Concern" (see Appendix B.1.1).

Targeted Design Constituents are: phosphorus; nitrogen; total copper; dissolved copper; total lead; dissolved lead; total zinc; dissolved zinc; sediments; and general metals [unspecified metals]. <u>A project must consider treatment to target a TDC when an affected water body within the project limits (or with the sub-watershed as defined by the Water Quality Planning Tool) is on the 303(d) list for the one or more of these constituents</u>.

2.4 BEST MANAGEMENT PRACTICES

As used in this document, the term BMP refers to operational activities or physical controls that control, prevent, remove, or reduce pollution and minimize potential impacts upon receiving waters. Accordingly, the term BMP refers to both structural and nonstructural controls that have direct effects on the release, transport or discharge of pollutants.

Federal stormwater regulations call for the implementation of both operational and technology-based BMPs to reduce the discharge of pollutants to the Maximum Extent Practicable (MEP) in municipal-type stormwater systems. Caltrans drainage facilities are considered a municipal separate storm sewer system under the Caltrans permit and are, therefore, held to the MEP requirement. For construction projects that disturb areas of one acre or more, the technology-based requirements include the use of Best Conventional Technology (BCT) and Best Available Technology (BAT).

Four categories of BMPs (Design Pollution Prevention, Treatment, Construction Site, and Maintenance) are described in Table 2-3. Design Pollution Prevention BMPs, Treatment BMPs and Construction Site BMPs are discussed in further detail in Sections 2.4.1 through 2.4.3 of this document.

Table 2-3: BMP Descriptions

BMP	Description
Design Pollution Prevention BMPs	Preservation of existing vegetation, concentrated flow conveyance, slope/surface protection, etc.
Treatment BMPs	Permanent treatment devices and facilities.
Construction Site BMPs	Temporary soil stabilization and sediment control, non-stormwater management, and waste management. Refer to the Construction Site BMP Manual.
Maintenance BMPs	Litter pickup, waste management, street sweeping, etc.

Designers should consider BMPs throughout the development of their project. Design Pollution Prevention and Treatment BMPs should be selected and designed to minimize life-cycle maintenance costs and resources. Adequate site access and maximum worker safety should be considered for maintenance of Design Pollution Prevention and Treatment BMPs. Construction Site BMPs should consider staging and other aspects of construction activities when developing the BMP strategy for the project. All BMPs should be considered when estimating the cost of a project so that adequate cost is projected and enough funding is allocated. Maintenance BMPs are related to typical maintenance activities and equipment, but are not otherwise discussed within this document. In addition to the above BMP categories, the designer must also be aware of, and address, non-stormwater discharges associated with a project, such as pumping stations, tunnel washing, etc. The designer should coordinate with the District/Regional Storm Water Coordinator if there are present and persistent non-stormwater discharges associated with a project.

2.4.1 Design Pollution Prevention Best Management Practices

Design Pollution Prevention BMPs are permanent measures to reduce pollution discharges (e.g., reduce erosion, manage non-stormwater discharges, etc.) after construction is completed. The Design 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 2-4. Design guidelines for Design Pollution Prevention BMPs are included in Appendix A.

Table 2-4: Design Pollution Prevention BMPs

Consideration of Downstream Effects Related to Potentially Increased Flow
Peak Flow Attenuation Basins
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.

A flow chart illustrating the Design Pollution Prevention BMP selection process for projects is shown in Figure 2-2.

2.4.2 Treatment Best Management Practices

Treatment BMPs are permanent measures to improve stormwater quality after construction is completed. The Treatment BMPs listed in Table 2-5 will be considered for all projects identified pursuant to Section 4 of this PPDG. These BMPs have been approved for statewide use. Appendix B provides a general description and design guidelines for the approved Treatment BMPs, and criteria for considering existing roadway features as Treatment BMPs (see Section B.1.4). Appendix E includes an Evaluation Documentation Form for Treatment BMPs that designers are to use to determine if a project is required to consider incorporating Treatment BMPs (see discussion of evaluation process in Section 4).

Table 2-5: Approved Treatment BMPs

Biofiltration Systems
Infiltration Devices
Detention Devices
Traction Sand Traps
Dry Weather Flow Diversion
Gross Solids Removal Devices (GSRDs)
Media Filters
Multi-Chamber Treatment Train
Wet Basins

A flowchart illustrating the Treatment BMP selection process for projects required to consider Treatment BMPs is shown in Figure 2-3. Designers are encouraged to consider combining approved BMPs (e.g., overflow from a Detention Device may be discharged to a Bioswale or an Infiltration Basin could be preceded by a Traction Sand Trap). These considerations shall be utilized at all phases of the project delivery process (PID, PA/ED, and PS&E).

Figure 2-2: Decision Process for Selecting Design Pollution Prevention BMPs

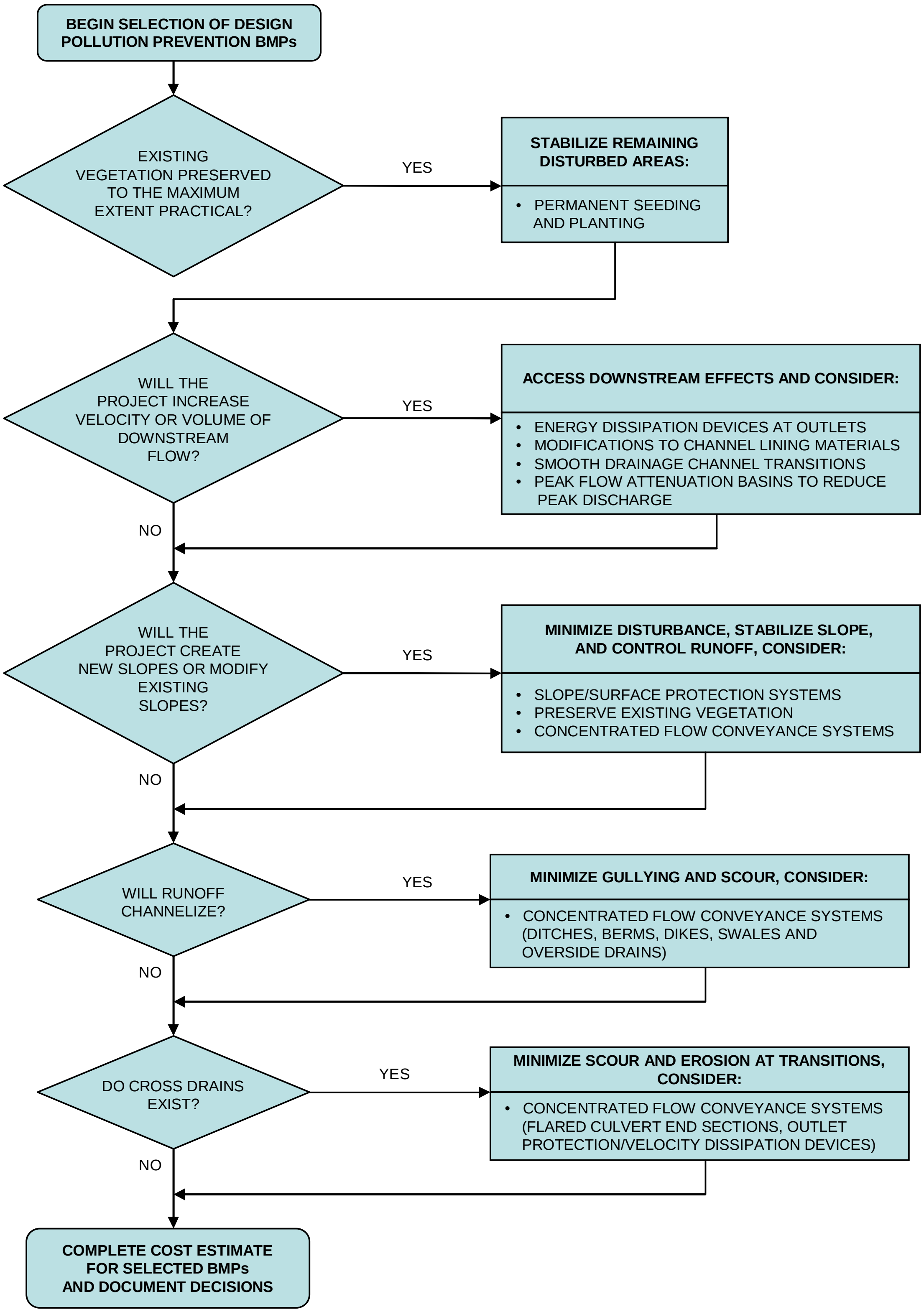
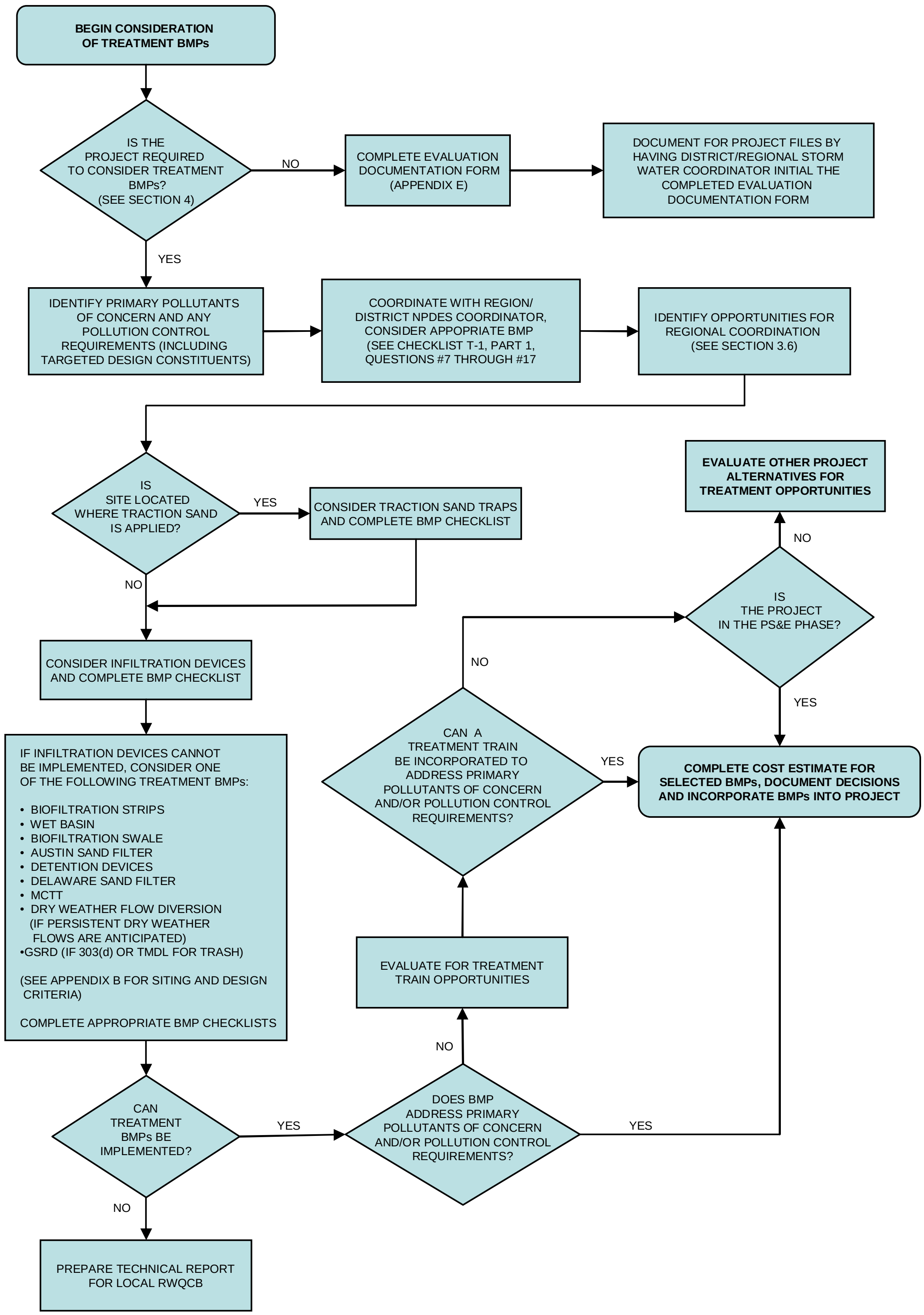


Figure 2-3: Decision Process for Selecting Treatment BMPs at Specific Sites



Biofiltration Strips and Swales are vegetated surfaces that remove pollutants by filtration through grass, sedimentation, sorption to soil or grass, and infiltration through the soil. Strips and swales are mainly effective at removing debris and solid particles, although some constituents are removed by sorption to the soil. Biofiltration Swales are vegetated channels that receive directed flow and convey stormwater. Biofiltration Strips, also known as vegetated buffer strips, are vegetated sections of land over which stormwater flows as overland sheet flow.

Biofiltration Strips and Swales are to be implemented at all sites to the extent that implementation is consistent with existing Caltrans policies, as described herein. In practice, this means maximizing the use of vegetation in the right-of-way wherever site conditions and climate allow vegetation to establish and where flow velocities are not high enough to cause scour.

Infiltration Devices are basins or trenches that store runoff and allow it to infiltrate into the ground. Infiltration prevents pollutants in the captured runoff from reaching surface waters. In areas of high sediment loads, pretreatment may be required. Infiltration Devices are permanent Treatment BMPs, and should be considered wherever site conditions allow, and shall be sited and designed according to the criteria presented in Appendix B of this PPDG.

Detention Devices are basins or tanks that temporarily detain runoff under quiescent conditions to allow particles to settle out. A Detention Device is a permanent Treatment BMP designed to reduce the sediment and particulate loading in runoff from the Water Quality design storm.

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. Traction Sand Traps are permanent Treatment BMPs, and should be considered at sites where traction sand or other traction-enhancing substances are commonly applied (more than twice per year) to the roadway.

Dry Weather Flow Diversions are devices that direct flow through a pipe or channel to nearby municipal sanitary sewer systems for treatment at a local wastewater treatment plant during dry weather or during periods of dry weather. Dry Weather Flow Diversions may be feasible if dry weather flow from Caltrans activities is persistent, and the sanitary sewer authority is willing to accept the flow. They should only be considered if dry weather flow from Caltrans activities is persistent or the result of an ongoing Caltrans activity. Additionally, Dry Weather Flow Diversions should only be considered if connection to a nearby sanitary sewer would not involve excessive measures to implement.

Gross Solids Removal Devices (GSRDs) are devices that remove litter from stormwater runoff using various screening technologies. GSRDs should be considered for areas where receiving waters are on the 303(d) list for trash or areas for which TMDLs have been adopted that require trash removal.

Media Filters are devices that remove sediment, particulate-associated pollutants, and sometimes dissolved pollutants from stormwater runoff by filtration. The normal configuration of such a device consists of two chambers, an initial sedimentation basin or vault followed by a filtering basin or vault that incorporates a filtering media.

Multi-Chamber Treatment Trains (MCTT) are devices that utilize three chambers to remove sediment, particulate-associated pollutants, and sometimes dissolved pollutants from stormwater runoff using media filter materials. MCTTs use three different treatment mechanisms in three separate chambers. These include a grit chamber with a sump, a sedimentation chamber with tube settlers and sorbent pads, and a filtering chamber provided with a filtering media.

Wet Basins are permanent pools of water designed to mimic naturally occurring wetlands. The main distinction between Wet Basins and natural wetlands is that Wet Basins are placed in upland areas and are not subject to wetland protection regulations.

Wet Basins should be considered when the site is located in a location where the visual aesthetics of the permanent pool is considered a benefit (such as a roadside rest area or vista point). Potential sites must have a high water table or another source of water must be present to provide base flow sufficient to maintain the plant community year-round.

Total Wet Basin volume shall be at least four times the Water Quality Volume (WQV). Permanent pool volume shall have a 3:1 permanent pool to WQV ratio and an additional temporary storage capacity greater than or equal to the WQV. The WQV is determined by the procedure described in Section 2.4.2.2.

2.4.2.1 Site-Specific Determination of Feasibility

General criteria used during the evaluation of Treatment BMPs include relative effectiveness, technical feasibility, costs and benefits, and legal and institutional constraints.

Relative Effectiveness: A recommended BMP should generally demonstrate greater pollution control benefits than a design without any BMP. Effectiveness may be assessed in terms of specific pollutants of concern. For further information, see Section 15 of the *BMP Retrofit Pilot Program Final Report*, California Department of Transportation, January 2004, and consult with the District/Regional Storm Water Coordinator.

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 infeasible.

Costs and Benefits: The pollution control benefits must have a reasonable relationship to the costs. The costs and benefits analysis will consider the impacts to the receiving waters that are being reduced or eliminated through implementing the BMP.

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 up gradient 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).

Feasibility Assessment: The first step in assessing the feasibility of incorporating a potential BMP into a project is to gather the data needed to both determine the size and to estimate the cost of that specific BMP. In addition, it should be determined whether the site characteristics, particularly the soil characteristics, are appropriate (checklists are provided in Appendix E for this purpose).

The second step is to determine the WQV or Water Quality Flow (WQF) that must be treated. (See Section 2.4.2.2 for guidance.)

Next, for all BMPs except GSRDs and Traction Sand Traps, calculate the size of the proposed BMP needed to treat the WQV (or anticipated flow). Use the procedures defined in Appendix B to evaluate the appropriate BMP, giving proper consideration 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 WQV (or flow).

For siting and evaluation criteria for all of the approved Treatment BMPs, see Appendix B.

During the planning and design process, multiple project alternatives may be evaluated. If a project requires the consideration of Treatment BMPs, yet the preferred alternative cannot incorporate Treatment BMPs, then the designer should re-evaluate the other alternatives that may provide greater opportunities for incorporating Treatment BMPs and reducing impacts to receiving waters. This consideration of project alternatives shall be documented in the Storm Water Data Report. If it is ultimately found not feasible to incorporate Treatment BMPs within the project, then the designer shall document the reasons in a technical report submitted to the RWQCB. This technical report must be submitted at a minimum of 60 days prior to PS&E submittal date of the project.

Sites requiring extraordinary plumbing to collect and treat runoff (e.g., jacking operations under a highway, bridge deck collection systems, etc.) may be considered infeasible due to their associated costs. 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. Extraordinary plumbing, features, or construction practices should be brought to the attention of the District/Regional Storm Water Coordinator for consideration on a project-by-project basis; all decisions shall be documented accordingly.

If a BMP is too large to fit at a site, several options should be considered: (1) cooperation with another jurisdiction contributing drainage to obtain sufficient additional space; (2) purchase of additional land; and (3) installing a BMP that is smaller than what normal sizing procedures would dictate, if agreeable to the RWQCB. Again, these are issues to be brought to the attention of the District/Regional Storm Water Coordinator so that decisions can be made on a project-by-project basis.

2.4.2.2 Treatment BMP Use and Placement Considerations

Several factors must be considered to determine which BMPs are suitable for a given application. Site-specific conditions can affect operations, maintenance, construction costs, safety and aesthetics. The designer must determine if sufficient right-of-way is available for the desired BMP, or if the benefits associated with a potential BMP justify the consideration of acquiring additional right-of-way.

The physical dimensions of a BMP may have an important bearing on the factors identified in this section. The size of many BMPs is determined by the amount of runoff the system will be required to treat. The amount of runoff is affected by the location, land use, drainage area, storm intensity, topography, soil characteristics and the extent of impervious areas. For the design of Treatment BMPs that have the potential to affect drainage, the District's hydraulics staff should be consulted.

Both storm volume and peak flow rates must typically be considered in the design of highway drainage facilities. The "Design Storm" is the particular event that generates runoff rates or volumes that the drainage facilities are designed to handle. Determining the "Design Storm" involves the selection of an appropriate design storm frequency for the specific project, location or site under consideration. In order for a design frequency to be a meaningful criterion for roadway drainage design, it must be tied to an acceptable tolerance of flooding. Design water spread involving encroachment upon the roadbed or adjacent property determines the tolerance of flooding directly related to roadway drainage design. The Highway Design Manual (HDM) Chapter 831 provides a detailed discussion on how the probability of exceedance of the design storm and the acceptable tolerance to flooding depends on the importance of the highway and risks involved. For the purposes of this PPDG, the term "Design Storm" used in reference to designing drainage facilities will refer to the peak drainage facility design event as determined in accordance with the HDM.

Unlike flood control measures that are typically designed to store or convey the peak volumes or flows of infrequent (i.e. return period typically > 5 years) storm events, Treatment BMPs are designed to treat the lower volume or flow of more frequent (i.e. return period < 1 year) storm events. The volume or flows associated with the frequent events are commonly referred to as the WQV for BMPs designed based on volume, and WQF for BMPs designed based on flow. Treatment BMPs are sized to accommodate the WQF or WQV from the contributing drainage area. Flows in excess of these values (i.e. those larger runoff volumes or rates associated with the "Design Storm") are diverted around or through the Treatment BMP. Methods for determining the WQV are generally tied to an analysis of rainfall depths generated over 24-hour periods although the WQV may be determined by the drawdown time of certain Treatment BMPs.

The WQV of Treatment BMPs is based on using either of the following methods:

1. Where they are established, sizing criteria from the RWQCB or local agency (whichever is more stringent) will be used; or
2. Where the RWQCB or local agency does not have an established sizing criterion, Caltrans will use the following method:
   - 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 (WEF) and the American Society of Civil Engineers (ASCE). 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. This method requires the designer to assume a drawdown time. Any drawdown time between 24 and 72 hours can be used (the 24-hour limit provides adequate settling and the 72-hour maximum addresses vector concerns). A design tool (Basin Sizer) that uses data from more than 700 California rainfall stations, has been created for Caltrans use. It is available at:

http://www.owp.csus.edu/research/stormwatertools/

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.

Alternatively, the District and the appropriate RWQCB may discuss the potential need for modification of the criteria on a case-by-case basis if one of the following situations applies:

- The site area is limited and cannot accommodate a Treatment BMP sized according to either of the methods for determining WQV; or
- Sizing a Treatment BMP using either method in areas of the State with significant annual precipitation results in excessively large treatment units.

The WQF is the primary design criteria used for various types of flow-based Treatment BMPs (e.g. Biofiltration Swales). Caltrans, the SWRCB and the nine RWQCBs worked cooperatively to establish these values.

The following WQFs negotiated with the SWRCB and RWQCBs should be used as the basis for designing the approved flow-based Treatment BMPs. Where there are special circumstances or conditions, the PE, the District/Regional Storm Water Coordinator and the related RWQCB should discuss the potential need for modification of the criteria on a case-by-case basis.

In addition to designing for the WQF, the designer must also insure that the flow-based Treatment BMPs include a bypass or an overflow device to convey peak discharges from larger design storms consistent with Section 861.3 of the Highway Design Manual.

The listed values of rainfall intensity would be used in the Rational Formula (Q=CiA) to estimate runoff from areas that would discharge flow to flow-based Treatment BMPs. The resulting runoff rate would be the design WQF to be used at any specific site.

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 and for that portion of San Mateo County within the region; 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 and that portion of Ventura County within the Region.

4. Region 4 (Los Angeles) –0.20 "/hr region wide.
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, and 0.24 "/hr for all elevations above 4,000' in the Sierra Nevadas.
6. Region 6 (Lahontan) –

   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:

   a) 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' elevation will be 0.16 "/hr.

   b) 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.

2.4.3 Construction Site Best Management Practices

Construction Site BMPs (also called temporary control practices) are deployed during construction activities to reduce pollutants in stormwater discharges. Table C-1 in Appendix C is a matrix of approved Construction Site BMPs that are consistent with the BMPs and control practices required under the General Permit and the SWMP. The Department's construction site BMPs are divided into six categories as shown in Table 2-6:

Table 2-6: Approved Construction Site BMP Categories

Temporary Soil Stabilization
Temporary Sediment Control
Wind Erosion Control
Tracking Control
Non-Stormwater Management
Waste Management and Materials Pollution Control

Additional information on design, placement, and applicability of Construction Site BMPs can also be found in Appendix C of this document, or in the Construction Site BMP manual.

2.4.4 Maintenance Best Management Practices

Maintenance BMPs are water quality controls used to reduce pollutant discharges during highway maintenance and activities conducted at maintenance facilities. One example of a Maintenance BMPs is the Department's practice of stenciling messages at storm drain inlets located at highway facilities such as park and ride lots, rest areas and vista points to assist in educating the public about stormwater runoff pollution. Additionally, all new inlets located within cities, towns, and communities with populations of 10,000 or more, or within designated MS4 areas, shall be stenciled when constructed. Designers should contact the District Maintenance Storm Water Coordinator to identify stencil types, specifications and details for projects falling within these areas.

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3.1 INTRODUCTION TO DESIGN PROGRAM RESPONSIBILITIES

The Caltrans design staff responsibilities regarding implementation of the stormwater management program are described in the following sections. All Caltrans Districts have developed responsibility matrices to identify staff and divisional responsibility for duties assigned under the Storm Water Management Plan (SWMP).

The Caltrans Project Delivery Storm Water Management Program includes the Design Division, the Construction Division, and their associated functional units. Project Delivery Program provides guidance and direction to the District Design and Construction Divisions.

3.2 MANAGEMENT

The role of the Design Storm Water Management Program includes:

- **Coordination:** In coordination with the Water Quality Program, the Design Storm Water Management Program provides general guidance to the Districts on the implementation of stormwater quality management practices;
- **Program Evaluation:** The Design Storm Water Management Program assesses District incorporation of stormwater quality management features into facility designs;
- **Reporting:** The Design Storm Water Management Program assists the Water Quality Program in the preparation of the Annual Report to the State Water Resources Control Board (SWRCB), as it relates to Design activities.

The Design Program Manager is responsible for statewide implementation policies and procedures and management of the personnel of the Design program. This includes the responsibility for ensuring compliance with all elements of the SWMP that are required to be implemented by the Design Division.

3.3 STORM WATER ADVISORY TEAMS

Caltrans design staff provide valuable input and consultation to the Storm Water Advisory Teams (SWATs) as follows:

- The Maintenance SWAT (M-SWAT) is composed of District Maintenance Storm Water Coordinators and representatives from each of the affected Headquarters Divisions. The M-SWAT provides any necessary review and/or evaluation of proposed and existing BMPs used by the Division of Maintenance. In addition, the M-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities described in the SWMP for maintaining highways, bridges, facilities, and other appurtenances related to transport.

- The Project Design SWAT (PD-SWAT) is composed of District/Regional Design Storm Water Coordinators and related functional units and representatives from each of the affected Headquarters Divisions. The PD-SWAT provides review of proposed and existing BMPs utilized in the planning and design of projects. BMPs include construction BMPs, design pollution prevention BMPs, and Treatment BMPs. In addition, the PD-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities relevant to project design.

- The Construction SWAT (C-SWAT) is composed of District Construction Storm Water Coordinators and representatives from each of the affected Headquarters Divisions. The C-SWAT provides review of proposed and existing construction BMPs and measures used for stabilization of soils. In addition, the C-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities relevant to construction activities.

- The Encroachment Permits SWAT (EP-SWAT) is composed of District Permit Coordinators and representatives from each of the affected Headquarters Divisions. The EP-SWAT reviews existing procedures to ensure that they integrate the appropriate stormwater BMPs into the requirements of encroachment permits. The EP-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities for issuing and administering encroachment permits.

- The Water Quality SWAT (WQ-SWAT) is composed of the District NPDES Storm Water Coordinators and representatives from each of the affected Headquarters Divisions. The WQ-SWAT provides review of proposed and existing treatment BMPs, and prioritizes research or studies of Treatment BMPs. The WQ-SWAT is a forum for discussing stormwater coordination activities underway or planned with other municipalities, reviewing and recommending public education efforts, sharing technical information, providing advice on compliance issues, and resolving issues of dispute on stormwater. Many of these activities result in recommendations for changes to the SWMP or policies and other documents on stormwater. The WQ-SWAT discusses stormwater budget allocations for the Districts and HQ Divisions. The WQ-SWAT reviews data and findings from compliance-monitoring and evaluation activities, and recommends changes in practices to improve compliance efforts.

3.4 STORM WATER COORDINATORS

All Districts/Regions have designated NPDES Storm Water Coordinators. Other functional-unit Storm Water Coordinators exist in the Planning, Design, Construction and Maintenance Divisions. Also, depending upon the complexity of the district, additional Storm Water Coordinators may be identified to represent other functional units or special needs (e.g. TMDLs); these roles are described in the District Work Plan (DWP). The functional unit coordinators assist the District Divisions in implementing stormwater management activities. The District/Regional NPDES Storm Water Coordinators serve as liaisons with the Water Quality Program. Liaison activities also include regular communications with representatives of the Regional Water Quality Control Board (RWQCB).

3.5 RESPONSIBILITIES AS THEY RELATE TO ENCROACHMENT PERMITS AND THIRD-PARTY ACTIVITIES

Districts control third-party activities on Caltrans rights of way (e.g., utility construction) through the conditions associated with encroachment permits. These conditions require compliance with Caltrans standard plans and specifications. Encroachment permits require environmental compliance, including implementation of BMPs comparable to those required of Caltrans. For larger encroachments, project design is overseen by District Design and construction activities by District Construction. Smaller projects are managed by the Encroachment Permit Unit.

3.6 RESPONSIBILITIES FOR COORDINATION WITH MUNICIPAL STORM WATER PERMITTEES (LOCAL AGENCIES)

Coordination with Municipal Separate Storm Sewer System (MS4) permit holders and other municipalities (cities and counties) must take place whenever a proposed project would result in stormwater discharges from the Department’s stormwater drainage systems to stormwater drainage systems owned and operated by the MS4 or municipality, and vice versa. This coordination includes attending meetings, participating in special studies, identifying stormwater run-on issues, etc. The Project Engineer (PE) should consult with the District/Regional Storm Water Coordinator to identify any MS4 permit requirements that may affect the project.

3.7 CONSULTATION WITH REGIONAL WATER QUALITY CONTROL BOARDS AND LOCAL REGULATORY AGENCIES

Consultation with the RWQCBs and local regulatory agencies is strongly recommended to coordinate project issues and develop consensus. The number of coordination meetings may vary depending upon the complexity of the stormwater quality issues, stormwater pollutants involved, and project site constraints. The District/Regional NPDES Storm Water Coordinators are the liaisons between the RWQCBs and the Districts.

3.8 STAFF AND FUNCTIONAL UNITS

3.8.1 Staff

Project Manager

Typically, the Project Manager (PM) is responsible for all project development phases from project initiation to closeout of the construction contract. The PM has full authority, delegated from the District Division Chief for Program and Project Management, to produce the results that were intended, meet schedules, stay within budget and keep the sponsors and customers satisfied. The PM retains these responsibilities over the entire life of the project.

During project initiation, the PM identifies the needs and expectations of the project sponsors, including the need for permanent stormwater BMPs. The PM also leads the Project Development Team (PDT) in the development of a “Project Work Plan” that defines the project scope, schedule, cost, and resource needs. Finally, the PM ensures that the Project Work Plan includes all the work required. Resources are assigned to a project based upon the Project Work Plan developed by the PM and the PDT.

During the design phase of a project, the PM monitors project performance and resolves problems that affect project scope, cost or schedule. This includes the BMP evaluation and selection process for incorporation into the project. The PM coordinates the efforts of the overall team, and typically chairs the PDT meetings. During the entire process, the PM controls the project budget (both support and capital).

Project Engineer

The Project Engineer (PE) is responsible for the preparation of a Project Initiation Document (PID) and a Project Report (PR) during the project-planning phase. The PE is also responsible for preparing plans, specifications and estimates (PS&E) documents (otherwise known as contract plans or bid documents) during the design phase. The PE determines whether a Storm Water Pollution Prevention Plan (SWPPP) or a Water Pollution Control Program (WPCP) is required for the construction project. Where the re-use of soils that contain aerially deposited lead is proposed, the PE and the District/Regional NPDES Coordinator will ensure that written notification is provided to the RWQCB 30 days prior to advertisement for bids.

The PE considers, and where appropriate, incorporates Design Pollution Prevention, Treatment and Construction Site BMPs into the project plans and specifications. The PE prepares and updates the Storm Water Data Report (SWDR) throughout the life of the project. In addition, the PE is responsible for assembling information necessary to assist the Resident Engineer (RE) and contractor in preparing and reviewing the SWPPP/WPCP.

Project Development Team

For most projects, the Department uses a formalized Project Development Team (PDT) that acts as a steering committee in directing the course of studies required to evaluate the various project alternatives during the early phases of the project life cycle. The PDT uses an interdisciplinary approach that draws upon different disciplines in planning, developing, and evaluating alternatives. The PDT advises and assists the PM in directing the course of studies, makes recommendations to the PM and district management, and works to carry out the Project Work Plan. The PDT is responsible for the completion of studies and the accumulation of data throughout project development to PS&E.

The primary functions of the PDT are listed as follows:

- To determine logical project limits;
- To recommend studies, timetables, alternatives, type of environmental documentation, and the feasibility of project impact mitigation measures;
- To ensure thorough analysis of the social, economic, environmental (including visual and aesthetic) and engineering aspects of the project. The PDT calls upon representatives of various disciplines as needed;
- To ensure that state and federal requirements for project development studies have been met;

- To use information in reports (PSR, Draft Project Report – Draft Environmental Document [DPR-DED], etc.) when recommending a preferred alternative to District Management for project approval; and
- To document the project history and decisions.

Functional Managers

Functional Managers supervise the Department functional units that provide technical data and plans to the PE, and schedule and resource data to the PM. Functional Managers are responsible for assigning staff to work on a project, and for ensuring the delivery of product(s) within the schedule agreed upon in the Project Work Plan. Functional Managers also ensure that the products comply with all applicable standards, regulations, and policies.

3.8.2 Functional Units

Design

The District's Design Unit is responsible for the implementation of Caltrans policies, programs, and procedures concerning design of Caltrans facilities. This includes ensuring compliance with all design elements of the Highway Design Manual (HDM), the SWMP, the Project Development Procedures Manual (PDPM), the PPDG and other guidance documents. The Design Unit is responsible for the following stormwater quality related activities:

- Preparation of a Project Initiation Document (PID) and a Project Report (PR) during the project planning phase, including evaluation and selection of potential BMPs that may be incorporated into the project;
- Preparation of plans, specifications and estimates (PS&E) documents during the design phase. This includes the selection and design of Design Pollution Prevention BMPs, Treatment BMPs and appropriate Construction Site BMPs into the plans and specifications;
- Determining whether an SWPPP or a WPCP is required for the project;
- Ensuring that written notification is provided to the RWQCB 30 days prior to advertisement for bids for projects that include the re-use of soils that contain lead; and
- Ensuring that a Notification of Construction is submitted to the appropriate RWQCB at least 30 days prior to the start of construction for projects that require a SWPPP.

Environmental

The District's Environmental Unit is responsible for the implementation of Caltrans policies, programs, and procedures concerning environmental considerations, analysis, and compliance with environmental laws and regulations under California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) as well as other state and federal regulations. Key responsibilities of the Environmental Unit include the following:

- Define stormwater quality issues in coordination with the PE and the District/Regional Storm Water Coordinator;

- Identify receiving water bodies and their beneficial uses, 303(d) listed water bodies, project-related stormwater discharges and quality;
- Prepare the Preliminary Environmental Assessment Report (PEAR) and the Water Quality Impact Questionnaire;
- Evaluate potential water quality impacts to the water quality of receiving waters;
- Prepare the Water Quality Assessment Technical Report (WQR), as determined by the Water Quality Impact Questionnaire;
- Provide input to the PE regarding information to be incorporated into the Storm Water Data Report (SWDR); and
- Make recommendations to the PDT regarding the avoidance, minimization and mitigation measures relating to compliance with the California Environmental Quality Act (CEQA).

This functional unit is known by various names in different Districts, including, but not limited to, Environmental, Environmental Planning, Environmental Analysis, Environmental Technical Studies, Environmental Engineering, Environmental Oversight, and Environmental Reports. A representative from this unit is a required member of the PDT.

Surveys

The District's Surveys Unit is responsible for the implementation of Caltrans policies and procedures concerning surveys and for conducting surveys. The Surveys Unit is a liaison between the Geometronics Branch of the Office of Engineering Technology in the Engineering Service Center and the PE.

Survey needs should be evaluated and identified early in the project initiation process and throughout the entire project development process when needed. After the first evaluation of survey needs, the PE should submit the initial survey request accompanied by a strip map. The extent of the survey will depend on the type of project, existing information available, sensitivity of the area of potential effect, and the number of viable project alternatives. The Right-of-Way Branch and the Environmental Unit require accurate mapping in order to properly carry out their functions, so their needs must be carefully considered when evaluating surveys.

Right-of-Way

The District's Right-of-Way Branch is responsible for the implementation of Caltrans policies, programs and procedures concerning right-of-way and utility considerations and compliance with state and federal laws and regulations. This function consists of various branches in the Districts under a District Division Chief for Right-of-Way, except for the Right-of-Way Engineering Unit which generally reports to another District Division Chief.

Since most transportation projects in California require right-of-way, utility easements, rights of entry, or some other right-of-way activity, the project development process requires close coordination between the PE, the PM, and representatives from the Right-of-Way Engineering

Unit and the Right-of-Way Branch to determine schedules and cost estimates, and to assure the acquisition of all necessary property rights.

The Right-of-Way Branch provides valuable information at the initiation of studies. Once the project limits have been tentatively determined, property ownership maps can be developed by the Right-of-Way Engineering Unit. Preliminary right-of-way estimates are required to properly develop and analyze project alternatives. Adequate mapping is required, as well as realistic project scope. A representative of the Right-of-Way Branch is a required member of the PDT.

Materials and Geotechnical

Materials information is required for almost all projects, usually related to pavement design, culvert selection, corrosion studies, and material sites. The District Materials Unit is involved throughout the project development process; after the project has been initiated, requests are made of the District's Materials Unit to update materials information.

If projects are located in areas where there are critical unanswered concerns such as gross slope stability, foundation problems, seismic, percolation, etc, preliminary evaluation should be made by DES Geotechnical Design unit. After the project has been initiated, requests should be directed to the DES Geotechnical Design unit to provide geotechnical information such as side slope recommendations, slide locations, etc. It is essential that sufficient geotechnical information be developed so that all viable project alternatives are evaluated at all stages of the design process. If a project includes new slope ratios steeper than 1:2 (v:h), then a Geotechnical Design Report should be prepared. Projects including slopes between 1:4 and 1:2 (v:h) should be coordinated with DES Geotechnical Design unit.

The PE uses the recommendations from these units to develop and analyze alternatives and estimate costs for use in project initiation and approval documents, and to prepare estimates, plans and specifications for both new construction and rehabilitation projects.

It is essential that enough materials information is available so that all viable project alternatives are evaluated at all stages of the design process.

Hydraulics

The District Division of Design is responsible for hydraulic design policies and procedures. The Design unit that performs the project drainage design is responsible for the implementation of these policies and procedures. District organizations differ, but for the purpose of this document, it is assumed that the PE is responsible for ensuring that proper project drainage design is performed. This will typically require the active participation in, or the review of, the design by the Hydraulics Unit.

Detailed drainage design, such as accurate sizing and location of culverts, storm drains, Treatment BMPs and roadway drainage, does not begin until after selection of the preferred alternative and approval of a project. However, the Hydraulics Unit should be involved during the entire project planning process. Their input in the project initiation process is invaluable, particularly in recommending facility types and estimating costs of large facilities.

The Hydraulics Unit should also be involved in the environmental studies. Early coordination between the two functional groups is important. Many projects, by necessity, will include water quality enhancement features or encroach on wetlands, floodplains, etc. When floodplain encroachment is involved, the Hydraulics Unit should be involved in preparing location hydraulic studies. Historical drainage maps often depict the extent of the encroachment and help determine which project alternatives should be considered. Documentation of these features must be included in the Draft Project Report (DPR).

Construction

The Construction Unit is responsible for administering contracts for the construction of projects by contractors to ensure that the final products are in accordance with the plans and specifications, and to deal with any problems that may arise in the process. The Construction Unit should review the project and BMP alternatives to determine if they are biddable and buildable. During environmental and project studies, the Construction Unit should be involved in the determination of measures to reduce or mitigate construction impacts.

During the design stage, the Construction Unit should review the project plans and specifications for such things as construction safety, logical staging, an analysis of the number of working days, supplemental funds, and special provisions usability. Also, the Construction Unit provides advice and concurrence to the PE for strategy, development and inclusion of temporary Construction Site BMPs into the project plans.

Prior to start of construction, the PE, along with other involved District units, will go over the project with the RE. The review at this stage will aid in clearing up reasons for design decisions and commitments such as; right-of-way obligations, signing and traffic handling, materials sites, selected material, foundation treatment, potential slides, environmental commitments, drainage, potential maintenance problems, erosion control, public notification, proprietary materials, special considerations in contract provisions, etc.

On almost all construction projects, developments in the field will necessitate some design changes. For early resolution of these changes, the RE, the PM, and the PE must coordinate with other functional units as needed to accommodate these changes without affecting scope, schedule and budget.

Maintenance

The Maintenance Unit will be responsible for maintaining the highway and BMP facilities once the project is complete. It is essential that the Maintenance Unit be involved in the project development process from conception through construction.

The Maintenance Unit should also review the proposed geometric layouts, typical sections, and final plans. Maintenance Units may have input on shoulder backing materials, drainage concerns, areas with existing erosion problems, access to buildings, access for Treatment BMPs, access for landscape facilities, access to encroachments for utility facilities, access for maintenance of noise barriers, fence and excess land review, etc. Maintenance Units should also participate in the preparation of maintenance agreements (setting maintenance control limits).

The Maintenance Unit field representatives have a unique insight into local problems and maintenance and safety concerns. This insight must be utilized in the project development process. Coordination with maintenance staff during the design process can minimize future maintenance problems and the potential for future lawsuits.

Typical Maintenance Unit involvement would be to comment on features such as the following:

- Drainage patterns – particularly known areas of flooding, debris, etc.;
- Stability of slopes and roadbed: Help determine if the project can be built and maintained economically;
- Possible material borrow or spoil sites;
- Concerns of the local residents;
- Existing and potential erosion problems;
- Facilities within the right-of-way that would affect alternative designs;
- Special problems such as deer crossings, endangered species, etc.;
- Traffic operational problems such as unreported accidents, etc.;
- Facility that is safe to maintain;
- Providing concurrence on any slopes steeper than 1:2 (v:h);
- Known environmentally sensitive areas; and
- Frequency of traction sand use and estimate of quantity applied annually.

Landscape Architecture

The Chief of the Office of Landscape Architecture is responsible for the development of Caltrans policies, programs, procedures, and standards for all aspects of landscape architecture (i.e., highway planting, highway planting restoration, replacement planting, revegetation, vegetative erosion control), safety roadside rest areas, vista points, scenic corridors, and noise barriers.

The Landscape Architect evaluates the implementation of mandatory stormwater Design Pollution Prevention BMPs into the overall landscaping plan for the project. Erosion prevention and stormwater pollution prevention BMPs are incorporated into the project's landscaping and revegetation plan. Additionally several approved Treatment BMPs require the establishment of vegetation. The Landscape Architect will provide recommendations for vegetation establishment when these BMPs are considered. All projects incorporating new slopes steeper than 1:4 (v:h) must have an erosion control plan developed or approved by the District Landscape Architect.

3.9 REPORTING REQUIREMENTS

Environmental

The Preliminary Environmental Assessment Report (PEAR) is prepared by the Environmental Unit. The purpose of the PEAR is to determine whether there are any potentially significant environmental issues that could affect the viability of the project alternatives. The PEAR identifies the environmental documents and supporting technical studies that would be required in subsequent project development processes to address potential environmental impacts. Based upon the potential for significant impacts, the PEAR would identify whether a California Environmental Quality Act (CEQA) Initial Study or Environmental Impact Report is needed and/or whether a National Environmental Policy Act (NEPA) Environmental Assessment or Environmental Impact Statement is needed. The Water Quality Impact Questionnaire identifying potential water quality impacts is incorporated into the PEAR. The Water Quality Impact Questionnaire has been developed to assist in early identification and consideration of the broadest range of potential water quality effects, and to scope the PEAR analysis with respect to water quality issues. The Questionnaire asks a series of questions about the project description and alternatives, the project setting, and potential project impacts on water quality. Answers developed in response to these questions should be coordinated with the PE and the District/Regional NPDES Coordinator.

The Water Quality Assessment Technical Report (WQR), at different levels of detail, describes existing water quality conditions, identifies potential project impacts and proposed BMPs and/or avoidance/minimization measures. This information will be utilized by Caltrans Design, Construction and Maintenance staff to develop and implement specific BMPs to mitigate any potential water quality impacts associated with stormwater discharges from the proposed project. The information from the PEAR and the WQR would be utilized to update the SWDR and associated checklists.

Surveys & Mapping

During a project evaluation, areas are identified as possible locations for Treatment BMPs. Therefore, surveys and vicinity mapping should be developed for these areas.

Right-of-Way

The right-of-way data sheet should be requested from the Right-of-Way functional unit as soon as possible after project alternatives have been developed. The right-of-way data sheet is prepared during the PID process and updated throughout the Project Approval/ Environmental Document (PA/ED) process, and is a required attachment to the PSR, the PR, and most other project initiation and project approval documents. The information in the right-of-way data sheet is vital to the project development process since it details all types of parcel information and the right-of-way estimate. The information from the right-of-way data sheet is also used to evaluate the feasibility of acquiring additional land for the incorporation of Treatment BMPs or drainage easements.

Hydraulics

Following project approval, a Drainage Report is typically prepared by the Hydraulics Unit. This report covers rainfall, runoff, existing flood records, gauging stations, debris, and any other pertinent drainage information. This report is transmitted to the PE so that pertinent drainage design can be started. The information in the Drainage Report is also used to evaluate and design stormwater BMPs.

Maintenance

In addition to participating on the PDT, the Maintenance Unit should review all major engineering reports such as the PSR, DPR, PR, etc. The review shall include the evaluation of all proposed BMPs, including the maintainability of those BMPs. Maintenance is also required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. Additionally, Maintenance concurrence must be obtained on any new slope steeper than 1:2 (v:h).

Landscape Architecture

Landscape Architecture is required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. The District Landscape Architect must either prepare or approve an Erosion Control Plan for any project incorporating new slopes steeper than 1:4 (v:h).

Construction

The Construction Unit should review the project and BMP alternatives to determine if they are biddable and buildable. After completion of the construction contract, the PM is responsible for gathering the construction contract records from the RE and the project planning and design data from the PE to put in the Project History File. During the design phase, the construction unit will also provide input and concurrence to the Project Engineer (PE) on the strategy for Construction Site BMPs.

District Materials Unit

The District Materials Unit provides a Materials Report for all projects that involve any of the following components:

- Pavement structure recommendations and/or pavement studies;
- Culverts (or other drainage materials);
- Corrosion studies;
- Materials disposal sites; or
- Slide prone areas with erosive soils.

Geotechnical Services

Geotechnical Services either prepares or approves a Geotechnical Design Report for all projects incorporating new cut slopes or embankments steeper than 1:2 (v:h), retaining walls, groundwater studies and any other studies involving geotechnical investigations and engineering geology.

District/Regional Design Storm Water Coordinator

The District/Regional Design Storm Water Coordinator is required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. The District/Regional Design Storm Water Coordinator may delegate this authority to the District/Regional NPDES Storm Water Coordinator.

District/Regional NPDES Storm Water Coordinator

The District/Regional NPDES Storm Water Coordinator verifies that the water quality issues are identified in the Water Quality Impact Questionnaire and later in the WQR (if one is prepared for the project).

Project Manager

The Project Manager (PM) is required to sign the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases. The PM also signs the PSR and the PR.

Project Engineer

The Project Engineer (PE) is responsible for the preparation of PSRs and PRs during the planning phase, and PS&E documents (otherwise known as contract plans or bid documents) during the design phase. Where the re-use of soils that contain lead is proposed, the PE will ensure that written notification is provided to the RWQCB 30 days prior to advertisement for bids, as discussed in Section 1.4.4. The PE determines whether a SWPPP or a WPCP is required for the construction project and incorporates appropriate permanent BMPs in the project.

The PE incorporates permanent Design Pollution Prevention, Treatment and temporary Construction Site BMPs into the project plans and specifications.

The PE also prepares and signs the SWDR at the conclusion of the PID, the PA/ED, and the PS&E phases.

4.1 INTRODUCTION AND OBJECTIVES

The Caltrans Statewide Storm Water Management Plan (SWMP) requires Project Development personnel to assess the need for stormwater Best Management Practices (BMPs) and incorporate these BMPs as appropriate during the initial planning and design phases of all Caltrans projects. Design Pollution Prevention BMPs and temporary Construction Site BMPs must be considered for every project. Additionally, every project must evaluate the maintainability of all permanent BMPs incorporated into the project. This section, however, focuses on evaluating whether a project must consider incorporating Treatment BMPs. If a project must consider incorporating Treatment BMPs, then a site-by-site determination of Treatment BMP feasibility is required, and Appendix B and Checklists T-1, Parts 1 through 10 of this document should be consulted.

4.2 PROJECT EVALUATION PROCESS

The attached decision tree, Figure 4-1, provides general guidance to determine when a project is required to consider implementing Treatment BMPs. The corresponding Evaluation Documentation Form is included in Appendix E of this document. The information in the following sub-sections supplements the attached decision tree by providing further detailed descriptions of the steps in the decision tree. The numbers in the descriptions correspond to the steps in the decision tree.

Step 1 - Begin

Caltrans construction projects may require the consideration of permanent Treatment BMPs. The projects required to consider permanent Treatment BMPs are identified based upon certain criteria as shown in Figure 4-1. The Project Engineer (PE) should use Figure 4-1, the detailed guidance provided in this Section 4, and the Evaluation Documentation Form in Appendix E to determine if a specific project requires the consideration of permanent Treatment BMPs.

Step 2 - Is this an Emergency Project?

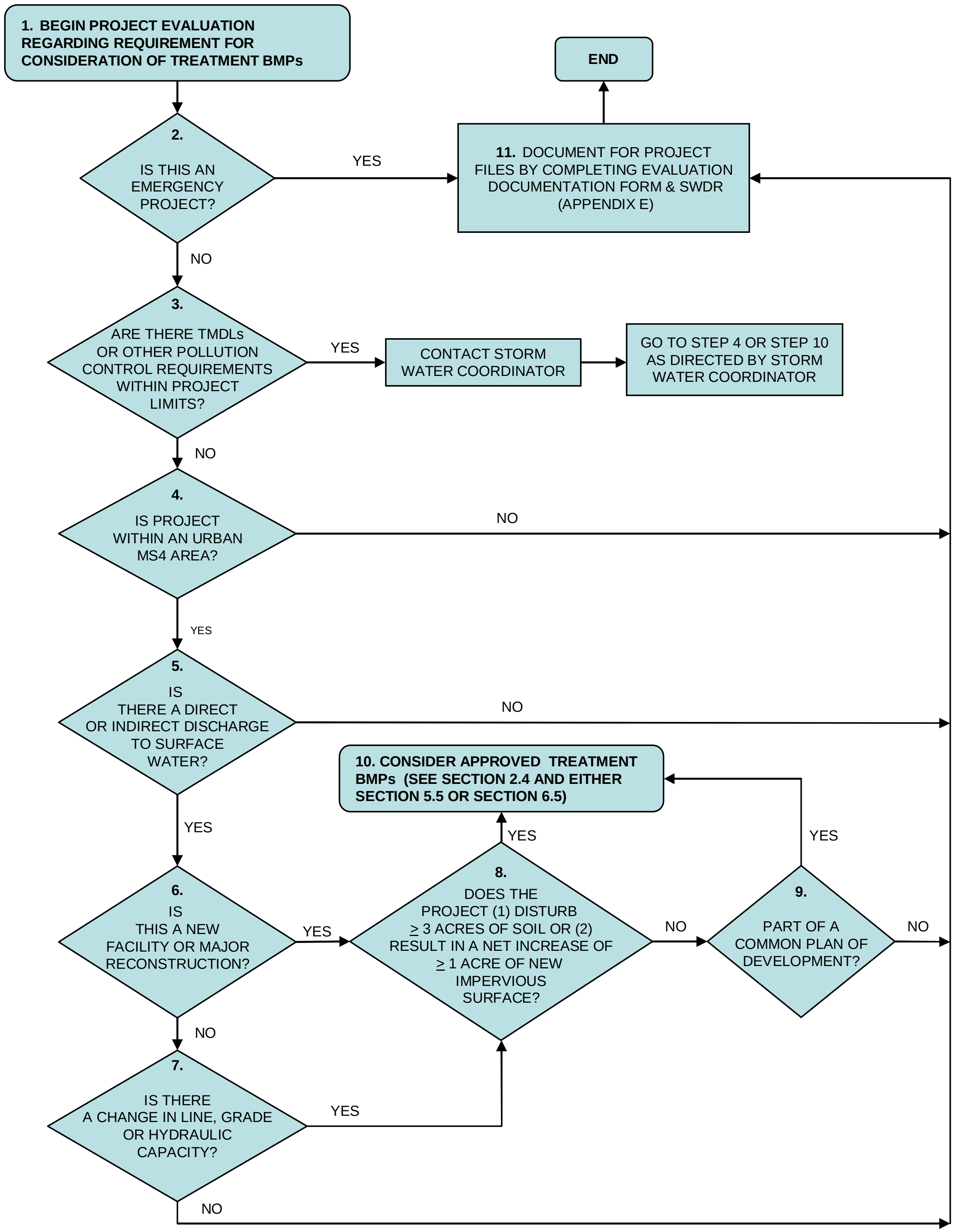
Certain Departmental projects are considered Emergency projects. Throughout the year conditions may arise that require Caltrans to conduct emergency projects to protect public health, safety and property.

Conditions during the emergency projects result in Caltrans being exempt from the requirement to implement Treatment BMPs due to the fact that adding Treatment BMPs could jeopardize the funding and expedient delivery of the project.

These projects may be retrofitted with Treatment BMPs after the objective to restore public health, safety and property has been completed.

Regardless of whether the project falls under an emergency project status, Design Pollution Prevention and Construction Site BMPs need to be considered in project design.

Figure 4-1: Project Evaluation Process for Consideration of Permanent Treatment BMPs



Step 3 – Have TMDLs or other Pollution Control Requirements been established for surface waters within the project limit?

All new construction and major reconstruction projects that discharge into a receiving water for which a TMDL or other Pollution Control Requirement has been established must consider whether Treatment BMPs are required to address the Department's obligations. Pollution Control Requirements include, but are not limited to Basin Plan requirements, TMDLs, 303(d) listings and numeric effluent limits. Contact the District/Regional NPDES Storm Water Coordinator to determine if there are any Pollution Control Requirements or TMDLs within the project limits.

Step 4 – Is the project within an urban MS4 area?

Projects and activities within urban areas subject to MS4 permits may require the consideration of incorporating Permanent Treatment BMPs Coordinate with the District/Regional NPDES and/or Design Storm Water Coordinator to determine if your project limits are within a currently designated urban MS4 area.

Step 5 - Is the project directly or indirectly discharging to Surface Waters?

Surface Waters are known as Waters of the United States and/or Waters of the State. In general, these include creeks, streams, rivers, oceans, reservoirs, wetlands, estuaries and lakes.

A direct discharge means a discharge of surface runoff directly to the surface water body without first flowing through a municipal separate storm sewer system (MS4). An indirect discharge means the discharge of surface runoff to the surface water body through an MS4 stormwater conveyance system, unlisted tributary to the surface water, or a stormwater discharge that otherwise reaches the water body.

If a project directly or indirectly discharges to surface water, the Project Engineer (PE) should consider the additional evaluation criteria in the decision tree, step numbers 3-12. If not, the project is not required to consider the incorporation of Treatment BMPs, and the PE should prepare the appropriate documentation to be attached to the Storm Water Data Report (SWDR).

Step 6 - Does the project constitute a new facility or major reconstruction of an existing facility?

New construction and major reconstruction includes new routes, route alignments, and route upgrades. 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.

New Construction and major reconstruction projects may include, but are not limited to:

- New highways and freeways;
- Highway-related facilities, including new or reconstructed maintenance facilities, safety roadside rest areas, toll plazas and inspection and weigh stations;
- Adding one or more lanes;

- Adding HOV lanes;
- Construction activities conducted within highway rights-of-way in conjunction with a new facility;
- New or reconstructed interchanges, including on-ramps, off-ramps, and connectors;
- New or reconstructed bridges;
- Tunnels; and
- Drainage system improvements, including changes to pipes, conduits, channels, etc.

Projects containing the elements listed in this section are classified as new facilities or major reconstruction for stormwater purposes.

Step 7 - Will there be a change in line/grade or hydraulic capacity?

Projects that propose a change to the original line, grade, hydraulic capacity, or original purpose of the facility may be required to consider permanent Treatment BMPs. Changes to line, grade or hydraulic capacity include any changes made within the project limits that would alter the hydrologic/hydraulic behavior of stormwater discharges. The following changes would be considered a change in line, grade or hydraulic capacity:

- A change in the time of concentration, peak flow, volume or velocity of stormwater discharges;
- Modifying or creating new drainage ditches, swales, culverts, or storm drain facilities; or
- Changing historic drainage patterns.

Modifying drainage ditches, swales, culverts, or storm drain facilities does not include repairs or grading to re-establish the original line, grade or hydraulic capacity of a ditch or swale, nor does it include minor improvements such as adding culvert flared end sections, energy dissipation, or replacing pipe sections "in-kind."

Examples of activities that would not be considered a change in line, grade or hydraulic capacity include:

- Overlaying a roadway surface;
- Re-grading a ditch to the original line and grade;
- Culvert lining; or
- Replacing a culvert in-kind.

Step 8 - Is the Disturbed Soil Area (DSA) created by the project greater than or equal to 3.0 acres <u>or</u> does the project result in a net increase of one acre or more of new impervious surface?

Both projects that will disturb a soil area of three (3) acres or more and projects that result in a net increase of one acre or more of new impervious surface must consider incorporating approved Treatment BMPs. The District/Regional Storm Water Coordinator should be consulted if there is any ambiguity or question regarding the determination of the extent of the disturbed area or the applicable Treatment BMPs.

Step 9 - Is the project part of a Common Plan of Development?

Projects that are part of a larger Common Plan of Development whose total land disturbing activities disturb three (3) acres or more and/or projects that result in a net increase of one acre or more of new impervious surface must consider Treatment BMPs. In addition, projects designated as part of a Common Plan of Development by the permitting authority must also consider Treatment BMPs. A Common Plan of Development is broadly defined as any announcement on a piece of documentation or physical demarcation indicating that construction activities may occur on a specific plot. This requirement remains in effect regardless of any lapse in time between the initial grading or clearing of the area and the actual construction on a portion of the land that was graded.

Step 10 - Consider Approved Treatment BMPs for the Project

Checklist T-1, Part 1 provides guidance on which Treatment BMP(s) to consider. Checklist T-1, Parts 2 through 10 also contains design questions that lead the designer through an evaluation of each approved Treatment BMP. See Section 2.4 and either Section 5.5, Section 6.5, or Section 7.4.

Step 11 - Project is not Required to Consider Treatment BMPs

All supporting data used to determine whether a project must consider incorporating Treatment BMPs should be summarized for inclusion in the Project Files. A copy of the completed Evaluation Documentation Form and the supporting data shall be attached to the Storm Water Data Report (SWDR).

If it is determined that a project is not required to consider Treatment BMPs, permanent Design Pollution Prevention BMPs and Construction Site BMPs shall still be considered.

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5.1 INTRODUCTION AND OBJECTIVES

The purpose of this section is to provide a consistent approach in the preparation of the Project Initiation Document (PID) as it relates to incorporating stormwater Design Pollution Prevention, Treatment, and Construction Site Best Management Practices (BMPs) into a project. Although there are several types of PIDs (for a complete list of PIDs, see Chapter 9 of the Project Development Procedures Manual [PDPM], updated September 2005), the most common is the Project Study Report (PSR). Instructions for preparing PSRs are provided in PDPM Appendix L, "Preparation Guidelines for Project Study Reports." This section has been incorporated directly from Appendix L of the PDPM and is to be used only as a supplement to the PDPM.

This section also relates the Work Breakdown Structure (WBS) codes and the Storm Water Data Report (SWDR) and checklists, to the PID process. WBS codes are provided in Appendix E for specific stormwater related tasks during the PID process. These codes are organized in the process form titled "Summary Process for Storm Water Activities for the PID" (included in Appendix E). These codes follow the "Guide to Project Delivery Workplan Standards – Release 8.0A" document. The SWDR and its corresponding checklists are described in this section and are included in Appendix E. These documents should be used for guidance in evaluating BMPs considered during the PID process.

5.2 PROJECT INITIATION DOCUMENT

The purpose of a PID is to develop consensus on the scope, schedule, and estimated cost of a project. The PID is used for programming the project, for proceeding to the environmental evaluation, and for selection of project alternatives. The overall objective of a PID is to gather pertinent information and to clearly define the design concept and design scope of project alternatives. Specific objectives of the PID process as it relates to stormwater quality are listed as follows:

- Define need and purpose of the project;
- Estimate and program the design resources needed to prepare the Plans, Specifications and Estimates (PS&E) and project management costs;
- Define stormwater quality issues and pollutants of concern;
- Form the Project Development Team (PDT), including a District/Regional Storm Water Coordinator;
- Develop project alternatives and evaluate potential stormwater impacts for each alternative;
- Develop a list of potentially feasible permanent stormwater Design Pollution Prevention and Treatment BMPs to be evaluated during later phases of project design;
- Develop the preliminary costs for BMPs and the associated right-of-way costs for incorporating BMPs, and include these costs in the PID;
- Discuss the stormwater quality elements of the project with the Regional Water Quality Control Board (RWQCB) and/or local agencies, if necessary, as determined

by the District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator or if requested by the RWQCB;

- Program the project construction costs, costs for right-of-way associated with construction, and stormwater quality related costs;
- Perform and document the field review and research of other projects in the same general area;
- Identify and document any existing Treatment BMPs within the project limits (e.g. contact Maintenance for an inventory of existing Treatment BMPs) or existing features that provide water quality benefits (see Appendix B.1.4);
- Develop an initial Construction Site BMPs strategy appropriate for the PID phase; and
- Prepare the Preliminary Environmental Assessment Report (PEAR) and Water Quality Impact Questionnaire.

5.3 PROJECT INITIATION DOCUMENT PROCESS

The PID process is intended to obtain management approval of candidate projects, identify right-of-way acquisition needs and determine costs for programming. Therefore, it is essential that all work incidental to the project, including stormwater quality items, be included in the scope and cost estimates. The outcome of the PID process is a well-defined, proposed project scope tied to a reliable cost estimate and schedule that is suitable for programming or local commitment, as well as for proceeding to the Project Approval/Environmental Document (PA/ED) process. It is understood, however, that a project's scope may change as environmental or other studies are completed.

A PEAR is prepared by the Environmental Unit when requested by the Design Unit, and is used to provide necessary information for the completion of a PID. The purpose of a PEAR is to determine whether there are any potentially significant environmental issues that could affect the viability of any project alternatives. When it is concluded that there are water quality issues raised by a proposed project (and its alternatives) and that a potential for one or more substantive water quality impacts exists, then a comprehensive Water Quality Assessment Technical Report (WQR) is prepared during the PA/ED phase of a project. The need for a WQR is determined by the Water Quality Impact Questionnaire completed as part of the PEAR.

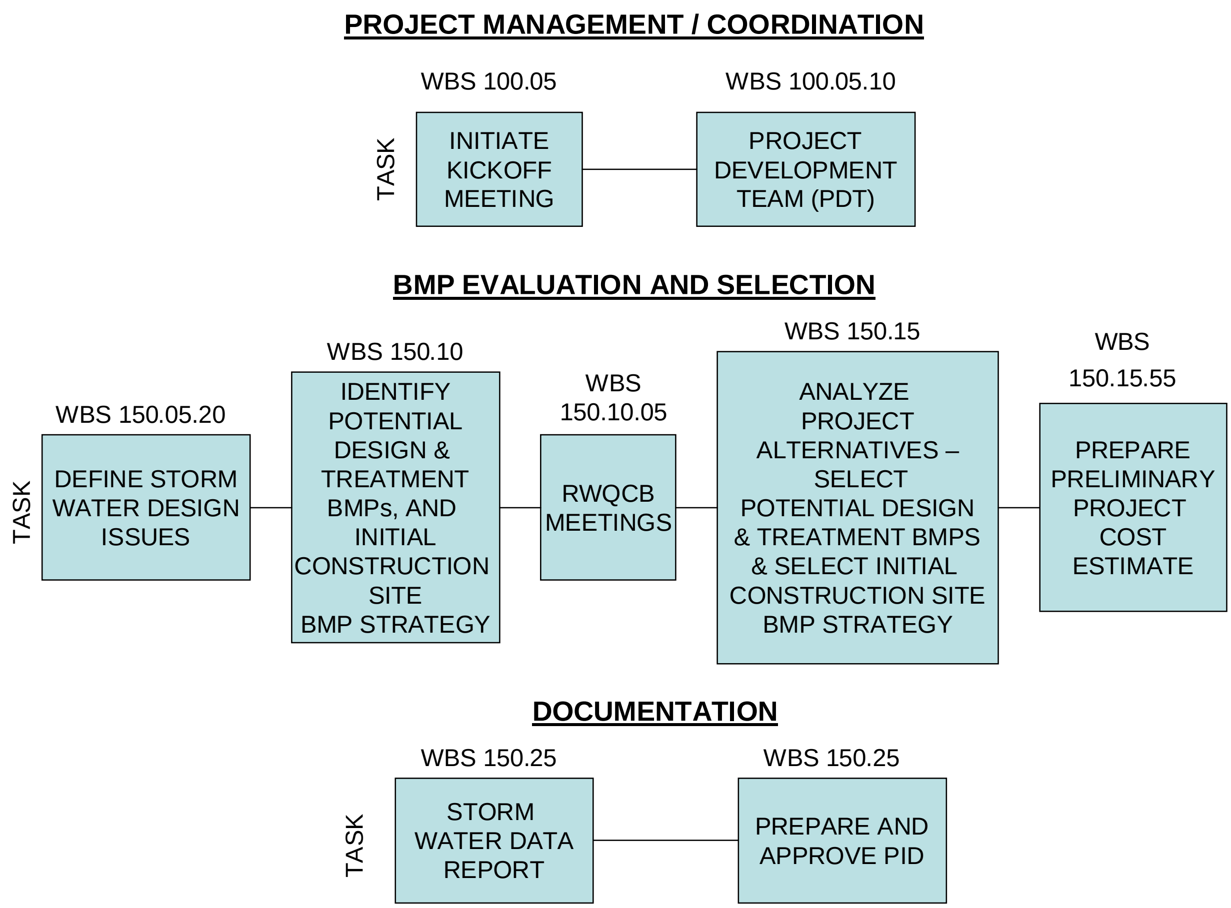
The Project Engineer (PE) should use the information from the PEAR during the PID process as a resource to prepare the SWDR when defining the stormwater quality issues for the project. The PE should provide the SWDR to the designated Environmental Staff who prepared the PEAR to verify the information included in the SWDR.

If the PEAR determines that a WQR is required for the project, the PE should coordinate with the Environmental Unit and District/Regional NPDES Storm Water Coordinator during its preparation to update the SWDR as part of the PA/ED process.

Figure 5-1 is a flowchart that illustrates the overall primary task categories for the PID process. Included in the flowchart are WBS Codes for each task. Appendix E includes a process form titled "Summary of Storm Water Activities for the PID" that provides a step-by-step process of the tasks described in this section.

The sub-sections that follow correspond to the task categories shown in Figure 5-1 and the PID Process Summary Form in Appendix E. Additional information is provided on the following pages detailing the recommended participants, discussion and decision topics, documentation, and verifications for each task to obtain final PID approval and funding for a project.

Figure 5-1: Project Initiation Document - Storm Water Task Categories



5.4 PROJECT MANAGEMENT / COORDINATION

This section describes the primary task categories involved with project management and the coordination in the PID process needed to obtain consensus between the different functional units regarding stormwater issues.

Initiate Kickoff Meeting, WBS 100.05

Narrative: The kickoff meeting is typically initiated by the Project Manager (PM) to discuss the need and purpose of the project.

Responsible: Project Manager (PM)

Recommended Participants:

Project Manager
Project Engineer
District/Regional Storm Water Coordinator
Appropriate functional units
Environmental Engineering Representative
Environmental Planning Representative

Discussion Topics: Project Definition**:** Discuss the project purpose, type, location, schedule, size, and project alternatives.

Project cost estimate**:** Discussion is included early so that the necessary funds can be estimated as soon as possible. Obtain Preliminary Project Cost Estimate (PPCE) form for items to be included.

Discuss the potential need for additional right-of-way to incorporate Treatment BMPs.

Discuss any environmental concerns and/or issues**.**

Decisions/actions: Determine if additional functional units should be involved.

Documentation: Meeting minutes
Start PID

Verification: There is no verification required at this phase.

Project Development Team (PDT), WBS 100.05.10

Narrative: The PDT advises and assists the PE in directing the course of studies, makes recommendations to the PE and District management, and works to carry out the project work plan. Members of the PDT participate in major meetings, public hearings, and community involvement. The PDT is responsible for conducting studies and accumulating data throughout the project's development, from the beginning of the PID process through the PS&E process. The PDPM, Chapter 8, Section 4 (July 1999), provides a thorough description of the PDT and its functions.

Responsible: Project Manager

Recommended Participants:

Project Manager
Project Engineer
District/Regional NPDES Storm Water Coordinator
District/Regional Design Storm Water Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative

Environmental Planning Representative

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

Right-of-Way Representative

Hydraulics Representative

District Materials Engineer

Geotechnical Representative

Traffic Representative

Local MS4 Representative (if applicable)

RWQCB Representative (at discretion of District/Regional NPDES Storm Water Coordinator)

Others as needed.

All Districts are not organized the same; therefore, the suggested PDT members may have different titles depending upon the District in which the project is located. The PM and the PE should consult the specific District Work Plan (DWP) to obtain the contacts listed in this section or the equivalent title or function in the District.

Discussion Topics: The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units.

The following stormwater quality issues are examples of what should be discussed:

- Viable alternatives for projects including location and alignments;
- Evaluate approved BMPs for potential implementation;
- Evaluate whether Treatment BMPs are required to be considered (see Section 4);
- Estimated project cost and BMP costs for various alternatives;
- Environmental issues;
- Site conditions and design constraints;
- Stormwater quality requirements/Basin Plan objectives;
- Storm Water Pollution Prevention Plan (SWPPP) versus Water Pollution Control Program (WPCP);
- Identifying the appropriate RWQCB jurisdiction;

- Identifying water bodies potentially affected by the project;
- Any special requirements established by the RWQCB for those water bodies, including numeric effluent limits, TMDLs, or other requirements;
- Water quality volume and flow;
- Right-of-way impacts, location and size of Design Pollution Prevention and Treatment BMPs;
- Need for permanent or temporary dewatering;
- Presence of aerially deposited lead or other contaminants;
- Evaluation of slope stability;
- Initial Construction Site BMPs strategy;
- Presence of Drinking Water Reservoirs and/or Recharge Facilities; and
- Public access and need for drain inlet stenciling.

Decisions/actions: Document any decisions made during PDT meetings.

Documentation: Meeting minutes

Evaluation Documentation Form

Checklists SW-1, SW-2, DPP-1 and T-1.

Verification: The PE verifies that all documentation is completed.

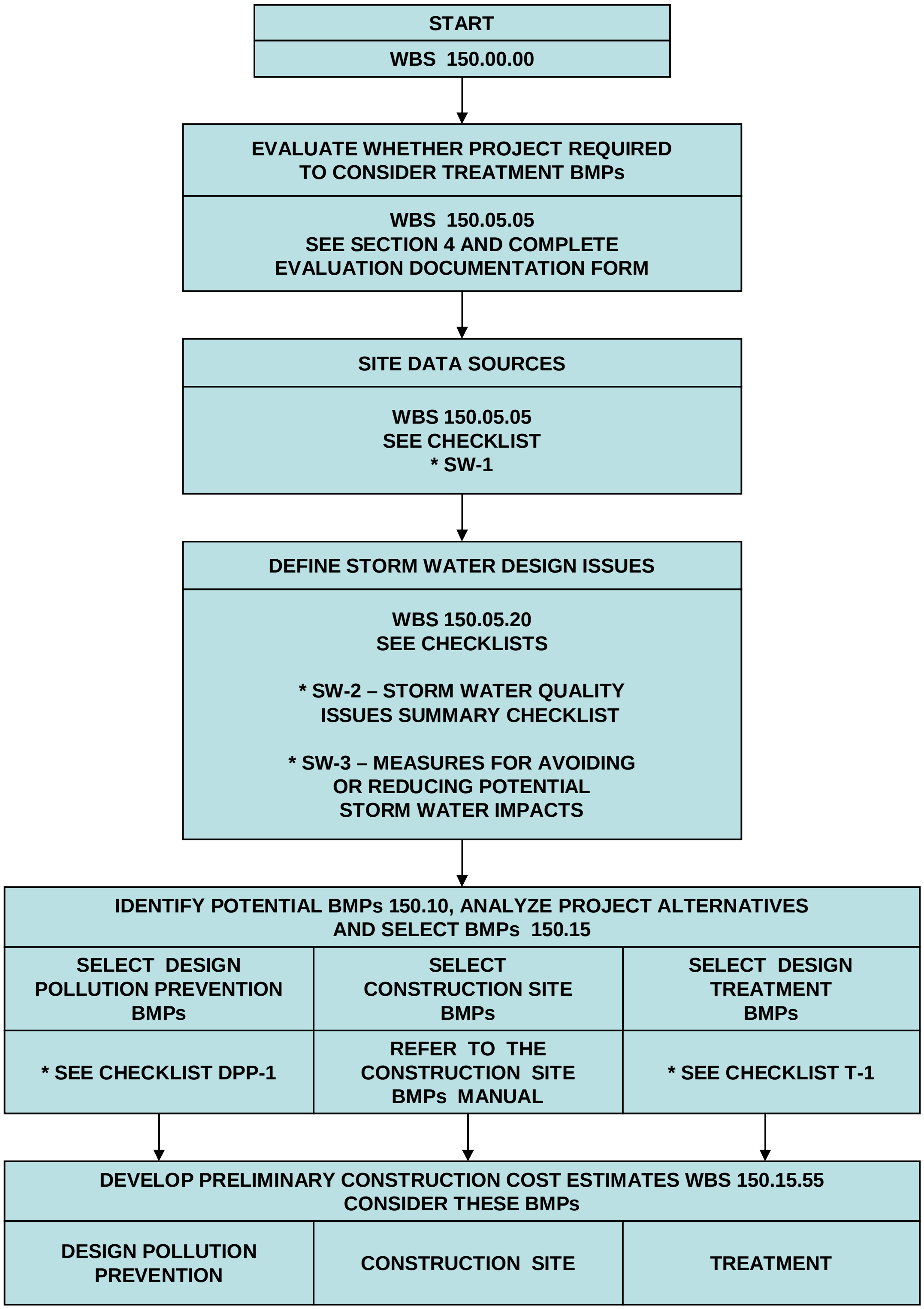
5.5 BMP EVALUATION AND SELECTION PROCESS

This section describes the primary task categories for the Design Pollution Prevention and the Treatment BMP selection procedures associated with the PID process. For information regarding the initial Construction Site BMPs strategy, consult with Construction Storm Water Coordinator and refer to Manual for Construction Site BMPs (see Appendix D for web address). Figure 5-2 is a flowchart that illustrates the process development of considering BMPs in a project. A description of the corresponding checklists listed in Figure 5-2 is provided in Section 5.5.1.

There are three goals for the evaluation and selection process. They are:

1. To obtain consensus between the different functional units regarding preliminary BMP selection;
2. To facilitate the consideration of the BMPs during the PID process; and
3. To provide sufficient information regarding BMP consideration, and if appropriate, evaluation and selection once the PA/ED process is initiated.

Figure 5-2: Flowchart for Consideration of Storm Water BMPs for the PID



* LOCATED IN APPENDIX E

5.5.1 Storm Water Data Collection

Define Storm Water Design Issues, WBS 150.05.20

Narrative: Checklists provided in Appendix E and described below are tools for designers to evaluate potential Design Pollution Prevention, Treatment, and Construction Site BMPs for incorporation into a project.

The checklists can be attached to the SWDR, which is also described herein. The SWDR and the checklists are refined during the PA/ED and PS&E processes.

Responsible: Project Engineer

Recommended Participants:

Project Manager

Project Engineer

District/Regional Storm Water Coordinator

Primary functional units

Discussion Topics: The following items 1 – 5 are initiated during the PID Process.

1. **Evaluation Documentation Form for Treatment BMPs, WBS 150.05.05**

   Following the directions provided in Section 4 of this document, determine whether or not the project is required to consider incorporating Treatment BMPs. Complete the Evaluation Documentation Form in Appendix E. If it is determined that the project is not required to consider incorporating Treatment BMPs, then attach the Evaluation Documentation Form and tabulated supporting data to the SWDR. Continue with the selection of Design Pollution Prevention BMPs.

2. **Storm Water Data Report, WBS 150.25**

   The SWDR summarizes the information found in Checklists SW-1, SW-2 and SW-3 (described as follows). The checklists and the SWDR are initiated during the PID process, updated during the PA/ED process and updated again and completed during the PS&E process. During each process, the SWDR is signed by the PE, District Design Storm Water Coordinator, designated Landscape Representative, designated Maintenance Representative, and by the PM to verify that stormwater quality design issues have been addressed and the data are complete, current and accurate. The PE stamp is required at PS&E. This report is to be included in the final PS&E package (see Section 7). Checklists SW-1, SW-2 and SW-3 should be included as a Supplemental Attachment to the SWDR during the review process.

3. Site Data Resources: Checklist SW-1, WBS 150.05.05

Checklist SW-1 lists categories of pertinent information required for stormwater planning and design. Checklist SW-1 should be completed citing the source and date of the information collected for each entry where appropriate.

The five main categories for site data collections are topographic, hydraulic, soils, climatic and water quality. These data should be collected from the various functional units. Field visits should also be conducted to gather pertinent data. The following provides some examples of data that can be collected pertaining to the aforementioned categories:

Topographic Data:

- United States Geological Survey (USGS) Quad Maps;
- Survey Reports and Maps – Survey needs should be evaluated and identified early in the PID process and throughout the entire project development process when needed. After the first evaluation of survey needs, the PE should submit the initial survey request accompanied by a location map;
- Aerial Mapping/Photo Mosaics;
- Vegetation – Existing cover and types of vegetation present should be documented; and
- Landscape/Aesthetic Analysis – The PE requests information from the Landscape Architect to Perform Landscape/Aesthetic Analysis. This helps to evaluate the implementation of mandatory stormwater Design Pollution Prevention BMPs into the overall landscaping plan for the project. Erosion prevention and stormwater pollution prevention BMPs should be incorporated into the project landscaping and revegetation plan.

Soils Data:

- Natural Resources Conservation Service (NRCS) Soil Survey Reports and Maps – Potential areas of serious erosion problems should be identified and provided; and
- Geotechnical Design Reports and Well Records – Well records and Geotechnical Design Reports can provide information regarding the depth from surface to seasonal high groundwater. The local Maintenance Supervisor should be consulted to identify existing drainage and/or erosion problems.

Hydraulic Data

- Groundwater Data;
- Stream Flow Data;
- Drainage Area – Routes and patterns (define sub-basins); and
- Identification of drainage areas affecting or tributary to Drinking Water Reservoirs and/or Recharge Facilities.

Climatic Data

- Rainfall Intensities (as required under HDM for drainage design and as necessary for sizing potential BMPs).

Water Quality Data

- The PE should coordinate with the Environmental Unit and the District/Regional NPDES Storm Water Coordinator during the preparation of the PEAR. This coordination enables the PE to share project-specific information, and to ensure consistency between the evaluation of project alternatives, the completion of the Storm Water Checklists, and the water quality assessments included in the PEAR;
- Receiving water bodies;
- Hazardous Material/Waste Information;
- RWQCB Jurisdiction and Basin Plan;
- Identifying TMDLs within project limits; and
- Water Quality Volume (WQV) and Water Quality Flow (WQF).

4. **Storm Water Quality Issues Summary: Checklist SW-2**

Checklist SW-2 provides a guide to collecting information relevant to project stormwater quality issues. The PE should coordinate with the Environmental Unit when compiling and reviewing the information required by Checklist SW-2. This information is critical in facilitating the selection and design of the preferred BMPs. This activity includes the following tasks:

- Compile and review existing background information that may impact the alternatives or the scope of the alternatives under consideration, including existing stormwater quality issues. Such background information will help identify specific District and RWQCB requirements as well as the possibility of sensitive receiving waters or valuable habitats; and
- Analyze future requirements to determine the project’s need and purpose. This task requires the analysis of site-specific conditions or potential sources of pollution for effective soil stabilization and

sediment control. This task includes discussion with internal and external stakeholders.

5. **Measures for Avoiding or Reducing Potential Storm Water Impacts: Checklist SW-3**

   Checklist SW-3 provides direction to the designer during the project planning phase to avoid or reduce potential stormwater impacts. The planning phase represents the greatest opportunity to avoid adverse water quality impacts as alignments and right-of-way requirements are developed and refined. Avoiding impacts may reduce or eliminate the need for mitigation measures. The PE should coordinate with the Environmental Unit when compiling and reviewing the information required by Checklist SW-3.

   Table 5-1 identifies many of the project features and potential stormwater impacts that should be considered. The PE should obtain or develop this information for each project or alternative. The PE must confer with other functional units, such as Landscape Architecture, Hydraulics, Environmental, Materials, Construction, Maintenance, Right-of-Way, and the NPDES office when necessary. This will usually be accomplished by submitting layouts/base maps, in conjunction with other information required by the functional units, to determine impacts and BMP requirements.

Decisions/actions: Identify potential stormwater quality impacts or issues.

Estimate project cost of the potential BMPs.

Documentation: Evaluation Documentation Form

Preliminary Checklists SW-1, SW-2, SW-3 and the SWDR. These will be first drafts since not all information will be available.

Verification: District/Regional Design Storm Water Coordinator or designated functional unit verifies that the SWDR and checklists are being completed appropriately.

Table 5-1: Project Features and Potential Impacts to Be Considered During Project Planning

Features and Potential Impacts to be Considered	Reason Why They Must be Considered
Identify which RWQCB will have jurisdiction over the project(s). Does the RWQCB have any special requirements?	Requirements may vary by RWQCB. May impact permanent and temporary control requirements.
Identify receiving waters and all other waters that may affect or may be affected by the project. Consider aquifers, wells, streams, lakes, reservoirs, wetlands, and waters both fresh and saline. Consider impacts throughout the project lifecycle, including construction, maintenance, and operation.	First step in identifying impacts and potential control measure requirements.
Are any of the receiving waters impaired [303(d) listed] or have TMDLs been established? (Discharges to impaired water bodies may be subject to strict numeric water quality standards and prescribed treatment controls.)	Supplemental controls may be required to further reduce pollutants to meet numeric water quality standards, waste load allocations or requirements of an adopted watershed plan.
Will construction require work in, above, or directly adjacent to the water bodies listed in this section?	Could require additional environmental permits/agreements and control measure requirements.
Are any sensitive fishery, wildlife, recreational, agricultural, or industrial aquatic resources located in the vicinity of the project?	Could require additional environmental permits/agreements and control measure requirements.
What is the unit cost for additional right-of-way should it be needed for Treatment BMPs or other control measures or requirements?	Used for budgeting and cost estimating.
Will the project increase the potential for downstream erosion by adding impervious surfaces, decreasing the time of concentration, or redirecting flows?	May need to implement Peak Flow Attenuation Basins or stabilized conveyance systems to prevent damage to off-site streambanks or channels.
Does the project discharge to lined, engineered drainage facilities or unlined, natural channels?	Will need to consider implementing Peak Flow Attenuation Basins or stabilized conveyance systems for streambank protection.
Identify general soil types and vegetation within the project site.	Basic information needed for slope design, slope protection plans and infiltration BMPs.
How difficult will it be to re-establish vegetation following construction?	May affect slope stabilizations plans.
How long will it take for the new vegetation to establish? What vegetation, if any, can be preserved?	Used to determine the need for separate vegetation establishment contract.
Are any slopes steeper than 1:4 vertical:horizontal (v:h)?	Slopes steeper than 1:4 require an erosion control plan prepared or approved by the District Landscape Architect.
Are any slopes as steep as or steeper than 1:2 (v:h) ?	If yes, a Geotechnical Design Report must be prepared by Geotechnical Services. Additionally, the District Landscape Architect should prepare or approve an erosion control plan and Maintenance must concur with the proposed slope.
Determine the general climate, annual rainfall, and typical seasonal rainfall patterns for the project area.	Basic information needed for slope design, slope protection plans, BMP feasibility, plus conveyance system design and sizing of treatment controls.
Determine the proposed project slopes, and areas of cut and fill.	Basic information needed for slope design and slope protection plans.
Does the project include contaminated or hazardous soils as identified in the initial site assessment (ISA) and environmental documents?	May impact project construction activities and deployment of temporary controls during construction. May affect whether soil can be re-used.

Table 5-1: Project Features and Potential Impacts to Be Considered During Project Planning (Continued)

Features and Potential Impacts to be Considered	Reason Why They Must be Considered
Will the contractor's yard be located within the State's right-of-way or otherwise be arranged for or provided by Caltrans? If so, what are the potential impacts?	May impact responsibility for deployment of temporary controls during construction.
Do the regulatory agencies have seasonal construction restrictions?	May impact project construction activities and deployment of temporary controls during construction.
Identify Drinking Water Reservoirs and/or Recharge Facilities that fall within or are adjacent to project limits.	Could require additional features to minimize spills or intercept spills.

5.5.2 Identify Potential BMPs, WBS 150.10

Narrative: This activity includes identifying potential Design Pollution Prevention and Treatment BMPs for implementation.

Responsible: Project Engineer

Recommended Participants:

Project Manager
Project Engineer
District/Regional NPDES Storm Water Coordinator
District/Regional Design Storm Water Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative
Environmental Planning Representative
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
Right-of-Way Representative
Hydraulics Representative
District Materials Engineer
Geotechnical Representative
Traffic Representative

Discussion topics:

Potential BMPs

Checklists, SW-1, SW-2, SW-3

Environmental Impacts

Decisions/actions: Develop general scope and study limits of the potential BMPs selected for further evaluation. These potential BMPs are now ready for further analysis to determine project features, cost, and feasibility.

Documentation: Completed PID level Checklists SW-1, SW-2, SW-3

Project descriptions for potential BMPs (including maps of areas with potential impact)

Verification: The PE must verify that consensus is reached with internal/external stakeholders on the potential BMPs that will be addressed in the PID.

Regional Water Quality Control Board Meetings, WBS 150.10.05

Narrative: Consultation with the RWQCB, local regulatory agencies and MS4 Permit Holders is strongly recommended to coordinate project issues and develop consensus for controversial or complex stormwater quality issues. The number of coordination meetings is dependent upon the complexity of the stormwater quality issues, stormwater pollutants involved, and project site constraints.

Responsible: PE and the District/Regional NPDES Storm Water Coordinator. The PE should consult with the District/Regional NPDES Storm Water Coordinator regarding the complexity of the project and the need to consult with the RWQCB at this early stage in the project.

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator (primary point of contact with the RWQCB)

RWQCB, MS4, and/or local agency representatives

Department of Fish and Game, if necessary

The Army Corps of Engineers, if necessary

County Health Department, if necessary

Discussion Topics: Present Project Information

- Site Conditions
- Project Alternatives
- Consider Approved Treatment BMPs
- Implement Design Pollution Prevention BMPs
- Storm Water Quality Impacts and Issues
- Right-of-Way Impacts

Decisions/actions: Complete project alternatives

Identify preliminary site conditions and stormwater concerns

Complete preliminary evaluation of permanent BMPs

Documentation: Meeting minutes

Verification: The PE must verify that all comments are recorded and resolved.

5.5.3 Analyze Project Alternatives / Select BMPs, WBS 150.15

Narrative: The purpose of this activity is to develop a general overview of the estimated costs for BMPs for different project alternatives. It is anticipated that a general discussion of each BMP alternative will be included for each project alternative that is presented in the PID. Thus, analysis of the project alternatives is required for this activity.

One of the variables considered when selecting a preferred project alternative may be the potential BMPs required for that alternative. Thus, it is anticipated that BMPs must be considered as early as possible. Costs developed in this activity will be used for programming purposes; consequently, the analysis should be of sufficient detail to identify all potential BMP costs.

Note: Appendix C of the SWMP is the design reference for all approved Construction Site BMPs. Appendices A and B of this PPDG contains specific information on Design Pollution Prevention BMPs and Treatment BMPs, respectively.

As described in Section 4 of this document, a project may not be required to consider incorporating approved Treatment BMPs based on the established criteria displayed in Figure 4-1. If a project is not required to consider Treatment BMPs, continue with the selection of Design Pollution Prevention BMPs. If it has been determined that a project is required to consider incorporating Treatment BMPs, the feasibility of the approved Treatment BMPs must be evaluated. If no approved Treatment BMPs can be deployed within a specific project and no pilot BMP has been identified, then the PE, in consultation with the District/Regional NPDES Storm Water Coordinator, will prepare a technical report documenting why Treatment BMPs could not be incorporated into the project (prepared during PS&E).

Responsible: Project Engineer

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

Hydraulics Representative

District Landscape Architect or Project Landscape Architect

Geotechnical Representative

Environmental Branch for coordination

- Coordination through the Environmental Branch includes NPDES review as part of the environmental process.

Maintenance Storm Water Coordinator

District Materials Engineer

Construction Storm Water Coordinator

Discussion Topics: Discuss Checklists DPP-1 and T-1 (all Checklists are located in Appendix E). These Checklists are used for guidance in selecting Design Pollution Prevention and Treatment BMPs. The following is a description of each Design Checklist.

- **Checklist DPP-1, Design Pollution Prevention BMPs**

  All projects must incorporate certain minimum design elements with respect to water quality. The design goals for the Design Pollution Prevention BMPs include the following:

  - Minimize Impervious Surfaces: The intent of this goal is to reduce the volume of runoff.
  - Prevent Downstream Erosion: Stormwater drainage systems will be designed to avoid causing or contributing to downstream erosion.
  - Stabilize Disturbed Soil Areas: Disturbed soil areas will be appropriately stabilized to prevent erosion.
  - Maximize Vegetated Surfaces: Vegetated surfaces prevent erosion, promote infiltration (which reduces runoff), and remove pollutants from stormwater.

  Part 1 of Checklist DPP-1 is a list of questions that will help the PE determine which Design Pollution Prevention BMPs to consider. Once Part 1 is completed, the PE can refer to Parts 2 – 5 for design questions regarding the specific Design Pollution Prevention BMPs.

- **Checklist T-1, Treatment BMPs.**

  Part 1 of the checklist provides guidance on which Treatment BMPs to consider. Once Part 1 is completed, the PE can refer to Parts 2 – 10 for design questions regarding the specific Treatment BMPs.

Other discussion topics include:

- General overview of estimated scope and cost for BMP deployments for different project alternatives;
- The location of permanent BMPs;
- Every SWPPP project is required to include separate bid items for Construction Site BMPs. See Appendix D for the most current Standard Special Provisions (SSP) web site;
- Acquisition of right-of-way, considered for funding allocation;
- Initiate Geotechnical Report, Materials Report and Drainage Report; and
- Determine quantities for BMPs, if possible. If quantities cannot be estimated at the PID stage, planning-level cost information (provided in Appendix F) is to be included in the PID to reference BMPs and their anticipated costs.

Decisions/actions: Establish project scope, cost, and feasibility for presentation in the PID and programming.

Determine all potentially feasible BMPs.

Documentation: Checklists DPP-1 and T-1

Preliminary Project Cost Estimate (PPCE), see Section 5.5.4

Preliminary Geotechnical Report

A final report on materials and geotechnical issues is not required at this stage, but a draft report would be appropriate

Preliminary SWDR

Verification: District/Regional Design Storm Water Coordinator or other designated person must verify documentation

5.5.4 Prepare Preliminary Project Cost Estimates, WBS 150.15.55

Narrative: A preliminary cost estimate is a required attachment for most PIDs. Because the PID cost estimate will most likely be used as the current PPCE, the importance of a reliable estimate at this stage cannot be overemphasized. The PPCE form to be filled out is located in Appendix L (2/18/00) and Appendix AA of the PDPM (7/1/99). It is the initial base against which following estimates are measured and has extremely high visibility. Chapter 20 of the PDPM provides guidance on the current method of cost estimating, the responsibilities of staff and functional units. Appendix F of this document provides greater detail on methods for cost estimating in order to include stormwater BMPs as part of the overall project cost.

Responsible: Project Engineer

Recommended Participants:
Project Manager
Project Engineer
Hydraulics Representative
Environmental Engineering Representative
Environmental Planning Representative
District/Regional NPDES Storm Water Coordinator
District/Regional Design Storm Water Coordinator
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
District Landscape Architect or Project Landscape Architect

Discussion Topics:
Bid data from similar projects
Sampling and Analysis Plans
Potential Construction Site BMPs to be incorporated into the project.
Sensitive Environments (such as 303(d) listed water bodies)
Highway Planting contracts
Supplemental funds
Costs for SWPPP or WPCP development and implementation
Costs for potential permanent stormwater BMPs
Available cost options (i.e., historical sample projects, percent of total project costs (see Appendix F)

Decisions/actions:
Prepare, revise and update project cost estimates.

Incorporate new or revised cost data from functional units in project cost estimate.

Provide revised or updated current cost estimates and their respective dates for inclusion in the project management data base in a timely manner.

Complete the PPCE

Documentation: Completed PPCE

Verification: The following functional units shall verify the completed PPCE:
NPDES
Landscape

Hydraulics

Environmental

Maintenance

Construction

5.6 DOCUMENTATION REQUIRED FOR PROJECT INITIATION DOCUMENT

This section describes the documents necessary for completion of a PID.

Prepare and Approve PID, WBS 150.25

Narrative: The overall purpose of a PID is to develop a purpose and need statement that solves a transportation problem. Areas under consideration are right-of-way needs, environmental impacts, accurate cost estimates and required scheduling. As mentioned earlier, the PSR is the most common PID. Preparation guidelines of the PSR are included in Chapters 2 and 3 of Appendix L of the PDPM, 2/18/00. These guidelines are available on-line at http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm

The purpose of this section is to ensure that stormwater quality issues are identified, and that all appropriate BMPs are being considered in the PID.

This activity includes all tasks required to develop the PID text and exhibits, as well as the effort required to circulate, review and update the PID (includes appropriate "constructability review" for project initiation process). This activity also includes development and approval of any required design exceptions and/or a Federal Highway Administration (FHWA) access modification request. This WBS also includes the development and approval of any supplemental PIDs.

Responsible: Functional Manager overseeing preparation of the PID. The final PID is submitted to the Division Chiefs. The PE is required to route for signature and approval of PID.

Recommended Participants:

Project Manager

Division Chiefs

Project Engineer

Contents: The following should be included in the PID package. Also refer to the PDPM, Appendix L, for the format and contents required.

- A brief discussion of the applicable stormwater treatment goals, including descriptions of the anticipated permanent and Construction Site BMPs plus their anticipated cost estimates
- Descriptions of the anticipated permanent and Construction Site BMPs including their anticipated cost estimates;

- Evaluation Documentation Form;
- General Overview of the Treatment BMPs considered by each viable alternative. That description shall include the anticipated location and size of any considered Treatment BMP. See Appendix L of the PDPM, page L-25 No. 4, Alternatives (2/18/00);
- A summary of the engineering features for each alternative used to satisfy stormwater pollution prevention measures described in Section 2;
- PEAR – The PE shall include a copy of the PEAR and the Water Quality Impact Questionnaire which identify potentially significant project-related water quality impacts and determines whether a WQR will need to be prepared.
- Right-of-Way Data Sheet. The PE shall also identify the additional right-of-way and consider costs related to stormwater treatment;
- SWDR;
- Storm Water Checklists SW-1, SW-2, and SW-3 should be included as a Supplemental Attachment to the SWDR during the approval process.

Documentation: The PID package includes a copy of the PID, PEAR, Right-of-Way Data sheets, Advanced Planning Study (APS), the PPCE, and the SWDR cover sheet. Incorporate "Storm Water Pollution Prevention Discussion (under "Considerations" heading) of planning document. See the "Summary Process for Storm Water Activities for PID" in Appendix E.

Verification: The following Division Chiefs shall approve the completed PID:

- The Functional Manager responsible for production of the PID;
- Program/Project Manager.

The District Division Chiefs are responsible for approving the project's scope, schedule, and cost within these established guidelines, and may exercise engineering judgment and flexibility in approving the PID. PIDs are to be approved by the District Director after review by the Division Chiefs, Functional Manager and the PDT.

Project Managers are to endorse the decision by "Approval Recommended By" or "Approved By" where such authority has been delegated.

The SWDR shall be signed by the PE, the District/Regional Design Storm Water Coordinator, the designated Landscape Representative, the designated Maintenance Representative, and the PM to verify that stormwater quality design issues have been addressed, and the data is complete, current, and accurate. The District/Regional Design Storm Water Coordinator should be the last person to sign the SWDR to ensure that all appropriate reviews have been completed.

This activity is complete with the approval and distribution of the PID.

6.1 INTRODUCTION AND OBJECTIVES

The purpose of this section is to provide a consistent approach in the Project Approval/Environmental Document (PA/ED) process as it relates to incorporating stormwater Design Pollution Prevention, Treatment, and Construction Site Best Management Practices (BMPs) into a project. The PA/ED process results in a Project Report (PR). Instructions for preparing PRs are provided in Appendix K, "Preparation Guidelines for Project Reports" of the Project Development Procedures Manual (PDPM). The described process has been incorporated directly from Appendix K of the PDPM and is to be used only as a supplement to the PDPM.

This section also relates the Work Breakdown Structure (WBS) codes and the Storm Water Data Report (SWDR), and checklists to the PA/ED process. WBS codes are provided in Appendix E for specific stormwater related tasks during the PA/ED process. These codes are organized as a process form, which is titled "Summary Process for Storm Water Activities for the PA/ED" (included in Appendix E). These codes follow the "Guide to Project Delivery Workplan Standards – Release 8.0A" document. The SWDR and its corresponding checklists are described both in this section and in Section 5 of this document and are included in Appendix E. These can be used for guidance in selecting BMPs for inclusion in the PA/ED process.

6.2 PROJECT APPROVAL/ENVIRONMENTAL DOCUMENT

The purpose of the PA/ED is to summarize the studies of the scope, cost, and overall environmental impact of alternatives so that the decision maker can make an informed decision about whether or not to proceed with the project, and also select appropriate Design Pollution Prevention, Treatment, and Construction Site BMPs.

The objective of a PA/ED process is to clearly refine the design concept and design scope of the project alternatives listed in the Project Initiation Document (PID), and to obtain the necessary environmental documents. As mentioned earlier, the PA/ED results in a PR. For a complete list of PRs, see the PDPM, Chapter 12, Section 4 (September 2005). PIDs and PRs require similar information, acquired at different points in time. The PID is preliminary in nature and does not benefit from knowledge acquired from detailed environmental studies. When preparing a PR, appropriate PID data should be updated prior to its insertion in the PR; appropriate data from the environmental studies should be included.

The water quality goal of the PA/ED phase is to utilize updated and more detailed engineering and environmental data to continue the BMP selection process that was initiated during the PID process. The design team should also review the BMPs previously identified to determine whether they are still appropriate and whether they represent the best application of the BMPs approved for statewide use. The PE should investigate whether new stormwater BMPs were approved for statewide use subsequent to the approval of the PID.

Specific objectives of the PA/ED process are listed as follows:

- Review and update project scope in the PID;
- Refine scope, estimate and Project Development Resources;

- Prior to initiating the environmental studies, prepare geometric plans and right-of-way maps in greater detail to identify the areas of potential effects;
- Begin the environmental studies to prepare and process the appropriate environmental document(s) and permits for the project;
- Complete detailed environmental and engineering studies for project alternatives;
- Select the preferred alternative and further define stormwater pollution impacts. Chapter 12 of the PDPM describes the project development policies and procedures for selecting and approving the preferred alternative and for project approvals. Selection of the preferred alternative authorizes the completion of the PR for project approval;
- Develop General Cost Estimate for potential BMPs to be incorporated into the project;
- Initiate and complete PR after environmental studies and costs estimates are completed;
- Continue coordinating the project with the Regional Water Quality Control Board (RWQCB) and local agencies; and
- Complete the Water Quality Assessment Technical Report (WQR), as determined by the Water Quality Impact Questionnaire or updated water quality information. The information presented in the WQR will be utilized by Caltrans Design, Construction and Maintenance staff to develop and implement specific BMPs to mitigate any potential water quality impacts associated with stormwater discharges from the proposed project.

6.3 PROJECT APPROVAL/ENVIRONMENTAL DOCUMENT PROCESS

The PA/ED process is generally initiated after the PID is approved, and the project is programmed. It is intended to obtain management approval of a selected preferred alternative project, identify right-of-way acquisition needs, further define costs, and develop the necessary environmental documents, in accordance with the California Environmental Quality Act and National Environmental Policy Act (CEQA/NEPA).

A WQR is prepared by the Environmental Unit, as determined by the Water Quality Impact Questionnaire as part of the PEAR, which is completed during the PID process. The WQR would typically be a technical appendix to the CEQA/NEPA document.

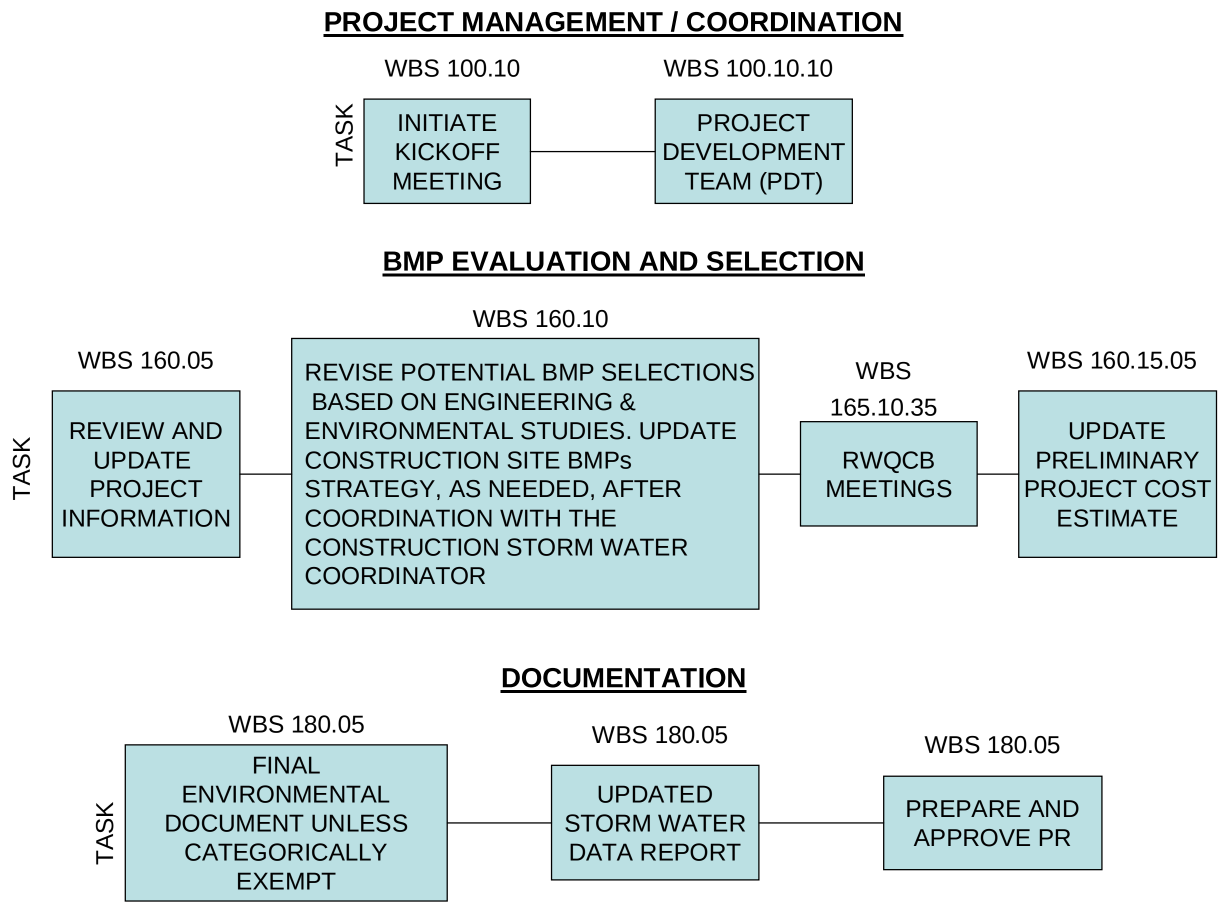
The Water Quality Impact Questionnaire identifies potential water quality impacts, and is incorporated into the PEAR. The Water Quality Impact Questionnaire was developed to assist in early identification and consideration of the broadest rage of potential water quality effects, determine whether a detailed WQR is appropriate, and to scope the PEAR analysis with respect to water quality issues. The Questionnaire asks a series of questions about the project description and alternatives, the project setting, and potential project impacts on water quality.

During the PA/ED process, the PE should coordinate with Environmental Unit staff to identify potential stormwater impacts associated with the project. The PE should update the SWDR based on the detailed information provided in the WQR, and as appropriate, incorporate Design Pollution Prevention and Treatment BMPs. The PE should also update Construction Site BMPs strategy, as needed, after coordination with the Construction Storm Water Coordinator.

Figure 6-1 illustrates the overall primary task categories for the PA/ED process. Included in the flow chart are WBS codes for each task. Appendix E includes the form titled "Summary Process for Storm Water Activities for the PA/ED" that provides a step-by-step process of the tasks described in this section.

The sub-sections that follow correspond to the task categories provided in Figure 6-1 and the PA/ED Process Summary Form in Appendix E. Additional information is provided on the following pages detailing the recommended participants, discussion and decision topics, documentation, and verifications for each task to obtain final PID approval and funding for a project.

Figure 6-1: Project Approval/Environmental Document - Storm Water Task Categories



6.4 PROJECT MANAGEMENT / COORDINATION

This section describes the primary task categories involved with project management and the coordination during the PA/ED process needed to obtain consensus between the different functional units and the RWQCB regarding stormwater issues.

Initiate Kickoff Meeting, WBS 100.10

Narrative: The initial kickoff meeting is initiated by the PM to review and discuss the PID. This is particularly important for projects that have been on hold. Major scope changes may require a supplemental or new PID.

Responsible: Project Manager

Recommended Participants: Project Manager

Project Engineer

District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator

District/Regional Design Storm Water Coordinator

Appropriate functional units

Environmental Engineering Representative

Environmental Planning Representative

Construction Storm Water Coordinator

Discussion Topics: Project Definition**:** Review PID. Refine type of project, scope, and schedule.

Review the Preliminary Project Cost Estimate (PPCE).

Environmental Studies: Determine status of the Environmental Document.

Right-of-way requirements.

Right-of-entry requirements.

Findings of the Water Quality Impact Questionnaire and WQR;

Possible compliance avoidance/minimization measures required by permits other than the Caltrans NPDES Permit (i.e. not required by SWMP);

Specific RWQCB requirements;

SWDR; and

Update Construction Site BMPs strategy, as needed.

Decisions/actions: Determine additional functional units to be involved.

Determine if right-of-way concerns have changed since the PID process.

Confirm PID is still valid. If not, a supplemental or new PID will be needed.

Initiate the PR.

Documentation: Meeting Minutes

Initial PR

Verification: Project Development Team (PDT) verifies that the PID is still valid.

Project Development Team, WBS 100.10.10

Narrative: The PDT has the responsibility to direct and evaluate the project studies to determine if any project re-scoping is needed, and to develop new alternatives, if required. When consensus is reached, the PDT determines the appropriate level of environmental evaluation. If an environmental document is required, the PDT directs its preparation. The PDPM, Chapter 8, Section 4, provides a thorough description of the PDT and its functions.

Responsible: Project Manager

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative

Environmental Planning Representative

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

Right-of-Way Representative

Hydraulics Representative

District Materials Engineer

Geotechnical Representative

Traffic Representative

Local MS4 Representative (if applicable)

RWQCB Representative (at discretion of District/Regional NPDES Storm Water Coordinator)

Others as needed.

All Districts are not organized the same and some of the suggested PDT members may have different titles depending upon the District in which the project is located. The PE should consult with the specific District Work Plan (DWP) to obtain the contacts listed in this section or the equivalent title or function in the District.

Discussion Topics: The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units. The following stormwater quality issues should be discussed:

- Viable alternatives for projects including location and alignments;
- Potential Design Pollution Prevention BMPs;
- Consider approved Treatment BMPs;
- Environmental issues;
- Site conditions and design constraints, including Construction Site and Maintenance BMPs;
- Stormwater quality BMP design criteria;
- Water quality volume and flow;
- Permanent BMP Locations: Identifying right-of-way impacts, utility conflicts and geotechnical issues;
- Landscape conflicts with conceptual plan;
- Permit requirements;
- Other agencies involved;
- BMPs to meet a prescribed Waste Load Allocation (WLA) and/or Total Maximum Daily Load (TMDL) for an impaired (303d listed) water body;
- Significant, unavoidable impacts to receiving waters;
- Mitigation measures prescribed by a Department of Fish & Game 1602 Streambed Alteration Agreement;
- Post Construction dewatering requirements. The RWQCB requires a separate Dewatering Permit under most conditions;
- Variance for lead contaminated soils, emphasizing the reuse of soils containing aerially deposited lead (ADL) due to vehicle emissions;
- Discharges of dredged or fill material into navigable waters (404 Permit/401 Certification);
- Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or potable water recharge facilities (i.e., Driving Water Reservoirs and Recharge Facility);
- Specific RWQCB requirements; and
- SWDR.

Decisions/actions: Tentatively select Design Pollution Prevention, Treatment and Construction Site BMPs for each project alternative.

Begin preliminary design of BMPs.

Determine necessary Environmental Documents (ED) and Permits.
Determine other agencies that should be involved.
Determine if an ED already exists. If not, the PDT initiates one.
Determine if project re-scoping is necessary.
Update PR and ED
Document any decisions made during the PDT meetings.

Documentation: Meeting minutes
Updated PR and ED

Verification: The PE verifies that all documentation is completed

6.5 BMP SELECTION PROCESS

This section describes the primary task categories for the Design Pollution Prevention and Treatment BMP selection processes associated with the PA/ED process (see Figure 6-2). For information regarding initial Construction Site BMPs strategy, consult with Construction Storm Water Coordinator and refer to Manual for Construction Site BMPs (see Appendix D for web address). There are three goals for the BMP identification process. They are: (1) to obtain consensus between the different functional units and the RWQCB regarding water quality issues; (2) to tentatively select Design Pollution Prevention and Treatment BMPs for each project alternative and incorporate them into the PA/ED, and (3) to provide sufficient information for the Plans, Specifications & Estimate (PS&E) process.

Review and Update Project Information, WBS 160.05

Narrative: Decisions for selecting the preferred project alternative, including the BMP alternatives, are the focus of the PA/ED process. Project alternatives, the Storm Water Data Report and Checklists SW-1, SW-2 and SW-3 that were initiated in the PID process are revisited and updated. The checklists should be updated continuously to provide documentation of stormwater quality issues and decisions.

Responsible: Project Manager

Recommended Participants: Project Manager

Project Engineer
District/Regional NPDES Storm Water Coordinator
District/Regional Design Storm Water Coordinator
District Materials Engineer

Figure 6-2: Project Approval/Environmental Document – BMP Selection Process

START
WBS 160.00.00

↓

REVIEW AND UPDATE PROJECT INFORMATION
WBS 160.05
UPDATE STORM WATER DATA REPORT AND CHECKLISTS

* SW-1 – SITE DATA SOURCES
* SW-2 – STORM WATER QUALITY ISSUES SUMMARY CHECKLIST
* SW-3 – MEASURES FOR AVOIDING OR REDUCING POTENTIAL STORM WATER IMPACTS
* DPP-1 – DESIGN POLLUTION PREVENTION BMPs
* T-1 – TREATMENT BMPs

↓

EVALUATE WHETHER A WATER QUALITY ASSESSMENT TECHNICAL REPORT (WQR) IS REQUIRED
WBS 160.05

↓

PREPARE THE WQR IF ONE IS REQUIRED
WBS 160.05

↓

PREPARE GEOMETRIC PLANS AND RIGHT OF WAY MAPS TO IDENTIFY AREAS NEEDED FOR TENTATIVELY SELECTED BMPs AND THEIR POTENTIAL IMPACTS
WBS 160.05

↓

REVISE POTENTIAL BMP SELECTIONS BASED ON LATEST INFORMATION
WBS 160.10

↓

COMPLETE ENVIRONMENTAL AND ENGINEERING STUDIES ON POTENTIAL BMPs AND EVALUATE PROJECT ALTERNATIVES
WBS 160.10

SELECT DESIGN POLLUTION PREVENTION BMPs	UPDATE CONSTRUCTION SITE BMPs	SELECT TREATMENT BMPs
SEE FIGURE 2-2, DECISION PROCESS FOR SELECTING DESIGN POLLUTION PREVENTION BMPs AND *CHECKLIST DPP-1	REFER TO THE CONSTRUCTION SITE BMPs MANUAL	SEE FIGURE 2-3, DECISION PROCESS FOR SELECTING TREATMENT BMPs AT SPECIFIC SITES AND *CHECKLIST T-1

↓

REVISE BMP COSTS AND UPDATE THE PPCE
WBS 160.15.05

↓

COMPLETE PROJECT REPORT AND ATTACH FINAL ENVIRONMENTAL DOCUMENT, STORM WATER DATA REPORT AND WQR
WBS 180.05

* LOCATED IN APPENDIX E

Discussion Topics: Review of the Checklists for DPP-1 and T-1 and the SWDR that were initiated in the PID process.

Stormwater quality impacts for each project alternative identified in the WQR.

Project Evaluation Documentation Form for Treatment BMPs.

Update to Construction Site BMPs strategy.

Decisions/actions: Review Project Alternatives, SWDR, Checklists for DPP-1 and T-1, and the PPCE.

Review the Evaluation Documentation Form. If the project was not required to consider incorporating Treatment BMPs in the PID process, confirm that this is still the proper determination pursuant to Section 4 of this PPDG.

Evaluate potential stormwater quality impacts and options for avoiding or reducing these impacts for the various project alternatives:

- Update Checklist SW-1, Site Data Sources;
- Update Checklist SW-2, Storm Water Quality Issues Summary; and
- Update Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.

Prepare WQR.

Perform Field Review of the area.

Determine if the scope has changed since the PID and if so, how stormwater quality issues are affected.

Begin environmental studies and permit process to evaluate the tentatively selected BMPs.

Evaluate project for types of stormwater quality impacts.

Based on the SWDR, checklists and the WQR, evaluate Design Pollution Prevention, Treatment and Construction Site BMP applications.

Materials Unit updates materials information and provides other information, such a side slope recommendations, wetland locations, slide locations, etc.

Prepare Geometric Plans and Right-of-way maps to identify areas needed for tentatively selected BMPs and their potential impacts.

Documentation: Updated SWDR and Checklists SW-1, SW-2 and SW-3Evaluation Documentation Form.

A final report on materials and geotechnical issues is still not required at this stage, but an updated draft report would be appropriate.

Verification: The PE verifies that all documentation is completed.

Revise BMP Selections Based on Engineering Studies, WBS 160.10

Narrative: Final decisions are made in regard to alternatives, costs, location, alignments, etc. Potential stormwater BMPs that were identified during the PID process are developed in more detail through additional technical studies in the PA/ED process. The costs of the potential BMPs should be estimated and prepared in accordance with Appendix F.

Responsible: Project Engineer

Recommended Participants:

Project Manager
Project Engineer
District/Regional NPDES Storm Water Coordinator
District/Regional Design Storm Water Coordinator
District Landscape Architect or Project Landscape Architect
Environmental Engineering Representative
Environmental Planning Representative
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
Right-of-Way Representative
Hydraulics Representative
District Materials Engineer
Geotechnical Representative
Traffic Representative

Discussion topics:

Engineering studies and checklists

Environmental impacts of proposed BMPs

Potential permanent BMPs

Construction Site BMPs

Decisions/actions:

Revise the preferred project alternative(s) and the tentative selection of potential BMPs to be incorporated into the project.

Review engineering studies and completed stormwater checklists.

Complete environmental and engineering studies on potential BMPs and evaluate project alternatives.

Review potential BMP selections, evaluating the pros and cons of each, including the WQR and the SWDR to evaluate potential environmental impacts, and how those impacts are addressed during BMP selection and design.

Identify anticipated Construction Site BMPs.

Documentation: Descriptions of project alternatives, including those under consideration, those withdrawn from consideration and the “no-action” alternative. Describe tentative BMP strategies for the project alternatives under consideration. These descriptions will be the basis for the “Description of Alternatives” section of the environmental document.

Updated Checklists DPP-1, parts 1 through 5, and T-1, parts 1 through 10, for selecting BMPs at specific sites.

Updated SWDR.

Verification: PDT verifies the preferred project alternative(s) and preferred BMP selection(s) are feasible. The District/Regional Storm Water Coordinator must be in concurrence on BMP feasibility.

Regional Water Quality Control Board Meetings, 165.10.35

Narrative: Consultation with the RWQCB, local regulatory agencies and Municipal Separate Storm Sewer System (MS4) Permit Holders is strongly recommended to coordinate project issues and develop consensus for controversial or complex stormwater quality issues. The number of coordination meetings is dependent upon the complexity of the stormwater quality issues, stormwater pollutants involved, and project site constraints.

Responsible: Project Engineer and District/Regional NPDES Storm Water Coordinator

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator (primary point of contact with the RWQCB)

Other regulatory agency representatives

Discussion Topics: Present Project Information

- Site Conditions;
- Project Alternatives;
- Potential Implementation of Approved BMPs;
- Storm Water Quality Impacts and Issues; and
- Right-of-way Impacts.

Decisions/actions: Determine preliminary site conditions and stormwater concerns

Documentation: Meeting minutes

Verification: The PE must verify that all comments are recorded and resolved.

Update Preliminary Project Cost Estimate, WBS 160.15.05

Narrative: The PR cost estimate is prepared as part of the project approval process. This generally occurs after completion of the public hearing, selection of the preferred project alternative, and completion of the environmental document.

The PR cost estimate is prepared using the same format as used for the other project planning cost estimates (see Appendix AA of the PDPM, 7/1/99 for current methods of cost estimating). However, since the initial preferred alternative(s) has been selected, the project cost estimate can now be more definitive.

Cost estimates for stormwater BMP alternatives can now also be more definitive. The PPCE for the BMP alternatives are now updated to provide a more detailed cost estimate in helping to select the preferred BMP alternative. Appendix F in this document provides greater detail on methods for cost estimating to include stormwater BMPs as part of the overall project cost.

Responsible: Project Engineer

Recommended Participants:

Project Manager

Project Engineer

Hydraulics Representative

Environmental Engineering Representative

Environmental Planning Representative

District/Regional Design Storm Water Coordinator

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

District Landscape Architect or Project Landscape Architect

Right-of-Way Representative

Discussion Topics:

PPCE developed during the PID process.

Bid data from actual projects

Sampling and Analysis Plans

Temporary items listed and the costs for SWPPP or WPCP development and implementation.

Sensitive Environments

Highway Planting contracts

Supplemental funds

Costs for a SWPPP or WPCP

Costs for potential alternative stormwater BMPs

Available cost options (see Appendix F)

Decisions/actions: Update and refine PPCE

Documentation: Completed PPCE

Verification: The following functional units shall verify the completed PPCE:
NPDES
Landscape
Hydraulics
Environmental
Maintenance
Right-of-Way

6.6 DOCUMENTATION REQUIRED FOR PROJECT APPROVAL/ENVIRONMENTAL DOCUMENT

This section describes the documents necessary for completion of a PA/ED package.

Prepare and Approve PR, WBS 180.05

Narrative: The purpose of the PR is to recommend approval of the selected preferred project alternative. Preparation Guidelines for a PR are included in Appendix K of the PDPM (2/18/00). The PID contained basic project data necessary for programming the project. These data have now been updated with the information that was developed during the environmental studies and included in the PR. The PR summarizes the studies of the scope, cost and overall impact of alternatives so that the decision maker can make an informed decision of whether or not to continue into the PS&E process.

Responsible: The final PR is submitted to the Division Chiefs by the Functional Manager responsible for production of the PR.

Recommended Participants: Project Manager

Division Chiefs

Contents: The following should be included in the PR. Also refer to the PDPM, Appendix K, 2/18/00, for the format, outline and contents.

- Final Environmental Document (FED) or CE if required;
- WQR;
- The Cover Sheet of the approved SWDR at the PA/ED phase.
- Evaluation Documentation Form;

- Right-of-Way Data Sheet;
- Discussion of stormwater quality issues under "Other Consideration.";
- PPCE;
- Description of project alternatives; and
- Recommendation for approval of the project.

Documentation: The PA/ED package includes a copy of the PR, the WQR, the SWDR, the FED or CE, the Evaluation Documentation Form, Right-of-Way Data Sheets, and the PPCE.

Verification: The following Division Chiefs shall approve the completed PR:

- The Functional Manager of PA/ED Production;
- The Program/Project Management; and
- The Functional Manager responsible for the next phase, which is the PS&E process.

The SWDR shall be signed by the PE, the District/Regional Design Storm Water Coordinator, the designated Landscape Representative, the designated Maintenance Representative and the PM. The PE's signature will verify that stormwater quality design issues have been addressed, and the data is complete, current and accurate. The District/Regional Design Storm Water Coordinator should be the last person to sign the SWDR to ensure that all appropriate reviews have been completed.

The Caltrans District Division Chiefs are responsible for approving the project's scope, schedule, and cost within these established guidelines, and may exercise engineering judgment and flexibility in approving the PA/ED document. PA/EDs are to be approved by the District Director after review by Division Chiefs, Functional Managers and the PDT.

Project Managers are to endorse the decision by "Approval Recommended By" or "Approved By" where such authority has been delegated.

7.1 INTRODUCTION AND OBJECTIVES

The purpose of this section is to provide a consistent approach in the Plans, Specifications and Estimates (PS&E) process as it relates to incorporating stormwater Design Pollution Prevention, Treatment, and Construction Site Best Management Practices (BMPs) into a project. This section has been incorporated directly from Chapter 14 of the Project Development Procedures Manual (PDPM), (7/1//99) and is to be used only as a supplement to the PDPM.

This section also relates the Work Breakdown Structure (WBS) codes and the Storm Water Data Report (SWDR) and checklists, to the PS&E process. WBS codes are provided in Appendix E for specific stormwater related tasks during the PS&E process. These codes are organized as a process form, which is titled “Summary Process for Storm Water Activities for PS&E” (included in Appendix E). These codes follow the “Guide to Project Delivery Workplan Standards – Release 8.0A” document. The SWDR and its corresponding checklists are described in Sections 5 and 6 and are included in Appendix E. These can be used for guidance in selecting BMPs for inclusion in the PS&E process.

7.2 PLANS, SPECIFICATIONS & ESTIMATES PROCESS

The purpose of the PS&E is for eventual contract advertising and bidding on a project. The PS&E process is generally initiated after the Project Report (PR) approval. Base maps, plan sheets, accurate cost estimates and specifications are developed for the selected preferred project alternative including selected BMPs within the project limits. The objective of this section is to present how stormwater quality issues are addressed within the overall PS&E process by the District functional unit personnel.

Figure 7-1 illustrates the primary task categories for the PS&E process. The “Summary Process for Storm Water Activities for PS&E” form in Appendix E provides a step-by-step process of these tasks.

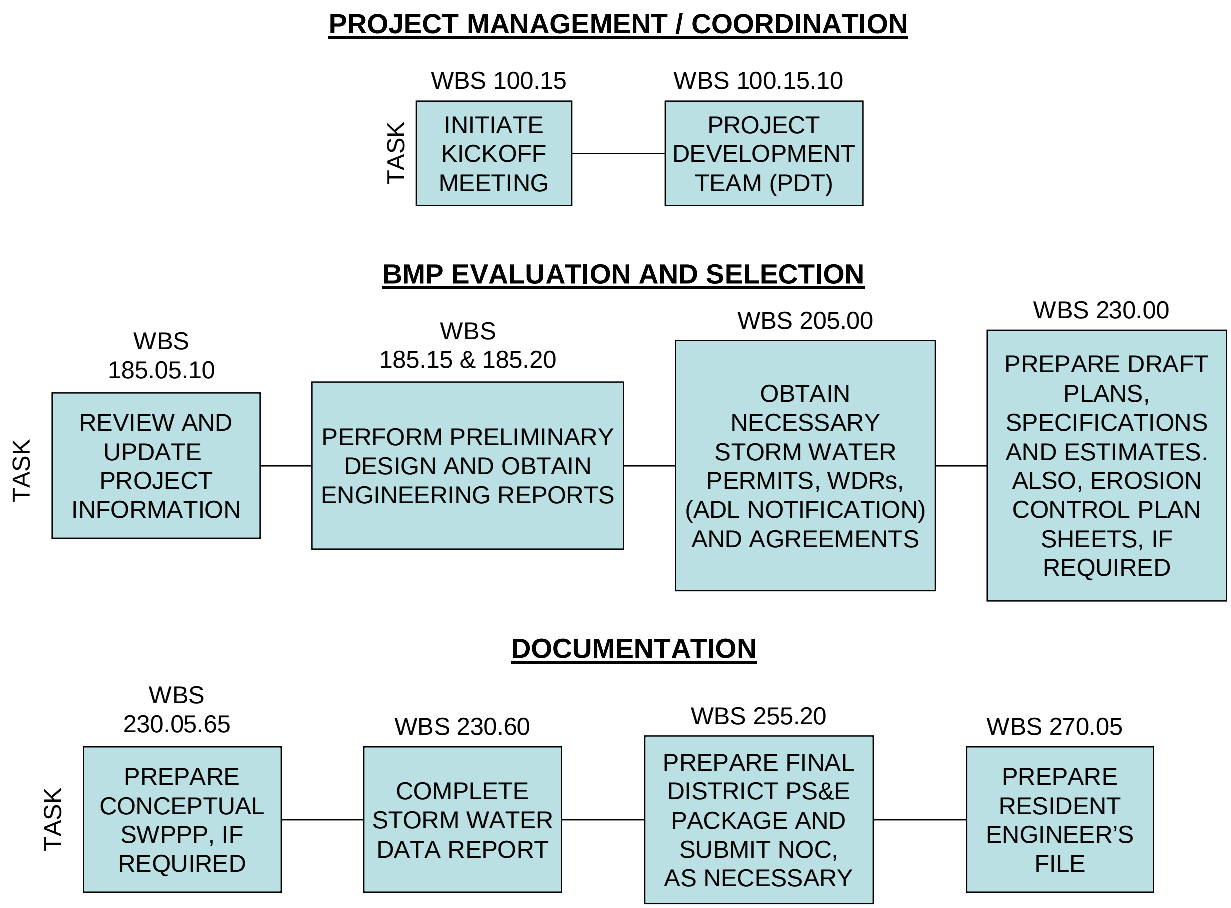
The sub-sections that follow correspond to the task categories provided in Figure 7-1 and the PS&E process summary form in Appendix E. Additional information is provided on the following pages detailing the recommended participants, discussion and decision topics, documentation and verifications for each task to develop the final PS&E package.

7.2.1 Conceptual Storm Water Pollution Prevention Plans and Water Pollution Control Plans

The designer may elect to prepare a Conceptual Storm Water Pollution Prevention Plan (CSWPPP) for a project. The CSWPPP will provide additional direction and convey specific BMP expectations to the contractor. However, the CSWPPP shall not be considered a complete SWPPP, and shall not replace the contractor’s SWPPP, since CSWPPPs are prepared assuming standard construction practices, and may not reflect the contractor’s actual methods of construction, access requirements, or project phases.

The designer may also elect to provide Water Pollution Control Plans showing the locations of appropriate Construction Site BMPs, or construction site BMPs that are designated as a separate bid line item in the Preliminary Project Cost Estimate (PPCE). These engineer-identified Construction BMPs must be deployed by the contractor to provide a minimal level of protection at specific locations within a project. The purpose of these Water Pollution Control Plans is to identify the deployment of appropriate Construction Site BMPs such as contractor staging areas, locations for concrete washouts, designated locations for storage of materials, etc. The Water Pollution Control Plans should be included as part of any Conceptual Storm Water Pollution Prevention Plan (CSWPPP) if provided, and as part of the contractor's Storm Water Pollution Prevention Plan (SWPPP) or Water Pollution Control Program (WPCP).

Figure 7-1: Plans, Specifications, and Estimates Document - Storm Water Task Categories



7.3 PROJECT MANAGEMENT/COORDINATION

This section describes the primary task categories involved with project management and the coordination in the PS&E process needed to obtain consensus between the different functional units as well as with the Regional Water Quality Control Board (RWQCB) regarding stormwater quality issues and BMP deployment.

Initiate Kickoff Meeting, WBS 100.15

Narrative: The purpose of the initial kickoff meeting is to review the Project Initiation Document (PID) and the PR. It is the first step in the process of formally recognizing that the project should continue through the PS&E process.

Responsible: Project Manager (PM)

Recommended Participants:

Project Manager

Project Engineer (PE)

District/Regional National Pollutant Discharge Elimination System (NPDES) Storm Water Coordinator

District/Regional Design Storm Water Coordinator

Appropriate functional units

Environmental Engineering Representative

Environmental Planning Representative

Discussion Topics:

Data gathered during the PID and Project Approval/Environmental Document (PA/ED) process.

WQR

SWDR and its corresponding checklists.

Decisions/actions:

Determine if the project should continue into the PS&E process.

Review PID and PR.

Review the SWDR and its corresponding checklists.

Coordinate Schedule.

Documentation: Meeting minutes

Verification: There is no verification required at this phase.

Project Development Team, WBS 100.15.10

Narrative: The Project Development Team (PDT) has the responsibility to direct and evaluate the project studies to determine if any project re-scoping is needed. The PDPM, Chapter 8, Section 4 (7/1/99) provides a thorough description of the PDT and its functions.

Responsible: Project Engineer

Recommended Participants:

Project Engineer

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative

Environmental Planning Representative

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

Right-of-Way Representative, Hydraulics Representative

District Materials Engineer, Geotechnical Representative

Traffic Representative, Local MS4 Representative (if applicable)

RWQCB Representative (at discretion of District/Regional NPDES Storm Water Coordinator)

Others as needed.

All Districts are not organized the same and some of the suggested PDT members may have different titles depending upon which District the project is located. The PE should consult with the specific District Work Plan (DWP) to obtain the contacts listed in this section or the equivalent title or function in the District.

Discussion Topics: Engineering Reports that must be prepared by different functional units of the PDT. This requires the functional units to develop project design reports needed to establish design parameters and complete design. Those related to stormwater quality issues are:

- Hydrology and Hydraulic Reports;
- Geotechnical Design Report;
- Materials Report;
- Environmental Document (ED) (Completed during PA/ED process); and
- WQR.

Decisions/actions: Update data gathered in the PID and PA/ED processes. Update Checklists SW-1, SW-2 and SW-3 and the Evaluation Documentation Form (EDF).

Review Geometric Base Maps - The appropriate functional unit in the PDT should identify problems that are easier to correct at early stages of design and to establish a foundation for skeleton layouts. Comments from Maintenance, Hydraulics, Landscape Architecture, Structures (to determine railroad involvement and easement requirements) and Traffic are particularly useful.

Documentation: Checklists and EDF

Meeting minutes

Any decisions made during PDT meetings should be documented.

Verification: The PE verifies that all documentation is completed.

7.4 BMP DESIGN PROCESS

Figure 7-2 is a flowchart outlining the BMP design process. This section describes the primary task categories listed in this flowchart.

Review and Update Project Information, WBS 185.05.10

Narrative: Project design requires the continuous review and update of data from the PID and PA/ED processes. During the PA/ED process, a preferred project alternative was selected. The SWDR and checklists that were initiated in the PID and PA/ED are revisited and updated to further define the stormwater quality issues. The checklists should continue to be used to provide documentation of these stormwater quality issues and decisions. A field review should have also been completed during the PID and PA/ED processes as well. Continue to arrange site investigations and screening for Treatment BMPs as needed.

Responsible: Project Engineer

Recommended Participants: Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

Environmental Unit and other appropriate functional units

Discussion Topics: The SWDR and Checklists SW-1, SW-2, and SW-3 that were initiated in the PID and updated in the PA/ED.

Project Scope

Stormwater impacts

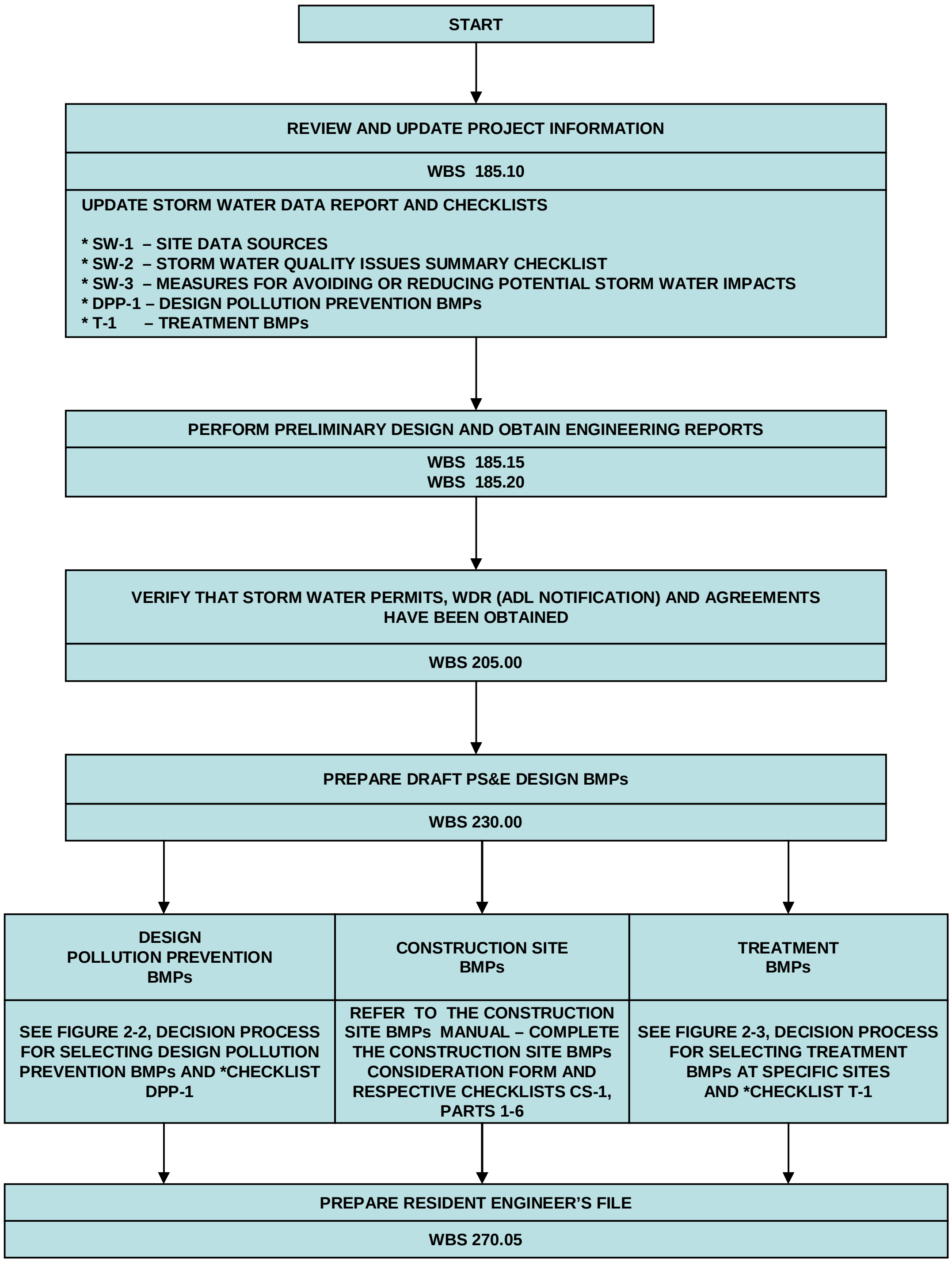
BMP deployment strategy plus siting and design criteria

Preliminary Project Cost Estimate (PPCE)

Design surveys and photogrammatric mapping

Utilities

Figure 7-2: BMP Design Process Flowchart



* LOCATED IN APPENDIX E

Screening for Treatment BMP installations

Site investigations for design of Treatment BMPs

Necessary Permits and Agreements (i.e., 1601, 1604, 404/401)

Decisions/actions: Review the SWDR, EDF and Checklists SW-1, SW-2, and SW-3 that were initiated in the PID and updated in the PA/ED.

Review selected project alternative.

Determine if the project scope has changed since the PA/ED and, if so, how stormwater quality issues are affected.

Evaluate project for types of stormwater impacts.

Evaluate BMP applications plus design and siting criteria.

PPCE: Determine if the budget has changed since the PA/ED and if so, how stormwater quality issues are affected.

Obtain updated design surveys and photogrammatric mapping.

Coordinate necessary agreements, permits, or actions.

Coordinate Utilities - Work involves identification, potholing, protection, removal and/or relocation of utility facilities as necessary to clear and certify right-of-way for deployment of stormwater BMPs.

Complete site investigations and screening for Treatment BMP installations.

Review Final ED for any non-SWMP compliant water quality impact avoidance, minimization or mitigation measures.

Documentation: N/A

Verification: There are no verifications required at this phase.

Perform Preliminary Design, WBS 185.15

Narrative: Many projects have revisions that may affect the project scope, length and description. Before starting detailed design, the project data should be updated to reflect the selected project alternative and selected BMPs within the project limits, as well as other revisions that may have occurred.

Responsible: Project Engineer

Recommended Participants:

Project Manager

Project Engineer

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

District Landscape Architect or Project Landscape Architect

	Environmental Engineering Representative Environmental Planning Representative Maintenance Storm Water Coordinator Right-of-Way Representative Hydraulics Representative District Materials Engineer Geotechnical Representative Traffic Representative
Discussion Topics:	Preferred selected alternative from the PA/ED Applicable stormwater regulations
Decisions/actions:	Analyze horizontal and vertical alignments, site data and stormwater data, including depth to groundwater, infiltration rates, available right-of way, soils, utilities, etc. Much of the data are included in the Checklists SW-1, SW-2, SW-3, DPP-1 and T-1. Review any changes to stormwater regulations that may affect the project. Perform or request additional field investigations as required. Analyze any existing drawings, reports, checklists. Update the SWDR, as needed. Review the PA/ED. Determine if the preferred selected BMP alternative in the PA/ED is still valid.
Documentation:	SWDR
Verification:	The PE verifies that all documentation is completed. PE and District/Regional Design Storm Water Coordinator to verify that selected BMP alternative is still valid.

Obtain Engineering Reports, WBS 185.20

Narrative:	Several engineering reports must be prepared. This involves various functional units to develop project design reports needed to establish design parameters and complete design.
Responsible:	Project Engineer
Recommended Participants:	Project Manager Project Engineer District/Regional NPDES Storm Water Coordinator District/Regional Design Storm Water Coordinator District Landscape Architect or Project Landscape Architect Environmental Engineering Representative

Hydraulics Representative
District Materials Engineer
Right-of-Way Representative
Geotechnical Representative

Discussion Topics: Reports required and the information contained within those reports (e.g., site data, site investigations, soil analysis, vegetation, contamination, right-of-way, right-of-entry, discharge conditions, Drinking Water Reservoirs and/or Recharge Facilities, stormwater drainage before and after construction, water bodies, vegetation issues, depth to groundwater, infiltration rates, etc.).

Decisions/actions: The functional units begin preparing the previously mentioned engineering reports as applicable.

Documentation: Hydrology and Hydraulic Report
Geotechnical Design Report
Materials Report

Verification: PE and District/Regional Design Storm Water Coordinator to verify that required stormwater reports are prepared.

Each functional unit verifies that the project issues pertained to their functional specialty have been completely addressed.

Obtain Necessary Storm Water Permits, WDRs and Agreements, WBS 205.00

Narrative: This activity involves all work involved in obtaining permits. This work includes: Filing the Notification of Construction (NOC) for coverage under the Caltrans Permit and the General Permit; determining other necessary permits or agreements; discussions and negotiations with the permitting agencies, especially in regards to dewatering and other known discharges; preparation of the permit and attachments such as exhibits, maps, etc.; obtaining funds for any required permit fee; and submitting the permit application. Send notification to RWQCB regarding the reuse of soil containing aerially deposited lead (ADL). Consultation with the RWQCB, local regulatory agencies and Municipal Separate Storm Sewer System (MS4) Permit Holders is strongly recommended to coordinate project issues and develop consensus for controversial or complex stormwater quality issues.

Responsible: Project Engineer

Recommended Participants: Project Engineer
District/Regional NPDES Storm Water Coordinator
District/Regional Design Storm Water Coordinator
District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative
Engineering Planning Representative
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
Right-of-Way Representative
Geotechnical Representative

Discussion Topics: Significant, unavoidable impacts to receiving waters.

BMPs to meet a prescribed Waste Load Allocation (WLA) and Total Maximum Daily Load (TMDL) for an impaired 303(d) listed water body.

Mitigation measures prescribed by a Department of Fish & Game 1601 Streambed Alteration Agreement.

Dewatering requirements. The RWQCB requires a separate dewatering permit under most conditions.

Variance for lead-contaminated soils, emphasizing the reuse of soils containing ADL due to vehicle emissions.

Discharges of dredged or fill material into navigable waters (404 Permit/401 Certification).

Potential impacts associated with spills, especially near municipal or domestic water supply reservoirs or potable water recharge facilities.

Specific RWQCB requirements.

Potential impacts of unique maintenance activities or known discharges.

Decisions/actions: Obtain required permits and agreements. These permits may include but are not limited to the following:

U.S. Army Corps of Engineer Permit (404)
U.S. Coast Guard Permit
Department of Fish & Game (1601/1603)
Coastal Development Permit
U.S. Fish and Wildlife Service approval
RWQCB Permit (401)
National Marine Fisheries Permit

Other permits and agreements: Bay Conservation and Development Commission (BCDC) permit, Tahoe Regional Planning Agency (TRPA) permit, and flood control District permits.

Documentation: Permit Applications

Request for funding permit fee

Completed permits

Verification:	Environmental Branch obtains the 401, 404, 1601, etc.
	Completed Permits.
	PE, District/Regional NPDES Storm Water Coordinator and District Environmental Office verify that required stormwater permits are identified and obtained.

Prepare Draft Plans, Specifications and Estimates, WBS 230.00

Narrative: The main activities in producing a draft set of plans are the completion of geometric base maps, the submittal of structure site data, the submittal of right-of-way maps, and the circulation of skeleton layouts. The PE's responsibilities during the design process are to; prepare quality plans that meet Caltrans standards, practices, and policies; include stormwater BMPs into the project; prepare project and BMP cost estimates and monitor costs to keep the project within budget; utilize available resources to maintain project schedules; monitor the project scope to ensure consistency with previous approvals; and inform the PM of any cost, scope, or schedule changes that may be required for the project.

Responsible: Project Engineer

Recommended Participants:

Project Engineer

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

District Landscape Architect or Project Landscape Architect

Environmental Engineering Representative

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

Right-of-Way Representative

Hydraulics Representative

District Materials Engineer

Geotechnical Representative

Discussion Topics: Plans to be obtained from the functional units include the following:

Traffic – Draft Roadway Plans

Landscape – Highway Planting Plans

Utility – Utility Relocation Plans

Hydraulics – Drainage Plans

Right-of-Way

Discuss drainage area information about the project site in order to select, locate, and design appropriate stormwater BMPs. This is extremely important information during the PS&E.

Decisions/actions: Review stormwater related activities to consider during project design, and complete the process form "Summary Process for Storm Water Activities for PS&E" found in Appendix E.

Review Checklist DPP-1 and determine Design Pollution Prevention BMPs.

Review Checklist T-1 and design Treatment BMPs.

Design Construction Site BMPs:

- See Storm Water Quality Handbook – Construction Site Best Management Practices Manual for additional guidance;
- Complete Construction Site BMPs Consideration Form and respective checklists CS-1, Parts 1-6;
- Division of Construction - Storm Water Quality webpage (http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm) contains links to resources for developing a Storm Water Pollution Prevention Plan (SWPPP), a Water Pollution Control Program (WPCP), and stormwater quality information to be included in the Information Handout. It is important to note that the PE is not responsible for preparing a Conceptual SWPPP (CSWPPP) for every project. The PE must provide tabular data identifying anticipated Construction Site BMP items and quantities, and provide the available Standard Special Provisions (SSPs) for those items;
- Include Erosion Control Plan Sheets, at discretion of Districts. These are developed by the Landscape Architect;
- Document concurrence with Construction – initial and date Construction Site BMP Consideration Form, include concurrence information in Section 6 of the SWDR
- Include rainy season data - The average rainfall in California varies greatly from region to region. To account for the various rainfall patterns (i.e., time frame, intensities, and amounts) the state is separated into several rainy seasons. These rainy seasons are used to identify the appropriate level of soil stabilization and sediment control protection.

Prepare Standard Special Provisions – More information can be obtained from the Web site located at:
http://www.dot.ca.gov/hq/esc/oe/specs_html/index.html

Identify physical attributes of site drainage areas that may affect the selection, siting, and design of BMPs (use Table 7-1). Attributes with an * in Table 7-1 are optional depending on the particular controls being considered for application. Required data can be gathered first, leaving optional data for later in the design process when the specific BMP is selected.

Table 7-1: Drainage Area Attributes and Their Effect on Storm Water BMPs

Attribute	Information Source	Effect on Design and Use of BMPs
Tributary Drainage Area Size	Topographic Maps Grading Plans Aerial Photos Survey Data	Used to select suitable Treatment BMPs and size them. Also used to determine need for and the design of stabilized conveyance systems, interception ditches, Biofiltration Swales, and to establish the need for energy dissipaters.
Slopes	Vicinity Map Aerial Photographs Field Reconnaissance Contour Grading Plan	Used to identify slopes that require controls to prevent erosion. Limits use of certain controls on or adjacent to slopes.
Site permeability (runoff coefficients)	Aerial Photographs Satellite Imagery Field Reconnaissance Geographic Information Systems (GIS) Map Geotechnical Design Report	Used to determine runoff flows and therefore sizing of many controls. The percentage of the drainage area covered by pavement, buildings, concrete, or other impermeable materials significantly affects the size of controls.
Soil Texture and Saturated Soil Infiltration Rate *	Materials Report Geotechnical Design Report Natural Resources Conservation Service (NRCS) Soil Survey	Used to size the surface area of Infiltration Devices.
Depth to Seasonal High Groundwater *	Well Records Geotechnical Design Report Environmental Site Investigation for Hazardous Wastes	Limits use of infiltration at sites with shallow groundwater tables. In areas with shallow groundwater tables consider Detention Devices.
Existing Vegetation/Ground Cover *	Aerial Photographs Field Reconnaissance Landscape Record Drawings GIS Map Satellite Imagery	Used to identify drainage areas with significant amounts of unstabilized soil, which limits use of infiltration and retention basins. An Infiltration Basin can be used in an area where there is unstabilized soil, but it may require soil stabilization (vegetation or mechanical), and/or a preceding forebay for the basin.

* These data are applicable to many of the Treatment BMPs considered during this phase.

If Infiltration or Detention Devices are being considered, then data regarding soil texture and saturated soil infiltration rate may be determined from a Soil Survey report. Aerial photographs and Geographic Information Systems (GIS) maps may provide information regarding the identification of drainage areas with significant amounts of unstabilized soil.

Documentation: From Traffic - Roadway Plans, WBS 230.05 – Includes all activities, from base maps (skeletons), such as design, delineation, field reviews, and internal/external coordination necessary to develop draft roadway plan sheets for the construction contract.

Conceptual Storm Water Pollution Prevention Plan (CSWPPP) and Water Pollution Control Plan (WPCP) Sheets

From Landscape - Highway Planting Plans, WBS 230.10 – All activities (such as design, field reviews, delineation, and internal/external coordination) necessary to develop highway planting plan sheets for construction contract.

From Utilities - Utility Relocation Plans, WBS 230.25.10

From Hydraulics - Draft Drainage Plans, WBS 230.30

Geometric Base Maps – A preferred alternative was selected during the PR approval process and must now be refined to produce geometric base maps, typical sections, and profiles. Preferably, the development of alternatives was performed using controlled aerial mapping, which can easily be transformed into geometric base maps. The geometric base maps must show existing topography and proposed engineering features. Accurate mapping is needed for all subsequent design activities, such as right-of-way needs, designing drainage facilities, etc.

Verification: PE, Hydraulics, Geotechnical, Structural and other appropriate members of the PDT verify that plans are being developed per Caltrans standards and that all necessary information is included in the plans.

Prepare Draft Specifications, WBS 230.35

Narrative: These activities are necessary to develop the project draft Standard Special Provisions (SSPs). SSPs must be incorporated into PS&E for all projects to ensure that the contract documents clearly set forth the contractor's responsibilities with respect to preparation and implementation of either a SWPPP or WPCP as required for the project.

Responsible: Project Engineer

Recommended Participants:

Project Manager

Project Engineer

Hydraulics Engineer

Environmental Engineering Representative

Environmental Planning Representative

District/Regional Design Storm Water Coordinator

Construction Storm Water Coordinator

Maintenance Storm Water Coordinator

District Landscape Architect or Project Landscape Architect

Discussion Topics: SSPs to make sure the most recent ones are being used.

CSWPPP**.** The PE is not responsible for preparing a Conceptual SWPPP for every project. The PE must provide tabular data identifying anticipated Construction Site BMP items and quantities, and provide the available SSPs and if available, include details and estimate codes for those items.

Decisions/actions: Complete Specifications.

Review the specifications to make sure they are complete and that they match the cost estimates and the plans.

Documentation: Standard Specifications including the following:

From Hydraulics – Hydraulic Specifications, WBS 230.35.30

From Landscape - Highway Planting Specifications, WBS 230.35.10

Water Pollution Control Specifications, WBS 230.35.35

Erosion Control Specifications, WBS 230.35.40

Verification: PE confirms that the Specifications are complete and are consistent with the cost estimate and plans.

Prepare Draft Estimates, WBS 230.40

Narrative: Project design cost estimates are initiated after the PR approval and are updated until completion of the PS&E process. These estimates are categorized as either preliminary or final. Project design cost estimates focus on the construction costs of the project and the stormwater BMPs, and are input into the Basic Engineering Estimating System (BEES). BEES has two components: (1) the District Cost Estimate, and (2) Structures (Bridge) Cost Estimate, that, when combined, equal the total construction cost for the project. See Appendix AA of the PDPM, 7/1/99 for current methods of cost estimating.

Project design cost estimates, including stormwater BMPs, should be considerably more detailed than project planning cost estimates. As engineering and environmental studies progress, more information, such as final contour mapping, materials and drainage information, and structure studies, becomes available. These data increase the ability to prepare a more detailed cost estimate. Appendix F of this document provides greater detail on methods for cost estimating to include stormwater BMPs as part of the overall project cost.

Responsible: Project Engineer

Recommended Participants: Project Manager

Project Engineer

Hydraulics Engineer
Environmental Engineering Representative
Environmental Planning Representative
District/Regional Design Storm Water Coordinator
Construction Storm Water Coordinator
Maintenance Storm Water Coordinator
District Landscape Architect or Project Landscape Architect

Discussion Topics: Storm water related quantities and estimates

Decisions/actions: PPCE developed during the PA/ED process.
Calculate Drainage Quantities and Estimate, WBS 230.40.15
Calculate Water Pollution Control Quantities and Estimate, WBS 230.40.35
Calculate Erosion Control Quantities and Estimate, WBS 230.40
Update quantities and estimates
Costs for stormwater BMPs
Designate appropriate Construction Site BMPs as separate contract bid line items as required per checklist CS-1
Available cost options (see Appendix F)

Documentation: Summary of Quantities

Verification: The following functional units shall verify the completed Cost Estimate:
NPDES
Landscape
Hydraulics
Environmental
Maintenance

7.5 DOCUMENTATION REQUIRED FOR PLANS, SPECIFICATIONS & ESTIMATES PACKAGE

This section describes the documents necessary for completion of a PS&E package. Preparation guidelines for the PS&E submittal are included in the PDPM, Chapter 14 (7/1/99). The PE works with the District Office Engineer to prepare the PS&E package. The following is a list of the stormwater documentation items included in the PS&E package.

Storm Water Data Report, WBS 230.60

The SWDR is updated and completed. Checklists SW-1, SW-2 and SW-3 should be included as a Supplemental Attachment to the SWDR during the approval process. The SWDR cover sheet is to be included in the final PS&E package.

Final District PS&E, WBS 255.20

Narrative: The PS&E is submitted to the Office Engineer for most projects. Guidance to PS&E submittal and documentation is located in the PDPM, Chapter 14, Section 3, dated 7/1/99.

Responsible: The final PS&E is submitted to the Division Chiefs by the Functional Manager overseeing the production of the PS&E.

Recommended Participants:

Division Chiefs

PE

PM

District/Regional NPDES Storm Water Coordinator

District/Regional Design Storm Water Coordinator

Other functional units as required.

Contents: The following should be included in the PS&E package. Also refer to the most current PDPM, Chapter 14 for the format and contents required.

- Final Standard Plans, including Water Pollution Control Plan Sheets identifying appropriate Construction Site BMPs and BEES designating appropriate Construction Site BMPs as separate bid line items.
- Quantities and Estimates;
- Right-of-Way Certification;
- Copy of NOC, WDR and other permits;
- SWDR - finalized and completed. Required Attachments are affixed to the report. Copy of Required Attachments, along with Supplemental Attachments (both listed in Appendix E) included in Resident Engineer (RE) File;
- SSPs and any non-standard special provisions required for the water quality BMPs or other contract items must be incorporated into PS&E for all projects, to ensure that the contract documents clearly set forth the contractor’s responsibilities with respect to preparation and implementation of the SWPPP or WPCP as required for the project;
- Layout sheets showing locations and limits for the BMPs identified in the PS&E; and
- A brief explanation of both the permanent and Construction Site BMPs that will be specified;

Documentation: The PS&E package should include copies of the final plans, quantities and estimates, Right-of-Way Certification, updated SWDR, SSPs, copies of permits, and any additional information the designer feels is necessary for the contractor to bid the project accurately.

Verification: District/Regional Design Storm Water Coordinator or other designated person verifies the PS&E package is complete, in relation to stormwater quality, with appropriate documentation and signatures on the SWDR.

The SWDR shall be signed by the PE, the District/Regional Design Storm Water Coordinator, a designated Landscape Representative, a designated Maintenance Representative, and by the PM to verify that stormwater quality design issues have been addressed, and the data is complete, current, and accurate. The District/Regional Design Storm Water Coordinator should be the last person to sign the SWDR to ensure that all appropriate reviews have been completed. The PE shall stamp the final SWDR.

The full PS&E package is circulated throughout the District to the functional units for comments and questions to make sure that each functional unit agrees with the package. After circulation and changes have been made, the PS&E goes to Headquarters (HQ) for final reviews before it is advertised for bidders. HQ will approve, make changes, or discuss with the District to make sure the project is “biddable” and “buildable.”

Resident Engineer’s File, WBS 270

This work involves preparing the District RE File/Structures RE File. It includes contacts with construction to transmit the file and determining what additional information may be required. Place information regarding stormwater quality issues in the RE File. See Section 8.1, Table 8-1 for a typical list of information to be included in the RE File.

8.1 INFORMATION FOR THE CONSTRUCTION PHASE OF THE PROJECT

The Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Permit requires a Storm Water Pollution Prevention Plan (SWPPP) for every project that meets the definition of Construction as outlined in the Construction General Permit. Specifically, a SWPPP is required when one of the following conditions exists:

- The project involves one (1) acre or more of soil disturbance;
- The project involves less than one (1) acre of soil disturbance but is considered part of a Common Plan of Development (see Section 4.2, Step #9); or
- The Regional Water Quality Control Board (RWQCB) designates the project as requiring a SWPPP based upon water quality concerns, even if the project does not meet the preceding requirements.

All projects that do not require a SWPPP must have a Water Pollution Control Program (WPCP). The purpose of both the SWPPP and the WPCP is to identify construction/contractor activities that could discharge pollutants in stormwater, and provide descriptions of measures or practices to control these pollutants. Both the SWPPP and the WPCP are the responsibility of the contractor to prepare, although the designer may elect to prepare a Conceptual SWPPP under certain circumstances (See the SWPPP and WPCP Preparation Manual, March 2003, Section 2.1.3).

In order to provide information for contractors to both bid on projects and prepare the SWPPP/WPCP, the design staff must supply certain water quality-related information. This information is incorporated into the Resident Engineer (RE) File (reference the Project Development Procedures Manual, Chapter 15, Section 2 and Section 7.5 of this manual) and may be included in the contractor’s Information Handout. This information is in addition to any Construction Site Best Management Practices (BMPs) identified during the Plans, Specifications and Estimates (PS&E) process and included in the plans and specifications.

Typical water quality information that must be in the RE File and may be included in the Information Handout is listed in Table 8-1.

Table 8-1: Water Quality Information to be Included in the Resident Engineer File and/or Information Handout

• Vicinity map of the project area.
• Soils/geotechnical report, project materials report and/or other reports for description of soils types, nature of fill materials and known buried hazardous or toxic materials.
• List of pre-construction (existing) control practices.
• List of and/or narrative description of permanent (post-construction) stormwater control measures.
• Layout sheets showing locations and limits for the Construction Site BMPs identified in the PS&E.
• A brief explanation of permanent and Construction Site BMPs bid items and implementation strategy. The explanation shall identify locations for BMP deployment and substantiate the quantity estimates (may be in tabular format).
• Copy of drainage report or other documentation for identifying flow patterns and tributary areas.
• Rainfall total from a 25-year, 24-hour event and rainfall intensity for a 2-year, 1-hour event.
• Construction site estimates such as area calculations, runoff coefficients and pervious area calculations.
• Copy of the submitted NOC for the project.
• Copy of any WDR or permits
• Any additional information the designer determines is necessary for the contractor to bid the project accurately and implement BMPs during the construction of the project.
• Listing or cross-reference of special (atypical) conditions and/or mitigations, if any, associated with permits and environmental document.

Most of the information listed in Table 8-1 may be taken directly from the Storm Water Data Report (SWDR). **However, the SWDR itself should not be provided to the contractors, as it is not appropriate to justify design decisions or provide construction cost estimates to the contractor.** The following sub-sections provide a description of the items listed in Table 8-1 and where to collect them.

8.1.1 Vicinity Map of the Project Area

Provide a vicinity map extending approximately one-quarter mile beyond the property boundaries of the construction site showing: the construction site, surface water bodies (including known springs and wetlands), known wells, an outline of off-site drainage areas that discharge into the construction site, general topography, and the anticipated discharge location(s) where the construction site's stormwater discharges to a municipal storm drain system or other water body. It is recommended that a U.S. Geological Survey (USGS) quadrangle map be used for showing the project site and a one-quarter mile extension beyond the property boundaries of the construction site. USGS maps display much of the required information; however, the map will need to be slightly modified to show anticipated drainage paths (onto and off the construction site) and construction site boundaries.

The following are additional recommended items that should be provided on the vicinity map:

- Legend;
- Measurement of the construction site area;
- Flow directions of nearby creeks, streams, and rivers; and
- North arrow and Scale.

8.1.2 Soils/Geotechnical Report, Project Materials Report and/or Other Reports

Toxic History of the Site*:* To the extent information is available from the soils/geotechnical report, include the project materials report, site investigation report developed by the Hazardous Waste Section, or other regulatory or environmental compliance documentation. Include any Waste Discharge Requirements (WDRs) issued from the RWQCB related to toxic materials.

The Nature of Fill Material and Existing Data Describing the Soil: Include a copy of the project materials report (and/or the geotechnical report). The Information Handout package must describe the conditions of the fill material and the soil that can be found at the construction site (i.e., types of soils, groundwater location and conditions, dewatering operations that may be necessary, etc.) A general description can usually be found in the project materials report or geotechnical report. Fill material should be described as whether it is native or non-native, contaminated or uncontaminated, and its coverage technique (i.e., native soil coverage, asphalt or concrete coverage, and/or landscape).

Show and/or describe existing site features that, as a result of known past usage, may contribute pollutants to stormwater (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, or leaked onto the construction site.) Review the contract documents and associated environmental documents to determine the known site contaminants.

8.1.3 Pre-Construction (Existing) Control Practices

Provide written descriptions of existing pre-construction practices, if any, which are already in place to reduce sediment and other pollutants in stormwater discharges. These permanent control practices may consist of rock slope protection, Infiltration Devices, Detention Devices, etc. If there are no pre-construction control practices, then this should be indicated. Existing features, structures, facilities, or practices that may be used by the contractor during construction should be clearly indicated. Conversely, if some or all may not be used, this likewise should be indicated (and consideration should be given to including such restrictions in the contract special provisions).

8.1.4 Permanent (Post-Construction) Storm Water Control Measures

Post-construction BMPs are permanent erosion and sediment control measures (i.e., Design Pollution Prevention BMPs) or Treatment BMPs that have been incorporated into the project plans. They include the minimization of land disturbance, minimization of impervious surfaces, treatment of stormwater runoff using approved Treatment BMPs, and appropriately designed and constructed energy dissipation devices. Provide a list containing narrative descriptions of post-construction permanent BMPs that have been included in the project to reduce pollutants in stormwater discharges after construction is completed.

In some cases, these permanent BMPs will be designed to meet the requirements of other agencies, permit conditions, or other agreements. Any BMP to be included at the request of another agency should be discussed in the information presented in the RE File, and listed in the Information Handout. For example, if the Department of Fish & Game required the construction of a permanent Detention Basin, then this basin and its purpose would be described in this section. In addition, if a local agency were to require hard surfacing for the purpose of controlling erosion in a particular area, then the purposes and requirements of that agency would be described.

8.1.5 Layout Sheets Showing Suggested Construction Site BMP Locations

The designer may elect to provide layout sheets showing the suggested locations of Construction Site BMPs. The purpose of these sheets is to show the contractor the designer's anticipated placement of Construction Site BMPs such as contractor staging areas, approximate location of concrete washouts, approximate locations for storage of materials, and preferred locations for vehicle and equipment maintenance. These are not intended to be highly detailed drawings. Typically, these layouts can be drawn on l:200 and l:500 scale drawings. Where multiple stages of construction are anticipated, the designer should use the stage construction sheets to show how deployment of the BMPs is expected to change over time. These locations and layouts will be, in most cases, subject to the contractor's phasing of the work and timing of operations. As a result, many of the suggested locations will be modified by the contractor in the SWPPP/WPCP. If provided, the layout sheet must also contain a disclaimer stating that the temporary BMP locations are suggestions only, and that the Contractor is ultimately responsible for developing a SWPPP that complies with the Permit.

8.1.6 Explanation of Permanent BMPs Used as Temporary BMPs During Construction

The purpose of this section is to provide a brief explanation of the permanent BMPs that may be utilized to prevent pollutant discharges during construction. The designer should identify both existing permanent BMPs within the project limits, and any new permanent BMPs that could be constructed as a first order of work for use as a temporary BMP during construction. An example of this may be the deployment of a Detention Device as a first order of work to treat construction site discharges. All requirements listed in this section should be included in the contract special provisions.

8.1.7 Drainage Information

Include a copy of the drainage information, such as the drainage report, hydrology maps, delineation of drainage boundaries, concentrations of runoff, and runoff coefficients sufficient to determine peak discharges or run-on flowcharts.

8.1.8 Construction Site Estimates

Provide the following information to the RE File:

- An estimate of the construction site area in acres;
- An estimate of the percentage of the area of the construction site that is impervious (e.g., pavement, building, etc.) before and after construction;
- An estimate of the runoff coefficient of the construction site before and after construction (The form shown in Table 8-2 may be used to develop the necessary information for runoff coefficients. Tables 8-3 and 8-4 provide supporting information for the calculation of runoff coefficients.); and
- An estimate of the total disturbed area in acres.

Table 8-2: Computation Sheet for Determining Runoff Coefficients

Total Site Area	=	________	(A)
Existing Site Conditions			
Impervious Site Area[1]	=	________	(B)
Impervious Area Runoff Coefficient[2,4]	=	0.95	(C)
Pervious Site Area[3]	=	________	(D)
Pervious Site Area Runoff Coefficient[4]	=	________	(E)
Existing Site Area Runoff Coefficient = $\frac{(B \times C) + (D \times E)}{A}$	=	________	(F)
Proposed Site Conditions (After Construction)			
Impervious Site Area[1]	=	________	(G)
Impervious Site Runoff Coefficient[2,4]	=	0.95	(H)
Pervious Site Area[3]	=	________	(I)
Pervious Site Area Runoff Coefficient[4]	=	________	(J)
Proposed Site Area Runoff Coefficient = $\frac{(G \times H) + (I \times J)}{A}$	=	________	(K)

Note: For sites with dissimilar drainage sub-areas, calculate the equivalent runoff coefficients for pervious and impervious areas by $C = (C_1A_1+C_2A_2+...+C_iA_i) / (A_1+A_2+....A_i)$ Refer to the HDM Section 819.2(1) for additional information.

[1] Includes paved areas, areas covered by buildings, and other impervious surfaces.
[2] Use 0.95 unless lower or higher runoff coefficients can be verified.
[3] Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.
[4] See Tables 8-3 and 8-4 for runoff coefficients.

Table 8-3: Runoff Coefficients for Undeveloped Areas
Watershed Types

	Extreme	High	Normal	Low
Relief	0.28 -0.35 Steep, rugged terrain with average slopes above 30%	0.20 - 0.28 Hilly, with average slopes of 10 to 30%	0.14 -0.20 Rolling, with average slopes of 5 to 10%	0.08 - 0.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	0.12 - 0.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	0.08 - 0.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	0.06 - 0.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	0.04 - 0.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	0.12 - 0.16 No effective plant cover, bare or very sparse cover	0.08 - 0.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	0.06 - 0.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	0.04 - 0.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	0.10 - 0.12 Negligible surface depression few and shallow; drainage-ways steep and small, no marshes	0.08 - 0.10 Low; well defined system of small drainage ways; no ponds or marshes	0.06 - 0.08 Normal; considerable surface depression storage; lakes and basin marshes	0.04 - 0.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes

Reference: Caltrans Highway Design Manual, Section 819.2, Figure 819.2A, November 1, 2001

Example Determination of Runoff Coefficient for a watershed:

Given: An undeveloped watershed consisting of:
1) rolling terrain with average slopes of 5%,
2) clay type soils,
3) good grassland area, and
4) normal surface depressions.

Find: The runoff coefficient, C, for the above watershed

Solution:

Relief	0.14
Soil Infiltration	0.08
Vegetal Cover	0.04
Surface Storage	0.06
C =	0.32

Table 8-4: Runoff Coefficients for Developed Areas

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, Cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.25
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95

Reference: Caltrans Highway Design Manual, Section 819.2, Table 819.2B, November 1, 2001

8.1.9 Other Information

Include any other information that would explain the decisions or rationale behind the selection and deployment of both permanent and Construction Site BMPs chosen by the designer. Examples include the designer's estimated staging of the project and estimated time of year for those stages; any scheduling modifications included in the Order of Work specifications that were included to enhance water pollution control; and any specific BMP deployments that are considered to be critical to the success of the contractor's SWPPP/WPCP. The designer should verify that all requirements listed herein would be reflective of the contract special provisions.

Other Plans/Permits: Other agencies may have issued permits or have plan requirements for the construction of the project or imposed certain conditions. If so, a written description of the permit conditions and a copy of the permit must be provided for inclusion in an appendix to the SWPPP. For example, hazardous materials must be handled in accordance with specific laws and regulations and disposed of properly. If during the preparation of the PS&E, it is known that special permits for hazardous waste disposal are required, a written explanation must be provided to the contractor to be incorporated within this section and it must be consistent with other specifications in the contract. In addition, information regarding other related permits such as California Department of Fish & Game or U.S. Army Corps of Engineers permits should also be included.

Information/Guidance for Maintenance Staff: Many of the permanent control measures will require ongoing inspection and maintenance once construction is completed and the project is operational. This information should include project-specific O&M procedures for the permanent BMPs. The design staff should assemble information to be included in the RE File to be turned over to District Maintenance upon project close-out.

8.2 CONCEPTUAL STORM WATER POLLUTION PREVENTION PLAN/WATER POLLUTION CONTROL PROGRAM

The Caltrans permit allows any RWQCB to request submission of a SWPPP up to 30 days prior to the start of construction. In order not to delay the start of construction, the District/Regional NPDES Coordinator should determine, through consultation with the local RWQCB, if the submittal of a "Conceptual SWPPP" (CSWPPP) would satisfy this requirement. In this case, the submission of the CSWPPP would be prior to the submittal of the PS&E package to the Office Engineer. This CSWPPP may be prepared by the District/Regional Storm Water Coordinator, the Project Engineer (PE), or by other designated personnel. If required, the Conceptual SWPPP should be developed and included with the Information Handout to the bidders. The District may also decide to develop a CSWPPP on any project for reasons other than a 30-day prior submittal request by a RWQCB.

The CSWPPP should contain all of the elements of a contractor prepared SWPPP, but it will not replace the contractor's SWPPP. The term conceptual is used because the designer does not know all aspects of the eventual contractor's actual methods of construction, access requirements, planned order of operations, or other items, processes, equipment, etc. that are under the purview and control of the contractor. When a CSWPPP has been prepared, the designer should make that information available to the contractor through the Construction Duty Senior and include the information in the RE File and in the Information Handout. The contractor may use the CSWPPP as a guide and reference tool to develop and submit the contract SWPPP.

8.3 PREPARATION AND SUBMITTAL OF THE NOTIFICATION OF CONSTRUCTION

The Permit requires that a NOC be submitted to the appropriate RWQCB for projects with a disturbed soil area (DSA) of at least one (1) acre of total land area. This NOC must be submitted at least 30 days prior to the start of construction. A copy of the NOC is contained in Attachment F of the SWPPP/WPCP Preparation Manual (this manual can be downloaded from the following web site: http://www.dot.ca.gov/hq/construc/stormwater1.htm). A copy of the NOC is included at the end of this section.

Designers should also be aware of the following information:

- The NOC form should be completed by the PE or Project Manager (PM), Environmental Unit or District/Regional Storm Water Coordinator, as determined by District procedure;
- The signed NOC shall be submitted to the appropriate RWQCB at a minimum of 30 days prior to construction. It is recommended that the NOC be submitted to the RWQCB when the PS&E package is transmitted to the Office Engineer;
- No filing fees are required to submit an NOC to the RWQCB;
- A signed copy of the NOC should be transmitted to the District Construction Division, and a copy should also be sent to the PE for the project file;
- At the time of the first submittal to the RWQCB, the District may elect to leave blank the information in Section IV, Construction Field Office, and resubmit a copy of the form with that information filled in at the time the RE is assigned, and the field office address and phone number are known. Alternatively, the District may wish to fill in a contact name of someone other than the RE, such as the Area Senior Construction Engineer or PM. This person will remain the contact for that project until the NOC is resubmitted with the new contact information, or until the Notice of Completion of Construction (NOCC) is filed;
- In some cases, the RWQCB may deem two or more small projects (less than one [1] acre of soil disturbance) in the same corridor as part of a larger Common Plan of Development. The PM should be aware of other projects in the corridor. If needed, the other projects may be mentioned in the NOC;
- Caltrans has applied for and received a variance from the Department of Toxic Substances Control for the reuse of some soils that can contain lead. The Caltrans permit requires written notification to the RWQCB at least 30 days prior to advertisement for bids for projects that involve soils subject to this variance. The PE is encouraged to submit the notification early in design as the RWQCB may take as long as 180 days to issue WDRs. This notification period will allow a determination by the RWQCB(s) of the need for development of WDRs or written conditional approvals by RWQCB staff; and
- For areas in RWQCB-Regions 6 and 7 below 3,937 feet in elevation, the following additional requirements apply: (1) The Department will notify the RWQCB staff of construction projects in these areas at least 30 days prior to the start of construction, (2) During the 30-day notification period, RWQCB staff may request to review the SWPPP or meet with the Department to discuss the project, and (3) If Board staff does not respond within the 30-day review period, then the Department can proceed with its construction activities.

NOTIFICATION OF CONSTRUCTION

IN COMPLIANCE WITH CALTRANS STATEWIDE NPDES STORM WATER PERMIT Order No. 99-06 DWQ, NPDES No. CAS000003

I. IDENTIFICATION-Attach Vicinity Map, ½ size copy of Title Sheet

Project		*Check One:* ☐First Submittal or ___Amendment No. __	*Contract Number* *EA*	*Date MM/DD/YY*
City(if applicable)		*County*	*Tentative Start Date*	*Tentative End Date*
Route	*Post Mile*	*Kilometer Post*		*Tentative Date SWPPP Available*

II. CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

☐Region 1, North Coast	Region 5, Central Valley	Region 6, Lahontan	☐Region 7, Colorado River
☐Region 2, San Francisco Bay	☐Sacramento	☐South Lake Tahoe	☐Region 8, Santa Ana
☐Region 3, Central Coast	☐Fresno	☐Victorville	☐Region 9, San Diego
☐Region 4, Los Angeles	☐Redding		

III. CALTRANS DISTRICT

Name/Number		*Project Contact*
Address		*Position Title*
City	*Zip*	*Phone* ( )

IV. CONSTRUCTION FIELD OFFICE- Attach Location Map

Street Address			*Construction Contact*
Physical Location if Different than address above			*Position Title*
City	*State*	*Zip*	*Phone* ( )

V. CONSTRUCTION SITE INFORMATION

Description and Type of Work					
Additional related required approvals: ☐ *DTSC Variance* ☐ *CWA 404/401* ☐ *DFG 1601* ☐ *NPDES/WDRs* ☐ *Other* *Describe:*					
Total Construction Area:	*Acres*	*Hectares*	*Total Disturbed Area:*	*Acres*	*Hectares*
Receiving Water Name:			*Project In Or Adjacent to Receiving Water?:*	☐ *Yes*	☐ *No*
Project Discharges to?: ☐ *Groundwater Infiltration*	*Basin Location:*		☐*Municipal/Other System Name:*		

VI. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is true, accurate, and complete to the best of my knowledge and belief. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment of knowing violations.

Signature: ____ Date:

Print/Type Name: Title:

Appendix A
Approved Design Pollution Prevention BMPs

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A.1 REQUIRED MINIMUM DESIGN ELEMENTS FOR STORM WATER CONTROL

The PE must consider, and as appropriate, incorporate certain Design Pollution Prevention Best Management Practices (BMPs) into a project to minimize impacts to water quality. These BMPs were developed in response to the three following design objectives:

- *Prevent Downstream Erosion:* Stormwater drainage systems will be designed to avoid causing or contributing to downstream erosion;
- *Stabilize Disturbed Soil Areas:* Disturbed soil areas will be appropriately stabilized to prevent erosion after construction; and
- *Maximize Vegetated Surfaces Consistent with Existing Caltrans Policies:* Vegetated surfaces prevent erosion and promote infiltration (which reduces runoff).

The Design Pollution Prevention BMPs listed in Table A-1 and described in the following sections are designed to accomplish these objectives.

Table A-1: Design Pollution Prevention BMPS

Consideration of Downstream Effects Related to Potentially Increased Flow
Peak Flow Attenuation Basins
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

A.2 CONSIDERATION OF DOWNSTREAM EFFECTS RELATED TO POTENTIALLY INCREASED FLOW

Description:

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.

Caltrans will evaluate the effects on downstream channel stability and the applicability of the mitigation measures described under Implementation for this BMP.

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. The designer must also consider the effect of collecting and concentrating flows in roadside ditches, storm drain systems, or the effect of re-directing flows to Treatment BMPs. Diversions or overflows from large storm events in these instances may create concentrated discharges in areas that have not historically received these flows.

Implementation:

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 peak flow attenuation 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.

A.3 PRESERVATION OF EXISTING VEGETATION

Description:

Preservation of existing vegetation involves 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;
- Delineate the areas to be preserved in the field prior to the start of soil-disturbing activities;
- Minimize disturbed areas by locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling; and

- When removing vegetation, consider impacts (increased exposure or wind damage) to the adjacent vegetation that will be preserved.

A.4 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. Concentrated flow conveyance systems may be used both within Caltrans rights-of-way (on-site) and downstream outside Caltrans rights-of-way.

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:

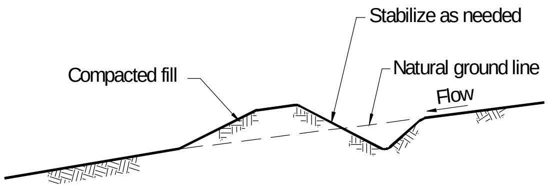
- At the top of slopes to divert run-on from adjacent slopes and areas;
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows;
- At other locations to convey runoff to overside drains, stabilized watercourses, and stormwater drainage system inlets (catch basins), pipes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

Implementation:

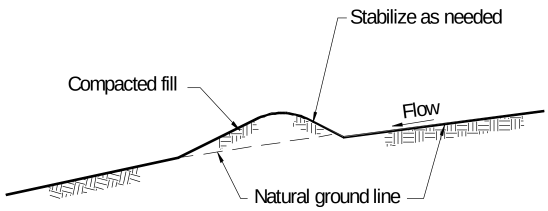
- Design must be in accordance with Chapter 800 of the Highway Design Manual (see Chapter 813, Topic 836 and Chapter 860);
- Select design flow based on careful evaluation of risks due to erosion, overtopping, flow backups or washout;
- Consider outlet protection where localized scour is anticipated;
- 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 (see Table 862.2 of the Highway Design Manual). Consider use of Rock Slope Protection (RSP), engineering fabric, vegetation, asphalt concrete or concrete (see Table 873.3E of the Highway Design Manual);

- Riprap should not be used where there is a high probability that traction sand or abrasives may enter the channel; and
- Ditches, berms, dikes and swales are shown in Figure A-1.

Figure A-1: Ditches, Berms, Dikes and Swales



Conceptual Diversion Ditch/Drainage Swale
Not to Scale



Conceptual Diversion Dike/Berm
Not to Scale

Note: Actual layout determined by design.

Overside Drains

Description:

Overside drains are conveyance systems used to protect slopes against erosion. Overside Drains may take the form of pipe downdrains, flumes or paved spillways, and 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:

- Design must be in accordance with Chapter 830 of the Highway Design manual (see Topic 834.4);

- Pipe downdrains are metal pipes adaptable to any slope. They are recommended where side slopes are 1:4 (V:H) or steeper;
- Flume downdrains are rectangular corrugated metal flumes with a tapered entrance. They are best adapted for low flow rates on slopes that are 1:2 (V:H) or flatter;
- Pipe and flume downdrains shall be securely anchored to the slope;
- Paved spillways are recommended on side slopes flatter than 1:4 (V:H). On steeper slopes, pipe downdrains should be used; and
- Drainage from benches in cut and fill slopes should be removed at intervals ranging from 300 to 500 feet.

An overside drain is shown in the Standard Plans, May 2006, Figure D87D.

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:

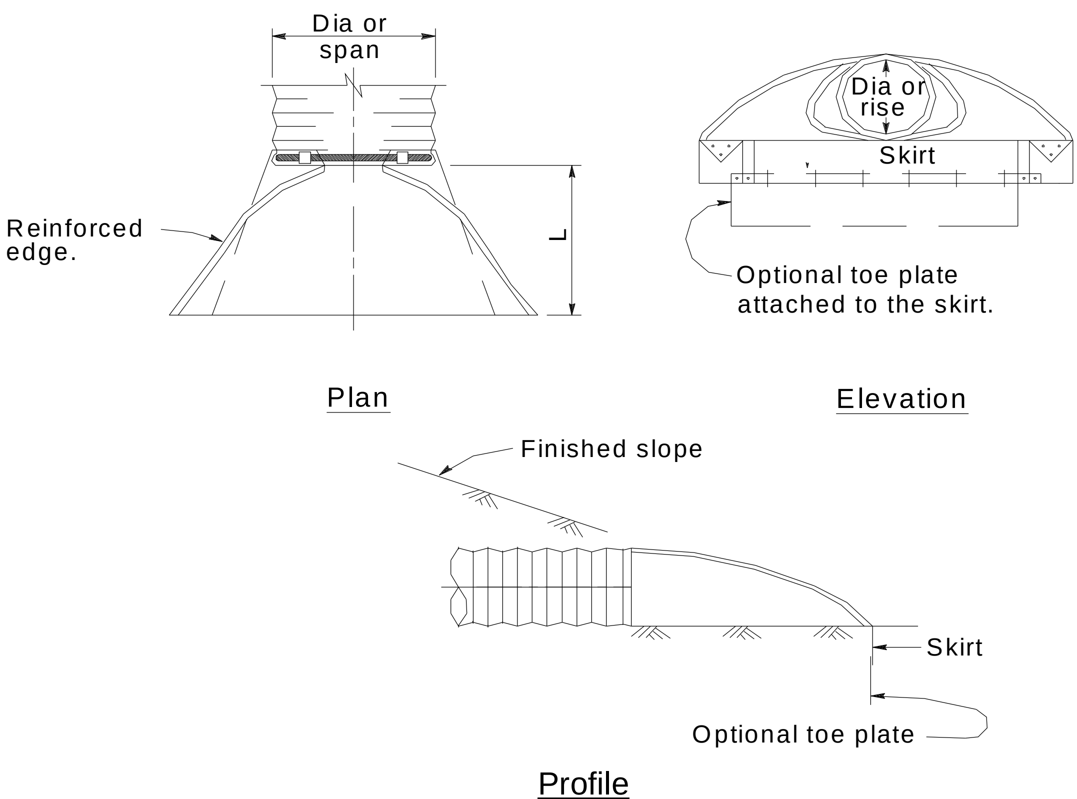
Use flared culvert end sections at outlets and inlets of overside drains and culverts.

Implementation:

- Design must be in accordance with Chapter 800 of the Highway Design Manual (see Topics 826 and 827); and
- Use with other outlet protection/velocity dissipation devices as appropriate.

A flared culvert end section is shown in Figure A-2 (see Standard Plans, May 2006, Figures D94A and D94B, Pages 181 and 182).

Figure A-2: 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 stormwater flows.

Appropriate Applications:

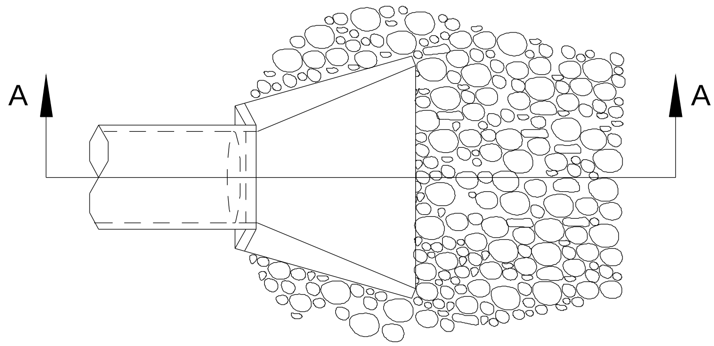
These devices are typically used at the outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels, where localized scouring is anticipated.

Implementation:

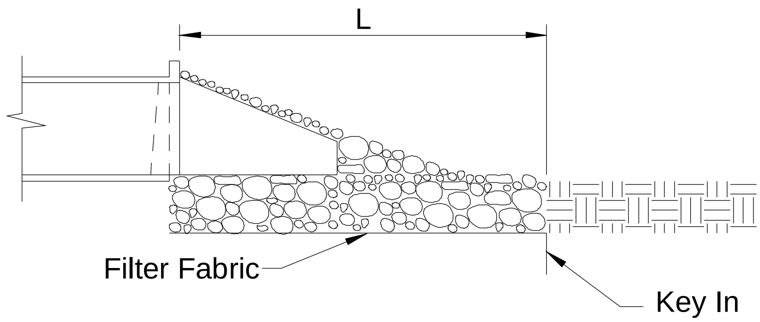
- Design must be in accordance with Chapter 800 of the Highway Design manual (see Topic 827 and Chapter 870);
- Install riprap, grouted riprap, or concrete apron at selected outlet;
- Apron length (L) is related to outlet flow rate and tailwater level; and
- For proper operation of apron, align apron with receiving stream and keep straight throughout its length.

An outlet protection/velocity dissipation device is shown in Figure A-3.

Figure A-3: Outlet Protection/Velocity Dissipation Device



Plan View
Not to Scale



Section A-A
Not to Scale

A.5 SLOPE/SURFACE PROTECTION SYSTEMS

Surface protection consists 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 a permanent perennial vegetative cover on areas that have been disturbed. The purpose of a vegetated surface (from a water quality perspective) is to prevent erosion and may additionally remove pollutants in stormwater and non-stormwater runoff.

Appropriate Applications:

Vegetated surfaces should be established on areas of disturbed soil after construction related activities in that area are completed, and after the slope has been prepared. Vegetated surfaces should only be considered for areas that can support the selected vegetation long-term. Consult the District's Landscape Architect regarding vegetated surfaces and appropriate applications.

Implementation:

The following steps are typically implemented by the Landscape Architect:

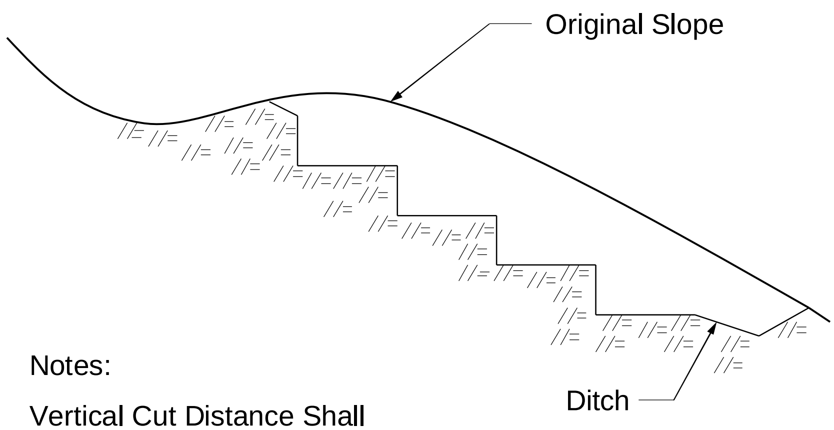
- The site should first be evaluated to select the appropriate vegetation and planting strategy. The site evaluation should consider soil type and condition; site topography; climate and season; types of appropriate native and adapted vegetation suited to the site; and maintenance;
- Vegetated surfaces 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; and
- When determined feasible, strip and stockpile topsoil (duff) and removed vegetation during construction. Use stockpiled materials in the surface preparation prior to seeding operations.

Slope Roughening/Terracing/Rounding/Stepping:

- 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; and
- Use on embankment or cut slopes, prior to the application of temporary soil stabilization or permanent seeding.

Slope roughening, terracing, rounding, and stepping, should be implemented as shown in Figure A-4.

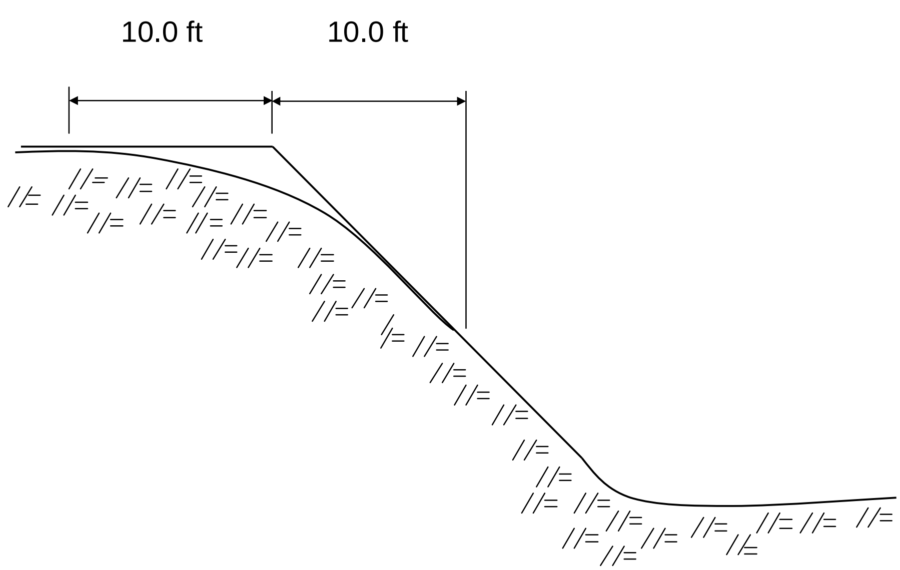
Figure A-4: Slope Rounding, Stepping, Terracing and Contouring



Notes:

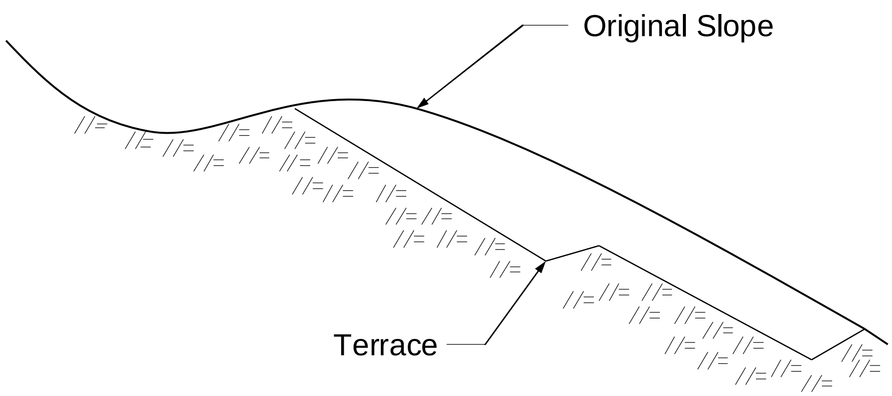
Vertical Cut Distance Shall Be Less Than Horizontal Distance

Stepped Slope (Not to Scale)

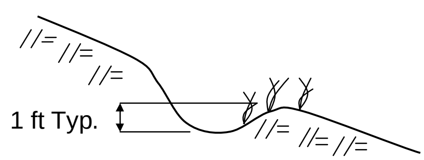


Slope Rounding

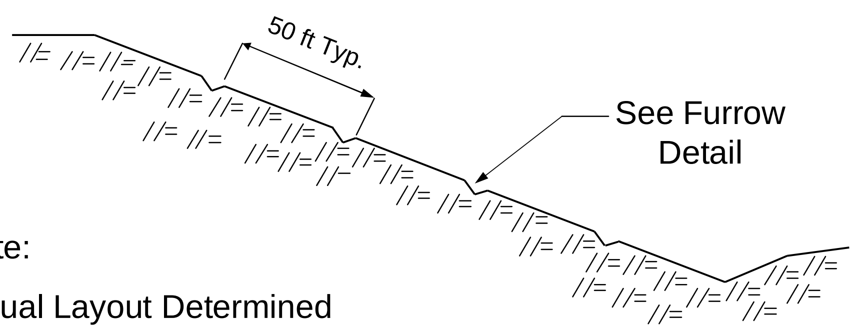
Figure A-4: Slope Rounding, Stepping, Terracing and Contouring (Continued)



Terraced Slope (Not to Scale)



Furrow Detail



Note:

Actual Layout Determined by Design

Contour Furrows (Not to Scale)

Hard Surfaces

Description:

Hard surfaces consist of placing concrete, rock, or rock and mortar slope protection. The designer needs to consider the effects of increased runoff from impervious areas.

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** (RSP) (See the California Bank and Shore Rock Slope Protection Design Manual. Web site: http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm
  - Angular rock of specified size is placed over fabric and used as rip rap to armor slopes, steambanks, etc.;
  - RSP 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; and
  - Local surface irregularities should not vary from the planned slope by more than 1.0 feet (ft) as measured at right angles to the slope.

- **Concreted RSP**:
  - Angular rock of specified size is placed over fabric;
  - Concrete is placed into the rock interstices by gravity flow and a minimum of brushing and troweling; and
  - Used to armor streambanks.

- **Rock Blanket**:
  - Consists of round cobble rock placed as a landscape feature in areas often inundated with water.

- **Sacked Concrete Slope Protection**:
  - Bags are filled with concrete mix and stacked against the slope to cure. Rebar can be driven into the wet mix and bags.
  - Used to create revetment or bank protection. (This is aesthetically less desirable.)

- **Slope Paving**:
  - Used almost exclusively below bridge decks at abutments.
  - Provides erosion control and soil stabilization in areas too dark for vegetation to establish.
  - May be constructed of finish poured Portland Cement Concrete (PCC), shotcrete, or masonry paving units.
  - 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.
- **Articulated Revetments**:
  - Mattresses composed of concrete units that are interlocked or interconnected with cables.
- **Gabions**:
  - Wire cages filled with rock. These units are then constructed into structures of various configurations.

Appendix B
Approved Treatment BMPs

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B.1 TREATMENT BMPS

This Appendix provides design guidelines for the Caltrans-approved Treatment Best Management Practices (BMPs) listed in Table 2-5. These BMPs have been approved for statewide use and should be considered for all projects that meet the criteria for incorporating Treatment BMPs, as described in Section 4 of this handbook.

B.1.1 Targeted Design Constituent

A Targeted Design Constituent (TDC) is defined as a pollutant that has been identified during Departmental runoff characterization studies to be discharging with a load or concentration that commonly exceeds allowable standards and which is considered treatable by currently available Department-approved Treatment BMPs. The Targeted Design Constituent approach is the Department's statewide design guidance to address the "Primary Pollutants of Concern" as listed in Figure 2-3.

Targeted Design Constituents are: phosphorus; nitrogen; total copper; dissolved copper; total lead; dissolved lead; total zinc; dissolved zinc; sediments; general metals [unspecified metals]. A project must consider treatment to target a TDC when an affected water body within the project limits (or with the sub-watershed as defined by the Water Quality Planning Tool) is on the 303(d) list for the one or more of these constituents. Infiltration Devices, being the approved Treatment BMP capable of treating all the constituents listed in Table 2-2, Pollutants of Concern and Applicable Treatment BMPs, should be considered as the desired Treatment BMP for all watersheds in projects that are required to consider Treatment BMPs. However, if Infiltration Devices cannot be incorporated, or if the proposed Infiltration Device(s) cannot accept all of the WQV runoff, Biofiltration Systems, Detention Devices, Multi-Chambered Treatment Trains, Media Filters (Austin Sand Filter and Delaware Filter), and Wet Basins must be considered based on the Targeted Design Constituent approach. The remaining Caltrans-approved Treatment BMPs, Dry Weather Flow Diversion, Gross Solids Removal Devices, and Traction Sand Traps, are applicable for specific situations as described in this Appendix and in this handbook.

B.1.2 Interaction with other Caltrans Functional Units

Besides Design, many other functional units may play a significant role in the implementation of the various Treatment BMPs into a project. These units should be consulted during the selection and design of Treatment BMPs. For example, District Landscape Architecture will select vegetative cover for many of the Treatment BMPs (e.g., Biofiltration BMPs), and should be consulted on siting issues for all the Treatment BMPs. District Maintenance must be consulted to insure that they can safely access and maintain the deployed BMPs. Proper hydraulic design is critical to the safe and efficient operation of all of the Treatment BMPs; this task is performed by either the Project Engineer or by District Hydraulics depending upon the District and level of complexity of the design. Geotechnical Services will conduct site investigations for Infiltration Devices and other Treatment BMPs. District Traffic Operations should be consulted when considering placement of Treatment BMPs in or near Clear Recovery Zones. The District Environmental unit plays a significant role in the environmental assessment of the project, and in the environmental clearance of sites for proposed Treatment BMPs. The District NPDES and/or the Design Storm Water Coordinator plays a significant role by assisting in the interpretation of the PPDG, and by reviewing Storm Water Data Reports produced for the PID, PA/ED, and PS&E phases of the project. District Construction will help to identify potential constructability issues with proposed Treatment BMPs. Other units may have a role in developing appropriate Treatment BMP strategies; therefore, the designer must identify key project information and coordinate with other Functional Units throughout each Project Phase.

B.1.3 Hydraulic Issues Related to Treatment BMPs

Treatment BMPs are designed for water quality purposes, but they must also operate safely and effectively as part of the overall highway drainage system; because of this, hydraulic design issues must be carefully evaluated during the consideration and design processes for Treatment BMPs, especially with regard to any upstream effects that would impact highway drainage. While some aspects of hydraulic engineering are presented in this handbook, those presented will focus on the site-specific design of a Treatment BMP, and not on all aspects of hydraulic or hydrologic engineering. Instead, the Project Engineer is referred to the Highway Design Manual - Section 800, Highway Drainage Design, and the Project Engineer may require the assistance of the District Hydraulics Unit (e.g., when a Treatment BMP is used for the dual purposes of peak flow attenuation and water quality treatment).

B.1.3.1 Treatment BMPs as a Component of the Drainage System

Several of the Treatment BMPs can be designed to work either online or offline; for convenience, within this handbook it is assumed that online placement will be chosen.[1] There are potentially different impacts and design issues associated with online versus offline placement, and these should be discussed with District Hydraulics.

Those WQV- and WQF-based Treatment BMPs that are designed for online placement must also safely pass events that are larger than the WQ event assumed in the design of that Treatment BMP; for all except the Biofiltration Swale, the release of larger events is usually accomplished as overflow through a weir, with the weir set at an elevation related to the WQV. The overflow event used in the design of the weir must be consistent with the intensity, duration and frequency of the rainfall event used in the roadway drainage design for that tributary area contributing runoff to the Treatment BMP (and from other sources that cannot be redirected around the Treatment BMP) as discussed in Highway Design Manual – Topic 831. Overflow weirs must also be considered for offline placement of Treatment BMPs in the event that clogging or other unusual conditions occur.

Associated with the overflow event, a minimum freeboard of 12 inches should be provided between the surface water elevation during the overflow event and the lowest elevation of the confinement (e.g. the lowest elevation at the top of berm or vault) in order to provide assurance

[1] When placed 'online', the BMP would be located in the drainage flow path of the runoff and the BMP must convey runoff from any storm that occurs by passing all flows through the BMP itself. Flows up to the WQV (or WQF, depending upon the Treatment BMP selected) are treated by the BMP, while larger storm events are safely passed through the BMP without adversely impacting the upstream drainage systems, but without treatment. In contrast, 'offline' Treatment BMPs systems primarily receive runoff from storm events up to and including the Water Quality event, while larger events are diverted around the Treatment BMP by an upstream flow splitter device. Treatment BMPs which use WQV as the design basis must make an estimate of an equivalent flow rate to capture the 85th percentile runoff when designing the flow splitter for the offline configuration.

of the physical integrity of the Treatment BMP and downstream facilities. This distance is referred to as the "Water Quality Freeboard."

B.1.3.2 Use of WQV-Based Treatment BMPs as Peak Flow Attenuation Devices

Usually a Treatment BMP is placed only for stormwater quality purposes; however, when a WQV-based Treatment BMP is proposed with the added purpose of a Peak Flow Attenuation Device (accomplished by delayed release of the runoff), District Hydraulics should be consulted to select the inflow hydrograph and runoff storage requirements within the Treatment BMP.

B.1.4 Incorporation of Existing Features as Treatment BMPs

Some existing features may be considered as Treatment BMPs even if they were not originally designed with that intent, provided that the existing features meet the guidelines in this handbook. These features (e.g. vegetated swales or detention basins, etc.) may perform the same functions as Treatment BMPs, but were not classified as Treatment BMPs at the time they were constructed. These features should be evaluated for possible classification as Treatment BMPs, considering the following:

- Determine the tributary area to the existing feature, and determine the associated Water Quality Volume or Water Quality Flow;
- Verify that the Applications/Siting criteria for the Treatment BMP listed in Appendix B is met at the existing location;
- Verify that the Design Factors of the Treatment BMP listed in Appendix B are met at the existing location.

Once these items are considered, the features that are under consideration for classification as Treatment BMPs should be discussed with the District Storm Water Coordinator and the entire Project Development Team (PDT). A final decision should be made after examining all the issues (e.g., Water Quality benefits versus changes in maintenance practices, future projects affecting the proposed Treatment BMP location).

If an existing feature is determined to be the functional equivalent of an approved Treatment BMP and classification as a Treatment BMP is accepted, then document the location in Section 2 and Section 5 of the Storm Water Data Report that this feature qualifies as an existing Treatment BMP and claim credit on the appropriate Treatment BMP Summary Spreadsheet.

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B.2 BIOFILTRATION STRIPS AND SWALES

(VEGETATED TREATMENT SYSTEMS)

B.2.1 Description

Biofiltration Strips are vegetated land areas, over which stormwater flows as sheet flow. Biofiltration Swales are vegetated channels, typically configured as trapezoidal or v-shaped channels, that receive and convey stormwater flows while meeting water quality criteria and other flow criteria.

Pollutants are removed by filtration through the vegetation, sedimentation, adsorption to soil particles, and infiltration through the soil. Strips and swales are effective at trapping litter, Total Suspended Solids (soil particles), and particulate metals.

B.2.2 Appropriate Applications and Siting Criteria

Biofiltration Strips and Swales should be considered wherever site conditions and climate allow vegetation to be established and where flow velocities will not cause scour. Vegetative cover of about 70% is required for treatment to occur. Biofiltration Strips and Swales should also be considered upstream of Treatment BMPs that would benefit from pretreatment by reducing sediment loading, such as Infiltration Devices, Detention Devices, and Wet Basins.

B.2.3 Factors Affecting Preliminary Design of Biofiltration Swales and Strips

B.2.3.1 Biofiltration Swales

Biofiltration Swales have two design goals: 1) to meet treatment criteria under Water Quality Flow (WQF) conditions, and 2) to provide adequate hydraulic function for conveyance and scour prevention for the peak drainage facility design event. Treatment is maximized by designing the swale to be as gently sloped and as long as the site constraints allow.

For a swale to be designated as a Treatment BMP, criteria relating depth, velocity, and Hydraulic Residence Time (HRT) as presented in the formula below must be met:

$$(\text{HRT} \times 60)/(\text{depth} \times \text{velocity}) \geq C \qquad \text{(Eq. 1)}$$

where:

HRT = Hydraulic Residence Time during WQF, minutes (≥ 5 minutes)
60 = conversion factor from minutes to seconds
depth = depth of flow at WQF (varies with velocity selected, up to 0.5 ft)
velocity = velocity of flow at WQF (varies with depth selected, up to 1.0 fps)
C = A constant: 1,300 (sec^2/ft^2)

Note that the Hydraulic Residence Time is that time during which the WQF travels in the Biofiltration Swale, and has no relation to the Time of Concentration term as used in hydrologic calculations.

The Rational Formula should be used to calculate the runoff entering the bioswale as described in Topic 819.2 of the Highway Design Manual, using the appropriate Water Quality storm intensity from Section 2.4.2.2, *Treatment BMP Use and Placement Considerations*, of this handbook to calculate the WQF. Calculation of the depth of flow and velocity in the bioswale should be made using the Manning's equation, with the Manning's number under the WQF for preliminary calculations taken as n = 0.20 for "routinely mowed" strips and swales, or at WQF Manning's n = 0.24 for "infrequently mowed" strips and swales. HEC 22, Tables 5-2 and 5-3 can also be consulted to determine an appropriate Manning's n for the site-specific depth if more rigorous calculations are deemed warranted.[2] In the situation where the WQF enters the proposed bioswale at a single upstream point, and only minor additional flow enters along the length of the swale, the calculation of Equation 1 is relatively simple. However, if the flow enters the Biofiltration Swale continuously along the length of the swale or at multiple discrete locations, other rational methods should be employed. In the case of continuous flow entering the swale, the designer may wish to initially calculate the depths and velocities at selected points along the swale to verify that the depth or velocity has not exceeded the maximum allowed values. This same calculation could also be used if there is a change of grade. The length of the swale that would qualify as a Biofiltration Treatment BMP must be upstream of the location where either the maximum depth or velocity was exceeded. The calculation of the HRT when the WQF enters at multiple (actual entry points or discretized from continuous flow) entry points could be done by calculating the HRT for the flow from each of the discrete entry points, and then taking a weighted average of the HRTs for the entire flow over the length that qualifies as a Biofiltration Treatment BMP; velocity and depth criteria would still need to be met.

To provide adequate hydraulic function, a swale should also be sized as a conveyance system calculated according to criteria and procedures for conveyance of design storm flows and scour associated with the peak drainage facility design event.

B.2.3.2 Biofiltration Strips

Biofiltration Strips should be designed to be as long and as flat as the site will allow, which maximizes treatment efficiency. The maximum strip length under which sheet flow conditions exist (and therefore treatment is obtained as a Biofiltration Strip) is dependent on site conditions; an upper limit for maximum strip length of approximately 100 ft in the direction of flow should be used, although there may be a greater opportunity for infiltration using longer lengths.

A study by Caltrans [Roadside Vegetated Treatment Sites (RVTS) Study, CTSW-RT-03-028] indicated that for Biofiltration Strips in certain slope and soil conditions, reductions were noted in the concentrations of copper, lead, zinc and TSS after flow passed through as little as 15 feet of Biofiltration Strip, and that little additional treatment was achieved after approximately 30 feet of flow length.

Areas with limited opportunity to sustain vegetative cover (i.e. sustain less than 70% coverage) provide little effective treatment, and should be considered unsuitable for Biofiltration Strips. The area to be used for the Biofiltration Strip should be free of gullies or rills that can concentrate overland flow and cause erosion.

[2] As a bioswale usually also conveys the HDM storm event (a much larger event than the WQF event), a more precise determination of Manning's n is usually unnecessary for water quality purposes.

Table B-1 summarizes preliminary design factors for Biofiltration Strips and Swales.

Table B-1: Summary of Biofiltration Strips and Swales Siting and Design Factors

Description	Applications/Siting	Preliminary Design Factors
Strips are vegetated land areas over which stormwater flows as sheet flow. Swales are vegetated channels that receive and convey storm water as a concentrated flow. Biofiltration treats the WQF. Treatment Mechanisms: • Filtration through the vegetation • Sedimentation • Adsorption to soil particles • Infiltration Pollutants primarily removed: • Litter • Total Suspended Solids • Particulate metals	• Site conditions and climate allow vegetation to be established – 70% minimum vegetation coverage will allow treatment, with better effects at higher coverage. • Consider locations for swales where flow velocities will not cause scour • Consider swales to provide pretreatment for other Treatment BMPs (Infiltration Devices, Detention Devices, and Wet Basins) • If proposed location is above hazardous soils or contaminated groundwater plumes, coordinate with District/Regional NPDES Storm Water Coordinator and RWQCB for clear direction	• Strips and Swales: vegetation mix appropriate for climates and location • Strips and Swales: Use the Rational Method to determine the Water Quality Flow (WQF) and peak flows for the peak drainage facility design event • Swales designed as a conveyance system for the peak drainage facility design event per HDM Chapters 800 to 890 • Swales: after designing to convey flows from the peak drainage facility design event, check swale against biofiltration criteria at WQF • Swales: design criteria under WQF: Hydraulic Residence Time of 5 minutes or more; maximum velocity of 1.0 ft/s; maximum depth of flow of 0.5 ft, and Eqn. 1 relationship among these variables. • Swales: slope in direction of flow: minimum 0.25%, maximum 6%, with 1 to 2% preferred; • Swales: A minimum width (in the direction of flow) at the invert of a trapezoidal bioswale typically 2.0 ft; maximum bottom typically up to 10 ft; side slope ratio should be 1:4 (V:H) or flatter; discuss bottom width and side slope ratio with District Maintenance. • Swales: if flow velocity under the peak drainage facility design event exceeds 4.0 ft/s, consult with Hydraulics to determine if geosynthetic reinforcement of the bioswale would be helpful to prevent erosion. • Swales: freeboard: Refer to HDM Topic 866 to determine if freeboard is required • Strips: sized as long (in direction of flow) and flat as the site will reasonably allow up to sheet flow boundaries (maximum length of Biofiltration Strip is approximately 100 ft); an HRT is not required. • Strips: should be free of gullies or rills

B.2.4 Vegetative Factors

Apart from meeting the hydraulic parameters presented above, vegetation is the critical component in the effectiveness of Biofiltration Treatment BMPs. The District Landscape Architecture Office should be consulted for each project to recommend appropriate vegetation species. Every effort should be made to assure the successful establishment of vegetation, including consideration of the topics discussed below.

B.2.4.1 Soils

Soils with favorable infiltration characteristics promote successful vegetative cover by allowing healthy root development, thereby promoting the effectiveness of the Biofiltration BMP. The Landscape Architect may recommend the following practices that foster infiltration and vegetation establishment:

- Stockpiling topsoil or duff prior to construction and replacement of topsoil in areas that will serve as Biofiltration Strips and Swales;
- Cultivating and ripping of existing soils along the areas to be converted into Biofiltration BMPs, to relieve compaction; and
- Incorporating soil amendments, including granular soils and organic material.

B.2.4.2 Selection of Plant Materials

Selection of plant materials for the Biofiltration BMP should be based on the following:

- Tolerance to varying soil moisture, and an ability to survive during dry season without irrigation (unless irrigation is already in place or has been proposed with highway planting in adjacent areas);
- Long-term survivability that includes a mix of long-lived perennial species and annual species that successfully reseed;
- Dense, continuous root mass; and
- Dense, continuous top growth that includes grasses and grass-like species, forbs, and some broad-leafed species.

B.2.4.3 Plant Establishment

Seeded Biofiltration Strips and Swales may require specific measures be incorporated in the design to ensure success. Consideration should be given to:

- Mulches, bark, straw, etc., on slopes that are steeper than 1:4 (V:H) to improve infiltration and protect against surface erosion when under sheet flow conditions;
- Erosion control blankets to protect against surface erosion when concentrated flow is present;
- Turf Reinforcement Mat (TRM) or a suitable geosynthetic fabric as a bioswale lining for flows from the peak drainage facility design event

(design with assistance of Regional/District Hydraulics using methods listed in HDM Chapter 870);

- Temporary flow diversion to direct concentrated flow around newly seeded areas until vegetation is established;
- The use of sod may be preferred over seeding;
- If sod is used, supplemental water/temporary irrigation may be required during an establishment period; and
- An appropriate plant establishment period to ensure plant survivability.

B.2.4.4 Resources about Plant Materials

For additional information about native plant species suited to varied hydrologic conditions within specific ecological subregions of California, consult:

- Ecological Subregions of California Section and Subsection Descriptions, USDA, Forest Service, USDA, Natural Resources Conservation Service, published May 1998

  (online at: http://www.fs.fed.us/r5/projects/ecoregions/);
- Calflora Database (online at: http://www.calflora.org); and
- Caltrans native grass database (online at: http://www.dot.ca.gov/hq/LandArch/grass.html).

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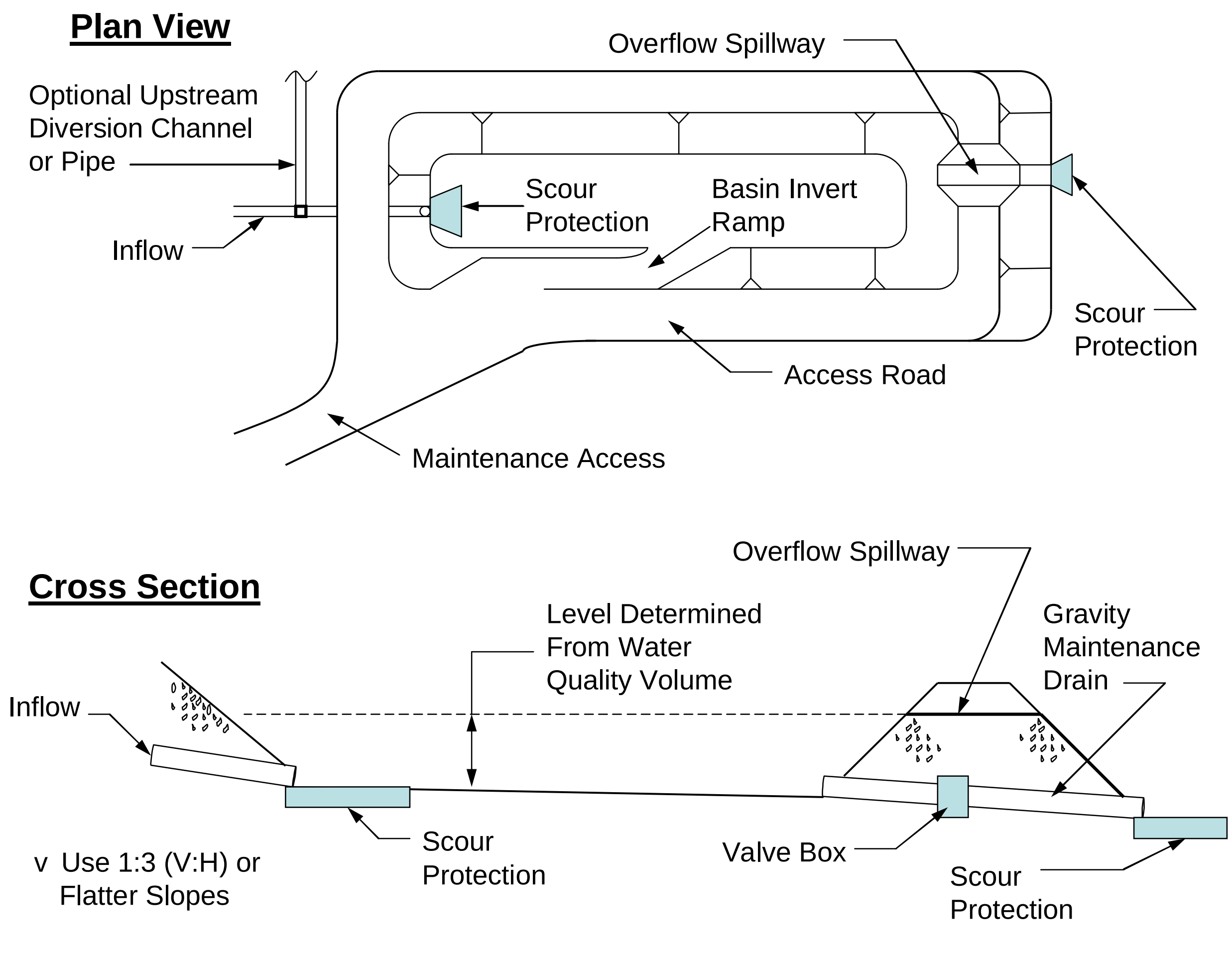
B.3 INFILTRATION DEVICES

An Infiltration Device is designed to remove pollutants from surface discharges by capturing the Water Quality Volume (WQV) and infiltrating it directly to the soil rather than discharging it to surface waters. Infiltration devices may be configured as basins or trenches.

B.3.1. Description

An Infiltration Basin temporarily stores the WQV while it infiltrates through the invert. An Infiltration Basin may be constructed in any shape to meet right-of-way restrictions. Runoff enters the basin under gravity flow. Storms producing runoff greater than the WQV will overflow through a spillway if the Infiltration Device is placed in an online configuration. However, an Infiltration Basin must always incorporate an overflow spillway whether placed online or offline. A schematic illustration of an Infiltration Basin is shown in Figure B-1.

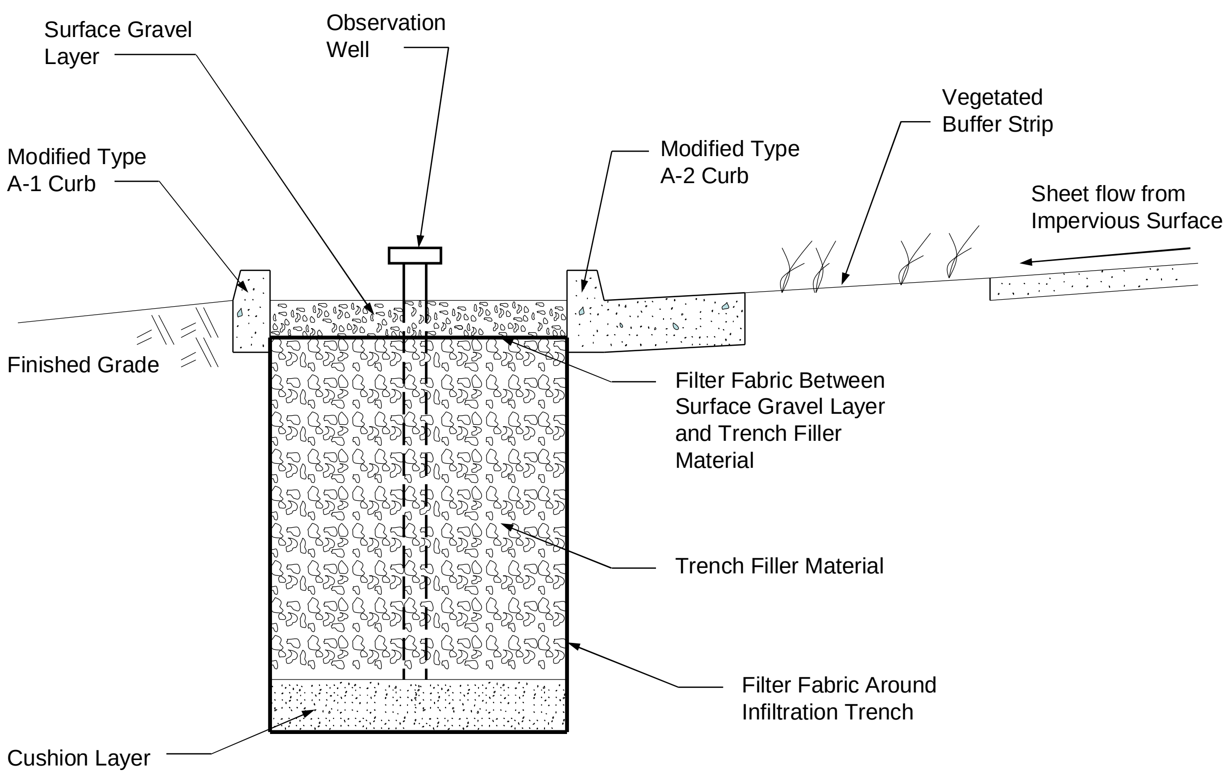
Figure B-1: Schematic of an Infiltration Basin



By contrast, an Infiltration Trench temporarily stores the WQV below ground in the void spaces between the rock or other material placed in the trench while it infiltrates through the invert.

Infiltration Trenches are often elongated, allowing them to be used in constricted areas, but there is no shape restriction. A schematic illustration of an Infiltration Trench is shown in Figure B-2.

Figure B-2: Schematic of an Infiltration Trench



In order to avoid the classification of an Infiltration Trench as a regulated injection well, the Infiltration Trench should be designed as follows: a) the WQV should be directed to the Infiltration Trench by gravity flow in an open channel or as sheet flow; b) the captured volume should flow downward within the trench by the action of gravity, and without vertical piping for distribution to lower depths of the trench; and c) the greater dimension (length or width) at the surface must exceed the depth of the trench.

Installation of an upstream bypass or flow splitter device should be considered for Infiltration Trenches.

Performance of the Infiltration Trench is monitored using an observation well placed within the Infiltration Trench; this observation well can also be used to access the trench if maintenance is required (e.g. using a hose and pump to remove standing water).

The required volume of the Infiltration Trench is roughly three times the WQV because only the void space within the rock backfill holds the WQV, and that void space is typically only 35% of the total volume of the rock. Other high porosity backfill materials are available, thus reducing the volume of the trench; consult with the Headquarters Division of Environmental Analysis – Policy, Planning and Permitting, and Headquarters Design Office of Storm Water Management if such materials are under consideration for a site.

The typical configuration uses a filter-fabric lined trench (i.e., the trench is formed against bare earth with a fabric as a separator, rather than concrete walls) with a curb or dike at its perimeter at the ground surface; the filter fabric is employed between the rock and the native ground to prevent soil intrusion into the void space.

B.3.2 Appropriate Applications and Siting Criteria: Infiltration Basins and Trenches

Infiltration Devices should be considered wherever site conditions allow and the design WQV exceeds 0.1 acre-feet; an Infiltration Trench may be considered whenever the WQV is between 0.065 and 0.1 acre-feet with concurrence of District/Regional Storm Water Coordinator. Appropriate sites for Infiltration Devices should have:

a) Sufficient soil permeability;

b) A sufficiently low water table;

c) The influent would not present a threat to local groundwater quality; and

d) Sufficient elevation to allow gravity drainage of the device when needed for maintenance purposes (Infiltration Basin only).

The Regional Water Quality Control Board (RWQCB) having jurisdiction may impose additional requirements for water protection purposes. Other physical siting conditions are discussed under Table 2, Applications/Siting. One other important siting requirement is that water stored in the Infiltration Basin, when constructed online, does not cause an objectionable backwater condition upstream in the storm drain system that would adversely impact its ability to convey flows generated by peak drainage facility design events as required in the HDM.

Infiltration Basins will function more effectively over the long-term if vegetated on the invert and side slopes. Consult the District Office of Landscape Architect for types of vegetation that can function effectively in Infiltration Basins in each of the various ecological subregions of a District. Additional information about grasses that have been successful within specific ecological subregions of California may be found in Ecological Subregions of California Section and Subsection Descriptions (as referenced in Appendix B, Biofiltration Strips and Swales).

Because an Infiltration Trench relies on flow through a filter fabric, the device is prone to clogging if excessive sediment loads are allowed to enter the device. Rehabilitation of a clogged Infiltration Trench is difficult, especially compared to the relative ease to rehabilitate an Infiltration Basin. Because of this, pretreatment to capture sediment in the runoff is required upstream of the Infiltration Trench to increase longevity of the system (by using Biofiltration devices or a forebay). To further minimize the clogging potential, the design may employ an upper layer of permeable material, typically about 0.5 feet in thickness, below which would be placed filter fabric; this upper layer would act as an initial filter, and could be periodically removed and replaced as conditions warrant rather than removing the entire rock volume.

Infiltration Trenches would likely be considered inappropriate for placement in close proximity to Drinking Water Reservoirs and/or Recharge Facilities due to the difficulty in cleaning in the event of a spill; consult the District/Regional NPDES Coordinator if an Infiltration Trench is being considered adjacent to a Drinking Water Reservoir or Recharge Facility.

B.3.3 Factors Affecting Preliminary Design

The following steps are recommended for determining the feasibility of an Infiltration Device. The major components are Pre-screening, Site Screening, Site Investigation and Preliminary Design. Siting and design criteria are summarized in Table B-2.

Table B-2: Summary of Infiltration Device Siting and Design Criteria

(Applicable to both Infiltration Basins and Infiltration Trenches unless noted)

Applications/Siting	Preliminary Design Factors
• Infiltration Basin and Trench: Ability to treat a WQV ≥ 0.1 acre-feet; consult District/Regional Storm Water Coordinator if an Infiltration Trench is being considered for a WQV between 0.065 and 0.1 acre-feet (between 2,833 ft^3 and 4,356 ft^3). • Runoff quality must meet or exceed standards for infiltration to local groundwater • Infiltration Devices should not be sited in locations over previously identified contaminated groundwater plumes • Separation from seasonally high water table > 10 ft, (or ≥ 4 ft if justified by adequate groundwater observations for a minimum of 1 year); for most projects, the minimum clearance of 10 ft should be provided; consult with District NPDES and Headquarters *Office of Storm Water Management Design* if < 10 ft of clearance is being considered. • Soil types restricted to HSG A, B, or C (for Infiltration Basins) or HSG A or B (for Infiltration Trenches) having an infiltration rate ≥ 0.5 in/hr; maximum infiltration rate is 2.5 in/hr unless a higher rate is approved in writing by RWQCB. For preliminary estimates of soil infiltration rate, consult Table B-3. • Soil should have a clay content < 30% and a combined silt/clay content < 40% • Site should not be located in area containing fractured rock within 10 ft of invert [Table continues on next page]	• Infiltration Basins: Infiltrate WQV within 40 to 48 hours; Infiltration Trenches: Infiltrate WQV up to 72 hours • Use representative infiltration or permeability rate to size the device • Provide maintenance access (for an Infiltration Basin, provide a road entirely around the basin or at least to the overflow spillway. Also provide a ramp to the basin invert, or provide an access road to an Infiltration Trench) • Infiltration Devices should not be placed in service within a construction contract until all upstream runoff is stabilized, or shall be protected from sediment-laden runoff. • Infiltration Basins: Optional upstream diversion channel or pipe for storm events > WQV; mandatory downstream overflow outlet as part of the Basin flow control device sized to pass the peak drainage facility design event (see HDM Chapter 830) that will enter the basin, minimum outlet length 3.0 ft, as overflow weir or outlet riser • Infiltration Basins: Provide a minimum 12 inch Water Quality freeboard (the difference between the surface water elevation during the overflow event and the lowest elevation of the confinement) • Infiltration Basin: Scour protection on inflow and overflow outlet • Infiltration Basins: Use as flat an invert as possible (3% maximum); Infiltration Trenches: flat invert (no slope) • Infiltration Basins: Provide maintenance gravity drain, if practicable • Infiltration Basins: Use 1:4 (V:H) side slope ratios or flatter for interior side slopes, unless approved by District Maintenance, with 1:3 (V:H) maximum • Infiltration Basins: Provide vegetation, typically grasses at invert and side slopes • Infiltration Basin: Provide a maintenance gravity drain, minimum 8-inch diameter [Table continues on next page]

Table B-2: Summary of Infiltration Device Siting and Design Criteria (cont.)

(Applicable to both Infiltration Basins and Infiltration Trenches unless noted)

Applications/Siting	Preliminary Design Factors
• Locate where sloping ground < 15%, and where infiltrated water is unlikely to affect the stability down gradient of structures, slopes, or embankments • Locate at least 1,000 ft from any municipal water supply well; at least 100 ft from any private well, septic tank or drain field; and at least 200 ft from a Holocene fault zone • Locate > 10 ft down gradient and 100 ft up gradient from structural foundations, when infiltrating to near surface groundwater. • Infiltration Trenches: installed down gradient from the highway structural section, and should not be placed closer horizontally than the Trench depth to the roadway if in a location subject to frost • Infiltration Trenches: would likely be considered inappropriate for placement in close proximity to a Drinking Water Reservoir and/or Recharge Facility due to the difficulty in cleaning in the event of a spill; consult District/Regional Storm Water Coordinator if an Infiltration Trench is being considered in close proximity to a Drinking Water Reservoir and/or Recharge Facility. • Locate outside the Clear Recovery Zone (HDM Topic 309.1), or consult with Traffic Operations to determine if guard railing is required	• Infiltration Trenches: total volume ≥ 2.85x WQV • Infiltration Trenches: Provide one observation well in the Trench, minimum diameter of 6 inches, with weatherproof cap; may be used to drain the trench if necessary. • Infiltration Trenches: maximum depth of trench is 13 feet, depth less than the widest surface dimension, and WQV should be directed to trench as surface flow, and allowed to gravity-flow downward to the invert of the trench. • Infiltration Trench: use rock specified elsewhere in this section; a 6 inch layer of Permeable Material (Standard Specification 68-1.025) is usually placed at the invert to protect the filter fabric from the rock during its placement. • Pretreatment to capture sediment in the runoff (such as with Biofiltration or a forebay): required for Infiltration Trenches, and recommended for Infiltration Basins. Only approved BMPs should be considered. • Infiltration Trenches often have a perimeter curb for delineation, and to limit vehicle wheel loads from encroaching upon the trench; may use A1-150 (Standard Plan sheet A87). • Wetting front water level should not cause groundwater to rise within 0.7 ft of the roadway subgrade;

Drain rock conforming to Rock Slope Protection, Method B Placement, Class 3 (Standard Specification 72-2.02, "Materials") should be used in Infiltration Trenches with the following gradation.[3]

Sieve Size, inches	Per cent passing
4	100
3	50 - 100
2	20 - 85
1.5	10 - 75
1	5 - 40

B.3.4 Pre-Screening for the Infiltration Device

Pre-screening for the Infiltration Device involves collecting site-specific information necessary to determine whether infiltration is an appropriate stormwater treatment method and to ensure the site meets criteria established by the local RWQCB. Consult with the District/Regional

[3] Minor variation from these gradations will have little effect on the void space available.

Storm Water Coordinator to obtain RWQCB criteria. No field testing is anticipated during this early investigation.

The steps involved in pre-screening include:

- Information collection; and
- Preliminary determination of infiltration appropriateness.

Sub-sections (*B.3.4.1 Information Collection* and *B.3.4.2 Preliminary Determination for Appropriateness of Infiltration*) describe the steps involved in Pre-Screening; these steps are usually conducted by the Project Engineer as early in the project as feasible, often during the PID phase. The Project Engineer could discuss the proposed site with the Geotechnical services representative, and a Preliminary Geotechnical Report might be deemed beneficial at this stage of the project.

B.3.4.1 Information Collection

Some of the basic site-specific data required for the determination of the appropriateness of an Infiltration Device are found in the sources listed below. Additional data may be required for local conditions. Data collected by Caltrans project engineering staff and Caltrans District/Regional Storm Water Coordinators include, but may not be limited to:

- Outfall inventory data available through District/Regional Storm Water Coordinators, 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-built drawings, aerial photographs, Geographic Information System (GIS) data from Caltrans and local planning agencies, etc.);
- 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 appropriate for the Caltrans land use in the tributary area (Caltrans Annual Report or Caltrans Discharge Characterization Study Report (CT SW-RT-03-065.51.42) htpp://www.dot.ca.gov/hq/env/stormwater/special/newsetup/index.htm); and
- WQV calculated in accordance with Section 2; the program Basin Sizer satisfies the requirements of Section 2 and is available at:

  http://www.owp.csus.edu/research/stormwatertools/

Site soil characteristics:

- Indigenous soil types: Natural Resources Conservation Services (NRCS) soil maps and corresponding hydrologic soil classes, USCS classifications, or similar;

- Soil infiltration rates (estimated and from any existing on-site testing in the vicinity); 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; and
- 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 (e.g., http://wdl.water.ca.gov/gw/)

Local groundwater quality concerns: Consult RWQCB, California Department of Toxic Substances Control (DTSC), local environmental/health department (city/county);

- Site hydrogeology (from any existing boring logs: lenses, hardpan, etc.);
- Known contaminated groundwater plumes (RWQCB);
- Groundwater rights data: adjudicated groundwater basins, other rights (RWQCB, DHS); and
- State Water Information Management System data for project area (State Water Resources Control Board [SWRCB]).

B.3.4.2 Preliminary Determination for Appropriateness of Infiltration

Once the data have been collected and placed in the context of the alignment and/or location of the Caltrans facility being considered for Infiltration Devices, the Project Engineer and the District/Regional Storm Water Coordinator will use the data and follow the procedure outlined in Figure B-3 (page B-17). Project Engineers shall also follow the procedures outlined in Figures B-22 and B-23 for an Infiltration Device being considered for District 7.

Applicable steps for determination of appropriateness of infiltration include:

1. Estimate the quality of runoff from the Caltrans facility draining into the proposed Infiltration Device using data from the Caltrans stormwater database and annual research summaries.

2. Determine if local Basin Plan or other local ordinances provide limits on quality of water that can be infiltrated. Compare with Caltrans runoff quality, and determine if infiltration is permissible. If not, document inapplicability of infiltration and continue to step 5 for consideration of other approved Treatment BMPs.

3. Determine if local agencies, public health authorities, legal restrictions, or other concerns preclude consideration of infiltration of stormwater runoff. Consult with District/Regional Storm Water Coordinator and representatives of appropriate authorities as needed. If infiltration into the aquifer is not acceptable to local authorities, document

inapplicability of infiltration, and continue to step 5 for consideration of other approved Treatment BMPs.

4. Compare the estimated Caltrans runoff water quality with available groundwater quality data, using receiving water quality objectives from the RWQCB Basin Plan, for each groundwater beneficial use. Determine if the separation between the maximum anticipated seasonal high groundwater table and the proposed device invert is at least 10 ft (or greater than or equal to 4 ft if justified by adequate groundwater observations for a minimum of one year). Tabulate the results and make a preliminary determination of the appropriateness of the Infiltration Device.
5. If the determination is negative (i.e., infiltration *not* appropriate), consider other approved treatment BMPs according to the Targeted Design Constituents (TDC) approach as defined in the Storm Water Data Report (SWDR). If determination is positive (i.e., infiltration potentially appropriate), proceed to infiltration site screening.

B.3.5 Infiltration Device Site Screening

Using data gathered in the pre-screening process, perform an initial screening of sites to narrow the number of potential sites to those that can be considered for field investigations within the project limits. As needed, collect additional information, and follow these procedures:

- Identify soil type (consider NRCS Hydrologic Soil Groups [HSG] A, B, or C only for Infiltration Basin, HSG A or B only for Infiltration Trench, as shown in Table B-3) from soil maps and/or U.S. Department of Agriculture (USDA) soil survey tables and/or background information. In areas where septic systems are in widespread use, the County Environmental Health Department may have information on appropriate soil types for infiltration of on-site wastewaters;
- 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 that may prohibit usage include: location in seismic impact zones, unstable areas such as landslides and Karst terrains, and areas with soil liquefaction and differential settlement potential, or highly expansive/collapsible soils. Generally, Infiltration Devices should not be constructed in fill, or on any slope greater than 15 percent; and
- The minimum acceptable spacing between the proposed Infiltration Device invert and the maximum seasonal high groundwater table is 10 ft. If a separation of less than 10 ft is proposed, the approval of the local RWQCB is required.

Figure B-3: Pre-screening for the Infiltration Devices

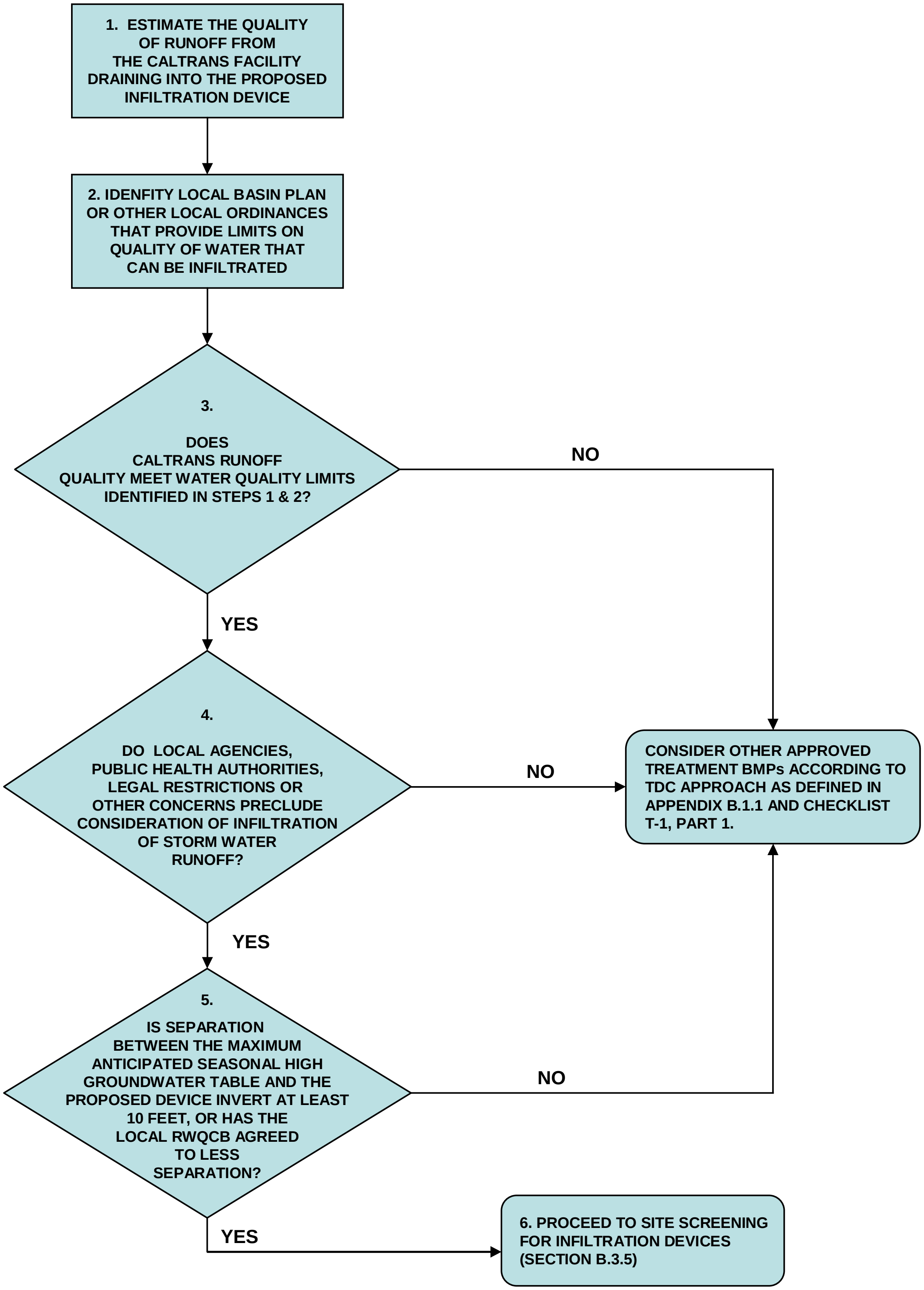


Table B-3: Typical Infiltration Rates for NRCS Type, HSG, and USCS Classifications

NRCS Soil Type	HSG Classification	USCS Classifications	Typical Infiltration Rates (inches/hour) See Notes 2 & 3
Sand	A	SP, SW, or SM	8
Loamy Sand	A	SM, ML	2
Sandy Loam	A	SM, SC	1
Loam	B	ML, CL	0.3
Silt Loam and Silt	B	ML, CL	0.25
Sandy Clay Loam	C	CL, CH, ML, MH	0.15
Clay Loam, Silty Clay Loam, Sandy Clay, and Silty Clay	D	CL, CH, ML, MH	< 0.05
Clay	D	CLM CH, MH	< 0.05

Note 1: USCS classifications are shown as approximation to the NRCS classifications. Note that the NRCS textural classification does not include gravel, while the USCS does. Note also that the gradation criteria (particle diameter) for the three soil types as used in the NRCS and the USCS, while agreeing in large part, are not congruent. Dual classifications in the USCS omitted. Infiltration estimates for USCS found in standard geotechnical references may vary from those shown for NRCS classifications, especially if significant gravel is present.

Note 2: Infiltration Basins should be placed at locations with soils classified as HSG A or B, although C soils can be acceptable if geotechnical investigations demonstrate minimum infiltration rate of 0.5 in/hr. Infiltration Trenches should be placed at locations with soils classified as HSG A or B and that have a minimum infiltration rate of 0.5 in/hr. Maximum infiltration rate allowed for any Infiltration Device is 2.5 in/hr unless RWQCB approval is received.

Note 3: When estimating the invert area for Infiltration Basins and Trenches placed in HSG Group B and C soils using the equations below, use the minimum infiltration rate of 0.5 in/hr to size the Infiltration Device until geotechnical investigation provides a field rate for the proposed location.

Infiltration Devices 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 the soil type at the site using Table B-3.

Estimate the area required for an Infiltration Basin as follows:

$$A_{est} = (C \times SF \times WQV)/(k_{est} \times t) \qquad \text{(Eq. 2)}$$

where:

A_{est} = estimated area of invert of Infiltration Basin (ft^2)
C = conversion factor (12 for inches to ft)
SF = safety factor of 2.0
WQV = Water Quality Volume calculated from the Water Quality design storm (ft^3)
k_{est} = estimated or representative infiltration rate from Table B-3 (inches/hr)
t = drawdown time, 40 to 48 hours

Infiltration Trenches are intended for use in areas with limited right-of-way. For this reason, an Infiltration Trench is typically designed using the minimum allowable invert area and the maximum allowable depth (not to exceed 13 ft) while still providing 10 ft separation between the trench invert and seasonally high ground water. To design an Infiltration Trench with a minimum invert area, first calculate the depth, D, as follows:

$$D = (k_{est} \times t)/(C \times SF \times 0.35) \qquad \text{(Eq. 3)}$$

Where:

D = depth of the Infiltration Trench (ft), [maximum depth = 13 ft]
k_{est} = permeability from Table B-3, (ft/hr)
t = drawdown time, up to 72 hours
C = conversion factor (12 to convert from inches to ft)
SF = safety factor of 2.0
0.35 = porosity of void material (value for rock shown)

Next calculate the required excavated volume for the Infiltration Trench:

$$EV = WQV / 0.35 \qquad \text{(Eq. 4)}$$

Where:

EV = excavated volume (ft^3)
WQV = Water Quality Volume calculated from the Water Quality design storm (ft^3)
0.35 = porosity of void material (value for rock shown)

Once the depth and excavated volume are obtained then calculate the invert area of the Infiltration Trench:

$$A = EV / D \qquad \text{(Eq. 5)}$$

Where:

A = estimated or calculated area of invert of Infiltration Trench (ft^2)
EV = excavated volume (ft^3)
D = depth of the trench ($\leq$13ft)

The final step is to calculate the invert dimensions for the Infiltration Trench:

$$A = L \times W \qquad \text{(Eq. 6)}$$

Where:
A = estimated or calculated area of invert of Infiltration Trench (ft^2)
L = length of Infiltration Trench (ft)
W = width of Infiltration Trench (ft)

Adjust length "L" and width "W" to meet site constraints.

Notes: a) The invert area of the Infiltration Trench having vertical sides is identical to the surface area.

b) To avoid classification as an underground injection well, the Infiltration Trench at its greatest surface dimension (length or width) must exceed its depth.

The efforts in B.3.5 Infiltration Device Site Screening usually occur in the PA/ED phase, but sometimes in the PID or even the PS&E phase depending upon the project. If it has not already been done, the Project Engineer should discuss the site with the Geotechnical Services representative and request a Preliminary Geotechnical Report if the information evaluated during Pre-Screening indicates that placement of Infiltration Devices appears favorable; the Preliminary Geotechnical Report would usually be completed without conducting field-testing, but other information could be developed that would produce indications whether the site conditions are favorable for infiltration.

B.3.6 Site Investigation

This step is usually conducted during the PS&E phase of the project. After the desktop screening of sites has been completed (including those sites outside of existing Caltrans right-of-way), proceed with field investigations of the remaining potential sites. Under *B.3.6 Site Investigation* a two-stage approach to the geotechnical investigation is proposed, *B.3.6.1 Procedure for Preliminary Infiltration Device Site Investigation* and *B.3.6.2 Detailed Investigation*. However, due to potential difficulties in scheduling geotechnical fieldwork, those activities might be conducted jointly.

- 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;
- If considering a parcel outside of the right-of-way, Caltrans must generate greater than 50% of the total tributary runoff directed toward that parcel; otherwise investigate opportunities for a cooperative agreement to share stormwater treatment facilities with the other agency, county, or city responsible for the additional flow;
- Assess the feasibility (e.g., degree of plumbing, features or construction practices required and available area) of directing runoff from additional tributary area to the device; additional Caltrans area would have priority; other off-site areas are secondary. Consider potential downstream impacts from diversions and cost of diverting additional flow. Diversions of runoff from outside the tributary area of the Infiltration Device to unimproved conveyances (creeks/streams) are prohibited due to the increased potential for erosion. Diversions to improved conveyances may be permitted if it can be demonstrated that the conveyance has sufficient capacity to accommodate the additional flow, and other environmental considerations are favorable or neutral. If such diversion is being considered, consult with District/Regional Environmental and Hydraulics units;
- Investigate feasibility of infiltration using criteria and the procedure in Section B.3.4.1. Recalculate and verify area requirements using the collected field data. Use Equation 2 (see Section B.3.5) and the lowest measured or anticipated infiltration rate, or value considered representative of by the geotechnical professional, to calculate area of the Infiltration Device; and
- If an Infiltration Device is feasible, proceed to Section B.3.7, Preliminary Design.

B.3.6.1 Procedure for Preliminary Infiltration Device Site Investigation

The following scope of work defines the steps for Infiltration Device studies necessary to determine if an Infiltration Device 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 would continue for other approved Treatment BMPs.

The depth to groundwater must be known as a first step in determining 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 device invert must also be known or reasonably estimated to ensure that infiltration of the calculated WQV is possible within 48 hours for an Infiltration Basin or within 72 hours for an Infiltration Trench. Due to the potential variability of site conditions, field investigation is almost always required to determine the depth to groundwater and to provide an evaluation of the *in situ* infiltration rate.

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 10 ft clearance for the groundwater elevation below the device invert is satisfied and the site is deemed appropriate for further consideration. Consult the local RWQCB for approval of proposed groundwater separation less than 10 ft.

Part A: Initial Technical Field Screening and Determination of Groundwater Elevation

A local or 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 resource agencies; and
- Information on local groundwater-related drinking water issues from DHS.

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 20 ft below the proposed device invert using the direct push or other suitable method. Initial groundwater levels will be recorded at least 24 hours after installation.

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 criterion, described as follows. 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 10 ft of the invert of the proposed Infiltration Device then <u>the site will be eliminated from further consideration unless the local RWQCB requires installation of an Infiltration Device with less than 10 ft separation to groundwater.</u> If there is not a reliable indication that the seasonal high water table is at least 10 ft below the invert of the proposed Infiltration Device (i.e., if there is reason to believe the water table may rise to within 10 ft of the proposed invert), a more extensive groundwater table elevation investigation will be performed as described in Section B.3.6.2 Part C. If the groundwater elevation at the site is clearly deeper than 10 ft from the proposed device 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 evaluate 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 to structures, slopes or groundwater that could result from locating the Infiltration Device at the site to structures, slopes or groundwater.

Geotechnical trenches (a boring may be used at the option of the geotechnical professional) 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 6 ft long and 6 ft deep below the proposed device 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. Two to four soil samples should be collected for determination of the soil particle size distribution at each site. Samples should be collected from the soil profiles at different horizons and transported to a laboratory for soil indices testing, plasticity, and chemical testing described as follows:

- Soil textures or classifications that are conducive to infiltration include sands, loamy sands, sandy loams, loams, silt loams, and silt in the NRCS classification system, or GW, GM, SP, SW, GC, SC, SM, and ML (in the Unified Soil Classification System [USCS]) as long as the soil does not have more than 30 percent clay or more than 40 percent of clay and silt combined; and

- The soil in the first 12 inches below the basin invert will be tested for organic content (OC), pH, and cation exchange capacity (CEC) only if required by the local approving agency (notify Geotechnical Services prior to site investigation for this testing). Values that promote pollutant capture in the soil are: OC > 5%, pH in the range of 6-8, and CEC > 5 meq/100 g of soil (however, soils that have this CEC value are typically fine-grained, and often would be rejected for infiltration based on permeability considerations).

In addition, the trenches or samples from borings 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, either horizontally or vertically. A summary report will be prepared addressing the issues noted in this section, 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.) The geotechnical professional will develop the detailed investigation phase for the sites deemed acceptable from the initial investigation.

B.3.6.2 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, Permeability Testing, and Part C, Detailed Groundwater Elevation Determination (if required by the geotechnical professional).

Part A. Detailed Subsurface Soil Investigation

Borings will be drilled to a maximum depth of 50 ft (or refusal in rock or rock-like material at a lesser depth) below the invert of the proposed basin, and to a minimum depth of 3 times the depth of water when in the basin (at the WQV depth) for each detailed investigation location. Samples will be obtained at 5-ft intervals for soil characterization and/or laboratory testing. Bulk samples will also be collected at shallow depths (i.e., just below the invert elevation) to verify information collected in Parts A and B of the Initial Investigation.

Part B. Permeability Testing

No single test method is appropriate for the variety of subsurface conditions that might be encountered, as, for example a percolation test at the invert elevation might not disclose the existence of layers of either highly permeable or low permeability within the depth of interest. Rather, a permeability evaluation below the invert of the proposed Infiltration Device will be made using infiltration rate tests or other method(s) selected by the geotechnical professional.

The minimum acceptable infiltration rate for an Infiltration Device is 0.5 in/hr. If any test hole shows less than the minimum value, the site will be disqualified from further consideration unless strong local geotechnical evidence exists to predict the successful performance of the device. If the infiltration rate at the site is greater than 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 within 13 ft of the device invert; fill tends to be compacted, with clays in a dispersed, rather than flocculated state, greatly reducing permeability.

The geotechnical investigation will be sufficient to develop an adequate understanding of how the stormwater 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 and, in the opinion of the geotechnical professional, the seasonal high groundwater elevation may come within 10 ft of proposed device invert, at least one groundwater monitoring well will be installed at a representative location. The well(s) 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 regional rainfall less than 80% of the historical average. The minimum acceptable spacing between the proposed Infiltration Device invert and the seasonal high water table is 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 agricultural practices. The geotechnical professional should 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.

B.3.7 Preliminary and Final Design

Table B-2 summarizes preliminary design factors for Infiltration Devices. Preliminary design includes the following:

- Obtain site topography (one-half meter contours, 1:500 scale). Extend topography 80 ft beyond the Infiltration Device perimeter to show where runoff enters or leaves Caltrans right-of-way, enters a drainage channel owned by others, or enters a receiving water;
- Develop a conceptual grading plan for improvements showing the device, maintenance access, device outlet and extent of right-of-way requirements to accommodate the improvements. An Infiltration Basin invert must not have a slope of greater than 3%, while the invert for an Infiltration Trench must have a slope of 0%;
- Develop unit cost-based cost estimate to construct the Infiltration Device. Include allowances for traffic management and storm drain system improvements as needed and determined by the PE; and
- Develop single paragraph assessments of: nonstandard design features; impact on utilities; hydrology (WQV, peak flow, land use); right-of-way total area needed;

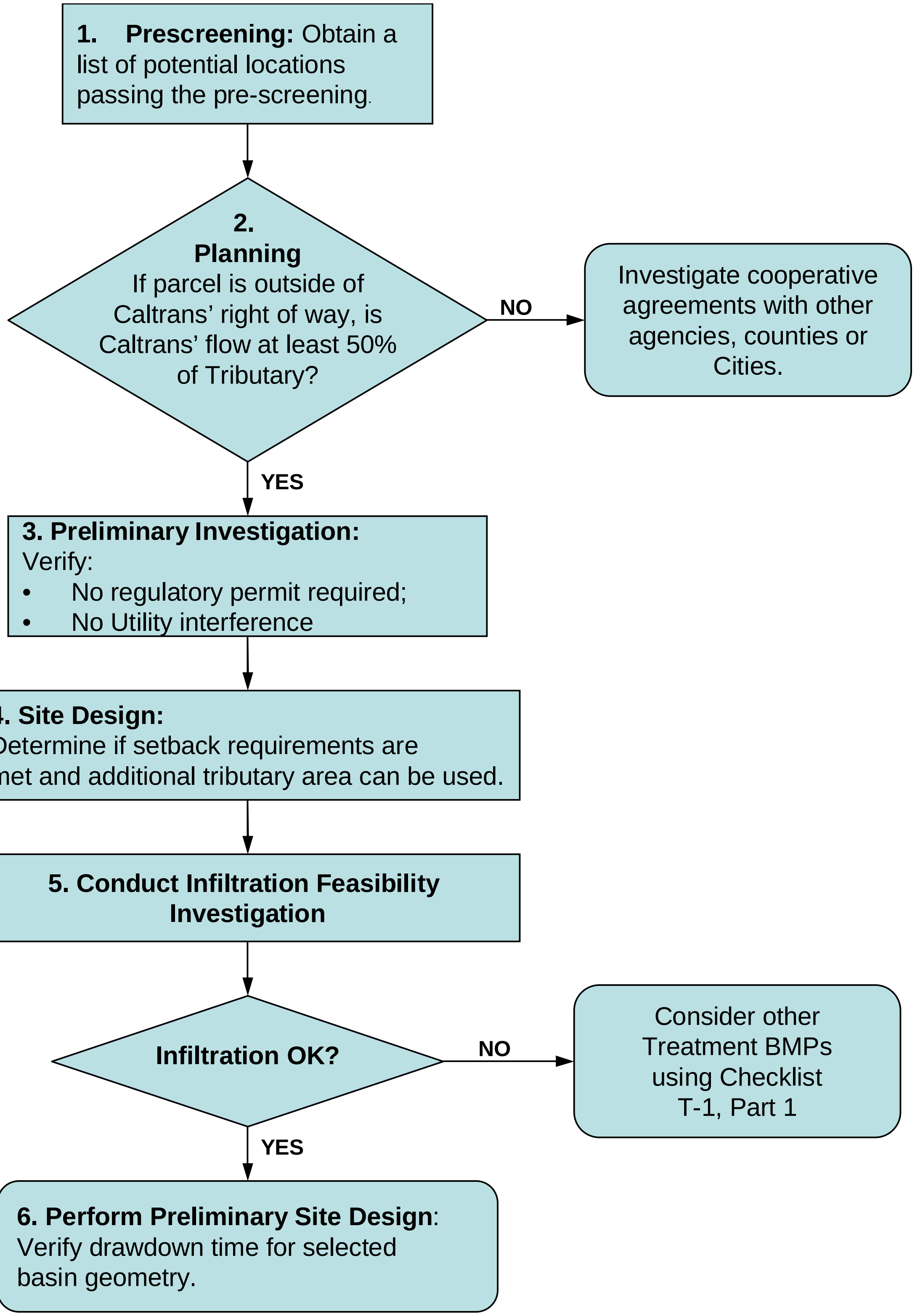
current ownership; highway planting and lighting; permits, hazardous materials, environmental clearance; and traffic management.

Final design efforts involve completing all required activities for which only preliminary assessments had been made, and developing the complete PS&E package for the Infiltration Devices.

Figure B-5 summarizes the BMP siting procedure for Infiltration Devices for all Districts except District 7, for which the procedures in Figures B-22 and B-23 apply.

Figure B-4: Caltrans' Pilot Infiltration Trenches

Figure B-5: BMP Siting Procedure for Infiltration Devices



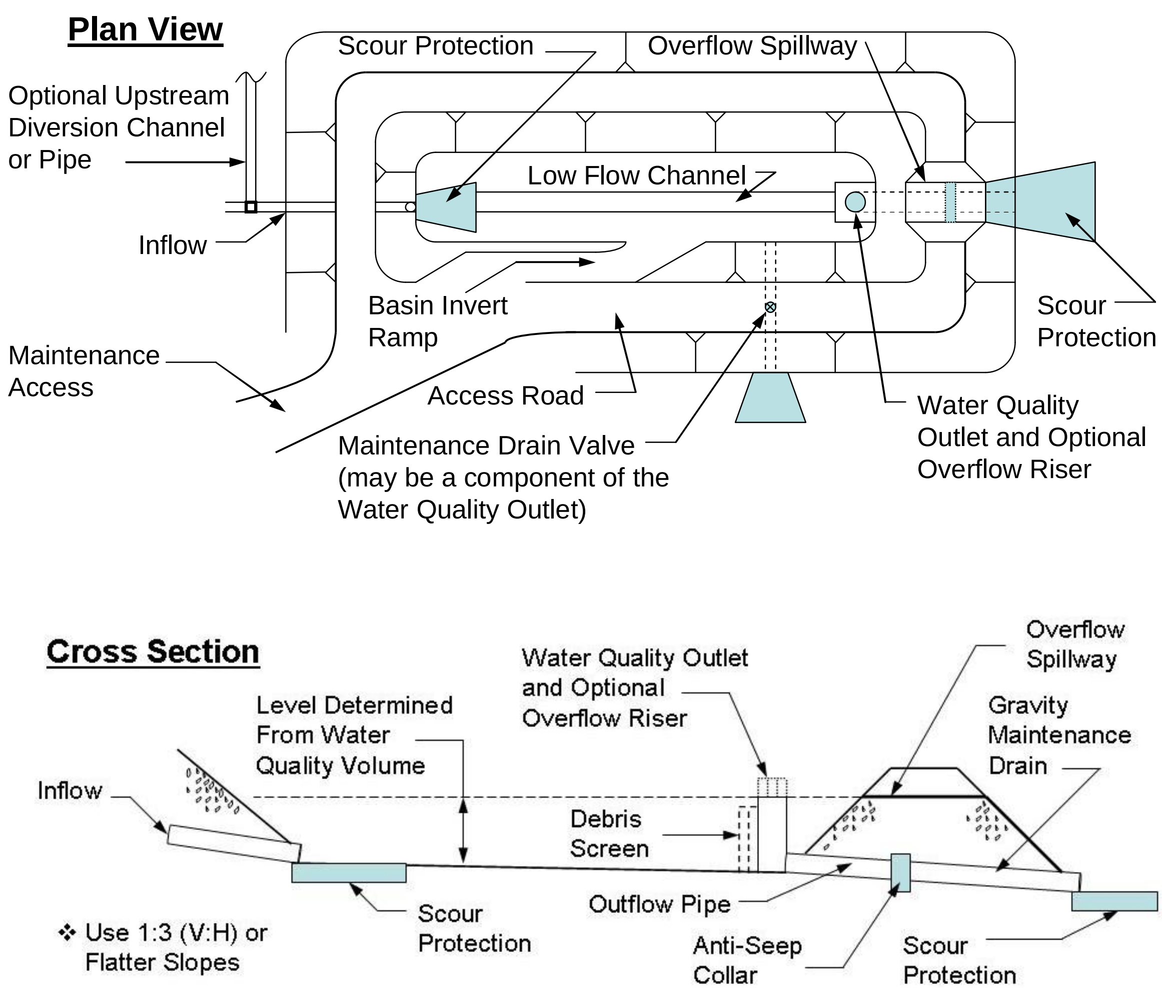
B.4 DETENTION DEVICES

B.4.1 Description

A Detention Device is a permanent treatment BMP designed to reduce the sediment and particulate loading in runoff from the water quality design storm (Water Quality Volume [WQV]). While the WQV is temporarily detained in the device sediment and particulates settle out under the quiescent conditions prior to the runoff being discharged. A Detention Device is typically configured as a basin. A schematic of a Detention Basin is shown in Figure B-6.

Detention Devices remove litter, total suspended solids (TSS), and pollutants that are attached (adsorbed) to the settled particulate matter.

Figure B-6: Schematic of a Detention Basin



B.4.2 Appropriate Applications and Siting Criteria

Detention Devices and other approved Treatment BMPs should be considered for implementation wherever Infiltration Devices are not feasible. For Detention Devices, the WQV should be at least 0.1 acre-foot and site conditions must meet criteria. Refer to Checklist T-1, Part 1 in Appendix E. See Table B-4 for siting and design criteria.

One important siting requirement is that sufficient hydraulic head is available so that water stored in the device does not cause an objectionable backwater condition in the storm drain system, which would adversely impact the system's ability to convey flows generated by the peak drainage facility design event as required in the HDM. A second siting requirement is that seasonally high groundwater cannot be higher than the bottom elevation of the device for reasons described in the section below.

B.4.3 Factors Affecting Preliminary Design

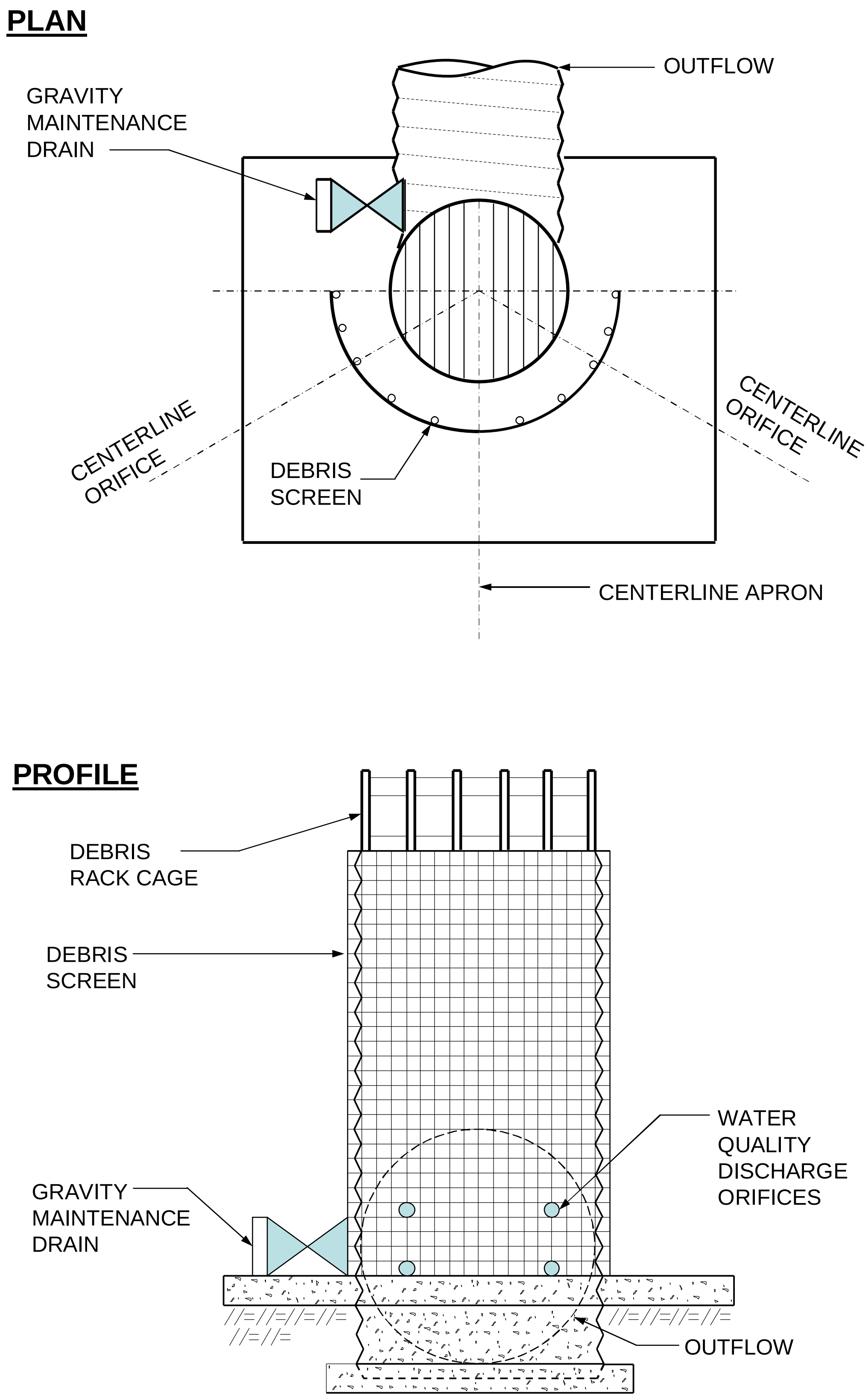
Detention Devices should be designed with a volume equal to at least the WQV determined using the methods described in Section 2.4.2.2, Treatment BMP Use and Placement Considerations. The maximum water level in the Detention Device should not cause seepage of water under the roadway to within 8 inches of the roadway subgrade. The flow-path-to-width ratio within the Detention Device at the elevation of the WQV is recommended to be ≥ 2:1; if needed, 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. However, they may be used to facilitate maintenance and to protect groundwater. Limited 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 down gradient of the basin. However, 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 10 ft; use a liner for an earthen Detention Basin if the groundwater separation distance between the basin invert and seasonally high groundwater is between 1.0 and 10 feet or if located over a known contaminated groundwater plume unless approved by the local RWQCB due to the presence of low permeability soils (Hydrologic Soil Groups C or D).

Entering flows should be distributed uniformly at low velocity to prevent re-suspension of settled materials and to encourage quiescent conditions. Low flow channels are often used to ensure conveyance to the outlet and to limit erosion during low flows.

Discharge should be accomplished through a water quality outlet; an example is shown in Figure B-7 (page B-31). A rock pile or rock-filled gabions can serve as an alternative to the debris screen around the outlet although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog. Proper hydraulic design of the outlet is critical to achieving good performance of the Detention Device. The water quality outlet should be designed to empty the device within 24 to 72 hours (also referred to as "drawdown time"), with 40-hrs the preferred design drawdown time. The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.

Figure B-7: Schematic of Water Quality Outlet Structure



The two most common outlet problems that occur are: a) the capacity of the outlet is too great resulting in only partial filling of the device and drawdown time less than designed for; and b) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) riser perforated vertically (orifices in multiple rows). Use of a V-notch weir as an outlet is not recommended because this design is susceptible to clogging. Design guidance for single orifice and for perforated riser outlets is presented in the following text.

Flow Control Using Orifices at The Bottom of the Device: The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H - Ho)^{0.5}}{3600CT(2g)^{0.5}} \qquad \text{(Eq. 7)}$$

where:

a	=	total area of orifice (ft^2) [4]
A	=	surface area of the device at mid elevation (ft^2)
C	=	orifice coefficient (see discussion on following page)
T	=	drawdown time of full device (Recommended 40 hrs)
g	=	gravity (32.2 ft/s^2)
H	=	elevation when the device is full (ft)
Ho	=	final elevation when device is empty (ft)

For a riser perforated vertically (orifices in single or multiple columns (see Figure B-7), use:

$$a_t = [2A \times h_{max}]/[3600 \times C \times T(2g\{h_{max} - h_{centroid\ of\ orifices}\})^{0.5}] \qquad \text{(Eq. 8)}$$

with terms as shown in Eqn. 7 except:

a_t	=	total area of orifices in the perforated riser, (ft^2);
h_{max}	=	maximum vertical distance from lowest orifice to the maximum water surface (ft);
$h_{centroid\ of\ orifices}$	=	vertical distance from the lowest orifice to the centroid of the orifice configuration (ft).

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally. If more than two orifice rows are used, a special design is required.

If the WQV (specifically Methods 1 and 2 in Section 2.4.2.2, Treatment BMP Use and Placement Considerations) was determined using an assumed drawdown time, then use the same

[4] In the 'single orifice' design, the total orifice area is placed at one elevation, and may be configured using one or several orifices, at the designer's option.

value for drawdown time (T) in equations 2 and 4. Because Detention Devices are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

Assuming an average release rate at one half the basin depth (a common approach in several design manuals) may lead to considerable error if the device has a significant variation of surface area with depth. If this is true, consult HEC-22, Chapter 10, for the design of detention facilities.

Care must be taken in the selection of "C"; 0.60 is most often recommended and used. However, based on actual tests, GKY (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

Drilling the orifice into an outlet structure that is made of concrete can result in considerable impact on the coefficient, as does the beveling of the edge. For steel outlet structures, it is recommended that outlet specifications require drilled and de-burred holes for any orifice incorporated into steel pipe.

Three alternative outlet structures that use single orifice outlets may be considered: a) A concrete block structure located in the containment berm for large devices. b) A riser pipe for small to large devices to prevent orifice clogging as shown in the equations above. c) Placing the outlet control downstream of the facility in the berm or in a manhole located may be considered for small devices as long as other outlets/spillways are provided for storms larger than the water quality design storm (consult District Hydraulics). For small facilities, place the control orifice in the outlet manhole downstream of the debris screen, or use a "T-pipe" to submerge the orifice. Variations of this alternative may include gates, valves, or weirs. The PE should consult with both the District Maintenance Storm Water Coordinator and the District Hydraulics Branch regarding these outfall structures.

Flow Control Using the Perforated Riser: For outlet control using the perforated riser as the outlet control, as shown on Figure B-7 (page B-30). This design incorporates flow control for the small storms in the perforated riser, and also provides an overflow outlet for large storms. If properly designed, the perforated riser can be used for both water quality and overflow control by: (1) sizing the perforated riser as indicated for water quality control; (2) sizing the top of the outlet riser pipe to function as an overflow weir to control peak outflow rate from the design storm (reference HDM Chapter 830).

If possible, an upstream flow-splitter should be provided to divert the peak hydraulic flow (calculated for the design storm); this minimizes scouring of previously deposited materials. Alternatively, an overflow spillway sized to accommodate the design storm can be provided in one of the downstream walls or berms. A third alternative is to include an overflow outlet in the top of the water quality outlet, as described in a preceding paragraph. In this case, an additional outlet (riser or spillway) is often still supplied to prevent overtopping of the walls or berms should blockage of the riser occur, based on a downstream risk assessment.

A Detention Device must be designed to allow for regular maintenance. Consideration should be made for a perimeter access road, safe access to and from the site from local streets or access roads, and an access ramp to the basin invert. Any diversion from these requires the concurrence from the Maintenance Storm Water Coordinator.

Preliminary design factors for Detention Devices are summarized in Table B-4. A Detention Device designed for dual purposes of water quality and attenuation of peak flows requires additional design considerations not included in this table.

Detention Basins will appear more aesthetic to the traveling public and function more effectively if vegetated on the invert rather than having a 'hard bottom' and/or side slopes; this will also eliminate the erosion from the side slopes of the basin.[5] Consult the District Office of Landscape Architect for types of vegetation that can function effectively in Detention Basins in each of the various ecological subregions of a District. Additional information about grasses that have been successful within specific ecological subregions of California, in grassland and wetland conditions, may be found in Ecological Subregions of California Section and Subsection Descriptions (as referenced in Appendix B, Biofiltration Strips and Swales).

[5] If a vegetated invert is used, consider adding a low-flow channel between the influent pipe and the outlet device, to reduce erosion caused under the initial flows into the basin.

Table B-4: Summary of Detention Device Siting and Design Criteria

Description	Applications/Siting	Preliminary Design Factors
Impoundments where the WQV is temporarily detained during treatment Treatment Mechanisms: • Sedimentation • Infiltration (if basin unlined) Pollutants primarily removed: • Sediment (TSS) • Particulate metals • Litter • Sorbed pollutants (heavy metals, oil and grease [O&G]) to some degree	• WQV ≥ 0.1 acre-feet • Sufficient head to prevent objectionable backwater condition in the storm drain system • Separation between seasonally high groundwater and basin invert > 10ft; use liner if separation between 1.0 foot and 10 ft. unless approved by the local RWQCB due to the presence of low permeability soils (Hydrologic Soil Groups C or D) • Use liner if basin is located over a known contaminated groundwater plume unless approved by the local RWQCB due to the presence of low permeability soils (Hydrologic Soil Groups C or D). • If significant sediment is expected (e.g., from erosion-prone cut slopes) consider increasing the volume of the Detention Device an amount equivalent to the annual loading (or more, if less frequent cleanout is expected); consult with District Maintenance. • Locate outside the Clear Recovery Zone (HDM Topic 309.1), or consult with Traffic Operations to determine if guard railing is required	• Size to capture the WQV according to Section 2.4.2.2. • Outlet designed to empty device within 24 to 72 hrs (consistent with device sizing method), with 40 hrs recommended, using debris screen (or equivalent). • Flow-path-to-width ratio of at least 2:1 recommended. • Maximum water level should not cause groundwater to occur under the roadway within 0.7 ft of the roadway subgrade. • Maintenance access (road around device and ramp to basin invert). • Upstream diversion channel or pipe (see Figure B-6), if possible. • Downstream spillway or overflow riser: sized to pass the design storm (see HDM Chapter 830); minimum spillway length of 3 feet, and/or minimum riser diameter of 36 in., or per District practice. Use local criteria for overflow design if more stringent. • Provide Water Quality freeboard ≥ 12 inches (distance between the elevation of water in the basin when passing the design storm and the elevation at the top of the confinement). • Provide a maintenance gravity drain. Use 8 inch diameter pipe for gravity drain; connect gravity drain to base of outlet riser. • Flows should enter at low velocity. Use scour protection on inflow, outfall and spillway if necessary • If a vegetated invert is used, consider adding a low-flow channel between the influent pipe and the outlet device, to reduce erosion caused under the initial flows into the basin. • Use 1:4 (V:H) slope ratios or flatter for interior slopes, unless approved by District Maintenance, with 1:3 (V:H) maximum. • Provide vegetation on (earthen) invert and on non-paved side slopes. • Minimum orifice size of 0.5 in

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B.5 TRACTION SAND TRAPS

B.5.1 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. In this handbook, traction sand refers to sand and other traction enhancing substances. These traps may take the form of basins, tanks, or vaults.

B.5.2 Appropriate Applications and Siting Constraints

Traction Sand Traps should be considered at sites where traction sand are commonly applied to the roadway. If traction sand is used only rarely (less than twice a year) then Traction Sand Traps need not be considered for installation.

Vault-style Traction Sand Traps should be considered only where Detention Basins or Basin-style Traction Sand Traps are infeasible.

Consult the District/Regional NPDES coordinator to ensure that a Traction Sand Trap which receives water from a pipe and discharges through the invert of the device is not classified as a regulated underground injection well.

B.5.3 Factors Affecting Preliminary Design

Traction Sand Traps are sized to convey the design peak flow while holding one year's worth of traction sand (or some other period of time chosen by the District). However, provisions should be made to divert the peak hydraulic flow (calculated for the peak drainage facility design event) and to prevent scouring if possible. Traction Sand Traps should have sufficient volume to store the settled sand with enough depth over the stored sand to prevent scouring and to promote relatively calm pool conditions.

The volume required to store traction sand is calculated by starting with the estimated amount of traction sand spread in a tributary area and applying reduction factors to account for sand that has been recovered by other means or that cannot be captured. The equation for calculating the volume of traction sand storage is:

$$V = (S \times R \times L \times E)/F \qquad \text{(Eq. 9)}$$

where:

V = The total volume of traction sand that must be stored (ft^3).
S = The estimated volume of sand applied (ft^3/yr).
R = A factor to account for sand recovered by roadway sweeping.
L = A factor to account for other miscellaneous losses/accumulations.
E = A factor to account for recovery efficiency.
F = The number of times the trap will be cleaned (times/yr).

Guidelines for defining the variables in this equation are as follows:

S: Typical sand application rates range from 100 $yards^3$/lane/mile/yr for areas with average application rates to 200 $yards^3$/lane/mile/yr for areas with high application rates. To estimate the total volume of traction sand applied, select an appropriate application rate from the range listed in this section, and multiply it by the total number of lanes (e.g., one lane in each direction equals two lanes) and the length of highway tributary to the Traction Sand Trap. Because some areas track sand usage by post mile, a more accurate estimate may be obtained by consulting with District Maintenance staff. In any event, consider the following guidelines when estimating the volume of sand that is spread annually in the tributary area:

Exposure: Roadways on north facing slopes generally require more traction sand than similar south facing slopes. The surrounding vegetation may also significantly affect exposure and traction sand application.

Roadway grade: Steeper grades generally receive more traction sand than flatter grades.

Other climatic and geographic factors, such as elevation, will affect the traction sand application rate for a specific area.

Other sources of similar material: Adjacent cut slopes and other non-paved tributary areas may contribute similar-sized sediment or other debris that will be retained in the trap.

R: This is a factor to account for traction sand that is recovered through roadway sweeping. Estimate a value between 1.0 (no roadway sweeping) and 0.6 (aggressive winter roadway sweeping) based on interviews with District maintenance staff. If actual sweeping records are available, these may provide a more accurate estimate.

L: This is a factor to account for traction sand that has been carried into or out of the tributary area by miscellaneous means such as wind (smaller particles), sand thrown out of the tributary area by snow clearing equipment, and sand splashed or carried by vehicles. Estimate an appropriate value in the range of 0.8 (high losses from known sources such as snow blowers) to 1.2 (high accumulation from known sources). Use a factor of 1.0 for no miscellaneous losses/accumulations.

E: This factor is provided to account for traction sand that passes through the Traction Sand Trap without settling out. Because of particle size limitations, settling inefficiencies, and other factors, it may not be realistic or practicable to recover all of the traction sand that reaches the Traction Sand Trap. Until empirical information is obtained from pilot studies, a value of 1.0 should be used for this factor.

F: This is the number of times the sand trap will be cleaned each year. Usually, the value for F is 1 as most Traction Sand Traps are cleaned once per year, usually in the summer. If obtaining the required storage volume is difficult, it may be possible to implement mid-season cleaning (F greater than 1), but District Maintenance staff should be consulted to make sure this is practicable. Mid-season cleaning requirements will also likely affect trap design, as maintenance equipment will have to access the trap under wet or snowy conditions.

Other design issues: Traction Sand Traps configured as vaults 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. Provide if possible at least 0.5 ft between top of captured sand and outlet pipe. Weep holes should be provided and the trap invert should be sufficiently high above groundwater 3 to 6 ft to allow for proper drainage. Traction Sand Traps that do not drain may create vector problems in the spring.

Maintenance needs: Traction Sand Traps require sufficient space and/or access ramps for maintenance by large equipment to remove the accumulated sand. Traction Sand Traps should also be located so that water is not infiltrated above the roadway subgrade should the Traction Sand Trap become blocked or fail to drain so as not to affect expected life of the pavement.

Preliminary design factors for Traction Sand Traps are summarized in Table B-5.

Table B-5: Summary of Traction Sand Trap Siting and Design Criteria

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. Designed for peak hydraulic flow. Treatment Mechanisms: • Sedimentation Pollutants removed: • Sand or other traction-enhancing substances	• Sites where sand or other traction-enhancing substances are commonly applied to the roadway • Not considered where sand is used only rarely (less than twice a year) • Use Detention Basins or forebays as Traction Sand Traps whenever feasible; if they are not feasible, then consider tanks or vaults • Consult District/Regional NPDES Storm Water Coordinator 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 anticipated sand recovery and cleanout interval • To the extent possible, stabilize areas within the tributary area to control sediment loads • Divert peak hydraulic flow if practical • Design to avoid or minimize scour • Provide, if possible, temporary storage volume (for sedimentation) using a minimum of 0.5 ft between top of sand (just prior to scheduled cleanout) and outlet pipe • Sufficient hydraulic head for gravity flow • Inlet and outlet arrangement to minimize short-circuiting of the flow • Weep holes to allow proper drainage • Invert 3 to 6 ft above groundwater if drainage is allowed through base (CMP riser type) • Maximum depth of tank or vault of 10 ft below ground surface (varies with equipment – consult District Maintenance) • Maintenance space and/or access ramps for large equipment (a maintenance vehicle access shoulder of up to 16 ft may be required; consult with District Maintenance)

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B.6 DRY WEATHER FLOW DIVERSION

B.6.1 Description

Dry Weather Flow Diversion devices provide permanent treatment by directing non-stormwater flow through a pipe or channel to a local municipal sanitary sewer system (publicly owned treatment works [POTWs]) during the dry season or dry weather. This flow must be generated by Caltrans activities or from Caltrans facilities.

B.6.2 Appropriate Applications and Siting Criteria

Dry Weather Flow Diversions 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, or having significant quantities that are periodically developed on-site), and contains pollutants;
- An opportunity for connecting to a sanitary sewer is reasonably close and would not involve extraordinary plumbing, features or construction practices to implement (e.g., jacking under a freeway);
- The POTW is willing to accept the flow during the dry season or dry weather.

An example of dry weather flow that could be considered for diversion is the runoff from a Caltrans tunnel generated during cleaning using water spray and scrubbing.

B.6.3 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 or during storms during the wet season (if the diversion will be made year-round). Accordingly, the conveyance to the sanitary sewer should be sized for the dry weather (non-storm) flows only. Wet weather flow is diverted (or remain undiverted, depending upon the design) back to the stormwater conveyance system.

If possible, a screen or trash rack 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 B-6.

Table B-6: Summary of Dry Weather Flow Diversion Siting and Design Criteria

Description	Applications/Siting	Preliminary Design Factors
Direct flow during dry weather (or non-storm periods) to a POTW. Treatment flow rate determined on a site-specific basis (not the WQF). 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) • Connection would not involve extraordinary plumbing, features or construction practices to implement • POTW willing to accept dry weather flow	• 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 • Consider a screen or trash rack to limit debris conveyed to the POTW • Maintenance vehicle access

B.7 GROSS SOLIDS REMOVAL DEVICES: LINEAR RADIAL DEVICE AND INCLINED SCREEN DEVICES

B.7.1 Description

Gross Solids Removal Devices (GSRDs) include physical or mechanical methods to remove litter and solids 0.20 inch nominal[6] and larger from the stormwater runoff, usually done using various screening technologies. GSRDs should be considered for projects in watersheds where a TMDL allocation or 303(d) listing for litter has been made. The design should be coordinated through the Headquarters – Office of Storm Water Management – Design. GSRDs should be designed to handle flows generated by the peak drainage facility design event, unless placed in an offline configuration. The devices also have an overflow feature in the event of clogging.

B.7.2 Appropriate Applications and Siting Criteria

There are currently two approved types of GSRDs that can be considered:

- The Linear Radial – this device requires very little head to operate and is well suited for narrow and relatively flat rights-of-way.
- The Inclined Screen – this device requires about 5.5 ft of head and is better suited for fill sections of the highways.

GSRDs require sufficient space and/or access ramps for maintenance and inspection including the use of vacuum trucks or other large equipment to remove accumulated trash.

B.7.3 Styles of Devices

B.7.3.1 Linear Radial Device

The Linear Radial Device (Figure B-8, page B-42) utilizes modular 2-ft diameter, stainless steel well casings with 0.20 inch by 2.5 inch nominal louver slots to remove gross solids, litter and debris from stormwater runoff. The louvered well casings are usually contained in a concrete vault. Flows pass radially through the louvers trapping litter and solids in the casing and passing flows through the screens for discharge via an outlet pipe. The bottom of the casing is smooth to allow trapped litter to move to the downstream end of the well casing. The Linear Radial Device is designed to work inline with the existing storm drain system or could be placed in an offline configuration; either placement will incorporate an overflow/bypass that will operate if the unit becomes plugged.

Detail sheets for construction are available for the Linear Radial GSRD for flows up to 21.91 cfs and debris volumes up to 47.5 cubic feet., A Linear Radial GSRD may be placed on a grade with slopes up to 1:4 (V:H). Other highlights of the Linear Radial GSRD include:

- Long and narrow shape, well-suited for narrow right-of-ways;
- Minimal hydraulic head needed for operation;

[6] The 0.20 inch dimension is based on requirements set forth in TMDLs applicable to certain District 7 watersheds; other sizes may be necessary if required to meet TMDLs issued by other RWQCBs.

- Overflow/Bypass opening at the upstream end;
- Multiple wall heights to accommodate varying pipe depths;
- Graded with slopes up to 1:4 (V:H)
- Six lengths to accommodate varying flow rates and debris areas;
- Sloped floor for self-draining without permanent pool of water;
- Solids storage volume to accommodate a once per year maintenance cycle;
- Circular louvered sections have access doors that can be easily opened to facilitate cleaning with a vacuum truck or other equipment if necessary;
- Grated cover for safety.

There are two Linear Radial configurations. One model (referred to as “Linear Radial”) is used for influent runoff velocities up to 8.2 feet per second; as shown in Figure B-8, the first half-meter of the Linear Radial well casing is non-louvered with an open top to allow for influent bypass should the device become clogged with litter. The other model (referred to as “Linear Radial (HV)”) is for influent velocities greater than 8.2 feet per second, and is shown in Figure B-9. The Linear Radial (HV) has an energy dissipation vault separate from the main vault, and overflows occur by overtopping the initial vault into the second chamber.

Rendered images of the Linear Radial (HV) are presented in Figures B-8 and B-9.

Figure B-8: Schematic of Linear Radial Device

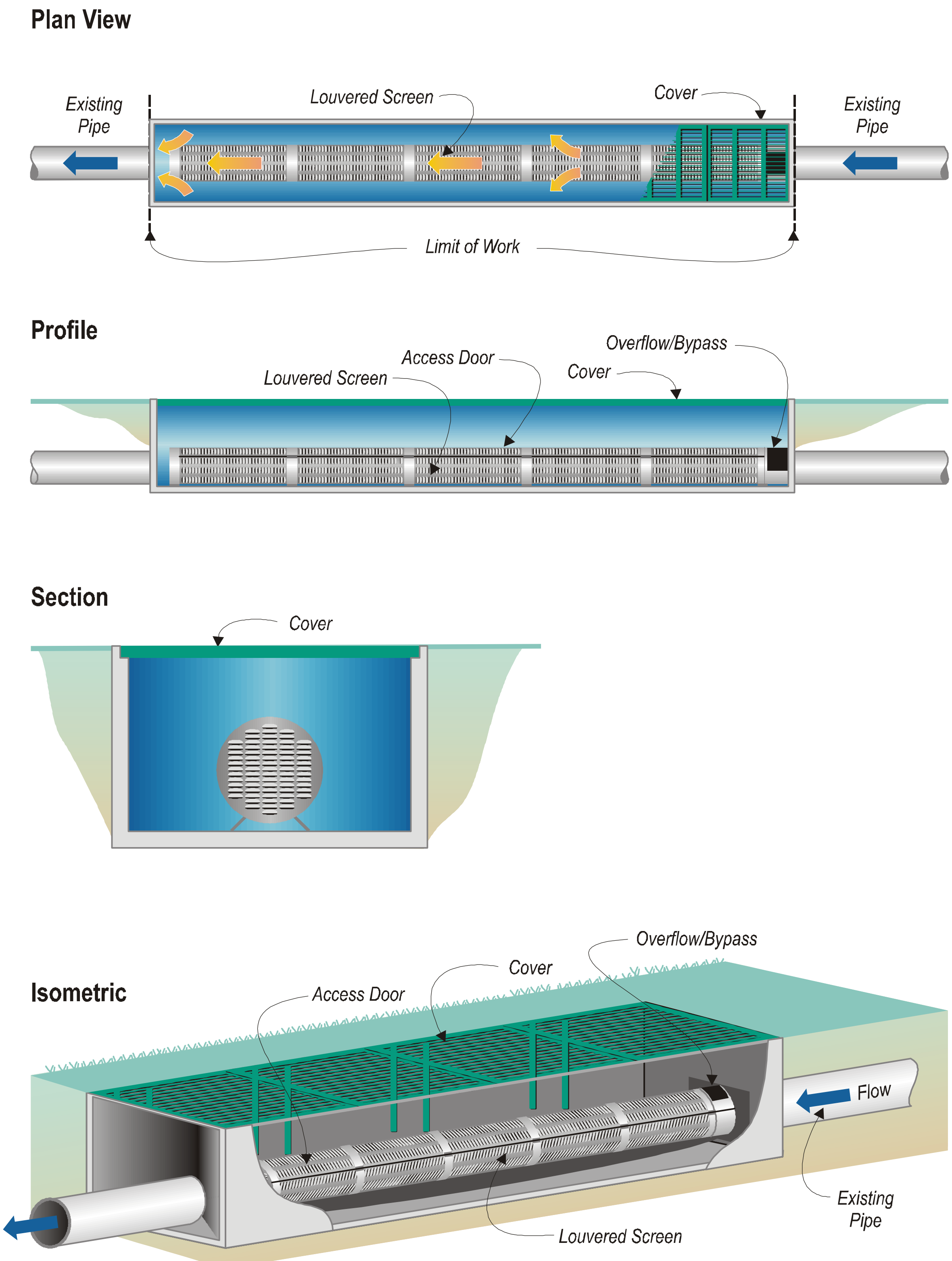
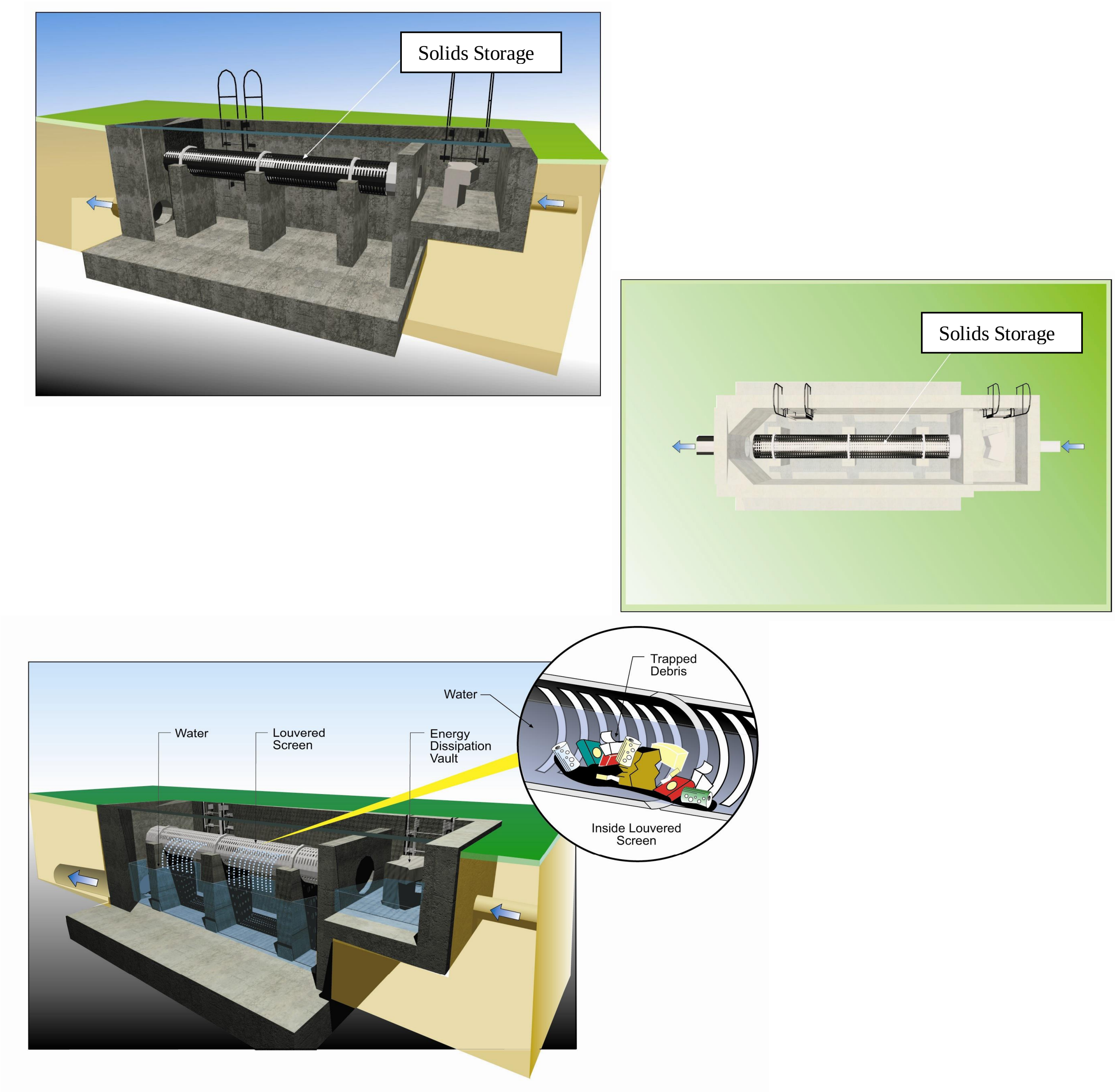


Figure B-9: Schematic of Linear Radial Device (HV)[7]



[7] Schematics shown represent one configuration; other configurations exist that operate with lower available hydraulic head.

Figure B-10: Linear Radial Device (partially full)

B.7.3.2 Inclined Screen Devices

Two versions of the Inclined Screen Device have been tested, and for which details sheets are available from HQ Office of Storm Water Management. In one the incoming flow overtops a weir and falls through an inclined bar rack (wedge-wire screen) with a 0.20-inch nominal maximum spacing between the bars, located after the influent trough. After passing through the rack, the flow exits the device via the discharge pipe. A distribution trough is provided to allow influent to be distributed along the length of the Inclined Screen. The litter captured by the bar rack is pushed down toward the litter storage area by the stormwater runoff. This version employs a parabolic wedge-wire screens inclined at 60 degrees and 3 ft high. The gross solids storage area is sloped and is provided with a drain to prevent standing water. As shown in Figure B-11 (page B-47), an opening above the litter storage area is provided to allow for overflow/bypass if the device becomes plugged. The device should be designed for litter and debris storage for a period of one year.

A second version uses a straight screen, and incoming flow is not required to overtop a weir to reach the screen (see Figure B-12).

Figure B-11: Type 1 Inclined Screen Device Schematic

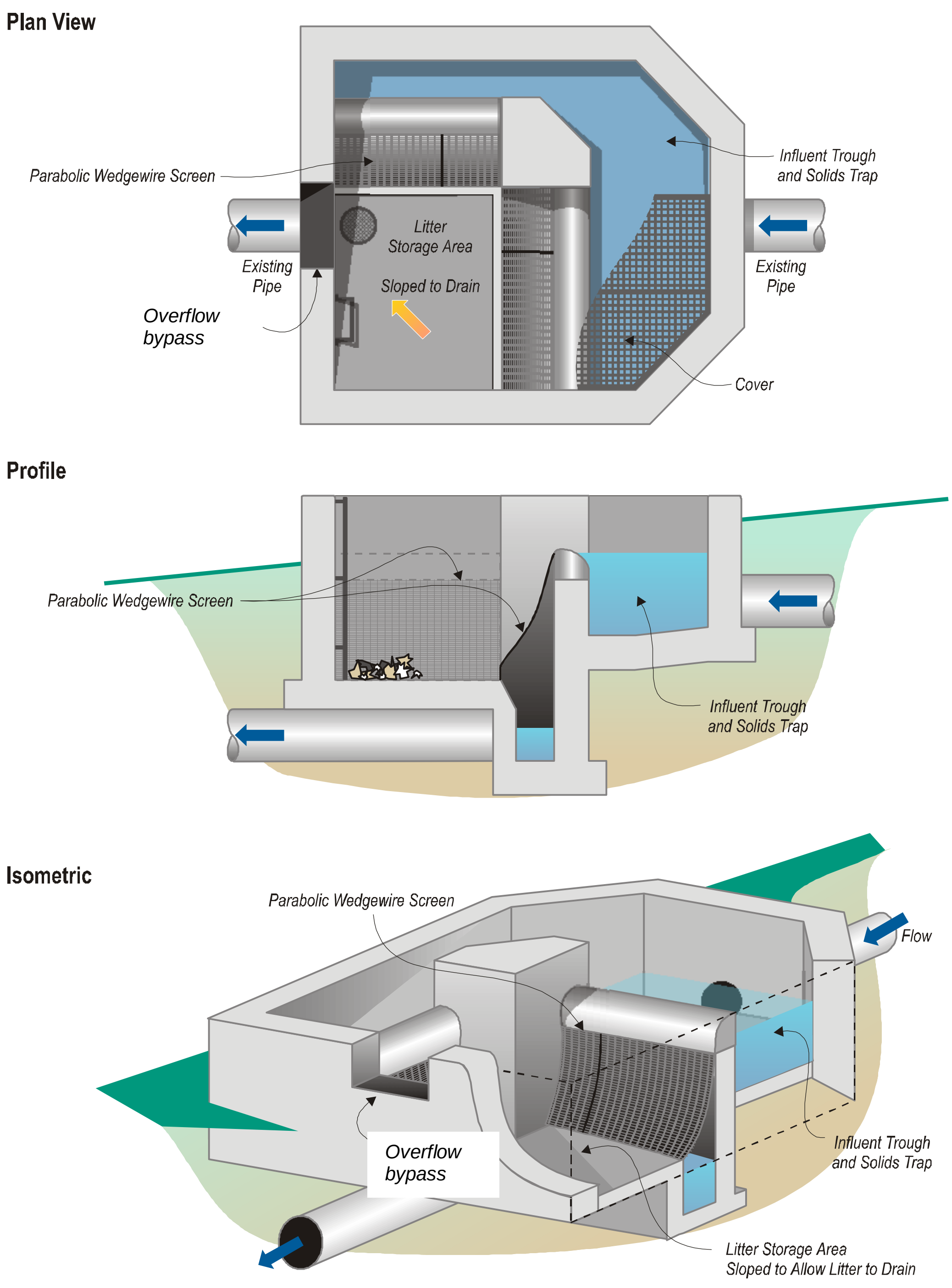
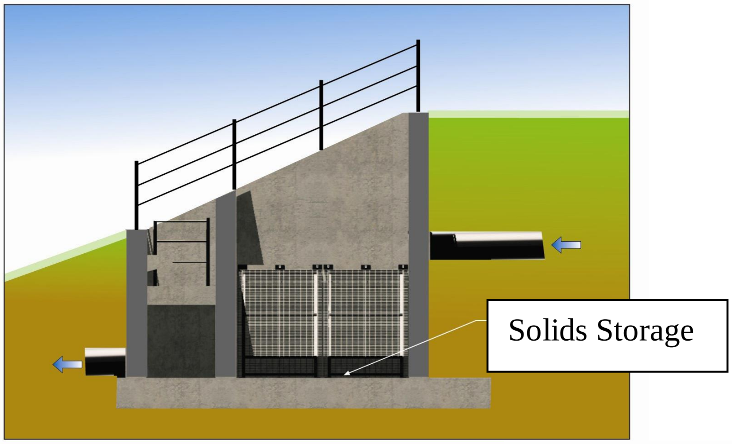
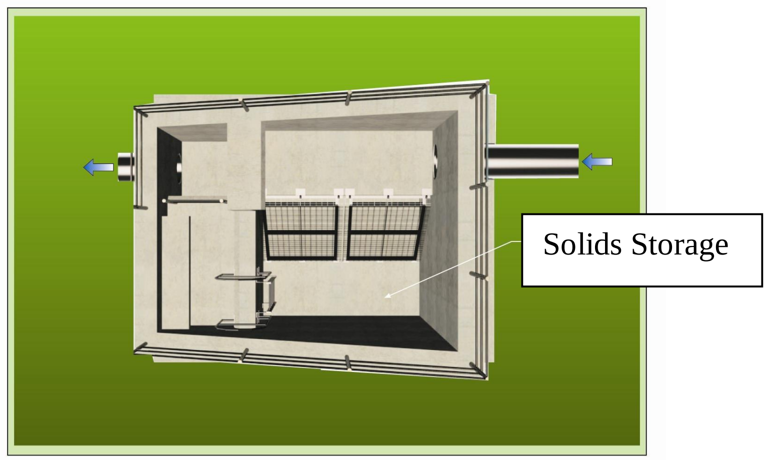


Figure B-12: Type 2 Inclined Screen Device Schematic





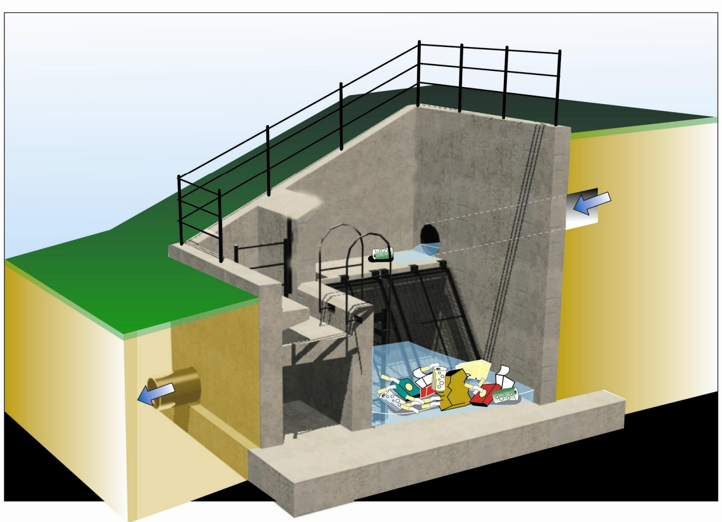


Figure B-13: Inclined Screen GSRD

B.7.4 Factors Affecting Preliminary Design

The two most important factors affecting the design of these devices are: a) sizing to accommodate gross solids storage for a given maintenance period (typically one year), and b) maintaining the hydraulic capacity of the drainage system in which it is to be installed. Litter and debris accumulation data need to be available to properly size the devices for the given drainage area. If regional litter and debris accumulation data are not available, then 10 ft^3/acre/yr may be used. Designers should consult with District Maintenance regarding litter and debris loads, access requirements for cleaning equipment, and District Hydraulics concerning drainage issues. These devices can be designed both online and offline.

Table B-7 provides external GSRD dimensions based on anticipated annual litter and debris accumulation and calculated maximum flow rate.

Table B-7: Summary of Dimensions for Gross Solids Removal Devices[8]

GSRD	Type	Max. Annual Litter/Debris Accumulation (cubic feet)	Max. HDM Flow Rate (cfs)	Out-to-out Dimension: Length (ft)	Out-to-out Dimension: Width (ft)
Linear Radial	LR-1	7.9	3.54	14.5	11.5
Linear Radial	LR-2	15.8	7.07	19.5	11.5
Linear Radial	LR-3	22.5	10.96	24.5	11.5
Linear Radial	LR-4	31.6	14.49	29.5	11.5
Linear Radial	LR-5	39.5	18.38	34.5	11.5
Linear Radial	LR-6	47.5	21.91	39.5	11.5
Linear Radial (HV)	LR(HV)-1	7.9	3.54	17.3	11.5
Linear Radial (HV)	LR(HV)-2	15.8	7.07	22.3	11.5
Linear Radial (HV)	LR(HV)-3	22.5	10.96	27.3	11.5
Linear Radial (HV)	LR(HV)-4	31.6	14.49	32.3	11.5
Linear Radial (HV)	LR(HV)-5	39.5	18.38	37.3	11.5
Linear Radial (HV)	LR(HV)-6	47.5	21.91	42.3	11.5
Type 1 Inclined Screen	1-A	24.6	9.66	17.2	13.5
Type 1 Inclined Screen	1-B	51.3	14.48	20.5	16.8
Type 1 Inclined Screen	1-C	87.7	19.31	23.8	20.2
Type 2 Inclined Screen	2-A	14.2	2.91	13.2	14.5
Type 2 Inclined Screen	2-B	21.2	4.37	14.8	14.5
Type 2 Inclined Screen	2-C	28.3	5.83	16.5	14.5
Type 2 Inclined Screen	2-D	35.4	7.28	18.2	14.5

[8] If HDM flow rate > 22 cfs, then a special design or bypass is required. Contact District Storm Water Coordinator.

A summary of preliminary design factors is presented in Table B-8:

Table B-8: Summary of Gross Solids Removal Devices (Linear Radial and Inclined Screen)

Description	Applications/Siting	Preliminary Design Factors
Devices to capture and remove litter from the stormwater runoff. • Designed to handle up the flow from the peak drainage facility design event (reference HDM Chapter 830) unless placed in an offline configuration Treatment Mechanisms • Filtration through screens Pollutants removed • Litter and solid particles greater than 0.20 inch nominal	• Site conditions must have adequate space for device and maintenance activities. • Sites that drain to litter sensitive receiving waters on 303(d) list for trash or areas where TMDLs require trash removal. • The Linear Radial Device requires little head to operate and is well suited for flat sections of highway. • The Inclined Screen requires approximately 5.5 ft of head measured between the top of the weir above the screen and the flowline of the outflow pipe; it is well suited for fill sections. • Locate outside the Clear Recovery Zone (HDM Topic 309.1), or consult with Traffic Operations to determine if guard railing is required	• Design using regional litter accumulation data if available, otherwise use 10 ft^3/acre/yr. • Devices must be sized for peak design flow while holding design (typically annual) gross solids load. • Some TMDLs also require full capture for events of up to a one-year, one-hour storm event (i.e., runoff should not be bypassed in the GSRD under that flow rate). Determine if this or other specific TMDL requirements apply at the project site. • The standard Linear Radial Device well casing is 24 inch diameter. • Standard designs for the Linear Radial GSRD have been evaluated for flows up to 22 cfs. If design flows exceed 22 cfs, then consider incorporating a flow-splitter device upstream of the GSRD to divert peak flows. • Structure and grate do not support traffic load. Traffic-rated GSRD would require special design. • Determine location and depth of device for maintenance access (coordinate with District Maintenance)

B.8 MEDIA FILTERS

B.8.1 Description

A Media Filter Treatment BMP device primarily removes TSS pollutants (sediments and metals) from runoff by sedimentation and filtering, and also is effective for dissolved metals, litter and potentially some nutrients (depending upon type of Media Filter selected).

There are two types of approved Media Filter devices: The Austin Sand Filter and the Delaware Sand Filter; each is configured using two chambers. An Austin Sand Filter is usually open and at grade, and has no permanent water pool; a Delaware Sand Filter is always configured with closed chambers and below grade, and has a permanent pool of water. An Austin Sand Filter may be configured with earthen or concrete sides and invert; a Delaware Sand Filter is always made using concrete sides and invert.

In both types of Media Filters, stormwater is directed into the first chamber where the larger sediments and particulates settle out, and the partially treated effluent is metered into the second chamber to be filtered through a media. In the Austin Sand Filter, the first chamber may be sized for the entire WQV ('full sedimentation') (see Figure B-15, page B-53) or as a 'partial sedimentation' chamber, holding only about 20% of the WQV (see Figure B-16, page B-54); the Delaware Sand Filter holds the entire WQV in the initial chamber, and is designed to pass the WQV from the second chamber (see Figure B-17, page B-55).

The treated effluent (filtered water) is captured by perforated underdrains (collector pipes) for release downstream. There is a drop in elevation of 3 ft to 6 ft between the invert of the inlet pipe and the invert of the device outflow pipe depending on device type, size or configuration.

The filter media typically consists of sand, which is effective for removal of coarse and fine sediments and particulate metals. Other materials, such as topsoil or organic materials may be added to the sand to increase the treatment capacity for some pollutants (for example, dissolved metals) but these additives often increase the nitrogen and phosphorus concentration levels in the effluent. Design of a Media Filter must be coordinated through the Headquarters Division of Environmental Analysis – Policy, Planning and Permitting, and Headquarters Design – Office of Storm Water Management.

Figure B-14: Caltrans Pilot Media Filters (Austin Sand Filter [left], Delaware Sand Filter [right])

B.8.2 Appropriate Applications and Siting Criteria

The minimum WQV for Media Filters is ≥ 4,356 ft^3 (0.1 acre-ft [a-f])[9]. Medial Filters will perform better if the tributary area has a relatively high percentage of impervious area, and low sediment loading.

Sites proposed for Media Filters must have sufficient hydraulic head to operate by gravity; generally between 3 to 6 ft of elevation drop is needed between the inflow to the initial chamber and effluent outflow from the second chamber.

Unless concurrence for the use of Delaware Sand Filters can be obtained from the local vector control agencies, the placement of a Delaware Sand Filter, which maintains a permanent pool of water in the sedimentation chamber, should be avoided in locations where there are concerns about vector control. It is anticipated that standard details for a vector-proof Delaware Sand Filter will be developed; contact the District/Regional NPDES Coordinator for availability.

For earthen-type Media Filters, at least 10 ft separation from seasonally high groundwater should be provided. For vault-type Media Filters, the level of the concrete base of the vault must be above seasonally high groundwater unless by special design.

B.8.3 Preliminary Design Factors

B.8.3.1 General Factors

Maintenance must have access to both chambers, and the distance below ground surface of the invert must be approved by Maintenance (maximum depth of 13 ft).

For the Austin Sand Filter designed for full sedimentation (see B.8.1), the following design features should be incorporated: a) the initial chamber should be sized to hold the entire WQV using a 24-hour release time; b) release to the second chamber is usually made using a perforated riser; and c) a minimum length to width ratio of 2:1 for the initial (sedimentation) chamber at the WQV elevation should be provided.

For partial sedimentation Austin Sand Filters the following design features apply: a) the initial chamber should be sized to hold a minimum of 20% of the WQV; b) release from the first chamber is made using a rock-filled gabion wall separating the chambers; c) the length to width ratio does not apply; and d) the sum of the volume of the sedimentation chamber plus the total volume stored in the filtration chamber should be ≥ the WQV. The volume stored in the filtration chamber is equal to the volume above the media material plus 35% of the media volume which accounts for void spaces within the media.

Figure B-15 provides a schematic of a full sedimentation Austin Sand Filter, while Figure B-16 provides a schematic of a partial sedimentation Austin Sand Filter.

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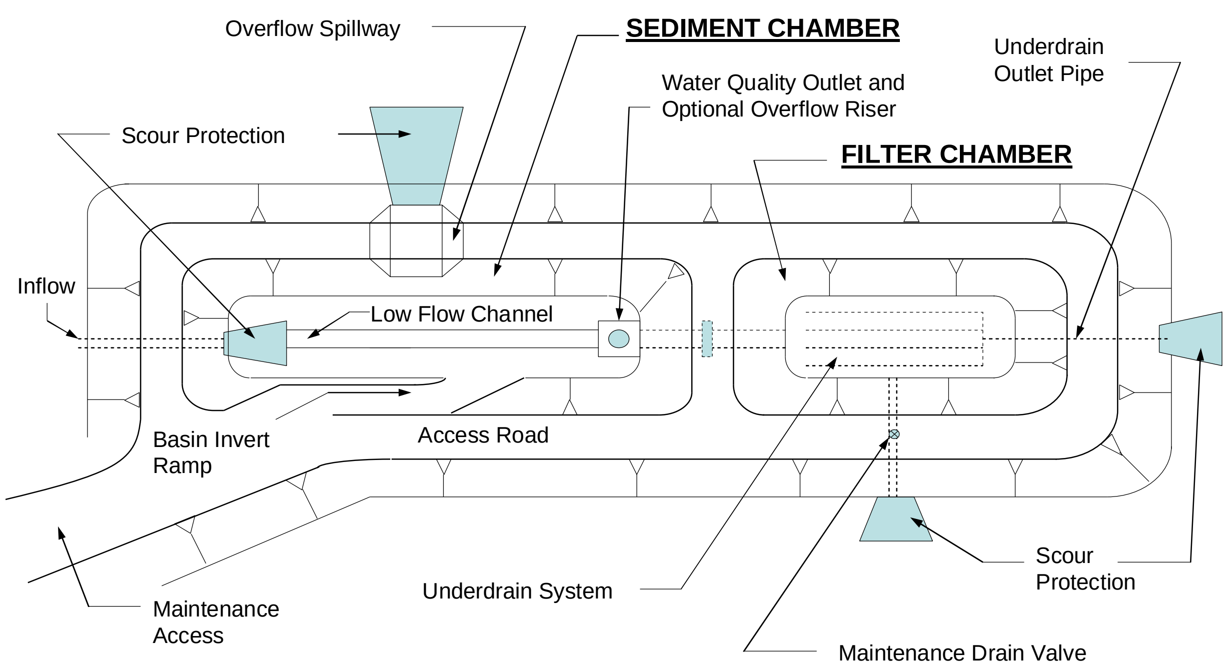
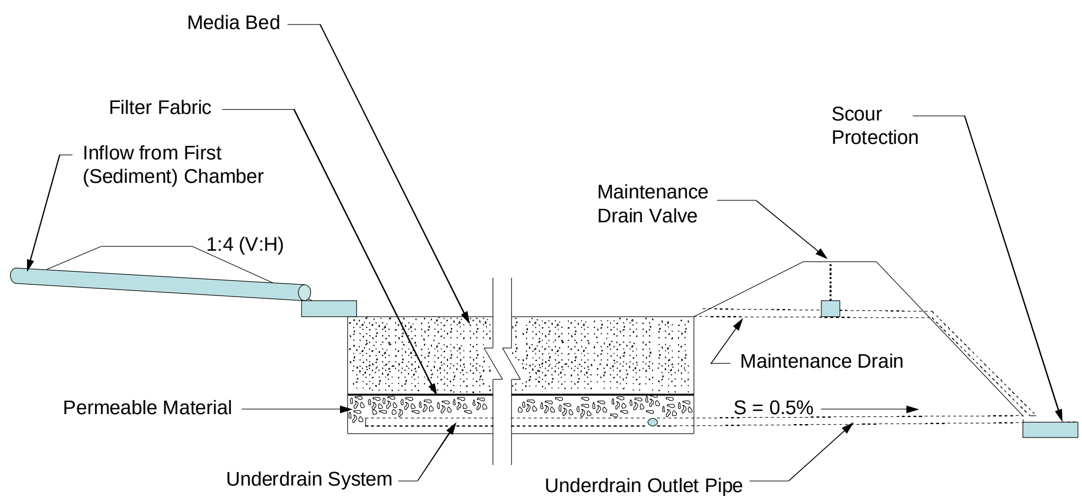
[9] Consult with District/Regional NPDES if less than 4,356 ft^3 is under consideration.

Figure B-15: Schematic of a Austin Sand Filter - Full Sedimentation (Earthen Type)



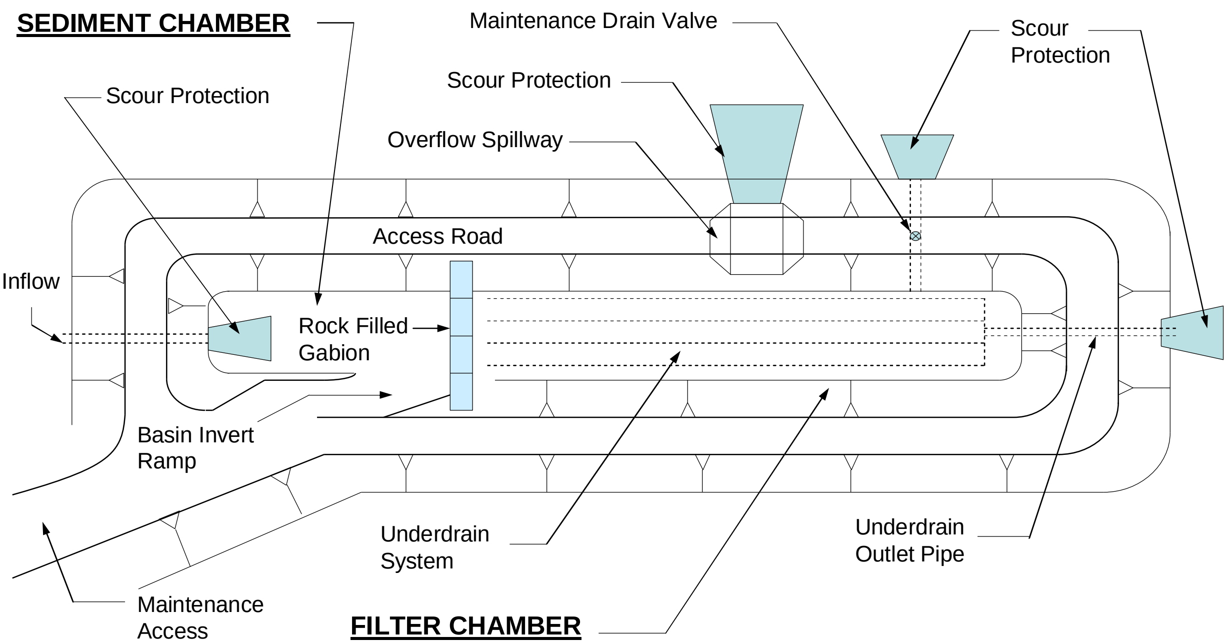
Plan View



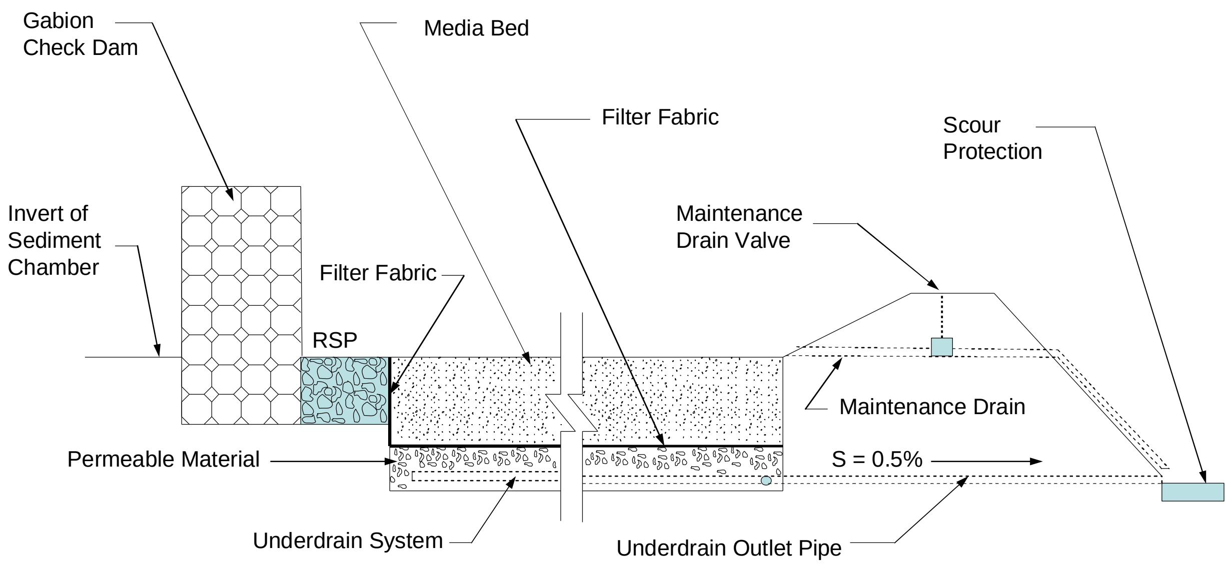
Second (Filter) Chamber Cross Section

NOT TO SCALE

Figure B-16 Schematic of an Austin Sand Filter - Partial Sedimentation (Earthen Type)



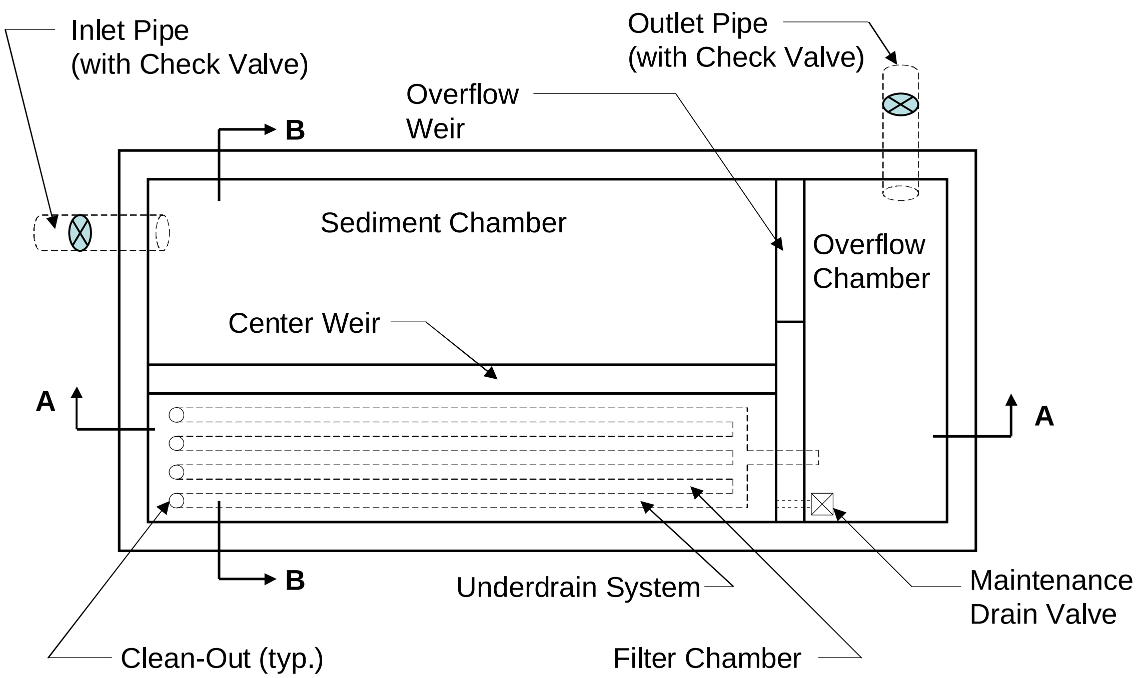
Plan View



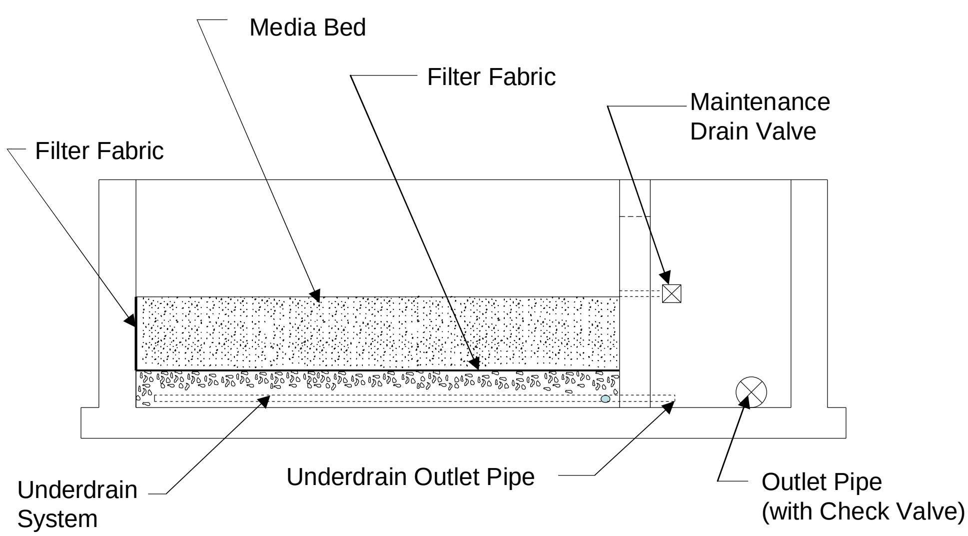
Second (Filter) Chamber Cross Section

NOT TO SCALE

Figure B-17: Schematic of a Delaware Sand Filter

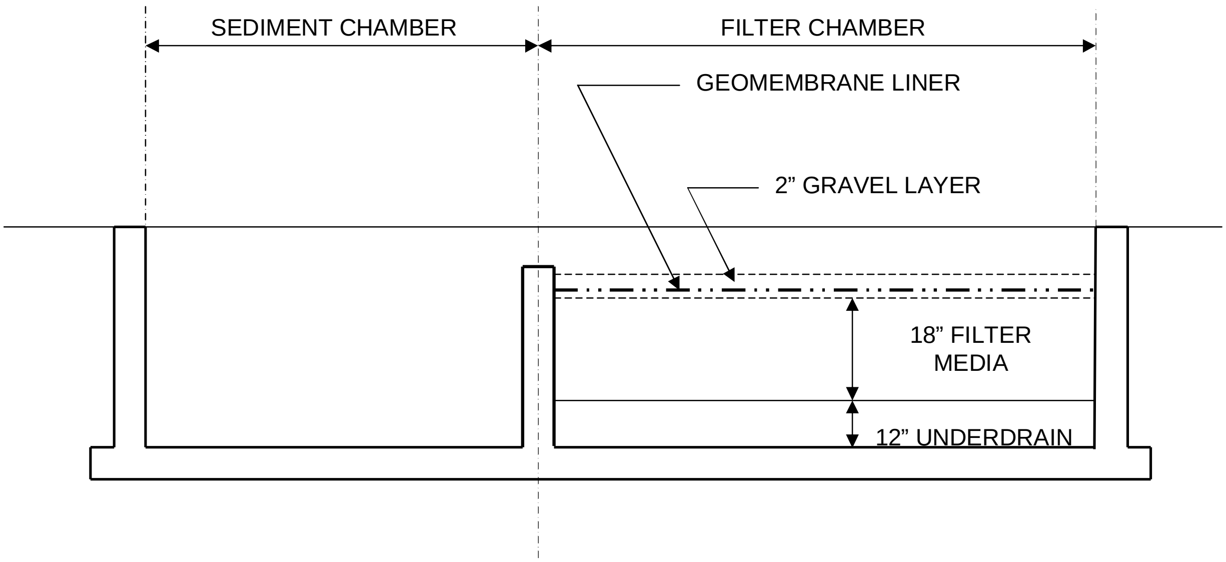


Plan View



Section A-A

Figure B-17 (Continued): Schematic of a Delaware Sand Filter



Section B-B

STANDARD LAYOUT

Other general factors include:

- Austin Sand Filter: Depth of the media layer (sand filter layer) typically 1.5 ft, and the gravel layer (collector layer) is 1.0 ft.
- Austin Sand filter with earthen base and sides, full or partial: side slopes should be 1:3 (V:H) or flatter, and should be stabilized by vegetation. Consult the District Office of Landscape Architect for types of vegetation that can function effectively in each of the various ecological subregions of a District. Additional information about grasses that have been successful within specific ecological subregions of California, in grassland and wetland conditions, may be found in *Ecological Subregions of California Section and Subsection Descriptions* (as referenced in Appendix B, Biofiltration Strips and Swales).
- Delaware: Depth of the media layer (sand filter layer) is 1.5 ft; depths of the two gravel layers are: top layer at 2.0 inches, and lower layer (collector layer) at 1.0 ft. Separate layers using geotextile fabric.
- For all types of Media Filters, upstream bypass for larger storms is preferred for storms > WQV; internal overflow protection also must be provided through the device, typically using weirs from the initial chamber.
- Upstream litter and sediment capture should be provided if possible, e.g., using Biofiltration or a forebay.

Preliminary Design Factors for Media Filters are summarized in Table B-8.

B.8.3.2 Austin Sand Filter Chambers - Full Sedimentation Device

Size the initial chamber to hold the WQV, and use the equation for the outlet riser presented under Detention Devices (Section B.4.1) to determine the diameter of the orifices, using a 24-hour hold time.

The equation for sizing the filter bed in the second chamber is:

$$A_{fc} = [C \times WQV \times d] / [k \times T \times (h + d)] \qquad \text{(Eq. 10)}$$

Where:

A_{fc}	=	area of 2nd chamber filter bed, full sedimentation basin; ft^2
C	=	conversion factor for units of permeability (12 for inches to ft)
WQV	=	Water Quality Volume; ft^3
d	=	depth of sand layer in the Austin-style filter bed, typically 1.5 ft
k	=	coefficient of permeability of the filtering medium; US Customary units: 2 inches/hr
T	=	design drain time for WQV, equal to 24 hours
h	=	average water height above the surface of the media bed, taken as ½ the maximum head of the second chamber (distance to any overflow device from that chamber to the surface of the media bed); ft

B.8.3.3 Austin Sand Filter Chambers, Partial Sedimentation Device

When sizing the two chambers for the Austin Sand Filter - Partial Sedimentation device, the following procedures are recommended:

First, size the filter bed in the second chamber using the following formula:

$$A_{fp} = 1.8A_{fc} \qquad \text{(Eq. 11)}$$

Where:

A_{fp} = area of 2nd chamber filter bed for a partial sedimentation device, and A_{fc} is calculated as above.

Note that the filter area is larger in the partial sedimentation version than the full sedimentation version due to the less efficient capture of sediments in the partial sedimentation device.

Then size the initial chamber to hold a minimum 20% of the WQV, subject to increase to meet the requirement that both chambers (including the void space in the filter chamber calculated using Eqn. 14 shown on page B-61) combine to hold the entire WQV.

With these requirements, the area of the Austin Sand Filter - Partial Sedimentation device is usually about 80 to 90% of the Austin Sand Filter - Full Sedimentation device. However, the efficiency of the partial sedimentation design is not greatly different from the full sedimentation version, and the overall maintenance is usually reduced because the release of stormwater from the partial sedimentation chamber to the filter chamber is usually done through a rock-filled gabion wall (and not an outlet riser), and no hold time is assigned to the water in the initial (sedimentation) chamber.

B.8.3.4 Delaware Sand Filter Chambers

When sizing the two chambers for the Delaware Sand Filter, the following procedure is recommended:

The area of the filter chamber is calculated using the following equation:

$$A_{fc} = [C \times WQV \times d] / [k \times T \times (h + d)] \quad \text{(Eq. 12)}$$

where

A_{fc} = area of filter chamber; ft^2
C = conversion factor for units of permeability (12 for inches to ft)
WQV = Water Quality Volume; ft^3
d = depth of sand layer in the Delaware filter bed, typically: US Customary units: 1.5 ft
k = coefficient of permeability of the filtering medium; US Customary units: 1 inches/hr
T = design drain time for WQV, 40 to 48 hours
h = average water height above the surface of the media bed, taken as ½ the maximum head of the second chamber (distance to any overflow device from that chamber to the surface of the media bed); ft

Note that the formula for the Delaware Sand Filter is very similar to that used for the full sedimentation Austin Sand Filter, except for the value assigned to the permeability (even though the same material is used); a more conservative permeability value is assigned to the Delaware Sand Filter, as the device, being underground and not directly visible during the wet season, requires a more conservative design.

Then, series of calculations must be made to verify that the required storage areas are sufficient. Step 1: Select a width for the chambers, normally between 1.5 feet and 2.5 feet, not including the one-foot thick concrete wall between them), and compute the length based on the area calculated above:

$$L_s = L_f = A/W \quad \text{(Eq. 13)}$$

where
L_s = length of the sediment chamber, ft
L_f = length of the filter chamber, ft
A = Area used for individual chambers (A_{sc} or A_{fc}), calculated above, ft^2
W = selected width for individual chamber (not total width), ft

Step 2: Calculate the storage volume available for water in the filter chamber (filter media), V_V:

$$V_V = 0.35A_{fc} \times (d + d_g) \quad \text{(Eq. 14)}$$

where

V_v = available storage volume of the filter chamber; ft^3
A_{fc} = area of the filter chamber; ft^2
d = depth of the filter (sand) layer; US Customary units: 1.5 ft
d_g = depth of the gravel layer(s); US Customary units: 1.0 ft
0.35 = assumed void ratio (dimensionless)

Step 3: Calculate the flow through the filter during filling, V_Q

$$V_Q = (k \times A_{fc} \times [d + d_g] \times t_f) / (C \times d) \quad \text{(Eq. 15)}$$

where

V_Q = volume of water passing through filter during time to fill voids, ft^3
k, A_{fc}, d, d_g, and d_f are terms as defined previously
C = conversion factor for units of permeability
(12 for inches to ft)
t_f = time to fill the voids, take as 1 hour

Step 4: Calculate the net volume required to be stored in chambers awaiting filtration, V_{ST}

$$V_{ST} = WQV - V_V - V_Q \quad \text{(Eq. 16)}$$

Step 5: Calculate available storage in chambers, V_{SF}

$$V_{SF} = 2h \times (A_{fc} + A_{sc}) \quad \text{(Eq. 17)}$$

Step 6: Compare V_{SF} and V_{ST}

If $V_{SF} > V_{ST}$, proceed with the design
If $V_{SF} > V_{ST}$, adjust the length or the width or either chamber, and repeat these Steps 1 through 5.

Table B-9: Summary of Media Device Siting and Design Criteria

(Applicable to both Austin Sand Filter and Delaware Filter unless noted)

Description	Applications/Siting	Preliminary Design Factors
Two-chambered treatment devices designed to treat the WQV. Treatment Mechanisms • Sedimentation • Filtration Pollutants removed • Suspended solids • Particulate metals • Dissolved metals • Litter (although preferred capture is upstream of the device) • Nutrients	• WQV ≥ 4,356 ft^3 (0.1 a-f). For WQV < 0.1 a-f, contact the District/Regional NPDES Coordinator. • Site must have sufficient hydraulic head to operate by gravity between inflow to the initial chamber and effluent outflow from the second chamber, about 3.0 to 6.0 ft. • Delaware Media Filters should avoid locations where there are concerns about vectors because they maintain a permanent pool of water unless concurrence for its use can be obtained from the local vector control agency. • For earthen-type Media Filters, at least 10 ft separation from seasonally high groundwater should be provided. For vault-type Media Filters, the level of the concrete base of the vault must be above seasonally high groundwater unless by special design. • Will perform better if the tributary area has a relatively high percentage of impervious area, and low sediment loading. • Maintenance must have access to both chambers. • Locate outside the Clear Recovery Zone (HDM Topic 309.1), or consult with Traffic Operations to determine if guard railing is required.	• Maximum depth: 13 feet below ground surface; verify with Maintenance • Upstream bypass for larger storms is preferred but bypass for storms > WQV must be provided through the device, typically using weirs from the initial chamber. • Provide if possible upstream litter and sediment capture, e.g., using Biofiltration or a Sediment Forebay. • Collector pipes: minimum 6 inches diameter laterals, and minimum 8 inches diameter collector pipe • Sand media: use Caltrans Standard Specification 90-3.03 for fine aggregate; Gravel: use Caltrans Standard Specification 68-1.025, Permeable Material, Class 1, Type B; separate layers using geotextile.[10] • Austin, full sedimentation design: design the initial chamber to hold the entire WQV and use a 24-hour release time if site constraints allow, release to the second chamber using a perforated riser, and a length to width ratio of 2:1 should be provided for the sedimentation chamber. • For partial sedimentation designs, the initial chamber should be sized to hold ≥ 20% WQV and the volume of the sedimentation chamber plus 35% of the total volume of the filtration chamber (available storage volume of filtration chamber based upon 35% porosity of filter rock) should be ≥ the WQV; provide a rock-filled gabion wall separating the chambers. • For either Austin or Delaware Sand Filters: Drainage over 24 hours from the second chamber (filtering chamber). • Austin Sand Filter: no permanent vegetation is desired on the invert of the second chamber. • Austin Sand Filter with earthen base and sides, full or partial: side slopes should be 1:3 (V:H) or flatter, and should be stabilized by vegetation. Consult the District Office of Landscape Architect for types of vegetation that can function effectively.

[10] Media Filters: The filter fabric should meet the requirements of Caltrans Standard Specification Section 88-1.03, Filter Fabric. The gravel layer can function without an intermediary geotextile, if designed using 'graded filter' criteria (e.g., see Soil Mechanics, DM 7.01, NAVFAC, 1986, page 271ff).

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B.9 MULTI-CHAMBER TREATMENT TRAIN (MCTT)

B.9.1 Description

The MCTT is a stormwater treatment device that uses different treatment mechanisms in each of three sequential chambers. An MCTT device primarily removes TSS pollutants (sediments and metals) from runoff by sedimentation and filtering, and may also be effective for some dissolved metals, litter and nutrients. The MCTT was developed for treatment of stormwater at critical source areas, such as vehicle service facilities, parking areas, paved storage areas and fueling stations. A pilot MCTT installation is presented in Figure B-18, and a schematic of an MCTT is shown in Figure B-19.

The initial chamber, also called a 'grit' chamber, captures the larger sized sediments; this may be configured as a catch basin with a sump. Some variations are employed in this chamber, such as including a trash rack. The second chamber, also called the main settling chamber, is designed to capture fine sediments; this chamber may also be configured with sorbent pads designed to capture hydrocarbons. The third chamber, also called the filter chamber, employs a media bed often configured as a combination of sand and peat moss; it removes even finer sized particles than were captured in the previous chambers and acts as a sorption area for some dissolved constituents.

Figure B-18: Caltrans' MCTT pilot installations

Water flows from the initial chamber to the second chamber via either a weir or an orifice, and this chamber will have a permanent pool of water. Water flows from the second to third chamber via either an orifice or a weir. The effluent leaves the third chamber via an underdrain system located at the base of this chamber. The MCTT may be covered or uncovered, but if uncovered should be protected by a fence. The design of this device should be coordinated through the Headquarters Office of Storm Water Management – Design.

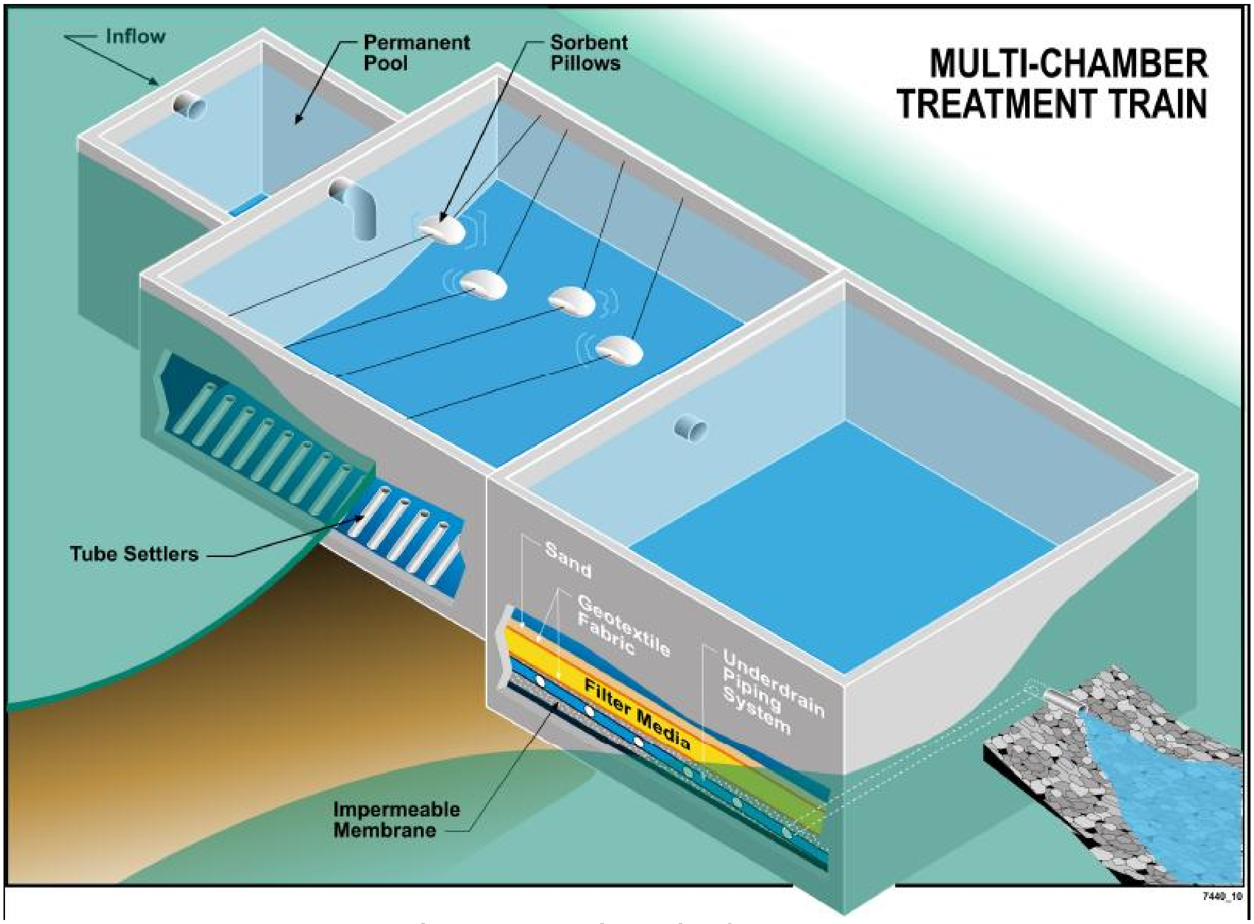


Figure B-19: Schematic of an MCTT

B.9.2 Appropriate Applications and Siting Criteria

The MCTT was developed for treatment of stormwater at critical source areas, such as vehicle service facilities, parking areas, paved storage areas, and fueling stations. To maintain longevity, potential sites should have a relatively high percentage of impervious surfaces contributing to the runoff, and runoff from the remaining area should not contain significant sediment. The WQV should be greater than or equal to 4,356 ft^3 (0.1 acre-foot [a-f]) for the MCTT to be considered.

Sites proposed for MCTTs must have a hydraulic head of approximately 5 ft to allow the device to operate by gravity. MCTTs are easier to place in flat to gently rolling terrain.

Designers should consult with the local vector agency regarding MCTTs proposed for locations having vector concerns due to the permanent pool of water present in the first and second chambers. If necessary, a MCTT may be provided with a permanent cover.

Upstream litter and sediment capture should be provided if possible, e.g., using Biofiltration or a forebay.

B.9.3 Preliminary Design Factors

B.9.3.1 General Factors

Maintenance vehicle access to all chambers is required for inspection, periodic maintenance, and cleanout.

The maximum depth to invert of second chamber is 13 ft below the ground surface; Maintenance must be able to access the invert at this depth.

Bypass overflow: offline placement of MCTTs is preferred, but the device should also have a separate overflow spillway, overflow riser or outlet pipe for events larger than the WQV, even if upstream diversion is provided; the overflow should be capable of passing the HDM design event (see Section B.1.3.1).

The combined storage capacity of all the MCTT chambers should be ≥ 100% of the WQV, excluding the permanent pool volumes in the grit and sedimentation chambers and the volume of the media in the filter chamber (assume a void ratio of 35% for the media bed which can be counted towards storage of the WQV). For 100% WQV storage in the device, the volume should be estimated as:

> *Total (100% WQV) = 10% WQV in grit chamber + live storage volume above the tube settlers in the sedimentation chamber + live storage in filter chamber including volume stored in media voids (assume 35% void ratio).*

If the site conditions allow, the second (sedimentation) chamber can be designed to store 90% of the WQV, with a minimum 24-hour drain time. The filter chamber should be designed to pass 75% to 100% of the WQV with a drain time of 24 to 48 hours.

Preliminary Design Factors for MCTT are summarized in Table B-10.

B.9.3.2 Sizing the MCTT Initial Chamber

The initial (grit) chamber should be sized to hold at least 10% of the WQV, with outflow to the second (sedimentation) chamber accomplished by using a weir or outlet pipes designed to pass a flow rate equal to the WQF (Water Quality Flow) or design flow for the site if bypass is not provided upstream. The weir or pipe outlet design should follow methods presented standard hydraulics texts. The depth of the initial chamber below the weir or outlet pipe invert should be at least 1.0 ft, to minimize re-suspension of sediments.

B.9.3.3 Sizing the MCTT Second Chamber

The size of the second (sedimentation) chamber depends on the site area available. If the site conditions allow, the second chamber can be designed to store 90% of the WQV above the permanent pool, and outflow to the third chamber can be regulated by a water quality outlet or an orifice for a minimum drain time of 24-hours.

If site conditions do not permit, the second and third chambers together may be designed to store a minimum of 90% of the WQV (refer to Equations 18 through 21). The outflow from the second chamber to the third chamber is generally accomplished via pipes located just at the top elevation of the tube settlers in the second chamber. The second chamber must have an overflow weir or pipe to pass runoff from storms larger than the Water Quality event if no upstream bypass is provided, or to pass volumes in excess of the second chamber storage volume (even if upstream bypass is provided).

B.9.3.4 Sizing the MCTT Third Chamber

The third chamber contains a filter bed. The surface area of this chamber should be sized to pass a minimum of 75% to 100% of the WQV within a drain time of 24 to 48 hours (Equation 18). As noted previously, the total minimum WQV for the filter chamber and sedimentation chamber should be 90% of the WQV. As noted in Section B.9.3.3, the volume of water stored above the media bed plus the volume of water stored within the media bed voids can be counted towards the total WQV, and the combined second and third chamber volume can be designed for a minimum of 90% of the WQV (Equations 19 and 20).The size is first calculated for the area of the filter bed, then the length is determined, as the width is usually set by the width of the second chamber.

The equation for calculating the area of the filter bed (third chamber) is:

$$A_f = (C \times VOL \times d) / (k \times T \times [h + d]) \qquad \text{(Eq. 18)}$$

where

A_f = area of filter bed in the third chamber, ft^2

C = conversion factor for units of permeability
12 for inches to ft

VOL = 75 to 100% of the Water Quality Volume, ft^3

d = depth of filter bed[11], typically about 1.0 to 1.5 ft

k = coefficient of permeability of the filtering medium;
2 inches/hr

T = design drain time for WQV, typically 24 to 48 hours

h = average water height above the surface of the media bed, taken as ½ the maximum head of the second chamber (distance to any overflow device from that chamber to the surface of the media bed); ft

The equation for calculating the length of the third chamber is:

$$L_{3rd\ chamber} = A_f / Width \qquad \text{(Eq. 19)}$$

Where:

$L_{3rd\ chamber}$ = length of the third chamber, ft

A_f = area of filter bed in the third chamber, ft^2

Width = width of filter bed selected for design, ft

[11] Note that in the final design for the MCTT a gravel layer is placed below the sand layer. This layer has a thickness of 1.0 ft, and it has within it the perforated underdrains.

The equation for determining the storage capacity in the third (filter) chamber is as follows:

$$V_{fc} = (L_{3rd\ chamber} \times Width \times h) + [0.35 \times L_{3rd\ chamber} \times Width \times (d+d_g)] \qquad \text{(Eq. 20)}$$

Where:

V_{fc} = storage capacity in third (filter) chamber, ft^3
$L_{3rd\ chamber}$ = length of the third chamber, ft
Width = width of filter bed selected for design, ft
h = average water height above the surface of the media bed, taken as ½ the maximum head of the second chamber (distance to any overflow device from that chamber to the surface of the media bed); ft
d = depth of filter bed, typically about 1.0 to 1.5 ft
d_g = depth of gravel under filter bed, typically about 1.0 ft
0.35 = assumed porosity of media and gravel

The volume of the second (sedimentation) chamber may now be calculated as follows:

$$V_{2nd\ chamber} = WQV - \text{Volume in first (grit) chamber} - V_{fc} \qquad \text{(Eq. 21)}$$

Where:

$V_{2nd\ chamber}$ = storage capacity in second (sedimentation) chamber, ft^3

Table B-10: Summary of Multi-Chamber Treatment Train Siting and Design Criteria

Description	Applications/Siting	Preliminary Design Factors
Vault-type multi-chambered treatment device Treatment Mechanisms: • Sedimentation • Filtration • Adsorption and ion exchange Pollutants removed: • Medium to fine sediments • Litter • Particulate metals • Some dissolved metals • Some nutrients	• WQV ≥ 4,356 ft³ (0.1 a-f) • Located at a areas as vehicle service facilities, parking areas, paved storage areas and fueling stations • Will perform better if the tributary area has a relatively high percentage of impervious area and/or a low sediment loading • Upstream litter and sediment capture should be provided if possible, e.g., using Biofiltration or a forebay. • Baffle wall or reverse pipe outlets can be used to control litter within the device • Site must have sufficient hydraulic head to operate under gravity flow, minimum 6 ft • MCTTs are not recommended for locations that have vector concerns due to the presence of a permanent pool of water in the second chamber; consult with local vector agency. • More appropriate in flat to gently rolling terrain • Locate outside the Clear Recovery Zone (HDM Topic 309.1), or consult with Traffic Operations to determine if guard railing is required	• Maintenance vehicle access to all chambers is required for inspection, periodic maintenance, and cleanout • Maximum depth to invert of second chamber of 13 ft below ground surface; verify that Maintenance can access invert at this depth. • Bypass overflow: offline placement of MCTTs is preferred, but the device should also have a separate overflow spillway, overflow riser or outlet pipe for events larger than the WQV, even if upstream diversion is provided; the overflow should be capable of passing the HDM design event (see Section B.1.3.1) • The second chamber employs an outlet orifice or weir to pass the runoff to the third chamber • Minimum of 100% WQV combined capacity for all chambers • Third chamber should be sized to pass a minimum of 75% to 100% of the WQV within a drain time of 24 to 48 hours • Third chamber filter media: 50% sand and 50% peat moss; for the sand: use Caltrans Standard Specification 90-3.03 for fine aggregate; Gravel: use Caltrans Standard Specification 68-1.025, Permeable Material, Class 1, Type B; Filter Fabric: Standard Specification Section 88-1.03, • Collector pipes: minimum 6 inches diameter laterals, and minimum 8 inches diameter collector pipe

B.10 WET BASIN

B.10.1 Description

Wet Basins are detention systems comprised of a permanent pool of water, a temporary storage volume above the permanent pool, and a shoreline zone planted with aquatic vegetation. Wet Basins are placed in locations where naturally occurring wetlands do not exist. Wet Basins are designed to remove pollutants from surface discharges by temporarily capturing and detaining the Water Quality Volume (WQV) in order to allow settling and biological uptake to occur. Wet Basins are effective in removing sediments, nutrients, particulate metals, pathogens, litter, and BOD from stormwater runoff. A schematic of a Wet Basin is shown in Figure B-20.

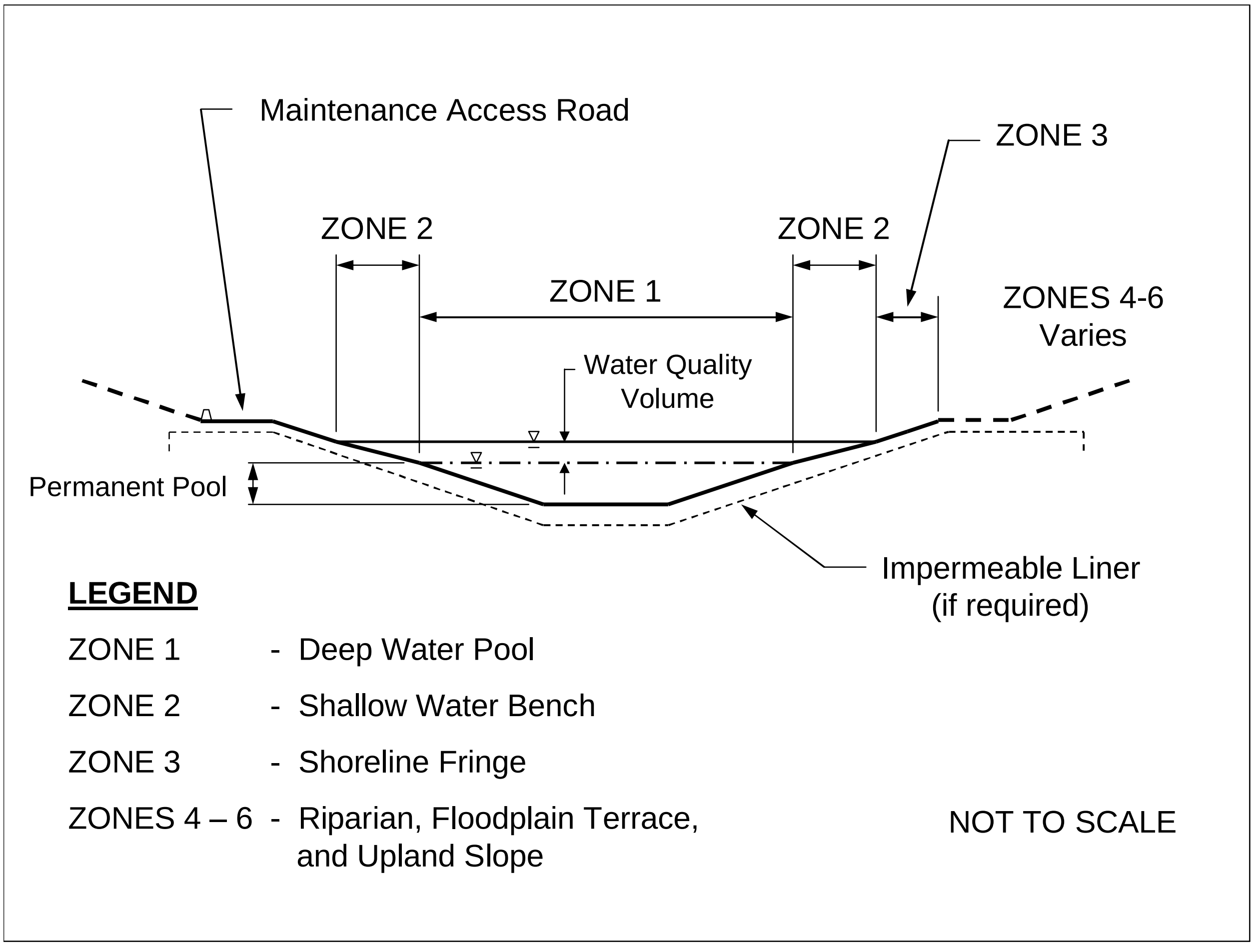


Figure B-20: Schematic of a Wet Basin

As indicated above, a Wet Basin has temporary storage capacity above the permanent pool for the Water Quality Volume. The WQV enters the Wet Basin and commingles with the permanent pool, during which time the water level in the basin rises to inundate the surrounding vegetation during a WQ event. The commingled water is slowly discharged through a water quality riser until the water level returns to the level of the permanent pool. To accommodate storms larger than the WQV design event, an upstream bypass should be considered. Regardless of whether an upstream bypass is incorporated into the design, an overflow spillway or riser should be provided. If the overflow riser is a component of the water quality riser, an overflow spillway also should be considered to provide additional safety in the event of failure of the overflow riser.

The level of the permanent pool must be maintained year-round to support the plant community in the Wet Basin; this water level is maintained by connecting the Wet Basin to a stream channel, by seepage from springs, or by water from some other source. In arid climates, it can be difficult to maintain the proper level of the permanent pool using natural sources, and augmentation may be required. If 'gray water' is available nearby (gray water is water sold for non-potable use by a wastewater treatment facility, after receiving secondary or tertiary treatment), it could serve as a permanent source of water, but the use of potable water for the permanent pool is considered inappropriate in almost all situations due to its scarcity. As some infiltration might also occur, even for soils with a low infiltration rate, approval from the RWQCB must be obtained if gray water will be considered.

Within the permanent pool, emergent plants provide biological processes that aid in reducing the amount of soluble nutrients and for some dissolved metals; however, the permanent pool of water should also have deeper zones to limit the growth of hydrophytic vegetation within the Wet Basin and also to reduce the plan view of the basin. Specific plant species suitable for inundated conditions are used in the Wet Basin (see the Hydrologic Conditions for Vegetation below).

Wet Basins have the potential to attract and harbor sensitive or endangered species, which may prevent the maintenance activities needed to maintain the proper functioning of the basins and for vector control. Because of the potential for endangered/sensitive species establishment, the Department is required to contact the appropriate state and federal regulatory agencies early in the design phase to discuss the proposed location of every Wet Basin.

Design of a Wet Basin must be coordinated through the Headquarters Division of Environmental Analysis – Policy, Planning and Permitting, and Headquarters Design – Office of Storm Water Management.

B.10.2 Appropriate Applications and Siting Criteria

For Wet Basins to be considered, the design Water Quality Volume must exceed 4,356 ft^3 (0.1 acre-foot [a-f]). The site under consideration for a Wet Basin should if possible be located where the visual aesthetics of the permanent pool is considered a benefit (such as a roadside rest area or vista point).

The proposed site must have a source of water to provide base flow sufficient to maintain a year-round plant community to account for losses due to infiltration and evapo-transpiration. The soil immediately below the invert must be relatively impermeable to limit loss of water by infiltration (NRCS Hydrologic Soils Group [HSG] soils C and D) unless a liner is used. Separation between seasonally high groundwater and basin invert should be > 10 ft; use liner if separation is between 1.0 ft and 10 ft unless approved by the local RWQCB due to presence of low permeability soils [Hydrologic Soil Groups C or D]).

The permanent pool volume should be at least 3x the Water Quality Volume, and additional temporary storage capacity greater than or equal to the Water Quality Volume, giving a minimum total volume of 4x the WQV below the spillway elevation. Consult public health and vector control authorities; mosquito fish may be required in the Wet Basin. [12]

Conditions that do not allow for siting are: a site having hazardous soils or a contaminated groundwater plumes; objectionable backwater conditions in the storm drain system being induced; placement on or near unstable slopes, or slopes steeper than 15 percent.

Note also that if the impounded volume exceeds 15 a-f then the Wet Basin may classify as a jurisdictional dam and be subject to other requirements; consult with District Hydraulics if the volume below the spillway exceeds this threshold.

The maximum width is suggested as 49 ft, although if the width is greater than 23 ft, access to both sides of the Wet Basin may be required; consult with the local vector agency and District Maintenance regarding accessibility requirements around the Wet Basin. A Wet Basin with maintenance access is shown in Figure B-21.

Figure B-21: Wet Basin in District 11

B.10.3 Preliminary Design Factors

The Wet Basin must employ an impermeable liner below the invert if placed in NRCS HSG A and B soils. Flow should enter the Wet Basin at low velocity, or scour protection should be provided at inflow. Outfalls and spillways should also be provided with scour protection as necessary. Maintenance access around basin and paved or unpaved ramp to basin invert must be provided.

[12] The biological agent most commonly used to control mosquitoes is the mosquito fish, *Gambusia affinis*. Mosquito fish are most effective in wet basins that have a depth of 4 to 12 ft and limited shallow shoreline (less than 30 percent of surface area); their effectiveness as a mosquito control agent declines greatly as the density of vegetation increases.

An upstream diversion channel or pipe for storms generating runoff volumes greater than the WQV should be implemented if possible. The Wet Basin should have an upstream forebay to capture coarse sediment and litter if possible having a volume of 10 to 25% of the WQV.

Within the Wet Basin, a flow-path-to-width ratio of at least 2:1 configured in an irregular or meandering configuration is preferred. The invert of the Wet Basin may employ a 'micro topography' (contouring and benching of the invert to vary the water depth); care should be exercised to minimize stagnant areas (areas where incoming water does not displace or commingle with permanent pool). The basin may also be configured to fit the surrounding topography.

For the ground above the WQV elevation: use 1:4 (V:H) side slope ratios or flatter for a minimum 16 ft horizontally, with 1:3 (V:H) side slopes maximum if approved by Maintenance. Below the WQV and the permanent pool elevation, the side slope ratios should be no steeper than 1:3 (V:H), with 1:4 (V:H) preferred along the entire shoreline. Within the Wet Basin, average water depth should be approximately 4.0 to 6.5 ft, and typical maximum depth usually between 8.0 and 10 ft. Usually the shallow area temporarily holding the WQV is limited to between 15 and 30% of the surface water area of the Wet Basin.

The outlet used to discharge the WQV is designed to complete the drawdown within 24 to 72 hrs, but typically within 24 to 48 hrs. The WQ outlet should employ a debris screen (or equivalent) and riser similar to that shown in Figure B-7 on page B-31. The orifice sizes for a WQ outlet using a perforated riser may be calculated using Equation 8, page B-32, taking the ($H-H_o$) term as equal to the height of the WQV above the permanent pool.

While the WQ outlet is designed to discharge the WQV, additionally either the WQ outlet or a separate outlet device must pass the flows generated by a design storm. If a separate outlet device is used, the outlet for an overflow event may be in the form of a weir or a pipe riser having a minimum nominal diameter of 36 in., or larger if District practice, designed using methods found in standard hydraulics references.

The Wet Basin should have a Water Quality freeboard ≥ 12 in, where freeboard is defined as the distance between the elevation at the top of the containment forming the basin and the water surface elevation during an overflow event (the Highway Design Manual event as discussed in Section B.1.3.1); note that when runoff from a storm event is passed through the Wet Basin, it is assumed that the initial water surface elevation in the Wet Basin is the Water Quality elevation (i.e. the elevation of the water surface at the top of the temporary pool).

Finally, some local jurisdictions may have more stringent requirements, and these should be consulted.

A drain for maintenance purposes should be placed if possible in a Wet Basin, or a defined sump area constructed for pumping during major maintenance. Consider fencing around the Wet Basin to restrict public access.

The design for the Wet Basin must provide appropriate vegetation for each hydrologic zone. Native soils at invert may require added organics.

Preliminary design factors are shown in Table B-11.

Table B-11: Summary of Wet Basin Siting and Design Criteria

Description	Applications/Siting	Preliminary Design Factors
• Impoundments where the WQV is temporarily detained in a permanent pool. Treatment Mechanisms: • Sedimentation/filtration • Adsorption to soil particles and by vegetation for certain contaminants Pollutants removed: • Total Suspended Solids • Nutrients* • Particulate Metals • Pathogens • Litter • BOD * Reductions observed for dry weather flow only. [End of this column]	• Minimum WQV > 4,356 ft^3 (0.1 a-f) • Volume of water in temporary pool > WQV • Volume of water in permanent pool > 3x WQV • Should if possible be located where the visual aesthetics of the permanent pool is considered a benefit (such as a roadside rest area or vista point). • Permanent source of water must be available, and sufficient for all losses including infiltration and evapo-transpiration • Do not consider for sites with hazardous soils or contaminated groundwater plumes • Sufficient head to prevent objectionable backwater condition in the storm drain system • Preferred maximum width 49 ft; consult with the local vector agency and District Maintenance regarding accessibility requirements around the Wet Basin. • Consult public health and vector control authorities; mosquito fish may be required in the permanent pool of the Wet Basin • If the impounded volume exceeds 15 a-f consult with District Hydraulics to determine if the basin would classify as a jurisdictional dam • Not appropriate on or near unstable slopes, best sited in flat or gentle terrain of up to 15% slopes [This column continues on next page]	• NRCS HSG A and B soils at invert requires the use of an impermeable liner to maintain the permanent pool • Flows should enter at low velocities, otherwise use scour protection on inflow; protect outfall and spillway with scour protection as necessary. • Maintenance access around basin • Upstream diversion channel or pipe for storms > WQV if possible • Place if possible an upstream forebay for sediment and litter, with a volume of 10 to 25% WQV • Flow-path-to-width ratio of 2:1 if possible, configured in an irregular or meandering configuration • The invert may employ a 'micro topography' (contouring and benching of the invert to vary the water depth); care should be exercised to minimize stagnant areas (areas where incoming water does not displace or commingle with permanent pool) • Use 1:4 (V:H) side slope ratios or flatter for area above the WQV for a minimum 16 ft horizontally; 1:3 (V:H) side slopes max. above this area if approved by Maintenance • Internal (below the permanent pool) side slope ratio: no steeper than 1:3 (V:H), and 1:4 (V:H) in Zone 2. [This column continues on next page]

Table B-11: Summary of Wet Basin Siting and Design Criteria (cont.)

Applications/Siting	Preliminary Design Factors
• Separation between seasonally high groundwater and basin invert > 10 ft; use liner if separation 1.0 and 10 ft. • Wet Basins placed in cold climates will have reduced effectiveness • Locate outside the Clear Recovery Zone (HDM Topic 309.1), or consult with Traffic Operations to determine if guard railing is required	• Average water depth should be approximately 4.0 to 6.5 ft, and typical maximum depth usually between 8.0 and 10.0 ft. • A deeper permanent pool is preferred to a shallower one, in order to reduce the area from which emergent vegetation (rooted below the water surface) can grow. • Usually the shallow (vegetated) areas are limited to between 15 and 30% of surface water area. • Outlet design to drawdown the WQV within 24 to 72 hrs, typically 24 to 48 hrs • Downstream spillway or overflow riser: sized to pass flows generated by the peak drainage facility design event (reference HDM Chapter 830); minimum spillway length of 3.0 ft, and/or minimum riser diameter of 36 in., or per District practice. Use local criteria for overflow passage if more stringent. • Provide Water Quality freeboard ≥ 12 in (distance between the elevation of water in the basin when passing the design storm, and the elevation at the top of the confinement) • Discharge the WQV through an outlet riser and include a debris screen (or equivalent) • An 8 inch drain valve should be placed to evacuate water during major maintenance • Provide vegetation appropriate for each hydrologic zone in the Wet Basin • Native soils at invert may require added organics • Consider fencing around the Wet Basin to restrict public access

B.10.4 Hydrologic Conditions for Vegetation

Wet Basins may have up to six specific hydrologic zones, as described in Table B-12. Local or native plant species should be used in all zones of the Wet Basin, if possible. Typically five to seven species of emergent wetland plants are used in the permanent pool. Large woody plants should not be allowed to be established in Zones 1, 2, or 3 of the Wet Basin. The District Office of Landscape Architecture should be consulted early in the design process to consider overall shape of the Wet Basin and plant materials for each hydrologic zone, if the design of the Wet Basin will be produced by the District. See also Caltrans *Technical Memorandum: Constructed Wetland Siting Study*, CTSW-TM-01-013, December 2001, page 5-10, for a list of native plants suitable for the shallow zones of Wet Basins (prepared for Caltrans Division of Environmental Analysis).

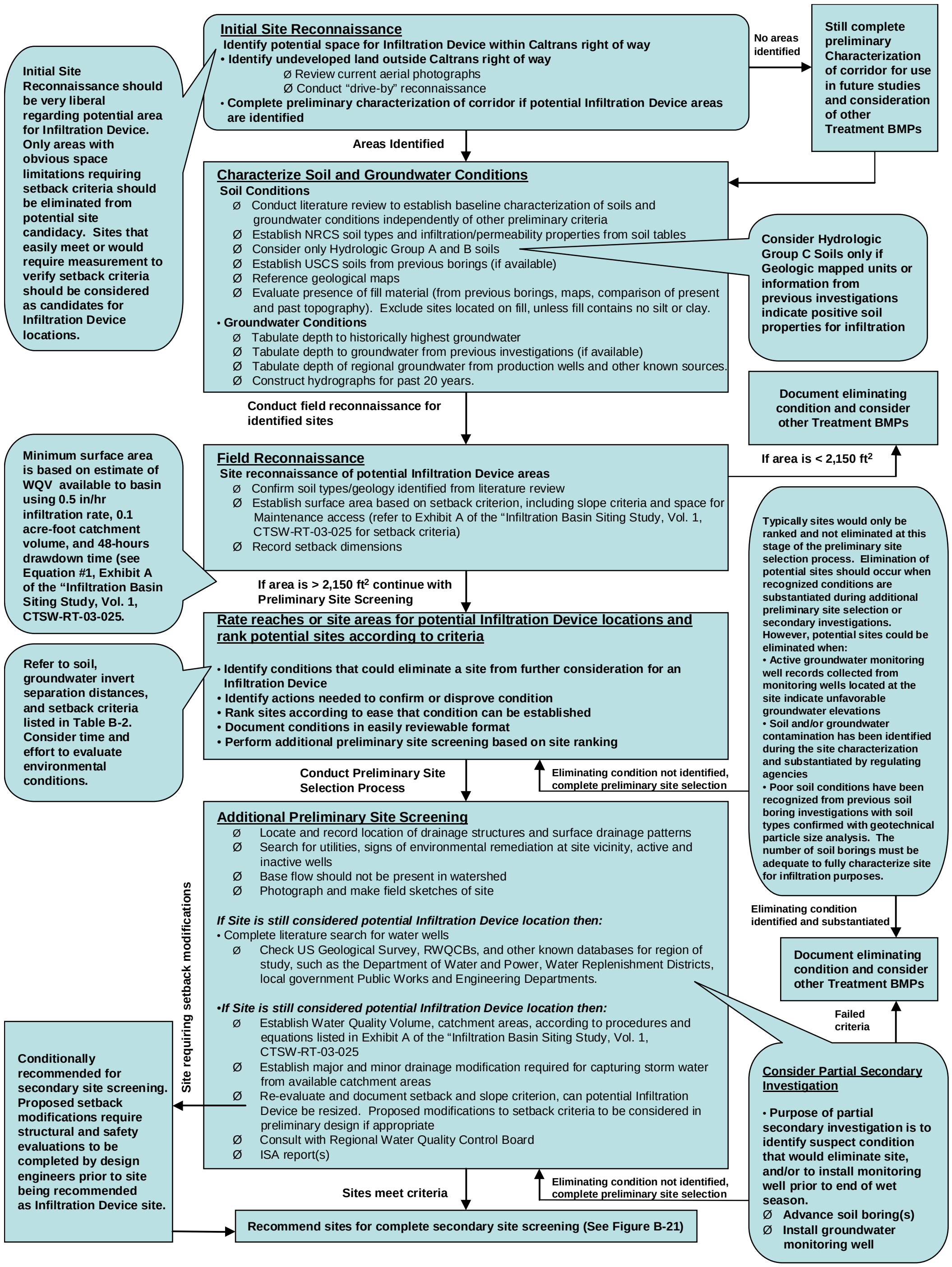
Table B-12: Wet Basin Hydrologic Zones

Zone number	Description and Topography	Hydrologic Condition and Water Depths Between Storm Events
1	Deep water pool (permanent pool): usually accounts for 70% to 85% of the total surface area at the WQV elevation (See Note 1), with a generally flat invert bordered by side slopes up to 1:3 (V:H) where adjoining Zone 2	Permanently inundated. Usually 6.0 to 10.0 ft depth at invert; little or no plant growth in this zone, especially below a depth of 6.0 ft, except for emergent vegetation on the side slopes
2	Shallow water bench (holds the WQV): usually between 15 to 30% of the total surface area at the WQV elevation; side slopes of 1:4 (V:H) preferred, but up to 1:3 (V:H) allowed if approved by maintenance	Portions will be inundated (up to the WQV elevation) during every rainfall event; depth usually between 0.75 and 1.5 ft (varies with design of the Wet Basin). Vegetation able to survive frequent inundation and saturated or nearly saturated soil condition
3	Shoreline fringe (up to the top of the Water Quality Freeboard): side slopes of 1:4 (V:H) preferred, but up to 1:3 (V:H) allowed if approved by maintenance	Occasionally inundated by overflow events (frequency is difficult to quantify, but potentially several times per year); vegetation able to survive occasional inundation and nearly saturated soil conditions in this zone (depending upon soil conditions)
4	Riparian fringe: no set side slopes or distance from preceding zones (see Note 2)	Only inundated during major events; vegetation selection much less influenced by presence of permanent and temporary pool of water
5	Floodplain Terrace: no set side slopes or distance from preceding zones (see Notes 2 and 3)	Only inundated during extreme events; vegetation selection much less influenced by presence of permanent and temporary pool of water.
6	Upland slopes: no set side slopes or distance from preceding zones (see Note 2)	Rarely or never inundated; vegetation selection much less influenced by presence of permanent and temporary pool of water.

Note 1: Surface area is defined as the area below the elevation of Zone 2.
Note 2: Zones 4, 5 and 6 may be omitted depending upon the site-specific design of the Wet Basin.
Note 3: Zone 5 will usually not be part of the typical Caltrans design (with overflow events handled in Zone 3).

Figure B-22: District 7 Infiltration Device Site Selection Logic Tree (Initial Site Screening)

See Footnote [13]



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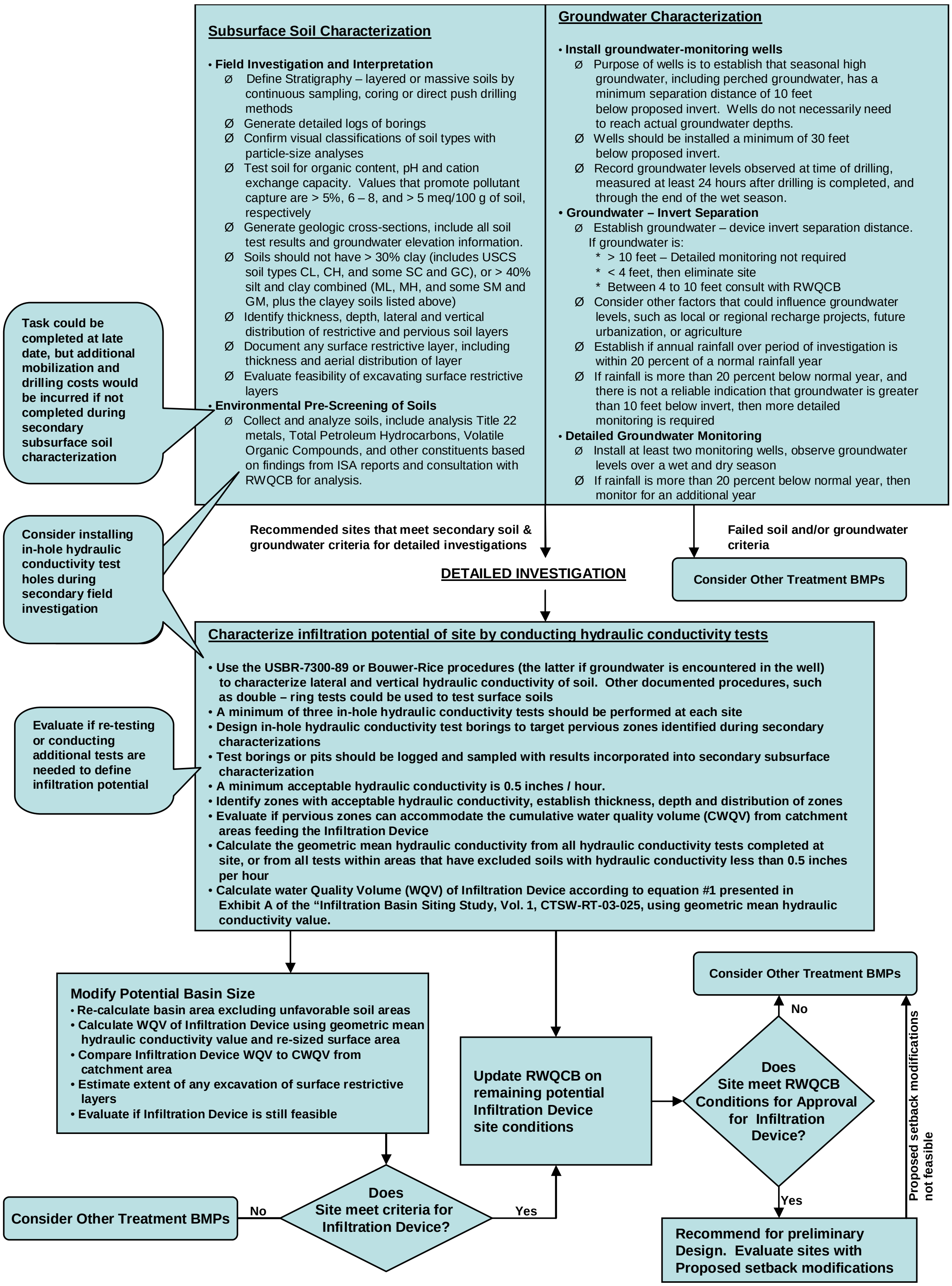
[13] Figure B-22 from this handbook is taken from the "Infiltration Basin Siting Study, Vol. 1," CTSW-RT-03-025, Caltrans, June 2003, Figure 32. Available online: http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-03-025/figures/FR_IFB_Figure_32.pdf

Figure B-23: District 7 Infiltration Device Site Selection (Secondary Site Screening)



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Appendix C
Approved Construction Site BMPs

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C.1 CONSTRUCTION SITE BEST MANAGEMENT PRACTICES (BMPS)

Construction Site Best Management Practices (BMPs) are applied during construction activities to reduce the pollutants in stormwater discharges throughout construction. These Construction Site BMPs provide both temporary erosion and sediment control, as well as control for potential pollutants other than sediment. There are six categories of BMPs suitable for controlling potential pollutants on construction sites. They are:

- Soil Stabilization Practices;
- Sediment Control Practices;
- Tracking Control Practices;
- Wind Erosion Control;
- Non-Stormwater Controls; and
- Waste Management and Material Pollution Controls.

It is generally accepted that practices that perform well by themselves can be complemented by other practices to raise the collective level of erosion control effectiveness and sediment retention. Effective erosion and sediment control planning relies on a system of BMPs (e.g., mulches for source control, fiber rolls on slopes for reducing runoff velocities, silt fence at the toe of slopes for capturing sediment, etc.).

To meet regulatory requirements and protect the site resources, every project must include an effective combination of erosion and sediment control measures. These measures must be selected from all of the BMP categories presented in this section: soil stabilization practices, sediment control practices, tracking control practices, and wind erosion control practices. Additionally, the project plan must include non-stormwater controls, waste management and material pollution controls.

Table C-1 is a matrix of the Construction Site BMPs that have been approved for use during construction. Detailed descriptions and guidance regarding implementation of these BMPs may be found in the Construction Site Best Management Practices Manual and Section 4 of the Statewide Storm Water Quality Practice Guidelines (Guidelines).

The individual BMPs, designated by an “X” in Table C-1 as being applicable to a particular typical construction activity, will not necessarily be appropriate for all projects involving the noted activity. For example, not all projects will have on-site vehicle fueling and maintenance operations; however, those that do will be required to conduct those operations in a manner consistent with the intent of the BMP description contained in Appendix B of the Storm Water Management Plan (SWMP) and BMP implementation detailed in the Guidelines.

Table C-1 shows the Construction Site BMPs by construction activity.

Table C-1: Construction Site BMPS By Construction Activity

	Typical Highway Construction Activities																											
	Demolish Pavement/Structures	Clear and Grub	Construct Access Roads	Grading (inc. cut and fill slopes)	Channel Excavation	Channel Paving	Trenching/ Underground Drainage	Underground Drainage Facility Installation	Drainage Inlet Modification	Utility Trenching	Utility Installation	Subgrade Preparation	Base Paving	AC Paving	Concrete Paving	Saw Cutting	Joint Sealing	Grind/Groove	Structure Excavation	Erect Falsework	Bridge/Structure Construction	Remove Falsework	Striping	Miscellaneous Concrete Work	Sound Walls/Retaining Walls	Planting and Irrigation	Contractor Activities	Treatment BMP Construction
Best Management Practices																												
Temporary Sediment Control																												
Silt Fence	X	X	X	X	X		X			X		X							X		X					X		X
Sandbag Barrier	X	X	X	X	X		X			X		X							X		X					X		X
Straw Bale Barrier	X	X	X	X	X		X			X		X							X		X					X		X
Fiber Rolls	X	X	X	X	X		X			X											X					X		X
Gravel Bag Berm	X	X	X	X	X		X			X											X					X		X
Check Dam	X	X		X	X		X																					X
Desilting Basin	X	X	X	X	X																X					X		X
Sediment Trap	X	X	X	X	X		X			X		X							X		X					X		X
Sediment Basin		X		X	X																X					X		X
Temporary Soil Stabilization																												
Hydraulic Mulch	X	X		X	X																X					X		X
Hydroseeding	X	X		X	X																X					X		X
Soil Binders	X	X		X	X														X		X					X		X
Straw Mulch	X	X	X	X	X		X	X		X		X							X		X					X		X
Geotextiles, Mats/Plastic Covers and Erosion Control Blankets	X	X	X	X	X		X	X		X		X							X		X					X		X
Scheduling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X
Preservation of Existing Vegetation		X	X	X			X	X		X									X	X		X			X			
Temporary Concentrated Flow Conveyance Controls																												

Table C-1: Construction Site BMPS By Construction Activity

	Typical Highway Construction Activities																											
	Demolish Pavement/Structures	Clear and Grub	Construct Access Roads	Grading (inc. cut and fill slopes)	Channel Excavation	Channel Paving	Trenching/ Underground Drainage	Underground Drainage Facility Installation	Drainage Inlet Modification	Utility Trenching	Utility Installation	Subgrade Preparation	Base Paving	AC Paving	Concrete Paving	Saw Cutting	Joint Sealing	Grind/Groove	Structure Excavation	Erect Falsework	Bridge/Structure Construction	Remove Falsework	Striping	Miscellaneous Concrete Work	Sound Walls/Retaining Walls	Planting and Irrigation	Contractor Activities	Treatment BMP Construction
Best Management Practices (Cont'd)																												
Earth Dikes/Drainage Swales & Lined Ditches		X	X	X																	X							
Outlet Protection/Velocity Dissipation Devices		X	X	X																	X							
Slope Drains				X																	X							
Temporary Stream Crossing			X				X	X		X	X									X	X	X		X				
Clear Water Diversion	X		X		X	X														X	X	X			X			X
Wind Erosion Control		X	X	X	X		X			X		X	X	X	X											X		X
Sediment Tracking Control	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X		X				X	X	X	X
Street Sweeping and Vacuuming	X	X	X	X	X		X	X		X	X	X	X	X	X	X		X	X		X				X	X	X	X
Stabilized Construction Roadway		X	X	X																								
Entrance/Outlet Tire Wash		X	X	X																						X	X	
Waste Management																												
Spill Prevention and Control	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Solid Waste Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hazardous Waste Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Contaminated Soil Management	X	X		X			X	X		X	X									X								
Concrete Waste Management	X		X			X		X			X		X		X	X		X	X		X			X	X	X	X	X
Sanitary/Septic Waste Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table C-1: Construction Site BMPS By Construction Activity

	Typical Highway Construction Activities																											
	Demolish Pavement/Structures	Clear and Grub	Construct Access Roads	Grading (inc. cut and fill slopes)	Channel Excavation	Channel Paving	Trenching/ Underground Drainage	Underground Drainage Facility Installation	Drainage Inlet Modification	Utility Trenching	Utility Installation	Subgrade Preparation	Base Paving	AC Paving	Concrete Paving	Saw Cutting	Joint Sealing	Grind/Groove	Structure Excavation	Erect Falsework	Bridge/Structure Construction	Remove Falsework	Striping	Miscellaneous Concrete Work	Sound Walls/Retaining Walls	Planting and Irrigation	Contractor Activities	Treatment BMP Construction
Best Management Practices (Cont'd)																												
Liquid Waste Management														X		X	X		X		X		X				X	X
Materials Handling																												
Material Delivery, and Storage	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Material Use	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Operations																												
Vehicle and Equipment Cleaning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Fueling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vehicle and Equipment Maintenance	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Paving Operations			X			X			X				X	X	X	X	X	X			X							
Stockpile Management	X		X					X		X	X		X	X	X			X										
Water Conservation Practices	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X		X			X		X	X	X
Potable Water/Irrigation																												
Dewatering Operations	X			X	X	X	X	X	X	X	X								X		X			X	X	X		X
Illicit Connection/Illegal Discharge Detection and Reporting	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Storm Drain Inlet Protection	X	X	X	X	X		X	X	X	X		X	X			X	X	X	X								X	X
Stabilized Construction Entrance/Exit		X	X	X																						X		X
X BMP may be applicable to activity																												

C.1.1 Soil Stabilization BMPs

Examples of Soil Stabilization BMPs include:

- SS-1 Scheduling;
- SS-2 Preservation of Existing Vegetation;
- SS-3 Hydraulic Mulch;
- SS-4 Hydroseeding;
- SS-5 Soil Binders;
- SS-6 Straw Mulch;
- SS-7 Geotextiles, Plastic Covers and Erosion Control Blankets;
- SS-8 Wood Mulching;
- SS-9 Earth Dikes/Drainage Swales and Ditches;
- SS-10 Outlet Protection/Velocity Dissipation Devices; and
- SS-11 Slope Drains.
- SS-12 Streambank Stabilization

Provided in Table C-2 are selection criteria information and ratings for temporary soil stabilization BMPs. The BMPs are described in detail following Table C-2.

Table C-2: Temporary Soil Stabilization Criteria Matrix

CLASS	TYPE	TEMPORARY SOIL STABILIZATION CONTROL CRITERIA													
		Antecedent Moisture	Availability	Ease of Clean-Up	Installed Cost Per Acre	EC Effectiveness (%)	Degradability	Length of Drying Time (hrs)	Time to Effectiveness (days)	Longevity	Mode of Application	Residual Impact	Native	Runoff Effect	Water Quality Impact
CATEGORY: STANDARD BIODEGRADABLE MULCHES (SBM)															
Straw Mulch	Wheat Straw	D	S	H	$12,844	90-95	B	0	1	M	L/M	M		+	M
	Rice Straw	D	S	H	$12,844	90-95	B	0	1	M	L/M	M		+	L
Wood Fiber Mulch	Wood Fiber	D	S	H	$5,434	50-60	B	0-4	1	M	H	L		+	M
Recycled Paper Mulch	Cellulose Fiber	D	S	H	$5,187	50-60	B	0-4	1	S	H	L		+	L
Bonded Fiber Matrix	Biodegradable	D	S	H	$33,592	90-95	B	12-18	1	M	H	M		+	H
CATEGORY: ROLLED EROSION CONTROL PRODUCTS (RECP)															
Biodegradable	Jute Mesh	D	S	H	$39,520	65-70	B		1	M	L	M		+	UNK
	Curled Wood Fiber	D	S	H	$64,220	85-90	P/B		1	M	L	M		+	L
	Straw	D	S	H	$54,340	85-90	P/B		1	M	L	M		+	H
	Wood Fiber	D	S	H	$54,340	85-90	P/B		1	M	L	M		+	L
	Coconut Fiber	D	S	H	$79,040	90-95	P/B		1	L	L	M		+	L
	Coconut Fiber Mesh	D	S	H	$190,190	85-90	B		1	L	L	M		+	UNK
	Straw Coconut Fiber	D	S	H	$66,690	90-95	P/B		1	L	L	M		+	M
Non-Biodegradable	Plastic Netting	D	M	H	$12,350	<50	P		1	L	L	H		+	UNK
	Plastic Mesh	D	M	H	$19,760	75-80	P		1	L	L	H		+	UNK
	Synthetic Fiber with Netting	D	M	H	$212,420	90-95	P		1	L	L	H		+	UNK
	Bonded Synthetic Fibers	D	M	H	$298,870	90-95	P		1	L	L	H		+	UNK
	Combination with Biodegradable	D	M	H	$195,130	85-90	P		1	L	L	H		+	UNK
CATEGORY: TEMPORARY SEEDING (TS)															
High-Density	Ornamentals		S-M	H	$2470 - $9880	50-60			28	M-L	H	L-M	N/E	+	UNK
	Turf species		S	H	$2,223	50-60			28	L	H	M-H	N/E	+	UNK
	Bunch grasses		S-M	H	$1853 - $7904	50-60			28	L	H	L-M	N	+	UNK
Fast-Growing	Annual		S	H	$2223 - $3952	50-60			28	L	H	L-H	N/E	+	UNK
	Perennial		S	H	$1976 - $4940	50-60			28	L	H	M	N/E	+	UNK
Non-Competing	Native		S-M	H	$1729 - $9880	50-60			28	L	H	L-M	N	+	UNK
	Non-Native		S-M	H	$2470 - $2964	50-60			28	L	H	L-H	E	+	UNK
Sterile	Cereal Grain		S	H	$2,964	50-60			28	L	H	L	E	+	UNK
CATEGORY: IMPERVIOUS COVERS (IC)															
Plastic	Rolled Plastic Sheeting		S		$41,990	100	P		1	M	L	H		-	UNK
	Geotextile (Woven)		S		$36,556	90-95	P		1	M	L	H		-	UNK
CATEGORY: HYDRAULIC SOIL STABILIZERS (HSS)															
(PBS) Plant Material Based- Short Lived	Guar	D	S	H	$2,470	80-85	B	12-18	Same as Length of	S	B	L		0/+	M/L
	Psyllium	P	S	H	$2,470	25-35	B	12-18		M	B	L		0	L/H
	Starches	D	S	H	$2,470	25-30	B	9-12		S	H	L		0	L
(PBL) Plant Material Based- Long Lived	Pitch/ Rosin Emulsion	D	S	M	$7,410	60-75	B	19-24		M	B	M		-	H
(PEB) Polymeric Emulsion Blends	Acrylic polymers and copolymers	D	S	M	$7,410	35-70	P/C	19-24		L	B	M		+/-	L/M
	Methacrylates and acrylates	D	M	M	$2,470	35-40	P/C	12-18		S	W	L		0/+	L
	Sodium acrylates and acrylamides	D	M	M	$2,470	20-70	P/C	12-18		S	H	L		+/-	L/M
	Polyacrylamide	D	M	M	$2,470	55-65	P/C	4-8		M	H	L		0/+	L
	Hydro-colloid polymers	D	M	H	$2,470	25-40	P/C	0-4		M	H	L		0/+	L/M
(PRB) Petroleum/ Resin-Based Emulsions	Emulsified Petroleum Resin	D	M	L	$7,410	10-50	P/C	0-4		M	B	M		0/-	H
(CBB) Cementitious Based Binders	Gypsum	D	S	M	$4,940	75-85	P/C	4-8		M	H	L		-	M/H

[shaded box] = not applicable for category, class or type

UNK = unknown

See next page for Legend

Table C-2: Temporary Soil Stabilization Criteria Matrix (continued)

Antecedent Moisture	D P	Soil should be relatively dry before application Soil should be pre-wetted before application
Availability	S M	A short turn-around time between order and delivery, usually 3-5 days A moderate turnaround time, between 1-2 weeks
Ease of Clean-Up	L M H	Require pressure washing, a strong alkali solution, or solvent to clean up Requires cleanup with water while wet; more difficult to clean up once dry May be easily removed from equipment and overspray areas by a strong stream of water
Installed Cost		Dollars per acre
Degradability	C P B	Chemically degradable Photodegradable Biodegradable
Length of Drying Time		Estimated hours
Time to Effectiveness		Estimated days
Erosion Control Effectiveness		Percent reduction in soil loss over bare soil condition.
Longevity	S M L	1 - 3 months 3 – 12 months > than 12 months
Application Mode	L W H B M	Applied by hand labor Applied by water truck Applied by hydraulic mulcher Applied by either water truck or hydraulic mulcher Applied by a mechanical method other than those listed above (e.g., straw blower)
Residual Impact	L M H	Projected to have a low impact on future construction activities Projected to have a moderate impact on future construction activities Projected to have a significant impact on future construction activities
Native	N E	Plant or plant material native to the State of California Exotic plant not native to the State of California
Runoff Effect	+ 0 -	Runoff is decreased over baseline (bare soil) No change in runoff from baseline Runoff is increased over baseline
Water Quality Impact	L M H	Low potential to impact water quality Moderate potential to impact water quality Higher potential to impact water quality

C.1.1.1 Scheduling (SS-1)

This BMP involves developing, for every project, a schedule that includes sequencing of construction activities with the implementation of Construction Site BMPs such as temporary soil stabilization (erosion control) and temporary 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.

C.1.1.2 Preservation of Existing Vegetation (SS-2)

Preservation of existing vegetation is the identification and protection of desirable vegetation that provides erosion and sediment control benefits. Whenever practical, existing vegetation should be preserved. Plants and trees act as effective soil stabilization and sediment control devices, particularly around the perimeter of construction sites. Areas that will not be disturbed as part of construction activities should be clearly marked on plans and protected in the field with fencing prior to clearing and grubbing. Access limitations should also be shown on the plans and described in the Special Provisions. Any damage to preservation areas should be repaired immediately.

Items to consider when preserving existing vegetation include:

- Preserve existing vegetation to provide effective erosion control;
- Consider the age, life expectancy, health, aesthetic value, and habitat benefits of vegetation to be preserved;
- Areas containing vegetation to be preserved must be shown on the plans; and
- Preserve native plants on the site wherever possible.

C.1.1.3 Hydraulic Mulch (SS-3)

Hydraulic mulch consists of applying a water-based mixture of wood or paper fiber and stabilizing emulsion with hydro-mulching equipment. This will protect disturbed soil from erosion by raindrop impact or wind. Specifications for mulch can be found in Caltrans Standard Specifications, Section 20-2.08.

Type: <u>Wood Fiber</u>

Wood fiber mulch is generally used as a component of hydraulic applications. It is usually used in combination with seed, fertilizer and other materials, and is typically applied at the rate of 2,010 to 4,020 pounds per acre (lb/acre).

Wood fiber mulch can be specified with or without a tackifier. Previous work has shown that wood fiber mulches with tackifiers have better erosion control performance.

Type: <u>Recycled Paper</u>

Recycled paper mulch is generally used in hydraulic applications. It is usually used in combination with seed and fertilizer and is typically applied at the rate of 2,010 to 4,020 lb/acre.

Type: <u>Cellulose Fiber</u>

Cellulose fiber mulch contains fibers of shorter length than wood fiber mulches and is typically made from recycled newsprint, magazine, or other waste paper sources. It can be specified with or without a tackifier.

Type: Bonded Fiber Matrix

A bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion-resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,035 to 4,020 lb/acre based on the manufacturer's recommendation.

The biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall so that the matrix will have an opportunity to dry for 24 hours after application.

C.1.1.4 Hydro seeding (SS-4)

Hydro seeding consists of applying a water-based mixture of wood or paper fiber, stabilizing emulsion, and seed with hydro-mulching equipment. This is usually a multi-step process with a layer of straw and tackifier placed over the initial hydraulic application. Often fertilizer and compost are added to the hydraulic mixture. This will protect disturbed soil from erosion by raindrop impact or wind. Hydraulic mulches are typically combined with a seed mixture for achieving longer term temporary soil stabilization than by hydraulic mulching alone. The selection of plant materials to be included in the seed mixture can be based, in part, on the length of time temporary stabilization is required.

Temporary Erosion Control with perennial grasses, especially California native species, is not appropriate for Caltrans projects. The most effective method is to use straw and tackifier with cereal barley (45 lb/acre). Temporary seeding on construction projects should last one to two seasons before the grass is removed and the slopes re-graded.

If a follow-up planting project is to re-vegetate an area, it might be possible to seed with natives and perennials. The key here is that there will be another project. The seeding on the first project would not be temporary; it would be permanent, as it would continue beyond project completion.

C.1.1.5 Soil Binders (SS-5)

Soil binders, also known as soil stabilizers, are adhesives that stabilize soil by binding soil particles together. This will protect disturbed soil from erosion by raindrop impact or wind. Soil binders can also be used in combination with hydraulic mulches to improve their erosion control effectiveness.

There are five types of soil binders:

- Plant Material-Based (Short-Term);
- Plant Material-Based (Long-Term);
- Polymeric Emulsion Blends;
- Petroleum or Resin-Based Emulsions; and
- Cementitious-Based Binders.

Type: Plant-Material Based (Short-Term)

Guar

Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersent agents for easy field mixing. It should be applied at the rate of 10.0 to 15.0 lb per 1,000 gallons of water, depending on application machine capacity. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (V:H):	Flat	1:4	1:3	1:2	1:1
lb/acre:	40	45	50	60	70

Psyllium

Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but re-wettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates are generally 80 to 200 lb/acre, with enough water in solution to allow for a uniform slurry flow.

Starch

Starch is non-ionic, cold-water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Type: Plant-Material Based (Long-Term)

Pitch and Rosin Emulsion

Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should be non-corrosive, water-dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted as follows:

For clayey soil: 5 parts water to 1 part emulsion
For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion/product mixture applied at the rate specified by the manufacturer.

Type: Polymeric Emulsion Blends

Acrylic Copolymers and Polymers

Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55% solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should have a minimum shelf life of one year. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and should not re-emulsify when cured. The applied compound should air cure within a maximum of 36 to 48 hours. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and applied to soil at a rate of 1,175 gallons per acre.

Liquid Polymers of Methacrylates and Acrylates

This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water and applied with a hydraulic seeder at the rate of 20 gallons per acre. Drying time is 12 to 18 hours after application.

Copolymers of Sodium Acrylates and Acrylamides

These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

Slope Gradient (V:H)	lbs per acre
Flat to 1:5	3.0 – 5.0
1:5 to 1:3	5.0 – 10.0
1:2 to 1:1	10.0 – 20.0

Poly-Acrylamide and Copolymer of Acrylamide

Linear copolymer poly-acrylamide is packaged as a dry-flowable solid. When used as a stand-alone stabilizer, it is diluted at a rate of 10 lbs/1,000 gallons of water and applied at the rate of 5.0 lbs per acre.

Hydro-Colloid Polymers

Hydro-colloid polymers are various combinations of dry-flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 54 to 62 lbs per acre. Drying times are 0 to 4 hours.

Type: Petroleum or Resin-Based Emulsions

Emulsified Petroleum Resin

This material is a concentrated petroleum hydrocarbon emulsion that is mixed with water and applied to the soil surface at a rate of 2,460 gallons per acre. Dilution rates vary with the type of soil and other site conditions, and should be provided by the manufacturer. They typically range from 12:1 to 20:1 parts water to emulsion.

Type: Cementitious-Based Binders

Gypsum

This is a formulated gypsum-based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86 percent. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lbs per acre. Drying time is 4 to 8 hours.

Comparative testing of Hydraulic Soil Stabilizers has been conducted at the Caltrans/SDSU Soil Erosion Research Laboratory for application on two soil types, sandy clay and clayey sand ("Soil Stabilization for Temporary Slopes," URSGWC, October 1, 1999). Both erosion control effectiveness and water quality were evaluated for soil stabilizers representing the available classes and types.

C.1.1.6 Straw Mulch (SS-6)

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller, or anchoring it with a tackifier. Straw mulch is used for soil stabilization, as a temporary surface cover, on disturbed areas until soils can be prepared for re-vegetation. It is also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Loose straw is the most common mulch material used in conjunction with direct seeding of soil. Straw mulching is generally the second part of multi-step process where seed and fertilizer is first applied, then straw mulch applied as the second step. The final step of the process involves holding the loose straw in place by a) using netting, b) applying a liquid tackifier, or c) punching it into the soil by a process known as "crimping" or "incorporating."

Type: Wheat or Rice Straw

Straw can be hand applied or machine applied. The fiber length of the straw should be typically greater than 6 inches.

C.1.1.7 Geotextiles, Mats/Plastic Covers and Erosion Control Blankets (SS-7)

This BMP involves the placement of geotextiles, plastic covers, or erosion control blankets/mats to stabilize disturbed soil areas (DSAs) and protect soil from erosion by wind or water. These measures are typically used when DSAs are particularly difficult to stabilize, around Environmentally Sensitive Areas (ESAs), and as a temporary quick stopgap measure.

Type: Biodegradable Rolled Erosion Control Products

Biodegradable Rolled Erosion Control Products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. For an RECP to be considered 100% biodegradable, the netting, sewing or adhesive system that holds the biodegradable mulch fibers together must also be biodegradable.

Jute Mesh

Jute is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. It is designed to be used in conjunction with vegetation and has longevity of approximately one year. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Curled Wood Fiber

Excelsior (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80% of the fiber 6 inches or longer. The excelsior blanket should be of consistent thickness. The wood fiber should be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and shall be non-toxic and non-injurious to plant and animal life. Excelsior blanket should be furnished in rolled strips, a minimum of 48 inches wide, and should have an average weight of 0.1 lbs per square foot (lb/ft^2), ±10 percent, at the time of manufacture. Excelsior blankets should be secured in place with wire staples. Staples should be made of 0.12 inch steel wire and should be U-shaped with 7.9 inch legs and 2 inch crown.

Straw

Straw blanket should be machine-produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. The straw blanket should be furnished in rolled strips a minimum of 6.6 feet (ft) wide, a minimum of 82 ft long and a minimum of 0.055 lb/ft^2. Straw blankets should be secured in place with wire staples. Staples should be made of 0.12 inch steel wire and should be U-shaped with 7.9 inch legs and 2 inch crown.

Wood Fiber

Wood fiber blanket is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance revegetation. The material is furnished in rolled strips, which should be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Coconut Fiber

The coconut fiber blanket should be machine-produced mats of 100% coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. The coconut fiber blanket should be furnished in rolled strips with a minimum of 6.6 ft wide, a minimum of 82 ft long and a minimum of 0.055 lb/ft^2. Coconut fiber blankets should be secured in place with wire staples. Staples should be made of 0.12 inch steel wire and should be U-shaped with 7.9 inch legs and 2 inch crown.

Coconut Fiber Mesh

Coconut fiber mesh is a thin permeable membrane made from coconut or corn fiber that is spun into a yarn and woven into a biodegradable mat. It is designed to be used in conjunction with vegetation and typically has longevity of several years. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Straw Coconut Fiber

The straw coconut fiber blanket should be machine-produced mats of 70% straw and 30% coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. The straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.6 inch wide, a minimum of 82 ft long and a minimum of 0.055 lb/ft^2. Straw coconut fiber blankets should be secured in place with wire staples. Staples should be made of 0.12 inch steel wire and should be U-shaped with 7.9 inch legs and 2 inch crown.

Type: Non-Biodegradable Rolled Erosion Control Products

Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.

Plastic Netting

Plastic netting is a lightweight biaxially-oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Plastic Mesh

Plastic mesh is an open-weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than 0.2 inches. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Synthetic Fiber with Netting

Synthetic fiber with netting is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three-dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Bonded Synthetic Fibers

This type of product consists of a three-dimensional, geomatrix nylon (or other synthetic) matting. Typically it has more than 90% open area, which facilitates root growth. Its tough root-reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Combination Synthetic and Biodegradable

Combination synthetic and biodegradable RECPs consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high-strength continuous-filament geomatrix or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which should be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Rolled Plastic Sheeting

Plastic sheeting should have a minimum thickness of 0.24 inch, and should be firmly held in place with sandbags or other weights placed no more than 9.8 ft apart. Seams are typically taped or weighted down their entire length, and there should be at least a 12 inches to 24 inches overlap of all seams. Edges should be embedded a minimum of 6 inches in native soil.

All sheeting should be inspected periodically after installation and after significant rainstorms to check for erosion and undermining. Any failures shall be repaired immediately. If washout or breakages occurs, the material should be re-installed after repairing the damage to the slope.

Geotextile (Woven)

Woven geotextile material should be a woven polypropylene fabric with a minimum thickness of 0.6 inches, a minimum of 12ft wide and should have a minimum tensile strength of 150 lbs (warp) 80 lbs (fill) in conformance with the requirements in American Society of Testing and Materials (ASTM) Designation: D 4632. The permittivity of the fabric shall be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D 4491. The fabric should have an ultraviolet (UV) stability of 70% in conformance with the requirements in ASTM designation: D 4355. Geotextile blankets should be secured in place with wire staples or sandbags and by keying into tops of slopes and edges to prevent infiltration of surface waters under geotextile. Staples should be made of 0.12 inch steel wire and shall be U-shaped with 7.9 inch legs and 2 inch crown.

Geotextile (Non-Woven)

Non-woven geotextile shall be manufactured from polyester, nylon, or polypropylene material, or any combination thereof. The fabric shall be permeable, non-woven, shall not act as a wicking agent. The fabric shall weigh a minimum of 0.25 lbs per square yard (per ASTM Designation: D 3776), have a minimum grab tensile strength of 50 lbs in each direction (per ASTM Designation: D 4632), have a minimum elongation at break of 10% (per ASTM Designation: D 4632), have a minimum toughness of 2900 lbs (percent elongation x grab tensile strength), and a minimum permittivity of 0.5 sec^{-1} (per ASTM Designation: D 4491).

C.1.1.8 Wood Mulching (SS-8)

Wood mulching consists of applying shredded wood, bark, or green material. The primary function of wood mulching is to reduce erosion by protecting bare soil from raindrop impact and reducing runoff. Use is limited to slopes that are less than 1:3 (V:H) and depth of the mulch blanket is typically 3 – 4 inches. The material is typically spread by hand, although pneumatic methods are available. Wood mulching is primarily applicable for landscape projects.

C.1.1.9 Earth Dikes/Drainage Swales and Ditches (SS-9)

The primary function of earth dikes, drainage swales and ditches is to prevent erosion and reduce pollutant loading. They are structures that intercept, divert, and convey surface runoff in a controlled, non-erosive manner. Top, toe, and mid-slope diversion ditches, berms, dikes, and swales should be used to intercept runoff and direct it away from critical slopes without allowing it to reach the roadway.

Typically, mid-slope diversion ditches should have a cross-slope of at least 2%, and should be concrete or rock-lined. Top of slope diversions should be paved along cut slopes where the slope length above the cut is greater than 40 ft. Earthen diversion ditches, berms, dikes, and swales channelize flow and should be stabilized with vegetation or other materials to prevent erosion.

Alternatively, drop structures can be placed along the diversion to maintain a grade sufficiently mild to prevent erosive velocities, or a paved chute can be placed down the side of the fill before the accumulated runoff in the diversion is sufficient to cause erosive velocities.

Design guidelines include:

- Select design flow and safety factor based on careful evaluation of the risk due to erosion of the measure, over topping, flow backups, or wash out;
- Examine the site for run-on from off-site sources. These off-site flows should be diverted from the right-of-way;
- Select flow velocity limit of unlined conveyance systems based on soil types and drainage flow patterns for each project site. Establish a maximum flow velocity for using earth dikes and swales, above which a lined ditch must be used (see Highway Design Manual Table 862.2). Consider use of rip-rap, engineering fabric, vegetation or concrete lining;
- Consider outlet protection where localized scour is anticipated;
- Consider order of work provisions early in the construction process to effectively install and use the permanent ditches, berms, dikes, and swales; and
- A sediment-trapping device should be used in conjunction with conveyances where sediment-laden water is expected.

C.1.1.10 Outlet Protection/Velocity Dissipation Devices (SS-10)

Outlet protection/velocity dissipation devices are rock, riprap, or other materials placed at pipe outlets to reduce flow velocity and the energy of exiting stormwater flows and to prevent scour. They are used where localized scouring is anticipated, such as outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels. They are also used where lined channels or ditches discharge to unlined conveyances.

Appropriate applications include:

- Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels;
- Outlets located at the bottom of mild to steep slopes;
- Discharge outlets that carry continuous flows of water;
- Outlets subject to short, intense flows of water, such as from flash floods; and
- Where lined conveyances discharge to unlined conveyances.

C.1.1.11 Slope Drains (SS-11)

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 used with lined ditches to intercept and direct surface flow away from slope areas to protect cut or fill slopes.

Slope drains should be sized to convey large, infrequent storms down or around the slope (see the Highway Design Manual for additional information). Design the top and toe of slope diversion ditches/berms/dikes/swales to direct flow into the drain. Provide for outlet protection/velocity dissipation devices at the outlet of the drain, as needed.

C.1.1.12 Streambank Stabilization (SS-12)

Drainage systems including the stream channel, streambank, and associated riparian areas, are dynamic and sensitive ecosystems that respond to changes in land use activity. Streambank and channel disturbance resulting from construction activities can increase the stream's sediment load, which can cause channel erosion or sedimentation and have adverse effects on the biotic system. Best management practices can reduce the discharge of sediment and other pollutants and minimize the impact of construction activities on watercourses. Streams included on the 303(d) list by the State water Resources Control Board (SWRCB) may require careful evaluation to prevent any increases in sedimentation, siltation and/or turbidity to the stream.

C.1.2 Sediment Control Practices

Sediment control is required along the site perimeter at all operational internal inlets and at all times during the rainy season.

Sediment control devices function by:

- Slowing water velocities, thereby allowing soil particles to settle out; and
- Attenuating the flood peak by detaining flow and releasing water at a slower rate.

All sediment control devices require continued maintenance to function properly. Excess sediment not removed reduces capacity and efficiency.

Examples of sediment control practices include:

SC-1	Silt Fence	SC-6	Gravel Bag Berm
SC-2	Desilting Basin	SC-7	Street Sweeping and Vacuuming
SC-3	Sediment Trap	SC-8	Sand Bag Barrier
SC-4	Check Dam	SC-9	Straw Bale Barrier
SC-5	Fiber Rolls	SC-10	Storm Drain Inlet Protection

C.1.2.1 Silt Fence (SC-1)

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 the construction site.

Silt fences are placed below the toe of exposed and erodible slopes, downslope of exposed soil areas, around temporary stockpiles and along streams and channels. Silt fences should not be used to divert flow or in streams, channels or anywhere flow is concentrated.

C.1.2.2 De-silting Basin (SC-2)

A de-silting 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 before the runoff is discharged.

De-silting basins shall be considered for use:

- On construction projects with disturbed areas during the rainy season;
- Where sediment-laden water may enter the drainage system or water courses; and
- At outlets of disturbed soil areas between 5 acres and 10 acres.

C.1.2.3 Sediment Trap (SC-3)

A sediment trap is a temporary basin with a controlled release structure, formed by excavating or constructing an earthen embankment across a waterway or low drainage area. As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

Sediment traps may be used on construction projects during the rainy season when the contributing drainage area is less than 5 acres. Traps would be placed where sediment laden stormwater may enter a storm drain or watercourse, and around and/or up-slope from storm drain inlet protection measures.

C.1.2.4 Check Dam (SC-4)

A check dam is a small device constructed of rock, sand bags, or fiber rolls, placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and channel erosion by reducing flow velocity and encouraging sediment dropout.

Check dams may be installed:

- In small open channels that drain 10 acres or less;
- In steep channels where stormwater runoff velocities exceed 5 feet per second (ft/s);
- During the establishment of grass linings in drainage ditches or channels; and
- In temporary ditches where a short length of services does not warrant establishment of erosion-resistant linings.

C.1.2.5 Fiber Rolls (SC-5)

A fiber roll consists of straw, flax or other similar materials inserted into a tube of netting. Fiber rolls are placed on the face of slopes at regular intervals and/or at the toe of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide some removal of sediment from the runoff. Fiber rolls may be used along the top, face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.

C.1.2.6 Gravel Bag Berm (SC-6)

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 runoff velocity, release runoff as sheet flow and provide some sediment removal. The gravel bag berm should be installed along a level contour with the bags tightly abutted.

C.1.2.7 Street Sweeping and Vacuuming (SC-7)

Street sweeping and vacuuming are practices to remove tracked soil particles from paved roads to prevent the sediment from entering a storm drain or watercourse. Street sweeping and vacuuming are implemented anywhere sediment is tracked from the project site onto public or private paved roads, typically at points of egress.

C.1.2.8 Sand Bag Barrier (SC-8)

A sand bag barrier is a temporary linear sediment barrier consisting of stacked sand bags, designed to intercept and slow the flow of sediment-laden sheet flow runoff. Sand bag barriers allow sediment to settle from runoff before water leaves the construction site.

Sand bags can also be used:

- Where flows are moderately concentrated to divert and/or detain flows;
- Along the perimeter of a site;
- Along streams and channels;
- Below the toe of exposed and erodible slopes; and
- Around stockpiles.

C.1.2.9 Straw Bale Barrier (SC-9)

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

Typical applications for straw bale barriers include:

- Along the perimeter of a site;
- Along streams and channels;
- Below the toe of exposed and erodible slopes;
- Downslope of exposed soil areas; and
- Around stockpiles.

C.1.2.10 Storm Drain Inlet Protection (SC-10)

Storm drain inlet protection is a practice to reduce sediment from stormwater runoff discharging from the construction site prior to entering the storm drainage system. Effective storm drain inlet protection allows sediment to settle out of water or filters sediment from the water before it enters the drain inlet. Storm drain inlet protection is the last line of sediment control defense prior to stormwater leaving the construction site.

Storm drain inlet protection is used:

- Where ponding will not encroach into highway traffic;
- Where sediment-laden surface runoff may enter an inlet;
- Where disturbed drainage areas have not yet been permanently stabilized; and
- Where the drainage area is 1.0 acre or less.

C.1.3 Tracking Control Practices

Tracking control practices prevent or reduce off-site tracking of sediment by vehicles. Tracking is a common source of complaints, and can result the discharge of sediment to storm drains or watercourses. These measures include:

- TC-1 Stabilized Construction Entrance;
- TC-2 Stabilized Construction Roadway; and
- TC-3 Entrance/Outlet Tire Wash.

C.1.3.1 Stabilized Construction Entrance (TC-1)

A stabilized construction entrance is a designated point of access (ingress and egress) to a construction site that is stabilized to reduce tracking of sediment (mud and dirt) onto public roads by construction vehicles. Stabilized construction entrances are an effective method to limit the migration of sediment from the construction site, especially when combined with street sweeping and vacuuming. The stabilized entrance is typically composed of a crushed aggregate layer over a geotextile fabric or constructed of steel plates with ribs.

C.1.3.2 Stabilized Construction Roadway (TC-2)

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 a dust and erosion created by vehicular traffic. A stabilized construction roadway may be constructed of aggregate, asphalt concrete, or concrete based on the desired longevity.

C.1.3.3 Entrance/Outlet Tire Wash (TC-3)

A tire wash is an area located at stabilized construction access points to remove sediment from tires and undercarriages, and to prevent tracking of sediment onto public roads. The tire wash typically includes a wash rack on a pad of coarse aggregate. The runoff water from the wash area must be conveyed to a sediment trap or basin.

C.1.4 Wind Erosion Control (WE-1)

Wind erosion control consists of applying water or other dust palliatives as necessary to prevent or alleviate wind-blown dust. Dust control must be applied in accordance with Caltrans standard practices. Water or dust palliatives should be applied so no runoff occurs.

The California General Construction Permit (General Permit) requires that special attention be paid to stockpiles. Stockpiles may be covered with plastic, mats, blankets, mulches, or sprayed with water or soil binders. It may also be prudent to surround the base of a stockpile with a row of fiber rolls, silt fence, or other sediment barrier.

Another means to reduce the potential for wind erosion of stockpiles is to keep the height of stockpiles low, and to adjust the shape and orientation of the stockpiles to reduce the area of exposure to the prevailing wind.

C.1.5 Non-Storm Water Controls

The National Pollutant Discharge Elimination System (NPDES) stormwater regulations for construction sites also require that BMPs be included in the project plans for control of non-stormwater discharges. Non-stormwater management measures are source controls that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with stormwater. These BMPs are also known as "good housekeeping practices." These BMPs must be in place throughout the grading and construction phases. The measures include:

- NS-1 Water Conservation Practices
- NS-2 Dewatering Operations
- NS-3 Paving and Grinding Operations
- NS-4 Temporary Stream Crossing
- NS-5 Clear Water Diversion
- NS-6 Illicit Connection/Illegal Discharge Detection and Reporting
- NS-7 Potable Water/Irrigation
- NS-8 Vehicle and Equipment Cleaning
- NS-9 Vehicle and Equipment Fueling
- NS-10 Vehicle and Equipment Maintenance
- NS-11 Pile Driving Operations
- NS-12 Concrete Curing
- NS-13 Material and Equipment Use Over Water
- NS-14 Concrete Finishing
- NS-15 Structure Demolition/Removal Over or Adjacent to Water

During preparation of the project plans, it is not always possible to know where a contractor will be performing certain activities. To provide the contractor with flexibility, but to assure that proper control measures are implemented, it is appropriate to identify in the project plans that specific BMPs will be implemented for certain activities regardless of where on the site those activities are performed.

C.1.5.1 Water Conservation Practices (NS-1)

Water conservation practices are activities that use water during the construction of a project in a manner that avoids erosion caused by runoff and the transport of pollutants off the site. If less water is used, the potential for erosion decreases and the transport of construction-related pollutants off site is less likely. Water conservation practices must be implemented on all construction sites wherever water is used. It includes preventing water leaks, avoid vehicle washing on site, sweeping in lieu of hosing areas, and applying water for dust control to minimize runoff.

C.1.5.2 Dewatering Operations (NS-2)

This BMP is intended to prevent the discharge of pollutants from construction site dewatering operations associated with stormwater (accumulated rain) and non-stormwater (groundwater, water from a diversion or cofferdam, etc.). Dewatering effluent that is discharged from the construction site to a storm drain or receiving water is subject to the requirements of the applicable NPDES permit. Refer to the Caltrans Field Guide to Construction Site Dewatering for detailed guidance for management of dewatering operations. The District Storm Water Coordinator is also available for assistance.

C.1.5.3 Paving and Grinding Operations (NS-3)

Procedures that minimize pollution of stormwater runoff during paving operations include new paving and preparation of existing paved surfaces for overlays. Paving and grinding operations include handling materials, wastes and equipment associated with pavement removal, paving, surfacing, resurfacing, pavement preparation, thermoplastic striping and placing pavement markers.

C.1.5.4 Temporary Stream Crossing (NS-4)

A temporary stream crossing is a structure placed across a waterway that allows vehicles to cross the waterway during construction without contacting the water, thus reducing erosion and the transport of pollutants into the waterway. Temporary stream crossings are typically conditions of regulatory permits for work near live streams. Installation may require dewatering or temporary diversion of the stream. Types of temporary stream crossings include culverts, fords, and bridges. Their design requires knowledge of stream flows, soils, and wildlife.

C.1.5.5 Clear Water Diversion (NS-5)

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a construction site, transport it around the site, and discharge it downstream with minimal water quality impact. A common example is a temporary creek diversion system that consists of a sandbag cofferdam and a flexible plastic pipe to divert the water around the construction site. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, drainage, and interceptor swales.

C.1.5.6 Illicit Connection/Illegal Discharge Detection and Reporting (NS-6)

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 Resident Engineer (RE).

C.1.5.7 Potable Water/Irrigation (NS-7)

Potable water/irrigation consists of practices and procedures to reduce the discharge of potential pollutants generated from irrigation water lines, landscape irrigation, lawn or garden watering, potable water sources, water line flushing, and hydrant flushing. These practices include reusing discharges for landscaping, automatic shut-off valves, prevention of impacts to downstream drainage systems, leak detection, inspection of equipment and lines, and repair of broken pipes.

C.1.5.8 Vehicle and Equipment Cleaning (NS-8)

This BMP consists of procedures and practices used to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning operations to storm drains or watercourses. On most construction sites, vehicle and equipment cleaning on site should be discouraged.

If vehicle or equipment cleaning is allowed, then soap, solvents, or steam shall not be used unless approved by the RE. Vehicle and equipment wash water must be contained for percolation or evaporation, and must not be discharged off site.

C.1.5.9 Vehicle and Equipment Fueling (NS-9)

This BMP consists of measures and practices to minimize or eliminate the discharge of fuel spills and leaks into the storm drain system or to watercourses. These measures include containment of fueling areas, spill prevention and control, drip pans or absorbent pads, automatic shut-off nozzles, vapor recovery nozzles, topping off restrictions, and leak inspection and repair.

C.1.5.10 Vehicle and Equipment Maintenance (NS-10)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants to the storm drain system or to watercourses from vehicle and equipment maintenance procedures. Practices include drip pans or absorbent pads, spill kits, dedicated maintenance areas, proper waste disposal, leak repair, and secondary containment.

C.1.5.11 Pile Driving Operations (NS-11)

The construction of bridges and retaining walls often includes driving piles for foundation support. Piles are typically constructed of cast in place concrete, steel, or timber. Driven sheet piles are also used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce the discharge of potential pollutants to the storm drain system or watercourses. These procedures apply to all construction sites where permanent and temporary pile driving operations take place.

C.1.5.12 Concrete Curing (NS-12)

This BMP consists of procedures that minimize pollution of stormwater runoff during concrete curing. Concrete curing includes the use of both chemical and water methods. Concrete curing is used for the construction of structures such as bridges, retaining walls, and pump houses. Any element of the structure (i.e., footings, columns, abutments, stem and soffit, decks) may be subject to curing requirements.

C.1.5.13 Material and Equipment Use Over Water (NS-13)

This BMP consists of procedures for the proper use, storage, and disposal of materials and equipment on barges, boats, temporary construction pads, or similar locations that minimize or eliminate the discharge of potential pollutants to a watercourse. These procedures shall be implemented for construction materials and wastes (solid and liquid), soil or dredging materials, or any other materials that may be detrimental if released and apply where equipment is used over or adjacent to a watercourse.

C.1.5.14 Concrete Finishing (NS-14)

This BMP consists of procedures to minimize the impact that concrete finishing methods may have on stormwater runoff. Methods include sand blasting, lead shot blasting, grinding, or high pressure water blasting. Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances.

C.1.5.15 Structure Demolition/Removal Over Water (NS-15)

This BMP consists of procedures to protect water bodies from debris and wastes associated with structure demolition or removal over or adjacent to watercourses. These procedures shall be implemented for full bridge demolition and removal, partial bridge removal (i.e., barrier rail, edge of deck) associated with bridge widening projects, concrete channel removal, or any other structure removal that could potentially affect water quality.

C.1.6 Waste Management and Materials Pollution Control

The NPDES stormwater regulations for construction sites also require that BMPs be included in the project plans for waste management and materials pollution control. These are source control BMPs that prevent pollution by reducing pollutants at their source, and require a clean, well-kept site. The measures include:

WM-1	Material Delivery and Storage	WM-6	Hazardous Waste Management
WM-2	Material Use	WM-7	Contaminated Soil Management
WM-3	Stockpile Management	WM-8	Concrete Waster Management
WM-4	Spill Prevention and Control	WM-9	Sanitary/Septic Waste Management
WM-5	Solid Waste Management	WM-10	Liquid Waste Management

As with the non-stormwater management measures, it is important to provide the contractor with flexibility, but to identify that in the plans, that specific BMPs will be implemented for certain activities regardless of where on the site those activities are performed.

C.1.6.1 Material Delivery and Storage (WM-1)

This BMP consists of procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses. These procedures include secondary containment, spill prevention and control, product labeling, quantity reduction, proper storage, material covering, training, and inventory control.

C.1.6.2 Material Use (WM-2)

This BMP consists of procedures and practices for use of construction material in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or watercourses. These procedures include proper waste disposal, product labeling, proper cleaning techniques, recycling materials, reducing quantities, and application rates, spill prevention and control, training, and reduction of exposure to stormwater.

C.1.6.3 Stockpile Management (WM-3)

This BMP consists of procedures and practices to eliminate pollution of stormwater from stockpiles of soil and paving materials (such as concrete rubble, aggregate, and asphalt concrete). These procedures include locating stockpiles away from drainages, providing perimeter sediment barriers, and wind erosion control measures.

C.1.6.4 Spill Prevention and Control (WM-4)

This BMP consists of procedures and practices implemented to prevent and control spills in a manner that minimizes or prevents the discharge of spilled material to storm drain systems or watercourses. Spill prevention and prompt appropriate spill response reduce the potential for polluting receiving waters with spilled contaminants. Spills of concern include chemicals and hazardous wastes such as soil stabilizers/binders, dust palliatives, herbicides, growth inhibitors, fertilizers, de-icing products, fuels, lubricants, paints, and solvents. Spill prevention practices include education as well as cleanup and storage procedures that address small spills, semi-significant spills, and significant/hazardous spills.

C.1.6.5 Solid Waste Management (WM-5)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants to storm drain systems or watercourses as a result of the creation, stockpiling or removal of construction site wastes. Solid wastes include such items as used brick, mortar, timber, steel, vegetation/landscaping waste, empty material containers, and litter. Measures include education as well as collection, storage, and disposal practices.

C.1.6.6 Hazardous Waste Management (WM-6)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants from construction site hazardous waste to the storm drain system or watercourses. Hazardous wastes should be collected, stored, and disposed of using practices that prevent contact with stormwater. The following types of wastes are considered hazardous; petroleum products, concrete curing compounds, palliatives, septic wastes, paints, stains, wood preservatives, asphalt products, pesticides, acids, solvents, and roofing tar. There may be additional wastes on the project that are considered hazardous. It is also possible that non-hazardous waste could come into contact with these hazardous wastes, such that they become contaminated and are therefore considered hazardous waste. Measures include education, storage procedures, and disposal procedures.

C.1.6.7 Contaminated Soil Management (WM-7)

This BMP consists of procedures and practices to minimize or eliminate the discharge of pollutants to the storm drain system or watercourses from contaminated soil. Typical soil contamination is due to spills, illicit discharges, and underground storage tank leaks, or aerially deposited lead (ADL). Contaminated soils tend to occur on projects in urban or industrial areas. Soil contaminants and locations are often identified in the project plans and specifications. Measures include identifying contaminated areas, education, handling procedures for material with ADL, handling procedures for contaminated soils, procedures for underground storage tank removals, and water control.

C.1.6.8 Concrete Waste Management (WM-8)

This BMP consists of procedures and practices that are implemented to minimize or eliminate the discharge of concrete waste materials to the storm drain system or to watercourses. These measures include education, concrete slurry waste handling procedures, on-site concrete washout facility, transit truck washout procedures, and procedures for removal of temporary concrete washout facilities.

C.1.6.9 Sanitary/Septic Waste Management (WM-9)

This BMP consists of procedures and practices to minimize or eliminate the discharge of construction site toilet facilities to the storm drain system or watercourse. Measures include education, and storage and disposal procedures.

C.1.6.10 Liquid Waste Management (WM-10)

This BMP includes procedures to prevent pollutants related to non-hazardous liquid wastes from entering storm drains or receiving waters. Liquid wastes include drilling slurries, drilling fluids, wastewater that is free from grease and oil, dredgings, and other non-storm water liquid discharges not covered by separate permits. This BMP does not apply to the following:

- Dewatering operations (see NS-2);
- Solid wastes (See WM-5);
- Hazardous wastes (See WM-6);
- Concrete slurries (See WM-8);
- Liquid wastes covered by specific laws or permits; and
- Non-stormwater discharges permitted by any Caltrans NPDES permit unless Caltrans determines that the discharge contains pollutants.

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Appendix D
Relevant Storm Water Documents and Web Sites

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Table D-1: Relevant Storm Water Documents and Purpose

Date	Document	Purpose
May 2003	Storm Water Management Plan (SWMP) – approved May 2003 by the State Water Resources Control Board (SWRCB).	Policy Document that ties the functional area activities together and describes the procedures and practices to address stormwater quality statewide. It identifies how Caltrans will comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) permit.
March 2003	Storm Water Quality Handbooks: Construction Site Best Management Practices (BMPs) Manual	Provides instructions for the selection and implementation of Construction Site BMPs. Caltrans requires contractors to identify and utilize these BMPs in the preparation of their SWPPP or WPCP.
March 2003	Storm Water Quality Handbooks: Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual	Guides contractors and Caltrans staff through the process of preparing a SWPPP and WPCP. This manual provides detailed step-by-step procedures, instructions, examples and a template that contractors shall use to prepare the SWPPP/WPCP.
Pending	Water Quality Assessment Guidelines (WQAG) and Templates for the Water Quality Assessment Technical Report (WQR), Volume 5 Standard Environmental Reference	Provides guidance on preparing WQRs as well as methods for assessing stormwater quality impacts of a project in support of preparing the PA/ED.
Current edition. Updated annually	Regional Work Plans (RWP)	Describes how Caltrans will specifically implement the SWMP within the jurisdiction of each RWQCB as required by the Caltrans Permit. The RWP provides District-specific information on Caltrans facilities, water bodies, BMPs and monitoring programs. It also includes a list of personnel titles and responsibilities.

Table D-2: Storm Water Related Web Sites

Web Sites	Description
http://www.swrcb.ca.gov/stormwtr/docs/caltranspmt.pdf	Caltrans NPDES Statewide Storm Water Permit (Caltrans Permit)
http://www.swrcb.ca.gov/stormwtr/construction.html	Construction General Permit (General Permit)
http://www.owp.csus.edu/research/stormwatertools/	This web site contains a water quality planning tool that provides information on water quality standards, and also contains a Basin Sizer program that calculates the WQV for Treatment BMPs located within California.
http://www.dot.ca.gov/hq/construc/stormwater/stormwater1.htm	A Division of Construction - Storm Water Quality Link. Contains links to resources for developing SWPPP, WPCP, and the Storm Water Quality Information Handout.
http://www.dot.ca.gov/hq/esc/oe/specs_html/index.html	Current Standard Special Provisions (SSPs)
http://www.dot.ca.gov/hq/projmgmt/documents/wsg/workplan_standards_guide_8.0a.doc	Guide to Project Delivery Workplan Standards – Release 8.0A
http://www.dot.ca.gov/hq/oppd/pdpm/pdpmn.htm	The Project Development Procedures Manual
http://www.dot.ca.gov/hq/construc/stormwater/manuals.htm	Storm Water Pollution Prevention Plan/Water Pollution Control Program Preparation Manual
http://www.epa.gov	U.S. Environmental Protection Agency (EPA)
http://www.dhs.ca.gov/	California Department of Health Services (DHS)
http://www.epa.gov/epahome/cfr40.htm	Code of Federal Regulations (CFR)
http://www.ceres.ca.gov/ceqa	California Environmental Quality Act (CEQA)
http://ceres.ca.gov/topic/env_law/ceqa/guidelines/art19.html	CEQA web site that lists Categorical Exemptions
http://www.dot.ca.gov/hq/oppd/stormwtr/index.htm	Web site for the Office of Storm Water Management Design.
http://www.dot.ca.gov/hq/env/stormwater/index.htm	Contains links to the 2006 Annual Report, the SWMP, and the 2006 Regional Work Plans
http://wdl.water.ca.gov/gw/	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.
http://www.dot.ca.gov/ser/	This website is the Standard Environmental Reference (SER) which is an online resource to help state and local agency staff plan, prepare, submit, and evaluate environmental documents for transportation projects. The site includes five Environmental Handbooks, as well as guidance, forms, templates and memos pertaining to the environmental process at Caltrans. Volume 5 of the SER is the Storm Water Quality Assessment document.
http://www.dwr.water.ca.gov	California Department of Water Resources web site that provides data regarding: Water quality; groundwater level; climatology, and surface water.
http://www.dot.ca.gov/hq/oppd/hydrology/hydroidx.htm	California Bank and Shore Rock Slope Protection.

Appendix E

Water Quality Summary Forms

Storm Water Data Report

and

Checklists

- PID Process Summary Forms
- PA/ED Process Summary Forms
- PS&E Process Summary Form
- Storm Water Data Report
    - § Short Form - Storm Water Data Report Template
    - § Long Form – Storm Water Data Report Template
    - § Evaluation Documentation Form
    - § Construction Site BMP Consideration Form
    - § Storm Water Checklist SW-1, Site Data Sources
    - § Storm Water Checklist SW-2, Storm Water Quality Issues Summary
    - § Storm Water Checklist SW-3, Measures for Avoiding or Reducing Storm Water Impacts
    - § Checklist DPP-1, Parts 1–5 (Design Pollution Prevention BMPs)
    - § Checklist T-1, Parts 1–10 (Treatment BMPs)
    - § Checklist CS-1, Parts 1–6 (Construction Site BMPs)

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Summary Process for Storm Water Activities for Project Initiation Document (PID)

WORK BREAKDOWN STRUCTURE (WBS) CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PID PHASE	DATE (S) COMPLETED	COMPLETED BY
100.05	Project Management – PID Process	**Invite District/Regional Storm Water Coordinators to project kickoff meeting and to participate in the Project Development Team (PDT).**		
100.05.10	PDT meetings	**The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units throughout the project.** Any decisions made during the PDT meetings should be documented.		
150.05.05	Site Data Sources	**Complete Checklist SW-1 (Site Data Sources)** **From Section 4, determine if project is required to consider incorporating Treatment BMPs.** § Complete Evaluation Documentation Form (Appendix E). § If the project is not required to consider Treatment BMPs, verify with District/Regional Storm Water Coordinator. Continue with the PID process with the selection of Design Pollution Prevention and Construction Site Best Management Practices (BMPs). § If the project is required to consider Treatment BMPs, select Treatment, Design Pollution Prevention and Construction Site BMPs.		
150.05.20	Define Storm Water Design Issues	**Obtain any existing available data.** **After obtaining existing data and selecting project alternatives, determine potential stormwater quality impacts and issues. Obtain additional data from the different functional units.** § Complete Checklist SW-2 (Storm Water Quality Issues Summary Checklist) **Perform Field Review of the Area** **Begin Filling out the Storm Water Data Report (SWDR).** **Coordinate with Environmental Unit during preparation of the PEAR and the Water Quality Impact Questionnaire.** **Evaluate options for avoiding or reducing potential impacts.** Begin to fill out Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.		

WORK BREAKDOWN STRUCTURE (WBS) CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PID PHASE	DATE (S) COMPLETED	COMPLETED BY
150.10	Identify Potential BMPs	**Determine Potential/Likely BMPs for each site of impact to receiving waters.** § Complete Checklist DPP-1 (including all applicable parts 1-5) and T-1 (including all applicable parts 1-10) for selecting BMPs at specific sites (Appendix E). § Complete decision tree for Pre-Screening for the Infiltration BMP – Appendix B.		
150.10.05	RWQCB Meetings	**Consultation with the Regional Water Quality Control Board (RWQCB) is strongly recommended to coordinate project issues and develop consensus for controversial or complex stormwater quality issues.** Initiate meetings with the RWQCB as necessary. Number of coordination meetings is entirely dependent upon the complexity of the stormwater quality issues, stormwater pollutants involved, and project site constraints. District/Regional NPDES Storm Water Coordinator serves as the single point of contact with the RWQCB.		
150.15	Analyze Project Alternatives	**Discuss BMPs with District/Regional Storm Water Coordinator, Landscape Architecture and Maintenance Storm Water Coordinator**.		
150.15.55	Preliminary Project Cost Estimate (PPCE)	**Develop preliminary BMP costs and incorporate into the PID cost estimate.** **Evaluate for Construction Site BMP costs.** § Refer to cost estimating procedure in Appendix F. § Meet with Construction to obtain concurrence with the Construction Site BMP strategy – cost estimate.		
150.25	Storm Water Data Report (SWDR)	**Route SWDR for functional units' signature.** **Coordinate with the Environmental Unit.** **Complete the SWDR using available data.**		
150.25	Prepare and Approve PID	**Incorporate "Storm Water Pollution Prevention Discussion" under "Considerations" heading of the planning document.**		
150.25.20	Circulate, Review, and Approve PID	**Attach signed SWDR cover sheet to PID and circulate to obtain functional unit concurrence. Original copy of SWDR should be kept in the project file.**		

Summary Process for Storm Water Activities for Project Approval/Environmental Document (PA/ED)

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PA/ED PHASE	DATE (S) COMPLETED	COMPLETED BY
100.10	Project Management Process (PA/ED)	**Invite District/Regional Storm Water Coordinators to project kickoff meeting and to participate in the PDT.**		
100.10.10	PDT meetings	**The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units throughout the project.** Any decisions made during the PDT meetings should be documented.		
160.05	Review and Update Project Information	**Confirm whether or not the project is required to consider incorporating Treatment BMPs.** § Complete/Update Evaluation Documentation Form (Appendix E). § If the project is not required to consider Treatment BMPs, verify with District/Regional Storm Water Coordinator. Continue with selection of Design Pollution Prevention and Construction Site BMPs. § If the project is required to consider Treatment BMPs, select Treatment, Design Pollution Prevention and Construction Site BMPs. **Review Information Developed in the PID Process.** **Determine potential stormwater quality impacts and issues for project alternatives.** **Obtain updated data and reports from the different functional units.** § Update Checklist SW-1 (Site Data Sources) § Update Checklist SW-2 (Storm Water Quality Issues Summary). **Consult with Environmental Unit to coordinate the PA/ED Phase - SWDR with the WQR prepared by Environmental (WBS 165.10.35).** **Perform Field Review of the Area.** **Update SWDR.** § **Evaluate options for avoiding or reducing potential impacts.** Update Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.		

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PA/ED PHASE	DATE (S) COMPLETED	COMPLETED BY
160.10	Revise Potential BMP Selections Based on Engineering Studies	**Select Potential/Likely BMPs for each site of unavoidable impact to receiving waters.** § Complete Checklist DPP-1 (including all applicable parts 1-5) and T-1 (including all applicable parts 1-10) for selecting BMPs at specific sites (Appendix E). § Complete decision tree for Pre-Screening for the Infiltration BMP – Appendix B. **Coordinate with Environmental Unit to coordinate the PA/ED – Phase SWDR with the WQR prepared by Environmental.** **Discuss BMPs with District/Regional Storm Water Coordinator, Maintenance Storm Water Coordinator and other functional units (e.g. Hydraulics, LA, etc.) to obtain concurrence.** **Evaluate potential Construction Site BMPs.** § See Construction Site BMPs Manual. § Meet with District/Regional Storm Water Coordinator to discuss BMPs for project required by RWQCB or other agency. § Meet with Construction to obtain concurrence with the Construction Site BMP strategy.		
165.10.35	RWQCB Meetings	**Consult with the RWQCB to coordinate project issues and develop consensus for controversial or complex stormwater quality issues.** Initiate meetings with the RWQCB through the District/Regional NPDES Storm Water Coordinator, as necessary. The number of coordination meetings is entirely dependent upon the complexity of the stormwater quality issues, stormwater pollutants involved, and project site constraints.		
160.15	Prepare Draft Project Report (DPR)	**Incorporate "Storm Water Pollution Prevention Discussion" under "Considerations" heading of the planning document.** (This is done only if the project does not have categorical exemption and has an Environmental Document (ED)) See Figure 6-2 in Section 6.		
160.15	Storm Water Data Report (SWDR)	**Coordinate with the Environmental Unit.** **Complete the SWDR using available data.** **Route SWDR for functional units' signature.**		
160.15.05	Update Preliminary Project Cost Estimates	**Develop preliminary BMP costs and incorporate into PA/ED cost estimate.**		
180.05	Prepare and Approve Project Report (PR)	**Attach signed SWDR cover sheet to PR and circulate to obtain functional unit concurrence. Original copy of SWDR should be kept in the project file.**		

Summary Process for Storm Water Activities for Plans, Specifications & Estimates (PS&E)

WBS CODE	ACTIVITY	STORM WATER QUALITY PLANNING ACTIVITY DURING THE PS&E PHASE	DATE (S) COMPLETED	COMPLETED BY
100.15	Project Management Process (PS&E)	**Invite District/Regional NPDES and Design Storm Water Coordinators to project kickoff meeting and to participate in the PDT.**		
100.15.10	PDT Meetings	**The PDT should meet throughout the entire project in order to maintain communication and to obtain consensus between the functional units throughout the project.** Any decisions made during the PDT meetings should be documented.		
205.10.40	RWQCB Meetings	**Consultation with the RWQCB to coordinate project issues and develop consensus for controversial or complex stormwater quality issues.** Initiate meetings with the RWQCB through the District/Regional NPDES Storm Water Coordinator as necessary. The number of coordination meetings is entirely dependent upon the complexity of the stormwater quality issues, stormwater pollutants involved, and project site constraints.		
185.05.10	Review and update project information	**Review Information Developed in the PID and PA/ED Process.** § Update Checklist SW-1 (Site Data Sources) § Update Checklist SW-2 (Storm Water Quality Issues Summary) **Consult with Environmental Unit to obtain permits.** **Perform Field Review of the Area.** **Review and Update the SWDR; if a WQR is prepared for the project, reference the WQR findings.** **Evaluate options for avoiding or reducing potential impacts.** Update Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts.		
185.15	Perform Preliminary Design	**Perform Preliminary Design.** § Delineate drainage areas and define total disturbed area. § Review and update need to consider Treatment BMPs. § Obtain Engineering Reports, WBS 185.20, from the different functional units.		

205.00	Obtain Necessary Permits, WDRs and Agreements	**Obtain NPDES Storm Water Permits and Local Agency Agreements.** § File Notification of Construction (NOC) for coverage under the Caltrans Permit. § Obtain Waste Discharge Requirement (WDR) for Aerially Deposited Lead (ADL) reuses. § Coverage for dewatering activities under separate NPDES permit. Contact your District/Regional NPDES Storm Water Coordinator. § Obtain other agreements with RWQCB and other agencies.		
230.00 230.30 230.40	Prepare Draft PS&E - Design Pollution Prevention BMPs	**Prepare Draft PS&E - Design Pollution Prevention BMPs.** § Update Checklist DPP-1 (and all applicable Parts 2-5) § Incorporate Design Pollution Prevention BMPs in all applicable plans, specifications, and estimates. § Review with District Landscape Architect and Maintenance as necessary. § Calculate quantities, estimates, and prepare Standard Special Provisions (SSPs).		
230.00 230.35 230.40	Prepare Draft PS&E – Treatment BMPs	**Prepare Draft PS&E – Design Treatment BMPs.** § Update Checklist T-1 (and all applicable Parts 2-10) § Incorporate Treatment BMPs in all applicable plans, specifications, and estimates. § Hydraulics to design or review design as per Highway Design Manual (HDM) requirements. § Review Treatment BMPs and future maintenance with District/Regional Storm Water Coordinator and Storm Water Maintenance Coordinator. § Calculate quantities, estimates, and prepare SSPs.		
230.00 230.35 230.40	Prepare Draft PS&E – Construction Site BMPs	**Prepare Draft PS&E - Construction Site BMPs.** § Review Appendix C of the PPDG and the Construction Site BMP Manual. § Complete Construction Site BMPs Consideration Form and respective Checklists CS-1, Parts 1-6 § Meet with District/Regional Storm Water Coordinator to discuss BMPs for project required by RWQCB or other agency. § Meet with Construction on inclusion of Construction Site BMPs. § Document Concurrence with Construction –initial and date Construction Site BMPs Consideration Form § Calculate quantities, estimates, and prepare SSPs.		

230.05.65	Prepare Conceptual SWPPP (if required)	**Prepare Conceptual Storm Water Pollution Prevention Plan (CSWPPP) if required.** § Includes preparing a Water Quality (WQ) information handout for bidders if necessary, Storm Water Pollution Prevention Plan (SWPPP), or Water Pollution Control Program (WPCP). § Includes how to develop estimates and deployment of BMPs.		
230.60	Storm Water Data Report	**Complete and stamp SWDR. Route for functional unit concurrence.**		
255.20	Prepare Final District PS&E Package	**Attach signed SWDR cover sheet for the PS&E package and obtain functional unit signature. Original copy of the SWDR should be kept in the project file.**		
270.05	Prepare RE File	**Submit Storm Water Information to Resident Engineer (RE) File. See Section 7.5.**		

Storm Water Data Report (SWDR)

In general, a Storm Water Data Report (SWDR) shall be prepared for every project. Depending upon the extent of soil disturbance and degree of stormwater impacts, a “Long Form” or “Short Form” SWDR shall be required. Projects that do not have the potential to create stormwater impacts, and have little or no soil disturbance (less than 0.25 acre) may utilize the “Short Form” SWDR. A Short Form SWDR may be appropriate for (but not limited to) the following types of projects:

- Signing and striping projects;
- Weigh-in-motion projects;
- Traffic monitoring projects (closed-circuit camera installation, etc.);
- Construction of ADA ramps;
- Bridge rail projects;
- Chip seal and/or fog seal projects;
- Pavement marker projects (raised or depressed);
- Metal Beam Guardrail Projects;
- Loop detector installations;
- Median Barrier Projects;
- Extended plant establishment projects,
- Emergency projects* using informal bids (as defined per PDPM); and
- Building remodeling or refurbishment such as painting, tile, or plumbing repair.

Please note that all the aforementioned project types may still be required to utilize a “Long Form” Storm Water Data Report if meeting the following conditions:

1. The Project is required to consider Treatment BMPs.
2. The project disturbs more than 0.25 acres of soil.
3. The project is part of a Common Plan of Development.
4. The project potentially creates permanent water quality impacts.
5. The project requires a notification of ADL reuse.

Any exceptions must be under the direction of the Design District/Regional Storm Water Coordinator.

The Licensed Person in responsible charge of the project (either the Project Engineer or the Licensed Landscape Architect) determines whether a project qualifies and may utilize a Short Form SWDR based upon the previously identified criteria. During the Project Initiation phase, the Design District/Regional Storm Water Coordinator shall confirm that the project may appropriately utilize the Short Form SWDR. The applicability of the Short Form will be reviewed and changed (if necessary) during the Project Approval and PS&E phases.

* Note that an Emergency Project done under Force Account does not require a SWDR.

Dist-County-Route____________________________

Post Mile (Kilometer Post) Limits:________________

Project Type:________________________________

EA: ______________________________________

RU: ______________________________________

Program Identification:________________________

Phase:
- ☐ PID
- ☐ PA/ED
- ☐ PS&E

Regional Water Quality Control Board(s): ____

1. Is the project required to consider incorporating Treatment BMPs? Yes ☐ No ☐
2. Does the project disturb more than 0.25 acres of soil? Yes ☐ No ☐
3. Is the project part of a Common Plan of Development? Yes ☐ No ☐
4. Does the project potentially create permanent water quality impacts? Yes ☐ No ☐
5. Does the project require a notification of ADL reuse? Yes ☐ No ☐

If the answer to any of the preceding questions is "Yes", prepare a Long Form - Storm Water Data Report.

Estimated Construction Start Date:_________________ Construction Completion Date:____________________

Separate Dewatering Permit (if yes, permit number) Yes ☐ Permit # ______________________ No ☐

This Short Form - Storm Water Data Report has been prepared under the direction of the following Licensed Person. The Licensed Person attests to the technical information contained herein and the data upon which recommendations, conclusions, and decisions are based. Professional Engineer or Landscape Architect stamp required at PS&E.

____

[Name], Registered Project Engineer/Landscape Architect *Date*

I have reviewed the stormwater quality design issues and find this report to be complete, current, and accurate:

____

[Stamp Required for PS&E only] *[Name], District/Regional SW Coordinator or Designee* *Date*

1. Project Description

- Clearly describe the type of project and major engineering features, including a brief explanation why project does not have the potential to create water quality impacts.
- Quantify total disturbed soil area and describe how it was calculated.
- Provide any additional information that may be pertinent to the project (e.g. TMDLs, Drinking Water Reservoirs and/or Recharge Facilities, 303(d) water bodies, 401 certifications, etc.).

2. Construction Site BMPs

- Identify whether the project requires a WPCP or SWPPP.
- Coordinate with Construction to determine the appropriate selection of Construction Site BMPs being implemented into the contract documents (e.g. separate line items and/or lump sum).
- Summarize those Construction Site BMPs that have been designated as separate Bid Line Items.
- Describe any pertinent details from the strategy used for estimating Construction Site BMPs.
- Document coordination effort to get concurrence from Construction regarding the Construction Site BMP strategy and associated quantities (provide names of staff and date of meeting(s)). Attach a copy of the Construction Site BMP Consideration Form to the SWDR at PS&E.

REQUIRED ATTACHMENTS

- Vicinity Map
- Evaluation Documentation Form
- Construction Site BMP Consideration Form (required at PS&E only)

Dist-County-Route________________________________
Post Mile (Kilometer Post) Limits:_________________
Project Type:_____________________________________
EA: ____
RU: ____
Program Identification:___________________________

Phase: ☐ PID
☐ PA/ED
☐ PS&E

Regional Water Quality Control Board(s): ____

Is the Project required to consider Treatment BMPs? Yes ☐ No ☐

If yes, can Treatment BMPs be incorporated into the project? Yes ☐ No ☐

If No, a Technical Data Report must be submitted to the RWQCB
at least 60 days prior to PS&E Submittal. List Submittal Date: ______________________________

Total Disturbed Soil Area: ____

Estimated: Construction Start Date: _______________ Construction Completion Date: ________________

Notification of Construction (NOC) Date to be submitted: ___________________________________

Notification of ADL reuse (if Yes, provide date) Yes ☐ Date _______________ No ☐

Separate Dewatering Permit (if Yes, permit number) Yes ☐ Permit # ____________ No ☐

This Report has been prepared under the direction of the following Licensed Person. The Licensed Person attests to the technical information contained herein and the data upon which recommendations, conclusions, and decisions are based. Professional Engineer or Landscape Architect stamp required at PS&E.

____

[Name], Registered Project Engineer/Landscape Architect *Date*

I have reviewed the stormwater quality design issues and find this report to be complete, current, and accurate:

____

[Name], Project Manager *Date*

____

[Name], Designated Maintenance Representative *Date*

____

[Name], Designated Landscape Architect Representative *Date*

____

[Stamp Required for PS&E only] *[Name], District/Regional SW Coordinator or Designee* *Date*

STORM WATER DATA INFORMATION

1. Project Description

- Clearly describe the type of project and major engineering features.
- Quantify total disturbed soil area and describe how it was calculated.
- Quantify the existing impervious surface, and the impervious surface area after the project is completed.
- Identify all urban MS4 areas within the project limits.

2. Define Site Data and Storm Water Quality Design Issues (refer to Checklists SW-1, SW-2, and SW-3)

Project Engineer (PE) should confer with District/Regional Storm Water Coordinator, Landscape Architecture, Maintenance, Hydraulics, Construction and Environmental Units to define design issues. Provide a narrative that contains pertinent information from source documents identified on SW-1 (e.g. Preliminary Geotechnical Report [PGR]) and a summary of the answers to the questions in SW-2 and SW-3. Use the bullets listed below as examples of information that should be described in the narrative. Note, not all of the information listed is available at each phase of a project (document status of availability, as appropriate). Information to be included will depend on the nature of the project and the site conditions.

- Identify Receiving Water Bodies (including the Hydrologic Area or sub-area [name and/or number]) and distance from the project's outfalls
- Identify if any of the Receiving Water Bodies are on the 303(d) list / describe Pollutants of Concern
- Identify if 401 certification is required
- Identify any Drinking Water Reservoirs and/or Recharge Facilities within project limits
- Describe RWQCB special requirements/concerns, including TMDLs or effluent limits
- Describe local agency requirements/concerns
- Describe project design considerations (climate, soil, topography, geology, groundwater, right-of-way requirements, slope stabilization, etc.)
- Include soil classifications and geology information, if pertinent
- Identify if project involves reuse of soil containing Aerially Deposited Lead (ADL)
- Identify Right-of-way costs for BMPs
- Describe measures for avoiding or reducing potential stormwater impacts
- Identify any existing Treatment BMPs within the project limits and their association with the project

3. Regional Water Quality Control Board Agreements

The District/Regional NPDES coordinator will furnish information and language for this part of the Checklist.

- Summarize any key negotiated understandings or agreements with RWQCB pertaining to this project. This would include any discussions relating to 401 Certifications, Waste Discharge Requirements, or other required permits/certifications.
- Document any specific meeting dates and contact names that reference the negotiated understandings and/or agreements. (Communication with the RWQCB is coordinated through the District/Regional NPDES Storm Water Coordinator.)

4. Describe Proposed Design Pollution Prevention BMPs to be used on the Project.

Summarize responses to Checklist DPP-1, Parts 1-5 in a short narrative. Use the sub-headings shown below for the type of information that should be described in the narrative. Note, not all of the bulleted information listed is required or available at each phase of a project. Information to be included will depend on the nature of the project and the site conditions.

Develop an estimate of quantities and costs for the erosion control/revegetation portion of the Design Pollution Prevention BMPs as part of the for the Storm Water BMP Cost Summary; include right-of-way costs if additional right-of-way is needed for erosion control. Complete for each phase of the project.

Downstream Effects Related to Potentially Increased Flow, Checklist DPP-1, Parts 1 and 2

- Identify velocity or volume of downstream flow
- Describe Existing vs. Post Construction Conditions
- Describe channel condition and design (e.g., will the project discharge to unlined channels)
- Describe potential for increased sediment loading
- Identify hydraulic changes (realignment, encroachment, etc.)

Slope/Surface Protection Systems, Checklist DPP-1, Parts 1 and 3

- Describe cut and fill requirements
- Describe existing and proposed slope conditions
- Identify vegetated surfaces (plants, soils, mulch, blankets, establishment periods, etc.)
- When required, provide date of approval of the Erosion Control Plan by Landscape Architecture and Maintenance
- Summarize any hard surfaces (rock blankets, paving)

Concentrated Flow Conveyance Systems, Checklist DPP-1, Parts 1 and 4

- Briefly describe the Concentrated Conveyance Systems to be implemented for this project

Preservation of Existing Vegetation, Checklist DPP-1, Parts 1 and 5

- Describe area(s) of clearing and grubbing identified and defined in the contract plans
- Describe area(s) that will be placed off-limits to the contractor, if applicable (e.g., ESA areas)
- Consider project changes to increase preservation or preserve/avoid critical areas such as floodplains, wetlands, problem soils, and steep slopes.

5. Describe Proposed Permanent Treatment BMPs to be used on the Project

Summarize responses to Checklist T-1, Parts 1-10 in a short narrative. Use the bullets listed below as examples of information that should be described in the narrative. Note, not all of the information listed is required or available at each phase of a project. Information to be included will depend on the nature of the project and the site conditions.

Develop an estimate of quantities and costs for the proposed Treatment BMPs as part of the Storm Water BMP Cost Summary; include additional right-of-way costs if needed for these BMPs. Complete for each phase of the project.

This section of the SWDR should be used to develop the Technical Report required by the SWMP for projects that must consider Treatment BMPs, but are not able to incorporate them due to siting constraints. At PS&E stage, if the project must consider Treatment BMPs but is not able to incorporate them, document the date of the submittal of the Technical Report to the appropriate RWQCB.

Treatment BMP Strategy, Checklist T-1

- List the Targeted Design Constituent(s), if any.
- List what percentage of the WQV (or WQF depending upon device) will be treated. If less than 100%, describe justification.
- Describe the Treatment BMP strategy for the watershed(s) within the project limits.

Biofiltration Swales/Strips, Checklist T-1, Parts 1 and 2

- Are Biofiltration Swales/Strips incorporated into project? If not, explain reason why not feasible. If yes, list number of Biofiltration Swales and Strips, location(s), approximate total area, and total WQF treated.
- Quantify Tributary Area
- Calculate Design Storm Flow and calculate Water Quality Flow
- Determine depth of flow and velocities at Design Storm and at Water Quality Flow

Dry Weather Diversion, Checklist T-1, Parts 1 and 3

- Are Dry Weather Diversions incorporated into project? If not, explain reason why not feasible. If yes, list number of Dry Weather Diversions, location(s), and total flow rate diverted.
- Describe persistent dry weather flows
- Describe proximity to sanitary sewer
- Document Publicly Owned Treatment Works (POTW) and local health agencies acceptance
- Identify need for existing sanitary sewer pipeline upgrade

Infiltration Devices – Checklist T-1, Parts 1 and 4

- Are Infiltration Devices incorporated into project? If not, explain reason why not feasible (e.g. threat to local groundwater quality, etc.). If yes, list number of Infiltration Devices, location(s), and total WQV treated.
- Quantify approximate tributary area of impervious surface per Infiltration Device
- Calculate Water Quality Volume (WQV) treated per Treatment Infiltration Device
- Document soil type and permeability
- Document groundwater depth
- Identify infiltration rate

Detention Devices, Checklist T-1, Parts 1 and 5

- Are Detention Devices incorporated into project? If not, explain reason why not feasible. If yes, list number of Detention Devices, location(s), and total WQV treated.
- Quantify approximate tributary area of impervious surface per Treatment Detention Basin
- Calculate WQV treated per Treatment Detention Basin
- Discuss Geotechnical Integrity
- Document groundwater depth
- Discuss hydraulic head sufficiency

Gross Solids Removal Devices (GSRDs), Checklist T-1, Parts 1 and 6

- Are GSRDs incorporated into project? If not, explain reason why not feasible or required. If yes, list number of GSRDs, location(s), and total tributary area treated.
- Is receiving water on a 303(d) list for trash or have Total Maximum Daily Loads (TMDLs) for trash been established?
- Calculate Tributary Area for each GSRD
- Estimate volume of each GSRD device
- Identify peak design flow

Traction Sand Traps, Checklist T-1, Parts 1 and 7

- Are Traction Sand Traps incorporated into project? If not, explain reason why not feasible or required. If yes, list number of Traction Sand Traps, location(s), and total WQV treated.
- Is Traction Sand or an abrasive applied to roadway more than twice per year?
- Estimate volume of traction sand applied (S) (ft^3/yr)
- Estimate impact from highway sweeping, snow-blowing operations, or accumulation from other sources
- Discuss Traction Sand Trap cleaning frequency and Maintenance operational needs such as pullouts

Media Filters, Checklist T-1, Parts 1 and 8

- Are Media Filters incorporated into project? If not, explain reason why not feasible. If yes, list number of Media Filters, location(s), and total WQV treated.
- Identify type of Media Filter incorporated: Full Sedimentation Austin Sand Filter, Partial Sedimentation Austin Sand Filter or Delaware Sand Filter
- If an Austin Sand Filter is incorporated into project, identify if earthen configuration or lined
- Is pretreatment provided to capture sediment and litter?
- Quantify approximate tributary area of impervious surface per Media Filter
- Identify Water Quality Volume (WQV) treated per Media Filter
- Identify depth to groundwater
- Discuss local vector agency issues

Multi-Chambered Treatment Trains (MCTTs), Checklist T-1, Parts 1 and 9

- Are MCTTs incorporated into project? If not, explain reason why not feasible. If yes, list number of MCTTs, location(s), and total WQV treated.
- Quantify approximate tributary area of impervious surface per MCTT
- Identify Water Quality Volume (WQV) treated per MCTT
- Discuss local vector agency issues

Wet Basins, Checklist T-1, Parts 1 and 10

- Are Wet Basins incorporated into project? If not, explain reason why not feasible. If yes, list number of Wet Basins, location(s), and total WQV treated.
- Quantify approximate tributary area of impervious surface per Wet Basin
- Identify Water Quality Volume (WQV) treated per Wet Basin
- Identify soil type and permeability
- Document groundwater depth

6. Describe Proposed Temporary Construction Site BMPs to be used on Project

Summarize the selected Construction Site BMPs in a Short Narrative. The narrative should also include any pertinent details from the strategy used for the implementation of Construction Site BMPs (e.g. specific project conditions, construction operations, etc.). It is understood that the level of detail discussed will be different at each phase of the project. Include a brief summary to how the BMPs were estimated.

- Identify those Construction Site BMPs that have been designated as separate Bid Line Items.
- Identify those Construction Site BMPs incorporated as a lump sum.
- Identify if dewatering will be required during the construction of the project. Describe circumstances. (i.e. will a separate dewatering permit be needed?)

- Document the coordination effort to get concurrence with Construction regarding the Construction Site BMP strategy and associated quantities (provide names of staff and date of meeting(s)). Attach a copy of the Construction Site BMP Consideration Form to the SWDR at PS&E.
- Develop an estimate of quantities and costs for Construction Site BMPs as a part of the Storm Water BMP Cost Summary. Complete for each phase of the project.

7. Maintenance BMPs (Drain Inlet Stenciling)

Briefly describe locations where drain inlet stenciling is required, such as within cities, towns, and communities with populations of 10,000 or more, or within designated MS4 areas. Include any specific stencil types and names of contacts that recommended stencil types or locations.

REQUIRED ATTACHMENTS

⇒ **Vicinity Map**
⇒ **Evaluation Documentation Form (EDF)**
⇒ **Construction Site BMP Consideration Form (required at PS&E only)**
⇒ **Treatment BMP Summary Spreadsheets (required, if Treatment BMPs are incorporated into project)**
⇒ **Quantities for Construction Site BMPs (required at PS&E only)**

SUPPLEMENTAL ATTACHMENTS

Note: Supplement Attachments are to be supplied during the SWDR approval process; where noted, some of these items may only be required on a project-specific basis.

⇒ Storm Water BMP Cost Summary
⇒ BMP cost information from: Preliminary Project Cost Estimate (PPCE) during PID and PA/ED project phases; Engineer's Cost Estimate for PS&E project phase
⇒ Plans showing BMP Deployment (i.e. Layout Sheets, Water Pollution Control Sheets, etc)
⇒ Pertinent Correspondence with RWQCB (if requested or recommended by District/Regional NPDES Storm Water Coordinator or Designated Reviewer)
⇒ Checklist SW-1, Site Data Sources
⇒ Checklist SW-2, Storm Water Quality Issues Summary
⇒ Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water BMPs
⇒ Checklists DPP-1, Parts 1–5 (Design Pollution Prevention BMPs) [only those parts that are applicable]
⇒ Checklists T-1, Parts 1–10 (Treatment BMPs) [only those Parts that are applicable]
⇒ Checklists CS-1, Parts 1–6 (Construction Site BMPs) [only those Parts that are applicable]
⇒ Calculations and cross sections related to BMPs (if requested by District/Regional Storm Water Coordinator)
⇒ 07-340 or 07-345 (if requested or recommended by District/Regional Storm Water Coordinator)
⇒ Conceptual Drainage Map or Drainage Plans, if available (if requested by District/Regional Storm Water Coordinator for review)

DATE: ______________________

EA: ______________________

NO.	**CRITERIA**	**YES** ü	**NO** ü	**SUPPLEMENTAL INFORMATION FOR EVALUATION**
1.	Begin Project Evaluation regarding requirement for consideration of Treatment BMPs	ü		See Figure 4-1, Project Evaluation Process for Consideration of Permanent Treatment BMPs. Go to 2
2.	Is this an emergency project?			If **Yes**, go to 11. If **No**, continue to 3.
3.	Have TMDLs or other Pollution Control Requirements been established for surface waters within the project limits?			If **Yes**, contact the District/Regional NPDES Coordinator to discuss the Department's obligations under the TMDL (if Applicable) or Pollution Control Requirements, go to 10 or 4 (as determined by the NPDES Coordinator). _______ *(Dist./Reg. SW Coordinator initials)* If **No**, continue to 4.
4.	Is the project within an urban area subject to an MS4 permit?			If **Yes**, continue to 5. *(write the MS4 Area here)* If **No**, go to 11.
5.	Is the project directly or indirectly discharging to surface waters?			If **Yes**, continue to 6. If **No**, go to 11.
6.	Is it a new facility or major reconstruction?			If **Yes**, continue to 8. If **No**, go to 7.
7.	Will there be a change in line/grade or hydraulic capacity?			If **Yes**, continue to 8. If **No**, go to 11.
8.	Is the Disturbed Soil Area (DSA) created by the project greater than or equal to 3.0 acres or does the project result in a net increase of one acre or more of new impervious surface?			If **Yes**, continue to 10. If **No**, go to 9. _________ *(Total DSA quantity)* _________ *(Net Increase New Impervious Surface)*
9.	Is the project part of a Common Plan of Development?			If **Yes**, continue to 10. If **No**, go to 11.
10.	Project is required to consider approved Treatment BMPs.			See Sections 2.4 and either Section 5.5or 6.5 for BMP Evaluation and Selection Process. Complete Checklist T-1 in this Appendix E.
11.	Project is not required to consider Treatment BMPs. _______*(Dist./Reg. SW Coord. Initials)* _______*(Project Engineer Initials)* ______________ *(Date)*			Document for Project Files by completing this form, and attaching it to the SWDR.

See Figure 4-1, Project Evaluation Process for Consideration of Permanent Treatment BMPS

DATE: ___________
EA: ___________

Project Evaluation Process for the Consideration of Construction Site BMPs

NO.	CRITERIA	YES ü	NO ü	SUPPLEMENTAL INFORMATION
1.	Will construction of the project result in areas of disturbed soil as defined by the Project Planning and Design Guide (PPDG)?			If Yes, Construction Site BMPs for Soil Stabilization (SS) will be required. Complete CS-1, Part 1. Continue to 2. If No, Continue to 3.
2.	Is there a potential for disturbed soil areas within the project to discharge to storm drain inlets, drainage ditches, areas outside the right-of-way, etc?			If Yes, Construction Site BMPs for Sediment Control (SC) will be required. Complete CS-1, Part 2. Continue to 3.
3.	Is there a potential for sediment or construction related materials and wastes to be tracked offsite and deposited on private or public paved roads by construction vehicles and equipment?			If Yes, Construction Site BMPs for Tracking Control (TC) will be required. Complete CS-1, Part 3. Continue to 4.
4.	Is there a potential for wind to transport soil and dust offsite during the period of construction?			If Yes, Construction Site BMPs for Wind Erosion Control (WE) will be required. Complete CS-1, Part 4. Continue to 5.
5.	Is dewatering anticipated or will construction activities occur within or adjacent to a live channel or stream?			If Yes, Construction Site BMPs for Non-Storm Water Management (NS) will be required. Complete CS-1, Part 5. Continue to 6.
6.	Will construction include saw-cutting, grinding, drilling, concrete or mortar mixing, hydro-demolition, blasting, sandblasting, painting, paving, or other activities that produce residues?			If Yes, Construction Site BMPs for Non-Storm Water Management (NS) will be required. Complete CS-1, Parts 5 & 6. Continue to 7.
7.	Are stockpiles of soil, construction related materials, and/or wastes anticipated?			If Yes, Construction Site BMPs for Waste Management and Materials Pollution Control (WM) will be required. Complete CS-1, Part 6. Continue to 8.
8.	Is there a potential for construction related materials and wastes to have direct contact with precipitation; stormwater run-on, or stormwater runoff; be dispersed by wind; be dumped and/or spilled into storm drain systems?			If Yes, Construction Site BMPs for Waste Management and Materials Pollution Control (WM) will be required. Complete CS-1, Part 6. Continue to 9.
9.	End of checklist.		Document for Project Files by completing this form, and attaching it to the SWDR.	

PE to initialize after concurrence with Construction (PS&E only) *Date*

Checklist SW-1, Site Data Sources

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):_______________________________________EA:________________________________
RWQCB:____

Information for the following data categories should be obtained, reviewed and referenced as necessary throughout the project planning phase. Collect any available documents pertaining to the category and list them and reference your data source. For specific examples of documents within these categories, refer to Section 5.5 of this document. Example categories have been listed below; add additional categories, as needed. Summarize pertinent information in Section 2 of the SWDR.

DATA CATEGORY/SOURCES	Date
Topographic	
•	
•	
•	
Hydraulic	
•	
•	
•	
Soils	
•	
•	
•	
Climatic	
•	
•	
•	
Water Quality	
•	
•	
•	
Other Data Categories	
•	
•	
•	
•	
•	
•	
•	

Checklist SW-2, Storm Water Quality Issues Summary

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):_______________________________________EA:_______________________________
RWQCB:____

The following questions provide a guide to collecting critical information relevant to project stormwater quality issues. Complete responses to applicable questions, consulting other Caltrans functional units (Environmental, Landscape Architecture, Maintenance, etc.) and the District/Regional Storm Water Coordinator as necessary. Summarize pertinent responses in Section 2 of the SWDR.

1. Determine the receiving waters that may be affected by the project throughout the project life cycle (i.e., construction, maintenance and operation).	o Complete	oNA
2. For the project limits, list the 303(d) impaired receiving water bodies and their constituents of concern.	o Complete	oNA
3. Determine if there are any municipal or domestic water supply reservoirs or groundwater percolation facilities within the project limits. Consider appropriate spill contamination and spill prevention control measures for these new areas.	o Complete	oNA
4. Determine the RWQCB special requirements, including TMDLs, effluent limits, etc.	o Complete	oNA
5. Determine regulatory agencies seasonal construction and construction exclusion dates or restrictions required by federal, state, or local agencies.	o Complete	oNA
6. Determine if a 401 certification will be required.	o Complete	oNA
7. List rainy season dates.	o Complete	oNA
8. Determine the general climate of the project area. Identify annual rainfall and rainfall intensity curves.	o Complete	oNA
9. If considering Treatment BMPs, determine the soil classification, permeability, erodibility, and depth to groundwater.	o Complete	oNA
10. Determine contaminated or hazardous soils within the project area.	o Complete	oNA
11. Determine the total disturbed soil area of the project.	o Complete	oNA
12. Describe the topography of the project site.	o Complete	oNA
13. List any areas outside of the Caltrans right-of-way that will be included in the project (e.g. contractor's staging yard, work from barges, easements for staging, etc.).	o Complete	oNA
14. Determine if additional right-of-way acquisition or easements and right-of-entry will be required for design, construction and maintenance of BMPs. If so, how much?	o Complete	oNA
15. Determine if a right-of-way certification is required.	o Complete	oNA
16. Determine the estimated unit costs for right-of-way should it be needed for Treatment BMPs, stabilized conveyance systems, lay-back slopes, or interception ditches.	o Complete	oNA
17. Determine if project area has any slope stabilization concerns.	o Complete	oNA
18. Describe the local land use within the project area and adjacent areas.	o Complete	oNA
19. Evaluate the presence of dry weather flow.	o Complete	oNA

Checklist SW-3, Measures for Avoiding or Reducing Potential Storm Water Impacts

Prepared by:________________Date:_______________District-Co-Route:__________________
PM (KP):_______________________________________EA:______________________________
RWQCB:____

The PE must confer with other functional units, such as Landscape Architecture, Hydraulics, Environmental, Materials, Construction and Maintenance, as needed to assess these issues. Summarize pertinent responses in Section 2 of the SWDR.

Options for avoiding or reducing potential impacts during project planning include the following:

1. Can the project be relocated or realigned to avoid/reduce impacts to receiving waters or to increase the preservation of critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions?	o Yes	o No	o NA
2. Can structures and bridges be designed or located to reduce work in live streams and minimize construction impacts?	o Yes	o No	o NA
3. Can any of the following methods be utilized to minimize erosion from slopes:			
a. Disturbing existing slopes only when necessary?	o Yes	o No	o NA
b. Minimizing cut and fill areas to reduce slope lengths?	o Yes	o No	o NA
c. Incorporating retaining walls to reduce steepness of slopes or to shorten slopes?	o Yes	o No	o NA
d. Acquiring right-of-way easements (such as grading easements) to reduce steepness of slopes?	o Yes	o No	o NA
e. Avoiding soils or formations that will be particularly difficult to re-stabilize?	o Yes	o No	o NA
f. Providing cut and fill slopes flat enough to allow re-vegetation and limit erosion to pre-construction rates?	o Yes	o No	o NA
g. Providing benches or terraces on high cut and fill slopes to reduce concentration of flows?	o Yes	o No	o NA
h. Rounding and shaping slopes to reduce concentrated flow?	o Yes	o No	o NA
i. Collecting concentrated flows in stabilized drains and channels?	o Yes	o No	o NA
4. Does the project design allow for the ease of maintaining all BMPs?	o Yes	o No	
5. Can the project be scheduled or phased to minimize soil-disturbing work during the rainy season?	o Yes	o No	
6. Can permanent stormwater pollution controls such as paved slopes, vegetated slopes, basins, and conveyance systems be installed early in the construction process to provide additional protection and to possibly utilize them in addressing construction stormwater impacts?	o Yes	o No	o NA

Design Pollution Prevention BMPs
Checklist DPP-1, Part 1

Prepared by:________________Date:________________District-Co-Route:__________________
PM (KP):______________________________________EA:______________________________
RWQCB:____

Consideration of Design Pollution Prevention BMPs

1. Consideration of Downstream Effects Related to Potentially Increased Flow [to streams or channels]?

(a) Will project increase velocity or volume of downstream flow?	o Yes	o No	o NA
(b) Will the project discharge to unlined channels?	o Yes	o No	o NA
(c) Will project increase potential sediment load of downstream flow?	o Yes	o No	o NA
(d) Will project encroach, cross, realign, or cause other hydraulic changes to a stream that may affect downstream channel stability?	o Yes	o No	o NA

If Yes was answered to any of the above questions, consider ***Downstream Effects Related to Potentially Increased Flow***, complete the DPP-1, Part 2 checklist.

2. Slope/Surface Protection Systems

(a) Will project create new slopes or modify existing slopes?	o Yes	o No	o NA

If Yes was answered to the above question, consider ***Slope/Surface Protection Systems***, complete the DPP-1, Part 3 checklist.

3. Concentrated Flow Conveyance Systems

(a) Will the project create or modify ditches, dikes, berms, or swales?	o Yes	o No	o NA
(b) Will project create new slopes or modify existing slopes?	o Yes	o No	o NA
(c) Will it be necessary to direct or intercept surface runoff?	o Yes	o No	o NA
(d) Will cross drains be modified?	o Yes	o No	o NA

If Yes was answered to any of the above questions, consider ***Concentrated Flow Conveyance Systems***; complete the DPP-1, Part 4 checklist.

4. Preservation of Existing Vegetation

a) It is the goal of the Storm Water Program to maximize the protection of desirable existing vegetation to provide erosion and sediment control benefits on all projects. o Complete

Consider ***Preservation of Existing Vegetation***, complete the DPP-1, Part 5 checklist.

Design Pollution Prevention BMPs

Checklist DPP-1, Part 2

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):_______________________________________EA:______________________________
RWQCB:____

Downstream Effects Related to Potentially Increased Flow

1. Review total paved area and reduce to the maximum extent practicable. o Complete
2. Review channel lining materials and design for stream bank erosion control. o Completed
   (a) See Chapters 860 and 870 of the HDM. o Completed
   (b) Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity. o Completed
3. Include, where appropriate, energy dissipation devices at culvert outlets. o Completed
4. Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour. o Completed
5. Include, if appropriate, peak flow attenuation basins to reduce peak discharges. o Completed

Design Pollution Prevention BMPs
Checklist DPP-1, Part 3

Prepared by:________________ Date:________________ District-Co-Route:__________________
PM (KP):______________________________________ EA:______________________________
RWQCB:____

Slope / Surface Protection Systems

1. What are the proposed areas of cut and fill? (attach plan or map) — o Complete
2. Were benches or terraces provided on high cut and fill slopes to reduce concentration of flows? — o Yes o No
3. Were slopes rounded and/or shaped to reduce concentrated flow? — o Yes o No
4. Were concentrated flows collected in stabilized drains or channels? — o Yes o No
5. Are new or disturbed slopes > 1:4 vertical:horizontal (V:H))? — o Yes o No

   If Yes, District Landscape Architecture must prepare or approve an erosion control plan.

6. Are new or disturbed slopes > 1:2 (V:H)? — o Yes o No

   If Yes, Geotechnical Services must prepare a Geotechnical Design Report, and the District Landscape Architect should prepare or approve an erosion control plan. Concurrence must be obtained from the District Maintenance Storm Water Coordinator for slopes steeper than 1:2 (V:H).

7. Estimate the change to the impervious areas that will result from this project. ________________ acres — o Complete

VEGETATED SURFACES

1. Identify existing vegetation. — o Complete
2. Evaluate site to determine soil types, appropriate vegetation and planting strategies. — o Complete
3. How long will it take for permanent vegetation to establish? — o Complete
4. Minimize overland and concentrated flow depths and velocities. — o Complete

HARD SURFACES

1. Are hard surfaces required? — o Yes o No

   If Yes, document purpose (safety, maintenance, soil stabilization, etc.), types, and general locations of the installations. — o Complete

Review appropriate SSPs for Vegetated Surface and Hard Surface Protection Systems. — o Complete

Design Pollution Prevention BMPs
Checklist DPP-1, Part 4

Prepared by:________________Date:________________District-Co-Route:__________________
PM (KP):____EA:______________________________
RWQCB:____

Concentrated Flow Conveyance Systems

Ditches, Berms, Dikes and Swales

1. Consider Ditches, Berms, Dikes, and Swales as per Chapters 813, 836, and 860 of the HDM. o Complete
2. Evaluate risks due to erosion, overtopping, flow backups or washout. o Complete
3. Consider outlet protection where localized scour is anticipated. o Complete
4. Examine the site for run-on from off-site sources. o Complete
5. Consider channel lining when velocities exceed scour velocity for soil. o Complete

Overside Drains

1. Consider downdrains, as per Index 834.4 of the HDM. o Complete
2. Consider paved spillways for side slopes flatter than 1:4 V:H. o Complete

Flared Culvert End Sections

1. Consider flared end sections on culvert inlets and outlets as per Chapter 827 of the HDM. o Complete

Outlet Protection/Velocity Dissipation Devices

1. Consider outlet protection/velocity dissipation devices at outlets, including cross drains, as per Chapters 827 and 870 of the HDM. o Complete

Review appropriate SSPs for Concentrated Flow Conveyance Systems. o Complete

Design Pollution Prevention BMPs
Checklist DPP-1, Part 5

Prepared by:________________Date:_______________District-Co-Route:__________________
PM (KP):_______________________________________EA:______________________________
RWQCB:____

Preservation of Existing Vegetation

1.	Review Preservation of Property, Standard Specifications 16.1.01 and 16-1.02 (Clearing and Grubbing) to reduce clearing and grubbing and maximize preservation of existing vegetation.	o Complete
2.	Has all vegetation to be retained been coordinated with Environmental, and identified and defined in the contract plans?	o Yes o No
3.	Have steps been taken to minimize disturbed areas, such as locating temporary roadways to avoid stands of trees and shrubs and to follow existing contours to reduce cutting and filling?	o Complete
4.	Have impacts to preserved vegetation been considered while work is occurring in disturbed areas?	o Yes o No
5.	Are all areas to be preserved delineated on the plans?	o Yes o No

Treatment BMPs
Checklist T-1, Part 1

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):_______________________________________EA:______________________________
RWQCB:____

Consideration of Treatment BMPs

This checklist is used for projects that require the consideration of Approved Treatment BMPs, as determined from the process described in Section 4 (Project Treatment Consideration) and the Evaluation Documentation Form (EDF). This checklist will be used to determine which Treatment BMPs should be considered for each watershed and sub-watershed within the project. Supplemental data will be needed to verify siting and design applicability for final incorporation into a project.

Complete this checklist for each phase of the project, when considering Treatment BMPs. Use the responses to the questions as the basis when developing the narrative in Section 5 of the Storm Water Data Report to document that Treatment BMPs have been appropriately considered.

Answer all questions, unless otherwise directed.

1. Dry Weather Flow Diversion

   (a) Are dry weather flows generated by Caltrans anticipated to be persistent? o Yes o No

   (b) Is a sanitary sewer located on or near the site? o Yes o No

   (c) Is connection to the sanitary sewer possible without extraordinary plumbing, features or construction practices? o Yes o No

   (d) Is the domestic wastewater treatment authority willing to accept flow? o Yes o No

   If Yes was answered to all of these questions consider Dry Weather Flow Diversion, complete and attach Part 3 of this checklist

2. Is the receiving water on the 303(d) list for litter/trash or has a TMDL been issued for litter/trash? o Yes o No

   If Yes, consider Gross Solids Removal Devices (GSRDs), complete and attach Part 6 of this checklist. Note: Biofiltration Systems, Infiltration Devices, Detention Devices, Media Filters, MCTTs, and Wet Basins also can capture litter – consult with District/Regional NPDES if these devices should be considered to meet litter/trash TMDL.

3. Is project located in an area (e.g., mountain regions) where traction sand is applied more than twice a year? o Yes o No
   If Yes, consider ***Traction Sand Traps***, complete and attach **Part 7** of this checklist.

4. (a) Are there local influent limits for infiltration or Basin Plan restrictions or other local agency prohibitions that would restrict the use of the Infiltration Devices? o Yes o No

   (b) Would infiltration pose a threat to local groundwater quality as determined by the District/Regional Storm Water Coordinator? o Yes o No

If the answer to either part of Question 4 is “Yes”, then Infiltration Devices are infeasible and the consideration of Infiltration Devices should not be made when completing Questions 5 through 17.

5. (a) Does the project discharge to any 303(d) listed water body or has a TMDL been issued? o Yes o No
If No, go to Question 17, General Purpose Pollutant Removal

(b) If Yes, is the identified pollutant(s) considered a Targeted Design Constituent (TDC) (check all that apply):
___ phosphorus, ___ nitrogen, ___ total copper, ___ dissolved copper,
___ total lead, ___ dissolved lead, ___ total zinc, ___ dissolved zinc,
___ sediments, ___ general metals [unspecified metals].

(c) If no TDC’s are checked above, go to Question 17

(d) If only one TDC is checked above, continue to Question 6. o Complete

(e) If more than one TDC is checked, contact your District/Regional NPDES Coordinator to determine priority before continuing with this checklist. o Complete

6. Consult with the District/Regional NPDES Storm Water Coordinator to determine whether Treatment BMP selection will be affected by any existing or future TMDL requirements. o Complete

The following questions list the approved Treatment BMPs in order of preference based on load reduction (performance) for the listed constituent and lifetime costs for the device, excluding right-of-way. Note that a line separates Treatment BMPs into groups of approximately equal effectiveness and within each grouping; any of the Treatment BMPs may be selected for placement if meeting site conditions. In the space provided next to the BMP, use Yes or a check mark to indicate a positive response.

If none of the listed Treatment BMPs for a specific constituent of concern (TDC) can be sited, go to Step #17 (General Purpose Pollutant Removal) to determine whether another Treatment BMP can be incorporated into the project.

***For the SWDRs developed for the PID and PA/ED phases of a project:* Consider all approved Treatment BMPs listed that can be reasonably incorporated into the project for each TDC.**

***For the SWDR developed for the PS&E phase:* Indicate (Yes or check mark) only those BMPs that will be incorporated into the project.**

7. Is phosphorus the TDC? [Use this constituent if “eutrophic” or “nutrients” is the TDC for the water body.] If Yes, consider: o Yes o No
____ <u>Infiltration Devices</u>
____ Austin Sand Filters

8. Is nitrogen the TDC? If Yes, consider: o Yes o No

____ Infiltration Devices
____ Austin Sand Filter
____ Delaware Filter
____ Detention Device
____ MCTT

9. Is copper (total) the TDC? If Yes for total Copper, consider: o Yes o No
____ Infiltration Devices
____ Wet Basins
____ Biofiltration Strips
____ Detention Devices
____ Biofiltration Swales
____ Austin Sand Filter
____ Delaware Filter
____ MCTT

10. Is copper (dissolved) the TDC? If Yes for dissolved Copper, consider: o Yes o No
____ Infiltration Devices
____ Biofiltration Strips
____ Wet Basin
____ Biofiltration Swale

11. Is lead (total) the TDC? If Yes for total Lead, consider: o Yes o No
____ Infiltration Devices
____ Wet Basin
____ Biofiltration Strips
____ Austin Sand Filter
____ Delaware Filter
____ Detention Devices
____ Biofiltration Swales
____ MCTT

12. Is lead (dissolved) the TDC? If Yes for dissolved Lead, consider: o Yes o No
____ Infiltration Devices
____ Biofiltration Strips
____ Wet Basin
____ Detention Device
____ Biofiltration Swales
____ Austin Sand Filters

13. Is zinc (total) the TDC? If Yes for total Zinc, consider: o Yes o No
____ Infiltration Devices
____ Delaware Filter
____ Wet Basin
____ Biofiltration Strips
____ Biofiltration Swales
____ Austin Sand Filter
____ MCTT
____ Detention Devices

14. Is zinc (dissolved) the TDC? If Yes for dissolved Zinc, consider: o Yes o No
    ____ Infiltration Devices
    ____ Delaware Filter
    ____ Biofiltration Strip
    ____ Biofiltration Swale
    ____ Austin Sand Filter
    ____ MCTT

15. Is sediment (total suspended solids [TSS]) the TDC? If Yes for TSS, consider: o Yes o No
    ____ Infiltration Devices
    ____ Austin Sand Filter
    ____ Delaware Filter
    ____ Wet Basin
    ____ Detention Device
    ____ Biofiltration Strip
    ____ MCTT
    ____ Biofiltration Swale

16. Are "General Metals" or (unspecified) "Metals" the TDC? If Yes for General Metals, consider: o Yes o No
    ____ Infiltration Devices
    ____ Biofiltration Strips
    ____ Wet Basin
    ____ Biofiltration Swale
    ____ Austin Sand Filter
    ____ Delaware Filter
    ____ MCTT

17. General Purpose Pollutant Removal: When it is determined that there are no TDCs, consider the Treatment BMPs in the order listed below. o Yes o No
    ____ Infiltration Devices
    ____ Biofiltration Strips
    ____ Wet Basin
    ____ Biofiltration Swale
    ____ Austin Sand Filter
    ____ Detention Device
    ____ Delaware Filter
    ____ MCTT

18. Biofiltration
    (a) Are site conditions and climate favorable to allow suitable vegetation to be established? o Yes o No

    (b) Have Biofiltration Strips and Swales been considered to the extent practicable? Note: Biofiltration BMPs should be considered for all projects, even if other Treatment BMPs are placed. o Yes o No

If No to (a) or (b), document justification in Section 5 of the SWDR.

19. After completing the above, complete and attach the checklists shown below for every Treatment BMP under consideration o Complete

    ____ Biofiltration Strips and Biofiltration Swales: Checklist T-1, Part 2
    ____ Dry Weather Diversion: Checklist T-1, Part 3
    ____ Infiltration Devices: Checklist T-1, Part 4
    ____ Detention Devices: Checklist T-1, Part 5
    ____ GSRDs: Checklist T-1, Part 6
    ____ Traction Sand Traps: Checklist T-1, Part 7
    ____ Media Filter [Austin Sand Filter and Delaware Filter]: Checklist T-1, Part 8
    ____ Multi-Chambered Treatment Train: Checklist T-1, Part 9
    ____ Wet Basins: Checklist T-1, Part 10

20. (a) Estimate what percentage of WQV (or WQF, depending upon the Treatment BMP selected) will be treated by the preferred Treatment BMP(s): ____________% o Complete

    (b) Have Treatment BMPs been considered for use in parallel or series to increase this percentage? o Yes o No

21. Prepare cost estimate, including right-of-way, for selected Treatment BMPs and include as supplemental information for SWDR approval. o Complete

Treatment BMPs

Checklist T-1, Part 2

Prepared by:________________Date:________________District-Co-Route:__________________
PM (KP):______________________________________EA:______________________________
RWQCB:____

Biofiltration Swales / Biofiltration Strips

Feasibility

1. Do the climate and site conditions allow vegetation to be established? o Yes o No

2. Are flow velocities from a peak drainage facility design event < 4 fps (i.e. low enough to prevent scour of the vegetated bioswale as per HDM Table 873.3E)? o Yes o No

If "No" to either question above, Biofiltration Swales and Biofiltration Strips are not feasible.

3. Are Biofiltration Swales proposed at sites where known hazardous soils or contaminated groundwater plumes exist? o Yes o No
   If "Yes", consult with District/Regional NPDES Coordinator about how to proceed.

4. Does adequate area exist within the right-of-way to place Biofiltration device(s)? o Yes o No
   If "Yes", continue to Design Elements section. If "No", continue to Question 5.

5. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Biofiltration devices and how much right-of-way would be needed to treat WQF? __________ acres o Yes o No
   If "Yes", continue to Design Elements section. If "No", continue to Question 6.

6. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of these Treatment BMPs into the project. o Complete

Design Elements

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Has the District Landscape Architect provided vegetation mixes appropriate for climate and location? * o Yes o No

2.	Can the bioswale be designed as a conveyance system under any expected flows > the WQF event, as per HDM Chapter 800? * (e.g. freeboard, minimum slope, etc.)	o Yes	o No
3.	Can the bioswale be designed as a water quality treatment device under the WQF while meeting the required HRT, depth, and velocity criteria? (Reference Appendix B, Section B.2.3.1)*	o Yes	o No
4.	Is the maximum length of a biostrip ≤ 300 ft? *	o Yes	o No
5.	Has the minimum width (in the direction of flow) of the invert of the bioswale received the concurrence of Maintenance? *	o Yes	o No
6.	Can bioswales be located in natural or low cut sections to reduce maintenance problems caused by animals burrowing through the berm of the swale? **	o Yes	o No
7.	Is the biostrip sized as long as possible in the direction of flow? **	o Yes	o No
8.	Have Biofiltration Systems been considered for locations upstream of other Treatment BMPs, as part of a treatment train? **	o Yes	o No

Treatment BMPs

Checklist T-1, Part 3

Prepared by:_______________Date:_______________District-Co-Route:__________________
PM (KP):_____________________________________EA:_____________________________
RWQCB:____

Dry Weather Flow Diversion

Feasibility

1. Is a Dry-Weather Flow Diversion acceptable to a Publicly Owned Treatment Works (POTW)? o Yes o No
2. Would a connection require ordinary (i.e., not extraordinary) plumbing, features or construction methods to implement? o Yes o No

   If "No" to either question above, Dry Weather Flow Diversion is not feasible.
3. Does adequate area exist within the right-of-way to place Dry Weather Flow Diversion devices? o Yes o No
   If "Yes", continue to Design Elements sections. If "No", continue to Question 4.
4. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Dry Weather Flow Diversion devices and how much right-of-way would be needed? _________ (acres) o Yes o No
   If "Yes", continue to the Design Elements section.

   If "No", continue to Question 5.
5. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. o Complete

Design Elements

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Does the existing sanitary sewer pipeline have adequate capacity to accept project dry weather flows, or can an upgrade be implemented to handle the anticipated dry weather flows within the project's budget and objectives? * o Yes o No
2. Can the connection be designed to allow for Maintenance vehicle access? * o Yes o No
3. Can gate, weir, or valve be designed to stop diversion during storm events? * o Yes o No
4. Can the inlet be designed to reduce chances of clogging the diversion pipe or channel? * o Yes o No
5. Can a back flow prevention device be designed to prevent sanitary sewage from entering storm drain? * o Yes o No

Treatment BMPs
Checklist T-1, Part 4

Prepared by:_______________Date:_______________District-Co-Route:__________________
PM (KP):_____________________________________EA:______________________________
RWQCB:____

Infiltration Devices

Feasibility

1.	Does local Basin Plan or other local ordinance provide influent limits on quality of water that can be infiltrated, and would infiltration pose a threat to groundwater quality as determined by the District/Regional NPDES Storm Water Coordinator?	o Yes	o No
2.	Does infiltration at the site compromise the integrity of any slopes in the area?	o Yes	o No
3.	Per survey data or U.S. Geological Survey (USGS) Quad Map, are existing slopes at the proposed device site >15%?	o Yes	o No
4.	At the invert, does the soil type classify as NRCS Hydrologic Soil Group (HSG) D, or does the soil have an infiltration rate < 0.5 inches/hr?	o Yes	o No
5.	Is site located over a previously identified contaminated groundwater plume?	o Yes	o No
	If "Yes" to any question above, Infiltration Devices are not feasible; stop here and consider other approved Treatment BMPs.		
6.	(a) Does site have groundwater within 10 ft of basin invert?	o Yes	o No
	(b) Does site investigation indicate that the infiltration rate is significantly greater than 2.5 inches/hr?	o Yes	o No
	If "Yes" to either part of Question 6, the RWQCB must be consulted, and the RWQCB must conclude that the groundwater quality will not be compromised, before approving the site for infiltration.	o Yes	o No
7.	Does adequate area exist within the right-of-way to place Infiltration Device(s)? If "Yes", continue to Design Elements sections. If "No", continue to Question 8.	o Yes	o No
8.	If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Infiltration Devices and how much right-of-way would be needed to treat WQV? _________ acres If Yes, continue to Design Elements section. If No, continue to Question 9.	o Yes	o No
9.	If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project.	o Complete	

Design Elements – Infiltration Basin

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1.	Has a detailed investigation been conducted, including subsurface soil investigation, in-hole conductivity testing and groundwater elevation determination? (This report must be completed for PS&E level design.) *	o Yes	o No
2.	Has an overflow spillway with scour protection been provided? *	o Yes	o No
3.	Is the Infiltration Basin size sufficient to capture the WQV while maintaining a 40-48 hour drawdown time? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet]) *	o Yes	o No
4.	Can access be placed to the invert of the Infiltration Basin? *	o Yes	o No
5.	Can the Infiltration Basin accommodate the Water Quality freeboard above the WQV elevation (reference Appendix B.1.3.1)? *	o Yes	o No
6.	Can the Infiltration Basin be designed with interior side slopes no steeper than 1:4 (V:H) (may be 1:3 [V:H] with approval by District Maintenance)? *	o Yes	o No
7.	Can vegetation be established in the Infiltration Basin? **	o Yes	o No
8.	Can diversion be designed, constructed, and maintained to bypass flows exceeding the WQV? **	o Yes	o No
9.	Can a gravity-fed Maintenance Drain be placed? **	o Yes	o No

Design Elements – Infiltration Trench

* **Required** Design Element – (see definition above)
** **Recommended** Design Element – (see definition above)

1.	Has a detailed investigation been conducted, including subsurface soil investigation, in-hole conductivity testing and groundwater elevation determination? (This report must be completed for PS&E level design.) *	o Yes	o No
2.	Is the surrounding soil within Hydrologic Soil Groups (HSG) Types A or B? *	o Yes	o No
3.	Is the volume of the Infiltration Trench equal to at least the 2.85x the WQV, while maintaining a drawdown time of ≤ 72 hours? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet], unless the District/Regional NPDES Storm Water Coordinator will allow a volume between 2,830 ft^3 and 4,356 ft^3 to be considered.) *	o Yes	o No
4.	Is the depth of the Infiltration Trench ≤ 13 ft, and is the depth < the width? *	o Yes	o No
5.	Can an observation well be placed in the trench? *	o Yes	o No
6.	Can access be provided to the Infiltration Trench? *	o Yes	o No
7.	Can pretreatment be provided to capture sediment in the runoff (such as using Biofiltration)? *	o Yes	o No
8.	Can flow diversion be designed, constructed, and maintained to bypass flows exceeding the Water Quality event? **	o Yes	o No
9.	Can a perimeter curb or similar device be provided (to limit wheel loads upon the trench)? **	o Yes	o No

Treatment BMPs

Checklist T-1, Part 5

Prepared by:_______________Date:_______________District-Co-Route:__________________
PM (KP):______________________________________EA:_____________________________
RWQCB:____

Detention Devices

Feasibility

1. Is there sufficient head to prevent objectionable backwater conditions in the upstream drainage systems?	o Yes	o No
2. 2a) Is the volume of the Detention Device equal to at least the WQV? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet])	o Yes	o No
Only answer (b) if the Detention Device is being used also to capture traction sand.		
2b) Is the total volume of the Detention Device at least equal to the WQV plus the anticipated volume of traction sand, while maintaining a minimum 12 inch freeboard (1 ft)?	o Yes	o No
3. Is basin invert ≥ 10 ft above seasonally high groundwater or can it be designed with an impermeable liner? (Note: If an impermeable liner is used, the seasonally high groundwater elevation must not encroach within 12 inches of the invert.)	o Yes	o No

If No to any question above, then Detention Devices are not feasible.

4. Does adequate area exist within the right-of-way to place Detention Device(s)? If Yes, continue to the Design Elements section. If No, continue to Question 5.	o Yes	o No
5. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Detention Device(s) and how much right-of way would be needed to treat WQV? _________ acres If Yes, continue to the Design Elements section. If No, continue to Question 6.	o Yes	o No
6. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project.	o Complete	

Design Elements

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Has the geotechnical integrity of the site been evaluated to determine potential impacts to surrounding slopes due to incidental infiltration? If incidental infiltration through the invert of an unlined Detention Device is a concern, consider using an impermeable liner. *	o Yes	o No
2. Has the location of the Detention Device been evaluated for any effects to the adjacent roadway and subgrade? *	o Yes	o No
3. Can a minimum Water Quality freeboard of 12 inches be provided above the WQV? *	o Yes	o No
4. Is an overflow outlet provided? *	o Yes	o No
5. Is the drawdown time of the Detention Device within 24 to 72 hours? *	o Yes	o No
6. Is the basin outlet designed to minimize clogging (minimum outlet orifice diameter of 0.5 inches)? *	o Yes	o No
7. Are the inlet and outlet structures designed to prevent scour and re-suspension of settled materials, and to enhance quiescent conditions? *	o Yes	o No
8. Can vegetation be established in an earthen basin at the invert and on the side slopes for erosion control and to minimize re-suspension? Note: Detention Basins may be lined, in which case no vegetation would be required for lined areas.*	o Yes	o No
9. Has sufficient access for Maintenance been provided? *	o Yes	o No
10. Is the side slope 1:4 (V:H) or flatter for interior slopes? ** (Note: Side slopes up to 1:3 (V:H) allowed with approval by District Maintenance.)	o Yes	o No
11. If significant sediment is expected from nearby slopes, can the Detention Device be designed with additional volume equal to the expected annual loading? **	o Yes	o No
12. Is flow path as long as possible ($\geq$ 2:1 length to width ratio at WQV elevation is recommended)? **	o Yes	o No

Treatment BMPs

Checklist T-1, Part 6

Prepared by:_______________Date:_______________District-Co-Route:__________________
PM (KP):_____________________________________EA:_____________________________
RWQCB:____

Gross Solids Removal Devices (GSRDs)

Feasibility

1. Is the receiving water body downstream of the tributary area to the proposed GSRD on a 303(d) list or has a TMDL for litter been established? o Yes o No

2. Are the devices sized for flows generated by the peak drainage facility design event or can peak flow be diverted? o Yes o No

3. Are the devices sized to contain gross solids (litter and vegetation) for a period of one year? o Yes o No

4. Is there sufficient access for maintenance and large equipment (vacuum truck)? o Yes o No

   If "No" to any question above, then Gross Solids Removal Devices are not feasible. Note that Biofiltration Systems, Infiltration Devices, Detention Devices, Dry Weather Flow Diversion, MCTT, Media Filters, and Wet Basins may be considered for litter capture, but consult with District/Regional NPDES if proposed to meet a TMDL for litter.

5. Does adequate area exist within the right-of-way to place Gross Solids Removal Devices? o Yes o No
   If "Yes", continue to Design Elements section. If "No", continue to Question 6.

6. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Gross Solids Removal Devices and how much right-of-way would be needed? _________ acres o Yes o No
   If "Yes", continue to Design Elements section. If "No", continue to Question 7.

7. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. o Complete

Design Elements – Linear Radial Device

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Does sufficient hydraulic head exist to place the Linear Radial GSRD? * o Yes o No

2. Was the litter accumulation rate of 10 ft^3/ac/yr (or a different rate recommended by Maintenance) used to size the device? * o Yes o No

3. Were the standard detail sheets used for the layout of the devices? ** o Yes o No
   If No, consult with Headquarters Office of Storm Water Management and District/Regional NPDES.

4. Is the maximum depth of the storage within 10 ft of the ground surface, or another depth as required by District Maintenance? * o Yes o No

Design Elements – Inclined Screen

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Does sufficient hydraulic head exist to place the Inclined Screen GSRD? * o Yes o No

2. Was the litter accumulation rate of 10 ft^3/ac/yr (or a different rate recommended by Maintenance) used to size the device? * o Yes o No

3. Were the standard details sheets used for the layout of the devices? ** o Yes o No
   If No, consult with Headquarters Office of Storm Water Management and District NPDES.

4. Is the maximum depth of the storage within 10 ft of the ground surface, or another depth as required by District Maintenance? * o Yes o No

Treatment BMPs

Checklist T-1, Part 7

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):____EA:_______________________________
RWQCB:____

Traction Sand Traps

Feasibility

1. Can a Detention Device be sized to capture the estimated traction sand and the WQV from the tributary area?
   If Yes, then a separate Traction Sand Trap may not be necessary. Coordinate with the District/Regional Storm Water Coordinator and also complete Checklist T-1, Part 5. o Yes o No

2. Is the Traction Sand Trap proposed for a site where sand or other traction enhancing substances are applied to the roadway at least twice per year? o Yes o No

3. Is adequate space provided for Maintenance staff and equipment access for annual cleanout? o Yes o No

4. Has the local RWQCB agreed that the proposed Traction Sand Trap would not be classified as a regulated underground injection well? o Yes o No

   If the answer to any one of Questions 2, 3 or 4 is No, then a Traction Sand Trap is not feasible.

5. Does adequate area exist within the right-of-way to place Traction Sand Traps? o Yes o No
   If Yes, continue to Design Elements section. If No, continue to Question 6.

6. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site Traction Sand Traps and how much right-of-way would be needed? __________ acres o Yes o No
   If Yes, continue to the Design Elements section. If No, continue to Question 7.

7. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. o Complete

Design Elements

* **Required** Design Element – A “Yes” response to these questions is required to further the consideration of this BMP into the project design. Document a “No” response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A “Yes” response is preferred for these questions, but not required for incorporation into a project design.

1. Was the local Caltrans Maintenance Station contracted to provide the amount of traction sand used annually at the location? * (Detention Device or CMP type) List application rate reported. __________ yd^3	o Yes	o No
2. Does the Traction Sand Trap have enough volume to store settled sand over the winter using the formula presented in Appendix B, Section B.5? * (Detention Device or CMP type)	o Yes	o No
3. Is the invert of the Traction Sand Trap a minimum of 3 ft above seasonally high groundwater? * (CMP type)	o Yes	o No
4. Is the maximum depth of the storage within 10 ft of the ground surface, or another depth as required by District Maintenance? * (CMP type)	o Yes	o No
5. Has the District/Regional NPDES Storm Water Coordinator been contacted to ensure that the Traction Sand Trap is not classified as a regulated underground injection well? * (CMP type)	o Yes	o No
6. Can peak flow be diverted around the device? ** (CMP type)	o Yes	o No
7. Within the tributary area, have the unstabilized areas (that would contribute sediment in addition to traction sand) been minimized as much as possible?**(Detention Device or CMP type)	o Yes	o No
8. Is 6 inches separation provided between the top of the captured traction sand and the outlet from the device, in order to minimize re-suspension of the solids? ** (CMP type)	o Yes	o No

Treatment BMPs

Checklist T-1, Part 8

Prepared by:_______________Date:_______________District-Co-Route:__________________
PM (KP):____________________________________EA:_____________________________
RWQCB:____

Media Filters

Caltrans has approved two types of Media Filter: Austin Sand Filters and Delaware Filters. Austin Sand filters are typically designed for larger drainage areas, while Delaware Filters are typically designed for smaller drainage areas. The Austin Sand Filter is constructed with an open top and may have a concrete or earthen invert, while the Delaware is always constructed as a vault. See Appendix B, Media Filters, for a further description of Media Filters.

Feasibility – Austin Sand Filter

1. Is the volume of the Austin Sand Filter equal to at least the WQV using a 24 hour drawdown? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet]) o Yes o No

2. Is there sufficient hydraulic head to operate the device (minimum 3 ft between the inflow and outflow chambers)? o Yes o No

3. If initial chamber has an earthen bottom, is initial chamber invert ≥ 3 ft above seasonally high groundwater? o Yes o No

4. If a vault is used for either chamber, is the level of the concrete base of the vault above seasonally high groundwater or is a special design provided? o Yes o No

   If No to any question above, then an Austin Sand Filter is not feasible.

5. Does adequate area exist within the right-of-way to place an Austin Sand Filter(s)? o Yes o No
   If Yes, continue to Design Elements sections. If No, continue to Question 6.

6. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site the device and how much right-of way would be needed to treat WQV? _________ acres o Yes o No
   If Yes, continue to the Design Elements section.

   If No, continue to Question 7.

7. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. o Complete

If an Austin Sand Filter meets these feasibility requirements, continue to the Design Elements – Austin Sand Filter below.

Feasibility- Delaware Filter

1. Is the volume of the Delaware Filter equal to at least the WQV using a 40 to 48 hour drawdown? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet], consult with District/Regional NPDES if a lesser volume is under consideration.) o Yes o No

2. Is there sufficient hydraulic head to operate the device (minimum 3 ft between the inflow and outflow chambers)? o Yes o No

3. Would a permanent pool of water be allowed by the local vector control agency? o Yes o No

If No to any question, then a Delaware Filter is not feasible

4. Does adequate area exist within the right-of-way to place a Delaware Filter (s)? If Yes, continue to Design Elements sections. If No, continue to Question 5. o Yes o No

5. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site the device and how much right-of way would be needed to treat WQV? _________ acres If Yes, continue to the Design Elements section. If No, continue to Question 6. o Yes o No

6. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project. o Complete

   If a Delaware Filter is still under consideration, continue to the Design Elements – Delaware Filter section.

Design Elements – Austin Sand Filter

* **Required** Design Element – A “Yes” response to these questions is required to further the consideration of this BMP into the project design. Document a “No” response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A “Yes” response is preferred for these questions, but not required for incorporation into a project design.

1. Is the drawdown time of the 2nd chamber 24 hours? * o Yes o No

2. Is access for Maintenance vehicles provided to the Austin Sand Filter? * o Yes o No

3. Is a bypass/overflow provided for storms > WQV? * o Yes o No

4. Is the flow path length to width ratio for the sedimentation chamber of the “full” Austin Sand Filter ≥ 2:1? **

5. Can pretreatment be provided to capture sediment and litter in the runoff (such as using Biofiltration)? ** o Yes o No

6. Can the Austin Sand Filter be placed using an earthen configuration? ** If No, go to Question 9.	o Yes	o No
7. Is the Austin Sand Filter invert separated from the seasonally high groundwater table by ≥ 10 ft)? * If No, design with an impermeable liner.	o Yes	o No
8. Are side slopes of the earthen chamber 1:3 (V:H) or flatter? *	o Yes	o No
9. Is maximum depth ≤ 13 ft below ground surface? *	o Yes	o No
10. Can the Austin Sand Filter be placed in an offline configuration? **	o Yes	o No

Design Elements – Delaware Filter

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1. Can the first chamber be sized for the WQV? *	o Yes	o No
2. Is the drawdown time of the 2nd chamber between 40 and 48 hours? *	o Yes	o No
3. Is access for Maintenance vehicles provided to the Delaware Filter? *	o Yes	o No
4. Is a bypass/overflow provided for storms > WQV? **	o Yes	o No
5. Can pretreatment be provided to capture sediment and litter in the runoff (such as using Biofiltration)? **	o Yes	o No
6. Can the Delaware Filter be placed in an offline configuration? **	o Yes	o No
7. Is maximum depth ≤ 13 ft below ground surface? *	o Yes	o No

Treatment BMPs
Checklist T-1, Part 9

Prepared by:_______________Date:_______________District-Co-Route:__________________
PM (KP):____________________________________EA:______________________________
RWQCB:____

MCTT (Multi-chambered Treatment Train)

Feasibility

1.	Is the proposed location for the MCTT located to serve a "critical source area" (i.e. vehicle service facility, parking area, paved storage area, or fueling station)?	o Yes	o No
2.	Is the WQV ≥ 4,346 ft^3 [0.1 acre-foot]?	o Yes	o No
3.	Is there sufficient hydraulic head (typically ≥ 6 feet) to operate the device?	o Yes	o No
4.	Would a permanent pool of water be allowed by the local vector control agency? If No to any question above, then an MCTT is not feasible.	o Yes	o No
5.	Does adequate area exist within the right-of-way to place an MCTT(s)? If Yes, continue to Design Elements sections. If No, continue to Question 6.	o Yes	o No
6.	If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site the device and how much right-of way would be needed to treat WQV? _________ acres If Yes, continue to Design Elements section. If No, continue to Question 7.	o Yes	o No
7.	If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project.	o Complete	

Design Elements

* **Required** Design Element – A "Yes" response to these questions is required to further the consideration of this BMP into the project design. Document a "No" response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A "Yes" response is preferred for these questions, but not required for incorporation into a project design.

1.	Is the maximum depth of the 3rd chamber ≤ 13 ft below ground surface and has Maintenance accepted this depth? *	o Yes	o No
2.	Is the drawdown time in the 3rd chamber between 24 and 48 hours? *	o Yes	o No
3.	Is access for Maintenance vehicles provided to all chambers of the MCTT? *	o Yes	o No
4.	Is there sufficient hydraulic head to operate the device? *	o Yes	o No
5.	Has a bypass/overflow been provided for storms > WQV? *	o Yes	o No

6. Can pretreatment be provided to capture sediment and litter in the runoff (such as using Biofiltration)? ** o Yes o No

Treatment BMPs

Checklist T-1, Part 10

Prepared by:________________Date:________________District-Co-Route:__________________
PM (KP):____EA:______________________________
RWQCB:____

Wet Basin

Feasibility

1.	Is the volume of the Wet Basin above the permanent pool equal to at least the WQV using a 24 to 72 hour drawdown (40 to 48 hour drawdown preferred)? (Note: the WQV must be ≥ 4,356 ft^3 [0.1 acre-feet] and the permanent pool must be at least 3x the WQV.)	o Yes	o No
2.	Is a permanent source of water available in sufficient quantities to maintain the permanent pool for the Wet Basin?	o Yes	o No
3.	Is proposed site in a location where naturally occurring wetlands do not exist?	o Yes	o No
	Answer either question 3 or question 4:		
4.	For Wet Basins with a proposed invert above the seasonally high groundwater, Are NRCS Hydrologic Soil Groups [HSG] C and D at the proposed invert elevation, or can an impermeable liner be used? (Note: If an impermeable liner is used, the seasonally high groundwater elevation must not encroach within 12 inches of the invert.)	o Yes	o No
5.	For Wet Basins with a proposed invert below the groundwater table: Can written approval from the local Regional Water Quality Control Board be obtained to place the Wet Basin in direct hydraulic connectivity to the groundwater?	o Yes	o No
6.	Is Water Quality freeboard provided ≥ 1 foot?	o Yes	o No
7.	Is the maximum impoundment volume < 14.75 acre-feet?	o Yes	o No
8.	Would a permanent pool of water be allowed by the local vector control agency? If No to any question above, then a Wet Basin is not feasible.	o Yes	o No
9.	Is the maximum basin width ≤ 49 ft as suggested in Section B.10.2? If No, consult with the local vector control agency and District Maintenance.	o Yes	o No
10.	Does adequate area exist within the right-of-way to place a Wet Basin? If Yes, continue to Design Elements sections. If No, continue to Question 7.	o Yes	o No

11. If adequate area does not exist within right-of-way, can suitable, additional right-of-way be acquired to site the device and how much right-of way would be needed to treat WQV? _________ acres If Yes, continue to Design Elements section. If No, continue to Question 8.	o Yes	o No
12. Have the appropriate state and federal regulatory agencies been contacted to discuss location and potential to attract and harbor sensitive or endangered species? If No, contact the Regional/District NPDES Coordinator	o Yes	o No
13. If adequate area cannot be obtained, document in Section 5 of the SWDR that the inability to obtain adequate area prevents the incorporation of this Treatment BMP into the project.	o Complete	

Design Elements

* **Required** Design Element – A “Yes” response to these questions is required to further the consideration of this BMP into the project design. Document a “No” response in Section 5 of the SWDR to describe why this Treatment BMP cannot be included into the project design.

** **Recommended** Design Element – A “Yes” response is preferred for these questions, but not required for incorporation into a project design.

1. Can a controlled outlet and an overflow structure be designed for storm events larger than the Water Quality event? *	o Yes	o No
2. Is access for Maintenance vehicles provided? *	o Yes	o No
3. Is the drawdown time for the WQV between 24 and 72 hours? *	o Yes	o No
4. Has appropriate vegetation been selected for each hydrologic zone? *	o Yes	o No
5. Can all design elements required by the local vector control agency be incorporated? *	o Yes	o No
6. Has a minimum flow path length-to-width ration of at least 2:1 been provided? **	o Yes	o No
7. Has an upstream bypass been provided for storms > WQV? **	o Yes	o No
8. Can pretreatment be provided to capture sediment and litter in the runoff (such as using Biofiltration, or a forebay)? **	o Yes	o No
9. Can public access be restricted using a fence if proposed at locations accessible on foot by the public? **	o Yes	o No
5. Is the maximum depth < 10 ft?"	o Yes	o No

Construction Site BMPs
Checklist CS-1, Part 1

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):____EA:_________________________________
RWQCB:____

Soil Stabilization

General Parameters

1. How many rainy seasons are anticipated between begin and end of construction? __________
2. What is the total disturbed soil area for the project? (ac) __________
   (a) How much of the project DSA consists of slopes 1V:4H or flatter? (ac) __________
   (b) How much of the project DSA consists of 1V:4H < slopes < 1V:2H? (ac) __________
   (c) How much of the project DSA consists of slopes 1V:2H and steeper? (ac) __________
   (d) How much of the project DSA consists of slopes with slope lengths longer then 20 ft? (ac) __________
3. What rainfall area does the project lie within? (Refer to Table 2-1 of the Construction Site Best Management Practices Manual) __________
4. Review the required combination of temporary soil stabilization and temporary sediment controls and barriers for area, slope inclinations, rainy and non-rainy season, and active and non-active disturbed soil areas. (Refer to Tables 2-2, and 2-3 of the Construction Site Best Management Practices Manual for Rainfall Area requirements.) o Complete

Scheduling (SS-1)

5. Does the project have a duration of more then one rainy season and have disturbed soil area in excess of 25 acres? o Yes o No
   (a) Include multiple mobilizations (Move-in/Move-out) as a separate contract bid line item to implement permanent erosion control or revegetation work on slopes that are substantially complete. (Estimate at least 6 mobilizations for each additional rainy season. Designated Construction Representative may suggest an alternate number of mobilizations.) o Complete
   (b) Edit Order of Work specifications for permanent erosion control or revegetation work to be implemented on slopes that are substantially complete. o Complete
   (c) Edit permanent erosion control or revegetation specifications to require seeding and planting work to be performed when optimal. o Complete

Preservation of Existing Vegetation (SS-2)

6. Do Environmentally Sensitive Areas (ESAs) exist within or adjacent to the project limits? (Verify the completion of DPP-1, Part 5) o Yes o No

   (a) Verify the protection of ESAs through delineation on all project plans. o Complete

   (b) Protect from clearing and grubbing and other construction disturbance by enclosing the ESA perimeter with high visibility plastic fence or other BMP. o Complete

7. Are there areas of existing vegetation (mature trees, native vegetation, landscape planting, etc.) that need not be disturbed by project construction? Will areas designated for proposed treatment BMPs need protection (infiltration characteristics, vegetative cover, etc.)? (Coordinate with District Environmental and Construction to determine limits of work necessary to preserve existing vegetation to the maximum extent practicable.) o Yes o No

   (a) Designate as outside of limits of work (or designate as ESAs) and show on all project plans. o Complete

   (b) Protect with high visibility plastic fence or other BMP. o Complete

8. If yes for 6, 7, or both, then designate ESA fencing as a separate contract bid line item, *if not already incorporated as part of design pollution prevention work (See DPP-1, Part 5).* o Complete

Slope Protection

9. Provide a soil stabilization BMP(s) appropriate for the DSA, slope steepness, slope length, and soil erodibility. (Consult with District/Regional Landscape Architect.)

   (a) Select SS-3 (Hydraulic Mulch), SS-4 (Hydroseeding), SS-5 (Soil Binders), SS-6 (Straw Mulch), SS-7 (Geotextiles, RECPs, Etc.), SS-8 (Wood Mulching), other BMPs or a combination to cover the DSA throughout the project's rainy season. o Complete

   (b) Increase the quantities by 25% for each additional rainy season. (Designated Construction Representative may suggest an alternate increase.) o Complete

   (c) Designate as a separate contract bid line item. o Complete

Slope Interrupter Devices

10. Provide slope interrupter devices for all slopes with slope lengths equal to or greater than of 20 ft in length. (Consult with District/Regional Landscape Architect and Designated Construction Representative.)

    (a) Select SC-5 (Fiber Rolls) or other BMPs to protect slopes throughout the project's rainy season. o Complete

    (b) For slope inclination of 1:4 (V:H) and flatter, SC-5 (Fiber Rolls) or other BMPs shall be placed along the contour and spaced 20 ft on center. o Complete

    (c) For slope inclination between 1:4 (V:H) and 1:2 (V:H), SC-5 (Fiber Rolls) or other BMPs shall be placed along the contour and spaced 15 ft on center. o Complete

    (d) For slope inclination of 1:2 (V:H) and greater, SC-5 (Fiber Rolls) or other BMPs shall be placed along the contour and spaced 10 ft on center. o Complete

    (e) Increase the quantities by 25% for each additional rainy season. (Designated Construction Representative may suggest alternate increase.) o Complete

    (f) Designate as a separate contract bid line item. o Complete

Channelized Flow

11. Identify locations within the project site where concentrated flow from stormwater runoff can erode areas of soil disturbance. Identify locations of concentrated flow that enters the site from outside of the right-of-way (off-site run-on). o Complete

    (a) Utilize SS-7 (Geotextiles, RECPs, etc.), SS-9 (Earth Dikes/Swales, Ditches), SS-10 (Outlet Protection/Velocity Dissipation), SS-11 (Slope Drains), SC-4 (Check Dams), or other BMPs to convey concentrated flows in a non-erosive manner. o Complete

    (b) Designate as a separate contract bid line item. o Complete

Construction Site BMPs
Checklist CS-1, Part 2

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):_____________________________________EA:______________________________
RWQCB:____

Sediment Control

Perimeter Controls - Run-off Control

1. Is there a potential for sediment laden sheet and concentrated flows to discharge offsite from runoff cleared and grubbed areas, below cut slopes, embankment slopes, etc.? o Yes o No

   (a) Select linear sediment barrier such as SC-1 (Silt Fence), SC-5 (Fiber Rolls), SC-6 (Gravel Bag Berm), SC-8 (Sand Bag Barrier), SC-9 (Straw Bale Barrier), or a combination to protect wetlands, water courses, roads (paved and unpaved), construction activities, and adjacent properties. (Coordinate with District Construction for selection and preference of linear sediment barrier BMPs.) o Complete

   (b) Increase the quantities by 25% for each additional rainy season. (Designated Construction Representative may suggest an alternate increase.) o Complete

   (c) Designate as a separate contract bid line item. o Complete

Perimeter Controls - Run-on Control

2. Do locations exist where sheet flow upslope of the project site and where concentrated flow upstream of the project site may contact DSA and construction activities? o Yes o No

   (a) Utilize linear sediment barriers such as SS-9 (Earth Dike/Drainage Swales and Lined Ditches), SC-5 (Fiber Rolls), SC-6 (Gravel Bag Berm), SC-8 (Sand Bag Barrier), SC-9 (Straw Bale Barrier), or other BMPs to convey flows through and/or around the project site. (Coordinate with District Construction for selection and preference of perimeter control BMPs.) o Complete

   (b) Designate as a separate contract bid line item. o Complete

Storm Drain Inlets

3. Do existing or proposed drainage inlets exist within the project limits? o Yes o No

   (a) Select SC-10 (Storm Drain Inlet Protection) to protect municipal storm drain systems or receiving waters wetlands at each drainage inlet. (Coordinate with District Construction for selection and preference of inlet protection BMPs.) o Complete

   (b) Designate as a separate contract bid line item. o Complete

4. Can existing or proposed drainage inlets utilize an excavated sediment trap as described in SC-10 (Storm Drain Inlet Protection- Type 2)? o Yes o No

   (a) Include with other types of SC-10 (Storm Drain Inlet Protection). o Complete

Sediment/Desilting Basin (SC-2)

5. Does the project lie within a Rainfall Area where the required combination of temporary soil stabilization and sediment control BMPs includes desilting basins? (Refer to Tables 2-1, 2-2, and 2-3 of the Construction Site Best Management Practices Manual for Rainfall Area requirements.) o Yes o No

   (a) Consider feasibility for desilting basin allowing for available right-of-way within the project limits, topography, soil type, disturbed soil area within the watershed, and climate conditions. Document if the inclusion of sediment/desilting basins is infeasible. o Complete

   (b) If feasible, design desilting basin(s) per the guidance in SC-2 Sediment/ Desilting Basins of the Construction Site BMP Manual to maximize capture of sediment-laden runoff. o Complete

   Designate as a separate contract bid item. o Complete

6. Will the project benefit from the early implementation of proposed permanent Treatment BMPs? (Coordinate with District Construction.) o Yes o No

   (a) Edit Order of Work specifications for permanent treatment BMP work to be implemented in a manner that will allow its use as a construction site BMP. o Complete

Sediment Trap (SC-3)

7. Can sediment traps be located to collect channelized runoff from disturbed soil areas prior to discharge? o Yes o No

   (a) Design sediment traps in accordance with the Construction Site BMP Manual. o Complete

   (b) Designate as a separate contract bid line item. o Complete

Construction Site BMPs
Checklist CS-1, Part 3

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):____EA:________________________________
RWQCB:____

Tracking Controls

Stabilized Construction Entrance/Exit (TC-1)

1. Are there points of entrance and exit from the project site to paved roads where mud and dirt could be transported offsite by construction equipment? (Coordinate with District Construction for selection and preference of tracking control BMPs.) o Yes o No

   (a) Identify and designate these entrance/exit points as stabilized construction entrances (TC-1). o Complete

   (b) Designate as a separate contract bid line item. o Complete

Tire/Wheel Wash (TC-3)

2. Are site conditions anticipated that would require additional or modified tracking controls such as entrance/outlet tire wash? (Coordinate with District Construction.) o Yes o No

   Designate as a separate contract bid line item. o Complete

Stabilized Construction Roadway (TC-2)

3. Are temporary access roads necessary to access remote construction activity locations or to transport materials and equipment? (In addition to controlling dust and sediment tracking, access roads limit impact to sensitive areas by limiting ingress, and provide enhanced bearing capacity.) (Coordinate with District Construction.) o Yes o No

   (a) Designate these temporary access roads as stabilized construction roadways (TC-2). o Complete

   (b) Designate as a separate contract bid line item. o Complete

Street Sweeping and Vacuuming (SC-7)

4. Is there a potential for tracked sediment or construction related residues to be transported offsite and deposited on public or private roads? (Coordinate with District Construction for preference of including street sweeping and vacuuming with tracking control BMPs.) o Yes o No

   Designate as a separate contract bid line item. o Complete

Construction Site BMPs
Checklist CS-1, Part 4

Prepared by:________________Date:________________District-Co-Route:___________________
PM (KP):____EA:_______________________________
RWQCB:____

Wind Erosion Controls

Wind Erosion Control (WE-1)

1. Is the project located in an area where standard dust control practices in accordance with Standard Specifications, Section 10: Dust Control, are anticipated to be inadequate during construction to prevent the transport of dust offsite by wind? *(Note: Dust control by water truck application is paid for through the various items of work. Dust palliative, if it is included, is paid for as a separate item.)* o Yes o No

   (a) Select SS-3 (Hydraulic Mulch), SS-4 (Hydroseeding), SS-5 (Soil Binders), SS-7 (Geotextiles, Plastic Covers, & Erosion Control Blankets/Mats), SS-8 (Wood Mulching) or a combination to cover the DSA subject to wind erosion year-round, especially when significant wind and dry conditions are anticipated during project construction. (Coordinate with District Construction for selection and preference of wind erosion control BMPs.) o Complete

   (b) Designate as a separate contract bid line item. o Complete

Construction Site BMPs
Checklist CS-1, Part 5

Prepared by:________________Date:________________District-Co-Route:____________________
PM (KP):____EA:________________________________
RWQCB:____

Non-Storm Water Management

Temporary Stream Crossing (NS-4) & *Clear Water Diversion* (NS-5)

1. Will construction activities occur within a waterbody or watercourse such as a lake, wetland, or stream? (Coordinate with District Construction for selection and preference for stream crossing and clear water diversion BMPs.) o Yes o No

   (a) Select from types offered in NS-4 (Temporary Stream Crossing) to provide access through watercourses consistent with permits and agreements.[1] o Complete

   (b) Select from types offered in NS-5 (Clear Water Diversion) to divert watercourse consistent with permits and agreements.[1] o Complete

   (c) Designate as a separate contract bid line item(s). o Complete

Other Non-Storm Water Management BMPs

2. Are construction activities anticipated that will generate wastes or residues with the potential to discharge pollutants? o Yes o No

   (a) Identify potential pollutants associated with the anticipated construction activity and select the corresponding BMP such as NS-1 (Water Conservation Practices), NS-2 (Dewatering Operations), NS-3 (Paving and Grinding Operations), NS-7 (Potable Water/Irrigation), NS-8 (Vehicle and Equipment Cleaning), NS-9 (Vehicle and Equipment Fueling), NS-10 (Vehicle and Equipment Maintenance), NS-11 (Pile Driving Operations), NS-12 (Concrete Curing), NS-13 (Material and Equipment Use Over Water), NS-14 (Concrete Finishing), and NS-15 (Structure Demolition/Removal Over or Adjacent to Water).[1] o Complete

   (b) Verify that costs for non-stormwater management BMPs are identified in the contract documents. Designate BMP as a separate contract bid line item if the requirements in Construction Site Management (SSP 07-346) are anticipated to be inadequate or if requested by Construction. o Complete

[1] Coordinate with District Environmental for consistency with US Army Corps of Engineers 404 permit and Dept. of Fish and Game 1601 Streambed alteration Agreements.

Construction Site BMPs
Checklist CS-1, Part 6

Prepared by:________________Date:________________District-Co-Route:__________________
PM (KP):_______________________________________EA:______________________________
RWQCB:____

Waste Management & Materials Pollution Control

Concrete Waste Management (WM-8)

1. Does the project include concrete placement or mortar mixing? o Yes o No

   (a) Select from types offered in WM-8 (Concrete Waste Management) to provide concrete washout facilities. In addition, consider portable concrete washouts and vendor supplied concrete waste management services. (Coordinate with District Construction for selection and preference of waste management and materials pollution control BMPs.) o Complete

   (b) Designate as a separate contract bid line item if the quantity of concrete waste and washout are anticipated to exceed 5.2 yd^3 or if requested by Construction. o Complete

Other Waste Management and Materials Pollution Controls

2. Are construction activities anticipated that will generate wastes or residues with the potential to discharge pollutants? o Yes o No

   (a) Identify potential pollutants associated with the anticipated construction activity and select the corresponding BMP such as WM-1 (Material Delivery and Storage), WM-2 (Material Use), WM-4 (Spill Prevention and Control), WM-5 (Solid Waste Management), WM-6 (Hazardous Waste Management), WM-7 (Contaminated Soil Management), WM-9 (Sanitary/Septic Waste Management) and WM-10 (Liquid Waste Management) o Complete

   (b) Verify that costs for waste management and materials pollution control BMPs are identified in the contract documents. Designate BMP as a separate contract bid line item if the requirements in Construction Site Management (SSP 07-346) are anticipated to be inadequate or if requested by Construction. o Complete

Temporary Stockpiles (Soil, Materials, and Wastes)

3. Are stockpiles of soil, etc. anticipated during construction? o Yes o No

   (a) Select WM-3 (Stockpile Management), SS-3 (Hydraulic Mulch), SS-4 (Hydroseeding), SS-5 (Soil Binders), SS-7 (Geotextiles, RECPs etc.), or a combination as appropriate to cover temporary stockpiles of soil, etc. o Complete

(b) Select linear sediment barrier such as SC-1 (Silt Fence), SC-5 (Fiber Rolls), SC-6 (Gravel Bag Berm), SC-8 (Sand Bag Barrier), SC-9 (Straw Bale Barrier), or a combination to encircle temporary stockpiles of soil, etc. (Coordinate with District Construction for selection and preference of BMPs related to stockpiles.) — o Complete

(c) Designate as a separate contract bid line item if the requirements in Construction Site Management (SSP 07-346) are anticipated to be inadequate or if requested by Construction. — o Complete

4. Is there a potential for dust and debris from construction material (fill material, etc.) and waste (concrete, contaminated soil, etc.) stockpiles to be transported offsite by wind? — o Yes o No

(a) Select SS-7, temporary cover, plastic sheeting or other BMP to cover stockpiles subject to wind erosion year-round, especially when significant wind and dry conditions are anticipated during project construction. (Coordinate with District Construction for selection and preference of wind erosion control BMPs.) — o Complete

(b) Designate as a separate contract bid line item. — o Complete

Appendix F

Cost Estimates

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F.1 INTRODUCTION

The reliability of project cost estimates at every stage in the project delivery process is necessary for responsible fiscal management (see Chapter 20 of the Project Development Procedures Manual (PDPM, July 1999) for additional information). Unreliable cost estimates can result in severe problems in Caltrans programming and budgeting, in local and regional planning, and it results in staffing and budgeting decisions that could impair effective use of resources. This, in turn, affects Caltrans relations with the California Transportation Commission (CTC), the Legislature, local and regional agencies, and the public, and results in loss of credibility. Storm Water Quality Best Management Practices (BMPs) are an integral part of a project, and need to be accurately estimated during the Project Initiation Document (PID), Project Approval/Environmental Document (PA/ED), and Plans, Specifications and Estimates (PS&E) phases.

F.2 OBJECTIVES

Caltrans strives to avoid cost overruns on projects. One objective is to anticipate “unforeseen items of work” before the project concept, scope, and cost have been determined; thus minimizing the differences between cost estimates during the PID process, the PA/ED process and the PS&E process. The objective of this appendix is to provide general guidance on incorporating the cost of stormwater BMPs into the project delivery process; however, it is understood that local district procedures for cost estimating may vary.

F.3 METHODOLOGY

Although cost estimating is not an exact science, Caltrans must strive for reliable project cost estimates so that projects can be delivered "within budget." To this end, it is required that project cost estimates be prepared using a consistent and comprehensive methodology. Even with a consistent and comprehensive methodology, careful attention is needed to ensure a quality cost estimate. The cost estimator needs to research, compare and, above all, use their professional judgment to prepare a quality cost estimate.

F.3.1 Categories of Project Cost Estimates

There are two categories of project cost estimates: Project Planning Cost Estimates (PPCE) and Project Design Cost Estimates (PDCE). PPCEs are used for project justification, analysis of alternatives, approval, and for programming. PDCEs are used to summarize the cost of a project's contract items of work and will be part of the construction contract for the project.

PPCEs are cost estimates prepared in advance of project approval. The initial programmed cost (see PDPM, Chapter 6, Article 2) that appears the first time a project is listed is based on an escalation of a PPCE. PPCEs are categorized as: (1) Project Feasibility; (2) Project Summary Report (PSR); (3) Draft Project Report (DPR); and (4) Project Report (PR).

PDCEs are design cost estimates made after PR approval and until completion of the PS&E process. These estimates are categorized as either preliminary or final. PDCEs focus on the construction costs of the project and are input into the Basic Engineering Estimating System (BEES). BEES has two components: (1) the District (Highway) Cost Estimate, and (2) the

Structures (Bridge) Cost Estimate, that, when combined, equal the total construction cost for the project.

PDCEs should be considerably more detailed than PPCEs. As engineering and environmental studies progress, more information, such as final contour mapping, materials and drainage information, and structure studies, becomes available. This data increases the ability to prepare a more detailed cost estimate.

Cost estimates, in a sense, are never completed. They are not static, but have to be reviewed continually to keep them current. Other functional units (Division of Structures, Right-of-Way, Traffic Operations, Materials, Maintenance, Construction, Environmental, Landscape Architecture, etc.) and local entities should be involved, as appropriate, in the preparation of both PPCEs and PDCEs. The designer should gather as much information as possible for the project and its various alternatives. It is better to have too much information than not enough. Coordination between the PPCEs, the PDCEs, and the Standard Specifications that will be used to construct the project is required.

F.3.2 Systematic Field Reviews

During the planning phase, it is essential that project alternatives be adequately scoped. This is best accomplished by performing systematic field reviews to obtain factual data. This data is used to backup the cost estimates so that the estimates can be used with confidence. In addition, a systematic field review will help to ensure that the project is adequately scoped. Systematic field reviews are an essential part of the project delivery process. They provide an important perspective that supplements the mapping, photos, survey data and other sources of information about the project that are used in the office. Systematic field reviews will minimize the possibility of overlooking significant features that could affect project design.

While in the field, project personnel should be on the lookout for high cost items (i.e., retaining walls, major storm drains, additional rights-of-way required for installation of Treatment BMPs, utility obstructions, traffic handling, etc.). If high cost items are present or need to be designed into the project alternatives, then they must be quantified. The "worse probable case" should always be assumed, particularly on reconstruction projects. Existing facilities thought to be adequate may have become inadequate because of changes to standards, new data, etc. Design feature decisions, project constructability, construction staging, are among a variety of issues that should be evaluated in the field. Notes should be taken to document decisions and to identify limits, boundaries, and other conditions.

F.3.3 Technical Information

Technical information that must be obtained to prepare a PPCE includes, but is not limited to: geotechnical design information (particularly where infiltration is being considered or slope stability problems can be anticipated); materials information; hazardous waste assessment; potential environmental issues and mitigation; right-of-way and utilities data sheets; traffic handling and transportation management plans; etc. The designer should refer to as-built drawings or other references to see what information is available early in the project delivery process. If necessary information is not available, then it should be requested from the appropriate source unit.

F.3.4 Use Groupings from Standard Cost Estimate Format

Individual contract items are difficult to identify at the early project development stages, but it is possible to group basic work functions together to form a systematic approach to project cost estimating. Most projects have Design Pollution Prevention BMPs, Treatment BMPs, and Construction Site BMPs that are relatively easy to recognize and quantify. The standard cost estimating format (see Section F.7) provides for this approach by using such groupings. Coordination between the planning cost estimate and the Standard Specifications is essential, since these elements will directly influence construction of the project. A thorough knowledge of the Standard Specifications is essential.

F.3.5 Contingencies Versus Confidence Factor

Contingency factors for project planning cost estimates vary depending on the cost estimate type. Contingencies are intended to compensate for the use of limited information. The percentage goes down as the project becomes more defined and thus less unknown. Contingencies are not intended to take the place of complete design work. Project alternatives and their associated cost estimates must be thoroughly compiled by diligently using all of the available data, modifying that data with good judgment and using past cost estimating experience so that the cost estimates can be used with confidence.

F.3.6 Construction Seasons

Consideration should be given when a project is anticipated to extend beyond a single construction season. If the project cannot be finished before the end of the construction season and the project needs to be suspended, contractors will increase their bid prices to cover their overhead during the winter (i.e. “rainy” or “wet” season) and repair any damage that may occur. Even if contractors reasonably expect to finish before the winter, they may protect themselves to allow for an early winter. This can especially be true if construction involves work on items that may be affected by winter weather (i.e., drainage channels, earthwork, slope stabilization, etc.), or that requires deployment of additional Construction Site BMPs. Therefore, if a construction project is anticipated to extend over two or more construction seasons, add 25% to the estimated cost for Construction Site BMPs as determined by Section F.6.1 or Section F.6.3.

F.4 SUPPLEMENTAL WORK

Supplemental work is work of an uncertain nature or amount and, therefore, it is not done on a contract item basis. Work that is known but cannot be predetermined and provided for under contract items of work should be included as supplemental work. Supplemental work is not intended to take the place of complete design work, nor is it to be used for contingencies. The designer should not add supplemental work items for "possible additional work" for any major area of work (i.e. drainage, traffic items, etc.). Additional funds for undeterminable changes, such as increased dewatering operations, additional soil stabilization, or increased maintenance of Construction Site BMPs due to unusual weather (i.e. early winter or heavier than normal rainfall), should be included as supplemental work.

Extra work identified in the contract special provisions must be itemized as supplemental work. Contingencies are a percentage of the subtotal of the cost of contract items, supplemental work, and state-furnished materials and expenses, and are included in the grand total of the District Cost Estimate to allow for unforeseen increases.

F.5 STANDARD SPECIFICATIONS, CONTRACT PLANS AND SPECIAL PROVISIONS

All District Cost Estimates are to be based on the *Standard Specifications*, Contract Plans and Special Provisions. These documents form the basis for determining contract items. The *Standard Specifications*, along with the Contract Plans and Special Provisions for a specific project, prescribe the details for construction and completion of the work that the Contractor undertakes to perform in accordance with the terms of the contract. Coordination between the District Cost Estimate, the *Standard Specifications*, Contract Plans and Special Provisions is required.

F.6 ESTIMATING OPTIONS

There are three estimating options that may be used to establish prices for Storm Water BMPs considered during the PID, PA/ED, and PS&E processes of a project. These options may be used individually or in combination, and are shown in Table F-1:

Table F-1: Options for Estimating Storm Water BMPs

Option	Description
1	Percent of Total Project Cost
2	Historical Project Information
3	Estimated Unit Cost Sample
4	Actual Unit Cost

Although the cost estimating procedures may vary for each District, Table F-2 lists the options that are generally available during the different project delivery processes:

Table F-2: Estimating Options Available During the Project Development Processes

Project Process	Option	Documentation
PID	1 or 2	Storm Water Data Report (SWDR) / Preliminary Project Cost Estimate (PPCE)
PA/ED	2 or 3 or 4	Updated PPCE
PS&E	3 or 4	PDCE

The designer must provide estimates for the following Storm Water – related items:

- Design Pollution Prevention BMPs;
- Treatment BMPs;
- Construction Site BMPs;
- Cost for the contractor to prepare a SWPPP or WPCP; and
- Right-of-way Acquisition.

Design Pollution Prevention BMPs are normally covered under bid line items for excavation, grading, backfill, etc. Treatment BMPs may also be covered under bid line items, but are difficult to estimate during the planning phase. Construction Site BMPs are normally estimated as a percentage of the total project cost due to the uncertainty of the contractor's schedule. In addition, costs for right-of-way acquisitions to accommodate Treatment BMPs or drainage easements need to be incorporated into the estimate. The designer should base the estimated cost for land acquisition upon the unit right-of-way costs established by the District Right-of-Way Branch for the specific project area (see Section F.7.3).

F.6.1 Option 1: Percent of Total Cost Method

The Percent of Total Project Cost method can be used during the PID process when no unit costs or sample historical project costs are available. Table F-3 can be used to determine the percentage of cost for Construction Site BMPs based on the total construction costs (not including right-of-way costs). Typically, the total cost of Construction Site BMPs range from one percent (1%) to two percent (2%) of total project cost.

To use Table F-3, add the adjustments that apply for the particular project and then multiply the total estimated construction cost by the total of adjustments.

Table F-3: Percentage of Extra Cost to Project Due to Construction Site BMPs

Description	Recommended Adjustment (%)
Baseline Cost Percentage	1.25 [1]
Adjustment for Project Magnitude (Cost)	
$0 to $1,000,000	2.00
$1,000,000 to $1,500,000	1.25
$1,500,000 to $12,000,000	0.25
Greater than $12,000,000	0.00
Adjustment for Location (RWQCB)	
Region 9 (San Diego)	0.75
All other Regions	0.00
Adjustment for Type of Project	
Highway Planting (Landscaping)	0.10
All other projects	0.00
Adjustment for Work near 303(d) Water Bodies	
Work near 303(d) Water Bodies	Project Specific[2]
Adjustment for Project Specific Issues	
Project specific issues such as environmental sensitivity, monitoring, dewatering and discharge restrictions, permits, extreme construction conditions (coastal, mountain, urban), etc.	Project Specific[2]
a) Total Adjustments for Water Pollution Control	(sum)

[1] Baseline cost percentage of 0.75 is based upon actual construction costs for projects completed in 2003, 2004 and 2005 as described in the Water Pollution Cost Report prepared in 2005. (CT-SW-RT-05-138-04.1). Increase the baseline percentage to 1.25 or higher as necessary to reflect cost increases since 2005.

[2] Engineer preparing estimate should discuss the cost implications of project specific issues with District Storm Water Coordinator and District Construction Storm Water Coordinator.

Example:

For an interchange modification project consisting of structure widening, ramp realignment, and embankment construction, the estimated cost is $16,000,000. The project is located in San Diego County and is within RWQCB Region 9. The project drains to an unlisted water body. The adjustment factor is based upon the following:

Baseline Cost Percentage	1.25
Greater than $12,000,000	0.00
Adjustment for Location (RWQCB 9))	0.75
Adjustment for Type of Project	0.00
Adjustment for Work near 303(d) Water Bodies	0.00
Adjustment for Project Specific Issues	0.00
Total Adjustments for Water Pollution Control	2.00

The PID phase estimate for water pollution control is $320,000 ($16,000,000 x 2.00%).

As previously mentioned, the Design Pollution Prevention BMPs are normally covered under individual bid line items. The Treatment BMPs, however, are not normally defined enough at the PID stage to estimate as excavation, backfill, etc. For <u>New Construction or Major Reconstruction Projects, an additional $100,000 to $250,000 per lane mile should be added to cover costs associated with incorporating Treatment BMPs</u>. The lower end of this range would apply to projects that are not adjacent to a 303(d) listed water body. Conversely, the higher end of this range would be for projects that are adjacent to 303(d) listed water bodies. This price does not include right-of-way acquisition costs for constructing Treatment BMPs or for establishing drainage easements.

F.6.2 Option 2: Historical Project Method

The Historical Project method uses historical project cost information and updates that information to present day costs using the cost indexes in the Engineering News Record. This method can be generally used during the PID and PA/ED processes.

The following guidelines apply when using Historical Project costs:

- Similar size projects should be used and quantities for individual items should be similar;
- Consider using the average of the five lowest bidders, or possibly applying an increase factor to the low bid;
- Previous bid prices should be revised by the projected change in the California Construction Cost Index between the date of the old bid and the date of the anticipated new bid;
- The reference bid price should be adjusted to reflect different conditions between the reference project and the project for which the cost estimate is being prepared. This would include considerations of differences in type of terrain, geographical location, soil, traffic and specifications; and
- Lump sum bid prices or unit prices for items of work (e.g. culverts) that include varying amounts of other related work should not be used.

Table F-4 is a sample table that may be used to list the project, description of BMP(s), and corresponding unit price (if available) and the total dollar amount of specific BMPs. This table should be used separately to complete cost estimates for Design Pollution Prevention, Treatment and Construction Site BMPs. The total costs for each can then be added together.

Table F-4: Sample Table

Historical Project Name/EA	BMP Description	Unit of Measurement	Unit Price	Total Dollar Amount

F.6.3 Option 3, Unit Costs

The Unit Cost method uses estimated (Option 3) and actual (Option 4) unit costs. Both Options 3 and 4 can be used during the PS&E process. However, Option 4 is preferred.

Sources for estimating unit cost include the following:

- Design Pollution Prevention BMPs – See Table F-5;
- Construction Site BMPs – Table F-5;
- Basic Engineering Estimating System (BEES).

Table F-5 lists a range of unit costs for erosion and sediment control BMPs along with their related effectiveness. This table does not include costs for additional right-of-way acquisitions, if needed.

Table F-5: Installed Costs and Effectiveness of BMPs

BMP	Unit Cost Installed	Estimated Relative Erosion/ Sediment Control Effectiveness
SEDIMENT CONTROL		
Silt Fence	$3.00 – 4.00 per lineal foot	UNK
Fiber Rolls	$3.50 – 4.25 per lineal foot	58%
Gravel/Sand Bags Barrier	$0.45 – 0.90 per linear foot	UNK
Temporary Straw Bale Barrier	$2.30 – 4.50 per linear foot	UNK
TRACKING CONTROL		
Stabilized Construction Entrance/Exit	$1,500 – 2,500 each	UNK
NON-STORM WATER CONTROL		
Temporary Concrete Washout Facility	$1,500 – 3,000 each	UNK
SOIL STABILIZATION		
Vegetative:		
Fertilizer	$450 – 550 per acre	N/A
Seeding	$870 – 2,170 per acre	50%
Stolonizing	$2,200 per acre + cost of stolons	90%
Hydraulic Mulching	$900 – 1,200 per acre	50 – 60%
Compost Application	$900 – 1,200 per acre	40 – 50%
Straw Mulching	$1,800 – 2,100 per acre	90 – 95%
Mulch (Bark/Wood Chips –2 inch layer	$4,000 – 9,000 per acre	UNK
Erosion Control (Type C) {reference application of 110 lb seed, 1,000 lb fertilizer, 660 lb fiber, and 4.5 tons incorporated straw}		
Erosion Control (Type D) {reference application of 110 lb seed, 660 lb fertilizer, 4,400 lb compost, 1,300 lb fiber, 4.5 tons straw, and 300 lb tackifier}		
Non-Vegetative:		
Temporary Cover/Plastic Sheeting	$2.00 – 3.00 per square yard	UNK
Slope Roughening, Trackwalking, Imprinting	$0 – 350 per acre	
Rock Blanket (Cobble)	$12,000 – 28,000 per acre	
Rock Slope Protection (RSP-Light)	$15,600 – 25,700 per acre	
Rock Slope Protection (RSP-1/4 Ton)	$16,200 – 40,500 per acre	
Rock Slope Protection (RSP-1/2 Ton)		
Rock Slope Protection (RSP-1 Ton)		
Soil Binders		
Plant Material-Based (Short-Term)	$700 – 900 per acre	80 – 85%
Plant Material-Based (Long-Term)	$1,200 – 1,500 per acre	60 – 65%
Polymeric Emulsion Blends	$700 – 1,500 per acre	30 – 70%
Petroleum Resin-Based	$1,200 – 1,500 per acre	25 – 20%

Table F-5: Installed Costs and Effectiveness of BMPs

Cementitious Binder-Based		80 – 85%
Bonded Fiber Matrices		90 – 95%
Rolled Erosion Control Products		
Biodegradable:		
Jute	$6,000 – 7,000 per acre	65 – 70%
Curled Wood Fiber	$8,000 – 10,500 per acre	85 – 90%
Straw	$8,000 – 10,500 per acre	85 – 90%
Wood Fiber	$8,000 – 10,500 per acre	85 – 90%
Coconut Fiber	$13,000 – 14,000 per acre	90 – 95%
Coconut Fiber Net		85 – 90%
Straw Coconut		90 – 95%
Non-Biodegradable:		
Plastic Netting	$5,000 – 6,500 per acre	< 50%
Plastic Mesh	$3,000 – 3,500 per acre	75 – 80%
Synthetic Fiber w/Netting	$34,000 – 40,000 per acre	90 – 95%
Bonded Synthetic Fibers		90 – 95%
Combination Synthetic and Erosion Control		85 – 90%
STABILIZED CONVEYANCE SYSTEMS		
Culverts, Ditches, Berms, Dikes, Swales, Bio-strip*, Bio-swales* *Listed in this section for convenience but listed in the SWMP as Treatment BMPs		
TREATMENT BMPs		
Infiltration Device; Detention Device; Gross Solids Removal Device; Dry Weather Flow Diversion; Traction Sand Trap	Estimate using individual components of entire system, e.g.: Infiltration Device would require earthwork, minor concrete, asphalt concrete; various landscape items, various hydraulic items.	
NEW AND/OR UNAPPROVED BMPs		
MISCELLANEOUS		
Dewatering (Sediment Removal Only)	$100 per day per discharge	N/A
Temporary Creek Diversion System	$15,000 – 35,000	N/A

Sources: Unless otherwise noted, information derives from the Erosion Control Pilot Study Report, URS Greiner Woodward Clyde, June 2000, Table 4-1; and Caltrans Costs Data

[1] 2005 Caltrans Contract Cost Data

Prepare Water Pollution Control Program (BEES Item: 074017) &

Prepare Storm Water Pollution Prevention Plan (BEES Item: 074019)

Use Table F-6 to estimate the cost of preparing the written document describing the implementation of the project's water pollution controls. Projects with less than one (1) acre of soil disturbance will have Prepare Water Pollution Control Program (WPCP). Projects with one

(1) acre or more disturbed soil area will have Prepare Storm Water Pollution Prevention Plan (SWPPP). Prepare SWPPP will usually include the cost to prepare the Sampling and Analysis Plan (SAP).

Table F-6: Construction Site Water Pollution Control

a) *Total Construction Cost*	**Prepare SWPPP**	**Prepare WPCP**
$0 to $500,000	$5,000	$3,000
$500,000 to $1,000,000	$6,000	$5,000
$1,000,000 to $1,500,000	$6,000	$5,000
$1,500,000 to $12,000,000	$6,000	-
Greater than $12,000,000	$10,000	-

Construction Site Management (BEES Item: 074016)

Since bid history for Construction Site Management (SSP 07-346) is not yet available, the result from Table F-3 will be used as a starting figure. From this amount, subtract out costs for all separate BMPs bid items included. As a rule-of-thumb, Construction Site Management cost should be no lower than what is estimated for Prepare SWPPP (or Prepare WPCP).

Storm Water Sampling and Analysis (BEES Item: 066597)

Supplemental work items for Storm Water Sampling and Analysis (monitoring) are typically overestimated. It has been suggested that funds should only be included for projects that drain into a 303(d) water body listed for sediment or turbidity. Supplemental Work funds are not needed for non-visible pollutant testing as the conditions requiring testing rarely arise. Since information on what has been paid out for Storm Water Sampling is difficult to obtain, this extra work item should be estimated at the same rate as for Prepare SWPPP. This would be incremented for each rainy season anticipated and only included for sediment and turbidity listed waters.

Additional Water Pollution Control (BEES Item: 066596)

The Supplemental Work item for Additional Water Pollution Control will cover the addition of WPC BMPs suggested by the RE or Contractor. This is expected to be minor for most projects. As such, it is suggested to use the same rate as for Prepare SWPPP (or Prepare WPCP).

Water Pollution Control Maintenance Sharing (BEES Item: 066595)

The Supplemental Work item for Water Pollution Control Maintenance Sharing still exists but has been shifted to the individual separate item BMPs that allow for cost sharing. Water Pollution Control Maintenance Sharing cost should be no lower then the amount estimated for Prepare SWPPP (or Prepare WPCP). The following may be used to estimate BMP maintenance costs based upon input from Districts where this approach was piloted. The aggregate total of estimated maintenance costs would be combined into item WPC Maintenance Sharing:

- Temporary Silt Fence, estimate at 10% of the separate item cost per rainy season.
- Temporary Fiber Roll, estimate at 10% of the separate item cost per rainy season.
- Temporary Erosion Control and other hydraulically applied soil stabilization BMPs, estimate at 10% of the separate item cost per rainy season.
- Temporary Gravel Bag Berm, estimate at 25% of the item cost per rainy season.
- Temporary Drainage Inlet Protection, estimate at 25% of the item cost per rainy season.
- Temporary Construction Entrance, estimate at 25% of the item cost per rainy season.

All other Separate Item BMPs

For the variety of separate contract item BMPs such as hydraulic mulch or silt fence, the Item Cost database on the OE website will be sufficient. The items mentioned previously are not tracked so other methods must be used as tools for guidance. Also refer to Table F-5.

F.7 STANDARD FORMAT FOR PROJECT PLANNING COST ESTIMATES

The standard format included at the end of the PDPM (Appendix AA) may be used for all project planning cost estimates. For many projects, the form can be used as is by completing a cover sheet and "filling-in" the blanks. However, if needed, extra lines are provided for items not listed. Additional lines may be added as necessary.

The standard format is broken into four components:

- Cover Sheet;
- Roadway Items;
- Structure Items; and
- Right-of-Way.

Although the standard format was not written specifically for estimating Storm Water BMPs, Sections 3 (Drainage) and 4 (Specialty Items) may be used for this purpose. The concept behind the standard format requires that the cost estimator determine quantities and costs for groups of related work as previously discussed in Sections F.1 through F.5 of this Project Planning and Design Guide (PPDG). Identification of contract items is not necessary (but would be beneficial) to obtain a realistic cost estimate for each viable project alternative. Calculation sheets, maps and sketches used to determine costs and quantities for the cost estimate should be retained in the project files until the project has been completed and finalized.

F.7.1 Drainage

Large drainage facilities (i.e., reinforced concrete boxes, etc.) should be estimated separately and the *Standard Plans* should be consulted for quantities. Drainage items for widening and rehabilitation projects can be estimated by determining extensions to existing culverts and the number of other features, such as inlets, and overside drains, that will be affected. Be aware of any additional right-of-way that may be needed for drainage easements. Bid sheets from adjacent or similar type projects can be evaluated for estimating unit costs. Cost estimates for drainage on new alignment projects can be quantified by comparisons with similar types of projects.

F.7.2 Specialty Items

Items such as erosion control or slope protection (both during construction and permanent) can be estimated by using slope information obtained from the field review. Items such as hazardous wastes and environmental mitigation require consultation with other functional units in the District, the Engineering Service Center, and Headquarters. It is important to deal with hazardous waste and environmental issues immediately and design the project avoid them if possible, since they often adversely affect project cost estimates.

F.7.3 Right-of-Way Items

The right-of-way portion of the cost estimate should be obtained from the District Right-of-Way Branch. The Right-of-Way Branch prepares its cost estimate based on current procedures and guidelines contained in the *Right-of-Way Manual*. Costs for the listed right-of-way items are to be obtained from the Right-of-Way Data Sheet (see Appendix JJ of the PDPM). The Right-of-Way Data Sheet should be referred to in the project cost estimate as backup information.

"Construction Contract Work" (contractual obligations made by the Right-of-Way Branch with the property owner, such as the costs to relocate fencing, reconstruct gates, reconstruction of road approaches) should be described briefly and the estimated cost to perform this work given. The estimated cost should only be shown in this portion of the PPCE, not included. Construction contractual obligations are to be included in the project cost estimate as construction items of work.

F.7. 4 Cost Estimate

The following pages contain excerpts from Appendix AA of the PDPM. These sheets may be used to track estimates relating to costs for incorporating stormwater BMPs. The reader should refer to the PDPM for more specific guidance on using these forms.

(Enter Type of Project Planning Cost Estimate as Title)

Caltrans Metric

District-County-Route ____________________

KP (PM) ____________________

EA ____________________

Program Code ____________________

PROJECT DESCRIPTION:

Limits ____

____

Proposed Improvement (Scope) ____

____

Alternate ____

SUMMARY OF PROJECT COST ESTIMATE

TOTAL ROADWAY ITEMS	$__________
TOTAL STRUCTURE ITEMS	$__________
SUBTOTAL CONSTRUCTION COSTS	$__________
TOTAL RIGHT OF WAY ITEMS	$__________
TOTAL PROJECT CAPITAL OUTLAY COSTS	$__________

Reviewed by District Program Manager ____________________________
(Signature)

Approved by Project Manager ____________________________ Date __________
(Signature)

Phone No. ____________________ Page No. ____ of ____

District-County-Route ______________
KP (PM) ______________
EA ______________

Section 3 Drainage	Quantity	Unit	Unit Price	Item Cost
Large Drainage Facilities	_______	____	$_______	$_______
Storm Drains	_______	____	$_______	$_______
Pumping Plants	_______	____	$_______	$_______
Project Drainage (X-Drains, overside, etc.)	_______	____	$_______	$_______
________________________	_______	____	$_______	$_______
________________________	_______	____	$_______	$_______
________________________	_______	____	$_______	$_______
________________________	_______	____	$_______	$_______

Subtotal Drainage $__________

*Reference sketch showing typical pavement structural section elements of the roadway. Include (if available) T.I., R-Value and date when tests were performed.

NOTE: Extra lines are provided for items not listed, use additional lines as appropriate.

Page No. ___ of ___

District-County-Route ______________
KP (PM) ______________
EA ______________

Section 4 Specialty Items	**Quantity**	**Unit**	**Unit Price**	**Item Cost**
Retaining Walls	______	____	$______	$______
Noise Barriers	______	____	$______	$______
Barriers and Guardrails	______	____	$______	$______
Equipment/Animal Passes	______	____	$______	$______
Highway Planting	______	____	$______	$______
Replacement Planting	______	____	$______	$______
Irrigation Modification	______	____	$______	$______
Relocate Private Irrigation Facilities	______	____	$______	$______
Erosion Control	______	____	$______	$______
Slope Protection	______	____	$______	$______
Water Pollution Control	______	____	$______	$______
Hazardous Waste Mitigation Work	______	____	$______	$______
Environmental Mitigation	______	____	$______	$______
Resident Engineer Office Space	______	____	$______	$______
__________________	______	____	$______	$______
__________________	______	____	$______	$______
			Subtotal Specialty Items	$________

NOTE: Extra lines are provided for items not listed, use additional lines as appropriate.

District-County-Route ______________

KP (PM) ______________
EA ______________

III. RIGHT OF WAY ITEMS ESCALATED VALUE

A. Acquisition, including excess lands, damages to remainder(s) and Goodwill $____________

B. Utility Relocation (State share) $____________

C. Relocation Assistance $____________

D. Clearance/Demolition $____________

E. Title and Escrow Fees $____________

TOTAL RIGHT OF WAY ITEMS $__________
(Escalated Value)

Anticipated Date of Right of Way Certification $__________
(Date to which Values are Escalated)

F. Construction Contract Work

Brief Description of Work:

____

____

____

Right of Way Branch Cost Estimate for Work * $______________

* This dollar amount is to be included in the Roadway and/or Structures Items of Work, as appropriate. Do not include in Right of Way Items.

COMMENTS:

Estimate Prepared By ______________________ Phone# ________________

Date _________ ____
(Print Name)

NOTE: If appropriate, attach additional pages and backup.

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Appendix G

Abbreviations, Acronyms and Definition of Terms

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G.1 ABBREVIATIONS

a-f	acre-feet
cm	centimeter
cm/hr	centimeters per hour
cfs	cubic feet per second
fps	feet per second
’ or ft	feet
ft^2	square feet
ft^3	cubic feet
g	gram
ha	hectares
” or in	inches
”/hr or in/hr	inches per hour
hr(s)	hour(s)
kg	kilogram
kg/ha	kilograms per hectare
kg/m^2	kilograms per square meter
km	kilometer
l	liter
m	meter
mg	milligram
meq	milliequivalents
min	minute
mm	millimeter
m/s	meters per second
m^3	cubic meters
m^3/yr	cubic meters/year
v:h	vertical : horizontal
yd^3	cubic yard
yr	year
^oC	degrees Celsius
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to

G.2 ACRONYMS

ADL	Aerially Deposited Lead
ADT	Annual Average Daily Traffic
APS	Advanced Planning Study
ASCE	American Society of Civil Engineers
ASTM	American Society of Testing and Materials
BAT	Best Available Technology
BCT	Best Conventional Technology
BCDC	Bay Conservation and Development Commission
BEES	Basic Engineering Estimating System
BFM	Bonded Fiber Matrix
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BOD_5	5-Day BOD
Caltrans	California Department of Transportation
CDERP	Consideration of Downstream Effects Related to Potentially Increased Flow
CE	Categorical Exemption/Exclusion
CEC	Cation Exchange Capacity
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
C-SWAT	Construction Storm Water Advisory Team
CSWPPP	Conceptual Storm Water Pollution Prevention Plan
CTC	California Transportation Commission
CWA	Clean Water Act
DED	Draft Environmental Document
DHS	California Department of Health Services
DPR	Draft Project Report
DTSC	Department of Toxic Substances Control
DSA	Disturbed Soil Area
DWR	California Department of Water Resources
DWP	District Work Plan
EA	Expenditure Authorization
ED	Environmental Document
EPA	U.S. Environmental Protection Agency
ESA	Environmentally Sensitive Area
FED	Final Environmental Document
FES	Flared End Section
FHWA	Federal Highway Administration
GIS	Geographic Information System
GSRD	Gross Solids Removal Device
GW	Groundwater
HDM	Highway Design Manual
HOV	High Occupancy Vehicle
HRT	Hydraulic Residence Time
HSG	Hydrologic Soil Group

HQ	Headquarters
ISA	Initial Site Assessment
KP	Kilometer Post
MCL	Maximum Contaminant Level
MCTT	Multi-Chamber Treatment Train
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
M-SWAT	Maintenance Storm Water Advisory Team
N	Nitrogen (elemental)
N_2	Nitrogen (molecular) or Nitrogen gas
NEPA	National Environmental Policy Act
NH_3	Ammonia
NH_4^+	Ammonium ion
NO_3^-	Nitrate ion
NOCC	Notice of Completion of Construction
NOC	Notification of Construction
NPDES	National Pollutant Discharge Elimination System
NPRPD	National Pollutant Removal Performance Database
NRCS	Natural Resources Conservation Service
NSBMDB	National Storm Water Best Management Database
OC	Organic Content
OE	Office Engineer
O&G	Oil and Grease
O&M	Operation and Maintenance
PA/ED	Project Approval/Environmental Document
PCC	Portland Cement Concrete
PDCE	Project Design Cost Estimate
PDPM	Project Development Procedures Manual
PD-SWAT	Project Design Storm Water Advisory Team
PDT	Project Development Team
PE	Project Engineer
PEAR	Preliminary Environmental Assessment Report
PEE	Preliminary Environmental Evaluation
PGR	Preliminary Geotechnical Report
PID	Project Initiation Document
PM	Project Manager
POTW	Publicly Owned Treatment Works
PPCE	Preliminary Project Cost Estimate
PPDG	Project Planning and Design Guide (Storm Water Quality Handbooks)
PR	Project Report
PS&E	Plans, Specifications and Estimates
PSR	Project Study Report
RE	Resident Engineer
RECP	Rolled Erosion Control Products
RO	Runoff
RRR	Resurfacing, Restoration & Rehabilitation projects
RSP	Rock Slope Protection

RWQCB	Regional Water Quality Control Board
SAP	Sampling Analysis Plan
SSP	Standard Special Provisions
SUSMP	Standard Urban Storm Water Mitigation Plan
SW	Storm Water
SWAT	Storm Water Advisory Team
SWDR	Storm Water Data Report
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	California State Water Resources Control Board
TDC	Targeted Design Constituent
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
Total Ortho-P	Total Ortho Phosphate
TP	Total Phosphorous
TRPA	Tahoe Regional Planning Agency
TSS	Total Suspended Solids
UNK	Unknown
USA	Underground Service Alert
USDA	United States Department of Agriculture
USCS	Unified Soil Classification System
USGS	United States Geological Survey
UV	Ultraviolet
WBS	Work Breakdown Structure
WDR	Waste Discharge Requirement
WEF	Water Environment Federation
WLA	Waste Load Allocations
WPCP	Water Pollution Control Program
WQ	Water Quality
WQAG	Water Quality Assessment Guidelines
WQF	Water Quality Flow
WQR	Water Quality Assessment Technical Report
WQ-SWAT	Water Quality Storm Water Advisory Team
WQV	Water Quality Volume

G.3 DEFINITION OF TERMS

Bolded items in the following text signify that their definition can be found in this Appendix.

5-Day Biochemical Oxygen Demand (BOD) Test:

BOD refers to the oxygen used in meeting the metabolic needs of aerobic microorganisms in water containing organic matter. The higher the level of organic matter, the higher the BOD. For example, water polluted with sewage would have a high BOD.

The 5-day BOD test (BOD_5) measures the rate of oxygen required by microorganisms (i.e., a laboratory inoculation) to oxidize the biodegradable matter in a sample under controlled laboratory test conditions. High BOD results (usually the result of organic contamination) suggest that the dissolved oxygen levels in **receiving water** may be depleted.

303(d) List:

The 303(d) list is a list of **water bodies** that have one or more **beneficial uses** that are impaired by one or more pollutants. The 303(d) list is required by Section 303(d) of the federal **CWA**. Water bodies included on this list are referred to as "impaired waters." The State must take appropriate action to improve impaired water bodies, such as development of a **TMDL.**

Aerially Deposited Lead (ADL):

ADL is the lead that is frequently found in urbanized highway corridors due to historic emissions from automobile exhaust. These emissions are the result of past use of leaded gasoline. Soil impacted by ADL must be handled appropriately to prevent it from impacting the quality of stormwater runoff from Caltrans projects. Caltrans has applied for and received variances from the **DTSC** for the reuse of soils containing hazardous concentrations of lead. However, as per provision H(8) of the **Caltrans Permit**, the **RWQCB** must be notified at least 30 days prior to advertisement for bids to allow a determination by the RWQCB of the need for the development of **WDRs.**

Basin Plan:

A Basin Plan is a water quality control plan developed by each **RWQCB** to identify designated **beneficial uses** and water quality objectives for the **water bodies** and watershed areas within that specific region.

Beneficial Uses:

Streams, lakes, rivers, and other water bodies, have uses to humans and other life; these uses are referred to as the Beneficial Uses of a water body. The beneficial uses of waters in California are described in the Basin Plans adopted by the nine California RWQCBs. Section 13240 of the California Water Code requires adoption of water quality control plans, called Basin Plans, for the protection of water quality within the State's watersheds. **Discharges** from stormwater drainage systems may convey **pollutants** to waters of the State, and therefore may have an adverse impact on the beneficial uses of that water resource. Beneficial uses fall into one or more of the following categories:

- Agricultural Supply (AGR) – water used for irrigation, leaching of salts, stock watering, etc.;
- Industrial Service Supply (IND) – use of water for industrial activities that do not depend primarily on water quality;
- Industrial Process Supply (PRO) – uses of water that depend primarily on water quality;
- Groundwater Recharge (GWR) – replenishment of **groundwater** by percolation from surface waters;
- Municipal and Domestic Supply (MUN) – water supply systems including drinking water supply;
- Freshwater Replenishment (FRSH) – maintenance of surface water quality or quantity;

- Cold Freshwater Habitat (COLD) – maintenance of cold water ecosystems;
- Warm Freshwater Habitat (WARM) – maintenance of warm water ecosystems;
- Estuarine Habitat (EST)) – habitat resulting from commingling of freshwater and saltwater;
- Wildlife Habitat – (WILD) water used to support terrestrial or aquatic ecosystems;
- Preservation of Biological Habitats of Special Significance (BIOL) – water used to support designated areas such as refuges, parks or sanctuaries;
- Spawning, Reproduction, and/or Early Development (SPWN) - water used to support aquatic habitats suitable for reproduction and early development of fish;
- Migration of Aquatic Organisms (MIGR) – water used to support migration or other temporary aquatic organism uses;
- Rare, Threatened, or Endangered Species (RARE) – water used to support aquatic habitats necessary for the survival and maintenance of rare, threatened or endangered species;
- Aquaculture (AQUA) – using water for the propagation, cultivation, maintenance, or harvesting of aquatic plants or animals;
- Shellfish Harvesting (SHELL) – water used to support habitats for the maintenance of filter feeding shellfish;
- Commercial and Sport Fishing (COMM) – collecting fish for commercial or recreational purposes;
- Hydropower Generation (POW) – water used to produce electricity;
- Navigation (NAV) – the use of water for shipping or travel;
- Water Contact Recreation (REC-1) – recreational activities involving body contact with water; and
- Non-Contact Water Recreation (REC-2) – recreational activities involving proximity to water, but generally no body contact or ingestion of water.

Best Available Technology (BAT):

BAT is a term derived from Section 301(b) of the **CWA** and refers to **BMPs** to reduce toxic and non-conventional **pollutants** in **discharges** from **construction sites**. Toxic pollutants are those defined in Section 307 (a)(1) of the **CWA** and include heavy metals and man-made organics. Non-conventional pollutants are those not covered by conventional and toxic pollutants, such as ammonia, chloride, toxicity and nitrogen.

Best Conventional Technology (BCT):

BCT is a term derived from Section 301(b) of the federal **CWA** and refers to **BMPs** to reduce conventional **pollutants** in **discharges** from **construction sites**. Conventional pollutants include **TSS**, oil and grease, fecal coliforms, pH and other pollutants.

Best Management Practice (BMP):

A BMP is a measure that is implemented to protect water quality and reduce potential for pollution associated with stormwater **runoff**. Any program, technology, process, siting criteria, operating method, or device that controls, prevents, removes, or reduces pollution. There are four categories of BMPs: Maintenance, Design Pollution Prevention, Construction Site, and Treatment:

Maintenance:

Maintenance BMPs are water quality controls used to reduce pollutant discharges during highway maintenance activities and activities conducted at maintenance facilities. These BMPs are technology-based controls that attain MEP pollutant control. This category of BMPs includes litter pickup, toxics control, street sweeping, etc.

Design Pollution Prevention:

Design Pollution Prevention BMPs are permanent water quality controls used to reduce pollutant discharges by preventing **erosion**. These BMPs are standard technology-based, non-treatment controls selected to reduce pollutant discharges to the **MEP** requirements. They are applicable to all projects. This category of BMPs includes preservation of existing vegetation; concentrated flow conveyance systems, such as ditches, berms, dikes, swales, overside drains, outlet protection/velocity dissipation devices; and slope/surface protection systems such as vegetated surfaces and hard surfaces.

Construction Site:

Construction site BMPs are temporary controls used to reduce pollutant discharges during construction. These controls are best conventional technology/best available technology **BCT/BAT** based BMPs that may include **soil stabilization**, sediment control, wind **erosion** control, tracking control, non-stormwater management and waste management.

Treatment:

Treatment BMPs are permanent water quality controls used to remove pollutants from stormwater **runoff** prior to being discharged from Caltrans right-of-way. These controls are used to meet **MEP** requirements and are considered for projects discharging directly or indirectly to **receiving waters**. This category of BMPs includes: Traction Sand Traps, Infiltration Devices, Detention Devices, Biofiltration Systems, Dry Weather Flow Diversion, Media Filters, Multi-Chamber Treatment Trains, Wet Basins and **GSRDs**.

California Department of Health Services (DHS):

The California DHS (http://www.dhs.ca.gov/) is a State Government department created to protect and improve the health of Californians. DHS is concerned about the potential of any **BMP** device creating a public hazard by increasing habitat availability for aquatic stages of mosquitoes, and by creating harborage, food, and moisture for other reservoirs and nuisance species.

California Environmental Quality Act (CEQA):

The CEQA of 1970 requires public agencies to prevent significant, avoidable damage to the environment by regulating activities that may affect the quality of the environment. Public agencies accomplish this by requiring projects to consider the use of alternatives or mitigation measures. Regulations for the implementation of CEQA are found in the CEQA

Guidelines and are available online by the California Resources Agency at http://ceres.ca.gov/ceqa.

Caltrans Permit:

Caltrans Permit refers to the **NPDES** Statewide Storm Water Permit issued to Caltrans in 1999 (Order No. 99-06-DWQ) (CAS000003), to regulate stormwater discharges from Caltrans facilities. Caltrans is currently negotiating an updated permit with the **State Water Resources Control Board** (SWRCB).

Categorical Exemption (CE):

A CE is a list of classes of projects that have been determined not to have a significant effect on the environment and which shall, therefore, be exempt from the provisions of **CEQA**. For a list of classes of projects and further information see the web site:

http://ceres.ca.gov/topic/env_law/ceqa/guidelines/art19.html.

Clean Water Act (CWA):

The CWA, originally enacted by Congress in 1972, is a federal law that requires states to protect, restore, and maintain the quality of the waters of the United States, including lakes, rivers, aquifers and coastal areas. The CWA, as amended in 1987, is the enabling legislation for the **NPDES** permitting process.

Code of Federal Regulations (CFR):

The CFR is a document that codifies all rules of the executive departments and agencies of the federal government. It is divided into 50 volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) contains all environmental regulations. 40 CFR is available from bookstores operated by the Government Printing Office and online at: http://www.epa.gov/epahome/cfr40.htm.

Common Plan of Development:

Although not clearly defined by statute, a Common Plan of Development is generally a contiguous area where multiple, distinct construction activities may be taking place at different times under one plan. A plan is broadly defined as any piece of documentation or physical demarcation that indicates that construction activities may occur on a common plot. For Caltrans, such documentation could consist of the ED, the PSR, condemnation plans or contract documents. Any of these documents could delineate the boundaries of a common plan area.

Construction General Permit (General Permit):

The General Permit is a Statewide General Permit for construction activities (Order No. 99-08-DWQ) (CAS000002) that applies to all stormwater discharges from activities that result in a **DSA** of at least one acre or more. Construction activity that results in a DSA of less than one acre is subject to this General Permit if the construction activity is part of a larger **Common Plan of Development** that encompasses one or more acres of DSA or if there is the potential for significant water quality impairment resulting from the activity as determined by the **RWQCB**.

Construction Site:

The term "construction site" should apply to all areas both within the construction limits on state right-of-way and areas that are directly related to the construction activity, including but not limited to staging areas, storage yards, material borrow areas and storage areas, access roads, barges or platforms, etc., whether or not they reside within the Caltrans right-of-way.

Construction Site Best Management Practices Manual:

The Construction Site Best Management Practices Manual provides instructions for the selection and implementation of Construction Site **BMPs**. Caltrans requires contractors to identify and utilize these BMPs in preparation of their **SWPPP** or **WPCP**.

Department of Toxic Substances Control (DTSC):

The DTSC (http://www.dtsc.ca.gov/) is the department within the California EPA that has responsibility for regulating the generation, management and disposal of hazardous wastes. Caltrans has applied for and received variances from the DTSC for the reuse of some soils that can contain lead. Caltrans will provide written notification to the **RWQCB** at least 30 days prior to advertisement for bids for projects that involve soils subject to this variance.

Department of Water Resources (DWR):

The California DWR (http://wwwdwr.water.ca.gov/) is a State Government department created to manage the water resources of California in cooperation with other agencies in such a way as to benefit the State's people, and to protect, restore, and enhance the natural and human environments. The DWR is a source for hydrology data, **groundwater** information, water maps, etc.

District Work Plan (DWP):

DWPs (formerly Regional Work Plans) are annual detailed plans subject to the approval of the RWQCB that describes when and how the various programs and BMPs contained in the SWMP will be implemented by each District in each RWQCB jurisdictional area.

Discharge:

The term “discharge” refers to the amount of water flowing out of a drainage structure or facility. It is measured in cubic meters/second. It is any release, spill, leak, pump, flow, escape, dumping, or disposal of any liquid, semi-solid or solid substance.

Disturbed Soil Area (DSA):

DSAs are areas of exposed, erodible soil, including stockpiles, that are within the construction limits and that result from construction activities.

Erosion:

Erosion is the wearing away of earth surfaces by the action of external forces. In the case of drainage terminology, this term generally refers to the wearing away of the earth’s surface by flowing water.

Existing Vegetation:

Existing vegetation is any plant material within the project limits that is present prior to the beginning of construction.

Geographic Information System (GIS):

GIS is a system of hardware and software used for storage, retrieval, mapping, and spatial analysis of geographic data.

Groundwater (GW):

GW is defined as the water that is naturally occurring under the earth's surface. It is situated below the surface of the land, irrespective of its source and transient status. Subterranean streams are flows of GW parallel to and adjoining stream waters, and usually determined to be integral parts of the visible streams. GW is considered a jurisdictional water of the State under the Porter-Cologne Water Quality Act (California Water Code, Division 7).

High Risk Areas:

High Risk Areas are defined as municipal or domestic water supply reservoirs or **groundwater** percolation facilities discharging to aquifers designated as water supply sources.

Highway Design Manual (HDM):

The HDM is a Caltrans document that establishes uniform policies and procedures to carry out the highway design functions of Caltrans.

Litter:

Litter in stormwater is defined by Caltrans as manufactured objects made from paper, plastic, cardboard, glass, metal, etc. This definition does not include materials of natural origin such as gravel or vegetation. Litter in surface waters can inhibit the growth of aquatic vegetation, harm aquatic organisms by ingestion or entanglement, convey other **pollutants** and cause aesthetic problems on shorelines.

Maximum Contaminant Level (MCL):

The MCL is the highest level of a contaminant that is allowed in drinking water.

Maximum Extent Practicable (MEP) Analysis:

The MEP analysis is the process of evaluating the selected **BMPs** based on legal and institutional constraints, technical feasibility, relative effectiveness, and cost/benefit ratio.

Metals (Total and Dissolved):

Metals, both total and dissolved, are commonly monitored constituents and, next to **TSS** and **nutrients**, are the most common constituents cited in the literature as being present in stormwater **runoff.**

Trace quantities of many metals are necessary for biological growth and may naturally occur in runoff. Most metals, however, have numeric water quality standards because of their toxicity to aquatic organisms at high concentrations.

The toxicity of some metals is inversely related to water hardness. The numeric water quality standards for cadmium, chromium, copper, lead, nickel, silver and zinc are hardness-dependent. Copper, lead and zinc are the metals most commonly found in highway runoff.

Municipal Separate Storm Sewer System (MS4):

MS4s are storm drain systems regulated by the federal Phase I and Phase II stormwater regulations. Municipal combined sewer systems are regulated separately. MS4s are defined in the federal regulations at 40 **CFR** 122.26(b)(8). Caltrans is designated as an MS4 permittee.

National Environmental Policy Act (NEPA):

The NEPA of 1969 establishes policies and procedures to bring environmental considerations into the planning process for federal projects. NEPA requires all federal agencies to identify and assess reasonable alternatives to proposed actions that will restore and enhance the quality of the human environment and avoid or minimize adverse environmental impacts. The NEPA process is an overall framework for the environmental evaluation of federal actions.

National Pollutant Discharge Elimination System (NPDES) Permit:

The NPDES Permit is **EPA's** program to control the **discharge** of **pollutants** to waters of the United States. NPDES is a part of the federal **CWA**, which requires point and non-point source dischargers to obtain permits. These permits are referred to as NPDES permits.

Natural Resources Conservation Service (NRCS):

As part of the USDA, the NRCS provides leadership in a partnership effort to help people conserve, maintain, and improve natural resources and the environment. Soil types and local soil survey data can be obtained from the NRCS soil maps. The soil type and soil survey data are used during the desktop screening of potential Infiltration Device sites.

New Construction/Major Reconstruction:

New construction and major reconstruction includes new routes, route alignments, route upgrades (i.e., from two-lane conventional highway to four-lane expressway or freeway), 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.

Notice of Completion of Construction (NOCC):

The NOCC is a formal notification submitted by Caltrans to the appropriate **RWQCB** upon completion of the construction activities and stabilization of a site for which an **NOC** was previously submitted.

Notification of Construction (NOC):

The NOC is a formal notification submitted by Caltrans to the appropriate **RWQCB** at least 30 days prior to the start of a construction project that will result in the disturbance of one or more acres of soil. Information on the tentative start date, tentative duration, location of construction, description of project, estimated number of affected acres and the address and phone number of the construction field office is provided.

Nutrients:

Nutrients are nutritive substances such as phosphorous and nitrogen whose excessive input into **receiving waters** can over-stimulate the growth of aquatic plants.

Algae and vascular plants can cause numerous deleterious effects. Algae and vascular aquatic plants produce oxygen during the day via photosynthesis and consume oxygen during the night via respiration. The pH of the water is linked to this phenomenon through the carbonate cycle: the pH rises during the day when carbon dioxide (CO_2) is consumed for the photosynthetic production of plant tissue and falls at night when CO_2 is released by respiration. Algal blooms due to inputs of nitrogen or phosphorus can cause wide fluctuations in this dissolved oxygen and pH cycle during a 24-hour period, which can cause fish kills and mass mortality of benthic organisms. In addition, excessive algal and vascular plant growth can accelerate eutrophication, interfere with navigation, and cause unsightly conditions with reduced water clarity, odors, and diminished habitat for fish and shellfish.

Other trace nutrients, such as iron, are also needed for plant growth. In general, however, phosphorus and nitrogen are the nutrients of importance in aquatic environments.

Phosphorus. Phosphorus is taken up by algae and vascular aquatic plants and, when available in excess of the plant's immediate needs for metabolism and reproduction, can be stored in the cells. With bacterial decomposition of plant materials, relatively labile pools of phosphorus are later released and recycled within the biotic community. The refractory portion (i.e., compounds relatively resistant to biodegradation) tends to sink to the bottom, where it degrades slowly over time.

Analytical tests for the minimum constituent list include TP, which is the sum of the dissolved and particulate orthophosphate, polyphosphate and organic phosphorus; and Total Ortho-P, which is the sum of the dissolved and particulate orthophosphate.

Nitrogen. Transformation of nitrogen compounds can occur through several key mechanisms: fixation, ammonification, synthesis, nitrification, and denitrification. Nitrogen fixation is the conversion of nitrogen gas into nitrogen compounds that can be assimilated by plants; biological fixation is the most common, but fixation can also occur by lightning and through industrial processes. Ammonification is the biochemical degradation of organic-N into NH_3 or NH_4^+ by heterotrophic bacteria under aerobic or anaerobic conditions. Synthesis is the biochemical mechanism in which NH_4^+-N or NO_3^--N is converted into plant protein (Organic-N); nitrogen fixation is also a unique form of synthesis that can be performed only by nitrogen-fixing bacteria. Nitrification is the biological oxidation of NH_4^+ to NO_3^- through a two-step autotrophic process by the bacteria *Nitrosomonas* and *Nitrobacter*; the two-step reactions are usually very rapid, and hence it is rare to find nitrite levels higher than 1.0 mg/l in water. The nitrate formed by nitrification is, in the nitrogen cycle, used by plants as a nitrogen source (synthesis) or reduced to N_2 gas through the process of denitrification; NO_3^- can be reduced, under anoxic conditions, to N_2 gas through heterotrophic biological denitrification.

Analytical tests for the minimum constituent list include NH_3/NH_4^+-N, NO_3^--N, and Total TKN. TKN is a measure of NH_3/NH_4^+-N plus organic-N; the concentration of organic-N is thus obtained by subtracting the concentration of NH_3/NH_4^+-N found in the sample from that of the TKN value.

Pathogens:

Pathogens include viruses, bacteria, protozoa, and possibly helminth worms and are a concern in stormwater **runoff**. The direct measurement of specific pathogens in water is extremely difficult. The coliform group of organisms is commonly used as an indicator of the potential presence of pathogens of fecal origin.

Sources of total and fecal coliforms in stormwater runoff are ubiquitous (e.g., soil particles, droppings of wild and domestic animals, etc.). Human sources could include illicit sewer connections and seepage from septic tanks.

Pesticides:

A pesticide is a chemical agent designed to control pest organisms. The most common forms of pesticides are organic chemicals designed to target insects (insecticides) and vascular plants (herbicides).

Chlorpyrifos and Diazinon. Chlorpyrifos and Diazinon are organophosphate pesticides that have been detected in stormwater **runoff**. Organophosphates exhibit a high pesticidal activity and relatively low persistence in the environment. They also exhibit acute toxicity effects to humans and animals by inhibiting the acetylcholinesterase enzyme activity at nerve endings, which affects the proper functioning of the nervous system. Absorption through the skin is a major route of exposure for all organisms.

Pollutant:

Any constituent present in sufficient quantity to impair the **beneficial uses** of a **receiving water body.**

Primary Pollutant of Concern:

A "Primary Pollutant of Concern" is a constituent that has been identified as a **Targeted Design Constituent** by the Department and for which a water body of interest is listed on the 303(d) list.

Project Development Procedures Manual (PDPM):

The PDPM describes the policies and procedures to be followed by Caltrans for State highway project development.

Project Development Team (PDT):

The PDT guides and develops specific projects. The PDT is typically managed by a District PM and is supported by Functional Managers and units.

Receiving Water:

A river, lake, ocean, stream or other watercourse into which wastewater or treated effluent is discharged as provided in the "Terms of Environment" (U.S. EPA Office of Communications, Education, and Public Affairs; December 1997).

Resident Engineer (RE):

The RE administers the construction contract, makes decisions regarding acceptability of material furnished and work performed, and exercises contractual authority to direct the contractor. The RE may impose sanctions if the contractor fails to follow the appropriate actions specified in the contract to correct deficiencies.

Regional Water Quality Control Board (RWQCB):

The RWQCB means any California RWQCB for a region as specified in Section 13200 of the California Water Code. There are nine RWQCBs that serve under the **SWRCB.** These nine RWQCBs are located in California and are responsible for enforcing water quality standards within their boundaries. A map of these boundaries is located in Section 2, Figure 2-1.

Runoff (RO):

RO is comprised of surface waters that exceed the soil's infiltration rate and depression storage. It includes that portion of precipitation that appears as flow in streams, and also includes drainage or flood discharges that leave an area as surface flow or as pipeline flow, having reached a channel or pipeline by either surface or subsurface routes.

Slope/Soil Stabilization:

Soil stabilization is described as vegetation, such as grasses and wildflowers, and other materials, such as straw, fiber, stabilizing emulsion, protective blankets, etc. Soil stabilization is placed to stabilize areas disturbed by grading operations, to reduce loss of soil due to the action of water or wind, and to prevent water pollution.

Source Controls:

Source controls are control measures used on disturbed areas to reduce the introduction of sediment or other **pollutants** into stormwater **runoff**. Source controls prevent or limit the exposure of materials to stormwater at the source of those materials.

Standard Urban Storm Water Mitigation Plan (SUSMP):

SUSMPs are special local requirements that designate **BMPs** that must be used for specific categories of development projects. Designers should contact the District/Regional **NPDES** Storm Water Coordinator to see if an SUSMP is applicable for projects in urban areas.

State Water Resources Control Board (SWRCB):

As delegated by the **EPA**, the SWRCB is a California agency that implements and enforces the **CWA** Section 401 (p) **NPDES** permit requirements, and is the issuer and administrator of the **Caltrans Permit**. The SWRCB's mission is to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations.

Storm Water Advisory Teams (SWAT):

Caltrans has established four Department-wide SWATs to evaluate new or modified **BMPs** and to develop procedures and guidance for implementing the SWMP:

- The Maintenance SWAT (M-SWAT) is composed of District Maintenance Storm Water Coordinators and representatives from each of the affected Headquarters Divisions. The M-SWAT provides any necessary review and/or evaluation of proposed and existing BMPs used by the Division of Maintenance. In addition, the M-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities described in the **SWMP** for maintaining highways, bridges, facilities, and other appurtenances related to transport.

- The Project Design SWAT (PD-SWAT) is composed of District/Regional Design Storm Water Coordinators and related functional units and representatives from each of the affected Headquarters Divisions. The PD-SWAT provides review of proposed and existing BMPs utilized in the planning and design of projects. BMPs include construction BMPs, design pollution prevention BMPs, and Treatment BMPs. In addition, the PD-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities relevant to project design.

- The Construction SWAT (C-SWAT) is composed of District Construction Storm Water Coordinators and representatives from each of the affected Headquarters Divisions. The C-SWAT provides review of proposed and existing construction BMPs and measures used for stabilization of soils. In addition, the C-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities relevant to construction activities.

- The Encroachment Permits SWAT (EP-SWAT) is composed of District Permit Coordinators and representatives from each of the affected Headquarters Divisions. The EP-SWAT reviews existing procedures to ensure that they integrate the appropriate stormwater BMPs into the requirements of encroachment permits. The EP-SWAT reviews and assists in the development of training classes and guidance documents for implementing stormwater activities for issuing and administering encroachment permits.

- The Water Quality SWAT (WQ-SWAT) is composed of the District NPDES Storm Water Coordinators and representatives from each of the affected Headquarters Divisions. The WQ-SWAT provides review of proposed and existing treatment BMPs, and prioritizes research or studies of Treatment BMPs. The WQ-SWAT is a forum for discussing stormwater coordination activities underway or planned with other municipalities, reviewing and recommending public education efforts, sharing technical information, providing advice on compliance issues, and resolving issues of dispute on stormwater. Many of these activities result in recommendations for changes to the SWMP or policies and other documents on stormwater. The WQ-SWAT discusses stormwater budget allocations for the Districts and HQ Divisions. The WQ-SWAT reviews data and findings from compliance-monitoring and evaluation activities, and recommends changes in practices to improve compliance efforts.

Storm Water Data Report (SWDR):

The SWDR is a document prepared by the PE that summarizes stormwater information. It is used to document decisions and to provide key project information to the Environmental Unit. The Environmental Unit uses the SWDR to assess the potential water quality impacts that may result from the proposed project, and will also use the project information to prepare the **WQR**, if one is required. This report is to be included in the final PS&E package.

Storm Water Management Plan (SWMP):

The SWMP is the Caltrans policy document that describes how Caltrans conducts its stormwater management activities (i.e., procedures and practices). The SWMP provides descriptions of each of the major management program elements, discusses the processes used to evaluate and select appropriate **BMPs**, and presents key implementation responsibilities and schedules.

Storm Water Pollution Prevention Plan (SWPPP):

The **General Permit** requires all construction projects that result in a **DSA** of at least one acre to develop and implement an effective SWPPP. The SWPPP is a plan that includes site map(s), an identification of construction/contractor activities that could cause pollutants in stormwater, and a description of measures or practices to control these **pollutants**. A **RWQCB** may require a SWPPP for projects which do not meet the DSA acreage requirements based upon water quality concerns, or if it is determined that a project is part of a larger **Common Plan of Development.**

Targeted Design Constituent (TDC)

A TDC is a pollutant that has been identified during Departmental runoff characterization studies to be discharging with a load or concentration that commonly exceeds allowable standards and which is considered treatable by currently available Department-approved Treatment BMPs.

Total Dissolved Solids (TDS):

TDS refers to the sum of all cations or anions (sometimes measured in parts per million as calcium carbonate). TDS comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) and small amounts of organic matter that are dissolved in water.

In fresh water the total dissolved solids concentration typically ranges from 20 to 1,000 mg/l; in seawater it ranges from 30,000 to 35,000 mg/l. High levels of dissolved solids concentrations can adversely affect drinking water quality.

Total Maximum Daily Load (TMDL):

TMDLs are pollutant load allocations for all point sources and nonpoint sources, and are intended to achieve a pollutant reduction goal along with a safety factor. TMDLs are developed in response to identification of **pollutants** as impairing a specific body of water identified in the 303(d) list.

Total Suspended Solids (TSS):

TSS is the weight of particles that are suspended in water. Suspended solids in water reduce light penetration in the water column, can clog the gills of fish and invertebrates, and are often associated with toxic contaminants because organics and metals tend to bind to particles.

United States Environmental Protection Agency (EPA):

The EPA (http://www.epa.gov/) provides leadership in the nation's environmental science, research, education and assessment efforts. The EPA works closely with other federal agencies, state and local governments, and Indian tribes to develop and enforce regulations under existing environmental laws. The EPA is responsible for researching and setting national standards for a variety of environmental programs and delegates to states and tribes responsible for issuing permits, and monitoring and enforcing compliance. The EPA issued regulations to control pollutants in stormwater **runoff discharges**, such as the **CWA**. (The CWA and **NPDES** permit requirement.)

Waste Discharge Requirement (WDR):

A WDR is a set of conditions issued by a **RWQCB** for a specific activity. The conditions may include numeric effluent criteria, monitoring requirements, reporting requirements, and other narrative criteria for discharge. WDRs may be required for any non-exempt non-stormwater **discharge.**

Waste Load Allocations (WLA):

A WLA represents the maximum load of **pollutants** each discharger of waste is allowed to release into a particular waterway for which a **TMDL** has been established. **Discharge** limits are usually required for each specific water quality criterion being, or expected to be, violated for that particular **water body.**

Water Body:

Water bodies refer to the waters of the United States. These include (a) All waters, which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; (b) All interstate waters, including interstate wetlands; (c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters: (1) which are or could be used by interstate or foreign travelers for recreational or other purposes; (2) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or (3) which are used or could be used for industrial purposes by industries in interstate commerce; (d) All impoundments of waters identified in paragraphs (a) through (d) of this definition; (f) The territorial sea; and (g) Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Water Pollution Control Program (WPCP):

A WPCP is a plan to identify water quality management practices to be implemented that must be prepared for all construction projects that do not require preparation of a **SWPPP.** For Caltrans projects disturbing more than one acre, a SWPPP satisfies the requirement for a WPCP.

Water Quality Assessment Guidelines (WQAG):

The Water Quality Assessment Guidelines (WQAG) provide direction on format, content, and methods for preparing detailed Water Quality Assessment Technical Reports (WQRs) and more summary Water Quality Assessment Technical Memoranda (WQMs).

Water Quality Assessment Technical Report (WQR):

When it is concluded that there are water quality issues raised by a proposed project (and its alternatives) and that a potential for one or more substantive water quality impacts exists, then a comprehensive Water Quality Assessment Technical Report (WQR) is prepared during the PA/ED phase of a project. The need for a WQR is determined by the Water Quality Impact Questionnaire completed as part of the PEAR.

Water Quality Flow (WQF):

The WQF is a design criterion used for various types of filtration treatment control devices currently under development. Caltrans has cooperatively developed rainfall intensity values with the **SWRCB** that can be used in the Rational Formula to calculate the WQF.

Water Quality Impact Questionnaire:

The Water Quality Impact Questionnaire, which identifies potential water quality impacts, is incorporated into the PEAR. The Water Quality Impact Questionnaire was developed to assist in early identification and consideration of the broadest range of potential water quality effects, determine whether a detailed WQR technical report is appropriate, and to scope the PEAR analysis with respect to water quality issues. The Questionnaire asks a series of questions about the project description and alternatives, the project setting, and potential project impacts on water quality.

Water Quality Volume (WQV):

The WQV is the volume of flows associated with the frequent storm events that must be treated. The WQV of treatment **BMPs** is based upon, where established, the sizing criteria from the **RWQCB** or local agency (whichever is more stringent). If no sizing criterion has been established, Caltrans will do one of the following: maximize detention volume determined by the 85^{th} percentile **runoff** capture ratio or; use volume of annual runoff based on unit basin storage WQV to achieve 80 percent or more volume of treatment. For further detail, refer to Section 2.4.2.2.

Work Breakdown Structure (WBS):

The WBS is a product-oriented grouping of project elements that organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of a project component. Project components may be products or services. The WBS defines the work elements, not the staff or resources that will perform the work.