Nevada Department of Transportation

NEVADA DOT

Storm Water Quality Manuals

Construction Site
Best Management Practices (BMPs) Manual

January 2006

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NDOT TRANSMITTAL

EFFECTIVE DATE: *January 3, 2006*

TO: **All *Construction Site Best Management Practices (BMPs) Manual* holders**
FROM: **Water Quality, Erosion and Sediment Control (WQESC) Implementation Team**
RE: **Replacement sheets for Manual Revision**

Instructions:
Page numbers and corresponding sheet-counts are given in the table below to indicate portions of the *Construction Site BMP Manual* that are to be removed and inserted to accomplish this revision.

Section	Remove		Insert	
	Pages	Sheets	Pages	Sheets
Forward - Revision Procedure		1		1
Table of Contents	i-iii	2	i-iii	2
Section 1 - Construction Site BMPs	1-7 of 7	4	1-7	4
Section 2 - Selecting and Implementing Construction Site BMPs	1-18 of 18	9	1-18	9
Section 3 - SS-5, Soil Stabilizer	1-7 of 7	4	1-8	4
Section 3 - SS-7, Geotextiles, Plastic Covers & EC Blankets/Mats	3-4 of 11	1	3-4	1
Section 3 - SS-7, Geotextiles, Plastic Covers & EC Blankets/Mats	7-8 of 11	1	7-8	1
Section 3 - SS-8, Wood Mulching	1-3 of 3	2	1-3	2
Section 3 - SS-9, Earth Dikes/Drainage Swales & Lined Ditches	1-4 of 4	2	1-3	2
Section 3 - SS-10, Outlet Protection/Velocity Dissipation Devices	1-3 of 3	2	1-2	1
Section 3 - SS-12, Streambank Stabilization	5-8 of 10	2	5-8	2
Section 3 - SS-13, Wind Erosion Control	1-2 of 2	1	1-2	1
Section 4 - Introduction	1 of 1	1	1-2	1
Section 4 - SC-1, Silt Fence	1-6 of 6	3	1-6	3
Section 4 - SC-4, Check Dams	1-4 of 4	2	1-4	2
Section 4 - SC-5, Sediment Log (was Fiber Roll)	1-6 of 6	3	1-6	3
Section 4 - SC-8, Storm Drain Inlet Protection	1-7 of 7	4	1-7	4
Section 6 - NS-5, Clear Water Diversion	1-15 of 15	8	1-16	8
Section 7 - WM-3, Stockpile Management	1-2 of 2	1	1-2	1
Section 7 - WM-6, Concrete Waste Management	1-6 of 6	3	1-3	2
Appendix A	A-1 to A-5	3	A-1 to A-5	3
Appendix B, SWPPP Template	all	42	B-1 to B-3, 1-15	10
Appendix C, WPCP Template (remove along with sheets)	all	13	none	none

Note: The removed sheets are still valid for projects advertised before the effective date of this transmittal. Retain old sheets if necessary.

NEVADA DEPARTMENT OF TRANSPORTATION

STORM WATER QUALITY HANDBOOKS
CONSTRUCTION SITE
BEST MANAGEMENT PRACTICES (BMPs) MANUAL

PROCEDURE FOR MANUAL REVISIONS

This manual was developed to reflect current policies, procedures, and practices. It is intended that the manual be periodically revised. Two procedures are included. For edits or updates, contact Thresa Zylstra, NDOT Hydraulics Administrative Assistant, at 775-888-7619. All updates will be available on the NDOT website which should be visited regularly for updated information.

Temporary Revisions

As new policies, procedures, and directives are developed, it is sometimes necessary to provide this information to field personnel prior to a scheduled revision. To expedite distribution of revisions, the Water Quality, Erosion and Sediment Control (WQESC) Implementation Team will issue "Temporary Revisions" as needs arise. The "Temporary Revision" should be inserted in the manual prior to the page it modifies.

Scheduled Revisions

In October of each year, the Implementation Team will review the manual to determine if revisions are required. The Implementation Team is comprised of staff from design, construction, maintenance, environmental services, materials, and FHWA and NDEP if necessary.

Revisions affecting department policies and procedures proposed by the Implementation Team will be reviewed by a Steering Committee. Results of the Steering Committee Meeting will be provided to the Implementation Team. After revisions have been approved, the Implementation Team will initiate the changes and distribute them to all holders of the manual. Revisions will be transmitted under a cover memorandum. Each page of the revision will contain a revision date. It will be the manual holders' responsibility to insert the new material in the manual.

Contents

Tables

Figures

Section 1
Construction Site Best Management Practices (BMPs)

1.1 Introduction

The State of Nevada Department of Transportation (NDOT) has a comprehensive statewide effort to prevent pollution in storm water runoff from NDOT construction projects. Contractors are required to prepare and implement a plan to control water pollution effectively during the construction of all projects within or in the vicinity of Waters of the United States (WOUS) - see Standard Specifications Section 637, Water Pollution.

Projects resulting in one acre (ac) or more of soil disturbance and that discharge to a WOUS are subject to the State of Nevada Stormwater General Permit ("General Permit") and are required to prepare a Storm Water Pollution Prevention Plan (SWPPP). When a SWPPP is required for a project, it shall satisfy the requirements of Standard Specifications Section 637, in addition to meeting other permit requirements.

Projects in the Lake Tahoe area fall under the jurisdiction of the Tahoe Regional Planning Agency (TRPA). Construction permits are issued by TRPA for all projects and include specific water quality control and other environmental requirements that are often more stringent than those mandated under the General Permit.

1.2 Organization of this Manual

This *Storm Water Quality Handbooks, Construction Site Best Management Practices Manual* (Manual) is intended to provide contractors and NDOT staff with detailed information on how to comply with the "Water Pollution Control" requirements contained in NDOT's construction contract documents, and in the State of Nevada Division of Environmental Protection (NDEP) permit requirements through the implementation of construction site best management practices (BMPs). This manual is organized as follows:

- **Section 1** introduces the construction site best management practices (BMPs) Manual.
- **Section 2** provides minimum requirements for the selection and implementation of construction site BMPs
- **Section 3** provides listing and working details for NDOT construction site BMPs for temporary soil stabilization.
- **Section 4** provides listing and working details for NDOT construction site BMPs for temporary sediment control.

- **Section 5** provides listing and working details for NDOT construction site BMPs for tracking control

- **Section 6** provides listing and working details for NDOT construction site BMPs for non-storm water management.

- **Section 7** provides listing and working details for NDOT construction site BMPs for waste management and materials pollution control.

- **Appendix A** provides a listing of frequently used abbreviations, acronyms, and definitions of terms used throughout this Manual.

- **Appendix B** provides a SWPPP Template that may be used to prepare SWPPPs.

1.3 Requirements for General Permit Sites

1.3.1 Nevada General Construction Permit

On September 16, 2002, NDEP adopted the *General Permit for Storm Water Discharges Associated with Construction Activity NVR100000*, hereby called "General Permit". The General Permit complies with provisions of the Federal Clean Water Act as amended (33 U.S.C. 1251 et. set: the "Act") and Chapter 445A of the Nevada Revised Statutes (NRS).

Under these regulations, owners or operators (contractors) of all proposed private and public construction sites that disturb a total of one or more acres of land are required to obtain coverage under the General Permit when the site discharges to a WOUS. Additionally, the following specific cases require coverage under the General Permit:

- Any land disturbance that is part of a larger common plan of development or sale with a planned disturbance of one acre or greater,

- All temporary plants or operations set up to produce concrete, asphalt or other materials for a permitted construction project (these are permitted with the project but require a separate SWPPP),

- Any repaving operation of one or more acres that creates fine-grained sediments that are not immediately removed from the site and properly disposed of at an acceptable facility, and

- Any construction activity, including sites disturbing less than one acre that are designated by NDEP or the U.S. Environmental Protection Agency (EPA) to have a potential for contribution to a violation of a water quality standard or may significantly contribute pollutants to waters of the United States.

Disturbance is defined as clearing, grading, or excavating underlying and/or surrounding soil as part of a repaving operation. NDEP may also require general permit coverage if repaving operations create loose fine-grained material (e.g. asphalt millings) that is not immediately disposed of and/or is stockpiled on the site. If the

material is immediately overlaid or hauled off-site, a permit may not be required depending on site-specific conditions.

BMP implementation must be appropriate for the sensitivity of the adjacent area. Geographically, portions of some NDOT projects are located in closed basin areas where storm water runoff ultimately flows to valleys and playas that have no standards for water quality and associated criteria for designated beneficial use. Typically, this will occur on linear projects where only a portion of the project discharges to a jurisdictional WOUS and/or environmentally sensitive area, but the entire project will require General Permit coverage. Only those topographically low discharge points to identified WOUS and/or environmentally sensitive areas along the length of the job require water pollution controls.

Under the General Permit, eligible discharger(s) who have submitted a Notice of Intent (NOI), paid an annual filling fee, and developed and implemented a SWPPP, are authorized to discharge stormwater associated with:

(1) Construction activity

(2) Small construction activity

(3) Industrial activity from temporary concrete, asphalt, and material plants or operations dedicated to the permitted construction project.

The NOI must be filed at least 48 hours before construction begins and the SWPPP must be prepared prior to submittal of the NOI. NDEP has the authority to waive General Permit requirements, such as preparing and implementing a SWPPP for small construction projects that will not have adverse impacts to water quality. Sites between one and five acres that have a rainfall erosivity factor less than five (5) during the period of construction may also be able to obtain a waiver. NDEP has the option not to allow waivers for small construction activity based on other criteria. A worksheet for the small construction site activity waiver may be obtained from the NDEP Bureau of Water Pollution Control Website (Stormwater Discharge Permits section) and submitted to NDEP for review. Other useful documents such as the NOI form and sample SWPPP can also be found at the website.

1.3.1.1 Storm Water Pollution Prevention Plan (SWPPP)

To comply with the General Permit, a SWPPP must be prepared prior to submittal of the NOI and must remain on the project site at all times. The SWPPP must be prepared in accordance with good engineering practices and must consist of the components listed in the General Permit, Part IB, and listed below:

- Project information and description including: site location; type of project; contact information; estimated soil disturbance; and a description of potential receiving waters;

- Description of all proposed and implemented major land disturbing activities;

- Description and sequencing of construction activities;
- Estimates of total area of the construction site and the area that will be disturbed;
- Estimates of pre- and post-construction runoff coefficients (refer to Appendix B for values);
- A general location map and detailed site map(s) including drainage patterns, areas of soil disturbance, location of BMPs, borrow and equipment storage areas, and potential receiving waters;
- Description of proposed and implemented erosion, sediment, and waste control practices to be used on the site;
- Description of permanent stormwater management practices that will be installed during the construction process to control pollutants in stormwater discharges after completion of construction operations;
- Documentation of self-inspections, maintenance of BMPs, and corrective actions that will be implemented throughout construction;
- Location and description of any non-stormwater discharges and stormwater discharges from dedicated asphalt and concrete plants located off-site;
- Copy of approved state or local plans, including a copy of the General Permit requirements; and
- Certification by the owner/operator or authorized representative and all contractors who work on the construction site.

A SWPPP template is available on the NDEP website. A copy of the template can be found in Appendix B; it is the contractor's responsibility to ensure that the most current version is used. Other SWPPP templates acceptable to NDEP may be used.

1.3.2 TRPA Construction Permit

As a regulatory agency, the TRPA reviews and permits construction projects, and seeks to minimize environmental impacts of new projects. Permits issued include Standard Conditions of Approval and Special Conditions for individual projects. Permanent and temporary erosion control BMPs are required for applicable projects.

There are numerous differences between typical TRPA construction permit conditions and those in the General Permit. The TRPA permits are issued individually and are generally more stringent. Contractors are subject to the following requirements for all TRPA approved projects:

- Comply with all conditions of the TRPA permit and the General Permit.

- The contractor's engineer must attend the pre-grade meeting with TRPA and their contract compliance officer to identify all other BMP items required by TRPA.

- Include any additional BMP requirements in the contractor's SWPPP.

1.3.3 NDOT Contract Requirements

All NDOT contracts require contractors to comply with Section 637 of the Standard Specifications and may include Special Provisions for pollution control. These specifications and provisions require contractors to comply with the General Permit for all projects greater than one acre. For projects that require General Permit coverage and are within or near WOUS, contractors shall prepare and effectively implement a SWPPP that fulfills both the General Permit requirements and those in Section 637 for a Temporary Working in Waterways / Discharge Permit. NDEP may require turbidity monitoring as a condition of the Temporary Working in Waterways / Discharge Permit. Contact NDEP's Bureau of Water Pollution Control for specific monitoring criteria.

If revisions to the SWPPP are required by site conditions, impending weather, or regulatory officials, the contractor shall incorporate the revisions. No construction activity having the potential to cause water pollution, as determined by the Engineer, shall be performed until the SWPPP has been completed in accordance with General Permit requirements. Construction activities such as traffic control, which will not threaten water quality, may proceed without a SWPPP, if allowed by the Engineer. Furnish a copy of the initial SWPPP to the Engineer as evidence of completion; the SWPPP may be reviewed for permit compliance but not formally approved by NDOT. The contractor is responsible for all regulatory compliance issues and will be responsible for any penalties or fines imposed by the NDEP for regulatory non-compliance.

For sites covered by the General Permit, the contractor is responsible for filing the NOI, and is the responsible permittee with NDEP. This includes being responsible for any fees associated with permit procurement, and for executing the permit requirements, as well as being responsible for any fines levied by a regulatory agency for water management violations.

1.3.3.1 Project Categorization and Temporary Erosion Control Plans

NDOT has adopted a policy of categorizing all construction projects as having no, low, medium or high potential for water quality impacts. The general definitions of each project category are as follows:

- **No impact**: Projects with ground/soil disturbance less than one acre or no potential discharge into WOUS.

- **Low Impact:** Projects with little ground/soil disturbance and low potential for discharge of sediment into WOUS.

- **Medium Impact:** New construction or reconstruction projects with potential discharge of sediments into a WOUS. Ground/soil disturbance is not excessive, construction phasing is simple, and construction duration is usually less than two years.

- **High Impact:** Projects with major ground/soil disturbance; high potential of sediment discharge; complex construction staging; and construction duration is longer than two years. All projects in the Lake Tahoe Basin are also classified in this category.

For projects categorized as having low or medium potential impacts, the contractor is responsible for SWPPP development including design of temporary BMPs and temporary erosion control plans.

For projects categorized as having a high potential for water quality impacts, NDOT may develop temporary erosion control plans for temporary BMPs for one construction phase of an assumed phasing sequence and include bid items in the final project plans and specifications. For these projects, the contractor is then required to employ a Professional Engineer (P.E.) to develop the SWPPP in compliance with the General Permit. Additionally, a P.E. must be responsible for the design of temporary BMPs, as specified within the BMP Fact Sheets included in this manual.

NDOT will include specific temporary BMPs in the design under any of the following conditions:

- The project is categorized as having high potential for water quality impacts,

- Specific construction site (temporary) BMPs are prescribed by the NDEP, TRPA or other environmental permits or certifications,

- The National Environmental Policy Act (NEPA) process has identified sensitive receiving waters or valuable habitats requiring special protection.

- There are site-specific conditions or sources of pollution that would not be adequately addressed by "typical" SWPPP deployment strategies.

1.3.4 Sites not Covered by the General Permit

Sites that disturb less than one acre of soil do not require General Permit coverage unless they are designated by NDEP or EPA to have a potential for contribution to violation of a water quality standard or may significantly contribute pollutants to WOUS. The special provisions will identify such projects.

Geographically, some NDOT projects are located in closed basin areas where storm water runoff ultimately flows to valleys and playas that have no standards for water quality and associated criteria for designated beneficial use. Typically, these projects will not require General Permit coverage (therefore SWPPP development and

implementation) as these areas in Nevada are not considered to be jurisdictional WOUS thereby alleviating the need for structural water pollution controls.

1.4 Temporary Working in Waterways / Discharge Permit

A Temporary Working in Waterways/Discharge Permit is required by NDEP for work within or immediately adjacent to, live streams or water bodies. NDEP issues individual temporary permits valid for no longer than six months. NDEP reviews and approves the submitted Temporary Working in Waterways/Discharge Permit application before work can start. For projects that require General Permit coverage in addition to this permit, the SWPPP may be submitted to the NDEP as part of the Temporary Working in Waterways/Discharge Permit application. For NDOT projects the contractor is responsible for obtaining this permit, where applicable, and the NDOT Water Quality Specialist provides oversight of the process if necessary.

The Temporary Working in Waterways/Discharge Permit application must include a detailed description of the BMPs to be implemented during the disturbance and/or work activities proposed in and along the stated water body for: erosion control; sediment control; riparian stream zone protection and restoration; streambank stabilization/protection/rehabilitation, water pollution control/prevention, dewatering controls, etc. Water quality monitoring may also be a permit requirement to verify compliance with the applicable receiving water standards.

1.5 Air Quality Regulations

NDOT projects may also require coverage under various Air Quality or Dust Control Permits. NDOT contractors are responsible for obtaining these permits from the appropriate agency. In Nevada, air quality is regulated by the NDEP or, within Washoe and Clark Counties, by each county's Air Quality Management Divisions. Permit requirements for the different jurisdictions are discussed in Section 2.6.2.

Air quality permits will also typically require some type of permanent soil stabilization after construction is complete. This stabilization may or may not be sufficient to satisfy the final stabilization requirements of the General Permit. The following methods shall be used to satisfy the final soil stabilization requirement of air quality permits for NDOT Projects:

- In the North areas of the state, seeding, slope paving and application of millings to the shoulders will be the methods of stabilization.

- In southern urban areas, where re-vegetation is not successful, slope paving or rock mulch will be the methods of stabilization for cut and fill slopes. For aesthetic reasons, in an area contained within the landscape master plan, millings are not appropriate.

- In southern rural areas, soil stabilizers, slope paving, or application of millings will be the methods of soil stabilization.

Section 2
Selecting and Implementing Construction Site Best Management Practices

2.1 Introduction

This section provides instructions for the selection and implementation of construction site best management practices (BMPs). It is important to note that the requirements of this Section are NDOT minimum requirements, and that the contractor must implement additional construction site BMPs if deemed necessary to meet permit requirements or control pollutant discharges. Additional requirements may be included in the project's Special Provisions. Working details of the construction site BMPs listed in this Section are presented in Sections 3 through 7 of this Manual.

2.2 NDOT Construction Site BMPs

This section lists those BMPs to be considered during the construction of NDOT projects. Construction site BMPs, also called temporary control practices, are best conventional technology/best available technology (BCT/BAT) based BMPs that are consistent with the BMPs and control practices required under the General Permit. NDOT construction site BMPs are divided into categories (see Table 2-1).

2.2.1 Minimum Requirements

NDOT has selected some BMPs as *Minimum Requirements* that must be implemented on all highway construction projects statewide to protect WOUS and environmentally sensitive areas. Implementation is dependent on conditions and applicability of deployment described as part of the BMP. These BMPs are typically implemented as applicable in all NDOT construction projects; they include practices for soil stabilization, sediment control, wind erosion control, tracking control, non-storm water management, and waste management.

There are other construction site BMPs that may be implemented, on a project by project basis, in addition to the minimum required BMPs, and when determined necessary and feasible by NDOT or by the contractor. NDOT may, on a project-by-project basis, specify or require contractors to implement some of these construction site BMPs. Additionally, NDOT will consider a contractor's recommendation to implement some of these or other construction site BMPs on a project, subject to NDOT's approval.

Construction site BMPs within each of the categories are described throughout Sections 3 through 7 of this Manual. Table 2-1 lists the minimum required construction site BMPs. Note that some BMPs are grouped in order to show that a combination of those BMPs will enhance protection over the use of only one BMP, or to show that one BMP can be selected from multiple equivalent choices.

Table 2-1
CONSTRUCTION SITE BMPs
MINIMUM REQUIREMENTS [1]

Sheet No.	Best Management Practice	Required	Option	Section
SEDIMENT CONTROL In addition to all of the required BMPs employ at least one BMP option				
SS-1	Scheduling	X		3
SS-2	Preservation of Existing Vegetation	X		3
SC-2	Sediment Basin[3]		X	4
SC-3	Sediment Trap[3]		X	4
SC-4	Check Dam		X	4
SC-7	Street Sweeping and Vacuuming	X		4
SC-8	Storm Drain Inlet Protection	X		4
SEDIMENT BARRIER	**Employ at least one BMP option[3]**			
SC-1	Silt Fence		X	4
SC-5	Sediment Logs		X	4
SC-6	Gravel Bag Berm		X	4
NON-STORM WATER MANAGEMENT				
NS-1 thru NS-16	All NS BMPs	X		6
WASTE MANAGEMENT AND MATERIAL CONTROL				
TC-1	Stabilized Construction Entrance/Exit	X		5
WM-1 Thru WM-8	All WM BMPs	X		7
SLOPE PROTECTION	**Employ at least one BMP option[3]**			
SS-7	Geotextiles and Erosion Control Blankets		X	3
SS-9	Earth Dikes/ Drainage Swales & Lined Ditches		X	3
SS-11	Slope Drains		X	3
SC-5	Sediment Logs		X	4
SC-6	Gravel Bag Berm		X	4
SOIL STABILIZATION (DISTURBED AREAS)	**Employ at least one BMP option[3]**			
SS-13	Wind Erosion Control	X		3
SS-5	Soil Stabilizers		X	3
SS-3/SS-6/SS-8	Hydraulic/ Straw/ Wood Mulch		X	3
SS-7	Geotextiles and Erosion Control Blankets		X	3
SS-7	Hydroseeding	X[2]	X[2]	3

[1] See also Section 2.2.1. Not all minimum requirements may be applicable to every project. Applicability to a specific project shall be verified by the contractor. See Section 2.5 for Implementation Guidance.
[2] When specified.
[3] See Tables 2-4 and 2-5 for implementation guidelines.

2.3 Definitions

2.3.1 Disturbed Soil Area (DSA)

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

- Areas where permanent soil stabilization, highway planting, or slope protection are applied and associated drainage facilities are in place and functional.
- Roadways, construction roads, access roads or contractor's yards that have been stabilized by the placement of compacted sub-base or base material or paved surfacing.
- Areas where construction has been completed in conformance with the contract plans and permanent erosion control is in place and functional.
- Erosion control is considered functional when a uniform vegetative cover equivalent to 70 percent of the native background vegetation coverage has been established or equivalent stabilization measures have been employed.

2.3.2 Active Areas and Non-Active Areas

Active Areas are construction areas where soil-disturbing activities occur or where soil-disturbing activities will be resumed within 21 days from when they were temporarily ceased.

Non-Active Areas are construction areas where soil-disturbing activities have ceased for 14 days and will not resume within 21 days. Stabilization measures shall be initiated as soon as possible in portions of the site where soil-disturbing activities have temporarily or permanently ceased, but in no case more than 14 days after soil-disturbing activities in that portion of the site have temporarily or permanently ceased.

The Contractor shall conduct a review of the existing active areas on a regular basis to determine if a non-active status should be applied to some DSAs.

2.3.3 Slope Length and Benches

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

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

2.3.4 Rainy Season

The average rainfall in Nevada varies greatly from region to region. To account for the various rainfall patterns (time frame, intensities, and amounts) the State is separated into several rainy seasons. Shown in Figure 2-1 is a map identifying the rainy seasons throughout the State. These rainy seasons are used to identify the appropriate level of soil stabilization and sediment control protection.

Area 1 is usually subject to major floods in the late fall and winter because of "spillover" from the rain and snowstorms in the western Sierras; this area also includes high elevations and is prone to snow storms. Area 2 is affected by winter storms and snowmelt runoff while Area 3 is subject to influence by rainstorms from the Gulf of Mexico or the Pacific Ocean. The major flood season in Area 3 is during the summer months of thunderstorm activity.

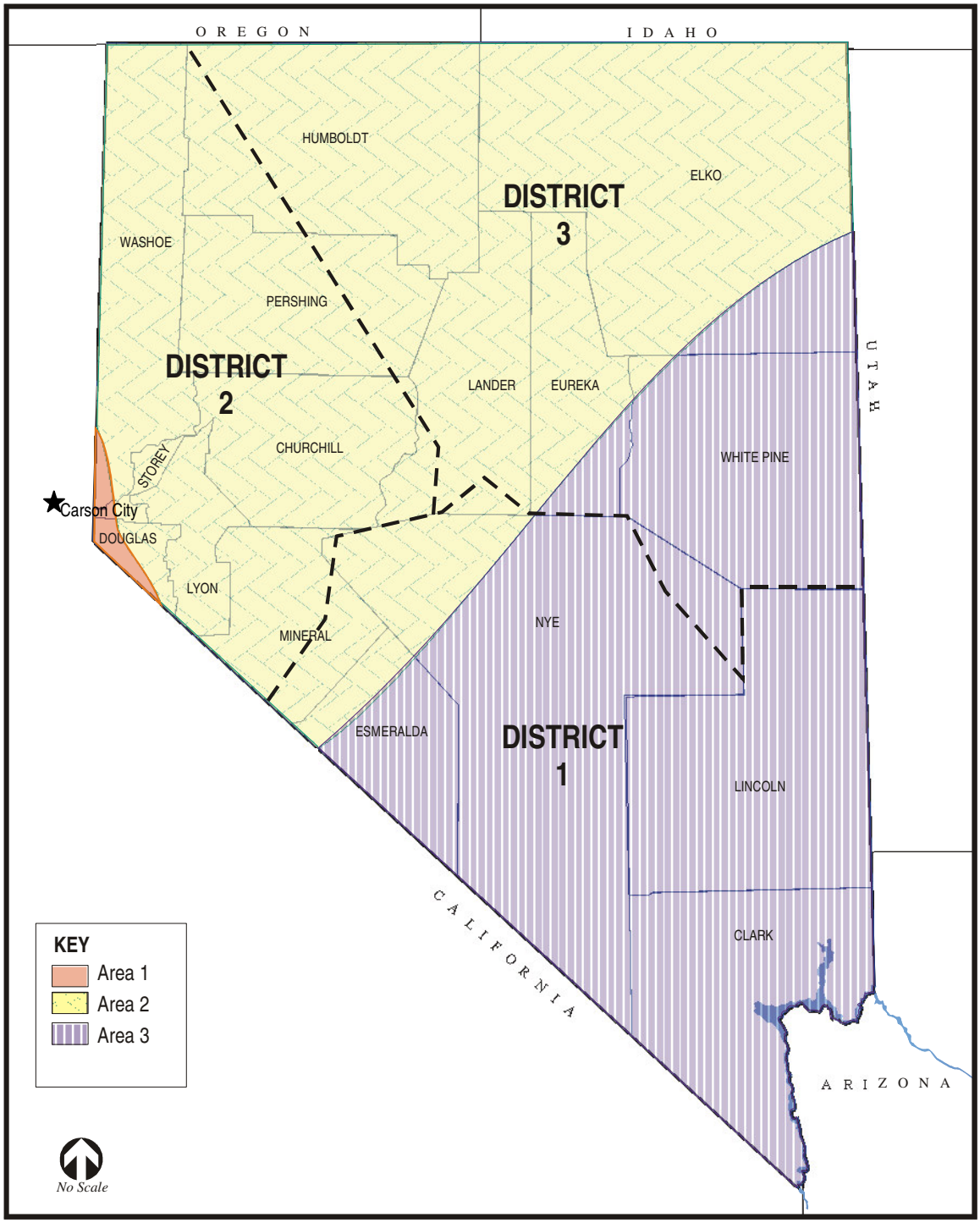


Figure 2-1
Designation of Homogeneous Rainfall Areas

2.4 Selection of Temporary Soil Stabilization Controls

There are many methods available to provide soil stabilization. Criteria were developed to allow for comparison and differentiation among the product types that are available. These criteria include installed cost, erosion control effectiveness, drying time, and others.

For some criteria, values have been assigned by characteristics: an example would be mode of application (e.g., hydraulic seeder, water truck, and hand labor). For other criteria, actual numeric values should be considered based on available data, such as drying time in hours. Refer to Table 2-2 for a summary of selection criteria information and ratings for temporary soil stabilization BMPs.

2.4.1 Antecedent Moisture

This criterion relates to the effect of existing soil moisture on the effectiveness of a soil stabilization method. While antecedent soil moisture conditions can have an effect on the performance of some methods, (e.g., hydraulic soil stabilizers, temporary seeding) other methods, such as erosion control blankets or impervious covers, are not affected, except perhaps in their ease of installation.

Suppliers of manufactured soil stabilization products affected by antecedent soil moisture specify the conditions under which their products are to be applied. For example, some products clearly benefit from having the soil "pre-wetted" before application of the hydraulic soil stabilizer and as a result, some manufacturers recommend application of water by itself as a first step. Conversely, the binding action of some adhesives on soil particles (and thereby their erosion control effectiveness) can be affected by excessive soil moisture. Therefore, some manufacturers recommend that their products not be applied when the soil is visibly saturated or when standing water is present.

2.4.2 Availability

A critical aspect of product specification and use is whether or not a soil stabilization product is readily available. While local sources may be preferable, the seasonal nature of soil stabilization work can create localized shortages of materials. In these cases, usually the material that can be delivered to the job most quickly is the material that is selected for application.

Table 2-2
Temporary Soil Stabilization Criteria Matrix

CLASS	TYPE	Antecedent Moisture	Availability	Ease of Clean-Up	Installed Cost per acre (ac)	Erosion Control Effectiveness (%)	Degradability	Length of Drying Time (hrs)	Time to Effectiveness (days)	Longevity	Mode of Application	Residual Impact	Native	Runoff Effect
Straw Mulch	Wheat Straw	D	S	H	$2,100	90-95	B	0	1	M	L/M	M		+
	Rice Straw	D	S	H	$2,100	90-95	B	0	1	M	L/M	M		+
Wood Fiber Mulch	Wood Fiber	D	S	H	$900	50-60	B	0-4	1	M	H	L		+
Recycled Paper Mulch	Cellulose Fiber	D	S	H	$850	50-60	B	0-4	1	S	H	L		+
Bonded Fiber Matrix	Biodegradable	D	S	H	$5,500	90-95	B	12-18	1	M	H	M		+
Biodegradable	Jute Mesh	D	S	H	$6,500	65-70	B		1	M	L	M		+
	Curled Wood Fiber	D	S	H	$10,500	85-90	P/B		1	M	L	M		+
	Straw	D	S	H	$9,000	85-90	P/B		1	M	L	M		+
	Wood Fiber	D	S	H	$9,000	85-90	P/B		1	M	L	M		+
	Coconut Fiber	D	S	H	$13,000	90-95	P/B		1	L	L	M		+
	Coconut Fiber Mesh	D	S	H	$31,000	85-90	B		1	L	L	M		+
	Straw Coconut Fiber	D	S	H	$11,000	90-95	P/B		1	L	L	M		+
Non-Biodegradable	Plastic Netting	D	M	H	$2,000	<50	P		1	L	L	H		+
	Plastic Mesh	D	M	H	$3,250	75-80	P		1	L	L	H		+
	Synthetic Fiber with Netting	D	M	H	$35,000	90-95	P		1	L	L	H		+
	Bonded Synthetic Fibers	D	M	H	$50,000	90-95	P		1	L	L	H		+
	Combination with Biodegradable	D	M	H	$32,000	85-90	P		1	L	L	H		+
High-Density	Ornamentals		S-M	H	$400 - $1,600	50-60			28	M-L	H	L-M	N/E	+
	Turf species		S	H	$350	50-60			28	L	H	M-H	N/E	+
	Bunch grasses		S-M	H	$300 - $1,300	50-60			28	L	H	L-M	N	+
Fast-Growing	Annual		S	H	$350 - $650	50-60			28	L	H	L-H	N/E	+
	Perennial		S	H	$325 - $800	50-60			28	L	H	M	N/E	+
Non-Competing	Native		S-M	H	$300 - $1,600	50-60			28	L	H	L-M	N	+
	Non-Native		S-M	H	$400 - $500	50-60			28	L	H	L-H	E	+
Sterile	Cereal Grain		S	H	$500	50-60			28	L	H	L	E	+
Plastic	Rolled Plastic Sheeting		S		$7,000	100	P		1	M	L	H		-
	Geotextile (Woven)		S		$6,000	90-95	P		1	M	L	H		-
(PBS) Plant Material Based- Short Lived	Guar	D	S	H	$400	80-85	B	12-18	Same as Length of Drying Time.	S	B	L		0/+
	Psyllium	P	S	H	$400	25-35	B	12-18		M	B	L		0
	Starches	D	S	H	$400	25-30	B	9-12		S	H	L		0
(PBL) Plant Material Based- Long Lived	Pitch/ Rosin Emulsion	D	S	M	$1,200	60-75	B	19-24		M	B	M		-
(PEB) Polymeric	Acrylic polymers and copolymers	D	S	M	$1,200	35-70	P/C	19-24		L	B	M		+/-
Emulsion Blends	Methacrylates and acrylates	D	M	M	$400	35-40	P/C	12-18		S	W	L		0/+
	Sodium acrylates and acrylamides	D	M	M	$400	20-70	P/C	12-18		S	H	L		+/-
	Polyacrylamide	D	M	M	$400	55-65	P/C	4-8		M	H	L		0/+
	Hydro-colloid polymers	D	M	H	$400	25-40	P/C	0-4		M	H	L		0/+
(PRB) Petroleum/ Resin-Based Emulsions	Emulsified Petroleum Resin	D	M	L	$1,200	10-50	P/C	0-4		M	B	M		0/-
(CBB) Cementitious Based Binders	Gypsum	D	S	M	$800	75-85	P/C	4-8		M	H	L		-

= not applicable for category, class or type

Table 2-2 (continued)
Temporary Soil Stabilization Criteria Matrix

Antecedent Moisture	D	Soil should be relatively dry before application
	P	Soil should be pre-wetted before application
Availability	S	A short turn-around time between order and delivery, usually 3-5 days
	M	A moderate turnaround time, between 1-2 weeks
Ease of Clean-Up	L	Require pressure washing, a strong alkali solution, or solvent to clean up
	M	Requires cleanup with water while wet; more difficult to clean up once dry
	H	May be easily removed from equipment and overspray areas by a strong stream of water
Installed Cost		Dollars per acre
Erosion Control Effectiveness		Percent reduction in soil loss over bare soil condition.
Degradability	C	Chemically degradable
	P	Photodegradable
	B	Biodegradable
Length of Drying Time		Estimated hours
Time to Effectiveness		Estimated days
Longevity	S	1 - 3 months
	M	3 – 12 months
	L	Greater than 12 months
Application Mode	L	Applied by hand labor
	W	Applied by water truck
	H	Applied by hydraulic mulcher
	B	Applied by either water truck or hydraulic mulcher
	M	Applied by a mechanical method other than those listed above (e.g., straw blower)
Residual Impact	L	Projected to have a low impact on future construction activities
	M	Projected to have a moderate impact on future construction activities
	H	Projected to have a significant impact on future construction activities
Native	N	Plant or plant material native to the State of Nevada
	E	Exotic plant not native to the State of Nevada
Runoff Effect	+	Runoff is decreased over baseline (bare soil)
	0	No change in runoff from baseline
	-	Runoff is increased over baseline

Source: California Department of Transportation (CALTRANS) Storm Water Quality Handbooks, Construction Site Best Management Practices Manual, Appendix B, August 2002.

2.4.3 Ease of Clean-Up

This criterion applies primarily to the hydraulically applied soil stabilization materials, but there may be clean-up issues associated with some of the other categories as well (e.g., packaging materials, disposal of excess product, etc).

All of the approved hydraulic soil stabilization products are typically applied using water as a carrier, and to varying degrees, these products can be removed from application machinery and overspray areas with the application of clean water as well. However, cleaning must occur before the material sets or dries, otherwise stronger cleaning solutions of detergent, a strong alkali solution, or a petrochemical solvent must be used.

A prudent contractor will take precautions when working with hydraulic products that have some clean-up limitations, and must follow the BMPs in the SWPPP for cleaning of equipment on site. Regardless of which approach is used for temporary soil stabilization, site clean up can be problematic due to the following:

- Added time to dispose of waste materials
- Added time to clean hydraulic equipment before the material sets or dries
- Additional quantities of water needed for cleaning operations
- Impact of quick-setting materials on overspray areas such as sidewalks, roads, vehicles
- Contractor resistance to products that require excessive clean-up
- Additional operation and maintenance costs included in contractor's bid.

2.4.4 Installed Cost

The estimated installed cost (the cost of the material itself, plus the cost associated with its installation) has a value that corresponds to cost in dollars per acre, which is used for estimating and bidding. This approach allows for the direct comparison of approaches.

2.4.5 Erosion Control Effectiveness

This criterion measures the ability of a particular product to reduce soil erosion relative to the amount of erosion measured for bare soil. Erosion control effectiveness is described as a percentage reduction in erosion as compared to an untreated or control condition.

2.4.6 Degradability

Degradability relates to the method by which the chemical components of a soil stabilization product are degraded over time. As might be expected, the way in which a product degrades is related to longevity, which is another selection criterion.

Both degradability and longevity are sometimes key issues in temporary soil stabilization and long-term erosion and sediment control planning.

Soil properties, climate, existing vegetation as well as slope aspect contribute to the degradation of soil stabilization materials. Knowing something about the physical and chemical properties of a product and how these characteristics might interact with site conditions is important when selecting a particular material.

2.4.7 Length of Drying Time

Not all materials require drying time, and the drying criterion may be used to differentiate categorical approaches as well as a final screen for the various types of materials within a class of approaches.

Determining when a soil stabilization material is dry or completely cured is a subjective exercise that relies a great deal on manufacturer-published information. In setting standards for this criterion, where drying or curing time is necessary for a particular method to become erosion control effective, manufacturers' recommendations have been followed.

2.4.8 Time to Effectiveness

Not all soil stabilization products are immediately effective in controlling erosion: some take time to dry (e.g., hydraulic soil stabilizers) and others take time to grow (e.g., temporary seeding). However, when some treatments are applied (e.g., rolled erosion control products, plastic sheeting, and straw mulch) they are immediately effective.

2.4.9 Longevity

This criterion simply considers the time that a soil stabilization product maintains its erosion control effectiveness.

2.4.10 Mode of Application

The mode of application criterion refers to the type of labor or equipment that is required to install the product or technique.

2.4.11 Residual Impact

This criterion relates to the impact that a particular practice might have on construction activities once they are resumed on the area that was temporarily stabilized. Some examples include:

- Temporary vegetation covers or standard biodegradable mulches might create problems with achieving final slope stability or compaction due to their organic content, and therefore would require removal and disposal.

- Applications of straw or hay fibers might keep soil from drying out as quickly as it might if it was bare.

- Plastic sheeting, netting or materials used in a soil stabilization product might last longer than needed on or in the soil.

2.4.12 Native

This criterion relates primarily to selection of plant materials and is important from the standpoint of environmental compatibility and competitiveness.

2.4.13 Runoff Effect

This criterion measures the effect that a particular soil stabilization product has on the production of storm water runoff. Similar to the erosion control effectiveness criterion, runoff from an area protected by a particular product may be compared to the amount of runoff measured for bare soil and is presented in the matrix as a percentage of the runoff that would occur in an untreated, or control condition.

2.5 Temporary Soil Stabilization and Sediment Control Implementation Guidance

Storm water pollution control requirements are intended to be implemented on a year-round basis at an appropriate level. The requirements must be implemented in a proactive manner during all seasons while construction is ongoing.

Nevada has varied rainfall patterns throughout the state; therefore, the appropriate level of BMP implementation will also vary throughout the state. The guidance for temporary sediment controls and soil stabilization BMPs specified in this section is based on rainfall patterns (time frames, intensities, and amounts), general soil types, seasons, slope inclinations and slope lengths.

Appropriate storm water pollution control includes the implementation of an effective combination of both soil stabilization and sediment controls. This section describes both general principles and specific guidance for selecting and implementing temporary soil stabilization and sediment control BMPs.

Sections 2.5.1, 2.5.2, and 2.5.3 provide key principles for preventing erosion on construction sites. Sections 2.5.4 and 2.5.5 provide the specific guidance for selecting and implementing temporary soil stabilization and sediment control BMPs to manage disturbed soil areas.

2.5.1 Scheduling

Construction scheduling must consider the amount and duration of soil exposed to erosion by wind, rainfall, runoff, and vehicle tracking, and must seek to minimize disturbed soil area in the rainy season. A schedule must be prepared that shows the sequencing of construction activities with the installation and maintenance of soil stabilization and sediment control BMPs. See Section 3, BMP SS-1, in this manual for BMP details.

2.5.2 Preservation of Existing Vegetation

Preserving existing vegetation to the maximum extent possible and for as long as possible on a construction site reduces or eliminates erosion in those areas. To facilitate this practice, on a year-round basis, temporary fencing must be provided prior to commencement of clearing and grubbing operations or other soil-disturbing activities in areas where no construction activity is planned or construction will occur at a later date. See BMP SS-2, Preservation of Existing Vegetation, for BMP details.

2.5.3 Storm Water Run-on and Concentrated Flows

The diversion of storm water run-on and conveyance of concentrated flows must be considered in determining the appropriateness of the BMPs chosen. BMPs to divert or manage concentrated flows in a non-erodible fashion may be required on a project-by-project basis to divert off-site drainage through or around the construction site or to properly manage construction site storm water runoff. See BMPs SS-9, Earth Dikes, Drainage Swales and Lined Ditches; SS-10, Outlet Protection/Velocity Dissipation Devices; and SS-11, Slope Drains for BMP details.

2.5.4 Disturbed Soil Area Management

The DSA management guidelines are based on rainfall patterns (time frames, intensities, and amounts), general soil types, seasons, slope inclinations, and slope lengths. All of these factors are considered in developing the appropriate levels of soil stabilization and sediment control, and must be considered by the contractor when selecting specific site-by-site actions.

2.5.4.1 Disturbed Soil Area Size Limitations

Limiting the amount of disturbed soil is a critical component in conducting an effective storm water management program. Contract Special Provisions may specify limits of DSA. The Engineer has the option of increasing the limit of the total DSA during the rainy season beyond five (5) acres if appropriate construction BMPs and an implementation plan are included in an accepted SWPPP.

2.5.4.2 Disturbed Soil Area Protection by Temporary Soil Stabilization and Temporary Sediment Controls

To account for rainfall patterns (time frames, intensities, and amounts) and to a lesser extent general soil type differences, the State has been divided into three areas requiring common protection requirements. These rainfall areas are described in Table 2-3. The specific temporary soil stabilization and sediment control BMPs for DSA protection in each area are determined from Tables 2-4 and 2-5 (for non-active disturbed soil areas and active disturbed soil areas, respectively). The slope length and slope inclination are the most important criteria for soil stabilization and sediment control requirements, as these factors have the largest potential impact on the erosion rate. As indicated on these tables, the temporary soil stabilization and sediment controls at a construction site will increase with increasing slope length and slope inclination combination.

DSAs shall be protected as follows:

- Temporary BMPs (as required in Table 2-4) shall be implemented on non-active DSAs within 14 days from the cessation of soil-disturbing activities or one day prior to the onset of precipitation, whichever occurs first.
- Temporary BMPs for active DSAs (as required in Table 2-5) shall be implemented prior to the onset of precipitation and throughout each day for which precipitation is forecasted.
- For non-active DSAs, limit the erosive effects of storm water flow on slopes by implementing BMPs such as sediment logs or gravel bag berms to break up the slope lengths as follows:
  - Slope inclination 4:1 and flatter: BMPs shall be placed on slopes at intervals no greater than 20 ft.
  - Slope inclination between 4:1 and 2:1: BMPs shall be placed on slopes at intervals no greater than 15 ft.
  - Slope inclination 2:1 or greater: BMPs shall be placed on slopes at intervals no greater than 10 ft.
- For non-active DSAs, permanent erosion control shall be applied to areas deemed substantially complete during the project's defined seeding window.
- Provide construction site BMPs in addition to those specified in Tables 2-4 and 2-5 to convey concentrated flows in a non-erodible fashion.

Table 2-3
AREA DEFINITIONS

AREA	DESCRIPTION
1	District 2 in the following areas: Along the Sierra Nevada from the westerly edge of Reno south through Douglas County
2	District 1, 2, and 3 (except within Area 1) North of line running from western edge of Esmeralda County northeasterly above Tonopah, south of Eureka to the eastern state line near Wendover.
3	District 1 and 3 (except within Area 2) South of line running from western edge of Esmeralda County northeasterly above Tonopah, south of Eureka to the eastern state line near Wendover.

Table 2-4
Required Combination of Temporary Slope Protection and Temporary Sediment Barriers [5] [6]
NON-ACTIVE DISTURBED SOIL AREAS

SEASON	AREA	TEMPORARY BMP	SLOPE [1]			
			≤ 20:1	> 20:1 ≤ 4:1	> 4:1 ≤ 2:1	> 2:1
RAINY	1	SLOPE PROTECTION [4]	X	X	X	X
		SEDIMENT BARRIER [4]	X	X	X	X
		SEDIMENT BASIN OR TRAP [2]		X	X	X
	2	SLOPE PROTECTION[4]	X[7]	X	X	X
		SEDIMENT BARRIER	X[7]	X	X	X
		SEDIMENT BASIN OR TRAP				X
	3	SLOPE PROTECTION[4]	X	X	X	X
		SEDIMENT BARRIER	X	X	X	X
		SEDIMENT BASIN OR TRAP				X
NON - RAINY	1	SLOPE PROTECTION [4]	X[3]	X[3]	X	X
		SEDIMENT BARRIER		X[3]	X	X
		SEDIMENT BASIN OR TRAP				
	2	SLOPE PROTECTION		X[3][7]	X[7]	X
		SEDIMENT BARRIER		X[3][7]	X[7]	X
		SEDIMENT BASIN OR TRAP				
	3	SLOPE PROTECTION				
		SEDIMENT BARRIER			X	X
		SEDIMENT BASIN OR TRAP				

(1) Unless otherwise noted, the temporary BMP is required for the slope inclinations indicated on slope lengths greater than 10 ft. The maximum slope length is 100 ft. for slope inclinations between 20:1 and 2:1 and 50 ft. for steeper slopes.

(2) Required in addition to the temporary sediment barrier, where feasible. Feasibility will depend on site-specific factors such as available right-of-way within the project limits, topography, soil type, disturbed soil area within watershed, and climate conditions.

(3) Implementation of controls not required except at least 24 hours prior to all predicted rain events.

(4) The indicated temporary BMP is required on all slope lengths.

(5) Temporary sediment barrier BMPs are equivalent to what are sometimes referred to as perimeter systems. Provide a barrier to the transport of sediment at the downslope edge of disturbed soil areas.

(6) Permanent erosion control seeding shall be applied to all non-active areas deemed substantially complete. Comply with seeding window in specifications or special provisions.

(7) Implement Slope Protection or Sediment Barrier

Table 2-5
Required Combination of Temporary Slope Protection
Temporary Sediment Barriers
ACTIVE DISTURBED SOIL AREAS [3] [6]

SEASON	AREA	TEMPORARY BMP	SLOPE [1]		
			≤ 20:1	> 20:1 ≤ 2:1	> 2:1
RAINY	1	SLOPE PROTECTION		X	X
		SEDIMENT BARRIER [4]	X	X	X
		SEDIMENT BASIN OR TRAP[2]		X	X
	2	SLOPE PROTECTION			X[5]
		SEDIMENT BARRIER		X	X
		SEDIMENT BASIN OR TRAP[2]			X[5]
	3	SLOPE PROTECTION			X[5]
		SEDIMENT BARRIER		X	X
		SEDIMENT BASIN OR TRAP[2]			X[5]
NON-RAINY	1	SLOPE PROTECTION			
		SEDIMENT BARRIER		X	X
		SEDIMENT BASIN OR TRAP[2]			X[5]
	2	SLOPE PROTECTION			
		SEDIMENT BARRIER			
		SEDIMENT BASIN OR TRAP			
	3	SLOPE PROTECTION			
		SEDIMENT BARRIER			
		SEDIMENT BASIN OR TRAP			

(1) Unless otherwise noted, the BMP is required for the slope inclinations indicated on slope lengths greater than 10 ft.

(2) Required in addition to the temporary sediment barrier, where feasible. Feasibility will depend on site-specific factors such available right-of-way within the project limits, topography, soil type, disturbed soil area within watershed, and climate conditions.

(3) Implementation of soil stabilization controls not required except prior to predicted rain.

(4) The indicated temporary BMP required on all slope lengths.

(5) The indicated temporary BMP required on slope lengths greater than 50 feet.

(6) Temporary sediment barrier BMPs are equivalent to what are sometimes referred to as perimeter systems. Provide a barrier to the transport of sediment at the downslope edge of disturbed soil areas.

2.5.5 Basins

The practices described herein are typical of those that will be implemented on a project-by-project basis. However, it is important to note that there will be instances where project and site conditions require deviation from the BMPs and the descriptions provided in this manual.

For instance, the proposed implementation of sediment basins (see BMP SC-2, Sediment Basin) is a new commitment that has not been incorporated into existing designs. In addition, the nature of linear projects and constrained rights-of-way inherent to NDOT work may prohibit the use of sediment basins at some locations on certain projects and on some projects altogether.

Implementation of sediment basins will be considered on a project-by-project basis. NDOT is committed to refining the sediment basin implementation criteria during the term of the General Permit while implementing the sediment basins on projects as practicable.

2.5.6 Stockpile Management

Soil stabilization and sediment control requirements, as they apply to stockpiles of various materials, are presented in BMP WM-3, Stockpile Management.

2.6 Guidance for Implementation of Other BMPs

2.6.1 Mobile Operations

Mobile operations common to the construction of a project include asphalt recycling, concrete mixing, crushing and the storage of materials. BMPs shall be implemented year-round, as appropriate, to control the individual situations these mobile operations can create.

2.6.2 Wind Erosion Controls

Wind erosion controls shall be implemented year-round for all disturbed soils on the project site that are subject to wind erosion and when significant wind and dry conditions are anticipated during construction of the project. See BMP SS-13, Wind Erosion, for BMP details.

The Special Provisions may also require issuance of Air Quality Permits. In Nevada, air quality is regulated by the NDEP or, within Washoe and Clark Counties, by each county's Air Quality Management Divisions. The Contractor is responsible for obtaining any air quality-related permits and developing any plans that may be required by the regulatory agencies.

2.6.2.1 NDEP

NDEP requires a Surface Area Disturbance Permit if land disturbance equals or exceeds five (5) acres. If the disturbed soil area exceeds twenty (20) acres, a dust control plan must also be submitted.

2.6.2.2 Clark County Department of Air Quality Management (AQMD)

In Clark County, the following construction activities require a Dust Control Permit:

- Soil disturbing or construction activity greater than or equal to one-quarter acre;
- Mechanized trenching greater than or equal to 100 feet in length; or
- Mechanical demolition of any structure larger than or equal to 1,000 ft^2.

A Dust Mitigation Plan is required for all projects and a Site Specific Dust Mitigation Plan is required for sites greater than 10 acres. Construction site superintendent(s), foremen and other designated on-site representatives, as well as the water truck/pull drivers are required to complete the Clark County Dust Control Class.

Clark County Dust Control Permits require explicit payment for temporary and permanent dust control in contract estimates. To comply with this requirement NDOT has created standard line items for these controls to be included in the cost estimates for every project that would disturb the soil.

2.6.2.3 Washoe County District Health Department Air Quality Management Agency (AQMA)

In Washoe County a Dust Control Plan is required for projects disturbing more than one acre of soil.

2.6.3 Tracking Controls

Tracking controls shall be implemented year-round, as needed, to reduce the tracking of sediment and debris from the construction site. At a minimum, entrances and exits shall be inspected daily, and controls implemented as needed. See Section 5 of this manual for BMP details.

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

The objective of the non-storm water and waste management and materials pollution controls is to reduce the discharge of materials other than storm water to the storm water drainage system or to receiving waters. These controls shall be implemented year-round for all applicable activities, material usage, and site conditions. Sections 6 and 7 of this manual provide guidance on implementation of BMPs related to the specific activity being conducted.

2.7 BMP Inspections

Construction site BMPs shall be inspected by the contractor in accordance with General Permit criteria as follows:

- Within 24 hours of the end of a storm event of 0.5 in. or greater;
- At least once every seven (7) calendar days;

- As specified in the project Special Provisions and/or SWPPP; and/or
- As directed by the Engineer.

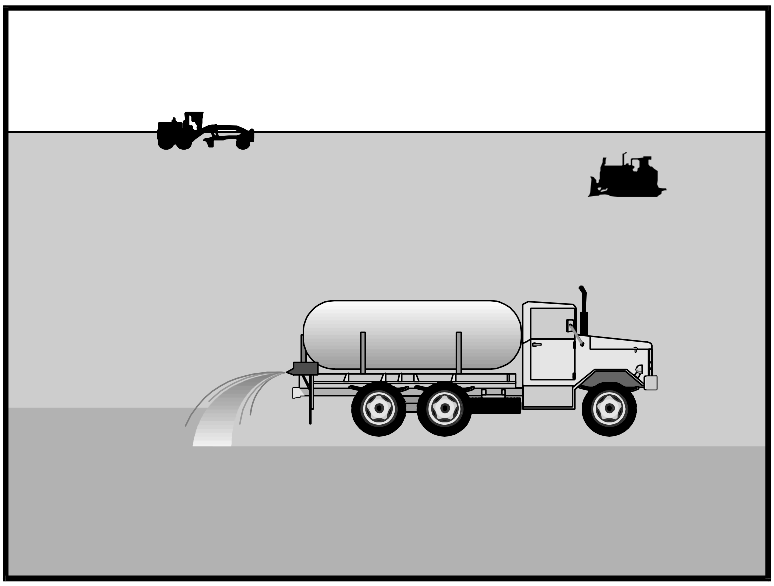
NDOT personnel also perform construction site BMP inspections in accordance with the above criteria. A *Weekly Construction Site Discharge Inspection Checklist* is filled out by NDOT inspectors and signed by the contractor. The checklist provides assistance with inspection criteria and the proper course of action once the inspection is completed. The RE works with the contractor to correct any problems immediately or schedules an approved alternative time, but no later than the onset of subsequent rain events. This Manual may be employed during inspections because it provides details for installation, application, and maintenance for each temporary BMP.

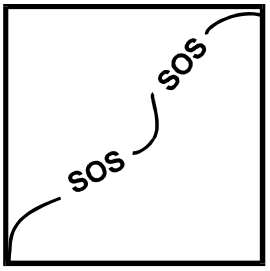
In general, repairs and/or placement of temporary pollution control BMPs shall begin within 24 hours of notification of a deficiency and shall be completed within 7 days. Should this restriction be exceeded, work may be immediately suspended and no other items of work shall be performed until the repairs are completed. Working days will continue to be assessed during the suspension period and partial payments as set forth under Subsection 109.06 may not be forthcoming until said repairs are completed.

Soil Stabilizers / Dust Palliatives

SS-5

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Soil stabilizers are applied to exposed or disturbed soil to reduce wind and water erosion, typically as a final treatment when construction activity has ceased. **Dust palliatives** are used during construction to reduce dust emissions due to mechanical and wind forces, and typically do not have the longevity of soil stabilizers.

Appropriate Applications

Soil stabilizers are applied where specified in the contract plans or as directed by the engineer. Dust palliatives are typically applied at the contractor's discretion to disturbed areas requiring short-term temporary protection for erosion control/dust control and to comply with air quality standards. Because dust palliatives can often be incorporated into the work, they may be a good choice for areas where grading activities will soon resume. Apply on stockpiles to reduce water and wind erosion.

Limitations

- Soil stabilizers and dust palliatives are temporary in nature and may need reapplication.
- Soil stabilizers and dust palliatives require a minimum curing time until fully effective, as prescribed by the manufacturer, which may be 24 hours or longer. They may need reapplication after a storm event.
- Soil stabilizers and dust palliatives may need reapplication after a storm event, and will generally experience spot failures during heavy rainfall. If runoff penetrates the soil at the top of a treated slope, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
- Some soil stabilizers and dust palliatives do not hold up to pedestrian or vehicular traffic across treated areas. For traffic areas, be sure to

select an appropriate product.

- Soil stabilizers and dust palliatives may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
- Some soil stabilizers and dust palliatives may have a deleterious effect on long-term landscaping. Use of soil stabilizers in areas to be landscaped should be coordinated with NDOT landscaping.
- Some soil stabilizers and dust palliatives may not perform well with low relative humidity. Refer to manufacturers' literature for humidity limitations. Under rainy conditions, some agents may become slippery or leach out of the soil.
- May not cure if low temperatures occur within 24 hours of application. Refer to manufacturers literature for temperature limitations.

Standards and Specifications

General Considerations

- Site-specific soil types will dictate appropriate soil stabilizers or dust palliatives to be used.
- Soil stabilizers and dust palliatives must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and shall not stain paved or painted surfaces, refer to Standard Specifications Section 211.03.09.
- Some products are compatible with existing vegetation.
- Performance of soil stabilizers and dust palliatives depends on temperature, humidity, and traffic across treated areas.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

Selecting a Soil Stabilizer or Dust Palliative

Properties of common soil stabilizers and dust palliatives used for erosion control are provided in Tables 1 and 2. Use Table 1 to select a product for non-traffic applications, and Table 2 for traffic areas. Refer to Wind Erosion Control, SS-13, for more information about dust control. Factors to consider when selecting a product include the following:

- Suitability to situation - Consider where the product will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with any existing vegetation. Determine the length of time stabilization will be needed, and if the product will be placed in an area where it will degrade rapidly.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil stabilizer or dust

palliative's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials. Soil information can be obtained from the project's geotechnical report or from a Natural Resources Conservation District (NRCS) website.

- If working in Clark County, soil maps are available from the county.
- Frequency of application - The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could lead to high costs. Application frequency may be minimized if the dust palliative has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean-up.

After considering the above factors, the soil stabilizers and dust palliatives in Tables 1 and 2 will be generally appropriate as follows:

Plant-Material Based (Short Lived)

Short lived products may only be used as dust palliatives.

Guar: Guar is a non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersing agents for easy field mixing. It shall be applied at the rate of 10 to 15 lb per 1,000 gal (1.2 to 1.8 kg per 1,000 L) 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
kg/ha:	45	50	56	67	78

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 rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates shall be applied at a rate of 80 to 200 lb/acre (90 to 225 kg/ha), 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 (170 kg/ha). Approximate drying time is 9 to 12 hours.

Plant-Material Based (Long Lived)

Tall Oil Pitch/Pitch and Rosin Emulsion: Generally, a non-ionic pitch and

rosin emulsion has a minimum solids content of 48%. The rosin shall be a minimum of 26% of the total solids content when included. The addition of rosin will strengthen the stabilizer, but also makes it more brittle and less UV resistant, decreasing its effective duration. The soil stabilizer shall be a non-corrosive, water-dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. Application rate will be per the manufacturer's recommendations for the given situation and required duration.

Lignin Sulfonate: Byproduct of the kraft paper-making process, it is a natural adhesive that holds plant fibers together. It greatly increases the dry strength of the soil, is not humidity-dependant, lowers the freezing point of the road, and retains its effectiveness after reblading. High solubility results in leaching during heavy precipitation. Lignin products have a high BOD, and should not be used where runoff could contaminate a body of water. A neutralizing additive must be added to reduce its corrosive effects to aluminum alloys.

Application can be by water truck or hydraulic seeder with the emulsion/product mixture application rate as specified by the manufacturer.

Polymeric Emulsion Blends

Acrylic Copolymers and Polymers: Polymeric soil stabilizers shall consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55 percent solids. The polymeric compound shall be handled and mixed in a manner that will not cause foaming or shall contain an anti-foaming agent. The polymeric emulsion shall not exceed its shelf life or expiration date; manufacturers shall provide the expiration date. Polymeric soil stabilizer shall be readily miscible in water, non-injurious to seed or animal life, non-flammable, shall provide surface soil stabilization for various soil types without totally inhibiting water infiltration, and shall not re-emulsify when cured. The applied compound shall air cure within a maximum of 36 to 48 hours. Liquid copolymer shall be diluted at a rate of 10 parts water to 1 part polymer and applied to soil at a rate of 1,175 gal/acre (11,000 L/ha).

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 gal/acre (190 L/ha). 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 (H:V)	lb/acre	kg/ha
Flat to 5:1	3.0 – 5.0	3.4 – 5.6
5:1 to 3:1	5.0 – 10.0	5.6 – 11.2
2:1 to 1:1	10.0 – 20.0	11.2 – 22.4

Poly-Acrylamide and Copolymer of Acrylamide: Linear copolymer polyacrylamide is packaged as a dry-flowable solid. When used as a stand-alone stabilizer, it is diluted at a rate of 10 lb/1,000 gal (1.2 kg/1,000 L) of water and applied at the rate of 5.0 lb/acre (5.6 kg/ha).

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 50 to 60 lb/acre (60 to 70 kg/ha). Drying times are 0 to 4 hours.

Cementitious-Based

Gypsum: This is a formulated gypsum-based product that readily mixes with water and sometimes 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%. It is mixed in a hydraulic seeder and applied at rates of 4,000 to 12, 000 lb/acre (4,500 to 13,500 kg/ha). Drying time is 4 to 8 hours.

Petroleum-Based

Petroleum Resin Emulsion: These products coat soil particles, increasing their mass and decreasing their likelihood of becoming airborne, but do not exhibit adhesive properties. They are water insoluble once cured, and hence provide a degree of surface waterproofing, and have good residual effectiveness. Used oils are prohibited as a soil stabilizers or dust palliatives because they contain toxic substances. Petroleum resin products should only be used for traffic areas such as haul roads, parking

and staging areas.

Applying Soil Stabilizers and Dust Palliatives

After selecting an appropriate product, the untreated soil surface must be prepared before applying the soil stabilizer. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps shall be followed:

- Follow manufacturer's recommendations for application rates and pre-wetting of application area.
- Prior to application, roughen embankment and fill areas. Track walking shall only be used where rolling is impractical.
- Consider the drying time for the selected product and apply with sufficient time before anticipated rainfall. Generally, soil stabilizers and dust palliatives require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure times. Soil stabilizers and dust palliatives shall not be applied during or immediately before rainfall.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- Soil stabilizers and dust palliatives shall not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the air temperature is below 4°C (40°F) during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate. Follow the manufacturer's application instructions.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd^2 (0.14 to 1.4 L/m^2) or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in. (150 to 300 mm).
  - Allow treated area to cure for the time recommended by the manufacturer; typically, at least 24 hours.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd^2 (0.5 to 0.9 L/m^2).

Maintenance and Inspection

- Reapplying the selected soil stabilizer may be needed for proper maintenance. High traffic areas shall be inspected on a daily basis, and lower traffic areas shall be inspected on a weekly basis.
- After any rainfall event, the Contractor is responsible for maintaining all slopes to prevent erosion.
- Maintain any unbroken, temporary mulched ground cover while DSAs are non-active. Repair any damaged ground cover and re-mulch exposed areas.
- Follow manufacturer's recommendations for maintaining and cleaning equipment after use.
- Maintenance and repair applications are included in the bid price. Additional payment will not be made.

Table 1
Properties of Soil Stabilizers for Erosion Control (Non-Traffic Areas)

Chemicals	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Stabilizers
Relative Cost	Low	Low	Low	Low
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/Chemically Degradable	Photodegradable/ Chemically Degradable
Labor Intensive	No	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean-Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies	Varies	Varies	4,500 to 13,500 L/Ha

Table 2
Properties of Soil Stabilizers for Erosion Control (Traffic Areas)

Chemicals	Ligninosulfonate	Tall Oil Pitch Emulsion	Petroleum Resin Emulsion
Relative Cost	Moderate	Moderate	Moderate
Resistance to Leaching	Low	High	High
Longevity	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	24 hours +	30-60 min (Prime Coat) 8-24 Hours (Mixed Into Base)	0-4 hours
Mode of Degradation	Biodegradable	Biodegradable	Photo/Chemically Degradable
Labor Intensive	No	No	No
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes
Clean-Up	Water	Water, before it dries	Water, before it cures

- Geotextiles 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 shall be made of 0.12 in. steel wire and shall be U-shaped with 8 in. legs and 2 in. crown.
- Geotextiles may be reused if, in the opinion of the Engineer, they are suitable for the use intended.

Plastic Covers

- Plastic sheeting shall have a minimum thickness of 6 mil and shall be keyed in at the top of slope and firmly held in place with sandbags or other weights placed no more than 10 ft. apart. Seams are typically taped or weighted down their entire length, and there shall be at least a 12 to 24 in. overlap of all seams. Edges shall be embedded a minimum of 6 in. in soil.
- All sheeting shall be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures shall be repaired immediately. If washout or breakages occur, the material shall be re-installed after repairing the damage to the slope.

Erosion Control Blankets/Mats

- Biodegradable rolled erosion control products (RECPs) are typically composed of jute fibers, curled wood fibers, straw, coconut fiber, or a combination of these materials. In order 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** 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 shall be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Excelsior (curled wood fiber)** blanket material shall consist of machine-produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket shall be of consistent thickness. The wood fiber shall be evenly distributed over the entire area of the blanket. The top surface of the blanket shall be covered with a photodegradable extruded plastic mesh. The blanket shall be smolder resistant without the use of chemical

additives and shall be non-toxic and non-injurious to plant and animal life. Excelsior blanket shall be furnished in rolled strips a minimum of 48 in. wide, and shall have an average weight of 0.1 lb/ft^2, ±10 percent, at the time of manufacture. Excelsior blankets shall be secured in place with wire staples. Staples shall be made of 0.12 in. steel wire and shall be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** shall be machine-produced mats of straw with a lightweight biodegradable netting top layer. The straw shall be attached to the netting with biodegradable thread or glue strips. The straw blanket shall be of consistent thickness. The straw shall be evenly distributed over the entire area of the blanket. Straw blanket shall be furnished in rolled strips a minimum of 6.5 ft. wide, a minimum of 82 ft. long, and a minimum of 0.055 lb/ft^2. Straw blankets shall be secured in place with wire staples. Staples shall be made of 0.12- in. steel wire and shall be U-shaped with 8 in. legs and 2 in. crown.

- **Wood fiber blanket** is composed of biodegradable fiber mulch with extruded plastic netting held together with adhesives. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which shall be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** shall be machine-produced mats of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber shall be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket shall be of consistent thickness. The coconut fiber shall be evenly distributed over the entire area of the blanket. Coconut fiber blanket shall be furnished in rolled strips with a minimum of 6.5 ft. wide, a minimum of 82 ft. long, and a minimum of 0.055 lb/ft^2. Coconut fiber blankets shall be secured in place with wire staples. Staples shall be made of 0.12 in steel wire and shall be U-shaped with 8 in. legs and 2 in. crown.

- **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 shall be secured to the

Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Anchoring

- U-shaped wire staples, metal geotextile stake pins or triangular wooden stakes can be used to anchor mats and blankets to the ground surface.
- Staples shall be made of 0.12 in. steel wire and shall be U-shaped with 8 in. legs and 2 in. crown. Wire staples shall be minimum of 11 gauge.
- Metal stake pins shall be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin.
- Wire staples and metal stakes shall be driven flush to the soil surface.
- All anchors shall be a minimum of 6 in. long and have sufficient penetration to resist pullout. Longer anchors may be required for loose soils as determined by the responsible party, NDEP Inspector, or by Manufacturer's installation guidelines.

Installation on Slopes

Installation shall be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Begin at the top of the slope and anchor the blanket in a 6 in. deep by 6 in. wide trench. Backfill trench and tamp earth firmly.
- Unroll blanket down slope in the direction of water flow.
- Overlap the edges of adjacent parallel rolls 6 in. and staple every 3 ft.
- When blankets must be spliced, place blankets end over end (shingle style) with 6 in. overlap. Staple through overlapped area, approximately 12 in. apart.
- Lay blankets loosely and maintain direct contact with the soil. Do not stretch.
- Staple blankets sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 to 2:1 , require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 to 3:1, require a minimum of 1½ staples/yd^2, placing 1 staple/yd on centers. Gentle slopes require a minimum of 1 staple/yd^2.

Geotextiles, Mats, Plastic Covers and Erosion Control Blankets

Installation in Channels

Installation shall be in accordance with the manufacturer's recommendations. In general, these will be as follows:

- Dig initial anchor trench 12 in. deep and 6 in. wide across the channel at the lower end of the project area.
- Excavate intermittent check slots, 6 in. deep and 6 in. wide across the channel at 25 to 30 ft. intervals along the channels.
- Cut longitudinal channel anchor slots 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 in. to 3 in. above the crest of the channel side slopes.
- Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at 12 in. intervals. Note: matting will initially be upside down in anchor trench.
- In the same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of 6 in.
- Secure these initial ends of mats with anchors at 12 in. intervals, backfill and compact soil.
- Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining a 6 in. overlap.
- Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot then fold back against itself. Anchor through both layers of mat at 12 in. intervals, then backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench.
- Alternate method for non-critical installations: Place two rows of anchors on 6 in. centers at 25 ft. to 30 ft. intervals in lieu of excavated check slots.
- Shingle lap ends by overlapping uphill on top of downhill fabric a minimum of 12 in. to prevent water from flowing underneath fabric at splice locations. See schematics at end of this fact sheet.
- Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.

Wood Mulching

SS-8

Adapted from Caltrans Construction Site BMPs

BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Wood mulching consists of applying a mixture of chipped or cut wood mulch per Standard Specification Section 726, bark or compost. Wood mulch is mostly applicable to landscape projects.

The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Appropriate Applications

Wood mulching is considered a temporary soil stabilization (erosion control) alternative in the following situations:

- As a stand-alone temporary surface cover on disturbed areas until soils can be prepared for revegetation and permanent vegetative cover can be established.
- As short term, non-vegetative ground cover on slopes to reduce rainfall impact, decrease the velocity of sheet flow, settle out sediment and reduce wind erosion.

Limitations

- Wood mulch may introduce unwanted species.
- Chipped or cut wood per Standard Specification Section 726 does not withstand concentrated flows and is prone to sheet erosion.
- Green material has the potential for the presence of unwanted weeds and other plant materials. Delivery system is primarily by manual labor, although pneumatic application equipment is available.
- Wood mulch should not be applied in winds that cause unwanted or excessive spreading of the mulch.

Standards and Specifications

Mulch Selection

There are many types of mulches, and selection of the appropriate type shall be based on the type of application and site conditions. Prior to use of wood mulches, there shall be concurrence with the NDOT headquarters Landscape Architect since some mulch use on construction projects may not be compatible with planned or future projects. Selection of wood mulches by the Contractor shall comply with Standard Specifications Sections 726 and 211.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a punching type roller or by track walking. The construction-application procedures for mulches vary significantly depending upon the type of mulching method specified. Two (2) methods are highlighted here:

- Green Material: This type of mulch is produced by recycling of vegetation trimmings such as chipped or cut shrubs and trees. Methods of application are generally by hand, although pneumatic methods are available. Materials composted must be indigenous-no compost of noxious weeds. Green material must conform to Standard Specification Section 726.
    - It can be used as a temporary ground cover with or without seeding.
    - The green material shall be evenly distributed on site to a depth of not more than 2 in.
- Chipped or cut Wood per Standard Specification Section 726: Suitable for ground cover in ornamental or revegetated plantings.
    - Chipped or cut wood/bark per Standard Specification Section 726 is conditionally suitable; see note under limitations.
    - Shall be distributed by hand or another method approved by the engineer.
    - The mulch shall be evenly distributed across the soil surface to a depth of 3 in.
- Avoid mulch placement onto the traveled way, sidewalks, lined drainage channels, sound walls, and existing vegetation.
- All material must be removed prior to re-starting work on the slopes. In some cases, wood mulch may be incorporated into the soil if approved

by the Engineer.

- Mulch material should come from indigenous plants only.

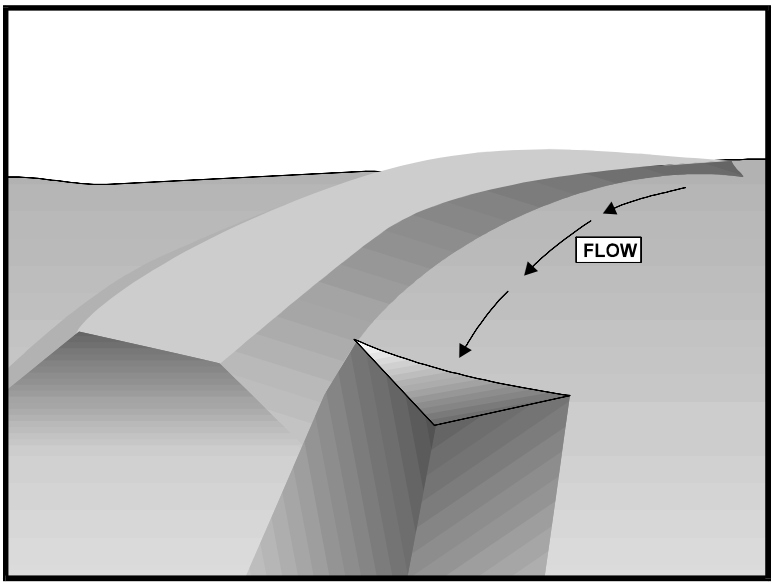
Maintenance and Inspection

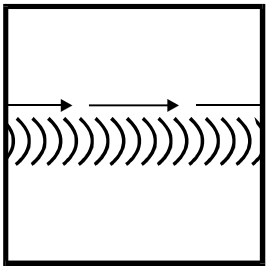
- Regardless of the mulching technique selected, the key consideration in Maintenance and Inspection is that the mulch needs to last long enough to achieve erosion-control objectives. If the mulch is applied as a stand-alone erosion control method over disturbed areas (without seed), it shall last the length of time the site will remain barren or until final re-grading and re-vegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance shall focus on longevity and integrity of the mulch.

Earth Dikes/Drainage Swales and Lined Ditches

SS-9

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

These are structures that intercept, divert and convey surface run-on, generally sheet flow, to prevent erosion.

Appropriate Applications

Earth dikes/drainage swales and lined ditches may be used to:

- Convey surface runoff down sloping land.
- Intercept and divert runoff to avoid sheet flow over sloped surfaces.
- Divert and direct runoff towards a stabilized watercourse, drainage pipe or channel.
- To intercept runoff from paved surfaces.

Earth dikes/drainage swales and lined ditches also may be used:

- Below any grade where runoff begins to concentrate
- Along roadways and facility improvements subject to flood drainage
- At the top of slopes to divert run-on from adjacent or undisturbed slopes
- At bottom and mid-slope locations to intercept sheet flow and convey concentrated flows

This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary.

SS-9 Earth Dikes/Drainage Swales and Lined Ditches

Adapted from Caltrans Construction Site BMPs

Limitations

- Earth dikes/drainage swales and lined ditches are not suitable as sediment trapping devices.
- May be necessary to use other soil stabilization and sediment controls, such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dikes, swales and ditches.

Standards and Specifications

Care must be applied to correctly size and locate earth dikes, drainage swales and lined ditches. The risks to public safety and property damage and environmental consequences, due to erosion of the measure, soil types, over topping, flow backups, washout, and drainage flow patterns, should be carefully considered when designing these facilities. Unless local drainage design ordinances or criteria state otherwise and are more stringent, the following general design guidelines should be considered:

- One temporary drain or swale should serve no more than 5 acres,
- In the Lake Tahoe Basin, temporary conveyances shall not be overtopped by the 20 yr., 1 hr. event, for the remainder of Nevada facilities should be designed for the 2 yr., 24 hour event unless local criteria are more stringent.
- Avoid constructing drains or swales in cut or fill slopes whenever possible.
- Compact all dikes, berms and fills per Standard Specification Section 207 for culvert foundation backfill,
- Conveyances with slopes less than 5% shall be stabilized by seeding or by mulching and/or geotextile fabric if re-vegetation is not possible. Slopes greater than 5% should be lined with erosion control mats, blankets, and/or geogrids, webs or meshes with rock mulch or rip-rap as deemed appropriate by the designer,
- Side slopes should be 2:1 or flatter,
- Drainage gradients should be at least 1% but not greater than 15%,
- Construct swales and dikes downstream to upstream
- Provide stabilized outlets.

Maintenance and Inspections

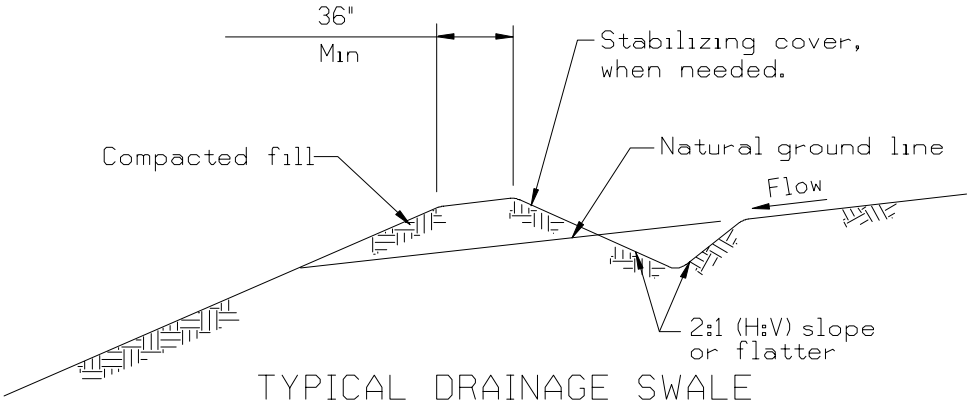
- Inspect temporary measures prior to the rainy season, after rainfall events, and regularly (approximately once per week) during the rainy season. See Section 2 of this manual for rainy season description.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.

Earth Dikes/Drainage Swales and Lined Ditches

SS-9

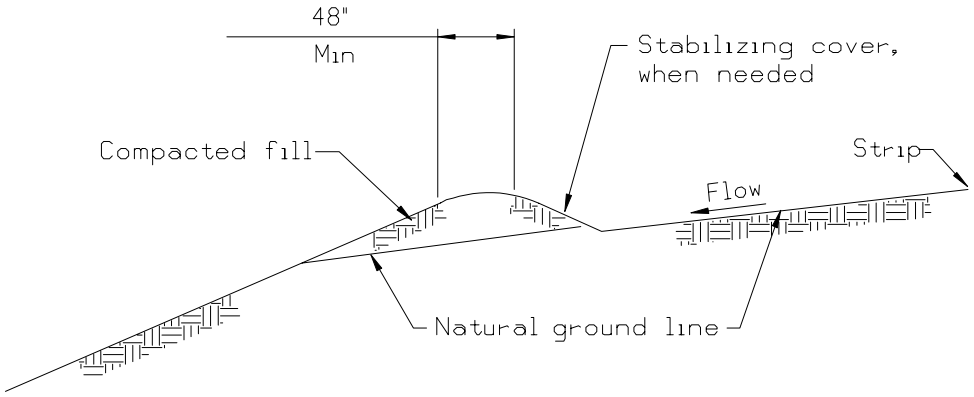
Adapted from Caltrans Construction Site BMPs

- Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment, and repair linings and embankments as needed.
- Temporary conveyances shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.



TYPICAL DRAINAGE SWALE
NOT TO SCALE

NOTES:
1. Stabilize inlet, outlets and slopes.
2. Properly compact the subgrade.

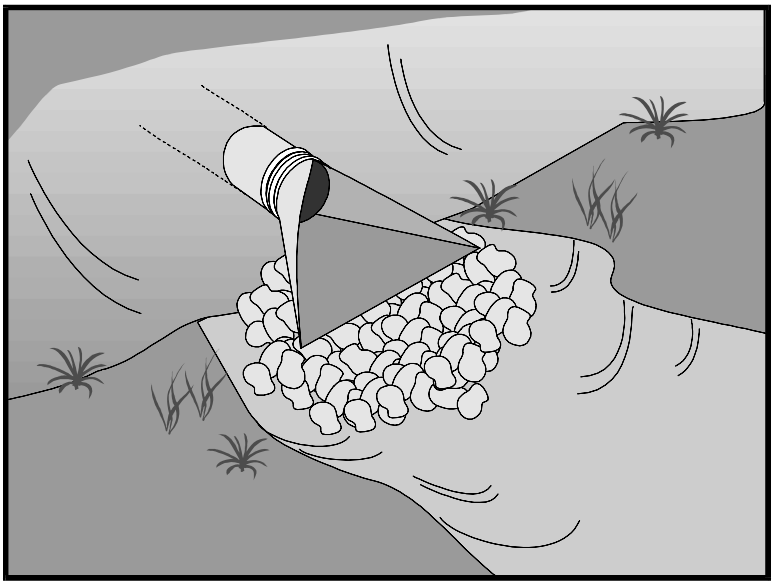


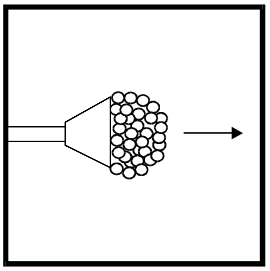
TYPICAL EARTH DIKE
NOT TO SCALE

Outlet Protection/Velocity Dissipation Devices

SS-10

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Outlet protection/velocity dissipation devices are placed at pipe outlets to prevent scour and reduce the velocity and/or energy of exiting storm water flows. This fact sheet provides guidance for their use as a temporary BMP, which must be removed at the end of construction. Permanent outlet protection will be specified in the construction plans. Additional guidance on the sizing and the use of outlet protection may be found in the NDOT Drainage Manual or in FHWA's Hydraulic Engineering Circular (HEC) 14, Hydraulic Design of Energy Dissipaters for Culverts and Channels, Sept. 1983 FHWA #EPD-86-110.

Appropriate Applications

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conveyances 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 flash floods.
  - Points where lined conveyances discharge to unlined conveyances.
- This BMP may be implemented on a project-by-project basis with other BMPs when determined necessary.

SS-10 Outlet Protection/Velocity Dissipation Devices

Adapted from Caltrans Construction Site BMPs

Limitations

- Loose rock may have stones washed away during high flows unless it is designed properly.

Standards and Specifications

- There are many types of energy dissipaters, one of which is shown in Standard Drawing R-3.1.4, Riprap Apron.
- Install riprap at selected outlet. Riprap aprons are best suited for temporary use during construction.
- Carefully place riprap to avoid damaging the filter fabric in accordance with Standard Specifications Section 610.
- For proper operation of apron:
  - Align apron with receiving stream and keep straight throughout its length. If a curve is needed to fit site conditions, place it in upper section of apron.
  - Protect the underlying erosion control fabric with the corresponding class of riprap bedding per Standard Specification Section 706.
- Outlets on slopes steeper than 10 percent shall have additional protection.

Maintenance and Inspection

- Inspect temporary measures prior to the rainy season, after rainfall events, and regularly (approximately once per week) during the rainy season.
- Inspect apron for displacement of the riprap and/or damage to the underlying fabric. Repair fabric and replace riprap that has washed away.
- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying erosion control fabric per Standard Specification Section 726.
- Temporary devices shall be completely removed as soon as the surrounding drainage area has been stabilized, or at the completion of construction.

Straw Mulch (SS-6)

- Apply straw mulch to disturbed streambanks in accordance with SS-6.

Limitations

- Do not place straw mulch below the mean high water level, as this material could wash into the channel and impact water quality or possibly cause eutrophication.

Geotextiles, Plastic Covers, and Erosion Control Blankets (SS-7)

- Install geotextiles, erosion control blankets and plastic as described in SS-7 to stabilize disturbed channels and streambanks. Not all applications should be in the channel, for example, certain geotextile netting may snag fish gills and are not appropriate in fish-bearing streams. Contact NDEP for appropriate applications. Geotextile fabrics that are not biodegradable are not appropriate for in-stream use. Additionally, geotextile fabric or blankets placed in channels must be adequate to sustain anticipated hydraulic forces.

Earth Dikes, Drainage Swales, and Lined Ditches (SS-9)

- Convey, intercept, or divert runoff from disturbed streambanks using earth dikes, drainage swales, or lined ditches (SS-9).

Limitations

- Do not place earth dikes in watercourses, as these structures are only suited for intercepting sheet flow, and should not be used to intercept concentrated flow.
- Appropriately sized outlet protection/velocity dissipation devices (SS-10) must be placed at outlets to minimize erosion and scour.

Outlet Protection/Velocity Dissipation Devices (SS-10)

- Place outlet protection or velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with SS-10.

Slope Drains (SS-11)

- Use slope drains to intercept and direct surface runoff or groundwater into a stabilized watercourse, trapping device or stabilized area in accordance with SS-11.

Limitations

- Appropriately sized outlet protection/velocity dissipation devices (SS-10) must be placed at outlets to minimize erosion and scour.

STREAMBANK SEDIMENT CONTROL

Silt Fences (SC-1)

- Install silt fences in accordance with SC-1 to control sediment. Silt fences should only be installed where sediment-laden water can pond, thus allowing the sediment to settle out.

Sediment logs (SC-5)

- Install sediment logs in accordance with SC-5 along contour of slopes above the high water level to intercept runoff, reduce flow velocity, release the runoff as sheet flow and provide removal of sediment from the runoff. In a stream environment, sediment logs should be used in conjunction with other sediment control methods such as silt fence (SC-1). Install silt fence (SC-1), or other sediment control method along toe of slope above the high water level.

Gravel Bag Berm (SC-6)

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment-laden sheet flow runoff in accordance with SC-6. In a stream environment, gravel bag barriers can allow sediment to settle from runoff before water leaves the construction site and can be used to isolate the work area from the live stream.

Limitations:

- Gravel bag barriers are not recommended as a perimeter sediment control practice around streams.

Rock Filter

Description and Purpose:

Rock filters are temporary erosion-control barriers composed of rock that is anchored in place. Rock filters detain the sediment-laden runoff, retain the sediment, and release the water as sheet flow at a reduced velocity. Typical rock filter installations are illustrated at the end of this Section.

Applications:

- Near the toe of slopes that may be subject to flow and rill erosion.

Limitations:

- Inappropriate for contributing drainage areas greater than 5 acres.
- Requires sufficient space for ponded water.
- Ineffective for diverting runoff because filters allow water to slowly seep through.

- Rock filter berms are difficult to remove when construction is complete.
- Unsuitable in developed areas or locations where esthetics is a concern.

Specifications:

- Rock: open-graded rock, 0.75 to 5 in. for concentrated flow applications.
- Woven wire sheathing: 1 in. diameter, hexagonal mesh, galvanized 20-gauge (used with rock filters in areas of concentrated flow).
- In construction traffic areas, maximum rock berm heights should be 12 in. Berms should be constructed every 300 ft on slopes less than 5%, every 200 ft on slopes between 5% and 10%, and every 100 ft on slopes greater than 10%.

Maintenance:

- Inspect berms before and after each significant rainfall event and weekly throughout the rainy season.
- Reshape berms as needed and replace lost or dislodged rock, and/or wire mesh.
- Inspect for sediment accumulation; remove sediments when depth reaches one-third of the berm height or 12 in., whichever occurs first.
- When project is complete remove the wire mesh.

Portable Precast Concrete Barrier Rail (PPCBR)

Description and Purpose:

This is temporary sediment control that uses PPCBR to form the sediment deposition area, or to isolate the near-bank construction area. Install PPCBR at toe of slope in accordance with procedures described in Clear Water Diversion (NS-5).

Barriers are placed end-to-end in a pre-designed configuration and gravel-filled bags are used at the toe of the barrier and also at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

Appropriate Applications:

- This technique is useful at the toe of embankments, cuts or fills slopes.

Limitations:

- The PPCBR method should not be used to dewater a project site, as the barrier is not watertight.

Standards and Specifications:

- Refer to NS-5 "Clear Water Diversion" for standards and specifications.

INSTREAM CONSTRUCTION SEDIMENT CONTROL

There are three different options currently available for reducing turbidity while working in a stream or river. The stream can be isolated from the area in which work is occurring by means of a water barrier, the stream can be diverted around the work site through a pipe or temporary channel, or one can employ construction practices that minimize sediment suspension.

Whatever technique is implemented, an important thing to remember is that dilution can sometimes be the solution. A probable "worst time" to release high TSS into a stream system might be when the stream is very low; summer low flow, for example. During these times, the flow may be low while the biological activity in the stream is very high. Conversely, the addition of high TSS or sediment during a big storm discharge might have a relatively low impact, because the stream is already turbid, and the stream energy is capable of transporting both suspended solids, and large quantities of bedload through the system. The optimum time to "pull" in-stream structures may be during the rising limb of a storm hydrograph.

Techniques to Minimize Total Suspended Solids (TSS)

- Clean, washed gravel - Using clean, washed gravel decreases solid suspension, as there are fewer small particles deposited in the stream.
- Excavation using a large bucket - Each time a bucket of soil is placed in the stream a portion of soil is suspended. Approximately the same amount is suspended whether a small amount of soil is placed in the stream, or a large amount. Therefore, using a large excavator bucket instead of a small one will reduce the total amount of soil that washes downstream.
- Use of dozer for backfilling - Using a dozer for backfilling instead of a backhoe follows the same principles – the fewer times soil is deposited in the stream, the less soil will be suspended.
- Partial dewatering with a pump - Partially dewatering a stream with a pump reduces the amount of water, and thus the amount of water that can suspend sediment.

Washing Fines

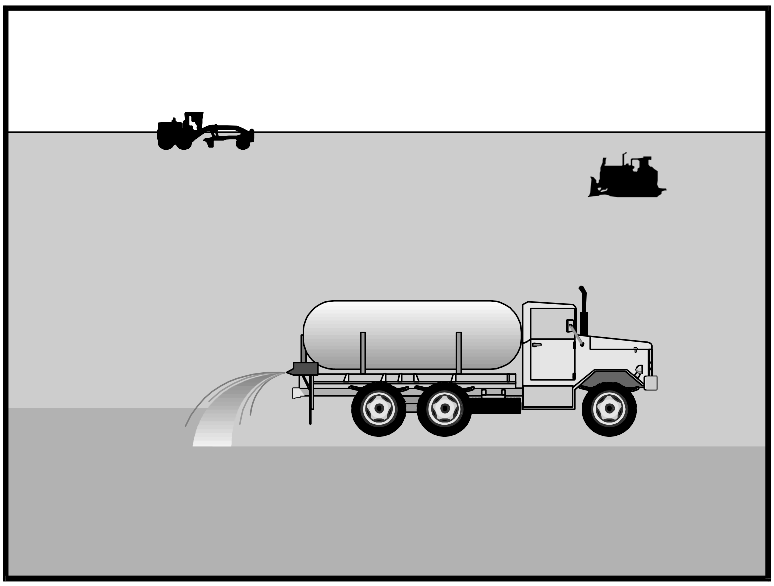
Definition and Purpose:

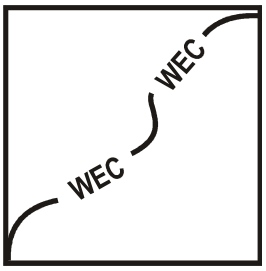
Washing fines is an "in-channel" sediment control method, which uses water, either from a water truck or hydrant, to wash any stream fines that were brought to the surface of the channel bed during restoration, back into the interstitial spaces of the gravel and cobbles.

Wind Erosion Control

SS-13

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ● Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ● Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Dust or wind erosion control consists of applying water, soil stabilizers, dust palliatives, or other soil stabilization BMP as necessary to prevent or alleviate dust nuisance and to comply with state and local permit regulations. Dust control shall be applied in accordance with NDOT Standard Specifications 107.21 and 107.22. Covering stockpiles or exposed soil areas with blankets, mats or mulches is an alternative to applying water, soil stabilizers, or dust palliatives.

Appropriate Applications

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

Limitations

Effectiveness depends on soil, temperature, humidity and wind velocity. Soil stabilizers are to be used where specified in the contract plans or as directed by the engineer. The contractor may determine when and where to apply dust palliatives in order to comply with applicable regulations.

Standards and Specifications

- Water shall be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure even distribution.
- All distribution equipment shall be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit shall be available at all times to apply water or dust palliative to the project.
- If reclaimed waste water is used, the sources and discharge must meet NDEP requirements. Non-potable water shall not be conveyed in tanks or drain pipes that will be used to convey potable water and

there shall be no connection between potable and non-potable supplies. Non-potable tanks, pipes and other conveyances shall be marked "NON-POTABLE WATER - DO NOT DRINK."

- Materials applied as temporary soil stabilizers will also provide wind erosion control benefits.
- Monitoring is required in Clark County and is performed visually.
- In Clark County, construction activity must cease if wind is causing Fugitive Dust in excess of 20% or 50% opacity (depending on analysis method), or if wind is causing a plume 100 yards or more in length (See Clark County Air Regulations).
- In Washoe county, construction activity must cease if dust generation cannot be satisfactorily controlled or upon request of the AQMD, i.e. under high wind conditions (See Washoe County Air Quality Management Division Regulations).
- In Clark County, contractor must document and retain records of all use of dust palliatives on the Dust Control Permit Forms.
- Application of dust palliatives are subject to sample collection and testing for compliance with applicable regulations of the Nevada Administrative Code and the requirements set for in the Interim Policy On Dust Palliative Use In Clark County.

Maintenance and Inspection

- Check areas protected to ensure coverage.
- Implement requirements of the Standard Specifications Section 107, 210 and 637.

Section 4
Temporary Sediment Control Best Management Practices

4.1 Temporary Sediment Control Practices

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

Temporary sediment control practices shall be implemented in conformance with the criteria presented in Section 2, Selecting and Implementing Construction Site Best Management Practices (BMPs), of this Manual. Temporary sediment control practices include the BMPs listed in Table 4-1.

Table 4-1
TEMPORARY SEDIMENT CONTROL BMPs

ID	BMP NAME
SC-1	Silt Fence
SC-2	Sediment Basin
SC-3	Sediment Trap
SC-4	Check Dam
SC-5	Sediment Logs
SC-6	Gravel Bag Berm
SC-7	Street Sweeping and Vacuuming
SC-8	Storm Drain Inlet Protection

The remainder of this Section shows the working details for each of the temporary sediment control BMPs.

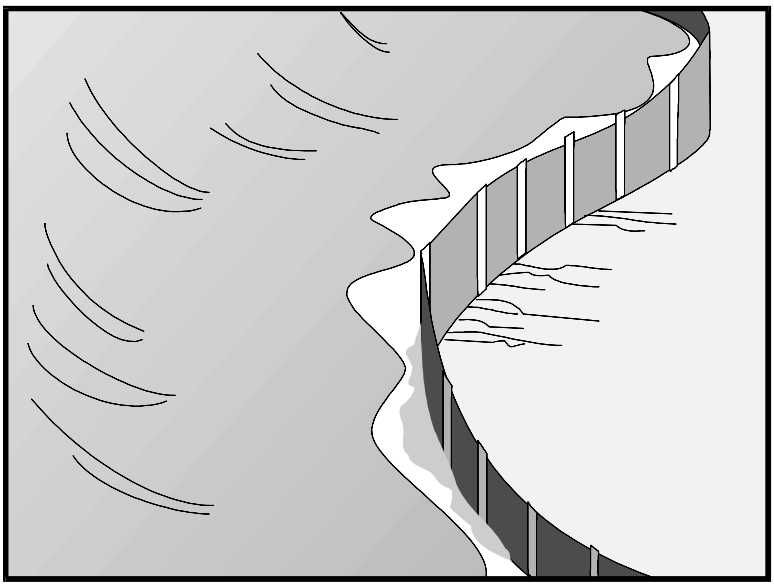
Use of straw bale barriers has been one of the most common and familiar methods historically used when attempting to retain sediment on construction sites. However,

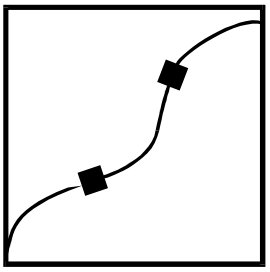
their widespread use does not reflect the fact that they are relatively ineffective and are maintenance intensive. Although initially inexpensive, improper installation and application of straw bale barriers can result in accelerated erosion and sediment transport. Straw bales typically only last three months, however they are often misused and remain onsite for extended periods of time, falling apart and becoming an additional pollutant source. Although "weed free straw" is typically specified, they can introduce noxious weeds to a site. In addition, health districts have requested that straw bales not be used because the straw provides a nutrient medium for the breeding of mosquitoes. For these considerations, straw bales shall not be used as BMPs on NDOT construction sites.

Silt Fence

SC-1

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

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.

Appropriate Applications

Silt fences are placed:

- Along the perimeter of a project.
- Below the toe of exposed and erodible slopes.
- Along slope contours for longer slope lengths.
- Down-slope of exposed soil areas.
- Around temporary stockpiles.
- Along streams and channels.

Limitations

- Not effective unless trenched and keyed in.
- The maximum length of slope draining to any point along the silt fence shall be 200 ft.
- Slope of area draining to fence shall be less than 1:1.
- Limit to locations suitable for temporary ponding or deposition of sediment.
- Fabric life span typically is increased if reinforced with wire mesh. Extended periods may require fabric replacement.
- Silt fences shall not be used in concentrated flow areas.

- Design in accordance with Page 5 of this working detail (BMP).
- Must be maintained by removing sediment accumulations and repairing damaged areas.
- Must be removed and disposed of.
- Don't use below slopes subject to creep, slumping, or landslides.
- Don't use in streams, channels, or anywhere flow is concentrated.
- Don't use silt fences to divert flow.

Standards and Specifications

Design and Layout

- **Type 1**. Silt fence shall be constructed of silt fence fabric and wood posts at 6′ maximum spacing. This installation typically is only suitable for up to two-week duration, especially in wind prone areas. Longer duration installations typically require significant maintenance as posts fail easily and the fabric quickly becomes unsuitable.
- **Type 2.** Silt fence shall be constructed of silt fence fabric, wire mesh backing, and steel T-posts at 8′ maximum spacing. This installation is intended for construction activities of two weeks duration or longer, and will typically last the duration of a construction season if installed and maintained properly.
- Not intended for use as mid-slope protection on slopes steeper than 4:1.
- For slopes steeper than 2:1 and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection fencing immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be required in accordance with Standard Specification Section 616.
- For slopes adjacent to water bodies or Environmentally Sensitive Areas (ESAs), additional temporary soil stabilization BMPs (SS-1 – SS-11) shall be used.

Materials

- Silt fence fabric shall be woven polypropylene with a minimum width of 35 in. and a minimum tensile strength of 100 lbs. The fabric shall conform to the requirements in ASTM designation D4632 and shall have an integral reinforcement layer. The reinforcement layer shall be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric shall be between 0.1 sec^{-1} and 0.15 sec^{-1} in conformance with the requirements in ASTM designation D4491. Contractor must submit certificate of

compliance in accordance with Standard Specifications Section 724.

- Wood posts shall be commercial quality lumber of nominal dimensions 2 in. x 2 in x 5 ft. Each post shall be free from decay, splits or cracks longer than the thickness of the post or other defects that would weaken the posts and cause the posts to be structurally unsuitable.
- Steel T-posts shall be 5 ft tall and conform to Standard Specifications Section 724.03.02.
- Wire mesh shall be 2 in x 2 in x 14-gauge wire.
- Fabric shall be fastened to the posts in accordance with manufacturer's recommendations.

Installation

- Generally, silt fences shall be used in conjunction with soil stabilization source controls up slope to provide effective control.
- Trenches shall not be excavated wider and deeper than necessary for proper installation of the temporary linear sediment barriers.
- Excavation of the trenches shall be performed immediately before installation of the temporary linear sediment barriers. The bottom of the silt fence shall be keyed-in a minimum of 6 in.
- Construct silt fences with a setback of at least 10 ft. from the toe of a slope. Where setback is not practical, the silt fence may be constructed at the toe of the slope, but shall be constructed as far from the toe of the slope as practical to allow for equipment (i.e. Bobcat) access for removal of accumulated sediment.
- Construct the length of each reach between the cross barriers so that the change in base elevation along the reach does not exceed 1/3 the height of the barrier; in no case shall the reach exceed 500 ft.
- Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier. Cross barriers shall be installed at the ends of fence sections (every 500 ft, see detail) or at joints in the fabric to minimize overloading of the fence due to sediment transport parallel to the fence line.
- Install in accordance with Page 5 of this Fact Sheet.

Maintenance and Inspection

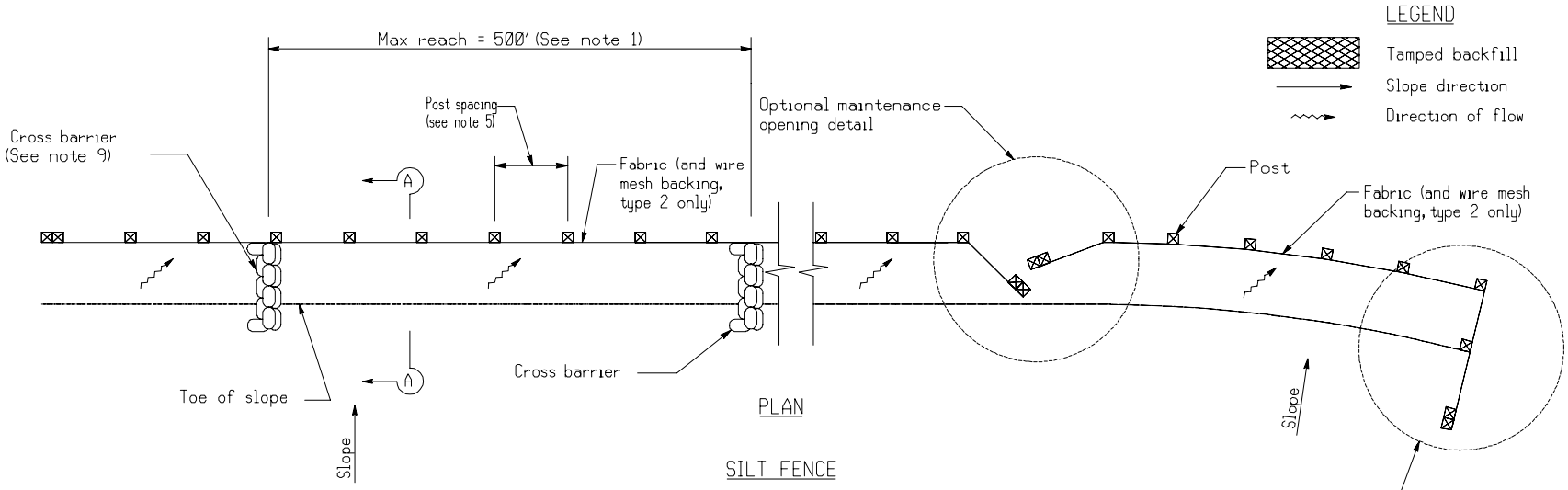
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric.
- Inspect silt fence when rain is forecast. Perform necessary maintenance, or maintenance as required by SWPPP.

- Inspect silt fence following rainfall events. Perform maintenance as necessary, or as required by the SWPPP.
- Maintain silt fences to provide an adequate sediment holding capacity. Sediment shall be removed when the sediment accumulation reaches one-third (1/3) of the barrier height. Removed sediment shall be incorporated in the project at locations designated by the RE or disposed of outside the highway right-of-way in conformance with the Standard Specifications.
- Silt fences that are damaged and become unsuitable for the intended purpose, as determined by the RE, shall be removed from the site of work, disposed of outside the highway right-of-way in conformance with the Standard Specifications, and replaced with new silt fence barriers. This is included in the maintenance of the silt fence, and is included in the bid price. Additional payment will not be made.
- Holes, depressions or other ground disturbance caused by the removal of the temporary silt fences shall be backfilled and repaired in conformance with the Standard Specifications.
- Remove silt fence when no longer needed or as required by the Engineer. Fill and compact postholes and anchorage trench, remove sediment accumulation, re-seed or re-vegetate as appropriate, and grade fence alignment to blend with adjacent ground.

Silt Fence

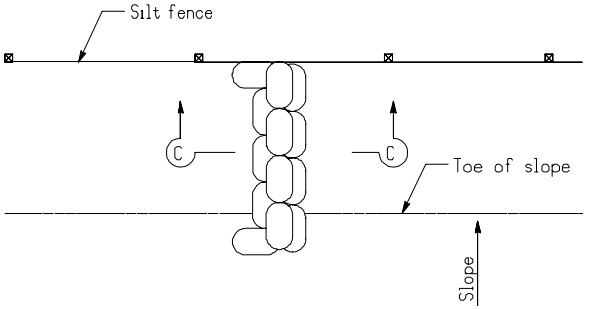
Adapted from Caltrans Construction Site BMPs

SC-1

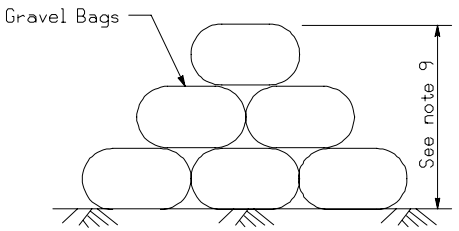


LEGEND
- Tamped backfill
- Slope direction
- Direction of flow

SILT FENCE



CROSS BARRIER DETAIL



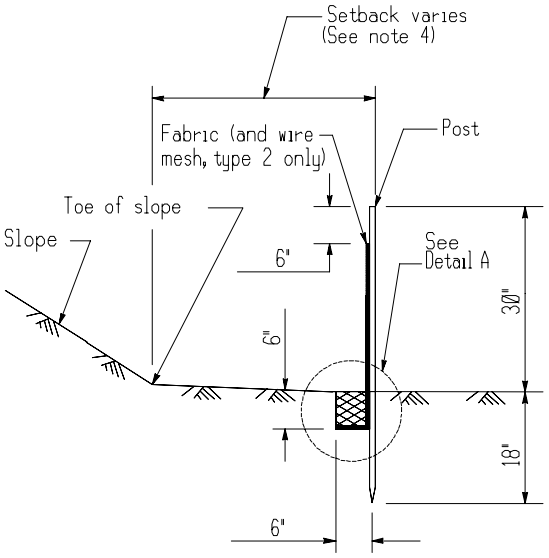
SECTION C-C

NOTES

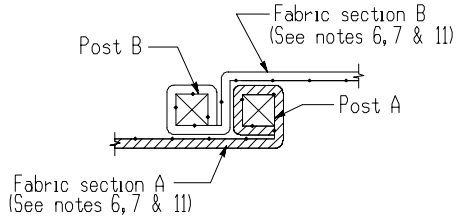
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach exceed 500'.
2. The end of the silt fence shall be turned up slope (see End Detail).
3. Post dimensions are nominal.
4. Dimensions may vary to fit field conditions. Room for maintenence shall be provided when practical.
5. Posts shall be spaced 6' maximum for Type 1, 8' maximum for Type 2, and shall be positioned on the downstream side of fence.
6. Posts to overlap and fence fabric to fold around each post one full turn at joint. Secure fabric to posts with 4 staples or wire rings.
7. Posts shall be driven tightly together to prevent potential flow-through of sediment at the joint. The tops of the posts shall be secured with wire.
8. For Type 1 end posts, fence fabric shall be folded around two posts one full turn and secured with 4 staples.
9. Cross barriers shall be a minimum of 1/3 and a maximum of ½ the height of the fence.
10. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
11. Joining sections shall not be placed as sump locations.
12. Gravel bag rows and layers shall be offset to eliminate gaps (see SC-6).

Silt Fence

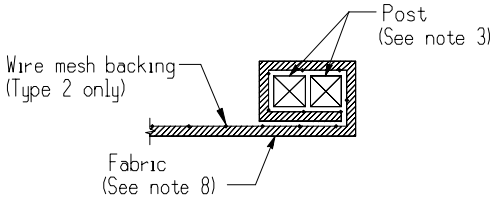
Adapted from Caltrans Construction Site BMPs



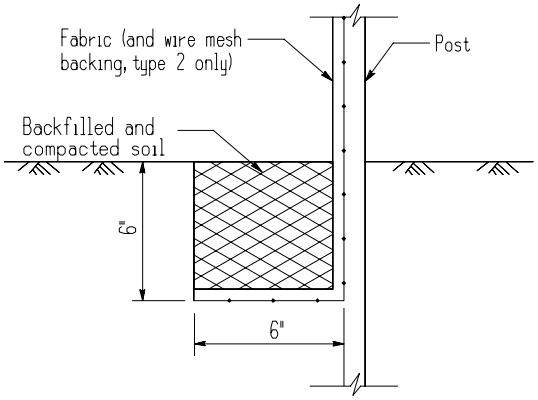
SECTION A-A



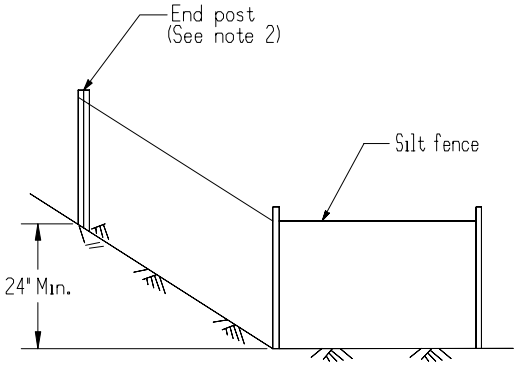
JOINING SECTION DETAIL (TOP VIEW)



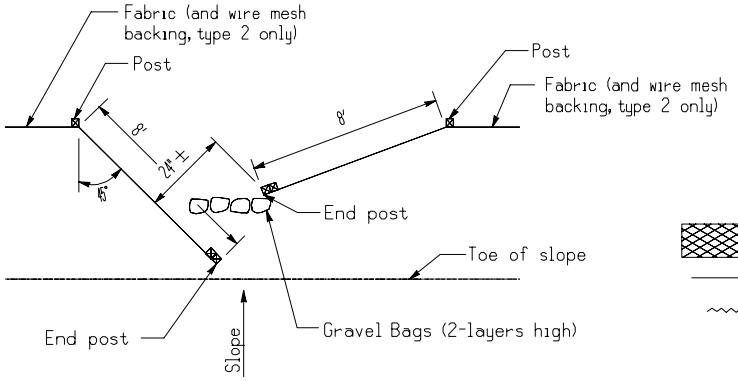
END STAKE DETAIL (TOP VIEW)



DETAIL A



END DETAIL

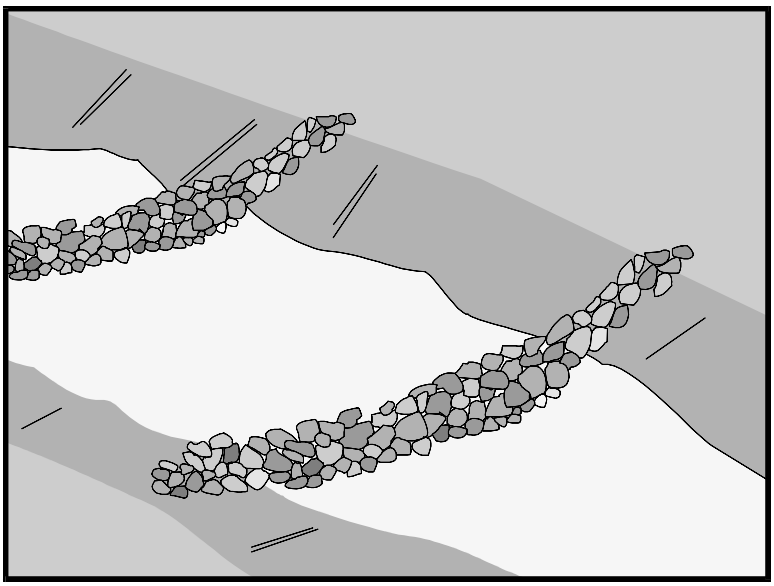


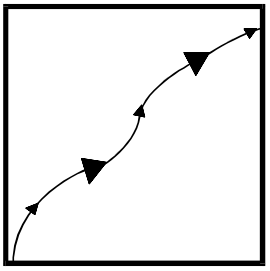
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 10)

Check Dams

SC-4

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A check dam is a device constructed of rock, gravel bags, sediment logs, or reusable products manufactured by one of the companies listed in the QPL placed across a natural or man-made channel or drainage ditch. Check dams reduce scour and provide runoff treatment by reducing flow velocity and encouraging sediment deposition. Sediment logs can be used in low flow and low gradient channels and have the advantage of decomposing naturally so removal is not required. They must be securely anchored and keyed-in at least one-third of their diameter. Sediment logs may be stacked, provided the anchorage is secure, typically stacks should not exceed three rows high.

Appropriate Applications

- The check dams described in this fact sheet are intended for low to moderate flow channels. Grade control in larger conveyances requires more detailed design beyond the scope of this fact sheet.
- Check dams may be installed in the following:
  - In small open channels that drain 10 acres or less.
  - In steep channels where storm water runoff velocities exceed 3 ft/s.
  - During the establishment of grass linings in drainage ditches or channels.
  - In temporary ditches where the short length of service does not warrant establishment of erosion-resistant linings.
- Sediment logs are appropriate for low flow channels, with gravel bags being more appropriate in moderate flow channels.
- This BMP may be implemented on a project-by-project basis with other BMPs.

Limitations

- Not to be used in live streams.
- Not appropriate in channels that drain areas greater than 10 acres.
- Not to be placed in channels that are already grass lined unless erosion is expected, as installation may damage vegetation.
- Can require extensive maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.
- Not to be constructed from a silt fence.

Standards and Specifications

- Check dams shall be placed at a distance and height to allow small pools to form behind them. Install the first check dam approximately 16 ft. from the outfall device and at regular intervals based on slope gradient and soil type.
- Install the first check dam approximately 16 ft. from the outfall device and at regular intervals based on slope gradient and soil type. Steeper slopes and more erosive soils (e.g. loose sand or silt) will require shorter spacing between check dams.
- For multiple check dam installation, backwater from downstream check dam shall reach the toe of the upstream dam.
- High flows (typically a 2-year storm or larger) shall safely flow over the check dam without an increase in upstream flooding or damage to the check dam.
- Where grass is used to line ditches, check dams shall be removed when grass has matured sufficiently to protect the ditch or swale. Sediment log or other degradable check dams may be left in place to minimize disturbance to the channel if appropriate.
- Rock shall be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.

Gravel bags may be used as check dams with the following specifications. See details at the end of this fact sheet for additional information.

Materials

- ***Sediment Logs:*** Sediment log materials shall conform to SC-05 fact sheet in this manual.
- ***Gravel Bags:*** Gravel bags and fill material shall conform to SC-06 fact sheet in this manual.
- ***Rock Size for Check Dams:*** Rock gradation shall conform to the following, or be designed in accordance with acceptable practices.

"Slope" in the table is to be the average channel flow line slope in the vicinity of the check dam. Check dams with rock selected from this table shall not exceed 2 ft in height. Check dams higher than 2 ft or with depth x slope values greater than 0.032 shall be designed by a Nevada registered Professional Engineer.

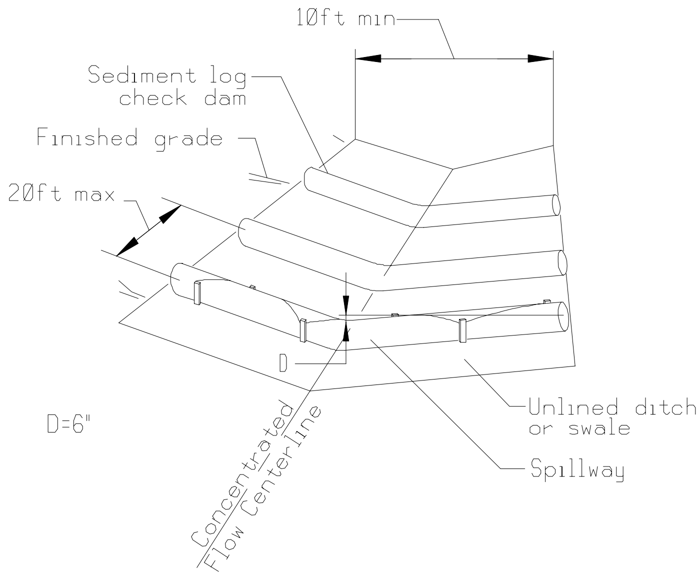
Rock Designation	D_{50}	Max Flow Depth (ft) x Slope (ft/ft)
Class 300/400 Riprap Bedding	3"	up to 0.016
Class 150 Riprap	6"	0.017 to 0.032

Installation

- Sediment Logs shall be installed per SC-05 fact sheet in this manual.
- Gravel Bags shall be installed per SC-06 fact sheet in this manual.
- Install along a level contour.
- Tightly abut bags and stack according to detail shown in figure. Gravel bags shall not be stacked any higher than 3 ft.
- For permanent or long-term rock check dams, installations (over one year), key stone into the channel banks and extend it beyond the abutments a minimum of 18 in. to prevent flow around the dam.

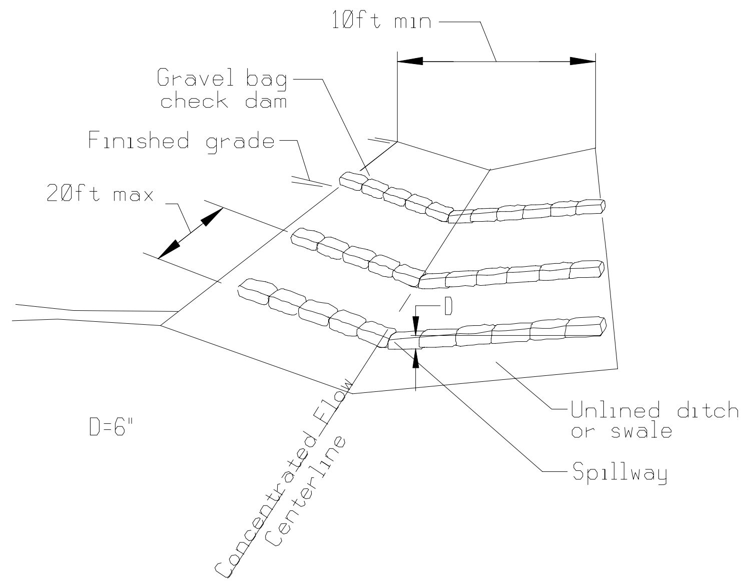
Maintenance and Inspection

- Inspect check dams after each significant rainfall event. Repair damage as needed.
- Remove sediments when depth reaches 50% of the check dam height and dispose of per Standard Specification Section 107.
- Remove accumulated sediment prior to permanent seeding or soil stabilization and dispose of per Standard Specification Section 107.
- Remove check dam and accumulated sediment when check dams are no longer needed.
- Removed sediment shall be incorporated in the project at locations designated by the Engineer or disposed of outside the highway right-of-way in conformance with the Standard Specifications section 107.



PERSPECTIVE

TEMPORARY CHECK DAM (TYPE I)



PERSPECTIVE

TEMPORARY CHECK DAM (TYPE II)

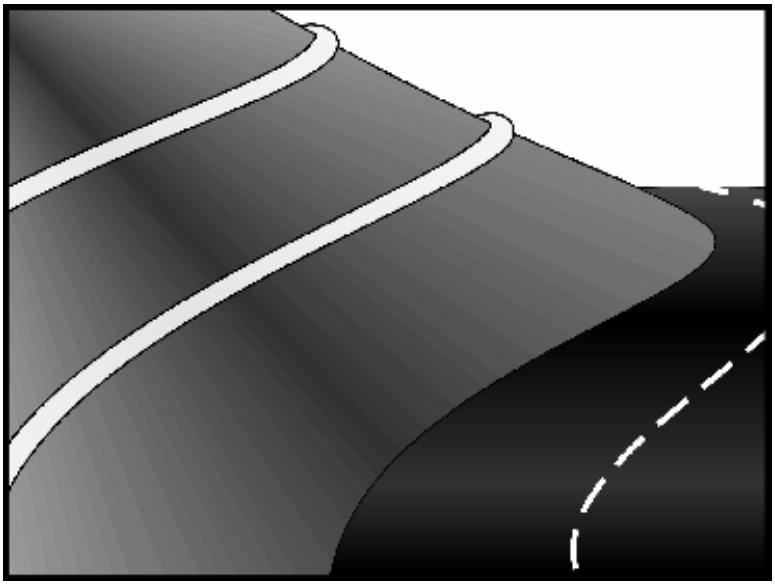
NOTES

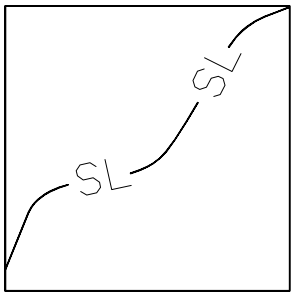
1. Spillway depth "D" shall be maintained to prevent flanking of concentrated flow around the ends of the check dam.
2. Sediment log materials and installation shall be per SC-5, Type 2
3. Gravel bag materials and installation shall be per SC-6

Sediment Logs

SC-5

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

A sediment log consists of wood excelsior, rice, or wheat straw, or coconut fibers that are rolled or bound into a tight tubular roll and placed on the toe and face of slopes to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff.

Appropriate Applications

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow.
- Below the toe of exposed and erodible slopes.
- Sediment logs may be used as check dams in unlined ditches if approved by the individual responsible for the implementation of the SWPPP.
- Down-slope of exposed soil areas.
- Around temporary stockpiles.
- This BMP may be implemented on a project-by-project basis with other BMPs.

Limitations

- Runoff and erosion may occur if sediment log is not adequately trenched in.
- Sediment logs at the toe of slopes greater than 2:1 shall be a minimum of 20- in. diameter or installations achieving the same protection (i.e. stacked at smaller diameter sediment logs, etc.).
- Sediment logs placed on paved surfaces for inlet protection must be weighted down to prevent sediment from passing beneath the roll.
- On soil, sediment logs must be keyed in a minimum of one-third their

diameter and securely anchored to be effective.

- Difficult to move once saturated.
- Sediment logs could be transported by high flows if not properly trenched in.
- Sediment logs have limited sediment capture zone.
- Do not use sediment logs on slopes subject to creep, slumping, or landslide.

Standards and Specifications

Sediment log Materials

- Sediment logs shall be either:
  - Prefabricated rolls; or,
  - Rolled tubes of erosion control blanket.
  - Plant-derived materials shall be certified weed free.

Assembly of Field Rolled Sediment log

- Roll length of erosion control blanket into a tube of minimum 8 in. diameter.
- Bind roll at each end and every 4 ft. along length of roll with jute-type twine.

Installation

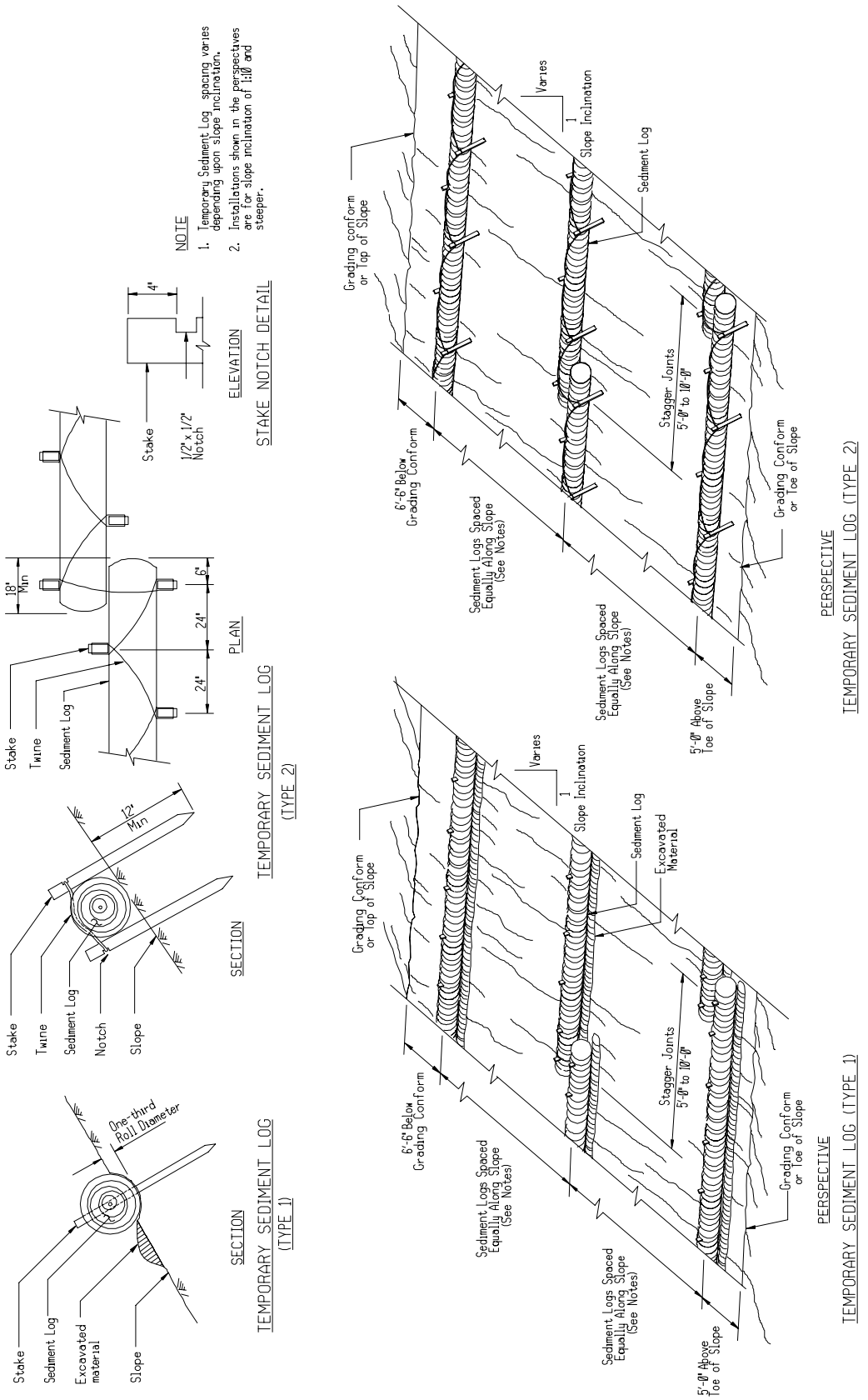
- Slope inclination of 4:1 or flatter: sediment logs shall be placed on slopes 20 ft. apart.
- Slope inclination of 4:1to 2:1: sediment logs shall be placed on slopes 15 ft. apart.
- Slope inclination 2:1 or greater: sediment logs shall be placed on slopes 10 ft. apart.
- Key –in sediment logs into the ground a minimum of one-third their diameter.
- Anchor sediment logs with stakes at the ends and spaced 4 ft. maximum on center.
- Use wood stakes with a nominal classification of 3/4 by 3/4 in., and minimum length of 24 in (Type 1 installation), and 1 by 1 ½ in. by minimum length of 24" (Type 2 installation).
- If more than one sediment log is placed in a row, the rolls shall be overlapped, not abutted.

Removal

- Sediment logs are typically left in place.
- If sediment logs are removed, collect and dispose of sediment accumulation, and fill and compact holes, trenches, depressions or any other ground disturbance to blend with adjacent ground.

Maintenance and Inspection

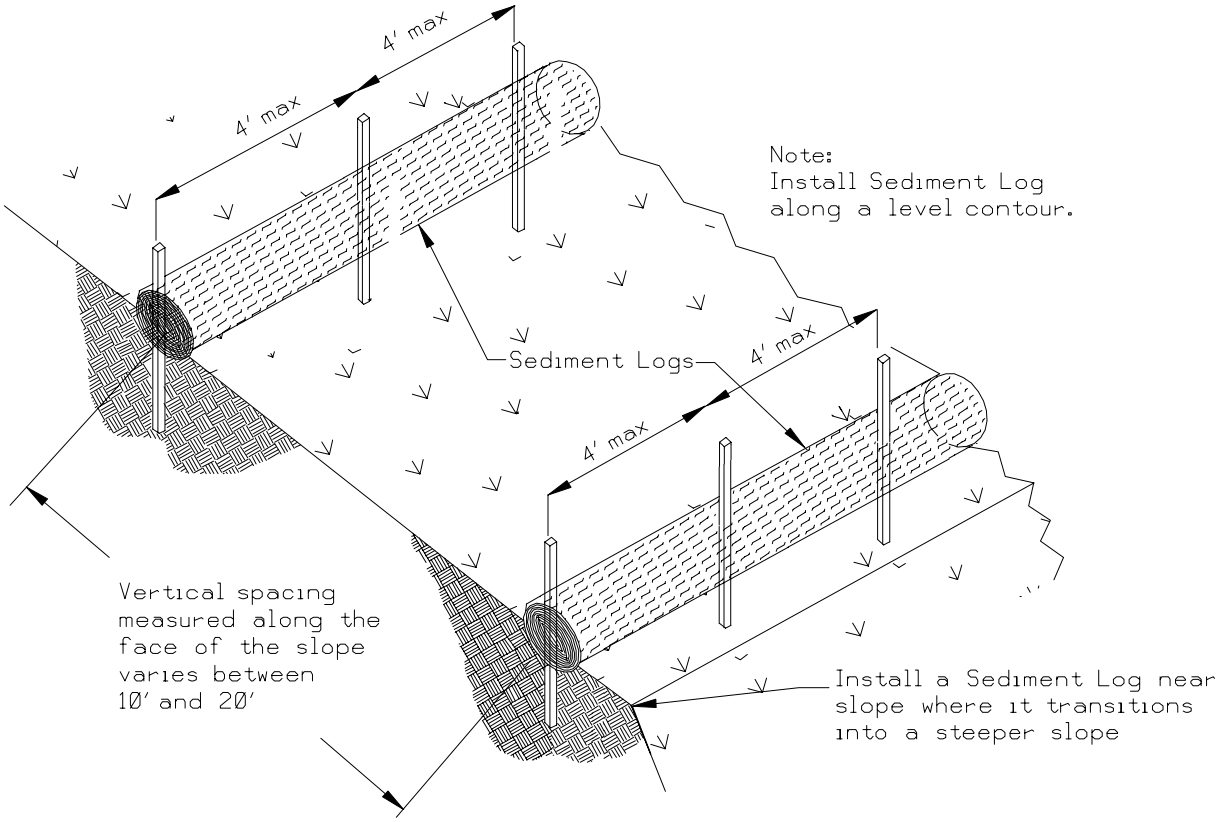
- Repair or replace split, torn, unraveling, or slumping sediment logs.
- Inspect sediment logs when rain is forecast, following rainfall events and at least daily during prolonged rainfall. Perform maintenance as needed or as required to comply with the SWPPP.
- Maintain sediment logs to provide an adequate sediment holding capacity. Sediment shall be removed when the sediment accumulation reaches three quarters (3/4) of the barrier height. Removed sediment shall be incorporated in the project or disposed of outside the highway Right-of-Way in conformance with the Standard Specifications Section 107.


NOTE
1. Temporary Sediment Log spacing varies depending upon slope inclination.
2. Installations shown in the perspectives are for slope inclination of 1:10 and steeper.
Stake
1/2" x 1/2" Notch
4"
ELEVATION
STAKE NOTCH DETAIL
18" Min
6"
24"
24"
Stake
Twine
Sediment Log
PLAN
TEMPORARY SEDIMENT LOG (TYPE 2)
12" Min
Stake
Twine
Sediment Log
Notch
Slope
SECTION
TEMPORARY SEDIMENT LOG (TYPE 2)
One-third Roll Diameter
Stake
Sediment Log
Excavated material
Slope
SECTION
TEMPORARY SEDIMENT LOG (TYPE 1)
Grading conform or Top of Slope
Varies
1
Slope Inclination
Sediment Log
6'-6" Below Grading Conform
Sediment Logs Spaced Equally Along Slope (See Notes)
Stagger Joints 5'-0" to 10'-0"
Grading Conform or Toe of Slope
Sediment Logs Spaced Equally Along Slope (See Notes)
5'-0" Above Toe of Slope
PERSPECTIVE
TEMPORARY SEDIMENT LOG (TYPE 2)
Grading Conform or Top of Slope
Varies
1
Slope Inclination
Sediment Log
Excavated Material
6'-6" Below Grading Conform
Sediment Logs Spaced Equally Along Slope (See Notes)
Stagger Joints 5'-0" to 10'-0"
Grading Conform or Toe of Slope
Sediment Logs Spaced Equally Along Slope (See Notes)
5'-0" Above Toe of Slope
PERSPECTIVE
TEMPORARY SEDIMENT LOG (TYPE 1)

Sediment Logs

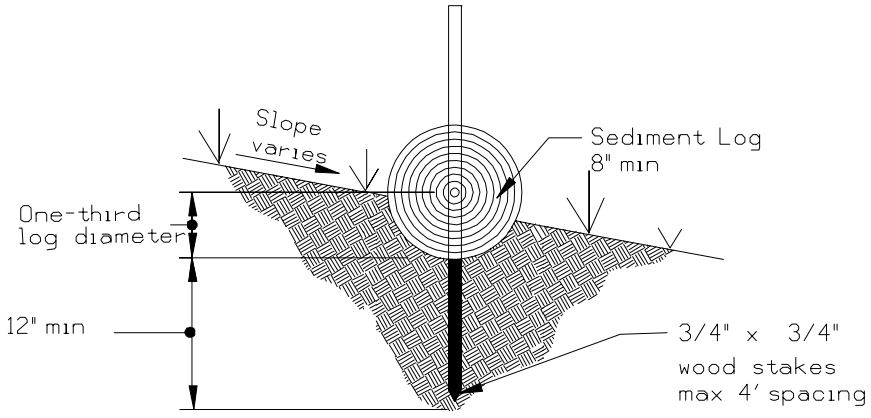
SC-5

Adapted from Caltrans Construction Site BMPs



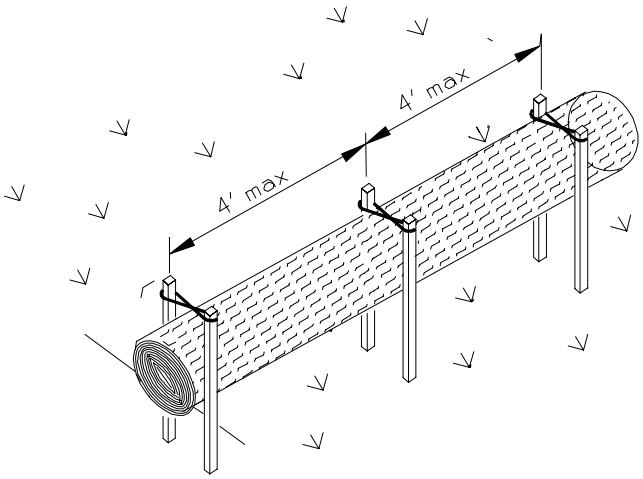
TYPE 1 SEDIMENT LOG INSTALLATION

N.T.S.



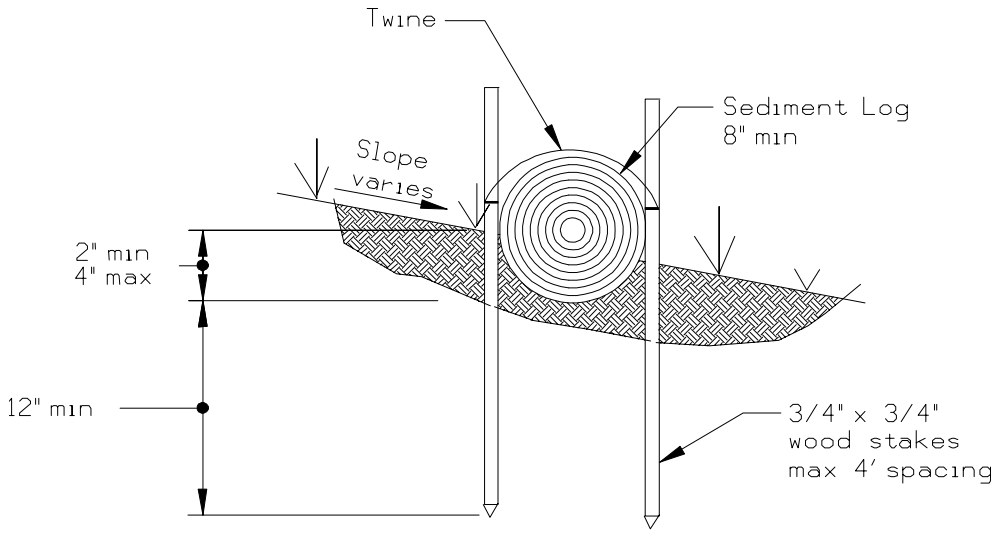
ENTRENCHMENT DETAIL

N.T.S.



TYPE 2 SEDIMENT LOG INSTALLATION

N.T.S.



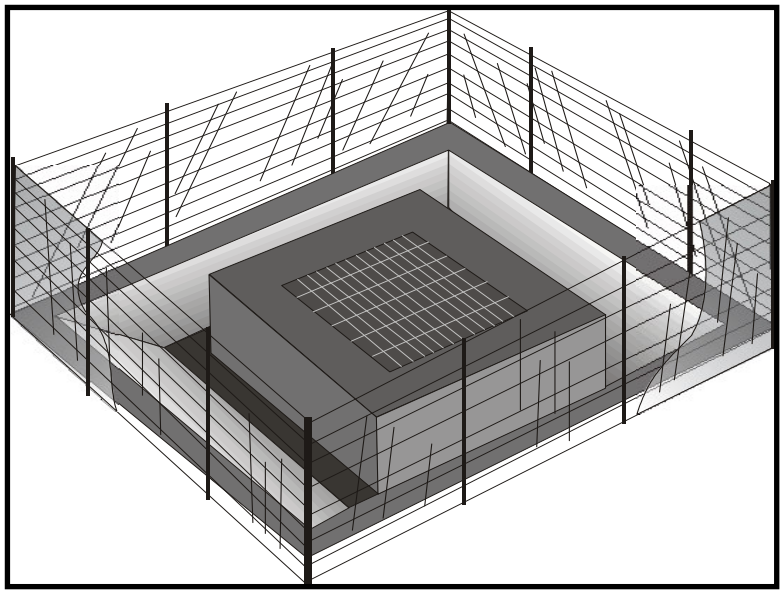
OPTIONAL ENTRENCHMENT DETAIL

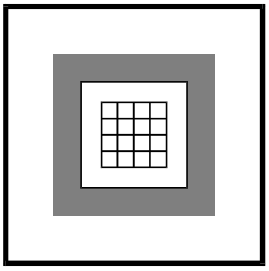
N.T.S.

Storm Drain Inlet Protection

SC-8

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Devices used at storm drain inlets that are subject to runoff from construction activities to allow sediment to settle and/or to filter sediment prior to discharge into storm water drainage systems or watercourses.

Appropriate Applications

- Where ponding will not encroach into highway traffic or adjacent property owners.
- Where sediment laden surface runoff may enter an inlet.
- Where disturbed drainage areas have not yet been permanently stabilized.
- Where the drainage area is 1 acre or less.

Limitations

- Requires an adequate area to place materials and for water to pond without encroaching upon the traveled portion of the highway.
- Shoulders and paved portions of active highways utilizing inlet protection structures must be thoroughly closed off from traffic to prevent vehicle accidents.
- May require other temporary BMPs in combination to prevent sediment-laden storm water and non-storm water discharges to enter the storm drain system.
- Sediment removal may be difficult in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other on-site sediment trapping techniques (i.e. check dams) in conjunction with inlet protection.
- Frequent maintenance is required.

- For drainage areas larger than 1 acre, runoff shall be routed to a sediment-trapping device designed for larger flows. See BMPs SC-2, "Sediment/Desilting Basin", and SC-3 "Sediment Traps".
- Filter fabric fence inlet protection appropriate in open areas is subject to sheet flow and for flows not exceeding 0.5 ft^3/s.
- Gravel bag barriers for inlet protection are applicable when sheet flows or concentrated flows exceed 0.5 ft^3/s, and it is necessary to allow for overtopping to prevent flooding.
- Sediment logs are not appropriate for inlet protection.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capability is needed.

Standards and Specifications

Identify existing and/or planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed, and which method to use.

Methods and Installation

- ***DI Protection Type 1 - Filter Fabric Fence*** - The silt fence fabric (Type 1) protection is illustrated on Page 5. Similar to constructing a silt fence. See BMP SC-1, "Silt Fence". Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drop inlet when the fabric is removed or replaced. This protection will only work if the inlet is surrounded by unpaved surface (e.g. when the road has not been built yet).

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - The excavated drop inlet sediment trap (Type 2) is illustrated on Page 6. Similar to constructing a temporary silt fence, See BMP SC-1, "Silt Fence". Size excavated trap to provide a minimum storage capacity calculated at the rate of 67 yd^3/acre of drainage area. This protection will only work if the inlet is surrounded by unpaved surface (e.g. when the road has not been built yet).

- ***DI Protection Type 3 - Gravel Bag Barrier*** - The gravel bag barrier (Type 3) is illustrated on Page 7. Flow from a severe storm shall not overtop the curb. In areas of high clay and silts, wrap or line the gravel bag structure with silt fence fabric and then cover with gravel to create additional filtering. Construct gravel bags in accordance with BMP SC-6, "Gravel Bag Berm". Gravel bags shall be used due to their high permeability.

- Many proprietary devices and products are available for drain inlet

protection and are listed in NDOT's qualified products list (QPL), or must be approved by the engineer. If used, these products should be installed and maintained per the manufacturer's recommendations.

Maintenance and Inspection

General

- Inspect all inlet protection devices before and after every rainfall event and weekly during the rest of the rainy season. During extended rainfall events, inspect inlet protection devices at least once every 24 hours.
- Inspect the storm drain inlet after severe storms in the rainy season to check for bypassed material.
- Remove all inlet protection devices within thirty days after the site is stabilized, or when the inlet protection is no longer needed.
  - Bring the disturbed area to final grade and smooth and compact it. Appropriately stabilize all bare areas around the inlet.

Requirements by Method

- ***Type 1 - Silt Fence Fabric***
  - This method shall be used for drain inlets requiring protection in areas where finished grade is established and erosion control seeding has been applied or is pending
  - Make sure the posts are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged posts in accordance with SC-1 "Silt Fence" and Standard Specifications Section 637.
  - Replace the fabric when the fabric becomes clogged with sediment. Make sure the fabric does not have any holes or tears. Repair or replace fabric as needed.
  - At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height. Removed sediment shall be incorporated in the project or disposed of outside the highway Right-of-Way in conformance with the Standard Specifications Section 107.
- ***Type 2 - Excavated Drop Inlet Sediment Trap***
  - This method may be used for drain inlets requiring protection in areas that have been cleared and grubbed, and where exposed

soil areas are subject to grading.

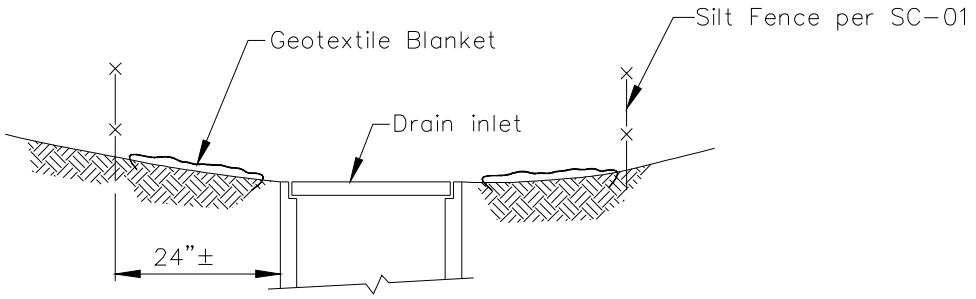
- Remove sediment from basin when the volume of the basin has been reduced by one-half.

■ ***Type 3 - Gravel Bag Barrier***

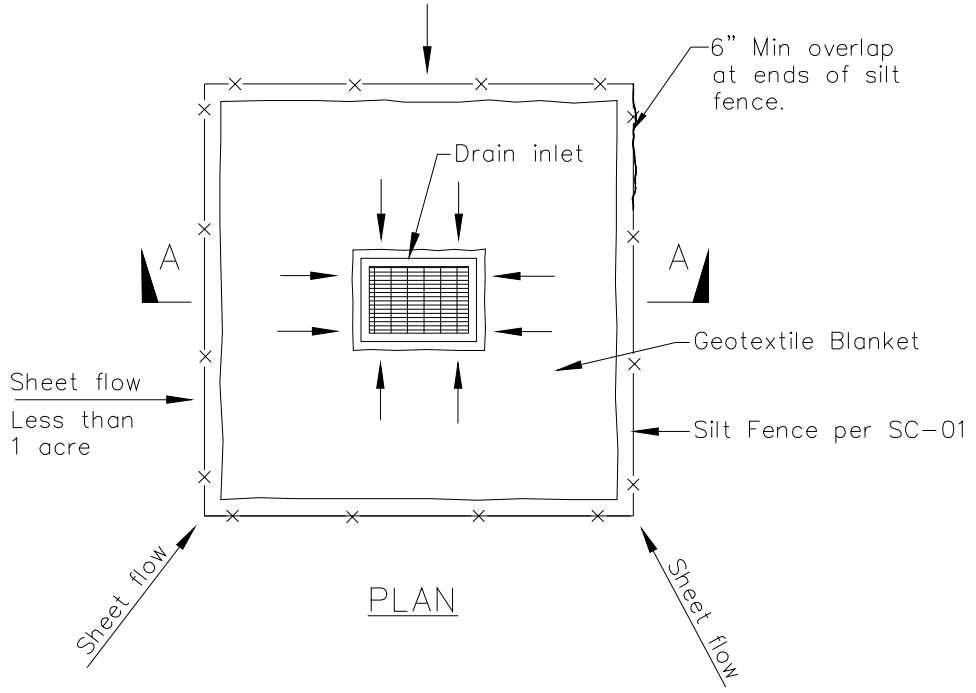
- This method may be used for drain inlets surrounded by AC or paved surfaces.

- Inspect bags for holes, gashes, and snags.

- Check gravel bags for proper arrangement and displacement. Remove sediment, manually or mechanically as appropriate, behind the barrier when it reaches one-third the height of the barrier. Removed sediment shall be incorporated in the project or disposed of outside the highway Right-of-Way in conformance with the Standard Specifications Section 107.



SECTION A–A



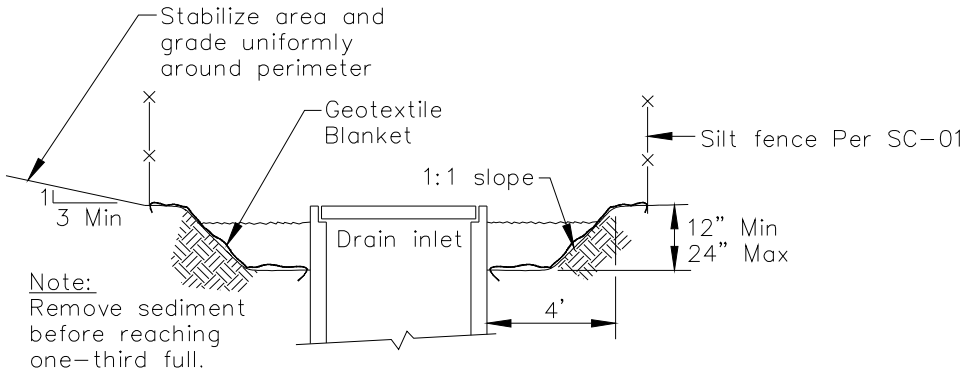
PLAN

DI PROTECTION TYPE 1
NOT TO SCALE

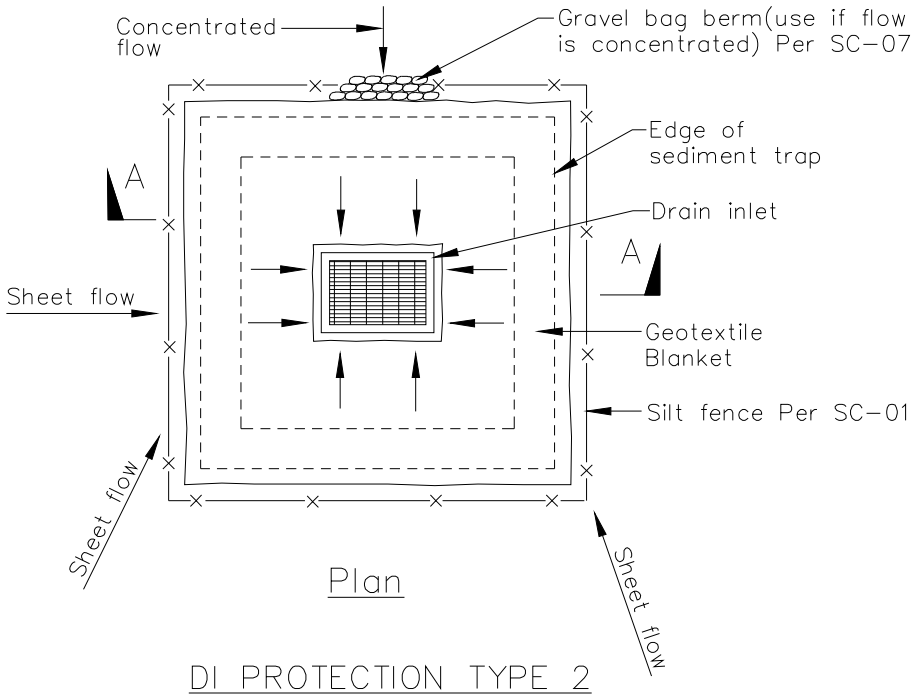
NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.

Storm Drain Inlet Protection



Section A-A



Plan

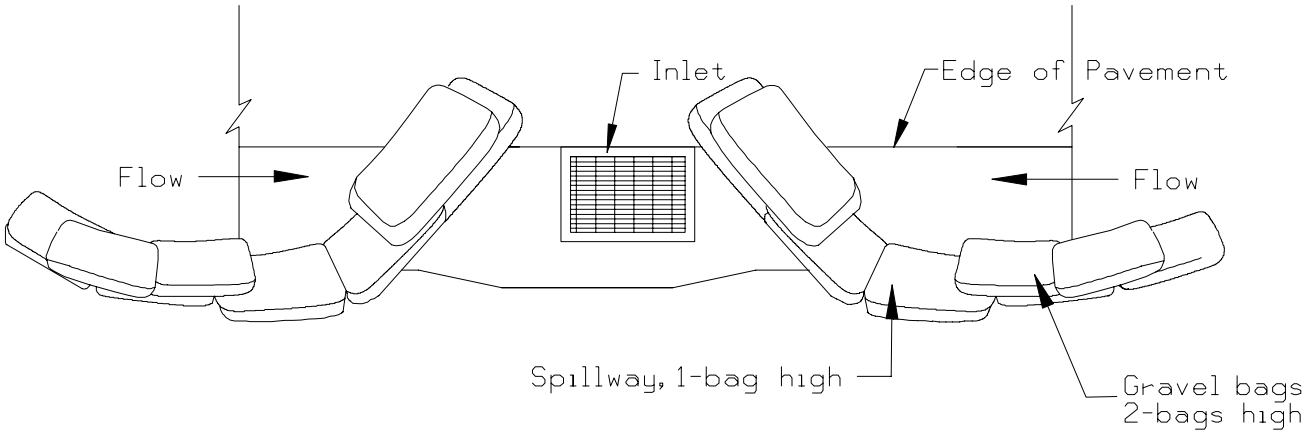
DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.

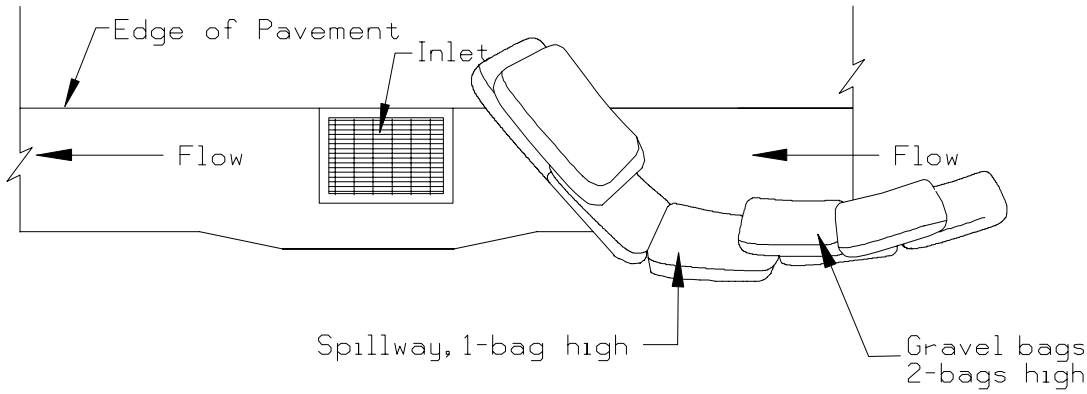
Storm Drain Inlet Protection

SC-8

Adapted from Caltrans Construction Site BMPs



TYPE 3 PROTECTION FOR INLET ON SUMP



TYPE 3 PROTECTION FOR INLET ON GRADE

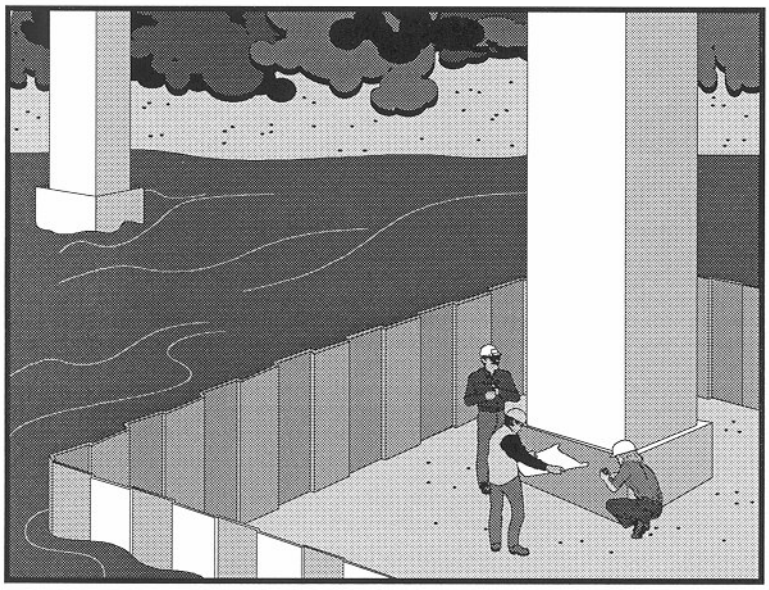
NOTES:

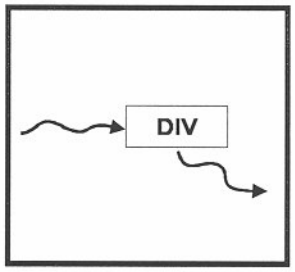
1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

Clear Water Diversion

NS-5

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ○ Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ○ Materials and Waste Management

Definition and Purpose

Clear water diversions consists of various structures and measures that intercept clear surface water runoff upstream of a project site, transport it around the work area, and discharge it downstream with minimal water quality degradation by either the project construction operations or the construction of the diversion. Clear water diversions are used in a waterway to enclose a construction area and reduce sediment pollution from construction work occurring in or adjacent to water. Isolation techniques are methods that isolate near shore work from a water body. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, rock, gravel bags, wood, aqua barriers, cofferdams, silt fence fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes.

Appropriate Applications

- A clear water diversion is typically implemented where appropriate USACE, NDEP, and other local permits have been secured and work must be performed in a live stream or water body.
- Clear water diversions are appropriate for isolating construction activities occurring within or near a water body such as streambank stabilization, or culvert, bridge, pier or abutment installation. They may also be used in combination with other methods, such as clear water bypasses and/or pumps.
- Pumped diversions are suitable for intermittent and low flow streams. Excavation of a temporary bypass channel or passing the flow through a flume is appropriate for the diversion of streams less than 20 ft. wide, with flow rates less than 99 ft^3/sec.
- Clear water diversions incorporating clean washed gravel may be appropriate for use in salmon spawning streams.

Limitations

- Diversion/encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
- Specific permit requirements or mitigation measures, such as the USACE, U.S. Fish and Wildlife Service (USFWS), NDEP, etc. may be included in contract documents because of clear water diversion/encroachment activities.
- Diversion/encroachment activities may constrict the waterway, which can obstruct flows and cause flooding or washouts.
- Diversion structures should not be installed without identifying potential impacts to the stream channel.
- Diversion or isolation activities are inappropriate in deep water unless designed or reviewed by a Hydraulic engineer.
- Diversion or isolation activities should not completely dam stream flow.
- Dewatering and removal may require additional sediment control or water treatment (See NS-2).

Standards and Specifications

General

- Implement guidelines presented in SS-12, Streambank Stabilization to minimize impacts to streambanks.
- Where working areas encroach on live streams, barriers adequate to prevent the flow of muddy water into streams shall be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams shall be held to a minimum.
- Where possible, avoid or minimize diversion/encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. See also the project special provisions for scheduling requirements. Scheduling shall also consider seasonal releases of water from dams, fish migration and spawning seasons, and water demands due to crop irrigation.
- Diversion structures must be adequately designed to accommodate fluctuations in water depth or flow volume due to storms, flash floods, etc.
- Heavy equipment driven in wet portions of a water body to accomplish work shall be completely clean of dirt and petroleum residue, and water levels shall be below the gearboxes of the equipment in use, or lubricants and fuels are sealed such that inundation by water shall not result in leaks. Review the project's "Temporary Permit for Working Waterways/Discharge Permit" for

additional project specific requirements.

- Excavation equipment buckets may reach out into the water for the purpose of removing or placing fill materials. Only the bucket of the crane/excavator/backhoe may operate in a water body. The main body of the crane/excavator/backhoe shall not enter the water body, except as necessary to cross the stream to access the work site.
- Stationary equipment such as motors and pumps, located within or adjacent to a water body, shall be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water shall, at all times, be allowed to pass downstream to maintain aquatic life downstream.
- The exterior of vehicles and equipment that will encroach on a water body within the project shall be maintained free of grease, oil, fuel, and residues.
- Equipment shall not be parked below the high water mark overnight unless allowed by a permit.
- Disturbance or removal of vegetation shall not exceed the minimum necessary to complete operations. Precautions shall be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation shall be replaced with the appropriate soil stabilization measures.
- Riparian vegetation, when removed pursuant to the provisions of the work, shall be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation shall be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble shall be removed upon completion of project activities.
- Drip pans shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.
- Construct diversion structures with materials free of potential pollutants such as soil, silt, sand, clay, grease, or oil.

Temporary Diversions/Encroachments

- Construct diversion channels in accordance with BMP SS-9, "Earth Dikes/Drainage Swales, and Ditches".
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, such as riprap in accordance with Standard Specifications Section 610 or with geotextile fabrics or erosion control mats as described in BMP SS-7,

"Geotextiles, Mats, Plastic Covers and Erosion Control Blankets", and in Standard Specifications Section 211, or combinations of these measures.

- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment/slope protection, or other temporary soil stabilization methods.
- Provide for velocity dissipation at transitions in the diversion, such as the point where the stream is diverted to the channel and the point where the diverted stream is returned to its natural channel. See also BMP SS-10, "Outlet Protection/Velocity Dissipation Devices".

Temporary Dry Construction Areas

- When dewatering behind temporary structures to create a temporary dry construction area, such as coffer dams, pass pumped water through a sediment settling device, such as a portable tank or settling basin, before returning water to the water body; see also BMP NS-2, "Dewatering Operations".
- If the presence of polluted water or sediment is identified in the contract, the contractor shall implement dewatering pollution controls as required by the contract documents. If the quality of water or sediment to be removed while dewatering is not identified as polluted in the contract documents, but is later determined by observation or testing to be polluted, the contractor shall notify the Engineer and comply with NDEP requirements.
- Any substance used to assemble or maintain diversion structures, shall be non-toxic and non-hazardous.
- Any material used to minimize seepage underneath diversion structures, such as grout, shall be EPA-approved, non-toxic, non-hazardous, and as close to a neutral pH as possible.

Isolation Techniques:

Isolation techniques are methods that isolate near shore work from a water body. Techniques include sheet pile enclosures, water filled geotextile (Aqua Dam), gravel berm with impermeable membrane, gravel bags, cofferdams, and Portable Precast Concrete Barrier Rails (PPCBR).

Comparison of Diversion/Isolation Techniques:

- Gravel bags are relatively inexpensive, but installation and removal can be labor intensive. It is also difficult to dewater the isolated area.

- Gravel bag berms (SC-6) used in conjunction with an impermeable membrane are cost effective, not labor intensive to install, and can be dewatered relatively easily. If spawning gravel is used, the impermeable membrane can be removed from the stream, and the gravel can be spread out and left as salmonid spawning habitat per USACE and USFWS permit only. Contact NDOT biologists for jobsite specific requirements.
- Aqua Barriers and cofferdams are relatively expensive, but frequently allow full dewatering. Also, many options now available are relatively easy to install. Sealants used in these structures shall be non-toxic.
- Sheet pile enclosures are a much more expensive solution, but do allow full dewatering. This technique is not well suited to small streams, but can be effective on large rivers or lakes, and where staging and heavy equipment access areas are available. Also they are useful for a water body with a sandy, non-cobble substrate.
- Portable Precast Concrete Barrier Rails (PPCBR) is an isolation method that does not allow full dewatering, but can be used in small to large watercourses, and in fast water situations.
- Turbidity curtains should be used where sediment discharge to a stream in unavoidable. They can also be used for in stream construction, when dewatering an area is not required. Turbidity curtains should be used with floatation collars and recommended for use in calm, slow moving water; must be properly anchored.
- Diversion structures should be installed following manufacturer's specification.
- Some diversions may require the acquisition of additional right-of-way or easements and could therefore add significant cost to the project. Diversion requirements must be identified early in the planning process so that all alternatives can be accurately assessed and additional costs can be minimized.
- When used in watercourses or streams, cofferdams must be used in accordance with permit requirements and/or the contract documents. Materials for cofferdams should be selected based on ease of maintenance, and complete removal following construction activities. Soil cofferdams are not permitted.

Silt Fence Fabric Isolation Technique

Definition and Purpose:

A silt fence fabric isolation structure is a temporary structure built into a waterway to enclose a construction area and reduce sediment pollution

from construction work in or adjacent to water. This structure is composed of silt fence fabric, gravel bags, and steel t-posts in accordance with Standard Specifications Section 724.

Appropriate Applications:

- Silt fence fabric may be used for construction activities such as streambank stabilization, or culvert, bridge, pier or abutment installation. It may also be used in combination with other methods, such as clean water bypasses and/or pumps.
- This method involves placement of gravel bags or continuous berms to 'key-in' the fabric, and subsequently staking the fabric in place.
- If spawning gravel is used, all other components of the isolation can be removed from the stream, and the gravel can be spread out and left as salmonid spawning habitat. Whether spawning gravel or other types of gravel are used, only clean washed gravel should be used as infill for the gravel bags or continuous berm.
- This is a method that should be used in relatively calm water, and can be used in smaller streams

Limitations:

- Do not use if the installation, maintenance and removal of the structures will disturb sensitive aquatic species of concern.
- Not appropriate for projects where dewatering is necessary.
- Not appropriate to completely dam stream flow.

Standards and Specifications:

- For the silt fence fabric isolation method, a non-woven or heavy-duty fabric is recommended over standard silt fence. Using rolled geotextiles allows non-standard widths to be used.
- Anchor silt fence fabric with gravel bags filled with clean, washed gravel. Do not use sand. If a bag should split open, the gravel can be left in the stream, where it can provide aquatic habitat benefits.
- Another anchor alternative is a continuous berm, made with the Continuous Berm Machine. This is a gravel-filled bag that can be made in very long segments. The length of the berms is usually limited to 20 ft. for ease of handling.

Installation

- Place the fabric on the bottom of the stream, and place either a bag of clean, washed gravel or a continuous berm over the bottom of the

fabric, such that a bag-width of fabric lies on the stream bottom. The bag should be placed on what will be the outside of the isolation area.

- Pull the fabric up, and place a metal t-post immediately behind the fabric, on the inside of the isolation area; attach the silt fence to the post with three diagonal nylon ties. (See SC-1)
- Continue placing fabric as described above until the entire work area has been isolated, staking the fabric at least every 6 ft.

Inspection and Maintenance:

- During construction, inspect daily during the workweek.
- Perform additional inspections before, during and after storm events.
- Immediately repair any gaps, holes or scour.
- Remove sediment buildup in accordance with Standard Specifications Section 107.
- Remove BMP upon completion of construction activity.
- Re-vegetate areas disturbed by BMP removal if needed.

Turbidity Curtain Isolation Technique

Definition and purpose:

A turbidity curtain is a relatively impervious fabric barrier used to isolate the near shore work area. The barriers are intended to confine the suspended sediment. The curtain is a floating barrier, and thus does not prevent water from entering the isolated area; rather, it prevents suspended sediment from getting out. This method is very good in isolating fine as well as coarse sediment.

Appropriate applications:

Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They are used when construction activities adjoin quiescent waters, such as lakes, ponds, lagoons, bays, and slow flowing rivers. The curtains are designed to deflect and contain sediment within a limited area and provide sufficient retention time so that the soil particles will fall out of suspension.

Limitations:

- Turbidity curtains should not be used in flowing water; they are best suited for use in ponds, lakes, and very slow-moving rivers.

- Turbidity curtains should not be placed across the width of a channel.
- Removing sediment that has been deflected and settled out by the curtain may create a discharge problem through the re-suspension of particles and by accidental dumping by the removal equipment. Caution must be taken in removal.

Standards and Specifications:

- Turbidity curtains should be oriented parallel to the direction of flow.
- The curtain should extend the entire depth of the watercourse in calm-water situations.
- In wave conditions, the curtain should extend to within 1 ft. of the bottom of the watercourse, such that the curtain does not stir up sediment by hitting the bottom repeatedly. If it is desirable for the curtain to reach the bottom in an active-water situation, a pervious silt fence fabric may be used for the bottom 1 ft.
- The top of the curtain should consist of flexible flotation buoys, and the bottom shall be held down by a load line incorporated into the curtain fabric. The fabric shall be a brightly colored impervious mesh.
- The curtain shall be held in place by anchors placed per manufacturer's specifications or closer as situation dictates (i.e. currents). See turbidity curtain detail.
- First place the anchors, then tow the fabric out in a furled condition, and connect to the anchors. The anchors should be connected to the flotation devices, and not to the bottom of the curtain. Once in place, cut the furling lines, and allow the bottom of the curtain to sink.
- Sediment that has been deflected and settled out by the curtain should be removed; however, consideration must be given to the probable outcome of the removal procedure. It must be asked if it will create more of a sediment problem through re-suspension of the particles or by accidental dumping of material during removal. It is recommended that the soil particles accumulated by the turbidity curtain be removed only if it is deemed necessary by NDEP or the Engineer.
- Check manufacturer's requirements when installing turbidity curtains.

Maintenance and Inspection:

- The curtain should be inspected daily for holes or other problems, and any repairs needed should be made promptly.
- Allow sediment to settle for prior to its removal or removal of the curtain. After removing sediment, wait at least 6-12 hours before removing the curtain.
- To remove, install furling lines along the curtain, detach from anchors, and tow out of the water.

Portable Precast Concrete Barrier Rail River Isolation

Definition and Purpose:

This is temporary sediment control, or stream isolation method that uses Portable Precast Concrete Barrier Rail (PPCBR) to form the sediment deposition area, or to isolate the in-stream or near-bank construction area.

Barriers are placed end-to-end in a pre-designed configuration and gravel-filled bags are used at the toe of the barrier and also at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls. A typical PPCBR installation is illustrated at the end of this Section.

Appropriate Applications:

The PPCBR isolation can be used in streams with higher water velocities than many other isolation techniques.

Limitations:

- The PPCBR method does not allow for full dewatering, but can be used in small to large watercourses, and in fast-water situations.

Standards and Specifications:

- To create a floor for the PPCBR, move large rocks and obstructions. Place washed gravel or gravel-filled bags to create a level surface for PPCBR to sit on.
- Place the bottom two PPCBR adjacent to each other, and parallel to the direction of flow; fill the center portion with gravel bags. Then place the third PPCBR on top of the bottom two; there should be sufficient gravel bags between the bottom PPCBRs such that the gravel supports the top one. Place plastic sheeting around the PPCBRs, and secure at the bottom with gravel bags.
- Further support can be added by pinning and cabling the PPCBRs together. Also, large riprap and boulders can be used to support

either side of the PPCBR, especially where there is strong current.

Inspection and Maintenance:

- The barrier should be inspected at least once daily, and any damage, movement, or other problems shall be addressed immediately.
- Allow sediment to settle prior to its removal of the barrier. After removing sediment, wait at least 6-12 hours before removing the barrier.

Stream Diversions

Definition and Purpose

Stream diversions consists of a system of structures and measures that intercept an existing stream upstream of the project and transports it around the work area, and discharges it downstream. The selection of which stream diversion technique to use depends upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Appropriate Applications:

- Pumped diversions are appropriate in areas where de-watering is necessary.
- Dam-type diversion may serve as temporary access to the site.
- Where work areas require isolations from flows.

Limitations:

- Pump diversions have limited flow capacity.
- Pumped diversions require frequent monitoring of pumps.
- Large flows during storm events can overtop dams.
- Flow diversion and re-direction with small dams involves in-stream disturbance and mobilization of sediment.

Standards and Specifications:

- Installation guidelines will vary based on existing site conditions and type of diversion used.
- Diversions shall be sized to convey design flood flows.
- Pump capacity must be sufficient for design flow; the upper limit is approximately 10 ft^3/sec (the capacity of two 8 in. pumps).
- Adequate energy dissipation must be provided at the outlet to minimize erosion.

- Dam materials used to create dams upstream and downstream of diversion should be erosion resistant. Materials such as steel plate, sheet pile, sandbags, continuous berms, inflatable water bladders, etc. would be acceptable.
- When constructing a diversion channel, begin excavation of the channel at the proposed downstream end, and work upstream. Once the watercourse to be diverted is reached, and the excavated channel is stable, breach the upstream end, and allow water to flow down the new channel. Once flow has been established in the diversion channel, install the diversion weir in the main channel; this will force all water to be diverted from the main channel.

Advantages of a pumped diversion include:

- Downstream sediment transport can be nearly eliminated.
- De-watering of the work area is possible.
- Pipes can be moved around to allow construction operations.
- The dams can serve as temporary access to the site.
- Increased flows can be managed by adding more pumping capacity.

Disadvantages of a pumped diversion are:

- Flow volume is limited by pump capacity.
- A pumped diversion may require 24-hour monitoring of pumps.
- Sudden rain could overtop dams.
- Erosion at the outlet.
- Minor in-stream disturbance is required to install and remove dams.

Advantages of excavated channels and flumes are:

- Excavated channels isolate work from water flow and allow dewatering.
- Excavated channels can handle larger flows than pumps.

Disadvantages of excavated channels and flumes are:

- Bypass channel or flume must be sized to handle flows, including possible floods.
- Channels must be protected from erosion.
- Flow diversion and re-direction with small dams involves in-stream disturbance and mobilization of sediment.

- May require acquisition of additional right-of-way or easements.

Installation

- Installation guidelines will vary based on existing site conditions and type of diversion used.

Construction Guidelines:

- Pump capacity must be sufficient for design flow; the upper limit is about 10 ft^3/s (the capacity of two 8 in. pumps).
- Dam materials used to create dams upstream and downstream of diversion should be erosion resistant; materials such as steel plate, sheet piles, sandbags, continuous berms, inflatable water bladders, etc. would be acceptable.
- When constructing a diversion channel, begin excavation of the channel at the proposed downstream end, and work upstream. Once the watercourse to be diverted is reached and the excavated channels are stable, breach the upstream end and allow water to flow down the channel. Once flow has been established in the diversion channel, install the diversion weir in the main channel; this will force all water to be diverted from the main channel.

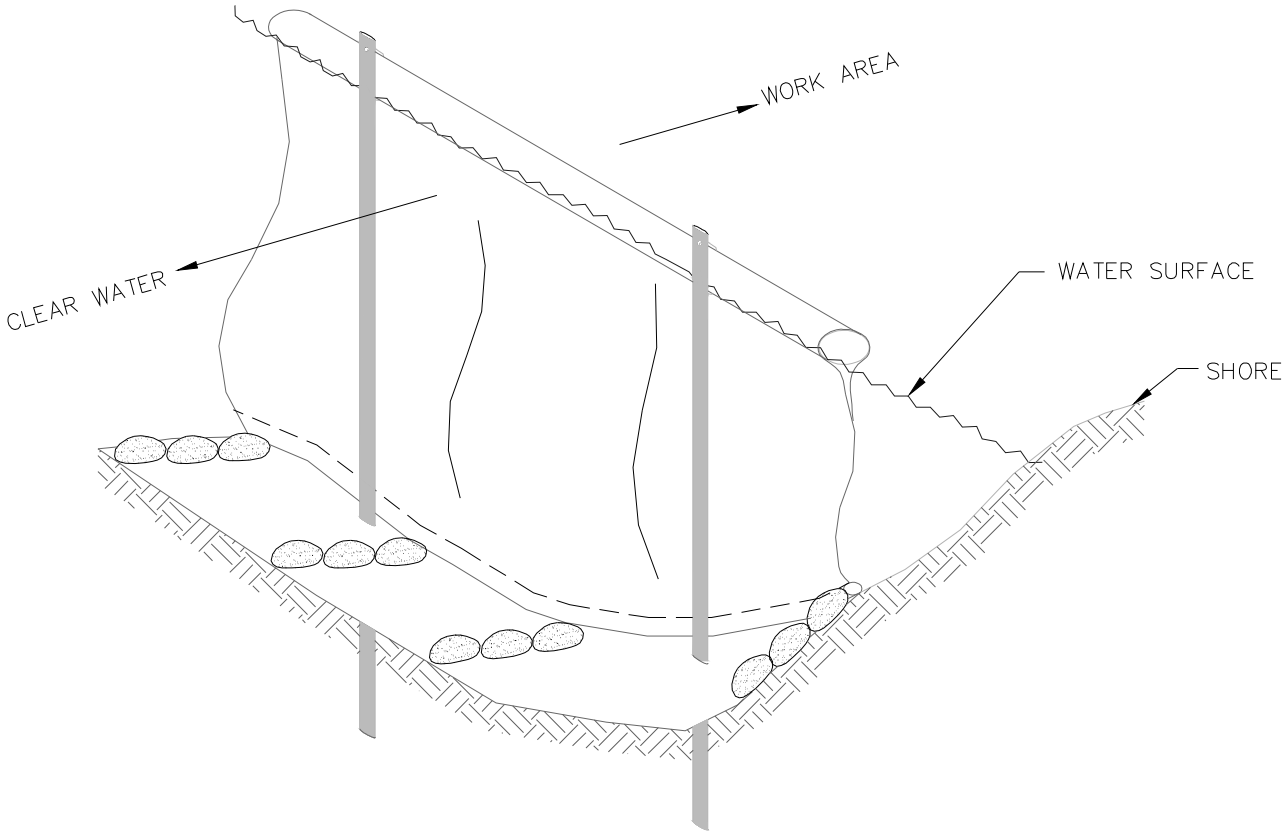
Maintenance and Inspection

- Inspect diversion/encroachment structures before and after significant storms, and at least once per week while in service. Inspect daily during the construction.
- Pumped diversions may require frequent monitoring of pumps.
- Inspect embankments and diversion channels before, during and after significant storms, and at least once per week while in service for damage to the linings, accumulating debris, sediment buildup, and adequacy of the slope protection. Remove debris and repair linings and slope protection as required. Repair holes, gaps, or scour.
- Upon completion of work, the diversion or isolation structure should be removed and flow should be re-directed through the new culvert or back into the original stream channel. Recycle or re-use if applicable.
- Re-vegetate areas disturbed by BMP removal if needed.

Clear Water Diversion

NS-5

Adapted from Caltrans Construction Site BMPs



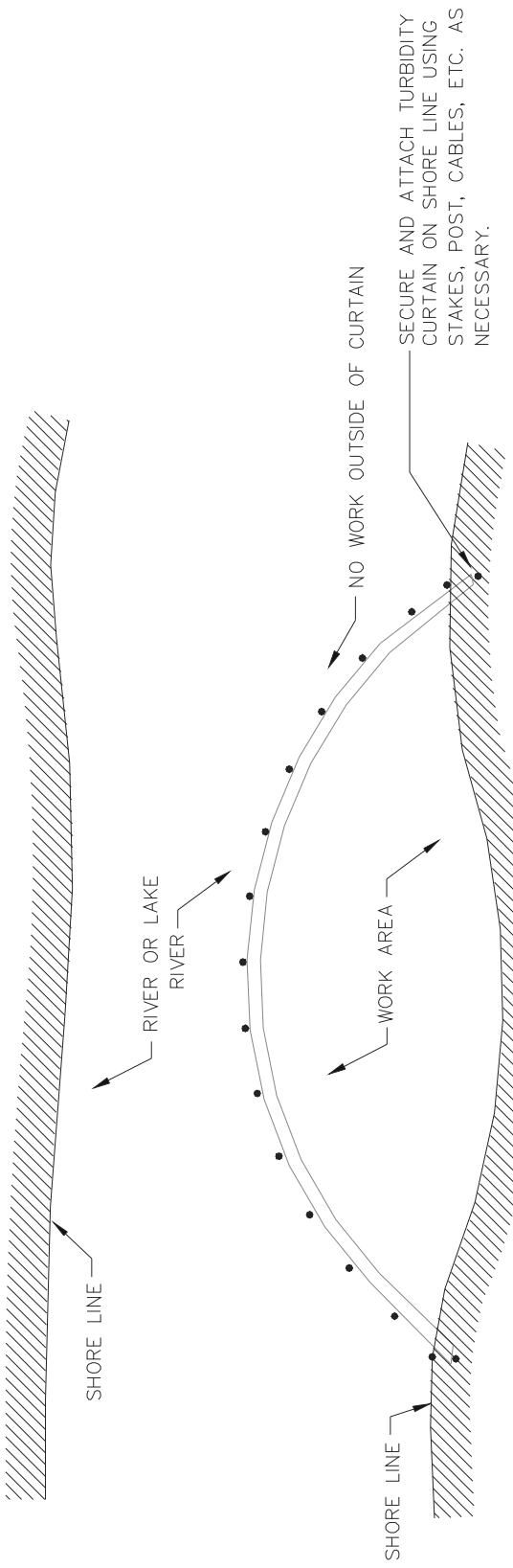
ISOMETRIC

TURBIDITY CURTAIN

NOT TO SCALE

Clear Water Diversion

Adapted from Caltrans Construction Site BMPs



PLAN

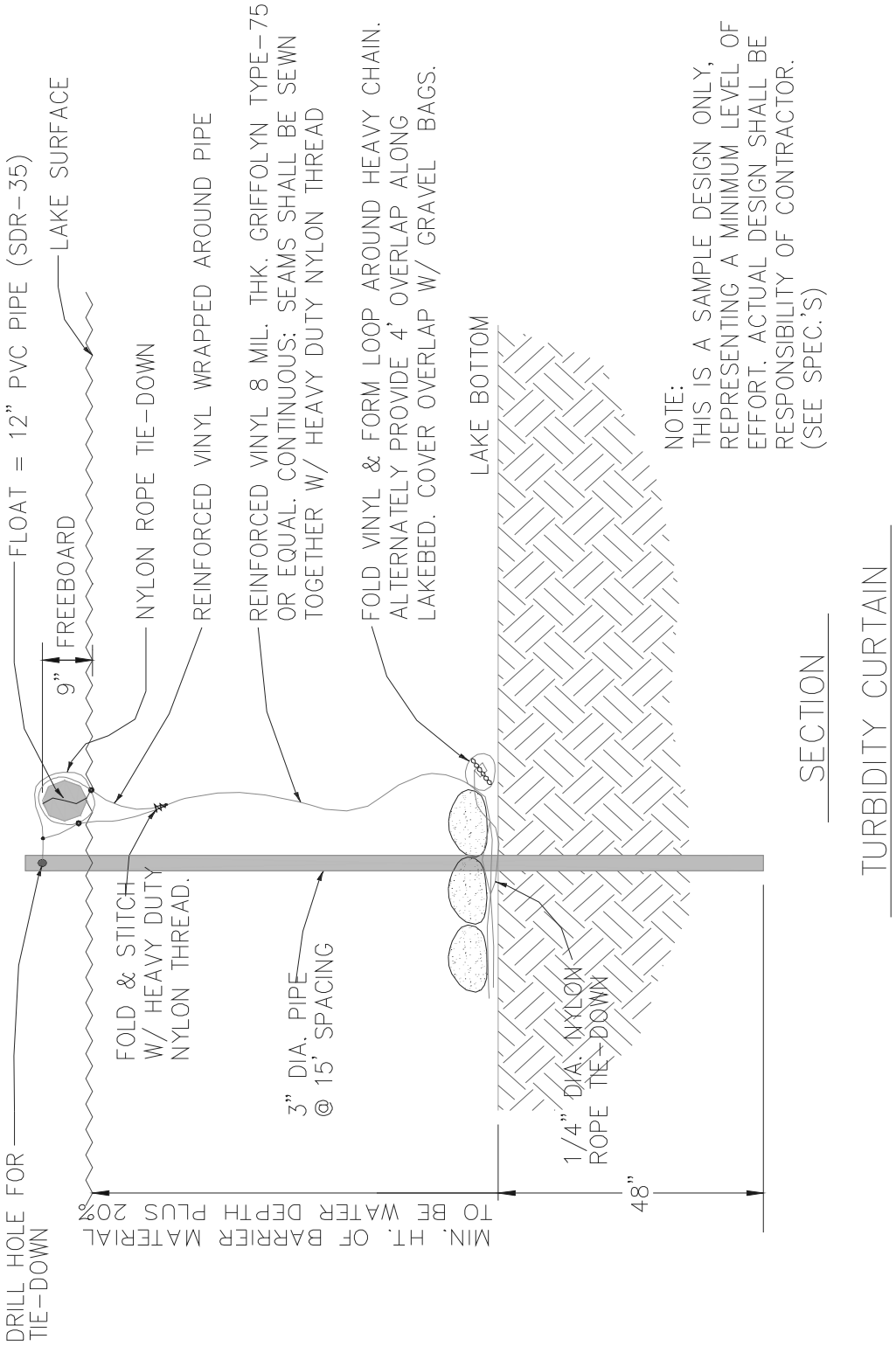
TURBIDITY CURTAIN

NOT TO SCALE

Clear Water Diversion

NS-5

Adapted from Caltrans Construction Site BMPs



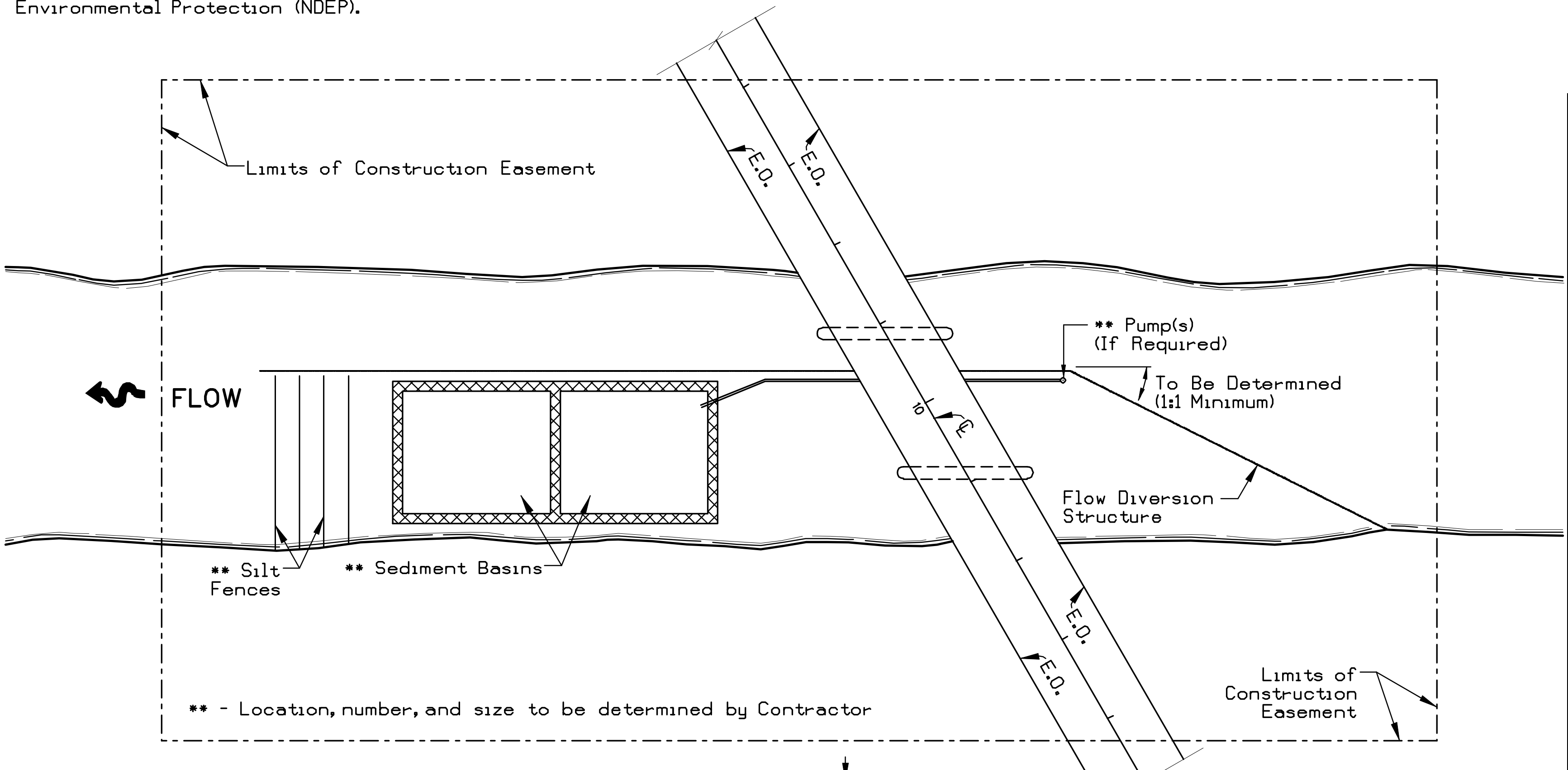
SECTION

TURBIDITY CURTAIN

NOT TO SCALE

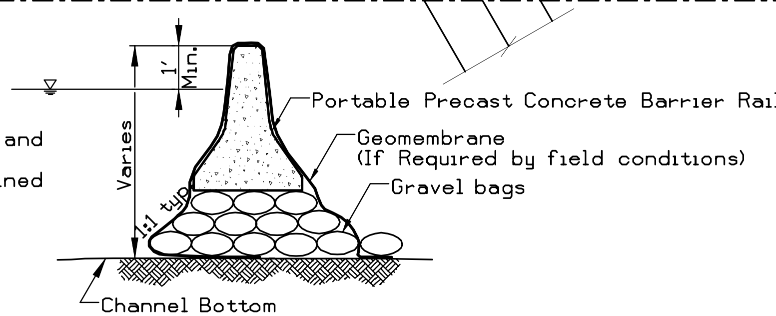
Adapted from Caltrans Construction Site BMPs

SCOPE OF WORK:
The Contractor shall place a Diversion Structure to channel flow through the project. The flow will be diverted to one side of the structure so that the construction can be completed on the other side. The water can then be diverted to the opposite side so that the first side can be constructed. All sediment impacted water created by the construction activities will be transported to a sediment basin and treated prior to release. The level of treatment shall be determined by Nevada Department of Environmental Protection (NDEP).



** - Location, number, and size to be determined by Contractor

Flow Diversion Structure
The structure may consist of a series of gravel bags with a portable precast concrete barrier rail on top and wrapped in a layer of impermeable geotextile. The actual structure height and composition to be determined by the Contractor with the approval of Nevada Department of Environmental Protection (NDEP).

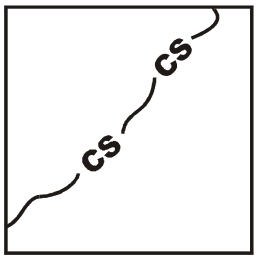


CONCEPTUAL FLOW DIVERSION PLAN

Stockpile Management

WM-3

Adapted from Caltrans Construction Site BMPs



BMP Objectives

- ● Soil Stabilization
- ● Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ○ Non-Storm Water Management
- ● Materials and Waste Management

Definition and Purpose

Stockpile management procedures and practices are designed to reduce or eliminate air and storm water pollution from stockpiles of soil, and paving materials such as portland cement, aggregate sub-base or pre-mixed aggregate and pressure treated wood.

Appropriate Applications

Implemented in all projects that stockpile soil and other materials that contain fine particles or other materials that have the potential to release into storm water runoff.

Limitations

None identified

Standards and Specifications

- Protection of stockpiles is a year-round requirement.
- Locate stockpiles a minimum of 100 ft. away from concentrated flows of storm water, drainage courses, and inlets wherever possible. See Standard Specification Section 107 for additional information.
- Protect stockpiles from storm water run-on using a temporary perimeter sediment barrier such as berms, dikes, sediment logs, gravel bag berm, silt fences or gravel bags.
- Implement wind erosion control practices, as appropriate, on all stockpiled material. For specific information see BMP SS-13, "Wind Erosion Control."
- Stockpiles of soil should be managed in accordance with Standard Specification Section 107.
- Bagged materials should be placed and stored in a manner consistent with BMP WM-1, "Material Delivery and Storage".

Protection of Non-Active Stockpiles

Non-active stockpiles, defined as stockpiles not in use for two or more weeks, of the identified materials should be protected further as follows:

- ***Soil stockpiles:***
  - May not be applicable to pits, batch plants, or commercial sources.
  - Soil stockpiles should be covered or protected with soil stabilization measures (See SS fact sheets) and a temporary perimeter sediment barrier at all times.
- ***Stockpiles of Portland Cement concrete aggregate, aggregate base, or aggregate sub-base:***
  - Stockpiles should be covered or protected with a temporary perimeter sediment barrier at all times.
- ***Stockpiles/Storage of pressure treated wood with copper, chromium, and arsenic or ammonical, copper, zinc, and arsenate:***
  - Treated wood stockpiles should be placed on and covered with plastic or comparable material at all times.

Protection of Active Stockpiles

Active stockpiles of the identified materials should be protected further as follows:

- Stockpiles should be covered, stabilized, or protected with a temporary linear sediment barrier prior to the onset of precipitation.

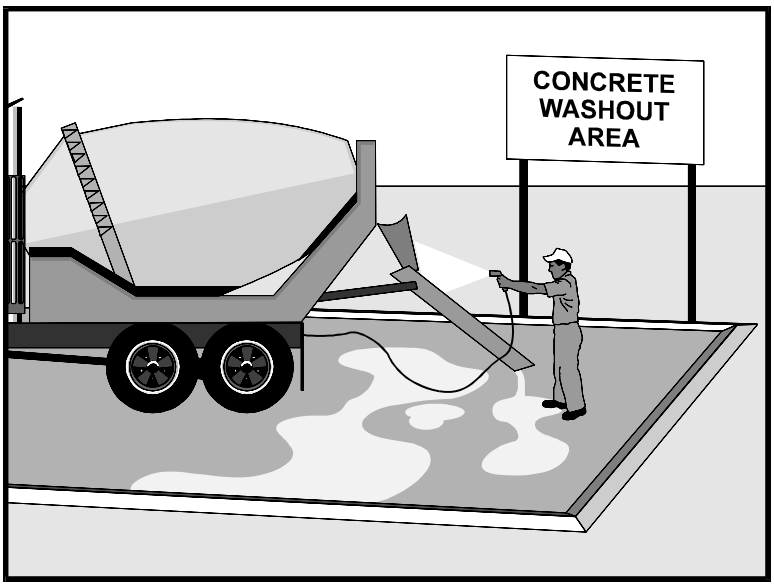
Maintenance and Inspections

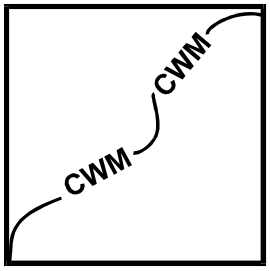
- Repair and/or replace perimeter controls and covers as needed, or as directed by the Resident Engineer (RE), to keep them functioning properly.

Concrete Waste Management

WM-6

Adapted from Caltrans Construction Site BMPs





BMP Objectives

- ○ Soil Stabilization
- ○ Sediment Control
- ○ Tracking Control
- ○ Wind Erosion Control
- ● Non-Storm Water Management
- ● Materials and Waste Management

Definition and Purpose

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

Appropriate Applications

- Concrete waste management procedures and practices are implemented on construction projects where concrete or mortar is used as a construction material or where concrete dust and debris result form demolition activities.
- Where slurries containing portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from sawcutting, coring, grinding, grooving, and hydro-concrete demolition.
- Where concrete trucks and other concrete-coated equipment are washed on site. See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Site may constrain location of an appropriate washout area.

Standards and Specifications

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
- The Contractor's Water Pollution Control Manager (WPCM) shall oversee and enforce concrete waste management procedures.
- PCC and AC waste shall not be allowed to enter storm drains or watercourses.
- PCC and AC waste shall be collected and properly disposed of outside the highway right-of-way in conformance with Standard Specifications Section 107 or placed in a temporary concrete washout facility. See also BMP NS-3, "Paving and Grinding Operations," and

WM-8, "Liquid Waste Management."

- Collect slurry residue and dispose in a temporary pit and allow slurry to dry.
- Temporary concrete washout facilities shall be located a minimum of 100 ft., where practical, from storm drain inlets, open drainage facilities, and watercourses, unless determined unfeasible by the Engineer. Each facility shall be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign shall be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities. The sign shall be installed as shown on the plans and in conformance with the provisions in Standard Specifications Section 625, "Construction Signs".
- Temporary concrete washout facilities shall be constructed above grade or below grade at the option of the Contractor. Temporary concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Temporary washout facilities shall have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures. The volume must also be designed to contain any runoff that drains to the facility and the rain falling directly into the facility during the 2-yr, 24-hr storm event.
- Wash concrete only from mixer truck chutes into approved designated concrete wash out facility.
- Concrete washout facilities shall not be used for disposal of excess concrete and trucks shall not be allowed to back turn and dispose of residual loads.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per BMP WM-5, "Construction Debris and Litter Management."
- Concrete washout facilities may need to be lined if the area is located near a stream or waterbody or in an area of shallow groundwater. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material
- The soil base shall be prepared free of rocks or other debris that may

cause tears or holes in the plastic lining material.

Maintenance and Inspection

- The Contractor's Water Pollution Control Manager (WPCM) shall monitor on site concrete waste storage and disposal procedures at least weekly.
- Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 4 in. for above grade facilities and 12 in. for below grade facilities. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
- When the washout is 75% full, it must be cleaned or a new washout must be constructed.

Appendix A
Abbreviations, Acronyms, and Definition of Terms

Abbreviations

ac	acre
ºC	Degrees Celsius
cfs	cubic feet per second
cy	cubic yards
ºF	Degrees Fahrenheit
ft	feet
g	gram
gal	gallon
gpm	gallons per minute
ha	hectares
hr	hour
in	inches
kg	kilogram
kN	Kilo-Newton
kPa	Kilo-Pascal
l	liter
lbs	pound
lf	linear feet
m	meter
m^2	square meters
m^3	cubic meters
mm	millimeter
N	Newton
psi	pounds per square inch
s	second
yd	yard
y^2	square yards
y^3	cubic yards

Acronyms

AASHTO	American Society of State Highway and Transportation Officials
AC	Asphalt Concrete
ABS	Acrylonitrile Butadiene Styrene
APCD	Air Pollution Control District
AQMD	Air Quality Management District
ARB	Air Resources Board
ASCA	American Society of Certified Arborists
ASTM	American Society of Testing Materials
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CCS	Cellular Confinement System
CMP	Corrugated Metal Pipe
CFR	Code of Federal Regulations
DSA	Disturbed Soil Area
ESA	Environmentally Sensitive Area
FEMA	Federal Emergency Management Agency
L:W	Length versus Width
MSDS	Material Safety Data Sheet
NDEP	Nevada Division of Environmental Protection
NPDES	National Pollutant Discharge Elimination System

OSHA	Occupation Safety and Health Association
PCC	Portland Cement Concrete
PPCBR	Portable Precast Concrete Barrier Rail
PVC	Polyvinyl Chloride
QPL	Qualified Product List
RE	Resident Engineer
ROW	Right of Way
SSP	Standard Special Provisions
SWPPP	Storm Water Pollution Prevention Plan
TRPA	Tahoe Regional Planning Agency
V:H	Vertical versus Horizontal
USACE	United States army Corps of Engineer
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
US EPA	United States Environmental Protection Agency
USFWS	United Fish and Wildlife Services
USLE	Universal Soil Loss Equation
WOUS	Waters of the United States
WPCM	Water Pollution Control Manager
WPCP	Water Pollution Control Plan
WQS	Water Quality Specialist (NDOT Environmental)

Definition of Terms

Active Construction Area: Construction areas where soil-disturbing activities have already occurred and continue to occur or will occur during the ensuing 21 days. This may include areas where soils have been disturbed as well as areas where soil disturbance has not yet occurred.

Antecedent Moisture: Amount of moisture present in soil prior to the application of a soil stabilization product.

Best Management Practice (BMP): Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.

Construction Activity: Includes clearing, grading, or excavation and contractor activities that result in soil disturbance.

Construction Site: The area involved in a construction project as a whole.

Contamination: An impairment of the quality of the waters of the state by waste to a degree that creates a hazard to the public health through poisoning or through the spread of disease including any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected.

Contractor: Party responsible for carrying out the contract per plans and specifications. The Standard Specifications and Special Provisions contain storm water protection requirements the contractor must address.

Degradability: Method by which the chemical components of a soil stabilization product are degraded over time.

Discharge: Any release, spill, leak, pump, flow, escape, dumping, or disposal of any liquid, semi-solid or solid substance.

Disturbed Soil Areas (DSAs): Areas of exposed, erodible soil, including stockpiles, that are within the construction limits and that result from construction activities

Drying Time: Time it takes for a soil stabilization product to dry or cure for it to become erosion control effective.

Environmental Protection Agency (EPA): Agency that issued the regulations to control pollutants in storm water runoff discharges (The Clean Water Act and NPDES permit requirements).

Erosion: The wearing away of land surface primarily by wind or water. Erosion occurs naturally as a result of weather or runoff but can be intensified by clearing, grading, or excavation of the land surface.

Erosion Control Effectiveness: The ability of a particular product to reduce soil erosion relative to the amount of erosion measured for bare soil. Percentage of erosion that would be reduced as compared to an untreated or control condition.

Exempt Construction Activities: Activities exempt from the General Permit, including routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility; and emergency construction activities required to protect public health and safety. Local permits may not exempt these activities.

Existing vegetation: Any vegetated area that has not already been cleared and grubbed.

Fair Weather Prediction: When there is no precipitation in the forecast between the current calendar day and the next working day. The National Weather Service NOAA Weather Radio forecast shall be used. The contractor may propose an alternative forecast for use if approved by the Resident Engineer.

Feasible: Economically achievable or cost-effective measures, which reflect a reasonable degree of pollutant reduction achievable through the application of available nonpoint pollution control practices, technologies, processes, site criteria, operating methods, or other alternatives.

General Permit: The General Permit for Storm Water Discharges Associated with Construction Activity (Stormwater General Permit NVR100000) issued by the Nevada Division of Environmental Protection.

Good Housekeeping: A common practice related to the storage, use, or cleanup of materials, performed in a manner that minimizes the discharge of pollutants.

Local permit: An NPDES storm water permit issued to a District by the NDEP having jurisdiction over the job site. Requirements of the local permit are generally similar to, but supersede the requirements of the General Permit.

Longevity: The time the soil erosion product maintains its erosion control effectiveness.

Mode of Application: Type of labor or equipment that is required to install the product or technique.

National Pollutant Discharge Elimination System (NPDES) Permit: A permit issued pursuant to the Clean Water Act that requires the discharge of pollutants to waters of the United States from storm water be controlled.

Native: Living or growing naturally in a particular region. Compatibility and competitiveness of selected plant materials with the environment.

Non-active Construction Area: Any area not considered to be an active construction area. Active construction areas become non-active construction areas whenever construction activities are expected to be discontinued for a period of 21 days or longer.

Non-Storm Water Discharge: Any discharge to a storm drain system or receiving water that is not composed entirely of storm water.

Pollution: The man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water. An alteration of the quality of the water of the state by waste to a degree, which unreasonably affects either the waters for beneficial uses or facilities that serve these beneficial uses.

Rainy Season: The dates of the rainy season shall be as specified: use dates in the local permit if a local permit is applicable to the project site and rainy season dates are specified therein; or, if the local permit does not specify rainy season dates and/or in areas of the state not subject to a local permit, the rainy season dates shall be determined using Figure 2-1.

Receiving Waters: All surface water bodies within the permit area.

Resident Engineer (RE): The NDOT representative charged with administration of construction contracts. The RE decides questions regarding acceptability of material furnished and work performed. The RE has "contractual authority" to direct the contractor and impose sanctions if the contractor fails to take prompt and appropriate action to correct deficiencies. The following contractual sanctions can be imposed by the RE: (a) withholding payments (or portions of payments), (b) suspending work, (c) bringing in a separate contractor to complete work items (the contractor is billed for such costs), (d) assessing liquidated damages including passing along fines for permit violations, (e) initiating cancellation of the construction contract.

Residual Impact: The impact that a particular practice might have on construction activities once they are resumed on the area that was temporarily stabilized.

Runoff Effect: The effect that a particular soil stabilization product has on the production of storm water runoff. Runoff from an area protected by a particular product may be compared to the amount of runoff measured for bare soil.

Sediment: Organic or inorganic material that is carried by or suspended in water and that settles out to form deposits in the storm drain system or receiving waters.

Storm Drain System: Streets, gutters, inlets, conduits, natural or artificial drains, channels and watercourses, or other facilities that are owned, operated, maintained and used for the purpose of collecting, storing, transporting, or disposing of storm water.

Storm Water: Rainfall runoff, snow melt runoff, and surface runoff and drainage. It excludes infiltration and runoff from agricultural land.

Storm Water Inspector: NDOT staff member who provides support to the Resident Engineer. Coordinates activities and correspondence related to SWPPP implementation.

Storm Water Pollution Prevention Plan (SWPPP): A plan required by the General Permit that includes site map(s), an identification of construction/contractor activities that could cause pollutants in the storm water, and a description of measures or practices to control these pollutants. It must be prepared and approved before construction begins. A SWPPP prepared in accordance with the special provisions and the Handbooks will satisfy Standard Specifications Section 637.01.02 - Water Pollution Control Plan, requirement for preparation of a program to control water pollution.

Temporary Construction Site BMPs: Construction Site BMPs that are required only temporarily to address a short-term storm water contamination threat. For example, silt fences are located near the base of newly graded slopes that have a substantial area of exposed soil. Then, during rainfall, the silt fences impound water, allowing sediment to settle out of runoff flowing off the slope.

Waters of the United States (WOUS): Jurisdictional bodies of water as defined in 40 CFR § 122.2. WOUS are navigable or non-navigable ephemeral (typically dry), intermittent, and perennial drainages and/or associated wetlands under the jurisdiction of the U.S. Environmental Protection Agency who granted regulatory authority to the U.S. Army Corps of Engineers. Environmental Services Division works with the appropriate regulatory agency to make a jurisdictional WOUS determination generally for permitting purposes.

Appendix B
SWPPP Template and Information

The following runoff coefficient values may be incorporated into the SWPPP development:

- An estimate of the construction site area in acres (refer to section 1.3);
- An estimate of the runoff coefficient of the construction site before and after construction (the form shown in Table B-1 may be used to develop the necessary information for runoff coefficients; Tables B-2 and B-3 provide supporting information for the calculation of runoff coefficients); and an estimate of the percentage of the area of the construction site that is impervious (e.g., pavement, building, etc.) before and after construction.

Table B-1
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 Runoff Coefficient = (BxC) + (DxE) / A	= _____(F)
Proposed Site Conditions (After Construction)	
Impervious Site Area[1]	= _____(G)
Impervious Site Runoff Coefficient[2,4]	= _____(H)
Pervious Site Area[3]	= _____(I)
Pervious Site Runoff Coefficient[4]	= _____(J)
Proposed Runoff Coefficient = (GxH) + (IxJ) / A	= _____(K)

(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 Table B-2 and B-3 for runoff coefficients

Table B-2
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 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 pond 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

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 B-3
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

STORM WATER POLLUTION PREVENTION PLAN (SWPPP) FOR CONSTRUCTION ACTIVITIES

Name and Location of Project:

_____
_____
_____
_____
_____

Operator: Name, Address, and Phone Number

_____
_____
_____
_____

Person Responsible for Implementing SWPPP:

_____
_____

Name, Address, and Phone Number

_____
_____
_____
_____

Notice of Intent Filing Date:

_____

NOTE: A WORKING COPY OF THIS SWPPP MUST BE KEPT AT THE CONSTRUCTION SITE OR BE LOCALLY AVAILABLE FOR REVIEW BY NDEP and LOCAL REGULATORY AGENCIES

A COPY OF STORMWATER GENERAL PERMIT NVR100000 AND THE NOTICE OF INTENT FOR THIS PROJECT MUST BE ATTACHED TO THIS SWPPP

GUIDANCE FOR SELECTING AND IMPLEMENTING BMPs IS AVAILABLE IN THE TRUCKEE MEADOWS CONSTRUCTION SITE BMP HANDBOOK. ATTACH ADDITIONAL PAGES WHEN NECESSARY TO PROVIDE THE REQUIRED INFORMATION

Table of Contents

II. PROJECT DESCRIPTION

Description of the Proposed Construction Activity [§ I.B.1a.(6)]	
Intended Sequence of Major Soil Disturbing Activities [§ I.B.1a.(7)]	
1.	9.
2.	10.
3.	11.
4.	12.
5.	13.
6.	14.
7.	15.
8.	16.
Total Area of Site (acres) [§ I.B.1a.(8)]	**Total Area to be Disturbed (acres)**
<u>Runoff Coefficients</u> [§ I.B.1a.(9)]: Use the following worksheet for sites with only 1 or 2 land uses, such as an undeveloped site with a proposed parking lot. For sites with 3 or more land uses (pre and/or post-project) attach a separate worksheet.	
Describe Pre-Project Conditions and Land Use(s)	
Pre-Project Land Use 1	
_____acres X _____ = _____(C1)	
Pre-Project Land Use 2	
_____acres X _____ = _____(C2)	
Average Pre-Project Runoff Coefficient	
(C1 + C2) / Total area =	
Post-Project Land Use 1	
_____acres X _____ = _____(C3)	
Post-Project Land Use 2	
_____acres X _____ = _____(C4)	
Average Post-Project Runoff Coefficient	
(C3 + C4) / Total area =	

III. EXISTING SOIL AND WATER QUALITY DATA

Provide a description of the existing soil and/or water quality data of any discharges from the site [§ I.B.1a.(9)] Existing water for adjacent waterways that may receive discharges from the site is also recommended, if available.

IV. SITE MAPS

Attach A. a General Location Map and B. a Detailed Site Map [§ I.B.1a.(10)] . Note that site maps must be updated and revised as site conditions change and new BMPs are implemented.
The Detailed Site Map must indicate the following: 1. Existing and proposed topography and drainage patterns drawn to scale with north arrow. 2. Areas of soils that will be disturbed and areas that will not be disturbed. 3. Locations of structural and non-structural controls identified in SWPPP. 4. Locations where stabilization practices will be applied. 5. Locations where vehicles and equipment will be stored and maintained. 6. Locations where materials and wastes will be stored (including concrete washout areas). 7. Location(s) and aerial extent of nearby receiving waters (including wetlands). 8. Location(s) where stormwater discharges will enter receiving waters and/or the municipal stormdrain system. 9. Legend identifying all symbols, BMP numbers or abbreviations used.
C. Location and description of any discharge(s) associated with Industrial Activity other than construction, including any stormwater discharges from dedicated asphalt or concrete plants covered under General Permit NVR100000 [§ I.B.1a.(11)].

V. RECEIVING WATERS

Receiving Water(s): Identify the name and location of the streams, rivers, ditches, drainages, lakes or wetlands (both perennial and intermittent) that will receive runoff from the construction site. If the site will drain to the municipal storm drain system, identify the receiving water to which the system discharges [§ I.B.1a.(12)].

VI. EROSION AND SEDIMENT CONTROLS

A. Best Management Practices (BMPs) [§ I.B.1b]

Describe each control measure and the general sequence of implementation during the construction process. Clearly identify below the BMPs that will be used for each of the major activities identified in 3) above. Also indicate each Contractor that will be responsible for installing and maintaining each control measure.

Control measures must be properly selected, installed, and maintained in accordance with the manufactures specifications and good engineering practices. Controls must be inspected at least weekly and sediments must be removed from when the design capacity has been reduced to 50%. Construction materials, chemicals, wastes, litter and debris must be prevented from becoming a stormwater pollutant source. Offsite material storage areas used solely by the permitted project must also be addressed.

Control Measures	Contractors
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.
11.	11.
12	12
13.	13.
14.	14.
15.	15.
16.	16.

B. Temporary Stabilization Practices [§ I.B.1b.(2)]
Describe the temporary stabilization BMPs (e.g. soil binders, revegetation and/or mulching) that will be provided on stockpiles and disturbed portions of the site where construction activity is expected to cease for 14 days or more and will not be resumed within 21 days.

C. Permanent Stabilization Practices [§ I.B.1b.(2)]
Describe the permanent stabilization BMPs (e.g. permanent revegetation and/or rolled erosion control products) that will be provided on disturbed portions of the site where construction activities have permanently ceased. Permanent stabilization measures must be applied no later than 14 days from the last construction activity in that area. Final stabilization with vegetation must achieve a uniform cover with a minimum density of 70% of what was on the site prior to commencement of construction activities. Permanent stabilization must be achieved prior to NDEP issuing a Notice of Termination.

D. Structural Practices [§ I.B.1b.(3)]
Provide a description of the temporary and permanent structural BMPs (e.g. temporary diversion dikes, silt fences, fiber rolls, check dams, sediment traps, storm drain inlet protection, etc.) that will be used during construction to divert or filter flows from exposed soils, reduce flow velocities or temporarily store flows and limit runoff from the exposed areas of the site. All sediment basins must be designed to the criteria outlined in the Truckee Meadows Construction Site BMP Handbook. From May to October, water must not be allowed to pond in any structural practice in excess of 7 days.

VII. STORMWATER MANAGEMENT

Stormwater Management Controls [§ I.B.1c.]
Provide a description of the measures installed during construction that will be used to control pollutants in stormwater discharges between the time construction has ceased and final site stabilization has been achieved. These stormwater management controls include but are not limited to sediment retention basins, infiltration trenches, vegetated swales and velocity dissipation measures, such as riprap aprons on culvert outfalls. Permittees are responsible for the installation and maintenance of these stormwater BMPs until an approved Notice of Termination is received by NDEP.

VIII. OTHER CONTROLS

A. Material Storage, Spill Prevention and Response [§ I.B.1d.(1)]

Provide a description of the construction materials and chemicals that are expected to be stored onsite, with updates as appropriate. Describe the BMPs that will be provided to ensure proper storage of these construction materials that will minimize their exposure to stormwater. Describe the response measures that will be provided if a spill occurs.

B. Offsite Vehicle Tracking Controls [§ I.B.1d.(2)]

Provide a description of the control measures that will be provided to prevent tracking or deposition of sediments offsite and the measures that will be used to remove any sediments that have been deposited on the paved roadways bordering the site.

C. Construction Waste Storage and Disposal [§ I.B.1d.(3)-(4)]
Describe the construction wastes that are expected to be generated onsite. Construction waste include concrete washout, excess building materials, chemicals, litter and debris. Describe the BMPs that will be used to temporarily store these wastes, how they will be collected and disposed, and the response measures that will be provided if a spill occurs.

D. Hazardous and Sanitary Waste Storage and Disposal [§ I.B.1d.(3)-(4)]
Provide a description of hazardous and sanitary or septic wastes that are expected to be generated onsite. Describe how these wastes will be temporarily stored, collected and the response measures that will be provided in the event of a spill. Describe the measures that will be used to ensure no contact with stormwater.

E. Offsite Discharges [§ I.B.1d.(5)]

Provide a description of potential offsite pollutant sources from dedicated sites such as asphalt of concrete plants and describe the BMPs that will be provided to minimize stormwater pollution.

F. Non-Stormwater Discharges [§ I.B.1h]

Provide a description of the activities that may produce non-stormwater discharges, such as water line flushings and dewatering from excavation. Describe the BMPs that will be used to minimize stormwater pollution.

IX. INSPECTION/MAINTENANCE PROCEDURES

The contractor or his qualified agent is required to inspect all disturbed areas, areas used for storage of materials and equipment that are exposed to precipitation, including vehicle entrance and exit locations and all erosion and sediment control BMPs. Inspections shall occur weekly, prior to forecasted rain events, and within 24 hours after any actual rain event. The following sources may be used to obtain weather forecasts:

- The National Weather Service: Telephone: (775) 673-8100
  Website: http://www.wrh.noaa.gov/Reno/
- The Western Regional Climate Center
  Website: http://www.wrcc.dri.edu/CURRENTOBS.html
- The Weather Channel
  Website: http://www.weather.com/weather/detail/USNV0076

Once storms are imminent, a portable NOAA weather radio can also provide useful information. NOAA weather radio broadcasts are made on one of seven high-band FM frequencies. These frequencies are typically only on radios that provide a "weather band" as an added feature or portable weather radios that exclusively provide weather broadcasts. The local FM frequency for the Reno/Sparks area is 162.500 MHz. Taped weather messages are repeated every four to six minutes and are routinely revised at least once every one to three hours, 24 hours daily.

A. Inspection and Maintenance of Stabilization and Structural Practices [§ I.B.1d.(f)-(g)]
Provide a description of the practices that will be used to inspect and maintain all Temporary and Permanent Stabilization Practices described in boxes 18) and 19) and all Structural Practices described in box 20).

B. Inspection and Maintenance of Other Controls [§ I.B.1d.(f)-(g)]
Provide a description of the practices that will be used to inspect and maintain all Other Controls described in Sections VIII. A. through F.

X. CERTIFICATIONS OF COMPLIANCE

A. This SWPPP must be certified that it is consistent with all applicable Federal, State and Local regulations, or other approved site plans or permits. It is to be prepared in accordance with the Truckee Meadows Construction Site Best Management Practices Handbook. This SWPPP must be updated as necessary to remain consistent with changes in other site plans that effect soil disturbing activities, site drainage patterns or any other activity that may impact stormwater runoff quality. It must also be re-certified annually by July 1 until the construction project is complete and a Notice of Termination has been submitted to NDEP.

OWNER/OPERATOR CERTIFICATION STATEMENT

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, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations [§ II.B.1d.].

Initial Certification:

Print Name _____ Title _____

Signature _____ Date _____

Annual Re-Certification:

Print Name _____ Title _____

Signature _____ Date _____

B. All contractors and subcontractors responsible for implementing pollution control measures must be identified in this SWPPP with the measures for which they are responsible. They must also sign the following certification statement that indicates they understand the requirements of the States General Permit for Construction Activities (Attach Copy of Permit).

CONTRACTOR'S CERTIFICATION STATEMENT

I certify under penalty of law that I understand the terms and conditions of the State's General Permit (NVR100000) that authorizes stormwater discharges associated with industrial activity from the construction site identified as part of this certification.

Company 1		Address
City	State	Phone No.
Print Name		Title
Signature		Date
Responsibilities		

Company 1		Address
City	State	Phone No.
Print Name		Title
Signature		Date
Responsibilities		

Company 3		Address
City	State	Phone No.
Print Name		Title
Signature		Date
Responsibilities		

XI. RECORD OF CONSTRUCTION ACTIVITIES

Dates of Major Construction Activities and BMPs
Provide the dates of when major grading activities occur, the dates when construction activities on a portion of a site temporarily or permanently cease, and list the dates when temporary and permanent stabilization practices are implemented. Photo documentation of major construction activities and implementation of BMPs is strongly recommended.