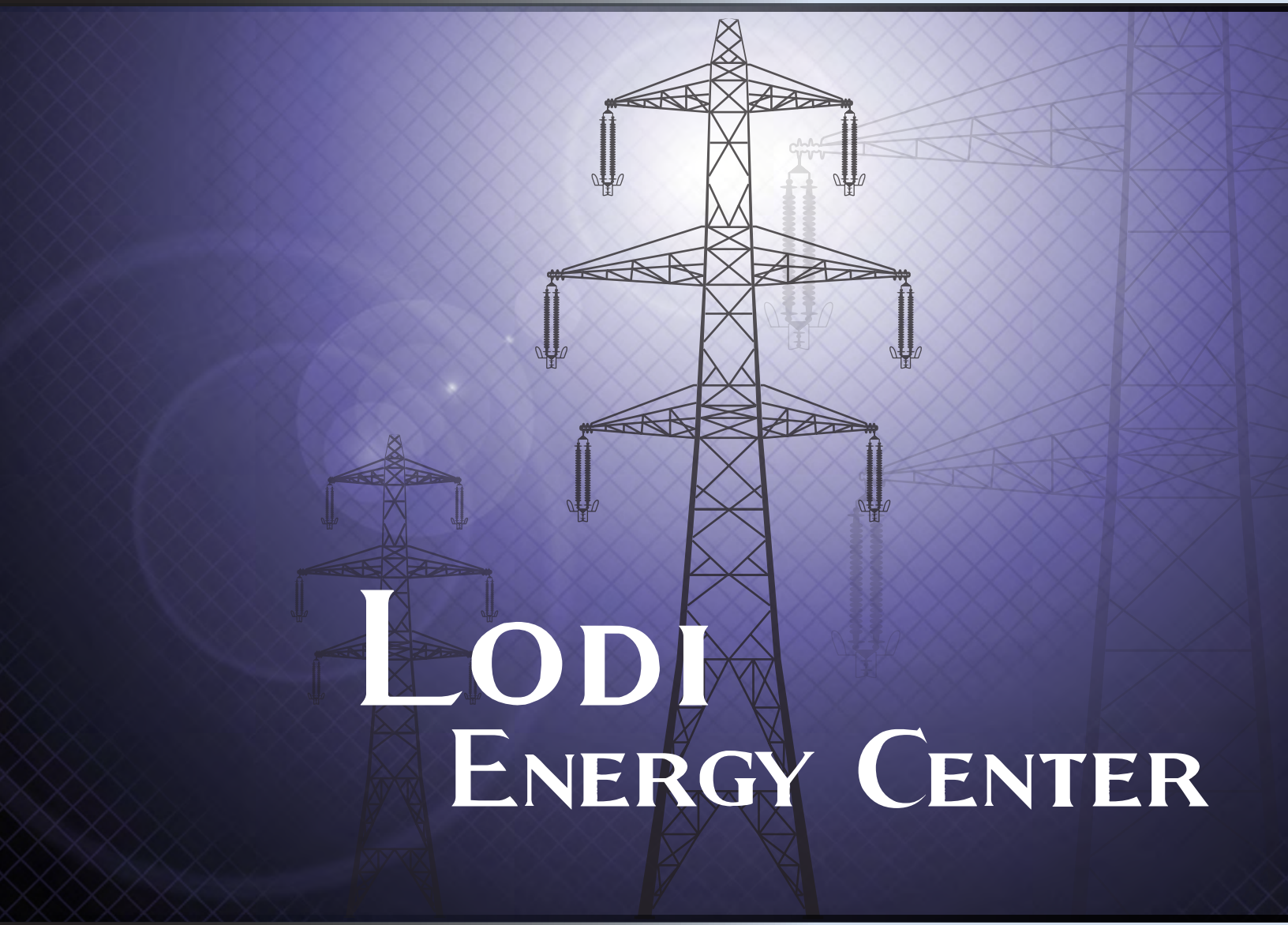
Application for Certification

Data Adequacy Supplement B



LODI ENERGY CENTER

October 2008

EY062008001SAC

Submitted by

NCPA
NORTHERN CALIFORNIA POWER AGENCY

Submitted to

California Energy Commission

With Technical Assistance by

CH2MHILL

Supplement B

Response to Data Adequacy Review

In support of the

Application for Certification

for the

Lodi Energy Center Project

Lodi, California

(08-AFC-10)

Submitted to the:

California Energy Commission

Submitted by:

NCPA

NORTHERN CALIFORNIA POWER AGENCY

With Technical Assistance by:

CH2MHILL

Sacramento, California

October 2008

Contents

Section **Page**

1.0 Introduction....1
3.0 Transmission System Engineering....3
5.1 Air Quality....9
5.2 Biological Resources....15
5.3 Cultural Resources....27
5.10 Socioeconomics....33
5.11 Soils....37
5.14 Visual Resources....39
5.15 Water Resources....43

Attachments

DA5.1-1 SJVAPCD Completeness Letter
DA5.1-2 Commissioning Activities Quantification and Duration
DA5.2-1 Records of Conversation
DA5.3-1 Architectural Historian Resume
DA5.10-1 Records of Conversation
DA 5.15-1 Draft Construction Stormwater Pollution Prevention Plan
DA 5.15-2 Notice of Intent (Construction)
DA 5.15-3 City of Lodi Stormwater Will-Serve Letter
DA 5.15-4 Lab Analytical Results for the WPCF Domestic Water Well
DA 5.15-5 City of Lodi Recycled Water Will-Serve Letter
DA 5.15-6 Stormwater Drainage Figures
DA 5.15-7 Preliminary Drainage Study
DA 5.15-8 City of Lodi Stormwater Management Plan
DA 5.15-9 Letter from City of Lodi Regarding Recycled Water Availability

Tables

DA 5.2-1 Agency Contacts
DA 5.3-1 Standing Structures within the 0.5-Mile Radius of the LEC
DA 5.15-1 Water Quality Characteristics from the White Slough WPCF Domestic Water Well
DA 5.15-2 Regional Floodplain Impact Calculation

Figures

DA 3.0-1 Take-off Structures
DA 3.0-2 One-Line Diagram
DA 5.2-1a Water Features

DA 5.2-1b Water Features – Natural Gas Line
DA 5.3-1 Cultural Study Area
DA 5.14-1 View of Proposed Plant Site (Facing West)
DA 5.14-2 View of Proposed Plant Site (Facing Northwest)
DA 5.14-3 View of Proposed Plant Site (Facing North)
DA 5.14-4 View of Laydown/Parking Site C
DA 5.14-5 View of Laydown/Parking Site D
DA 5.15-1 FEMA Flood Zone Map

1.0 Introduction

This supplement to Northern California Power Agency's (NCPA) Application for Certification (AFC) for the Lodi Energy Center Project (LEC) (08-AFC-10), responds to comments that California Energy Commission (CEC) Staff have made as a result of their data adequacy review of the AFC. The intention of this supplement is to provide all additional information necessary for Staff to find that the AFC contains adequate data to begin a power plant site certification proceeding under Title 20, California Code of Regulations and the Warren-Alquist Energy Resources Conservation and Development Act.

The format for this supplement follows the order of the AFC and provides additional information and responses to CEC information requests for several disciplines. Only sections for which CEC Staff posed requests or questions related to data adequacy are addressed in this supplement. If the response calls for additional appended material, it is included at the end of each subsection. Appended material is identified by the prefix "DA" indicating an item submitted in response to a Staff Data Adequacy comment, a number referring to the applicable AFC chapter, and a sequential identifying number. For example, the attachment in response to a Transmission System Engineering comment would be Attachment DA3.0-1, because the AFC section describing electrical transmission is Section 3.0. Tables are also numbered in this way. Appended material is paginated separately from the remainder of the document.

Each subsection contains data adequacy questions or information requests, with numbers and summary titles and, in parentheses, the citation from Appendix B, Title 22, California Code of Regulations (Regulations Pertaining to the Rules of Practice and Procedure and Power Plant Site Certification) indicating a particular information requirement for the AFC. Each item follows with the CEC Staff comment on data adequacy for this item, under the heading "Information required to make AFC conform with regulations" followed by NCPA's response to the information request and the information requested.

3.0 Transmission System Engineering

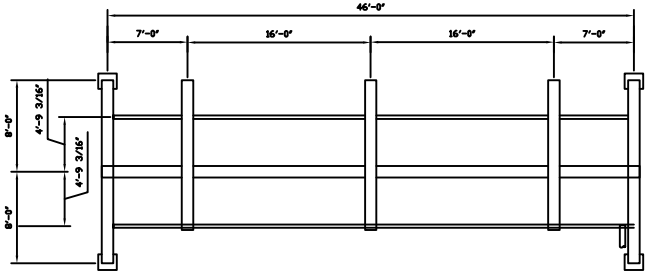
1. One-Line Diagrams (Appendix B (b) (2) (C))

A detailed description of the design, construction, and operation of any electric transmission facilities, such as power lines, substations, switchyards, or other transmission equipment, which will be constructed or modified to transmit electrical power from the proposed power plant to the load centers to be served by the facility. Such description shall include the width of rights of way and the physical and electrical characteristics of electrical transmission facilities such as towers, conductors, and insulators.

Information required to make AFC conform with regulations:

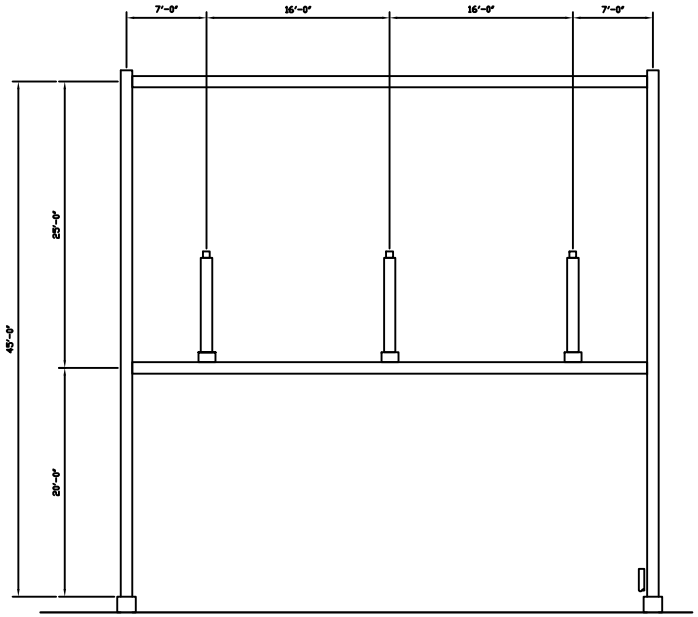
1. *Please provide detail drawings for the take off structures required in interconnecting the 230 kV transmission lines from the proposed power plant to the existing STIG power plant switching station.*
2. *Provide a one-line diagram for the existing STIG power plant switching station before the interconnection of the project.*
3. *Provide a one-line diagram for the existing STIG power plant switching station after the addition of the project. Show all equipment ratings including bay arrangement of the breakers, disconnect switches, buses, and etc. which are required for the addition of the project.*

Response: A figure identifying detailed drawings of the take off structures is provided as Figure DA 3.0-1. A one-line diagram showing the existing STIG power plant before and after the addition of the project is provided as Figure DA 3.0-2.

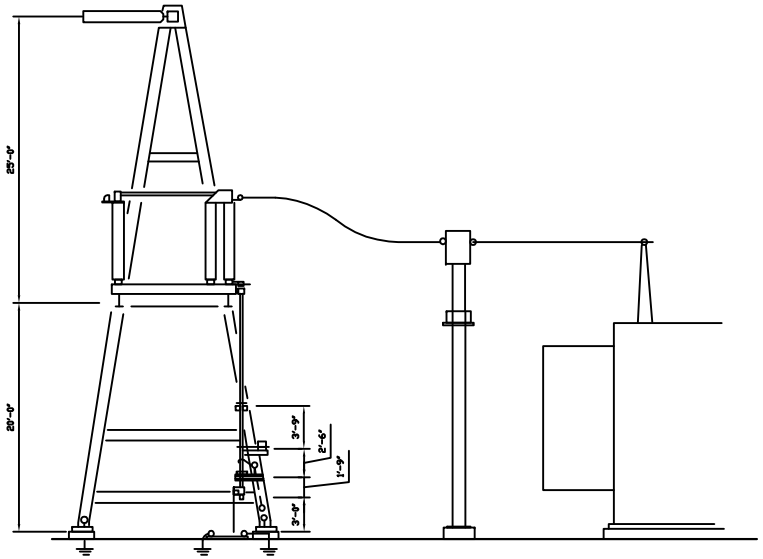


PLAN VIEW

NOTES:
1. THE 480 VOLT SWITCHGEAR DRAWOUT CIRCUIT BREAKERS CURRENT RATINGS ARE THE FRAME SIZE.
2. CIRCUIT BREAKERS AND CONTACTORS INDICATED BY "DCS" SHALL BE CONTROLLED FROM THE DCS.



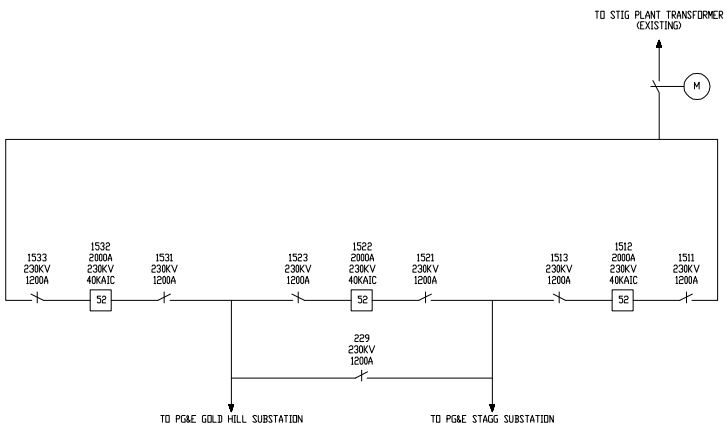
ELEVATION A-A



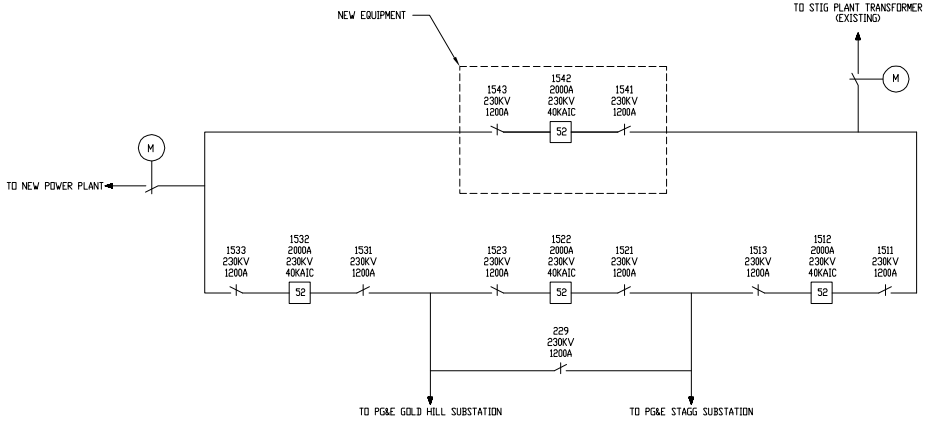
ELEVATION B-B

FIGURE DA 3.0-1
TAKE-OFF STRUCTURES
LODI ENERGY CENTER
LODI, CALIFORNIA

Source: WorleyParsons LTD., Drawing LODI-0-SK-623-206-103A, 10/21/08



EXISTING



AFTER MODIFICATION

NOTES:
1. THE 480 VOLT SWITCHGEAR DRAWOUT CIRCUIT BREAKERS CURRENT RATINGS ARE THE FRAME SIZE.
2. CIRCUIT BREAKERS AND CONTACTORS INDICATED BY "DCS" SHALL BE CONTROLLED FROM THE DCS.

LEGEND:

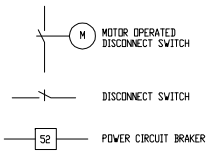


FIGURE DA 3.0-2
ONE-LINE DIAGRAM
LODI ENERGY CENTER
LODI, CALIFORNIA

Source: WorleyParsons LTD., Drawing LODI-0-SK-623-206-102A, 10/22/08

5.1 Air Quality

2. Compliance Determination (Appendix B (g) (8) (A))

The information necessary for the air pollution control district where the project is located to complete a Determination of Compliance.

Information required to make AFC conform with regulations:

Please provide a copy of the District's Notice of Completeness.

Response: A copy of the District's completeness letter dated October 2, 2008, was docketed on October 23, 2008. A copy of the letter is provided as Attachment DA 5.1-1.

3. Emission Quantification (Appendix B(g) (8) (F)(ii)

A description of the project's planned initial commissioning phase, which is the phase between the first firing of emissions sources and the commercial operations date, including the types and durations of equipment tests, criteria pollutant emissions, and monitoring techniques to be used during such tests.

Information required to make AFC conform with regulations:

Please provide description, duration and quantification of emissions for each commissioning activity.

Please provide method(s) to monitor the emissions of each commissioning activity.

Response: Each commissioning activity is described below. The expected duration and quantification of emissions from each commissioning activity are provided in Tables AQ-1 and AQ-2, attached as Attachment DA 5.1-2.

- Full Speed No Load Tests (FSNL) – This activity includes a test of the gas turbine ignition system, a test to ensure that the CTG is synchronized with its electric generator, and a test of the CTG's overspeed system.
- Steam Blows – During steam blows, steam is passed through the CTG and HRSG to remove all debris that could potentially damage the SCR and oxidation catalysts.
- Minimum Load Tests and Full Load Tests (without SCR Operational) – These tests will occur over several days. During this testing period, the CTG combustor will be tuned to minimize emissions and other checks will be performed.
- Multiple Load Tests (SCR/Oxidation Catalyst Operational at Various Levels) – These tests will occur over several days. By the beginning of this test period, the control systems will be installed and will be tuned to achieve NOx and CO control at design levels.
- Performance Tests (SCR/Oxidation Catalyst at Full Control) – These tests will also occur over a several-day period, with the CTG operating from minimum to maximum load.

NOx and CO emissions during each commissioning activity will be monitored using installed and calibrated (but not certified) continuous emissions monitoring systems. SOx, PM_{10} and VOC emissions will be monitored using measured fuel flow and emission factors based on permit limits.

ATTACHMENT DA 5.1-1

SJVAPCD Completeness Letter

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

CERTIFIED MAIL

October 2, 2008

Ed Warner
Northern California Power Agency
P.O. Box 1478
Lodi, CA 95241

NCPA CT2
Received by:
Date: 10.6.08

Re: Notice of Receipt of Complete Application
Project Number: N-1083490

Dear Mr. Warner:

The San Joaquin Valley Air Pollution Control District (District) has received your Authority to Construct application for the installation of a 255 MW (nominal) electric power generation plant, at 12751 N Thornton Rd, Lodi. Based on our preliminary review, the application appears to be complete. This means that your application contains sufficient information to proceed with our analysis. However, during processing of your application, the District may request additional information to clarify, correct, or otherwise supplement, the information on file.

During the preliminary review analysis, it appeared that you have proposed to use SO_x Emission Reduction Credits (ERCs) to offset a portion (27.8 tons) of PM_{10} emissions increase from this project. Using the proposed inter-pollutant offset ratio of 1.11 to 1, it appears that you have sufficient SO_x ERCs available to overcome the shortfall for PM_{10} emissions. Please note that the District is in the process of determining the appropriate SO_x for PM_{10} offset ratio for the Northern San Joaquin Valley. Should our analysis result in a higher inter-pollutant ratio than what you have proposed, you will be informed, and you may be required to identify additional SO_x credits.

Furthermore, you have recently proposed to use NO_x ERCs to offset a portion (1.0 ton) of VOC emissions increase from this project. Using an inter-pollutant offset ratio of 1.00 to 1, it appears that you have a sufficient amount of NO_x ERCs available to overcome the ERC shortfall for VOCs. At this time, an inter-pollutant offset ratio of 1.00 to 1 appears appropriate. However, if later, the District determines that a higher inter-pollutant offset ratio number is more appropriate, you will be informed, and you may be required to identify additional NO_x credits.

Per District Rule 2201, Section 5.3, Final Action, the District will not be able to issue the final ATC permits until the requirements of the California Environmental Quality Act have been fully satisfied by the Lead Agency.

Seyed Sadredin
Executive Director/Air Pollution Control Officer

Northern Region
4800 Enterprise Way
Modesto, CA 95356-8718
Tel: (209) 557-6400 FAX: (209) 557-6475

Central Region (Main Office)
1990 E. Gettysburg Avenue
Fresno, CA 93726-0244
Tel: (559) 230-6000 FAX: (559) 230-6061
www.valleyair.org

Southern Region
2700 M Street, Suite 275
Bakersfield, CA 93301-2373
Tel: (661) 326-6900 FAX: (661) 326-6985

Printed on recycled paper.

Per your request, the Authority to Construct will be issued with a Certificate of Conformity (COC). Your project will therefore go for EPA Review per District Rule 2520 for a 45-day period at the conclusion of our analysis, prior to the issuance of the final Authority to Construct permits.

We will begin processing your application as soon as possible. In general, complete applications are processed on a first-come first-served basis.

It is estimated that the project analysis process will take 171.2 hours, and you will be charged at the weighted hourly labor rate in accordance with District Rule 3010. This estimate includes the following major processing steps: Determining Completeness (21.2 hours), Engineering Evaluation (60 hours), BACT Analysis (30 hours), Health Risk Assessment (30 hours), CEQA Analysis (20 hours) and Permit Preparation (10 hours). The current weighted labor rate is $90.00 per hour, but please note that this fee is revised annually to reflect actual costs and therefore may change. No payment is due at this time; an invoice will be sent to you upon completion of this project.

Please note that this letter is not a permit and does not authorize you to proceed with your project. Final approval, if appropriate, will be in the form of ATC permits after application processing is complete. If you have any questions, please contact Mr. Rupi Gill at (209) 557-6400.

Sincerely,
David Warner
Director of Permit Services

Rupi Gill
Permit Services Manager
DW: jk

NCPA CT2
Received by:
Date: 10.6.08

cc: Gerardo Rios, USEPA Reg. IX
75 Hawthorne St.
San Francisco, CA 94205

Tuan Ngo, California Energy Commission – MS 40
1516 9th Street
Sacramento, CA 95814

Jeff Adkins, Sierra Research
1801 J Street
Sacramento, CA 95814

ATTACHMENT DA 5.1-2

Commissioning Activities Quantification and Duration

Table AQ-1
Detailed Emission Calculations for Turbine Commissioning
NCPA Lodi Energy Center

Commissioning Test	Activity	Days	Daily Operation (hrs/day)	GT Firing Rate (MMBtu/hr)	Pollutant	Emission Factor (lbs/MMBtu)	Hourly Emissions (lbs/hr)	Daily Emissions (lbs/day)	Total Emissions During Test (lbs)
FSNL + Ign. Tests	FSNL Operation	2	8	400	NOx		125	1,000.0	2,000.0
					CO		900	7,200.0	14,400.0
					VOC		16.00	128.0	256.0
					SOx	0.0028	1.12	9.0	17.9
					PM10		9.00	72.0	144.0
Steam Blows	Part Load Operation	3	10	1,220	NOx		400	4,000.0	12,000.0
					CO		2000	20,000.0	60,000.0
					VOC		16	160.0	480.0
					SOx	0.0028	3.42	34.2	102.5
					PM10		9.00	90.0	270.0
Part Load Tests	Part Load Operation	4	12	1,220	NOx	0.1088	132.71	1,592.5	6,369.9
					CO		385	4,620.0	18,480.0
					VOC		16.00	192.0	768.0
					SOx	0.00280	3.42	41.0	164.0
					PM10		9.00	108.0	432.0
Full Load Tests without SCR operational	Full Load Operation	4	12	1,885	NOx	0.0326	61.55	738.6	2,954.3
					CO	0.0066	12.46	149.5	598.1
					VOC	0.00180	3.33	40.0	159.8
					SOx	0.00280	5.37	64.4	257.8
					PM10		9.00	108.0	432.0
Multiple Load Tests with SCR at partial control	Startup/Shutdown	5	3	1,885	NOx		100.00	638.7	3,193.3
					CO		900.00	2812.1	14,060.7
					VOC		16.00	78.0	389.9
					SOx	0.0028	5.37	64.4	322.2
					PM10		9.00	108.0	540.0
	Full Load Operation		9		NOx	0.0200	37.63	inc	inc
					CO	0.0066	12.46	inc	inc
					VOC	0.0018	3.33	inc	inc
					SOx	0.0028	5.37	inc	inc
					PM10		9.00	inc	inc
Performance Tests with SCR at full control	Startup/Shutdown	10	3	1,885	NOx		100.00	437.3	4,372.5
					CO		900.00	2825.4	28,253.7
					VOC		16.00	95.9	958.8
					SOx	0.0028	5.37	70.1	701.1
					PM10		9.00	126.0	1,260.0
	Full Load Operation w/ Duct Firing		9	2,107.2	NOx	0.0072	15.25	inc	inc
					CO	0.0066	13.93	inc	inc
					VOC	0.0028	5.32	inc	inc
					SOx	0.0028	6.00	inc	inc
					PM10		11.00	inc	inc
Total Commissioning Hours:			292						

1. Emission factors during FSNL and ignition tests
   - NOx - based on max expected hourly emission rate of 125 lbs/hr.
   - CO - based on startup emission rate of 900 lbs/hr.
   - VOC, SOx and PM10 - based on startup emission rates and 1.0 grain S/100 dscf n.g.
2. Emission factors during steam blows
   - NOx - based on max expected hourly emission rate of 400 lbs/hr.
   - CO - based on maximum expected hourly emission rate of 2000 lbs/hr.
   - VOC, SOx and PM10 - based on startup emission rates and 1.0 grain S/100 dscf n.g.
3. Emission factors during part load tests
   - NOx - based on estimate for part load test tuning combustor (ppm @ 15% O2) = 30
   - CO - based on hourly emission rate used for Crockett Cogeneration plant commissioning period.
   - VOC, SOx and PM10 - based on startup emission rates and 1.0 grain S/100 dscf n.g.
4. Emission factors during full load tests without SCR operational
   - NOx level in ppmvd @ 15% O_2 = 9
   - CO, VOC - based on combustor operating in pre-mix mode (3 ppmc CO and 1.4 ppmc for VOC).
   - SOx and PM10 - emission factors based on fuel flow and 1.0 grain S/100 dscf n.g..
5. Emission factors during full load tests with SCR partially operational
   - NOx - based information with combustor operating in pre-mix mode and SCR controlling NOx to 5.5 ppmc.
   - CO, VOC - based on combustor operating in pre-mix mode (3 ppmc CO, 1.4 ppmc for VOC).
   - SOx and PM10 - emission factors based on fuel flow and 1.0 grain S/100 dscf n.g..
6. Emission factors during full load tests with SCR fully operational
   - NOx - based on combustor operating in pre-mix mode and SCR operational (2 ppmc NOx).
   - CO, VOC - based on combustor operating in pre-mix mode and ox cat operational, 3 hours of startups (3 ppmc CO, 1.4/2.0 ppmc for VOC for 9 hours; 900 lb/hr for CO and 16 lb/hr for VOC during startups).
   - SOx and PM10 - emission factors based on fuel flow and 1.0 grain S/100 dscf n.g..
7. Startup and shutdown emission rates unchanged.

Table AQ-2
Emissions During Commissioning
NCPA Lodi Energy Center

	Maximum Hourly and Daily Emissions									
	Peak Hour Emissions					Peak Day Emissions				
	NOx	CO	VOC	SOx	PM10	NOx	CO	VOC	SOx	PM10
Unit	(lbs/hr)					(lbs/day)				
One Gas Turbine in Steam Blow	400.0	2,000.0	16.0	6.0	11.0	4,000	20,000	192.0	70.1	126
Aux. Boiler	0.5	2.37	0.3	0.19	0.47	6.5	28.5	3.3	2.2	5.6
Total	400.5	2,002.4	16.3	6.2	11.5	4,007	20,028	195	72	132

	Total Commissioning Emissions				
	NOx	CO	VOC	SOx	PM10
Unit	(lbs)				
Gas Turbine/HRSG	30,890	135,792	2,853	1,565	3,078
Aux. Boiler (based on 60 hrs)	33	142	16	11	28
Total	30,923	135,935	2,869	1,577	3,106

5.2 Biological Resources

4. Wetlands Map (Appendix B (g) (13) (B) (iii))

An aerial photo or wetlands delineation maps at a scale of (1:2,400) showing any potential jurisdictional and non-jurisdictional wetlands delineated out to 250 feet from the edge of disturbance if wetlands occur within 250 feet of the project site and/or related facilities that would be included with the US Army Corps of Engineers (USACE) Section 404 Permit application. For projects proposed to be located within the coastal zone, also provide aerial photographs or maps as described above that identify wetlands as defined by the Coastal Act.

Information required to make AFC conform with regulations:

Please provide a map at a scale of 1 inch equals 200 feet (1:2,400) showing potential jurisdictional and non-jurisdictional wetlands and waters of the state for the project area.

Response: Please see the attached Figures DA 5.2-1a and b which identify waters in the project area.

5. Survey Protocol (Appendix (g) (13) (D) (i))

Current biological resources surveys conducted using appropriate field survey protocols during the appropriate season(s). State and federal agencies with jurisdiction shall be consulted for field survey protocol guidance prior to surveys if a protocol exists;

Information required to make AFC conform with regulations:

Please provide a discussion on survey protocols for burrowing owl, giant garter snake, and Swainson's hawk.

Please contact the appropriate state or federal agency for field survey protocol guidance.

Response: As discussed in conversations with the California Department of Fish and Game (CDFG) and provided as Attachment DA 5.2-1, preconstruction surveys will be completed for the giant garter snake, Swainson's hawk, and burrowing owl as described below.

Giant Garter Snake
The large agricultural irrigation canal located immediately south of the proposed project site provides suitable habitat for the federally threatened giant garter snake. Because giant garter snakes have been found in similar drainages in the project vicinity this species is assumed to have the potential to occur in the project area and, therefore, no protocol-level surveys to determine presence or absence will be conducted for this species. However, as part of the avoidance and minimization measures, the project area will be surveyed for giant garter snakes 24 hours prior to the start of any site mobilization or construction activities. Surveys will be conducted by a qualified biologist with knowledge and experience in the biology, ecology, and identification of the species. Additional avoidance and minimization measures will include conducting worker environmental awareness training, placement of flagging and fencing around sensitive habitats, and other measures developed in coordination with the San Joaquin County Multi-Species Habitat Conservation Plan

(MSHCP) oversight committee (including representatives from the U.S. Fish and Wildlife Service [USFWS] and CDFG).

Swainson's Hawk
Pre-construction surveys for Swainson's hawks will follow the methodology developed by the Swainson's Hawk Technical Advisory Committee (May 31, 2000) and will include all suitable nesting habitat within a 0.5-mile radius around the project area. Surveys will include a combination of driving and pedestrian methods to look for nesting activity and will be conducted by a qualified biologist familiar with the identification, behavior and general ecology of the species. Surveys would be completed for a minimum of two survey periods: one between March 20 and April 5, and the second between April 5 and April 20. In the event a nest location is identified within 0.5 mile of the project area, the appropriate avoidance and minimization measures would be developed in consultation with the MSHCP oversight committee and CDFG. Such measures may include the presence of a biological monitor, conducting worker environmental awareness training, flagging, avoidance of the nest area, and restricted work activities during the breeding season.

Burrowing Owl
Preconstruction surveys for burrowing owls will follow the methodology developed by the California Burrowing Owl Consortium (April 1993) and will include all suitable habitat within a 500-foot buffer area around the project site. Pedestrian surveys of the project area will be conducted, including the buffer area, to search for burrows or nest sites as indicated by excrement, molted feathers, cast pellets, or prey remains. Surveys will be conducted by a qualified biologist familiar with the identification, behavior, and general ecology of the species. In the event an occupied nest is identified on the project site or in the buffer area, appropriate avoidance and minimization measures would be developed in consultation with CDFG. Such measures may include the presence of a biological monitor, conducting worker environmental awareness training, flagging, avoidance of the nest area, and restricted work activities during the breeding season.

Other Nesting Bird Species
Nesting bird species are protected under Section 3503 of the California Fish and Game Code as well as the Migratory Bird Treaty Act. During the initial biological surveys, nesting species were observed in the immediate vicinity of the project site. Comprehensive nesting bird surveys will be conducted concurrent with the preconstruction surveys for Swainson's hawk and burrowing owls. All active nest locations will be recorded and mapped, and appropriate avoidance and minimization measures will be taken to protect any discovered nests during the breeding season.

6. Sensitive Species (Appendix (g) (13) (E) (i))

All impacts (direct, indirect, and cumulative) to biological resources from project site preparation, construction activities, plant operation, maintenance, and closure. Discussion shall also address sensitive species habitat impacts from cooling tower drift and air emissions;

Information required to make AFC conform with regulations:

Please address sensitive species habitat impacts from cooling tower drift and air emissions.

Response: The maximum annual predicted concentration of particulate matter from the project (chiefly from the cooling tower) is 0.94 µg/m^3. Assuming a deposition velocity of 2 cm/sec (worst-case deposition velocity, as recommended by the California Air Resources Board), this concentration converts to an annual deposition rate of 0.58 µg/m^2/year, which is several orders of magnitude below the 365 µg/m^2/year which is expected to result in mechanical injury to vegetation (Lerman and Darley, 1975).

Potential impacts of air emissions of other pollutants are discussed in Section 5.1.7.1.1 Federal Prevention of Significant Deterioration Program, p. 5.1-61 of the AFC. Maximum modeled concentrations of NOx, CO, and SO_2 from the project are compared with screening criteria provided in EPA guidance in Table 5.1-41 (Project Impacts to Vegetation and Sensitive Species). The text from Section 5.1.7.1.1 has been provided below:

5.1.7.1.1 Federal Prevention of Significant Deterioration Program

Vegetation, Soils and Sensitive Species

The LEC will be located in an area that is primarily agricultural. Criteria for evaluating impacts on soils and vegetation are provided by EPA guidance.[1] This document includes minimum impact levels for effects on sensitive vegetation and crops. Modeled project impacts are compared with these impact levels in Table 5.1-41 to demonstrate that no adverse impacts on vegetation are expected as a result of the project.

TABLE 5.1-41
Project Impacts to Vegetation and Sensitive Species

Pollutant	Averaging Period	Modeled Project Impacts (µg/m^3)	Ambient Background (µg/m^3)	Total (µg/m^3)	Minimum Ambient Concentration for Effects on Sensitive Plants (µg/m^3)
NO_2	4 hours[a]	27.5	163.6	191	3,760
	8 hours[a]	27.5	163.6	191	3,760
	1 month[a]	27.5	163.6	191	564
	Annual	0.3	34.0	34.3	94
SO_2	1 hour	10.4	46.8	57.2	917
	3 hours	7.6	28.6	36.2	786
	Annual	0.1	2.7	2.8	18
CO	1 week[b]	111	3,178	3,289	1,800,000

[a]*Maximum modeled 1-hour average NO_2 concentrations used to conservatively represent impacts for averaging periods up to one month.*

[b]*Maximum modeled 8-hour average CO concentration used to conservatively represent 1-week average impact.*

This comparison demonstrates that no adverse impacts on vegetation are expected as a result of the project. Therefore, no air emissions impacts are expected to occur to sensitive species habitats.

[1] Smith, A. E., and J. B. Levenson. *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals*. Research Triangle Park, N.C.: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, 1980.

7. Biological Resource Awareness Training (Appendix (g) (13) (F) (v))

Educational programs to enhance employee awareness during construction and operation to protect biological resources.

Information required to make AFC conform with regulations:

Please provide a discussion of the educational programs to be used to enhance employee awareness during construction and operation.

Response: Prior to the start of construction, materials will be prepared that discuss sensitive biological resources in the project vicinity. Training materials will include photographs of specific special-status species such as the giant garter snake, Swainson's hawk and burrowing owl, and information on appropriate avoidance and minimization measures required to protect these species. Training materials will also include information on nesting birds, including non-listed species that are protected. Information materials will include a discussion of applicable state and federal laws and regulations as well as potential consequences for violations. Contact information for the designated biologist and biological monitors will also be included. Training materials may include one or more of the following: color brochures, posters, tailgate briefings, and a training video.

8. Biological Resource Awareness Training (Appendix (g) (13) (H))

Submit copies of any preliminary correspondence between the project applicant and state and federal resource agencies regarding whether federal or state permits from other agencies such as the U. S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the U.S. Army Corps of Engineers (USACE), the California Department of Fish and Game (CDFG), and the Regional Water Quality Control Board (RWQCB) will be required for the proposed project.

Information required to make AFC conform with regulations:

Please provide any preliminary correspondence with state and federal agency personnel.

Please contact the USACE regarding the presence or absence of jurisdictional waters of the U.S. on the project site.

Response: The agencies identified in Table DA 5.2-1 have been contacted regarding the proposed project, and copies of the records of conversation are provided as Attachment DA 5.2-1:

TABLE DA 5.2-1
Agency Contacts

Agency	Contact	Date
San Joaquin Council of Governments (Multi-Species Habitat Conservation Plan)	Steve Mayo and Anne-Marie Castillou	9/3/2008
California Department of Fish and Game	Josh Bush	9/3/2008
U.S. Fish and Wildlife Service	Marry Hammer	10/16/2008
U.S. Army Corps of Engineers	Kate Dadey	10/23/2008

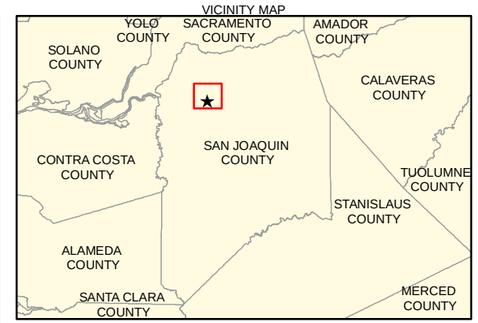
Summaries of the conversations to date are provided below:

San Joaquin Council of Governments
During a phone conversation with CH2M HILL biologist Russell Huddleston on September 3, 2008, Mr. Mayo explained that the giant garter snake and Swainson's hawk are both included in the San Joaquin County MSHCP and that this project would qualify to work under the existing plan. It was explained that protocol-level surveys would need to be conducted prior to construction for Swainson's hawks, and appropriate mitigation and avoidance measures described in the MSHCP would need to be followed. For the giant garter snake, Mr. Mayo explained that the MSHCP requires a 200-foot setback from areas of potential habitat. Mr. Huddleston explained that the drainage canal, located immediately south of the property would likely be closer than 200 feet from the project. Mr. Mayo stated that we should coordinate with Ms. Castillou to propose a buffer reduction proposal to be submitted to the MSHCP review committee that would include representatives from USFWS and CDFG. The committee would need to approve the buffer reduction area for the project to move forward under the MSHCP, but both Mr. Mayo and Ms. Castillou did not think this would be a problem as long as adequate information was provided as to the need for the reduction and appropriate measures were taken to ensure that no take would occur.

California Department of Fish and Game
During a phone conservation with CH2M HILL project manager/biologist Marjorie Eisert on September 3, 2008, Mr. Bush suggested that preconstruction surveys for pond turtle, giant garter snake, white-tailed kite, Swainson's hawk, and burrowing owl seemed sufficient for the proposed project. Mr. Bush also informed Ms. Eisert that CDFG recently filled the vacant San Joaquin County biologist position and that Eric Kleinfelter will be the biologist in charge of this project review. Mr. Bush indicated he will start a file for the project which will be passed on to Mr. Kleinfelter when he assumes his position in a couple of weeks. During a call between Mr. Kleinfelter and CH2M HILL biologist Russell Huddleston on October 20, 2008, Mr. Kleinfelter stated he may not be the correct resource as he does not do environmental review. He will be contacting Mr. Huddleston at a later date to provide correct contact information.

U.S. Fish and Wildlife Service
CH2M HILL biologist Russell Huddleston called and sent an e-mail to Marry Hammer with USFWS on October 15, 2008. Ms. Hammer replied via e-mail on October 16, 2008 that she would be on leave through October 30, 2008, but would be available to discuss the project on her return. Mr. Huddleston responded that he would follow up the first week of November.

U.S. Army Corps of Engineers
CH2M HILL biologist Russell Huddleston called and sent an email to Kate Dadey, project manager for San Joaquin County with the U.S. Army Corps of Engineers (USACE) to discuss the project and confirm that no jurisdictional wetlands or waters of the U.S. would be impacted by the proposed project. In addition, a copy of the wetlands and waters maps along with site photographs and descriptions has been provided to the USACE. Ms. Dadey has not yet responded.



LEGEND

- Natural Gas Pipeline
- 250-foot Buffer of Sites
- Project Sites

Potential Jurisdictional Waters of the U.S/State

- Irrigation Canal

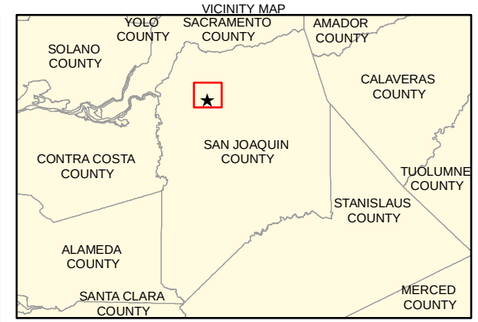
Potential Non-Jurisdictional Waters of the U.S/State

- Agricultural Drainage Ditch
- Vector Control Pond
- Water Treatment Pond

N

0 100 200
Feet

Figure DA 5.2-1a
Water Features
Lodi Energy Center
San Joaquin County, CA



LEGEND

Natural Gas Pipeline

Potential Non-Jursidictional Waters of the U.S/State

Agricultural Drainage Ditch

N

0 400 800

Feet

Figure DA 5.2-1b
Water Features- Natural Gas Line
Lodi Energy Center
San Joaquin County, CA

ATTACHMENT DA 5.2-1

Records of Conversation

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To: Steve Mayo and Anne-Marie Castillou with the San Joaquin Council of Governments MSHCP Program

Phone No.: 209-468-3913 **Date:** September 3, 2008

Call From: Russell Huddleston/BAO **Time:** 11:00 AM

Subject: Lodi Energy Center Special-Status Species

Project No.: 371322

Conference call between Mr. Mayo, Ms. Castillo and Mr. Huddleston to discuss the proposed Lodi Energy Center adjacent to the City of Lodi's White Slough Water Pollution Control Facility (WPCF) and the existing Northern California Power Agency Combustion Turbine Project STIG #2 Plant. Mr. Huddleston provided a brief introduction to the project and a summary of the biological resource surveys that have been conducted for the site. It was noted that the primary issues with special-status species would be Swainson's Hawk and the giant garter snake. Mr. Mayo explained that both of these species are included in the San Joaquin County Multi-Species Habitat Conservation Plan (MSHCP) and that this project would qualify to work under the existing plan. It was explained that protocol level surveys would need to be conducted prior to construction for Swainson's Hawks and appropriate mitigation and avoidance measures described in the MSHCP would need to be followed. For the giant garter snake Mr. Mayo explained that the MSHCP requires a 200-foot set back from areas of potential habitat. Mr. Huddleston explained that the drainage canal, located immediately south of the property would likely be closer than 200 feet from the project. Mr. Mayo stated that we should coordinate with Ms. Castillou to propose a buffer reduction proposal that would be submitted to the MSHCP review committee that would included representatives from the U.S. Fish and Wildlife Service and the California Department of Fish and Game. The committee would need to approve the buffer reduction area for the project to move forward under the MSHCP, but both Mr. Mayo and Ms. Castillou did not think this would be a problem as long as adequate information was provided as to the need for the reduction and appropriate measures were taken to ensure that no take would occur. Mr. Mayo explained that the MSHCP does not authorize take of giant garter snake.

Mr. Huddleston will provide additional information on the project to the San Joaquin Council of Governments MSHCP program and work with Ms. Castillo on the proposed buffer reduction for the giant garter snake and offered to coordinate a site visit. Mr. Mayo indicated that consultation with the MSHCP should occur no later than 4 to 6 months before construction begins.

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To: Josh Bush/CDFG

Phone No.: 916-358-1330 **Date:** September 3, 2008

Call From: Marjorie Eisert **Time:** 1:45 PM

Message Taken By: Marjorie Eisert

Subject: LEC Biological Resources – permitting/survey recommendations

I called CDFG to discuss survey/permitting requirements for the LEC project. I provided a general overview of the project and species identified as potentially affected by the project: western pond turtle, giant garter snake, burrowing owl, white-tailed kite, and Swainson's hawk. I discussed the AFC and the proposed preconstruction survey methods for determining special-status species use of the site. I also discussed the use of BMPs to protect the integrity of the drainage ditch located along the proposed gas line route.

Based on the initial information provided, implementation of preconstruction surveys for pond turtle, giant garter snake, white-tailed kite, Swainson's hawk and burrowing owl seemed sufficient for the proposed project. However, Mr. Bush informed me that they recently filled the vacant San Joaquin County biologist position and that Eric Kleinfelter would be the biologist in charge of this project review. He will start a file for the project that will be passed on to Mr. Kleinfelter when he assumes his position in a couple of weeks. I informed him that this project will be filed with the CEC later this week and that Mr. Kleinfelter will be contacted for his input on the application.

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From: Huddleston, Russell/BAO
Sent: Monday, October 20, 2008 2:30 PM
To: Madams, Sarah/SAC
Subject: FW: Lodi Energy Center

Attachments: Canal_south_edge_property.JPG; Plant_Site_View_South.JPG; Plant_Site_View North.JPG; Figure_1_1_2_Vicinity Map.pdf; Wildlife Survey.pdf

Russell Huddleston PWS
Wetlands Ecologist / Botanist
CH2MHILL
Office (510) 587-7681
Cell (916) 296-6792
Russell.Huddleston@ch2m.com

From: Mary_Hammer@fws.gov [mailto:Mary_Hammer@fws.gov]
Sent: Thursday, October 16, 2008 9:39 AM
To: Huddleston, Russell/BAO
Subject: Re: Lodi Energy Center

Hi Russell,
I am going on annual leave for a few weeks and am frantically trying to catch up on a few things before I leave, so would it be OK if we chatted about this project when I return around the 30th?

Mary

<Russell.Huddleston@CH2M.com>

10/15/2008 02:13 PM

To <Mary_Hammer@fws.gov>
cc
Subject Lodi Energy Center

Hi Mary -

I just left you a voice mail, but I also wanted to provide you with some additional background information. As I mentioned on the phone we are working with the City of Lodi and the Northern California Power Agency (NCPA) on a new power plant that would be located near Lodi, adjacent to the City of Lodi's White Slough Water Pollution Control Facility and NCPA Combustion Turbine Project STIG #2. The San Joaquin County Mosquito and Vector Control facility is located to the south. The majority of the proposed development site (approximately 3.4 acres) has previously been graded and is currently being used as a lay down and staging area for ongoing construction at the water treatment Plant. We have had an initial discussion with the environmental staff at the San Joaquin Council of Governments regarding coverage of this project under the San Joaquin County MSHCP. Principle species of concern are the giant garter snake, Swainson's hawk and burrowing owls. There are no wetlands on site, but there is a large agricultural canal along the southern end of the property that is within approximately 25-30 feet of the work area. This area is considered to be potential GGS habitat. In my discussions with Steve Mayo and Anne-Marie Castillou with the San Joaquin Council of Governments MSHCP Program its sounds like we need to work with them to develop an avoidance and mitigation plan fro GGS that would be submit to the MSHCP oversight committee. At this point we are still in the relatively early stage of planning and permitting, but I wanted to

be sure to touch base with the agency folks so that you are aware of the project and our current plans to work with the City and County under the MSHCP for this project. I have attached a few maps and photos, please let me know if I can provide any other information that would be useful at this point.

Thanks for your time,

Regards,

Russ

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Russell.Huddleston@ch2m.com

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To: Kate Dadey/USACE

Phone No.: 916-557-7253 **Date:** October 23, 2008

Call From: Russell Huddleston **Time:** 11:40 AM

Message Taken By: Russell Huddleston

Subject: Lodi Energy Center

I sent an e-mail to Ms. Dadey earlier this morning with a brief description of the project and attached maps showing the wetland and water resources in the vicinity of the project. The e-mail indicated that I would like to discuss the project with her in more detail. Followed up with a phone call to discuss the project. Left a message with my name and number and asked that she return my call at her earliest convenience.

.

5.3 Cultural Resources

9. Cultural Survey (Appendix B (g) (2) (C))

The results of new surveys or surveys less than 5 years old shall be provided if survey records of the area potentially affected by the project are more than five (5) years old. Surveys to identify new cultural resources must be completed by (or under the direction of) individuals who meet the Secretary of the Interior's Professional Standards for the technical area addressed.

New pedestrian archaeological surveys shall be conducted inclusive of the project site and project linear facility routes, extending to no less than 200' around the project site, substations and staging areas, and to no less than 50' to either side of the right-of-way of project linear facility routes. New historic architecture field surveys in rural areas shall be conducted inclusive of the project site and the project linear facility routes, extending no less than .5 mile out from the proposed plant site and from the routes of all above-ground linear facilities. New historic architecture field surveys in urban and suburban areas shall be conducted inclusive of the project site, extending no less than one parcel's distance from all proposed plant site boundaries. New historic architecture field reconnaissance ("windshield survey") in urban and suburban areas shall be conducted along the routes of all linear facilities to identify, inventory, and characterize structures and districts that appear to be older than 45 years or that are exceptionally significant, whatever their age.

Information required to make AFC conform with regulations:

Applicant needs to submit the names and qualifications for the architectural surveyors or directors. Response for this item will also be sufficient for item B (g) (2) (C) (v).

Response: Elizabeth Calvit reviewed archival research conducted during the original literature search for this project. Her curriculum vita is provided as Attachment DA 5.3-1.

10. Cultural Survey (Appendix B (g) (2) (C))

The results of new surveys or surveys less than 5 years old shall be provided if survey records of the area potentially affected by the project are more than five (5) years old. Surveys to identify new cultural resources must be completed by (or under the direction of) individuals who meet the Secretary of the Interior's Professional Standards for the technical area addressed.

New pedestrian archaeological surveys shall be conducted inclusive of the project site and project linear facility routes, extending to no less than 200' around the project site, substations and staging areas, and to no less than 50' to either side of the right-of-way of project linear facility routes. New historic architecture field surveys in rural areas shall be conducted inclusive of the project site and the project linear facility routes, extending no less than .5 mile out from the proposed plant site and from the routes of all above-ground linear facilities. New historic architecture field surveys in urban and suburban areas shall be conducted inclusive of the project site, extending no less than one parcel's distance from all proposed plant site boundaries. New historic architecture field reconnaissance ("windshield survey") in urban and suburban areas shall be conducted along the routes of all linear facilities to identify, inventory, and characterize structures and districts that appear to be older than 45 years or that are exceptionally significant, whatever their age.

Information required to make AFC conform with regulations:

Applicant needs to have a qualified architectural historian write a technical report for the built environment survey. A built environment survey was conducted by an archaeologist and does not meet the Secretary of the Interior Standards for a built environment survey. All sections pertaining to the built environment need to be verified and updated once the new built environmental survey is completed by a qualified architectural historian.

Response: As directed by the CEC regulations, new historic architecture field surveys in rural areas shall be conducted inclusive of the project site and the project linear facility routes, extending no less than 0.5 mile out from the proposed plant site and from the routes of all aboveground linear facilities. All linear facilities for this project are located below ground with the exception of some transmission structures that will be located on the project site. Because all offsite linears will be located below ground and no structures are located on the project site or within 0.5 mile that are older than 45 years, no architectural survey was conducted. Instead, an architectural historian conducted archival research, a review of historic topographic maps, and a review of the archaeological survey findings. Results of this review are discussed below.

Archival research conducted during the literature search revealed the presence of two buildings labeled 'Pump House' located on the 1952 7.5' *Terminous* topographic quadrangle map. During the archaeological survey, these buildings were no longer there, and their locations were photographed by the CH2M HILL archaeologist and provided to the CH2M HILL architectural historian. The only other buildings located within the 0.5-mile radius from the proposed plant site include the City of Lodi White Slough Water Pollution Control Facility (WPCF), constructed in 1966, and the NCPA Combustion Turbine Project STIG #2 (STIG plant) constructed in 1993. Improvements and upgrades to the WPCF facility have continued since initial construction. The laboratory building, constructed in 1966, was expanded in 1989; the control building, constructed in 1966 was upgraded in 1998 and 2002; and the original administration building was remodeled in 2007. Additional improvements to other facilities at the WPCF were made in 1992, 2003, and 2004. Pump stations associated with the San Joaquin County Mosquito and Vector Control District (Vector Control) mosquito fish breeding program are also located on the WPCF property. These pump stations were constructed 1995 and 1996, during the original construction of the breeding ponds (San Joaquin County Mosquito and Vector Control District, 2008, personal communication). (See Section 5.3 of AFC for other references and further information.)

11. Cultural Survey (Appendix B (g) (2) (C) (ii))

The survey procedures and methodology used to identify cultural resources and a discussion of the cultural resources identified by the survey;

Information required to make AFC conform with regulations:

See comment above.

Response: A literature search was conducted to determine the existing structures within a 0.5-mile radius of the LEC project site. Additional archival research included contacting the San Joaquin County Assessor's Office, the San Joaquin Community Development Department, the City of Lodi Building Department, and the San Joaquin County Mosquito

and Vector Control District. Addresses and parcel numbers for properties within a 0.5-mile radius of the LEC project site were provided to the previously mentioned offices, and building permits were pulled and reviewed for the following addresses and parcel numbers: 12745 N. Thornton Road, 12751 N. Thornton Road and APNs 055-130-15 (retired APN), 055-130-16, 055-120-11, and 055-150-29. Based on the results of the literature search and archival research, there are no historic structures within the project site or Area of Potential Effect. Table DA 5.3-1 identifies the existing structures within the Area of Potential Effect. The WPCF was constructed in 1966. Since its construction, improvements have been made to existing structures. The laboratory building was expanded in 1989; the control building was upgraded in 1998 and 2002, and the administration building was remodeled in 2007. Additional improvements to other facilities at the WPCF were made in 1992, 2003, and 2004. Also located on the WPCF property are the Vector Control mosquito fish breeding ponds. Structures associated with this program were constructed in 1995 and 1996 when the program began. The other structure in the area is the STIG plant, constructed in 1993. Table DA 5.3-1 summarizes the buildings and construction dates for the resources within the project area. In addition to these resources is a large concrete standpipe. Its construction date is unknown, but the field survey suggests that it was constructed post-1970 and appears to be related to the agricultural fields south of the project site.

To be eligible for the National Register of Historic Places (NRHP) a building typically needs to be over 50 years of age to fully be evaluated for its historic significance. If a building is less then 50 years of age, it can be eligible for listing on the NRHP if it meets the criteria of exceptional significance. Based on the literature review and information on existing structures, no structures over 50 years of age exist within the project area. Additionally, no structures less than 50 years of age that would be considered exceptionally significant exist within the project area.

TABLE DA 5.3-1
Standing Structures within the 0.5-Mile Radius of the LEC

Building type/name	Build date
White Slough Pollution Control Facility: Control Building	1966, upgrades in 1998, 2002
White Slough Pollution Control Facility: RAS Pump Station	1966
White Slough Pollution Control Facility: Administration Building	1966, upgrades in 2007
White Slough Pollution Control Facility: Chlorination Building	1966
White Slough Pollution Control Facility: Storage shed	1966
White Slough Pollution Control Facility: Sludge Dewatering Building	1966
White Slough Pollution Control Facility: Dissolved Air Flotation Thickening (DAFT) Unit No. 1 Building	1966
White Slough Pollution Control Facility: DAFT Unit No. 2 Building	1966
White Slough Pollution Control Facility: Boiler Headworks Building	1966
White Slough Pollution Control Facility: Storage Shed	1966
White Slough Pollution Control Facility: Laboratory Building	1966, expanded in 1989

TABLE DA 5.3-1
Standing Structures within the 0.5-Mile Radius of the LEC

Building type/name	Build date
San Joaquin County Mosquito and Vector Control District Pump Stations	1995/1996
NCPA Combustion Turbine Project STIG #2 Plant Buildings	1993

Sources: California Historical Resources Information System (CHRIS), Central California Information Center; City of Lodi, Building Department; San Joaquin Community Development Department; San Joaquin County Assessor's Office; NCPA Combustion Turbine Project STIG #2, Operations and Maintenance Manager; San Joaquin County Mosquito and Vector Control District, Assistant Manager

12. Architectural Forms (Appendix B (g) (2) (C) (iii))

Copies of all new and updated DPR 523(A) forms. If a cultural resource may be impacted by the project, also include the appropriate DPR 523 detail form for each such resource;

Information required to make AFC conform with regulations:

If new resources are found, then DPR523(A) form needs to be submitted.

Response: No historic resources were found within the project area that would require DPR523(A) forms.

13. Architecture Qualifications (Appendix B (g) (2) (C) (v))

The names and qualifications of the cultural resources specialists who contributed to and were responsible for literature searches, surveys, and preparation of the technical report.

Qualifications of surveyor and author of survey technical report.

Information required to make AFC conform with regulations:

Applicant needs to provide the qualifications for the architectural historian responsible for the survey and preparation of the technical report.

Response: Please see Attachment DA 5.3-1 for a copy of Elizabeth Calvit's resume.

Figure DA 5.3-1
Cultural Study Area
Lodi Energy Center
San Joaquin County, CA

ATTACHMENT DA5.3-1

Architectural Historian Resume

Elizabeth D. Calvit

Cultural Resource Specialist

Education

M.A., American Studies/Graduate Program in Historic Preservation, The George Washington University, September 1994

B.I.D., Interior Design, FIDER-accredited, Louisiana State University, 1991

B.S., General Studies (Psychology and Art History), Louisiana State University, 1981

Distinguishing Qualifications

- Qualified as a historian, an architectural historian, and a historic preservationist under the Secretary of the Interior's Historic Preservation Professional Qualification Standards, as defined in 36 *Code of Federal Regulations* (CFR) 61
- Experienced in cultural resource investigations in compliance with the National Environmental Policy Act, the National Historic Preservation Act, Section 106, and a variety of other federal cultural resource regulations
- Specializes in cultural resources of the U.S. Department of Defense (DoD), particularly Cold War-era resources

Relevant Experience

Ms. Calvit is a cultural resource specialist with more than 16 years of experience. She has participated in the technical aspects of CH2M HILL projects and managed a number of environmental projects, using her expertise in cultural resources. She has been extensively involved in the management of and participation in cultural resource investigations in compliance with the National Environmental Policy Act (NEPA), the National Historic Preservation Act (NHPA), Section 106, and a variety of other federal cultural resource regulations.

Representative Projects

Cultural Resources Projects

Cultural Resources Task Lead and Senior Technical Reviewer: Fort Wainwright, Alaska, December 2006 to Present. Serve as cultural resources task lead and senior technical reviewer for the Aviation EIS for Ft. Wainwright. The project includes evaluating the current National Historic Landmark District and Cold War resources. The base will be changing and altering its facilities with base realignment. The project will evaluate the potential impacts to the NHL with the demolition of two birch wood hangars. Serve as the primary author for the cultural resources technical report and the cultural resources sections of the EIS.

Cultural Resources Task Lead; Progress Energy HNP COLA ER, North Carolina and Florida; May 2006 to Present. Serve as cultural resources task lead and senior technical reviewer for the cultural resources component for this project. Potential impacts include affects to archaeological resources due to raising the lake level and standing structures that might be inundated by water.

Project Technical Staff; Port of Long Beach Cultural Resources Survey and Management Plan; Long Beach, California; January 2006 to December 2006. Conducted cultural resource survey and evaluation of all facilities in the Port of Long Beach, the second busiest port in the United States. Project included the development of a cultural resources management plan for the Port, which is a working industrial area with significant ongoing hazardous material remediation and redevelopment needs.

Task Manager and Primary Author; 11th Street Bridges Environmental Impact Statement, Washington, DC; August 2005 to March 2007. Currently serving as the task lead and primary author for a fast-tracked EIS for the District Department of Transportation. This complex and fast tracked project will evaluate the impacts for the replacement of two bridges over the Anacostia River. Project responsibilities include leading the cultural resources section including hiring and coordinating with the sub consultant for the archaeological services. Developed the extent of the survey area, initiated and coordinated with DC State Historic Preservation Office (SHPO) on Section 106.

Project Manager and Task Lead, Historic Building Maintenance Plan and Programmatic Agreement, Scott Air Force Base, IL. October 2005 to March 2006. Project manager and lead for two tasks at Scott AFB. This project will develop a plan to guide base staff on the maintenance of the numerous historic resources on the base. The Programmatic Agreement will help the base coordinate with the SHPO on the base's goals to meet its mission and help preserve it historic resources.

Task Lead, Port Townsend, Washington. May 2005 to Present. Task lead for the review and evaluation of structures in the project area around the ferry terminal in Port Towsend. Project work has included initiating Section 106 review with SHPO, developing the Area of potential effect, surveying the project and proposed APE and drafting the cultural resources report.

Task Lead, Texas Department of Transportation. February 2006 to October 2006. Task lead for three small transportation projects in central Texas. Project work included developing research methodology and APE for concurrence with SHPO, survey of APE and final report on potential impacts of proposed highway improvements.

Task Lead, Santa Susana Field Laboratory, California. September 2005 to February 2006. Task lead to review and evaluate the structures at the lab to determine the potential historically significant buildings. The lab is part of the US space program and as such, there are many structures that could be important to the nation's history. This project will assist the lab in its planning process and how it will need to treat its historic resources.

Task Manager; Historic American Building Survey; Fairchild AFB, Washington. November 2004 - March 2005. Task lead and principal author and photographer to document a historic hangar at Fairchild AFB. The project, to document the hangar before planned construction for rehabilitation of the roof, was agreed to in a Memorandum of Agreement. The project will follow Washington SHPO requirements for Level II documentation. Also served as the historic preservation specialist during the design and construction of the new roof system, per the Memorandum of Agreement. The documentation of the hangar was required prior to the demolition of the existing roof and installation of a roof. The documentation was approved by the State Historic Preservation Office with little comment and the project was completed on time and within budget.

Task Manager; Pipeline Permitting Project; Confidential Client; New Orleans, Louisiana. August 2004 - May 2005. Task lead for 6 of 14 distinct tasks for the permitting of a new 75-mile petroleum products pipeline in Louisiana. This project included a conducting a cultural resources survey and report to the Louisiana SHPO and the USACE, New Orleans District, for approval as part of the Section 404/401 and Section 10 permit for the pipeline. Other responsibilities included serving as the task lead for obtaining concurrence from assorted agencies on water quality, water certification, scenic river approval, air quality approval, etc.

Task Manager; Washington Aqueduct Environmental Impact Statement (EIS); Washington, D.C., U.S. Army Corps of Engineers (USACE), Baltimore District. May 2004 - May 2005. Task lead and primary author for the evaluation and determination of potential impacts to cultural resources, both National Register- and National Landmark-designated resources, within the Washington Aqueduct system that potentially could be affected by the proposed project. The EIS considered the alternatives needed to a new method of managing the residuals from the water treatment process. The Washington Aqueduct was under an EPA consent decree to stop placing residuals back into the Potomac River. This was a very intense EIS that had to consider a number of complicated issues while at the same time helping the client to meet its EPA deadline.

Senior Reviewer; Fireboat Ralph J. Scott Preservation Plan; Port of Los Angeles; Los Angeles, CA; August 2003 to February 2005. Reviewed draft and final documents for the development fo a preservation plan for this historic marine vessel, a National Historic Landmark, for the Port of Los Angeles and the Los Angeles Fire Department.

Project Manager and Task Lead; Integrated Cultural Resources Management Plan; Luke AFB, Arizona. November 2003 – March 2004. Project manager and task lead for updating Luke AFB's current Integrated Cultural Resources Management Plan. Project work entailed researching current issues, identifying resources and determining eligibility for listing on the National Register, updating standard operating procedures (SOPs), and developing new ones if necessary.

Project Manager; Integrated Cultural Resource Management Plan; U.S. Air Force Academy, Colorado Springs, Colorado. October 2002 - July 2003. Project manager for the development of an Integrated Cultural Resource Management Plan for the Academy. The Plan, based on the approved Air Force format, focused on integrating the ongoing management of the facility and its significant cultural resources with the unique mission of the Academy. The project included developing a comprehensive, user-friendly document to be used by Academy personnel. The document was designed so that it could be updated as needed in a hard copy format, and would be posted electronically for users on-base.

Project Technical Lead; Environmental Studies Manual; Iowa Department of Transportation, February 2002 - August 2003. Author for the "Cultural Resources" chapter of the *Environmental Studies Manual* for the Iowa DOT. Project work consisted of meeting with the Iowa DOT cultural resource staff to determine requirements for the chapter and reviewing numerous other manuals to create a new document. The new manual would have multiple audiences including new employees, existing DOT staff, and DOT consultants.

Task Manager, Cemetery Relocation, Confidential Client. August 2002-December 2002. Task Manager for researching a historic cemetery and determining the issues involved to relocate an

abandoned cemetery. Worked with the SHPO to determine the needs and potential Section 106 compliance issues with relocating a 150-year old rural cemetery.

Experience Prior to CH2M HILL

Principal, Calvit/Rivers & Associates, Historic Preservation and Design Firm, Nantucket, Massachusetts. Served as the principal for the firm and worked to market and develop work in the areas of historic preservation and design. In this capacity, served as project manager, marketing director, and bookkeeper, and was solely responsible for executing all project work. Managed architectural design projects that included design for both new construction and renovation. Preservation projects included the following: researched and wrote the history of the development and architecture of Quidnet, a small village on Nantucket; and wrote the proceedings for the American Institute of Architects' Historic Resources Committee forum, "Bringing Preservation to the Community."

Research Associate and Director of Culture and Preservation Partnerships, College of Urban and Public Affairs, University of New Orleans, New Orleans, Louisiana. This new program was established to expand the college's efforts in historic preservation and specifically to build a self-sustaining national and international program in historic preservation. As director of the program, oversaw the development of the program, including its name, goals, objectives, budget, and marketing plan. The program was designed to serve as both a local program with public workshops and a national forum for the discussion of current historic preservation and urban planning issues.

Executive Director, Save Our Cemeteries, Inc. (SOC), New Orleans, Louisiana. This local non-profit preservation organization is dedicated to preserving and restoring the historic cemeteries of Louisiana. Served as the executive director for the organization, managed the day-to-day operations, increased public awareness, expanded membership, and sought new avenues for funding. Administrative duties included managing all the day-to-day activities of the 1,000-member organization.

National Legacy Project Manager, National Trust for Historic Preservation, Washington, DC. 1994. This joint project between the National Trust, the DoD, and the National Park Service was funded by the DoD's Legacy Resource Management Program, a multi-year program designed to increase the awareness and the stewardship of cultural and historic resources on DoD installations. Served as project manager for the National Trust's Legacy Project Regional Legacy Coordinators. The project was designed to provide support in cultural resources to DoD installations for 3 regions of the United States, covering approximately 30 states. The goal of the project was to provide installations with cultural resources support; to help raise the DoD's awareness of its stewardship duties; and to develop partnerships between DoD installations and the surrounding communities.

Architectural Historian, CEHP Incorporated, Washington, D.C. Worked on the Cold War History Project, a task area of the DoD Legacy Resource Management Program. Defined historic and architectural themes relating to United States' involvement in the Cold War; surveyed and documented Cold War sites worldwide; researched and analyzed federal and private archival resources; developed and participated in site visits to U.S. military installations nationwide and overseas; and served as project photographer. Assisted in writing and editing the draft and final version of the *Report to Congress: Coming in from the Cold*. Also developed and managed

conferences and workshops for the Cold War History Project and other DoD Legacy Task Areas. Conference speakers and participants included the military services, federal agencies, international non-governmental agencies, and foreign government representatives. Specifically, developed conference programs, interviewed and chose speakers, and helped plan and coordinate the conferences and workshops.

Professional Development

"Section 106: An Introduction," 2001. National Preservation Institute.
"Integrating Cultural Resources in NEPA Compliance." 2002. National Preservation Institute.

Publications and Presentations

"The History and Evolution of Quidnet." July 2000. Quidnet-Squam Association, Quidnet, Massachusetts.

"Saving 'Sconset." Summer 1999. Sconset Trust, Sconset, Massachusetts.

"Bringing Preservation to the Community." Spring 1999. American Institute of Architects' Historic Resources Committee Report.

"Economic Development and Historic Preservation." October 1998. Conference Proceedings, College of Urban and Public Affairs, University of New Orleans, Louisiana.

"The National Trust for Historic Preservation Legacy Project." Spring 1994. *Federal Archeology Report.*

Co-author. May 1993. "Preserving the Legacy of the Cold War." *CRM.*

"The Cold War History Study." Spring 1993. *Federal Archeology Report*.

"Coming in from the Cold," (co-author). U.S. Department of Defense publication in partnership with the National Conference of State Historic Preservation Officers and the National Park Service; draft Winter 1991.

"National Trust for Historic Preservation Legacy Project." 1994. Preservation Action Annual Meeting. Washington, D.C.

"Cold War Sites in Alaska." 1993. National Council on Public History Conference. Valley Forge, Pennsylvania.

"Cold War History Project." 1993. U.S. and ICOMOS Annual Meeting. Washington, D.C.

"Cold War History Project." 1992. U.S. and ICOMOS Breakfast, National Trust for Historic Preservation Conference. Miami, Florida.

"The Significance of Cold War Sites." 1992. U.S. Army Natural/Cultural Resource Workshop, Fort Benjamin Harrision. Indianapolis, Indiana.

Supplemental Information

Years Experience Prior to CH2M HILL: 10
CH2M HILL Hire Date: September 4, 2001

5.10 Socioeconomics

14. Potential Impacts (Appendix B (g) (7) (B) (v))

The potential impacts, including additional costs, on utilities (gas, water, and waste) and public services, including fire, law enforcement, emergency response, medical facilities, other assessment districts, and school districts. Include response times to hospitals and for police, and emergency services. For projects outside metropolitan areas with a population of 500,000 or more, information on schools shall include project-related enrollment changes by grade level groupings and associated facility and staffing impacts by school district during the construction and operating phases;

Information required to make AFC conform with regulations:

Please provide the potential impacts, including additional costs on public services, including law enforcement, emergency response, medical facilities, other assessment districts, and school districts. Include response times for emergency medical services and for police.

Response: Additional information regarding potential impacts was requested from the Woodbridge Fire District, the San Joaquin County Sheriff's Office, San Joaquin County Emergency Medical Services (EMS), San Joaquin American Medical Response (AMR), the local assessment districts, and the Lodi Unified School District. A summary of the conversations with each of these agencies is provided below. Complete records of conversation are provided as Attachment DA 5.10-1.

Fire Department
Conversations with the fire department clarified the response time previously provided in the AFC. The response time for the first engine (from Woodbridge Station #4, which is about 2 miles away) is under 5 minutes. However, if a second engine is needed then it will come from another station, which is about 5 miles away, and the response time for this engine is 7.5 to 10 minutes. The response time to an emergency at the project site is not likely to be affected by the project. The response times for both the first and the second engines are within the average response times for the district. The district has expressed concerns that their biggest ladder (at 35 feet) may not be adequate for the project (Kirkle, 2008).

Law Enforcement
According to the San Joaquin County Sheriff's Office, the response time to an emergency at the project site would be 20 minutes. However, the average response time could be an hour or longer depending on the availability of a deputy and a patrol car in the area, the proximity of that patrol car to the area, and on the severity of the incident. The San Joaquin County Sheriff's Office has one car in the project area. The average response times and staffing levels are unlikely to be affected by the project, especially because the LEC project is not large enough to warrant the Sheriff's Office requesting additional funding from the county. The Sheriff's Office typically determines whether it needs to request additional funding after evaluating all potential demands on service (Picone, 2008).

Emergency Medical Services
San Joaquin County EMS and the San Joaquin American Medical Response (AMR) are the two resources available for transporting any injured individuals from the project site to the nearest hospital (Lodi Memorial Hospital). AMR's response time depends on distance and whether an area is more developed (Wattenbarger, 2008). AMR's average response time, 90 percent of the time, in San Joaquin County is 7:29 minutes. The response time to the project area and from the project area to the nearest hospital is expected to be within this average. However, as a general rule, the response times tend to increase in more developed areas. San Joaquin publishes EMS average response times online (http://www.co.san-joaquin.ca.us/ems/)

Assuming that the project site is within Zone B, the average response time for October 2007 through September 2008 is 7:06 minutes.

Assessment Districts
Because the LEC site is owned by the City of Lodi, no property taxes are assessed on it. However, there are a number of assessment districts that could levy fees (Chan, 2008). Currently there are five such assessment districts: San Joaquin Area Flood Control Agency, Delta Fire Protection, San Joaquin County Service Area (CSA) 53, Central Delta Water Agency, and the San Joaquin County and Vector Control District (formerly the San Joaquin Mosquito Abatement District). The County Auditor-Controller's Office does not keep information on which of these five assessment districts actually assesses fees on the parcel.

According to the San Joaquin County Mosquito and Vector Control District, parcels owned by cities are assessed benefits but not fees. Based on the APN information, the number of acres for the project (4.4 acres) and land use (power plant), the City would be expected to pay $60 per year.

According to Wildan Financial, a third-party agency that handles financials for the San Joaquin Area Flood Control Agency, the project site is exempt from any assessments levied on behalf of the Flood Control Agency (Duncan, 2008).

The San Joaquin CSA 53 does not levy any fees or assessments on the project site (Davenport, 2008).

School District
As stated in the AFC section 5.10.4.6, the LEC is expected to pay school impact fees in the amount of $2,350 to the Lodi Unified School District. These fees are expected to be sufficient to address any potential impacts that the project may have on school enrollment and capacity.

ATTACHMENT DA5.10-1

Records of Conversation

CH2MHILL TELEPHONE CONVERSATION RECORD

Call To:	Fire Chief Mike Kirkle		Woodbridge Fire Protection District
Phone No.:	(209) 369-1945	**Date:**	October 17, 2008
Call From:	Fatuma Yusuf	**Time:**	04:00 PM
Message Taken By:	Fatuma Yusuf		
Subject:	Fire response time		

Called Captain Keith Martin and Fire Chief Mike Kirkle. Both were out. Fire Chief Mike Kirkle is expected to be in on Monday while Captain Martin is expected to be in on Sunday, 10-19-08.

10/21/08:

Called and was informed that Captain Martin was out until Friday and that Fire Chief Kirkle was out until later in the afternoon. I spoke to another captain who thought that the response time of 7-10 minutes appeared to be wrong for such a short distance. Previous ROC indicated 2.5 miles as distance between LEC and the nearest station responding to a call (Woodbridge Station #4, located at 6365 W. Capitol Lodi, CA 95242). However, he wasn't able to answer my question and said that he would have the Fire Chief call me back this PM.

3:15 pm: Called to see if the Fire Chief was available and I was told he had come back but then left for another meeting. I left another message asking him to call me back.

4:45 pm: Fire Chief Kirkle returned my call. However, I was on the phone with the CS

10/21/08: 8:40 am

I called Fire Chief Kirkle. The response time for the first engine which is located at Woodbridge Station #4 would be under 5 minutes. However, if there is a need for the 2nd Dew engine then the response time for this engine would be 7.5 – 10 minutes. Response time is not likely to be affected by the project.

Fire Chief Kirkle has stated that currently, the biggest ladder the district has is 35'. This ladder may not be adequate for this project.

Fire Chief Mike Kirkle
405 E. Augusta St.
Woodbridge, CA 95258
(209) 369-1945
mike.kirkle@woodbridgefire.org

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CH2MHILL TELEPHONE CONVERSATION RECORD

Call To:	John Picone Undersheriff		San Joaquin County Sheriff's Office
Phone No.:	209-468-5077	**Date:**	October 17, 2008
Call From:	John Picone	**Time:**	4:00 PM
Message Taken By:	Fatuma Yusuf		
Subject:	Response times		

Called John Picone. His vm indicated that he was out of the office until Monday, 10-20-08.

Called on 10/21/08 and left a vm message.

John Picone returned my call. He confirmed that the response time to an emergency from the project site would be 20 minutes. However, the average response time could be an hour or longer depending on the availability of a deputy and a car in the area, the proximity of that patrol car to the area, and on the severity of the incident. The San Joaquin County Sheriff's Office has one car in the project area.

When asked if the response time is likely to be affected by the project, Mr. Picone indicated that developments, especially one the size of LEC, have no effect on response time or staffing level. The response time or staffing level depends on funding and is something the Sheriff's Office determines after evaluating all potential demands on service.

John Picone, Undersheriff
7000 S. Canlis Blvd
French Camp, CA 95231
(209) 468-5077
jpicone@sjgov.org

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CH2MHILL TELEPHONE CONVERSATION RECORD

Call To: Joanne Augusto

Phone No.: (209) 339-7560 **Date:** July 08, 2008

Call From: John J. Putrich/SAC **Time:** 11:27 AM

Message Taken By: CH2M HILL

Subject: LEC - Lodi Memorial Hospital Information

I spoke with Joanne Augusto, Executive Administrative Assistant at Lodi Memorial Hospital (LMH). She confirmed that LMH is a primary medical facility and has an emergency room, but is not a trauma center for industrial accidents. Any major trauma would be sent to San Joaquin General Hospital in Stockton or UCDavis Medical Center in Sacramento. LMH does have a helipad to transport patients to both of those facilities.

LMH is a not-for-profit hospital and is owned by the association members. It has 180 total beds, and an estimated 20 physicians and 1100 total staff, which encompasses full and part time employees.

LMH is located 8.7 miles away from the Lodi Energy Center project site.

Joanna Augusto, Executive Administrative Assistant
Lodi Memorial Hospital
975 Fairmont Ave.
Lodi, CA 95240
(209) 339-7560
jaugusto@lodihealth.org

10-21-08:

Called to speak to Joanna Augusto who informed that that emergency medical services are provided through EMS and AMR – both ambulance services. Someone else at the hospital informed me that the EMS Administrator is Dan Birch (209-468-6818). I found the AMR contact information online.

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CH2MHILL TELEPHONE CONVERSATION RECORD

Call To:	Bob Wattenbarger Operations Manager		San Joaquin American Medical Response (AMR)
Phone No.:	209-928-5136	**Date:**	October 21, 2008
Call From:	Fatuma Yusuf	**Time:**	04:18 PM
Message Taken By:	Fatuma Yusuf		
Subject:	Medical response time		

Bob Wattenbarger told me that the response time by AMR depends on the distance to the site. Average response time, 90 percent of the time, in San Joaquin is 7:29 minutes. He indicated that the response time to the project and from the project to the nearest hospital would most likely be within that average. However, as a general rule, the response times tend to increase in more developed areas. He suggested that I check out the response times on the San Joaquin EMS website. Assuming that the project site is within Zone B, the average response time for October 2007 through September 2008 is 7:06 minutes.

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CH2MHILL TELEPHONE CONVERSATION RECORD

Call To:	Sandra Chan Chief Deputy Auditor-		Controller San Joaquin County
Phone No.:	209-953-1193	**Date:**	October 21, 2008
Call From:	Sandra Chan	**Time:**	02:09 PM
Message Taken By:	Fatuma Yusuf		

Subject: Assessment districts that levy fees on LEC property

Sandra Chan returned my call from earlier today. I had called her office after Clay Hall, Supervisor Appraiser, San Joaquin County Assessor's Office, had informed me that the parcel (APN 055-130-016) is currently non-taxable as it belongs to the City. Mr. Hall did not have any information about assessment districts thus why he suggested that I talk to someone at the County Auditor-Controller's Office.

Ms. Chan told me that the parcel was in PRA 001015 tax rate area which had the following assessment districts:

San Joaquin Area Flood Control Agency

Delta Fire Protection

County Service Area (CSA) 53

Central Delta Water Agency

San Joaquin Mosquito Abatement (now called San Joaquin County Mosquito & Vector Control District

Ms. Chan told me that she wasn't sure if any of the above agencies were charging any assessment fees and that I would have to call them to find out.

<u>San Joaquin County Mosquito and Vector Control District</u>

This agency could apply benefit assessment but not fees on parcels of land owned by a city. Based on the APN info, # of acres (4.4) and the land use (power plant) that I gave him, he said that the City would pay about $60/yr.

<u>San Joaquin Area Flood Control Agency</u>

Marlo Duncan (Tel: 09-937-7900) told me to call the Wildan Financial, a third party agency that handles financials for the district, for information on fees charged to the parcel. According to Wildan Financial informed that the parcel was exempt from any assessments levied by this agency.

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San Joaquin County Service Area (CSA) 53

Molly Davenport, Office Assistant, Utility Maintenance, San Joaquin County Department of Public Works (Tel: 209-468-3091) checked to see if there were any fees or assessment levied on the LEC project site. According to her the parcel is not assessed any fees by CSA 53.

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5.11 Soils

15. Fill Sites (Appendix B (g) (15) (A) (iii))

The location of any proposed fill disposal or fill procurement (borrow) sites; and

Information required to make AFC conform with regulations:

Please identify the location of the fill disposal site and the engineered-fill borrow site.

Response: Only fill that is required for final grading will be imported to the site. There will be no excess fill materials disposed of on the site. All imported fill will be purchased and transported from commercial suppliers in the local project vicinity.

5.14 Visual Resources

16. Photographic Reproductions (Appendix B [(g) (6) (F)])

Provide:

i) full-page color photographic reproductions of the existing site, and

ii) full-page color simulations of the proposed project at life-size scale when the picture is held 10 inches from the viewer's eyes, including any project-related electrical transmission lines, in the existing setting from each key observation point. If any landscaping is proposed to comply with zoning requirements or to mitigate visual impacts, include the landscaping in simulation(s) representing sensitive area views, depicting the landscaping five years after installation; and estimate the expected time until maturity is reached.

Information required to make AFC conform with regulations:

Please provide a full-page color photographic reproduction of existing site.

Response: Full-page color photographs have been provided as Figures DA 5.14-1 through DA 5.14-5. These photos identify existing conditions at the proposed LEC site and laydown areas.

View of proposed plant site, looking west from southern edge of proposed plant site.

FIGURE DA 5.14-1
VIEW OF PROPOSED PLANT SITE (FACING WEST)
Lodi Energy Center
Lodi, California

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View of proposed plant site, looking northwest from southern edge of proposed plant site.

FIGURE DA 5.14-2
VIEW OF PROPOSED PLANT SITE (FACING NORTHWEST)
Lodi Energy Center
Lodi, California

CH2MHILL

View of proposed plant site, looking north from southern edge of proposed plant site.

FIGURE DA 5.14-3
VIEW OF PROPOSED PLANT SITE (FACING NORTH)
Lodi Energy Center
Lodi, California

CH2MHILL

View of proposed Laydown/Parking Site C, from southern edge of proposed plant site. Laydown/Parking Site C is adjacent to the east of the proposed plant site.

FIGURE DA 5.14-4
VIEW OF LAYDOWN/PARKING SITE C
Lodi Energy Center
Lodi, California

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View of proposed Laydown/Parking Site D, from southern edge of proposed plant site. Laydown/Parking Site C is adjacent to the southeast of the proposed plant site.

FIGURE DA 5.14-5
VIEW OF LAYDOWN/PARKING SITE D
Lodi Energy Center
Lodi, California

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5.15 Water Resources

17. Discharge Requirements (Appendix B [g][14][A][i])

Waste Discharge Requirements; National Pollutant Discharge Elimination System Permit; and/or a Section 401 Certification or Waiver from the appropriate Regional Water Quality Control Board (RWQCB);

Information required to make AFC conform with regulations:

Please provide a draft construction and a draft industrial Storm Water Pollution Prevention Plan, or all the information required to apply for these NPDES permits.

Response: The Central Valley Regional Water Quality Control Board requires an NOI to be filed prior to any stormwater discharge from construction activities, and also requires that the Stormwater Pollution Prevention Plan (SWPPP) be implemented and maintained on site. A draft construction SWPPP has been provided as Attachment DA 5.15-1. A Construction Drainage Erosion and Sediment Control Plan/SWPPP will be completed prior to the beginning of site mobilization and construction activities. A draft NPDES permit application (NOI) is included as Attachment DA 5.15-2.

During operations, the LEC project will discharge all stormwater runoff to the City of Lodi White Slough WPCF. NCPA will apply for an exemption from the General Permit for Discharges of Stormwater Associated with Industrial Activities because there will be no discharge off site and, therefore, a draft industrial SWPPP is not required for the LEC project.

18. Discharge Requirements (Appendix B [g][14][A][ii])

A copy of applicable regional and local requirements regulating the drainage systems, and a discussion of how the project's drainage design complies with these requirements.

Information required to make AFC conform with regulations:

Please provide a draft permit, or all the information required to apply for the permit, for the discharge of contact and non-contact storm water to the City of Lodi's White Slough Water Pollution Control Facility and identify any pretreatment requirements.

Response: A will-serve letter from the White Slough WPCF confirming acceptance of the stormwater runoff from the LEC is included as Attachment DA 5.15-3. The City of Lodi will not require pretreatment of stormwater received from the LEC.

19. UIW Permit (Appendix B [g][14][A][iv])

Underground Injection Control Permit(s) from the U.S. Environmental Protection Agency, California Division of Oil and Gas, and RWQCB.

Information required to make AFC conform with regulations:

Please provide a copy of the Class I Underground Injection Control permit, or all the information required to apply for the UIC permit, for the proposed wastewater injection well.

Response: A copy of the Class I Underground Injection Control permit was submitted to the EPA on October 10, 2008, and docketed with the California Energy Commission (CEC) as Supplement A – Class 1 Underground Injection Control Well Permit Application on October 10, 2008.

20. Aquifer Characteristics (Appendix B [g][14][(B) (i])

Ground water bodies and related geologic structures;

Information required to make AFC conform with regulations:

Please provide a description of the deep well injection aquifer that includes the overlying stratigraphy, geologic analysis, and the chemical and physical characteristics of the aquifer.

Response: Information regarding the deep well injection aquifer including overlying stratigraphy, geologic analysis, and the chemical and physical characteristics of the aquifer may be found in Supplement A – Class 1 Underground Injection Control Well Permit Application, docketed with the CEC on October 10, 2008. Specific information regarding the deep well aquifer can be found in Attachment F: Maps and Cross Sections of Geologic Structure of Area and Attachment I: Formation Testing Program.

21. 100-Year Floodplain (Appendix B [g][14][iv])

Flood control facilities (existing and proposed); and

Information required to make AFC conform with regulations:

Please provide a description and construction schedule for those facilities that will provide 100-year flood protection or method to elevate the site above the 100-year floodplain.

Response: Flood protection will be achieved by elevating the project site above the 100-year floodplain. Top of foundation elevation for all equipment foundations will be at least 6 inches above the site finished grade. Site finished grade will be elevated approximately 1 foot above the 100-year floodplain during construction using engineered fill purchased from an offsite source. It is anticipated that the fill will be brought in and added to the site during the second quarter of 2010.

22. Groundwater Characteristics (Appendix B (g) (14) (C) (ii])

The expected physical and chemical characteristics of the source and discharge water(s) including identification of both organic and inorganic constituents before and after any project-related treatment. For source waters with seasonal variation, provide seasonal ranges of the expected physical and chemical characteristics. Provide copies of background material used to create this description (e.g., laboratory analysis);

Information required to make AFC conform with regulations:

Please provide the expected physical and chemical characteristics of the groundwater proposed for domestic use, including the identification of both organic and inorganic constituents, before and after any project-related treatment.

Response: Water quality information from the domestic water well at the White Slough WPCF is provided in Table DA 5.15-1, and also as Attachment DA 5.15-4. Due to the close proximity of the City of Lodi's White Slough WPFC to the LEC, the water quality characteristics of the City of Lodi's White Slough WPCF well are considered representative of the expected water quality of the LEC well. Additionally, it is unknown if the well water will be pretreated prior to potable use. This determination will be made once well drilling is complete and water samples have been taken from the LEC domestic water well.

TABLE DA 5.15-1
Water Quality Characteristics from the White Slough WPCF Domestic Water Well

Parameter	Units	Value
Total Alkalinity ($CaCO_3$)	mg/L	400
Bicarbonate Alkalinity (HCO_3)	mg/L	490
Chloride	mg/L	130
Specific Conductance	microsiemens per centimeter	1100
Hardness	mg/L $CaCO_3$	440
Nitrate (NO_3)	mg/L	2.9
pH	Standard units	7.3
Sulfate (SO_4)	mg/L	15
Total Dissolved Solids	mg/L	660
Turbidity	Nephelometric Turbidity Units	0.50
Arsenic	µg/L	17
Barium	mg/L	0.78
Calcium	mg/L	97
Iron	mg/L	0.12
Magnesium	mg/L	49
Manganese	mg/L	1.7
Potassium	mg/L	8.0
Sodium	mg/L	73
Total Coliforms	n/a	Negative[a] / Positive[b]

[a] Testing performed at WPCF on 11/21/2006 and 2/6/2007

[b] Testing performed at STIG #2 facility on 10/20/2008

Source: Moore Twining Associates, Inc. 2007, Analytical Services, WS Plant Well (7C15023-01-groundwater). Sampled March 15, 2007.

23. Industrial Use Will-Serve Letter (Appendix B [g][14][v])

For all water supplies intended for industrial uses to be provided from public or private water purveyors, a letter of intent or will-serve letter indicating that the purveyor is willing to serve the project, has adequate supplies available for the life of the project, and any conditions or restrictions

under which water will be provided. In the event that a will-serve letter or letter of intent cannot be provided, identify the most likely water purveyor and discuss the necessary assurances from the water purveyor to serve the project;

Information required to make AFC conform with regulations:

Please provide a letter of intent or will-serve letter from the City of Lodi indicating that the city is willing to serve the project, has adequate supplies available for the life of the project, and any conditions or restrictions under which tertiary treated recycled water will be provided or provide a discussion of the necessary assurances from the city to serve the project.

Response: A copy of the will-serve letter from the City of Lodi to supply the LEC facility with tertiary treated recycled water is provided as Attachment DA 5.15-5.

24. Storm water Will-Serve Letter (Appendix B (g) (14) (C) (viii))

For all projects which have a discharge, provide a copy of the will-serve letter, permit or contract with the public or private entity that will be accepting the wastewater and contact storm water from the project. The letter, permit or contract, if possible, shall identify the discharge volumes and the chemical or physical characteristics under which the wastewater and contact storm water will be accepted.

In the event that a will-serve letter, permit, or contract cannot be provided, identify the most likely wastewater/storm water entity and discuss why the applicant was unable to secure the necessary assurances to serve the project's wastewater/storm water needs. Also, discuss the term of the wastewater service to the project, whether the wastewater entity has adequate permit capacity for the volume of wastewater from the project and has adequate permit levels for the chemical/physical characteristics of the project's wastewater and storm water for the life of the project, and any issues or conditions/restrictions the wastewater entity may impose on the project.

Information required to make AFC conform with regulations:

Please provide a copy of the will-serve letter, permit or contract from the City of Lodi accepting the contact and non-contact storm water from the project. The letter, permit or contract, if possible, shall identify the discharge volumes and the chemical or physical characteristics under which the storm water will be accepted.

In the event this information cannot be provided, please identify the most likely entity that will accept the project's contact and non-contact storm water and a discussion of why the necessary assurances to serve the project's storm water discharge needs were not secured.

Response: A copy of the will-serve letter from the City of Lodi, accepting stormwater from the LEC facility is provided as Attachment DA 5.15-3.

25. Runoff/Drainage Patterns (Appendix B (g) (14) (D) (i))

Monthly and/or seasonal precipitation and storm water runoff and drainage patterns for the proposed site and surrounding area that may be affected by the project's construction and operation;

Information required to make AFC conform with regulations:

Please provide the storm water runoff and drainage patterns for the proposed site and surrounding area that may be affected by the project's construction and operation.

Response: Stormwater runoff and drainage patterns for the proposed site and the immediate surrounding area are provided as Attachment DA 5.15-6.

26. Drainage Design Criteria (Appendix B (g) (14) (D) (ii))

Drainage facilities and the design criteria used for the plant site and ancillary facilities, including but not limited to capacity of designed system, design storm, and estimated runoff;

Information required to make AFC conform with regulations:

Please provide a description of the drainage facilities and the design criteria used for the plant site, laydown areas, and ancillary facilities including but not limited to capacity of designed system, design storm, and estimated runoff.

Response: A preliminary drainage study identifying drainage facilities and design criteria as well as run off and flow rate calculations is provided as Attachment DA 5.15-7.

27. Run-off and Flow Rate Calculations (Appendix B (g) (14) (D) (iii)])

All assumptions and calculations used to calculate runoff and to estimate changes in flow rates between pre- and post construction; and

Information required to make AFC conform with regulations:

Please provide the calculations used to determine the runoff and flow rates for the pre- and post construction values presented in Tables 5-15-9 & -10.

Response: A preliminary drainage study identifying drainage facilities and design criteria as well as run off and flow rate calculations is provided as Attachment DA 5.15-7.

28. Drainage Requirements (Appendix B (g) (14) (D) (iv))

A copy of applicable regional and local requirements regulating the drainage systems, and a discussion of how the project's drainage design complies with these requirements.

Information required to make AFC conform with regulations:

Please provide a copy of Sections 15.60.070 and 16.60.140 of the Lodi Municipal Code and a copy of the city's Stormwater Management Plan.

Response: Sections 15.60.070 and 15.60.140 of the Lodi Municipal Code are provided below in their entirety. The City of Lodi's Stormwater Management Plan (2007) is provided as Attachment DA 5.15-8.

15.60.070 Basis for establishing areas of special flood hazard.
The areas of special flood hazard, identified by the Federal Emergency Management Agency or the Federal Insurance Administration in a scientific and engineering report entitled "Flood Insurance Study for City of Lodi," dated June 18, 1987, with an accompanying flood insurance rate map, is adopted by reference and declared to be a part of this chapter. This flood insurance study is on file at City Hall, 221 West Pine Street, Lodi, California 95240. This flood insurance study is the minimum area of applicability of this chapter and may be supplemented by studies for other areas which allow implementation of this chapter and which are recommended to the city council by the floodplain administrator. (Ord. 1426 (part), 1988).

15.60.140 Standards of construction.
In all areas of special flood hazards the following standards are required:

A. Anchoring
   1. All new construction and substantial improvements shall be anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy.

   2. All manufactured homes shall meet the anchoring standards of Section 15.60.170.

B. Construction Materials and Methods
   1. All new construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.

   2. All new construction and substantial improvements shall be constructed using methods and practices that minimize flood damage.

   3. All new construction and substantial improvements shall be constructed with electrical, heating, ventilation, plumbing and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.

C. Elevation and Floodproofing
   1. New construction and substantial improvement of any structure shall have the lowest floor, including basement, elevated to or above the base flood elevation. Nonresidential structures may meet the standards in subdivision 2 of this subsection. Upon the completion of the structure the elevation of the lowest floor including basement shall be certified by a registered professional engineer or surveyor, or verified by the community building inspector to be properly elevated. Such certification or verification shall be provided to the floodplain administrator.

   2. Nonresidential construction shall either be elevated in conformance with subdivisions 1 or 2 of this subsection, or together with attendant utility and sanitary facilities:

      a. Be floodproofed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water;

      b. Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and

      c. Be certified by a registered professional engineer or architect that the standards of this subsection are satisfied. Such certifications shall be provided to the floodplain administrator.

   3. Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are subject to flooding shall be

designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect, or meet or exceed the following minimum criteria:

a. Either a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves or other coverings or devices; provided, that they permit the automatic entry and exit of floodwaters; or

b. Be certified to comply with a local floodproofing standard approved by the Federal Insurance Administration.

4. Manufactured homes shall also meet the standards in Section 15.60.170. (Ord. 1426 (part), 1988)

29. Recycled Water Supply (Appendix B (g) (14) (E) (i))

The effects of project demand on the water supply and other users of this source, including, but not limited to, water availability for other uses during construction or after the power plant begins operation, consistency of the water use with applicable RWQCB basin plans or other applicable resource management plans, and any changes in the physical or chemical conditions of existing water supplies as a result of water use by the power plant;

Information required to make AFC conform with regulations:

Please provide a discussion of the effects of project demand on the City of Lodi's recycled water supply on other users of recycled water, including, but not limited to, recycled water availability for other uses during construction and operation of the facility.

Response: As identified in Attachment DA 5.15-9, the City of Lodi has sufficient capacity to supply recycled water to the LEC as well as the existing current users including NCPA's STIG facility, the San Joaquin County Mosquito and Vector Control facility, and the adjacent City-owned agricultural land. The use of water by the LEC will not affect any existing or future planned recycled water users.

30. Deep Well Injection Effects (Appendix B (g) (14) (iv))

If not using a zero liquid discharge project design for cooling and process waters, include the effects of the proposed wastewater disposal method on receiving waters, the feasibility of using pre-treatment techniques to reduce impacts, and beneficial uses of the receiving waters. Include an explanation why the zero liquid discharge process is "environmentally undesirable," or "economically unsound;"

Information required to make AFC conform with regulations:

Please include a discussion of the effects of deep well injection on the groundwater basin, the feasibility of using pre-treatment techniques to reduce impacts, and beneficial uses of the injection aquifer. Also, please include an explanation why the zero liquid discharge process is environmentally undesirable, or economically unsound.

Response: The groundwater basin in the vicinity of the LEC-1 injection well is described in detail in Section 5.15, Water Resources, of the LEC AFC and in the docketed Supplement A – Class 1 Underground Injection Control Well Permit Application, Attachment D: Map and Cross Sections of USDWs. The target formation for the LEC-1 injection well is the Domengine Formation within the Eastern San Joaquin Subbasin portion of the San Joaquin Valley Groundwater Basin. The primary uses of groundwater in the vicinity are for agricultural and domestic supply. As described in Section 5.15, Water Resources, of the AFC, unless otherwise designated by the Central Valley Regional Water Quality Control Board or excluded based on minimum beneficial use exception criteria (described in Table 5.15-4 of the LEC AFC), all ground waters are considered suitable or potentially suitable, at a minimum, for municipal and domestic water supply, agricultural supply, industrial service supply, and industrial process supply. However, underground sources of drinking water (USDW) are defined (40 CFR 144.3) as any aquifer capable of supplying a public water system with water of less than 10,000 milligrams per liter (mg/L) total dissolved solids (TDS). The TDS values within the Domengine Formation are approximately 14,000 mg/L. Therefore, no underground sources of drinking water (USDW) are expected to be affected by the proposed LEC-1 injection operations.

The primary concern of the EPA's Underground Injection Control (UIC) program is the potential for injected fluid or poor quality native formation fluids to move from the injection interval due to inadequate confinement or the presence of natural or manmade conduits. In the case of the LEC-1 injection well, the only identified conduits through which fluids could migrate from the injection zone to a USDW, are test holes or oil and gas wells present in the area. In order for the boreholes to pose a threat to any USDW, the pressure increase in the injection zone must be greater than the required pressure to displace the drilling fluid left in the hole. For a detailed description and calculations of pressure scenarios at the LEC-1 injection well, refer to Attachment A of the Supplement A – Class 1 Underground Injection Control Well Permit Application. No faults have been identified in the immediate vicinity of the site.

Pre-treatment of the LEC-1 injectate is not necessary considering the composition of the LEC-1 injectate is modeled to be about 2,186 mg/L TDS and the TDS values within the Domengine Formation are approximately 14,000 mg/L. Based on TDS, the quality of the injectate would be of higher quality than the native groundwater. The one parameter of concern is nitrate. The proposed concentration of 253.7 mg/L could stimulate the growth of nitrogen-reducing bacteria in and around the LEC-1 well screen if organic carbon is also increased. However, because no analysis of organic carbon in the blowdown water has been performed, this cannot be predicted at this time. It is recommended that organic carbon be analyzed in the injectate water and re-assessed prior to routine injection.

A zero liquid discharge (ZLD) process is environmentally undesirable for the LEC because of the high nitrate level in the process water. Soluble nitrates can cause several problems for ZLD systems. Nitrate compounds, such as sodium, potassium, or magnesium nitrate, are very soluble in water. The high solubility of these nitrates causes boiling-point rise and necessitates direct steam use to induce boiling. Additionally, nitrate components aid biological growth and the organics are transferred to the ZLD system where they can interfere with settling in the softener, continue to grow on membranes, get cooked and

steam distilled in the evaporator, or get further cooked and interfere in the crystallizer. This impairs production of solids into a salt cake for waste disposal.

31. 100-Year Floodplain Effects (Appendix B (g) (14) (vi))

The effects of the project on the 100-year flood plain, flooding potential of adjacent lands or water bodies, or other water inundation zones; and

Information required to make AFC conform with regulations:

Please provide a discussion of the effects of the project on the 100-year flood plain, flooding potential of adjacent lands or water bodies, or other water inundation zones.

Response: The project site is located within the 100-year flood plain (Zone A) as defined by FEMA. The potential for a 100-year flood event to impact the site is medium to high. However, it is unlikely that the LEC project would affect the flooding potential of adjacent lands because all stormwater runoff would be routed to the White Slough WPCF prior to discharge. While the WPCF discharges effluent into Dredger Cut, a man-made channel that connects to both White Slough and Bishop Cut, which ultimately flow to the Delta, the additional discharge as a result of the LEC project would be less than significant and unlikely to increase the flooding potential of the receiving water bodies. While it was determined the peak runoff for the site in post-development condition would be higher than the pre-development condition due to the increase of impermeable surfaces, this increase in permeability and runoff would be less than significant considering the size of the project site (4.4 acres) in the context of the regional floodplain area (3,626 acres; Figure DA 5.15-1). Therefore, because the project site represents a very small percentage (less than one percent) of the regional floodplain area, development of the project site will not increase the flood potential on adjacent lands, water bodies, or other water inundation zones.

32. 100-Year Floodplain Analysis (Appendix B (g) (14) (vii))

All assumptions, evidence, references, and calculations used in the analysis to assess these effects.

Information required to make AFC conform with regulations:

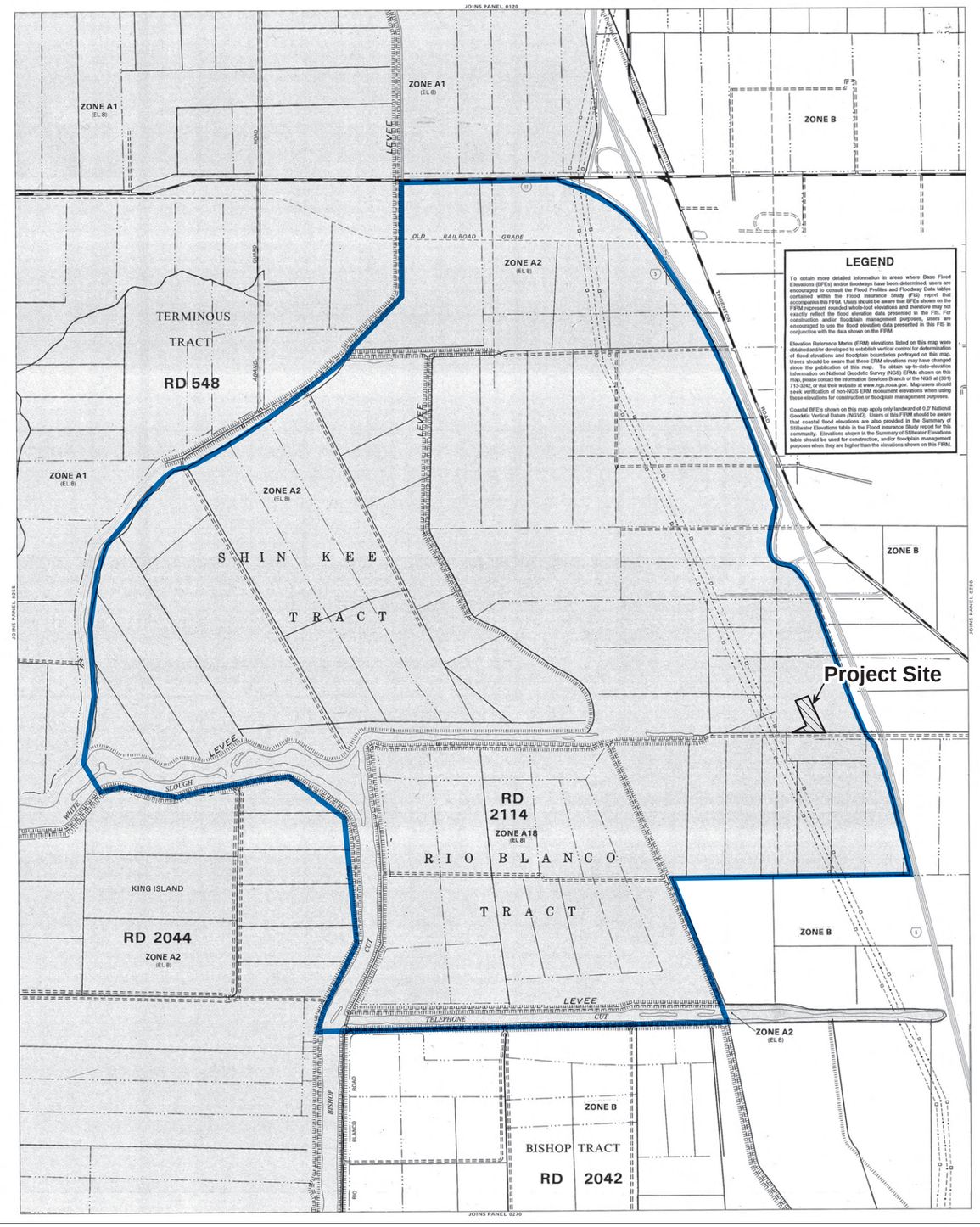
Please provide the assumptions, evidence, references, and calculations used in the analysis to assess the effects identified in (g) (14) (vi).

Response: Figure DA 5.15-1 shows the 4.4-acre project site within the context of the larger 100-year regional floodplain and Table DA 5.15-2 shows the numbers used to calculate the project site's percentage of the floodplain area.

TABLE DA 5.15-2
Regional Floodplain Impact Calculation

Regional Floodplain Acreage*	Project Site Acreage	Project Site (percent of regional floodplain area)
3,626	4.4	<1%

* For this analysis, the regional floodplain was generally delineated based on the topography and drainage in the area, as shown on Figure DA 5.15-1.



KEY TO MAP

500-Year Flood Boundary
100-Year Flood Boundary
Zone Designations*
100-Year Flood Boundary
500-Year Flood Boundary
Base Flood Elevation Line With Elevation in Feet**
Base Flood Elevation in Feet Where Uniform Within Zone**
Elevation Reference Mark
Zone D Boundary
*User Min
Approximate 100- Year Flood Boundary

ZONE B
ZONE A1
ZONE A5
ZONE B
513
(EL 987)
RM7×
•M1.5
ZONE A

**Reference to the National Geodetic Vertical Datum of 1929

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

† Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFEs, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For adjoining panels, see separately printed Map Index.

INITIAL IDENTIFICATION:
MAY 15, 1980

FLOOD HAZARD BOUNDARY MAP REVISION:

FLOOD INSURANCE RATE MAP EFFECTIVE:
MAY 15, 1980

FLOOD INSURANCE RATE MAP REVISIONS:
JULY 4, 1988

Map revised April 2, 2002 to update corporate limits, to change base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letter of amendment, and to change floodway.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE IN FEET
1000 0 1000

Regional Floodplain

FIGURE DA 5.15-1
FEMA FLOOD ZONE MAP
LODI ENERGY CENTER
LODI, CALIFORNIA

CH2MHILL

ATTACHMENT DA 5.15-1

Draft Construction Stormwater Pollution Prevention Plan

PRELIMINARY
STORM WATER POLLUTION
PREVENTION PLAN
For
NCPA Lodi Energy Center
12745 N. Thornton Road
Lodi, Ca. 95242

June, 2008
Revised October 2008

WDID No.: (To be Determined)

Prepared For:
North California Power Agency.
651 Commerce Drive
Roseville, CA 95678

Contractor:
To be Determined

Prepared By:

CARLTON
Engineering Inc.
3883 Ponderosa Road
Shingle Springs, CA 95682
(530) 677-5515

Table of Contents

Owner/Developer
Certification by Engineer or Authorized Qualified Designee 1
Owner's/Developer/Contractor's Approval of the Storm Water Pollution Prevention Plan 2
Reporting Requirements 3
Annual Compliance Certification 4
Notice of Anticipated Non-Compliance 5
Notice of Intent 6
New Owner Information and Change of Information Form 7
Notice of Termination Form 8

Water Pollution Manager
Notice to Contractor 9
Amendments 10
Owner's Approval and Certification of the Amendment 11
List of Contractors / Subcontractors 13
Personnel Training 14
Monitoring/Inspection 15
Inspection Report Form 17
I. Project Information 18
1. Construction Scheduling 20
A. Vicinity Map 21
II. Source Identification 22
A. Topography Map 22
B. Site Map 23
III. Narrative Descriptions 24
A. Project Description 24
B. Pollutants Likely to be Present in Storm Water Discharges 24
C. Nature of Fill Material and Existing Data 25
D. Existing (pre-construction) Control Measures 25
E. Erosion and Sediment Control Practices 26
1. General Practices 27
2. Sediment Control 28
3. Soil Stabilization 28
4. Practices to Reduce Tracking Sediment On To Public and Private Roads 28
5. Wind Erosion 29
6. Practices to Minimize Contact with Storm Water 29
7. Construction Material Loading, Unloading, and Access Areas 31
8. Waste Management and Disposal 32
F. Maintenance, Inspections, and Repair of Structural Controls 33
G. Non-Storm Water Management 34
H. Toxic Materials 35
I. Spill Prevention and Control 38
1. Minor Spills 38
2. Major Spills 39
J. Landscaping Activities 39
K. Post-Construction Storm Water Management 40
J. Construction Storm Water Sampling and Analysis Guidance 41
1. Sedimentation Monitoring 41
2. Non-visible Pollutant Monitoring and Sampling 41
3. Sampling Procedures 46
4. Sample Documentation Procedures 48
5. Sampling and Analysis Records 49
6. Data Evaluation 49

Appendix A – Sampling Data Forms 49
Appendix B – General Permit 51
Appendix C – BMPs 52
Appendix D – Drainage Study 53

SWPPP Certification by Engineer/SWPPP Preparer

Project Name: *NCPA Lodi Energy Center*

"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 ensure 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".

Jeff Thompson		10/23/08
Printed Name	Signature	Date

Senior Engineer

Title

Owner's/Developer/Contractor's Approval and Certification of the Storm Water Pollution Prevention Plan

Project Name: *NCPA Lodi Energy Center*

"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 ensure 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".

Printed Name	Signature	Date

Title

Reporting Requirements

1. Compliance Certification

   The owner must annually certify that its construction activity is in compliance with the requirements of the General Permit and this SWPPP. The certification must be completed by July 1 of each year. A copy of the certification shall be filed at the owner's office, but does not have to be submitted to the Regional Water Quality Control Board, Central Valley Region (5S) (Regional Board). The Annual Compliance form can be found after page 4 of this plan.

2. Noncompliance Reporting

   If construction activities are not in compliance with the General Permit and the SWPPP, the Contractor shall notify the owner and the Regional Board in writing. The notification's shall identify the type(s) of non-compliance, describe the actions necessary to achieve compliance, and include a time schedule, subject to the modifications by the Regional Board, indicating when compliance will be achieved. Non-compliance notifications must be submitted to the owner and Regional board within 30 days of identification of non-compliance.

   The Regional Board's address is:

   11020 Sun Center Drive, #200
   Rancho Cordova, CA 95670-6114
   (916) 464-3291, fax (916) 464-4645

   A copy of the Non-compliance form can be found after page 5 of this plan.

3. Records

   Upon completion of the project's construction and termination of coverage under the General Permit, all records shall be retained by the owner/operator with a copy of the final Plan. The owner shall retain records of all monitoring inspections, compliance certification, and non-compliance reports for a period of three years as part of the SWPPP.

   Please note that you are subject to the annual fee until a Notice of Termination is filed and approved with the Regional Board. A copy of the form can be found after page 8 of this plan.

Annual Compliance Certification

State Water Resources Control Board

SWPPP ANNUAL COMPLIANCE CERTIFICATION

JULY 1, 200_

STORM WATER POLLUTION PREVENTION PLAN

WASTE DISCHARGE IDENTIFICATION (WDID) # (To be Determined)

NCPA Lodi Energy Center

California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114
(916) 464-3291

I hereby certify that the construction activity at this site is in compliance with the requirements of General Permit No. CAS000002 issued by Order No. 92-08-DWQ by the State Water Resources Control, and the Storm Water Pollution Prevention Plan prepared for this site. This certification is based upon site inspections made by trained personnel in conformance with Paragraph 4, Section B of the General Permit.

I further 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.

North California Power Agency (NCPA)
651 Commerce Drive
Roseville, CA 95678
(916) 781-3636

By:_____ Date:_____

National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity

Annual Compliance Certification

Construction Site: _____

Property Owner: _____

The purpose of the annual compliance certification is to remind construction site owners and operators of their obligation to protect storm water at their sites over the entire duration of construction activities. Pursuant to Section B, Item 4, of the General Permit, this certification is required by July 1st of each year.

The annual compliance certification is based upon (1) a review of the Storm Water Pollution Prevention Plan (SWPPP) to ensure that it adequately prevents pollutant discharges; and (2) a review of the storm water inspections required under Section B, Item 3, of the General Permit. This review must be completed by a principal of the company or agency that owns the subject construction site, by the site person responsible for implementing the SWPPP, or by persons under their direct supervision.

Check one:

☐ Storm water inspections were completed during the past year in compliance with the General Permit. Accordingly, I certify under penalty of law that the above construction site is in compliance with the General Permit and the site-specific Storm Water Pollution Prevention Plan (SWPPP).

☐ Storm water inspections were not completed during the past year in compliance with the General Permit. Accordingly, I will ensure that storm water inspections are completed for future storm events. I recognize that deficiencies in our storm water inspections preclude me from certifying unconditionally that the subject construction site is in compliance with the site SWPPP and the General Permit.

Name_____Title_____

Signature_____Date_____

Notice of Anticipated Non-Compliance

State Water Resources Control Board

NOTICE OF ANTICIPATED NON-COMPLIANCE

STORM WATER POLLUTION PREVENTION PLAN

WASTE DISCHARGE IDENTIFICATION (WDID) # (To be Determined)

NCPA Lodi Energy Center

California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114
(916) 464-3291

Date of Notice:_____

Details of Anticipated Non-Compliance:_____

_____

_____

_____

Actions to Avert Non-Compliance:_____

_____

_____

_____

Time Schedule for Corrective Action:_____

_____

I further 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.

North California Power Agency (NCPA)
651 Commerce Drive
Roseville, CA 95678
(916) 781-3636

By:_____ Date:_____

Notice of Intent

New Owner Information and Change of Information Form

NEW OWNER INFORMATION AND CHANGE OF INFORMATION (COI) FORM FOR THE GENERAL CONSTRUCTION PERMIT NO. CAS000002

Owners Name: _____ Date: _____

WDID No.: _____ Date of Last NOI Change: _____

Prepared By: _____ Signature of Preparer: _____

	Area Transferred (acres)[1] column 1	Area Remaining (acres)[2] column 2	Lot/Tract Numbers Transferred	Contact Person and Company Name of NewOwner(s)	Address(es) of the New Owner(s)	Phone # of New Owner	Is Const/Post Construction Complete? Yes/No	Date of Ownership Transfer
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

[1]Use approximate area (in acres) if no exact figure is available.

[2]Calculate running total in this column as follows:

Enter in column 2, line 1, the area from NOI minus the area in column 1.

Enter in column 2, line 2, the area in column 2, line 1, minus the area in line 2, column 1.

Enter in column 2, line 3, the area in column 2, line 2, minus the area in line 3, column 1, and so forth.

Notice of Termination Form

State Water Resources Control Board

Division of Water Quality
1001 I Street • Sacramento, California 95814 • (916) 341-5537
Mailing Address: P.O. Box 1977 • Sacramento, California • 95812-1977
FAX (916) 341-5543 • Internet Address: http://www.waterboards.ca.gov/stormwtr/index.html

Linda S. Adams
Secretary for
Environmental Protection

Arnold Schwarzenegger
Governor

To: Storm Water Permit Holder

RE: NOTICE OF TERMINATION OF COVERAGE UNDER THE GENERAL **CONSTRUCTION** STORM WATER PERMIT (GENERAL PERMIT)

In order for us to terminate your coverage under the General Permit, please complete and submit the enclosed Notice of Termination (NOT) your local Regional Water Quality Control Board (RWQCB). Refer to the last page of the NOT packet for RWQCB locations.

Submittal of a NOT does not guarantee termination and outstanding invoices are still valid. If your NOT is denied, you will be required to continue complying with the requirements of the General Permit and all outstanding invoice(s) are due. You will be notified of your NOT status by the RWQCB or State Water Resources Control Board. Approval of your Notice of Termination does not relieve you from paying any applicable outstanding invoices.

Should you have any questions regarding this matter, please contact your local RWQCB at the number listed on the back page of the NOT package, or the Storm Water Unit at (916) 341-5537.

Sincerely,

Storm Water Unit
Division of Water Quality

Enclosure

SEND TO YOUR LOCAL RWQCB FOR APPROVAL

State of California{PRIVATE }
State Water Resources Control Board

NOTICE OF TERMINATION

OF COVERAGE UNDER THE NPDES GENERAL PERMIT NO. CAS000002
FOR DISCHARGES OF STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY

Submission of this Notice of Termination constitutes notice that the owner (and his/her agent) of the site identified on this form is no longer authorized to discharge storm water associated with construction activity by NPDES General Permit No. CAS000002.

I. WDID NO.

II. OWNER

COMPANY NAME _____ CONTACT PERSON

STREET ADDRESS _____ TITLE

CITY _____ STATE _____ ZIP _____ PHONE

III. CONSTRUCTION SITE INFORMATION

A. DEVELOPER NAME _____ CONTACT PERSON

STREET ADDRESS _____ TITLE

CITY _____ CA _____ ZIP _____ PHONE

B. SITE ADDRESS _____ COUNTY _____

CITY _____ CA _____ ZIP _____ PHONE

IV. BASIS OF TERMINATION

_____ 1. The construction project is complete and the following conditions have been met.

- All elements of the Storm Water Pollution Prevention Plan have been completed.
- Construction materials and waste have been disposed of properly.
- The site is in compliance with all local storm water management requirements.
- A post-construction storm water operation and management plan is in place.

Date of project completion _____/_____/_____

_____ 2. Construction activities have been suspended, either temporarily _____ or indefinitely _____ and the following conditions have been met.

- All elements of the Storm Water Pollution Prevention Plan have been completed.
- Construction materials and waste have been disposed of properly.
- All denuded areas and other areas of potential erosion are stabilized.
- An operation and maintenance plan for erosion and sediment control is in place.
- The site is in compliance with all local storm water management requirements.

Date of suspension _____/_____/_____ Expected start up date _____/_____/_____

_____ 3. Site can not discharge storm water to waters of the United States (check one).

SEND TO YOUR LOCAL RWQCB FOR APPROVAL

_____ All storm water is retained on site.

_____ All storm water is discharged to evaporation or percolation ponds offsite.

_____ 4. Discharge of storm water from the site is now subject to another NPDES general permit or an individual NPDES permit.

NPDES Permit No._____ Date coverage began _____/_____/_____

_____ 5. There is a new owner of the identified site. Date of owner transfer _____/_____/_____

Was the new owner notified of the General Permit requirements? YES ____ NO ____

NEW OWNER INFORMATION

COMPANY NAME _____ CONTACT PERSON

STREET ADDRESS _____ TITLE

CITY _____ STATE _____ ZIP _____ PHONE

V. EXPLANATION OF BASIS OF TERMINATION (Attach site photographs - see instructions).

VI. CERTIFICATION:

I certify under penalty of law that all storm water discharges associated with construction activity from the identified site that are authorized by NPDES General Permit No. CAS000002 have been eliminated or that I am no longer the owner of the site. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with construction activity under the general permit, and that discharging pollutants in storm water associated with construction activity to waters of the United States is unlawful under the Clean Water Act where the discharge is not authorized by a NPDES permit. I also understand that the submittal of this Notice of Termination does not release an owner from liability for any violations of the general permit or the Clean Water Act.

PRINTED NAME _____ TITLE

SIGNATURE: _____ DATE ____/____/____

REGIONAL WATER BOARD USE ONLY

This Notice of Termination has been reviewed, and I recommend termination of coverage under the subject NPDES general permit.

Printed Name _____ Region No. _____

Signature _____ Date _____/_____/_____

NOT effective date:

Date: ____/____/____

State of California
State Water Resources Control Board

INSTRUCTIONS FOR COMPLETING NOTICE OF TERMINATION FOR CONSTRUCTION ACTIVITY

Who May File

Dischargers who are presently covered under NPDES General Permit No. CAS000002 for discharge of storm water associated with construction activity may submit a Notice of Termination when they meet one of the following criteria.

1. The construction project has been completed and the following conditions have been met: all elements of the Stormwater Pollution Prevention Plan have been completed; construction materials and equipment maintenance waste have been disposed of properly; the site is in compliance with all local storm water management requirements including erosion/sediment control requirements and the appropriate use permits have been obtained; and a post-construction storm water operation and management plan is in place.

2. Construction activities have been suspended, either temporarily or indefinitely and the following conditions have been: all elements of the Stormwater Pollution Prevention Plan have been completed; construction materials and equipment maintenance waste have been disposed of properly; all denuded areas and other areas of potential erosion are stabilized; an operation and maintenance plan for erosion and sediment control is in place; and the site is in compliance with all local storm water management requirements including erosion/sediment control requirements.
   The date construction activities were suspended, and the expected date construction activities will start up again should be provided.

3. Construction site can not discharge storm water to waters of the United States. Please indicate if all storm water is retained on site or if storm water is collected offsite.

4. Discharge of construction storm water from the site is now subject to another NPDES general permit or an individual NPDES permit. The general permit or individual permit NPDES number and date coverage began should be provided.

5. There is a new owner of the identified site. If ownership or operation of the facility has been transferred then the previous owner must submit a Notice of Termination and the new owner must submit a Notice of Intent for coverage under the general permit. The date of transfer and information on the new owner should be provided. Note that the previous owner may be liable for discharge from the site until the new owner files a Notice of Intent for coverage under the general permit.

Where to File

Submit the Notice of Termination to the Executive Officer of the Regional Water Quality Control Board responsible for the area in which the facility is located. See attached. Submittal of a NOT does not guarantee termination and outstanding invoices are still valid. If the Executive Officer, or his designated staff, agrees with the basis of termination, the Notice of Termination will be transmitted to the State Water Board for processing at which time it will be determined if any outstanding invoices are still valid. Approval of your Notice of Termination does not relieve you from paying any applicable outstanding invoices. If the Executive Officer, or his designated staff, does not agree with the basis of termination, the Notice of Termination will be returned. The Regional Water Board may also inspect your site prior to accepting the basis of termination.

LINE-BY-LINE INSTRUCTIONS

All necessary information must be provided on the form. Type or print in the appropriate areas only. Submit additional information, if necessary, on a separate sheet of paper.

SECTION I--WDID NO.

The WDID No. is a number assigned to each discharger covered under the General Permit. If you do not know your WDID No., please call the State Water Board or Regional Water Board and request it prior to submittal of the Notice of Termination.

SECTION II--OWNER

Enter the owner of the construction site's official or legal name (This should correspond with the name on the Notice of Intent submitted for the site), address of the owner, contact person, and contact person's title and telephone number.

SECTION III--CONSTRUCTION SITE INFORMATION

In Part A, enter the name of the developer (or general contractor), address, contact person, and contact person's title and telephone number. The contact person should be the construction site manager completely familiar with the construction site and charged with compliance and oversight of the general permit. This information should correspond with information on the Notice of Intent submitted for the site.

In Part B, enter the address, county, and telephone number (if any) of the construction site. Construction sites that do not have a street address must attach a legal description of the site.

SECTION IV--BASIS OF TERMINATION

Check the category which best defines the basis of your termination request. See the discussion of the criteria in the Who May File section of these instructions. Provide dates and other information requested. Use the space under Explanation of Basis of Termination heading.

SECTION V--EXPLANATION OF BASIS OF TERMINATION

Please explain the basis or reasons why you believe your construction site is not required to comply with the General Permit. To support your explanation, provide a site map and photograph of your site.

SECTION VI--CERTIFICATION

This section must be completed by the owner of the site.

The Notice of Termination must be signed by:

For a Corporation: a responsible corporate officer

For a Partnership or Sole Proprietorship: a general partner or the proprietor, respectively.

For a Municipality, State, or other Non-Federal Public Agency: either a principal executive officer or ranking elected official.

For a Federal Agency: either the chief or senior executive officer of the agency.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

NORTH COAST REGION (1)
5550 Skylane Blvd, Ste. A
Santa Rose, CA 95403
(707) 576-2220 FAX: (707)523-0135
http://www.waterboards.ca.gov/rwqcb1

SAN FRANCISCO BAY REGION (2)
1515 Clay Street, Ste. 1400
Oakland, CA 94612
(510) 622-2300 FAX: (510) 622-2640
http://www.waterboards.ca.gov/rwqcb2

CENTRAL COAST REGION (3)
895 Aerovista Place, Ste 101
San Luis Obispo, CA 93401
(805) 549-3147 FAX: (805) 543-0397
http://www.waterboards.ca.gov/rwqcb3

LOS ANGELES REGION (4)
320 W. 4th Street, Ste. 200
Los Angeles, CA 90013
(213) 576-6600 FAX: (213) 576-6640
http://www.waterboards.ca.gov/rwqcb4

CENTRAL VALLEY REGION (5S)
11020 Sun Center Dr., #200
Rancho Cordova, CA 95670-6114
(916) 464-3291 FAX: (916) 464-4645
http:www.waterboards.ca.gov/rwqcb5

FRESNO BRANCH OFFICE (5F)
1685 E St.
Fresno, CA 93706
(559) 445-5116 FAX: (559) 445-5910
http://www.waterboards.ca.gov/rwqcb5

REDDING BRANCH OFFICE (5R)
415 Knollcrest Drive, Ste. 100
Redding, CA 96002
(530) 224-4845 FAX: (530) 224-4857
http://www.waterboards.ca.gov/rwqcb5

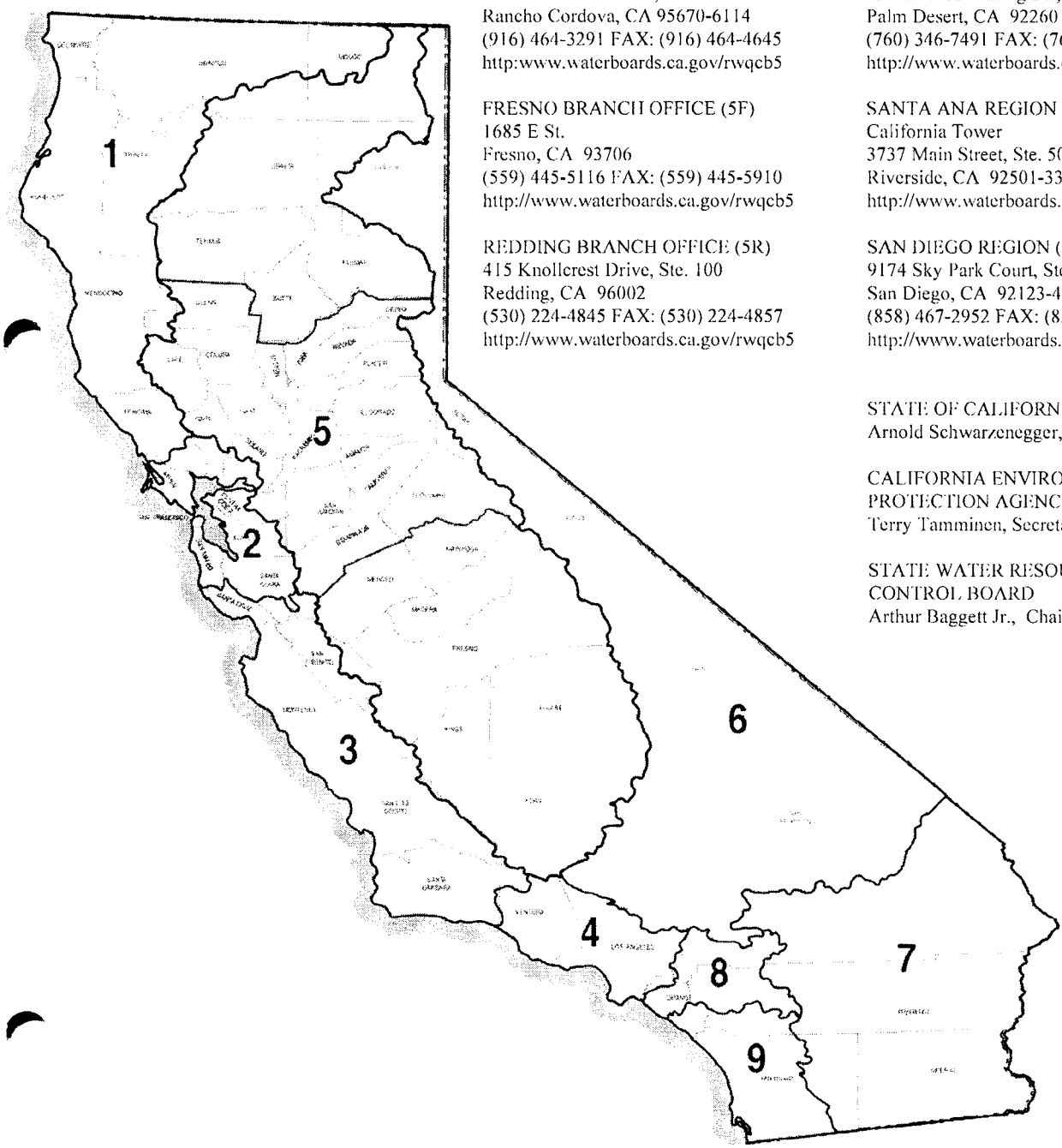
LAHONTAN REGION (6 SLT)
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
(530) 542-5400 FAX: (530) 544-2271
http://www.waterboards.ca.gov/rwqcb6

VICTORVILLE OFFICE (6V)
14440 Civic Drive, Ste. 200
Victorville, CA 92392-2383
(760) 241-6583 FAX: (760) 241-7308
http://www.waterboards.ca.gov/rwqcb6

COLORADO RIVER BASIN REGION (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491 FAX: (760) 341-6820
http://www.waterboards.ca.gov/rwqcb7

SANTA ANA REGION (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
http://www.waterboards.ca.gov/rwqcb8

SAN DIEGO REGION (9)
9174 Sky Park Court, Ste. 100
San Diego, CA 92123-4340
(858) 467-2952 FAX: (858) 571-6972
http://www.waterboards.ca.gov/rwqcb9



STATE OF CALIFORNIA
Arnold Schwarzenegger, Governor

CALIFORNIA ENVIRONMENTAL
PROTECTION AGENCY
Terry Tamminen, Secretary

STATE WATER RESOURCES
CONTROL BOARD
Arthur Baggett Jr., Chairman

Notice to Contractor

This is a living document and a tool to be used to assist the owner/contractor in complying with storm water quality regulations, and is required to be amended as necessary.

A copy of the SWPPP shall be kept at the construction site during the construction activity and made available upon request to representatives of the California Regional Water Quality Control Board, or the general public (public access pursuant to Section 308(b) of the Federal Clean Water Act).

The burden of comprehensive compliance rests solely with the project owner/developer. Carlton Engineering, Inc. does not guarantee compliance or assume any responsibility for failure to comply with the State General Permit as a result of using the information provided herein.

Amendments

This SWPPP shall be amended:

- Whenever there is a change in construction or operations which may affect the discharge of pollutants to surface, waters, groundwater(s), or a municipal separate storm sewer system (MS4); or
- If any condition of the Permit is violated or the general objective of reducing or eliminating pollutants in storm water discharges has been achieved. If the RWQCB or a local agency determines that a Permit violation has occurred, the SWPPP shall be amended and implemented within 14-calendar days after notification by the RWQCB: and/or
- Annually, prior to defined rainy season: and
- When deemed necessary by the Owner.

The following items will be included in each amendment:

- Who requested the amendment.
- The location of proposed changes.
- The original BMP proposed, if any.
- The new BMP proposed.

The amendments for this SWPPP, along with the Owner's Certification and the Owner's approval, can be found in the following page. Amendments are listed in the Amendment Log found in the following pages.

Owner's Approval and Certification of the Storm Water Pollution Prevention Plan Amendment

Project Name: *NCPA Lodi Energy Center*

"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 ensure 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".

_____	_____	_____
Printed Name	Signature	Date

Amendments

Amendments To
NCPA Lodi Energy Center
Stormwater Pollution Prevention Plan

Date	Action taken

List of Contractors / Subcontractors

The following contractors and subcontractors are responsible for implementing the Stormwater Pollution Prevention Plan:

Company Name	Address	Phone No.	Contact Person

Personnel Training

_____, will carry out responsibility for Storm Water Pollution Prevention Plan implementation, amendments, and revisions.

Contractor/Subcontractors shall train his/her employees regarding implementing and maintenance of the storm water management practices and controls described in this SWPPP (Stormwater Pollution Prevention Plan).

On-site construction personnel will have the responsibility for installation and maintenance of on-site BMPs.

Training Log

This person has received training:

-
-
-
-
-
-
-
-
-
-
-
-
-
-
-
-

Monitoring/Inspection

Name and contact number of those qualified personnel responsible for inspections of the construction site prior to anticipated rain events, 24-hour intervals during extended rain events, and after actual rain events.

In conformance with the U.S. Environmental Protection Agency definition, a minimum of 72 hours of dry weather will be used to distinguish between separate rain events.

_____

_____

_____

_____

_____

_____

Duties of this person(s) include but are not limited to:

- Ensuring full compliance with the SWPPP and the Permits
- Implementing all elements of the SWPPP, including but not limited to:
    - Implementation of prompt and effective erosion and sediment control measures
    - Implementing all non-storm water management, and materials and waste management activities such as:

      Monitoring discharges (dewatering, diversion devices); general site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems; etc.

- Pre-rain event inspections
- Extended rain event inspections
- Post-rain event inspections
    - Monthly inspections.
    - Updates/Amendments to the SWPPP, as needed.
    - Preparing annual compliance certification.
    - Ensuring elimination of all unauthorized discharges.
    - The responsible person shall be assigned authority by the Owner to mobilize crews to make immediate repairs to the control measures.

Coordinate with the Owner/Developer/Contractor to assure all the necessary corrections/repairs are made immediately, and that the project complies with the SWPPP, the Permit and approved plans at all times.

1. General Plan Summary

These monitoring and inspection requirements shall be implemented upon commencement of construction activities. The owner/contractor is responsible for implementing these requirements until construction activity is complete and no soil areas remain disturbed.

2. Site Inspections

The owner/contractor should maintain records of major grading and stabilization activities occurring at the site and the timing of each activity. The contractor should also keep track of dates that required control measures (best management practices) are to be installed, and by whom.

The site inspector should keep a weekly and pre-storm inspection report that provides the location description (and/or grid location), the maintenance or repairs needed, actions taken, the date completed, and any other observations made. Additionally, the inspector should keep post-storm inspection reports that include similar information plus the size and duration of the storm. Each report must include the inspector's name, the date of inspection, and the inspector's qualifications to perform the inspections. These reports should be kept with the SWPPP. The inspections may be summarized on a form that shows cumulatively for the site all the weekly as well as the pre- and post-storm inspections, when they were completed, and by whom.

The site inspector should also perform a weekly vegetation inspection to evaluate whether seeded or planted vegetation is becoming successfully established, or whether additional measures are needed, such as watering, fertilizing, or additional seeding.

3. Construction Storm Water Sampling and Analysis

On April 26, 2000, the State Water Resources Control Board adopted Resolution No. 2001-046. The sampling requirements added to the General Permit by this resolution are intended to supplement the visual monitoring program previously required by the General Permit. All construction projects must continue the visual monitoring program that requires inspections before predicted rain events, during extended rain events, and following actual rain events that produce runoff.

Resolution No. 2001-046 has two primary objectives. First, to identify a sampling and analysis strategy for discharges from construction activities which discharge directly into 303(d) listed water bodies that are listed for sedimentation. Secondly, for all construction activity, preventing other pollutants that are known or should be known to occur on construction sites and that can not be visually observed or detected in storm water discharges, form causing or contributing to exceedances of water quality.

Fee Exampt	Lab Type	Lab Name	Street	City	State	Zip	County	Phone	Cert No
	Industrial	AEROJET - ENVIRONMENTAL LABORATORY	AEROJET ROAD AT FOLSOM BLVD., BLDG. 02030	RANCHO CORDOVA	CA	95670	SACRAMENTO	(916) 355-4780	1208
	Commercial	AIR TOXICS LTD.	180 BLUE RAVINE ROAD, SUITE B	FOLSOM	CA	95630	SACRAMENTO	(916) 985-1000	02110CA
	Commercial	ASBESTECH	6825 FAIR OAKS BLVD # 103	CARMICHAEL	CA	95608	SACRAMENTO	(916) 481-8902	1153
	Commercial	BSK ANALYTICAL LABORATORIES	3140 GOLD CAMP DRIVE	RANCHO CORDOVA	CA	95670	SACRAMENTO	(916) 853-9293	2435
Y	State	AQUATIC TOXICOLOGY LABORATORY	9300 ELK GROVE - FLORIN ROAD	ELK GROVE	CA	95624	SACRAMENTO	(916) 685-1880	1977
Y	State	CALIFORNIA DEPT OF FISH & GAME	2005 NIMBUS ROAD	RANCHO CORDOVA	CA	95670	SACRAMENTO	(916) 358-2858	1622
	State	CALIFORNIA DEPT of FOOD & AGRICULTURE	3292 MEADOWVIEW ROAD	SACRAMENTO	CA	95832	SACRAMENTO	(916) 262-1434	2570
	State	CALIFORNIA DEPT. FOOD AND AGRICULTURE	3292 MEADOWVIEW ROAD	SACRAMENTO	CA	95832	SACRAMENTO	(916) 262-1434	2626
	Commercial	CLS LABS	3249 FITZGERALD ROAD	RANCHO CORDOVA	CA	95742-6813	SACRAMENTO	(916) 638-7301	1233
	Commercial	CONTINENTAL WATER LABORATORY	8631 YOUNGER CREEK DRIVE	SACRAMENTO	CA	95828	SACRAMENTO	(916) 379-2323	01106CA
	Public Wastewater System	RANCHO MURIETA COMMUNITY SERVICES DISTRICT LABORATORY	15160 JACKSON ROAD	RANCHO MURIETA	CA	95683	SACRAMENTO	(916) 354-3700	2559
	Municipal	RANCHO SECO NUCLEAR GENERATING STATION	14440 TWIN CITIES ROAD	HERALD	CA	95638-9799	SACRAMENTO	(916) 732-4812	1681
	City	CITY OF SACRAMENTO WATER QUALITY LABORATORY	7501 COLLEGE TOWN DRIVE	SACRAMENTO	CA	95826	SACRAMENTO	(916) 382-3737	1508
Y	County	SACRAMENTO COUNTY PUBLIC HEALTH LABORATORY	4600 BROADWAY, SUITE 2300	SACRAMENTO	CA	95820	SACRAMENTO	(916) 874-9231	1748
	County	SACRAMENTO WATER QUALITY CONTROL LABORATORY	8521 LAGUNA STATION ROAD	ELK GROVE	CA	95758-9550	SACRAMENTO	(916) 875-9020	1100
	Commercial	SMART CHEMISTRY CORPORATION	3401 LA GRANDE BLVD	SACRAMENTO	CA	95823	SACRAMENTO	(916) 391-3300	2409
	Commercial	SPARGER TECHNOLOGY, INC.	3738 BRADVIEW DRIVE	SACRAMENTO	CA	95827	SACRAMENTO	(916) 369-7688	1614
	Commercial	SUNLAND ANALYTICAL LAB, INC.	11353 PYRITES WAY, SUITE 4	RANCHO CORDOVA	CA	95670	SACRAMENTO	(916) 852-8557	2014
	Commercial	TEG - NORTHERN CALIFORNIA	11350 MONIER PARK PLACE	RANCHO CORDOVA	CA	95742	SACRAMENTO	(916) 853-8010	1671

Fee Exampt	Lab Type	Lab Name	Street	City	State	Zip	County	Phone	Cert No
	Commercial	TEG - NORTHERN CALIFORNIA	11350 MONIER PARK PLACE	RANCHO CORDOVA	CA	95742	SACRAMENTO	(916) 853-8010	2012
	Commercial	TESTAMERICA ANALYTICAL TESTING CORPORATION - SACRAMENTO	819 STRIKER AVENUE, SUITE 8	SACRAMENTO	CA	95834	SACRAMENTO	(916) 921-9600	2630
	Commercial	TJ/H2B ANALYTICAL SERVICES, INC	3123 FITE CIRCLE SUITE 105	SACRAMENTO	CA	95827	SACRAMENTO	(916) 361-7177	2112
	Commercial	WEIDMANN-ACTI, INC.	4011 POWER INN ROAD	SACRAMENTO	CA	95826	SACRAMENTO	(916) 455-2284	2130

Inspection Report Form

Storm Water Quality Construction Site Inspection Checklist

General Information

Project Name:	
Date of Inspection:	
Weather Conditions:	
Inspection Type:	☐ Prior to forecast rain ☐ After a rain event ☐ 24-hour intervals during extended rain ☐ Other _____
Season	☐ Rainy ☐ Non-Rainy
Inspector's Name:	

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Preservation of Existing Vegetation				
Is temporary fencing provided to preserve vegetation in areas where no construction activity is planned?				
Location:				
Location:				
Location:				
Location:				
Temporary Soil Stabilization				
Does the applied temporary soil stabilization provide 100% coverage for the required areas?				
Are there any non-vegetated areas that may require temporary soil stabilization?				
Is the area where temporary soil stabilization required free from visible erosion?				
Location:				
Location:				
Location:				
Location:				
Temporary Linear Sediment Barriers				
Are temporary linear sediment barriers properly installed in accordance with the details, functional and maintained?				
Are temporary linear sediment barriers free of accumulated litter?				
Is the built-up sediment less than 1/3 the height of the barrier?				

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Are cross barriers installed where necessary and properly spaced?				
Are fiber rolls installed and maintained on required slopes in accordance with the details, functional and maintained?				
Location:				
Location:				
Location:				
Location:				
Location:				
Storm Drain Inlet Protection				
Are storm drain inlets internal to the project properly protected?				
Are storm drain inlets that are necessary externally to the project properly protected?				
Are storm drain inlet protection devices in working order and being properly maintained?				
Location:				
Location:				
Location:				
Location:				
Location:				
Desilting Basins				
Are basins maintained to provide the required retention/detention?				
Are basin controls (inlets, outlets, diversions, weirs, spillways, and racks) in working order?				
Location:				
Location:				
Location:				
Location:				
Stockpiles				
Are all locations of temporary stockpiles, including soil, hazardous waste, and construction materials in approved areas?				
Are stockpiles protected from run-on, run-off from adjacent areas and from winds?				
Are stockpiles located at least 15 m from concentrated flows, downstream drainage courses and storm drain inlets?				
Are required covers and/or perimeter controls in place?				

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Location:				
Location:				
Location:				
Concentrated Flows				
Are concentrated flow paths free of visible erosion?				
Location:				
Location:				
Location:				
Location:				
Tracking Control				
Are points of ingress/egress to public/private roads inspected, swept, and vacuumed daily?				
Are all paved areas free of visible sediment tracking or other particulate matter?				
Location:				
Location:				
Location:				
Location:				
Wind Erosion Control				
Is dust control implemented?				
Location:				
Location:				
Location:				
Location:				
Dewatering Operations				
Is dewatering handled in conformance with the dewatering permit issued by the RWQCB?				
Is required treatment provided for dewatering effluent?				
Location:				
Location:				
Location:				
Location:				

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Vehicle & Equipment Fueling, Cleaning, and Maintenance				
Are vehicle and equipment fueling, cleaning and maintenance areas reasonably clean and free of spills, leaks, or any other deleterious material?				
Are vehicle and equipment fueling, cleaning and maintenance activities performed on an impermeable surface in dedicated areas?				
If no, are drip pans used?				
Are dedicated fueling, cleaning, and maintenance areas located at least 15 m away from downstream drainage facilities and watercourses, and protected from run-on and runoff?				
Is wash water contained for infiltration/ evaporation and disposed of outside the highway right of way?				
Is on-site cleaning limited to washing with water (no soap, soaps substitutes, solvents, or steam)?				
On each day of use, are vehicles and equipment inspected for leaks and if necessary, repaired?				
Location:				
Location:				
Location:				
Location:				
Waste Management & Materials Pollution Control				
Are material storage areas and washout areas protected from run-on and runoff, and located at least 15 m from concentrated flows and downstream drainage facilities?				
Are all material handling and storage areas clean; organized; free of spills, leaks, or any other deleterious material; and stocked with appropriate clean-up supplies?				
Are liquid materials, hazardous materials, and hazardous wastes stored in temporary containment facilities?				
Are bagged and boxed materials stored on pallets?				
Are hazardous materials and wastes stored in appropriate, labeled containers?				
Are proper storage, clean-up, and spill-reporting procedures for hazardous materials and wastes posted in open, conspicuous and accessible locations adjacent to storage areas?				
Are temporary containment facilities free of spills and rainwater?				

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Are temporary containment facilities and bagged/boxed materials covered?				
Are temporary concrete washout facilities designated and being used?				
Are temporary concrete washout facilities functional for receiving and containing concrete waste and are concrete residues prevented from entering the drainage system?				
Do temporary concrete washout facilities provide sufficient volume and freeboard for planned concrete operations?				
Are the temporary concrete washout facilities' PVC liners free from punctures and holes?				
Are concrete wastes, including residues from cutting and grinding, contained and disposed of off-site or in concrete washout facilities?				
Are spills from mobile equipment fueling and maintenance properly contained and cleaned up?				
Is the site free of litter?				
Are trash receptacles provided in the Contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods?				
Is litter from work areas within the construction limits of the project site collected and placed in watertight dumpsters?				
Are waste management receptacles free of leaks?				
Are the contents of waste management receptacles properly protected from contact with storm water or from being dislodged by winds?				
Are waste management receptacles filled at or beyond capacity?				
Location:				
Location:				
Location:				
Location:				
Temporary Water Body Crossing or Encroachment				
Are temporary water body crossings and encroachments constructed as shown on the plans or as approved by the engineer?				
Does the project conform to the requirements of the 404 permit and/or 1601agreement?				
Location:				
Location:				
Location:				

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Location:				
Illicit Connection/Illegal Discharge Detection and Reporting				
Is there any evidence of illicit discharges or illegal dumping on the project site?				
If yes, has the Engineer been notified?				
Location:				
Location:				
Location:				
Location:				
Discharge Points				
Are discharge points and discharge flows free from noticeable pollutants?				
Are discharge points free of any significant erosion or sediment transport?				
Location:				
Location:				
Location:				
Location:				
SWPPP Update				
Do the SWPPP, and Storm Water Control Plans (SWCPs) adequately reflect the current site conditions and contractor operations?				
Are all BMPs shown on the SWCPs installed in the proper location(s) and according to the details for the plan?				
Location:				
Location:				
Location:				
Location:				
General				
Are there any other potential water pollution control concerns at the site?				
Location:				
Location:				
Location:				
Location:				

OTHER REQUIREMENTS				
Requirement	**Yes**	**No**	**N/A**	**Corrective Action**
Storm Water Monitoring				
Does storm water discharge directly to an water body listed as impaired for sediment/sedimentation or turbidity in the General Construction Activity Permit?				
If yes, were samples for sediment/sedimentation or turbidity collected pursuant to the sampling and analysis plan, if required, during rain events?				
Were there any BMPs not properly implemented, or breaches, malfunctions, leakages or spills observed, which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water?				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				
Were soil amendments (e.g., gypsum) used on the project?				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				
Did storm water contact stored materials or waste and resulted in a discharge from the construction site? (Materials not in watertight containers, etc.)				
If yes, were samples for non-visually detectable pollutants collected pursuant to the sampling and analysis plan during rain events?				

I. Project Information

Project Name: NCPA Lodi Energy Center

Location: The NCPA Lodi Energy Center Project is located at 12745 N. Thornton Road in Lodi, San Joaquin County, California.

Owner Contact: North California Power Agency (NCPA)
651 Commerce Drive
Roseville, CA 95678
(916) 781-3636

Project Description: The NCPA Lodi Energy Center Project consists of on-site grading & drainage improvements, utility improvements, paving, construction of concrete pad for placement of power plant equipments, 2 industrial building and series of cooling towers on portion of the 162+/- acres government property, APN 055-130-16, situated in Lodi, San Joaquin County, California.

Total Site Area: 162.51 acres. Estimated size of disturbance is 4.6 acres.

Existing Conditions: The NCPA Lodi Energy Center site encompasses approximately 4.6 acres. At the time of exploration, a project site is surrounded by White Slough Water Pollution Control Plant on north and east and the existing phase I development of the NCPA Lodi Energy Center on west. Existing terrain consists of basin-like area with moderately covered with seasonal grass. A culvert exists at the southern portion of the site to convey drainage runoff exiting the site at the southwest corner via a natural swale along the south project limit.

Receiving Waters: Indirectly into White Slough and Bishop Cut

Permit: City of Lodi Grading Permit for Site Improvement: (To be Determined)

Unique Site Features: The project site lies between the City of Lodi's White Slough Water Pollution Control Facility (WPCF) lagoons on the north and east, and the existing NCPA Combustion Turbine Project #2 on the west. Existing berms separate the drainage from project site and WPCF areas. The site occupied by the NCPA Combustion Turbine Project #2 borders the site on the west and does not contribute drainage to project site. The general topography of the project site slopes to the south towards an existing drainage swale which is dry and only flows during storm events.

Construction Site Estimates:

The following are estimated of the construction site:

Construction Site Limits of Work Area:	4.6 acres
Percentage impervious area before construction:	6 %
Runoff coefficient before construction*:	C = 0.28
Percentage impervious area after construction:	40 %
Runoff coefficient after construction*:	C = 0.70
Anticipated storm water flow on to the construction site:	None

* Calculation are shown in Appendix D

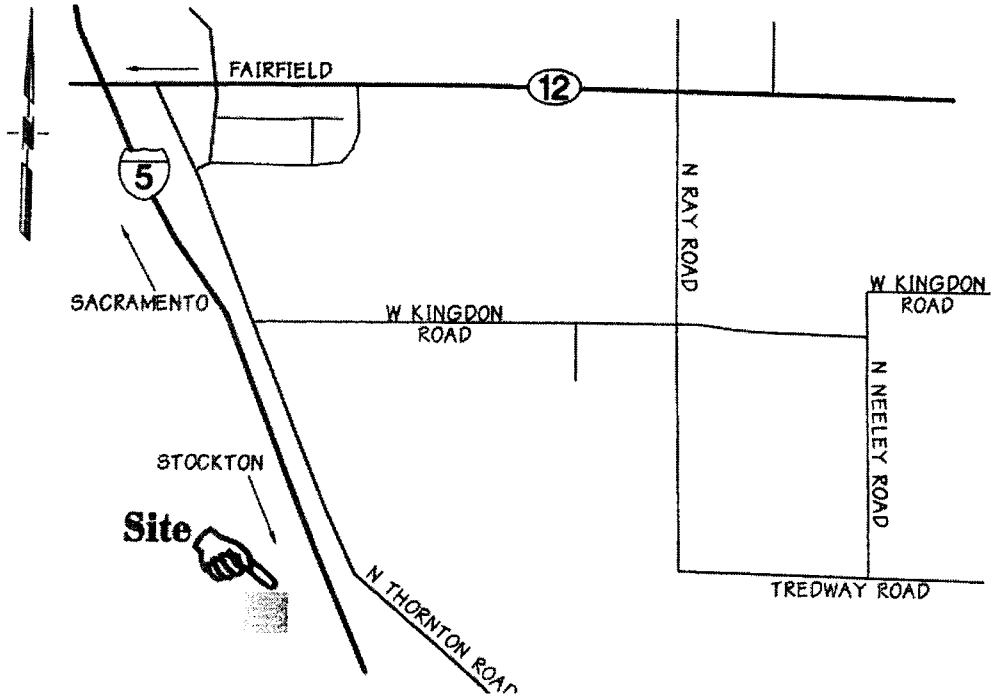
1. Construction Scheduling

Estimated Start of Construction: May 2009 Estimated Completion: June 2012

The order of activities may be as follows:

ACTIVITY	Erosion and Sediment Controls to be in place by:	APPROXIMATE START DATE	APPROXIMATE COMPLETETION DATE
1. Clearing and Grubbing			
2. Rough Grading			
3. Construction of Storm Drain Improvements			
4. Waterline Installation			
5. Final Grade			
6. Building Construction			
7. Paving			
8. Landscaping			

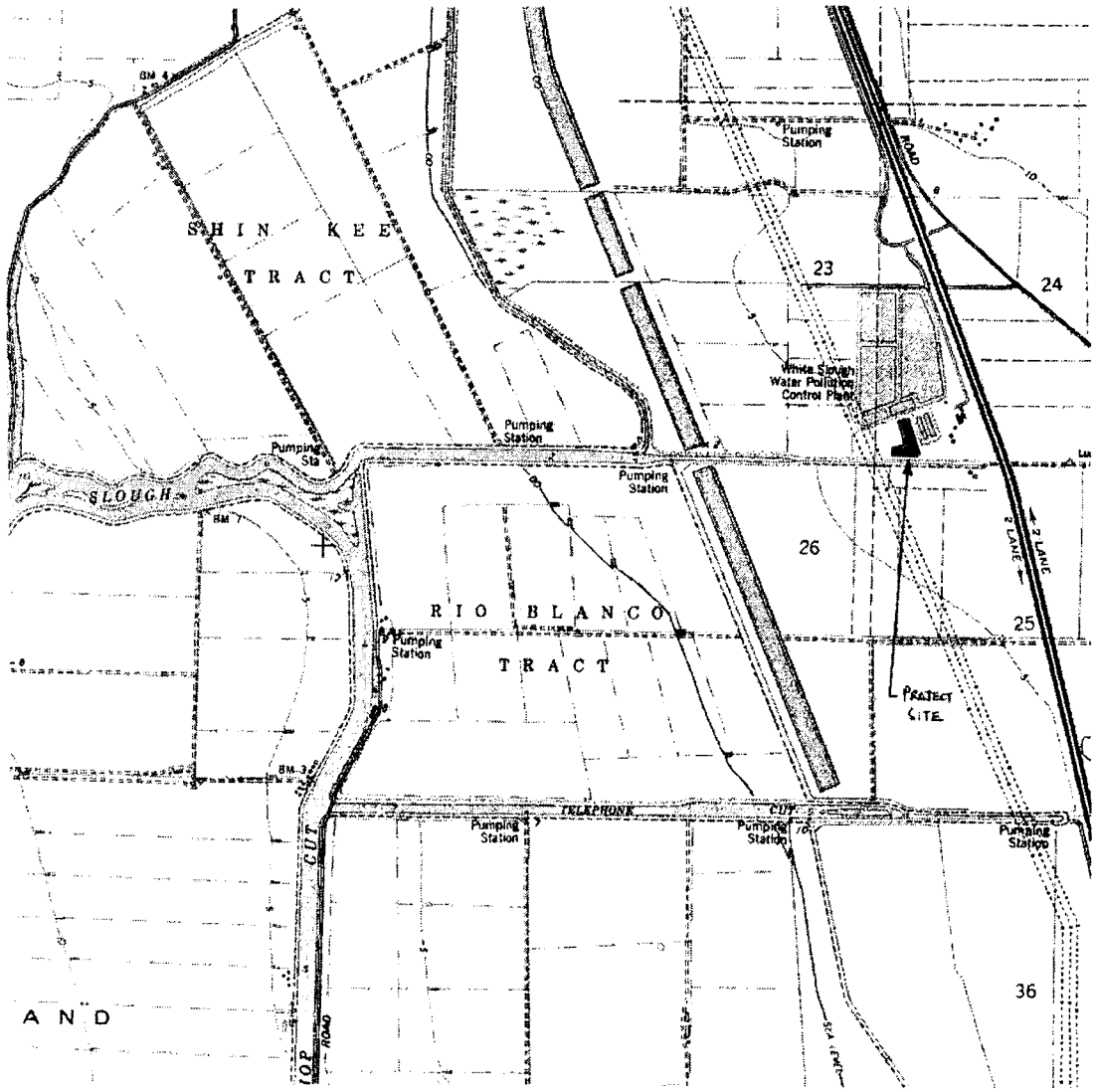
A. Vicinity Map



II. Source Identification

A. Topography Map

Below is the topographic map that shows the project site and the area extending approximately one-quarter mile beyond the project. It also shows nearby surface water bodies, which include watercourses such as rivers, creeks, streams, ponds and wetlands.



↑ North	USGS – 7.5 Minute Series Terminous California –San Joaquin County 1 inch equals 1000 feet

B. Site Map

The Erosion Control Plan maps with an overlain grid to facilitate the location of BMPs and inspection areas are included in the following pockets.

The following areas should be clearly identifiable on the site map, SWPP-2.

1. Areas of soil disturbance
2. Surface water locations
3. Areas of existing vegetation
4. Location of control practices (BMPs) used during construction
5. Drainage patterns and slopes anticipated after major grading activities are completed
6. Areas used to store soils, waste and materials
7. Vehicle and equipment storage and service/fueling areas will take place in a contained area well away from any water bodies and storm drains
8. Location of post-construction control practices
9. Storage of Construction Materials activities will take place in a contained area well away from any water bodies and storm drains.

Erosion Control Requirements and Specifications

1. MINIMUM CONSTRUCTION SITE STORM WATER MANAGEMENT PRACTICES

THE STORM WATER MANAGEMENT PRACTICES DESCRIBED BELOW ARE THE MINIMUM, REQUIRED WATER QUALITY PROTECTION MEASURES APPLICABLE TO ALL CONSTRUCTION SITES WITHIN CITY OF LODI. THIS LISTING DOES NOT INCLUDE THE VARIOUS INSPECTION, RECORD KEEPING, TRAINING AND REPORTING REQUIREMENTS. ADDITIONALLY, THERE WILL BE INSTANCES WHERE PROJECT AND SITE CONDITIONS REQUIRE SUPPLEMENTING OR DEVIATING FROM THESE MINIMUM PROTECTION REQUIREMENTS. THE CONTRACTOR IS EXPECTED TO DEPLOY MEASURES SUFFICIENT TO ACHIEVE COMPLIANCE WITH THE CITY'S GRADING ORDINANCE; AND, AS APPLICABLE (PROJECTS WHICH INVOLVE ONE ACRE OR MORE OF DISTURBED SOIL OR ARE PART OF A LARGER COMMON PLAN OF DEVELOPMENT THAT ENCOMPASSES ONE ACRE OR MORE OF DISTURBED SOIL), WITH THE STATE WATER RESOURCES CONTROL BOARD'S (SWRCB) NPDES GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY.

A. SCHEDULING

CONSTRUCTION SHALL BE SCHEDULED TO MINIMIZE CONSTRUCTION ACTIVITIES IN "HIGH-RISK AREAS" AND THE AMOUNT OF ACTIVE DISTURBED SOIL AREAS, DURING THE RAINY SEASON (OCT. 15th TO MAY 1st). "HIGH-RISK AREAS" INCLUDE THOSE AREAS WITHIN 50 FEET OF USGS WATERCOURSES, 100-YEAR FLOOD PLAINS, REGULATED WETLANDS, AND WHERE SLOPES EXCEED 16%.

UNLESS SPECIFICALLY AUTHORIZED BY THE CITY'S ON-SITE REPRESENTATIVE, DURING THE RAINY SEASON THE CONTRACTOR SHALL NOT SCHEDULE CONSTRUCTION ACTIVITIES IN "HIGH RISK AREAS" OR SCHEDULE TO HAVE MORE THAN 5 ACRES OF ACTIVE DISTURBED SOIL AREA. WHERE PERMANENT STORM WATER TREATMENT DEVICES ARE TO BE CONSTRUCTED, THESE DEVICES SHOULD, WHENEVER FEASIBLE, BE CONSTRUCTED AS AN EARLY WORK ITEM.

B. PRESERVATION OF NATURAL FEATURES

PRIOR TO THE COMMENCEMENT OF SOIL-DISTURBING ACTIVITIES, AREAS OF EXISTING VEGETATION THAT ARE TO REMAIN AND ENVIRONMENTALLY SENSITIVE AREAS (I.E. WETLANDS, PROTECTED HABITATS, ETC) SHALL BE FENCED FOR PROTECTION. IN GENERAL, SITE DESIGNS SHALL PRESERVE EXISTING VEGETATION TO THE MAXIMUM EXTENT POSSIBLE; AND DURING CONSTRUCTION, EXISTING VEGETATION SHALL BE PRESERVED (AND PROTECTED BY FENCING) FOR AS LONG AS POSSIBLE TO MINIMIZE EROSION.

C. STORM WATER RUN-ON AND CONCENTRATED FLOWS

EXISTING WATERCOURSES SHALL BE PROTECTED; AND IF DIVERTED, HANDLED IN A NON-ERODING FASHION. TO THE EXTENT FEASIBLE, ALL CONCENTRATED WATER FLOWS SHALL BE CHANNELED AWAY FROM DISTURBED SOIL AREAS / STOCKPILES. CONCENTRATED WATER FLOWS SHALL BE CONVEYED IN A NON-ERODING FASHION.

D. STOCKPILE MANAGEMENT

STOCKPILES SHALL BE MANAGED AS FOLLOWS:

1 SOIL STOCKPILES
- RAINY SEASON:
  - COVERED, OR PROTECTED WITH SOIL STABILIZATION MEASURES & PERIMETER SEDIMENT BARRIERS.
- NON-RAINY SEASON:
  - COVERED OR PROTECTED WITH PERIMETER SEDIMENT BARRIERS.

2. CONCRETE / ASPHALT RUBBLE, ROCK AND AGGREGATE BASE / SUB-BASE
- COVERED OR PROTECTED WITH PERIMETER SEDIMENT BARRIERS

3. "COLD MIX" ASPHALT
- COVERED

E. SEDIMENT TRACKING CONTROL

APPROPRIATE MEASURES SHALL BE DEPLOYED TO MINIMIZE THE TRACKING OF SEDIMENT OFF-SITE BY VEHICLES AND/OR EQUIPMENT. THESE MEASURES INCLUDE STABILIZED CONSTRUCTION ENTRANCES/EXITS & ROADWAYS, AND TIRE WASHING. WHERE TRACKING OCCURS, STREETS SHALL BE SWEPT USING A PICKUP SWEEPER WITH WATER SUPPLY.

F. NON-STORM WATER MANAGEMENT

NON-STORM WATER DISCHARGES SHALL BE MINIMIZED TO THE EXTENT FEASIBLE. SEDIMENT-LADEN NON-STORM WATER IS REQUIRED TO BE FILTERED (OR EQUIVALENT TREATMENT) PRIOR TO DISCHARGING. MEASURES REQUIRED TO MANAGE NON-STORM WATER DISCHARGES INCLUDE: WATER CONSERVATION PRACTICES, DUST CONTROL, MATERIAL STORAGE PRACTICES, VEHICLE/EQUIPMENT OPERATION AND MAINTENANCE REQUIREMENTS, WASTE MANAGEMENT PRACTICES, AND SPILL PREVENTION / CONTROL MEASURES.

G. DISTURBED SOIL AREA MANAGEMENT

DISTURBED SOIL AREAS (DSA) SHALL BE PROTECTED WITH AN "EFFECTIVE COMBINATION" OF MEASURES INCLUDING SOIL STABILIZATION, SEDIMENT BARRIERS AND BASINS / TRAPS. THERE MAY BE SITUATIONS WHERE "SEDIMENT BASINS" OR "TREATMENT" ARE ABLE TO SUBSTITUTE AS ALTERNATIVE CONTROL MEASURES TO THE NORMALLY REQUIRED "EFFECTIVE COMBINATION" OF SOIL STABILIZATION, SEDIMENT BARRIERS AND BASINS / TRAPS. HOWEVER, WHEN SUBSTITUTING THESE MEASURES, THE CONTRACTOR MUST BE PREPARED TO DEMONSTRATE THAT THE SEDIMENT LOAD WITHIN STORM WATER DISCHARGES FROM THE CONSTRUCTION SITE DOES NOT EXCEED NATURAL OR PRE-CONSTRUCTION LEVELS.

1. SOIL STABILIZATION MEASURES INCLUDE:
- HYDRAULIC MULCH (REF. CASQA BMP # EC-3)
- HYDROSEEDING (REF. CASQA BMP # EC-4)
- SUITABLY STABILIZED, NON-POLLUTING STRAW / WOOD / ORGANIC MULCH (REF. CASQA BMP #'s EC-6 & EC-8)
- GEOTEXTILES, MATS, PLASTIC COVERS AND EROSION CONTROL BLANKETS (REF. CASQA BMP # EC-7)
- STABILIZED CONSTRUCTION ROADWAYS (REF. CASQA BMP # TC-2)

2. SEDIMENT BARRIERS INCLUDE:
- SILT FENCES (REF. CASQA BMP # SE-1)
- SAND / GRAVEL BAG BARRIERS (REF. CASQA BMP #'S SE-6 & SE-8)
- STRAW BALE BARRIERS (REF. CASQA BMP # SE-9)
- FIBER ROLLS (REF. CASQA BMP # SE-5)

3. BASIN / TRAPS INCLUDE:
- DESILTING BASINS (REF. CALTRANS BMPS)
- SEDIMENT TRAPS (REF. CALTRANS BMPS)

4. ON DSAs WITH SLOPE LENGTHS GREATER THAN 10 FEET, THE FOLLOWING MEASURES SHALL BE DEPLOYED:

a. RAINY SEASON (OCT. 15TH TO MAY 1ST):
- NON-ACTIVE AREAS (NO SOIL DISTURBING ACTIVITIES FOR 21 OR MORE DAYS)
  - ON SLOPES EQUAL TO OR FLATTER THAN 1:20 (V/H), SOIL STABILIZATION
  - ON SLOPES STEEPER THAN 1:20 (V/H), SOIL STABILIZATION AND SEDIMENT BARRIERS
- ACTIVE AREAS
  - ON SLOPES STEEPER THAN 1:20 (V/H), SEDIMENT BARRIERS
  - ON SLOPES STEEPER THAN 1:2 (V/H) WITH SLOPE LENGTHS GREATER THAN 50 FEET: SOIL STABILIZATION: SEDIMENT BARRIERS: AND WHERE FEASIBLE, BASINS / TRAPS

b. NON-RAINY SEASON:
- NON-ACTIVE AREAS (NO SOIL DISTURBING ACTIVITIES FOR 21 OR MORE DAYS)
  - ON SLOPES STEEPER THAN 1:2 (V/H), SEDIMENT BARRIERS.

5. GENERAL:

PROTECTION SHALL BE DEPLOYED ON NON-ACTIVE DSAs WITHIN 14 DAYS FROM THE CESSATION OF SOIL-DISTURBING ACTIVITIES OR ONE DAY PRIOR TO THE PREDICTED (40% OR MORE CHANCE) ONSET OF SIGNIFICANT PRECIPITATION, WHICHEVER OCCURS FIRST. PROTECTION SHALL BE DEPLOYED ON ACTIVE DSAs PRIOR TO THE PREDICTED (40% OR MORE CHANCE) ONSET OF SIGNIFICANT PRECIPITATION.

"TERRACES." FOR CUT SLOPES UP TO 60 FEET IN HEIGHT, TERRACES AT LEAST 8 FEET (2.4 METERS) IN WIDTH SHALL BE ESTABLISHED AT NOT MORE THAN 30-FOOT (9.1 METERS) VERTICAL INTERVALS ON ALL CUT SLOPES TO CONTROL SURFACE DRAINAGE AND DEBRIS EXCEPT THAT WHERE ONLY ONE TERRACE IS REQUIRED, IT SHALL BE AT MIDHEIGHT. FOR CUT SLOPES GREATER THAN 60 FEET (18 METERS) AND UP TO 120 FEET (37 METERS) IN VERTICAL HEIGHT, ONE ADDITIONAL TERRACE AT APPROXIMATELY MIDHEIGHT SHALL BE 12 FEET (3.6 METERS) IN WIDTH. TERRACES SHALL SLOPE A MINIMUM OF 5 PERCENT GRADIENT TOWARD THE HILLSIDE. TERRACE WIDTHS AND SPACING FOR CUT SLOPES GREATER THAN 120 FEET (36 METERS) IN HEIGHT SHALL BE DESIGNED BY THE CIVIL ENGINEER AND APPROVED BY THE DIRECTOR. SUITABLE ACCESS SHALL BE PROVIDED TO PERMIT PROPER CLEANING AND MAINTENANCE.

"SEDIMENT BASIN:" A BASIN WITH A CAPACITY EQUIVALENT TO AT LEAST 3600 CUBIC FEET OF STORAGE (AS MEASURED FROM THE BOTTOM OF THE BASIN TO THE PRINCIPAL OUTLET) PER ACRE DRAINING INTO THE BASIN. THE LENGTH OF THE BASIN SHALL BE MORE THAN TWICE THE BASIN'S WIDTH (LENGTH IS DETERMINED BY MEASURING THE DISTANCE BETWEEN THE INLET AND THE OUTLET). THE DEPTH OF THE BASIN MUST NOT BE LESS THAN THREE FEET NOR GREATER THAN FIVE FEET.

"TREATMENT": A COMBINATION OF BASIN AND TREATMENT ENGINEERED TO CAPTURE AND TREAT (TO REMOVE 0.01 MM SIZED PARTICLES AND LARGER) THE 10-YEAR, 6-HOUR RAIN EVENT USING Q=CxIxA WHERE C=0.5 AND I RANGES FROM 0.14 TO 1.29.

DETAILED REFERENCES:

1. CALIFORNIA STORM WATER QUALITY ASSOCIATION (CASQA) "CONSTRUCTION HANDBOOK", JANUARY 2003. ERRATA SEPTEMBER 2004. AVAILABLE ON-LINE AT: HTTP://WWW.CABMPHANDBOOKS.COM/

2. CALTRANS "STATEWIDE STORM WATER QUALITY PRACTICE GUIDELINES", APRIL 2003. AVAILABLE ON-LINE AT: HTTP://WWW.DOT.CA.GOV/HQ/ENV/STORMWATER/SPECIAL/NEWSETUP/INDEX.HTM

CRITICAL AREA PLANTING CONSTRUCTION SPECIFICATIONS (JANUARY 2006)

A. SCOPE

ESTABLISHING VEGETATION ON SEVERELY ERODING AREAS OR AREAS WITH AN EROSION POTENTIAL. ITS PURPOSE IS TO STABILIZE THE SOIL, MINIMIZE OR PREVENT DAMAGE FROM SEDIMENT AND RUNOFF TO DOWNSTREAM AREAS, PROTECT WILDLIFE HABITAT, AND MAINTAIN AESTHETIC QUALITIES.

B. AREAS TO BE SEEDED, TIMING OF SEEDING

COMPLETE REVEGITATION AND STABILIZATION OF ALL DISTURBED SOILS, BOTH WITHIN AND OUTSIDE COUNTY RIGHT-OF-WAY, WILL BE ACCOMPLISHED WITH SPECIFIED AMOUNTS AND TYPES OF VEGETATIVE SPECIES, MULCH, AND FERTILIZER MATERIAL. SEE MAJOR LAND RESOURCE AREA EXHIBITS MLRA 15 OR 22.

ALL EROSION AND SEDIMENT CONTROL PRACTICES PERFORMED AFTER OCTOBER 15, SHALL FOLLOW "RAINY SEASON" SPECIFICATION CONTAINED IN THE STORM WATER MANAGEMENT PRACTICES.

C. MATERIAL

1. SEED - ALL SEED SHALL BE DELIVERED TO THE SITE TAGGED AND LABELED IN ACCORDANCE WITH THE CALIFORNIA AGRICULTURAL CODE AND SHALL BE ACCEPTABLE TO THE COUNTY AGRICULTURAL COMMISSIONER.

SEED SHALL BE OF A QUALITY WHICH HAS A MINIMUM PURE LIVE SEED CONTENT OF 80% (% PURITY X % GERMINATION) AND WEED SEED SHALL NOT EXCEED 0.5% OF THE AGGREGATE OF PURE LIVE SEED AND OTHER MATERIALS. LEGUME SEED SHALL BE INOCULATED WITH INOCULATE SPECIFIC TO ITS NEEDS WITHIN TWO HOURS PRIOR TO SEEDING. INOCULANTS SHALL NOT BE USED LATER THAN THE DATE INDICATED ON THE CONTAINER OR AS OTHERWISE SPECIFIED. ALL INOCULATED SEED SHALL BE LABELED TO SHOW WEIGHT OF SEED, THE DATE OF INOCULATION, AND THE WEIGHT AND SOURCE OF INOCULANT MATERIALS.

2. FERTILIZER - A COMMERCIAL FERTILIZER SHALL BE AMMONIUM PHOSPHATE AND CONTAIN A MINIMUM OF 16% NITROGEN, 20% PHOSPHORUS, AND 0% POTASH, UNIFORM IN COMPOSITION, DRY AND FREE FLOWING, PELLETED OR GRANULAR.

ALL FERTILIZER SHALL BE DELIVERED IN UNBROKEN OR UNOPENED CONTAINERS, LABELED IN ACCORDANCE WITH APPLICABLE STATE REGULATIONS AND BEARING THE WARRANTY OF THE PRODUCER FOR THE GRADE FURNISHED.

3. MULCH - MULCH SHALL BE ONE OF THE FOLLOWING MATERIALS AS APPROVED BY THE GOVERNMENT REPRESENTATIVE.

4. STRAW - STRAW SHALL BE NEW STRAW DERIVED FROM RICE, WHEAT, OATS, OR BARLEY, AND BE FREE OF MOLD AND NOXIOUS WEED SEED. STRAW SHALL BE FURNISHED IN AIR DRY BALES. EVIDENCE SHALL BE FURNISHED THAT CLEARANCE HAS BEEN OBTAINED FROM THE COUNTY AGRICULTURAL COMMISSIONER, AS REQUIRED BY LAW, BEFORE STRAW OBTAINED FROM OUTSIDE THE COUNTY IN WHICH IT IS TO BE USED IS DELIVERED TO THE SITE OF THE WORK.

5. WOOD FIBER MULCH - WOOD FIBER MULCH IS A WOOD CELLULOSE FIBER THAT CONTAINS NO GERMINATION OR GROWTH INHIBITING FACTORS. IT IS COLORED WITH A NON-TOXIC, WATER SOLUBLE, GREEN DYE TO PROVIDE A PROPER GAUGE FOR METERING OVER GROUND SURFACES. IT HAS THE PROPERTY TO BE EVENLY DISPERSED AND SUSPENDED WHEN AGITATED IN WATER.

D. SEEDING REQUIREMENTS

1. GENERAL - ALL SEEDING, FERTILIZER AND MULCHING OPERATIONS SHALL BEGIN WHEN APPROVAL IS GIVEN BY THE APPROPRIATE COUNTY ENGINEER OR CONSERVATION DISTRICT REPRESENTATIVE.

2. SEEDBED PREPARATION - THE ENTIRE AREA TO BE SEEDED SHALL BE REASONABLY SMOOTH AND CONFORM TO THE DESIRED SHAPE BEFORE ACTUAL SEEDBED PREPARATION IS BEGUN. ANY DEBRIS WHICH WOULD INTERFERE WITH SEEDING OPERATIONS GROWTH OR MAINTENANCE OF THE VEGETATIVE COVER WILL BE REMOVED. THE AREA TO BE SEEDED SHALL HAVE A FIRM SEEDBED WHICH HAS PREVIOUSLY BEEN ROUGHENED BY SCARIFYING, DISKING, HARROWING, CHISELING, OR OTHERWISE WORKED TO A DEPTH OF TWO TO FOUR INCHES (2" - 4"). NO IMPLEMENT SHALL BE USED THAT WILL CREATE AN EXCESSIVE AMOUNT OF DOWNWARD MOVEMENT OF SOIL OR CLODS OF SLOPING AREAS. SEEDBED MAY BE PREPARED AT TIME OF COMPLETION OF EARTH-MOVING WORK.

3. FERTILIZING - FERTILIZER SHALL BE DISTRIBUTED UNIFORMLY OVER THE SEEDBED AT THE RATE OF 300 POUNDS PER ACRE, AND SHALL BE IN SUCH PHYSICAL CONDITION TO INSURE UNIFORM APPLICATION OVER THE AREA TO BE FERTILIZED. FERTILIZER MAY BE APPLIED IN ANY WAY THAT WILL RESULT IN UNIFORM DISTRIBUTION. THE FERTILIZER SHALL BE INCORPORATED INTO THE SOIL.

4. SEEDING - SEED SHALL BE BROADCAST BY HAND, MECHANICAL HAND SEEDER, POWER OPERATED SEEDER, HYDROSEEDER OR OTHER APPROVED EQUIPMENT. SEED SHALL HAVE A SOIL COVER OF NOT MORE THAN ONE-HALF INCH. SEEDING WILL BE CARRIED OUT USING EITHER OF THE FOLLOWING METHODS:

METHOD 1 THE SEED MAY BE DRILLED, NOT TO EXCEED ONE-HALF (1/2) INCH DEEP AND CULTIPACKED OR ROLLED ONCE OVER WITH A CORRUGATED ROLLER ON ALL AREAS WHERE EQUIPMENT CAN BE OPERATED SAFELY. SEED OPERATIONS WILL BE ACROSS THE SLOPE.

METHOD 2 THE SEED MAY BE APPLIED IN A SLURRY MIX OF WOOD CELLULOSE FIBER DISTRIBUTED UNIFORMLY AT THE PRESCRIBED RATE. THE APPLICATION UNIT USED FOR "HYDRO MULCH" SHALL BE EQUIPPED WITH AN AGITATOR TO MAINTAIN THE SEED AND MULCH IN SUSPENSION WITHIN THE UNIT'S TANK PRIOR TO AND DURING APPLICATION.

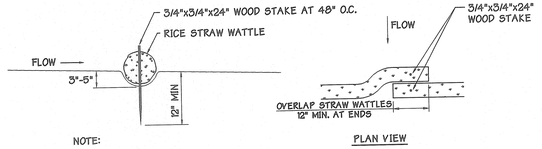
METHOD 3 WHERE EMERGENCY TREATMENT OF EXPOSED SOILS EXTENDS BEYOND OCTOBER 15, EMERGENCY MULCHING WITHOUT SEED WILL BE PRESCRIBED IN ACCORDANCE WITH "SOIL STABILIZATION MEASURES" DESCRIBED PREVIOUSLY.

SPECIAL NOTE: A MINIMUM 70% SEED GERMINATION WITH AT LEAST 1" GROWTH MUST BE OBTAINED BY DECEMBER 1ST, OR AREA MUST BE COVERED WITH STRAW MULCH.

SEED MIX

TIME PERIOD / MULCH TYPE	METHOD	TYPE OF SEED	AMOUNT/TYPE PER ACRE	PER 1000 SqFt
15 SEP - 15 OCT STRAW OR WOOD FIBER	HYDROSEED	BLANDO BROME AND EITHER	12 lbs/acre	0.3 lbs/1000 SqFt
		WIMERRA '62' OR ANNUAL RYE GRASS	9 lbs/acre	0.2 lbs/1000 SqFt
15 SEP - 15 OCT STRAW OR WOOD FIBER	BROADCASTED	BLANDO BROME AND ROSE CLOVER	12 lbs/acre	0.3 lbs/1000 SqFt
			9 lbs/acre	0.2 lbs/1000 SqFt
16 OCT - 14 SEP STRAW ONLY	HYDROSEED	BLANDO BROME AND EITHER	24 lbs/acre	0.6 lbs/1000 SqFt
		WIMERRA '62' OR ANNUAL RYE GRASS	18 lbs/acre	0.4 lbs/1000 SqFt
16 OCT - 14 SEP STRAW ONLY	BROADCASTED	BLANDO BROME AND ROSE CLOVER	24 lbs/acre	0.6 lbs/1000 SqFt
			18 lbs/acre	0.4 lbs/1000 SqFt

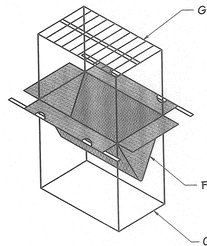
A MULCH COVERING SHALL BE APPLIED OVER THE SURFACE OF THE SEEDED AREA. MULCHING SHALL FOLLOW IMMEDIATELY AFTER SEEDING UNLESS OTHERWISE DIRECTED. MULCH WILL BE OF MATERIAL INDICATED.



NOTE: PLAN VIEW

STRAW WATTLES SHALL BE MANUFACTURED FROM RICE STRAW AND BE WRAPPED IN A TUBULAR BLACK PLASTIC NETTING. THE NETTING SHALL HAVE A STRAND THICKNESS OF 0.30 INCH, AND A KNOT THICKNESS OF 0.055 AND A WEIGHT OF 0.35 OUNCE PER FOOT (EACH ± 10%) AND SHALL BE MADE FROM 85% HIGH DENSITY POLYETHYLENE, 14% ETHYL VINYL ACETATE AND 1% COLOR FOR UV INHIBITION. STRAW WATTLE SHALL BE NINE INCHES IN DIAMETER (± 1"), BE TWENTY-FIVE FEET LONG (± 6") AND WEIGH APPROX 30 POUNDS (± 3LBS)

Straw Wattle Detail — NTS — 1



NOTES:

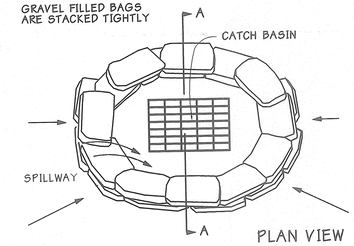
1. REMOVE DRAIN GRATE.

2. INSERT CATCH BASIN FILTER (DANDY BAG II BY DANDY PRODUCTS OR EQUAL) INTO BASIN LEAVING 3" FLAP EXPOSED.

3. REPLACE GRATE TO BASIN THEREBY PINCHING FABRIC BETWEEN GRATE AND CATCH BASIN AND HOLDING FILTER IN PLACE.

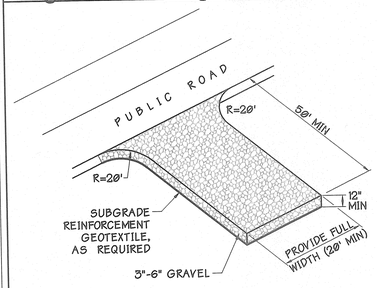
4. CONTRACTOR RESPONSIBLE TO INSPECT FILTERS WEEKLY AND AFTER EACH RAIN EVENT. EMPTY CATCH BASIN FILTERS WHEN HALF FULL. DISPOSE OF TRAPPED SEDIMENT IN ACCORDANCE WITH LOCAL REQUIREMENTS. CLEAN AND REUSE FILTERS IF POSSIBLE, DISCARD AND REPLACE AS NECESSARY.

Inlet Filterbag — NTS — 2



1. PLACE CURB TYPE SEDIMENT BARRIERS ON GENTLY SLOPING STREET SEGMENTS WHERE WATER CAN POND AND ALLOW SEDIMENT TO SEPARATE FROM RUNOFF.
2. BAGS, OF EITHER BURLAP OR WOVEN GEOTEXTILE FABRIC, ARE FILLED WITH GRAVEL, LAYERED AND PACKED TIGHTLY.
3. LEAVE ONE SANDBAG GAP IN THE TOP ROW TO PROVIDE A SPILLWAY FOR OVERFLOW.
4. INSPECT BARRIERS AND REMOVE SEDIMENT AFTER EACH STORM EVENT. SEDIMENT AND GRAVEL MUST BE REMOVED FROM THE TRAVELED WAY IMMEDIATELY.

Bags At Drainage Inlets — NTS — 3



1. A STABILIZED CONSTRUCTION ENTRANCE SHALL BE USED AT ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS.

2. THE ENTRANCE SHALL BE PROPERLY GRADED TO PREVENT RUNOFF FROM LEAVING THE CONSTRUCTION SITE.

3. CONSTRUCT ENTRANCE ON LEVEL GROUND

4. PERIODIC TOP DRESSING WITH ADDITIONAL ROCK SHALL BE PROVIDED TO INSURE THE INTEGRITY OF THE ENTRANCE DURING CONSTRUCTION.

5. THE ENTRANCE SHALL BE INSPECTED MONTHLY AND AFTER EACH RAINFALL.

6. REPLACE ROCK MATERIAL WHEN SURFACE VOIDS ARE VISIBLE.

7. ALL SEDIMENT DEPOSITS ON PAVED ROADWAYS SHALL BE REMOVED WITHIN 24 HOURS

8. THE FRACTURED ROCK AND GEOTEXTILE SHALL BE REMOVED AT COMPLETION OF CONSTRUCTION.

Stabalized Constuction Entrance — NTS — 4

WORKING DRAWING — DATE 10/23/2008 — REV

PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: PEM	
CHECKED BY: JDT	
LEAD DESIGNER: EC	
ENGINEER/TECH SPECIALIST: EC	
PROJECT ENGINEERING MANAGER: STEVEN BLUE	
PROJECT MANAGER	

Zero Harm — Leadership No Incidents Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: ____ STATE: ____ LIC. NO.: ____ DATE: ____

FORM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

CARLTON Engineering Inc.
3883 Ponderosa Road, Shingle Springs, CA 95682
Voice: 530.677.5515 Fax: 530.677.6645

PRELIMINARY NOT FOR CONSTRUCTION

WorleyParsons resources & energy

CLIENT/PROJECT TITLE: NCPA LODI ENERGY CENTER

PROJECT MANAGER	
PROJ ENGR MANAGER	
LEAD DISC ENGINEER	
ENGINEER/TECH. SPEC.	
LEAD DESIGNER	
CHECKED	
DRAWN	
DATE	
REV	

DRAWING TITLE: EROSION CONTROL NOTES AND DETAILS

SHEET NO: SWPPI

SCALE: N/A — DRAWING SIZE: ARCH D (24" x 36")

WORLEYPARSONS DWG. NO. — REV: A

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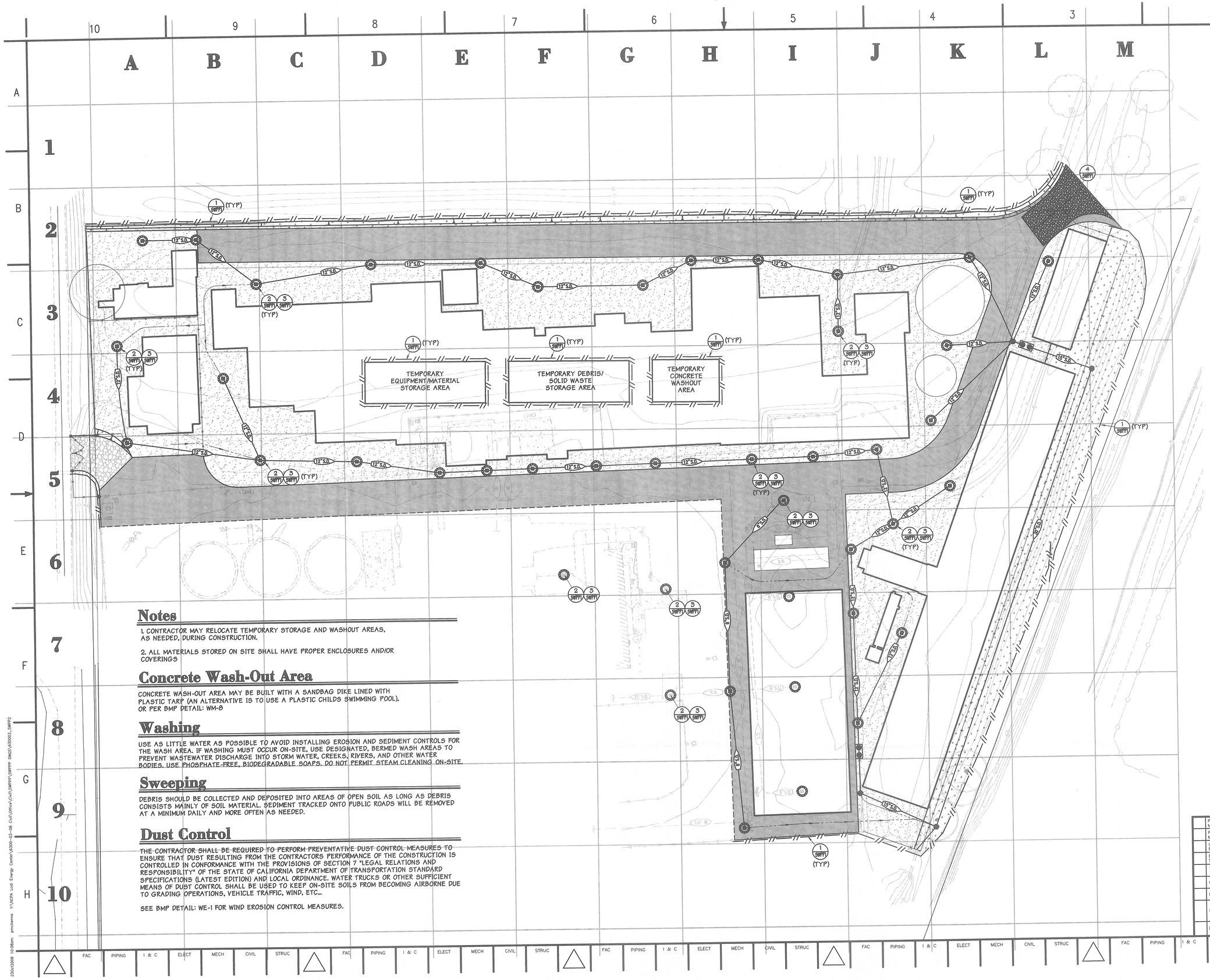

1 inch = 30 ft.

Legend

- DRIVE AISLE SECTION: 4" AC OVER 9.5" CLASS 2 AB
- 6" CRUSHED STONE (3/4" DRAIN ROCK)
- LANDSCAPE AREA
- CLASS 2 AGGREGATE BASE

Notes

1. CONTRACTOR MAY RELOCATE TEMPORARY STORAGE AND WASHOUT AREAS, AS NEEDED, DURING CONSTRUCTION.

2. ALL MATERIALS STORED ON SITE SHALL HAVE PROPER ENCLOSURES AND/OR COVERINGS

Concrete Wash-Out Area

CONCRETE WASH-OUT AREA MAY BE BUILT WITH A SANDBAG DIKE LINED WITH PLASTIC TARP (AN ALTERNATIVE IS TO USE A PLASTIC CHILDS SWIMMING POOL), OR PER BMP DETAIL: WM-8

Washing

USE AS LITTLE WATER AS POSSIBLE TO AVOID INSTALLING EROSION AND SEDIMENT CONTROLS FOR THE WASH AREA. IF WASHING MUST OCCUR ON-SITE, USE DESIGNATED, BERMED WASH AREAS TO PREVENT WASTEWATER DISCHARGE INTO STORM WATER, CREEKS, RIVERS, AND OTHER WATER BODIES. USE PHOSPHATE-FREE, BIODEGRADABLE SOAPS. DO NOT PERMIT STEAM CLEANING ON-SITE.

Sweeping

DEBRIS SHOULD BE COLLECTED AND DEPOSITED INTO AREAS OF OPEN SOIL AS LONG AS DEBRIS CONSISTS MAINLY OF SOIL MATERIAL. SEDIMENT TRACKED ONTO PUBLIC ROADS WILL BE REMOVED AT A MINIMUM DAILY AND MORE OFTEN AS NEEDED.

Dust Control

THE CONTRACTOR SHALL BE REQUIRED TO PERFORM PREVENTATIVE DUST CONTROL MEASURES TO ENSURE THAT DUST RESULTING FROM THE CONTRACTORS PERFORMANCE OF THE CONSTRUCTION IS CONTROLLED IN CONFORMANCE WITH THE PROVISIONS OF SECTION 7 "LEGAL RELATIONS AND RESPONSIBILITY" OF THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS (LATEST EDITION) AND LOCAL ORDINANCE. WATER TRUCKS OR OTHER SUFFICIENT MEANS OF DUST CONTROL SHALL BE USED TO KEEP ON-SITE SOILS FROM BECOMING AIRBORNE DUE TO GRADING OPERATIONS, VEHICLE TRAFFIC, WIND, ETC...

SEE BMP DETAIL: WE-1 FOR WIND EROSION CONTROL MEASURES.

WORKING DRAWING — DATE 10/23/2008 — REV

PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE		
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE		

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: PEM	
CHECKED BY: JDT	
LEAD DESIGNER: EC	
ENGINEER/TECH SPECIALIST: EC	
PROJECT ENGINEERING MANAGER: STEVEN BLUE	
PROJECT MANAGER	

Zero Harm — Leadership No Incidents Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

TEAM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

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3883 Ponderosa Road, Shingle Springs, CA 95682
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PRELIMINARY — NOT FOR CONSTRUCTION

WorleyParsons resources & energy

CLIENT/PROJECT TITLE: NCPA LODI ENERGY CENTER

DRAWING TITLE: EROSION CONTROL PLAN

SHEET NO: SWPP2

SCALE: 1" = 30'

DRAWING SIZE: ARCH D (24" x 36")

WORLEYPARSONS DWG. NO.

REV: A

PROJECT MANAGER	
PROJ ENGR MANAGER	
LEAD DISC ENGINEER	
ENGINEER/ TECH. SPEC.	
LEAD DESIGNER	
CHECKED	
DRAWN	
DATE	
REV	

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III. Narrative Descriptions

A. Project Description

The NCPA Lodi Energy Center is located at 12745 N. Thornton Road in San Joaquin County, California. The NCPA Lodi Energy Center site encompasses approximately 4.7 acres. At the time of exploration, a project site is surrounded by White Slough Water Pollution Control Plant on north and east and the existing phase I development of the NCPA Lodi Energy Center on west. Existing terrain consists of basin-like area with moderately covered with seasonal grass. A culvert exists at the southern portion of the site to convey drainage runoff exiting the site at the southwest corner via a natural swale along the south project limit.

The NCPA Lodi Energy Center Project consists of on-site grading & drainage improvements, utility improvements, paving, construction of concrete pad for placement of power plant equipments, 2 industrial building and series of cooling towers on portion of the 162+/- acres government property, APN 055-130-16, situated in Lodi, San Joaquin County, California.

B. Pollutants Likely to be Present in Storm Water Discharges

The following is a list of construction materials that will be used and activities that will be performed that will have the potential to contribute to pollutants, other than sediment to storm water runoff.

- A/C Paving
- Paint Products
- Petroleum Products (for equipment)
- Sanitary/Septic Fluids
- Cement Products
- _____
- _____
- _____

Construction activities that have the potential to contribute sediment to storm water discharges include:

- Clearing and Grubbing
- Grading
- Utility Excavation
- Paving
- Landscaping
- _____
- _____
- _____

E. Erosion and Sediment Control Practices

The implementation of proper erosion and sediment control measures is the most effective approach to reducing potential pollutants emitted from the construction site. Protection of existing plants, grasses and trees in any area subject to land-disturbing activities is beneficial and should be attempted wherever possible. Existing vegetation serves as an effective form of erosion and sediment control, and provides dust control, and pollution control.

Implementation of Erosion Control BMPs

BMPs will be deployed in a sequence to follow the progress of grading and construction. As the locations of soil disturbance change, erosion and sedimentation controls will be adjusted accordingly to control storm water runoff at the downgrade perimeter and drain inlets. BMPs will be mobilized as follows:

Year-round:

- Weather reports will be monitored to track conditions and alert crews to the onset of rainfall events.
- Disturbed soil areas will be stabilized with temporary erosion control or with permanent erosion control as soon as possible after rough grading is complete.

During the rainy season:

- Disturbed areas will be stabilized with temporary or permanent erosion control before rain events.
- Disturbed areas that are substantially complete will be stabilized with permanent erosion control (soil stabilization) and vegetation (if within seeding window for seed establishment).
- Prior to forecast storm events, temporary erosion control BMPs will be deployed and inspected.

During the non-rainy season:

The project schedule will sequence construction activities with the installation of both erosion control and sediment control measures. The construction schedule will be arranged as much as practicable to leave existing vegetation undisturbed until immediately prior to rough grading.

Specific to this construction project, effective erosion and sediment control Best Management Practices (BMPs) are included on Sheets SWPP-1, and SWPP-2 provided in the pockets of this plan.

1. General Practices

- Prior to Clearing and Grubbing, the following initial erosion/sediment control features shall be installed and completely functional:

  Perimeter controls such as silt fences, straw wattle, straw bales, entrance/exit tire wash, sediment basins.

  Protection of the existing storm drain system and drain inlets with the use of gravel bag berms and inlet filter bags.

- Intermediate erosion/sediment control features to be placed after initial disturbance of soil surface include but are not limited to the following:

  After clearing and grubbing: Division ditches with channel lining if necessary, sediment traps and basins at all boundary out falls.

  During Rough Grading: Temporary channel lining, inlet/outlet protective lining, temporary slope drains, temporary and permanent seeding/mulching or hydro seeding, permanent erosion/sediment control blanket settling structures, temporary and permanent check dams, sediment traps and basins in depressions, vacuum sweepers, and the placement of any other permanent erosion/sediment control features.

- Final erosion/sediment control features for final stabilization to be placed prior to final sign off of improvements include but are not limited to the following:

  Placement of seeding/mulching, hydro seeding, permanent turf on all unprotected soil surface, removal of debris form all drainage facilities, removal of any temporary erosion/sediment control features (if necessary), and the placement of any other permanent erosion/sediment control features.

- Construction Activities May 1 – October 15

  For construction activities during May 1 – October 15, the plan checker/inspector may consider the alternative of only requiring the stockpiling of erosion and sediment control features on-site for sites with gentle slopes, minimal grading, and no adjacent existing drainage facilities. This alternative requires immediate (same working day) installation of erosion and sediment control measures to prevent sediment discharge, to be accomplished by the contractor. The placement of final erosion control measures is required on all projects.

2. Sediment Control

- **Fiber Rolls (Straw Wattle)** Place as shown on SWPP-2 sheet (included in pocket):
  Along the face of exposed and erodible slopes to shorten slope length.
  Along perimeter of the project.

- **Gravel Bag Berms and Inlet Filter Bags at Drain Inlet.** Place as shown on SWPP-2 Sheet

- **Temporary Construction Entrance** Place as shown on SWPP-2 sheet.

3. Soil Stabilization

Follow Erosion Control Requirements on Sheet SWPP-1.

Erosion Control, referred to as soil stabilization, is a source control measure that is designed to prevent soil particles from detaching and becoming suspended in the storm water runoff. Soil stabilization BMPs protects the soil surface by covering and/or binding the particles. This project will incorporate effective soil stabilization measures selected by the Owner/Contractor. This construction project will utilize and implement the following principles to assure effective temporary and final soil stabilization (erosion control) during construction:

- Preserve existing vegetation where required and when feasible.
- Apply temporary soil stabilization (erosion control) to remaining active and non-active areas as needed. Reapply as necessary to maintain effectiveness.
- Implement temporary erosion control measures at regular intervals throughout the defined rainy season to achieve and maintain the contract's disturbed soil area requirements. Implement erosion control prior to the defined rainy season.
- Stabilize non-active areas within 14 days of cessation on construction activities.
- Control erosion in concentrated flow paths by applying erosion control blankets, erosion control seeding, and lining swales.
- Seeding will be applied either during the defined seeding window, and/or to areas deemed substantially complete by the owner/developer/contractor during the defined rainy season.
- At completion of this phase of construction, apply permanent erosion control to all remaining disturbed soil areas.

Sufficient quantities of temporary soil stabilization materials will be maintained on-site to allow implementation as described in this SWPPP. This included implementation requirements for active areas, non-active areas and areas that require deployment before the onset of rain.

4. Practices to Reduce Tracking Sediment On To Public and Private Roads

- **Temporary Construction Entrance**
  BMPs: TC-1, SC-7 (Appendix C)

A stabilized construction entrance (location shown on SWPP-2) off of North Thornton Road will be constructed and maintained to reduce tracking of sediments onto public streets (see detail included on Sheet SWPP-1). Excess material tracked onto public streets will be removed as necessary by sweeping. Dump trucks hauling material from the site will be covered with tarpaulin.

5. Wind Erosion

Dust Control
BMPs: WE-1, SS-7 (Appendix C)

Sweeping
BMP: SE-7 (Appendix C)

Debris should be collected and deposited into areas of open soil as long as debris consists mainly of soil material. Sediment tracked onto public roads will be removed at a minimum daily and more often as needed.

6. Practices to Minimize Contact with Storm Water

Construction Vehicles and Equipment
BMP: NS-10 (Appendix C)

Prevention and control of leaks from equipment and vehicles and proper management of wash water eliminates or minimizes discharge of toxic pollutants to waterways. This practice will be applied to all fueling areas, maintenance and storage/parking areas, and cleaning/wash areas.

Maintenance
BMP: NS-10 (Appendix C)

Fueling, major maintenance/repair, and washing shall be conducted offsite whenever feasible. Maintain all construction equipment to prevent oil or other fluid leaks. Keep vehicles and equipment clean; prevent excessive build-up of oil and grease. Regularly inspect on-site vehicles and equipment for leaks and repair immediately. Check incoming vehicles and equipment for leaking oil and fluids. Do no allow leaking vehicles or equipment on-site. Any onsite vehicle service areas will be clearly designated and located away from waterways. Keep stockpiled spill cleanup materials readily available. Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.

Fueling
BMP: NS-9 (Appendix C)

Place storage tanks within a bermed area designed to hold the tank volume. Cover retention area with an impervious material and install it in a manner to ensure that

any spills will be contained in the retention area. Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids. Use drip pans for any oil or fluid changes.

Washing
BMP: NS-8 (Appendix C)

Use as little water as possible to avoid installing erosion and sediment controls for the wash area. If washing must occur on-site, use designated, bermed wash areas to prevent wastewater discharge into storm water, creeks, rivers, and other water bodies. Use phosphate-free, biodegradable soaps. Do not permit steam cleaning on-site.

Materials
BMPs: WM-1, WM-2 (Appendix C)

Contractor shall designate on-site areas for material delivery and storage. Storage of reactive, ignitable, or flammable liquids shall comply with local fire codes. Contractor shall minimize long-term on-site storage of construction materials, including the following product and waste materials.

Material	Storage Area	Waste Disposal
Fertilizer		None Required
Pesticides/Herbicides		Disposed at a legal disposal site.
Petroleum Products		Removed by a waste contractor.

Contractor shall dispose of all construction waste, including debris from clearing, grubbing, and demolition, and sanitary waste at a legal disposal site.

Stockpile Management
BMP: WM-3 (Appendix C)

Stockpile Management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, paving materials such as Portland cement concrete (PCC), rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Concrete Waste Management
BMP: WM-8 (Appendix C)

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, performing onsite washout in a designated area, and training employee and subcontractors.

Good Housekeeping

Keep the site clean. Designate areas for waste storage outside of gutters and away from drain inlets. Contain, segregate and recycle wastes. Arrange for regular waste collection.

7. Construction Material Loading, Unloading, and Access Areas

Construction materials will be transported to the site via North Thornton Road. During construction activities a stabilized construction entrance will be used. All loading and unloading of materials will occur in a designated area.

Wet and dry construction materials with the potential to pollute runoff should be handled and delivered to designated material storage areas. Material storage areas are to be protected with earthen berms year-round. Materials listed in section are to be provided with cover when rain is forecasted or during wet weather. This practice will be applied at construction sites with delivery, handling/preparation, and storage of the following materials: soil, fertilizers, concrete compounds and components, petroleum products such as fuel, oil, and grease, hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds, and any other materials that may be detrimental if released to the environment.

Employees and subcontractors will be trained in proper material delivery, handling, and storage practices. Non-hazardous and environmentally friendly materials will be purchased and used when possible. All hazardous materials will be labeled according to local, state, and federal regulations. Hazardous materials/wastes are to be stored in secondary containment year-round. Granular materials will be stored at least 10 feet from waterways. Barriers around storage areas will be installed to prevent contact with runoff. A temporary roof, or secure plastic sheeting or tarp will be provided for appropriate stockpiled materials and wastes. Proper storage will be provided in accordance with secondary containment regulations. Proper secondary cover will be provided for containers of paints, chemicals, solvents, and other

hazardous materials during rainy periods. Mats or an impermeable barrier will be used during delivery and storage. Proper storage instructions will be posted at all times in an open and conspicuous location. An ample supply of appropriate spill clean up materials will be kept near storage areas. Materials must be stored according to fire code requirements.

Inspect storage areas before and after rainfall events, and at least weekly throughout the job. Designated storage areas will be inspected to ensure that they are kept clean and well organized. Perimeter controls, containment structures, and covers will be inspected and repaired or replaced as necessary to ensure their proper function.

8. Waste Management and Disposal

Miscellaneous Waste
BMP: WM-5 (Appendix C)

Proper management of demolition materials and/or solid waste created and stockpiled on site eliminates and minimizes the discharge of pollutants to the storm drain system and watercourses. This practice will be applied to all non-hazardous materials.

Construction materials and waste will be reused and recycled when possible. Waste collection areas will be kept away from waterways and close to construction entrances when possible. Dumpsters will be covered securely at night and during rainy weather. Leaky dumpsters will be replaced and any leaking material will be properly collected and disposed. An adequate disposal schedule will be arranged to ensure that dumpsters do not overflow. Any paved areas and roadways where work is being conducted will be cleaned and swept at the end of every working day.

Temporary stockpiling of certain construction wastes may necessitate stringent drainage-related controls during the wet season.

Monitor on site solid waste storage and disposal procedures and assign personnel to routinely police the site for litter and debris, and the inspection of dumpsters for leaks and secure covers.

Portable Toilets
BMP: WM-9 (Appendix C)

Portable toilets are to be placed on a flat area well away (50-feet) from streets and drain inlets. Anchor toilets to prevent blowing or tipping over. Report any leaks or spills immediately (sampling may be required if leaks or spills occur).

F. Maintenance, Inspections, and Repair of Structural Controls

Site inspections must identify all areas where Best Management Practice's (BMPs) have been implemented and check them for proper functioning and efficiency, including:

- All disturbed areas of the site
- Locations where vehicles enter or exit the site
- All erosion and sediment control measures
- Material storage areas.

A vegetation inspection is important to evaluate whether seeded or planted vegetation is becoming successfully established, or whether additional measures are needed, such as watering, fertilizing, or additional seeding.

Controls must be in good operating condition until the area they protect has been completely stabilized and the construction activity is complete. In the absence of significant storm events, all monitoring points must be inspected by the maintenance designee at least once a week and before any predicted, significant rain event (greater than 0.25 inches). Experience demonstrates that even the best control measures can fail if they are not properly and regularly maintained.

During significant rainfall events, the maintenance designee should be empowered to call out maintenance crews to inspect and repair the erosion and sediment control measures. Appropriate materials and equipment should be kept on hand to affect a quick and rapid response. Within 24 hours of a storm of 0.25 inches or more in depth, the maintenance designee must conduct an overall site inspection. The inspector must record any damages or deficiencies in the control measures on an inspection report form. Damage or deficiencies should be corrected as soon as practicable after the inspection. Substantial efforts should be expanded to minimize sediment discharge from the site if continued precipitation is forecast.

G. Non-Storm Water Management

BMPs: NS-1, NS-3, NS-6, NS-8, NS-9, & NS-10 (Appendix C)

A non-storm water discharge is a discharge from the construction site to storm drainage facilities (natural or man-made) of materials other than storm water.

Appropriate uses and restrictions on the use of water on construction sites reduce the potential for erosion and the transport of pollutants off site. This practice will be applied to all construction sites where water is used.

Water equipment will be kept in good working condition. Water leaks will be repaired promptly. Dust control water will be applied in appropriate amounts to suppress dust, and at the same time sparingly to avoid washing sediments into drainage system.

Water equipment will be inspected at least twice weekly.

Allowable non-storm water discharges to receiving waters from the construction site include:

- Discharges from fire fighting,
- Potable water sources including the flushing of de-chlorinated water lines,
- Naturally occurring water from springs, wetlands, and riparian areas,
- Irrigation water discharged during seeding, planting, and maintenance, provided fertilizer and pesticides are applied correctly.

However, implementation of the aforementioned BMPs will reduce the likelihood of allowable non-storm water discharges as well.

Discharging sediment-laden water, which will cause or contribute to water pollution from a dewatering site or sediment basin into any receiving water or storm drain without filtration or equivalent treatment is prohibited.

H. Toxic Materials

The owner/contractor is instructed to circle/highlight potential toxic materials listed in Table 1., that have been or may be stored at the construction site.

Indications of contaminated soils include discoloration, odor, or unusual soil properties that may be observed during construction. Presence of abandoned underground tanks or discoveries of buried debris or trash are also indicators of potential contamination.

Proper handling and disposal of hazardous waste eliminates or minimizes the discharge of such pollutants to waterways. This practice will be applied to all petroleum products (oil, fuel, and grease), cement products, concrete curing compounds, chemical additives used for soil stabilization, septic wastes, acids, paints, solvents, and wood preservatives. In addition, this practice will be applied to all materials that have been used to absorb hazardous spills, hazardous demolition waste, and any material considered a hazardous waste by the State of California.

All hazardous waste will be properly labeled and stored. Hazardous waste will be disposed only at authorized treatment, storage, and disposal facilities. Licensed hazardous waste haulers will be used for threshold quantities as required by state and federal regulations. Trailers containing hazardous waste will be covered during transit.

Hazardous and non-hazardous adhesives and cleaning fluids must be disposed of properly to avoid contact with storm water and discharge into watercourses. This practice will be applied to all hazardous liquid residues (adhesives, thinners, and solvents), non-hazardous dry materials (adhesive containers, used applicators, rags absorbent materials, and drop cloths), and adhesive removal wastes.

Safer products will be used when available and possible. An area or areas will be designated for cleaning adhesive applicators and tools. The cleaning of brushes and rinsing of containers will be conducted so as not to cause any discharge into waterways. Shovel, or sweep, any dry debris that remains on site and dispose of in an appropriate container.

- Do not apply herbicides and pesticides just before it rains. Apply surface dressings in several smaller applications to allow time for infiltration.

- Do not clean out brushes or paint containers into the soil, street, gutter, storm drain, or stream.

Table 1. Products and Potential Pollutants

Category	Possible Products	Potential Pollutants
Adhesives	• Adhesives, Glues • Resins, Epoxy Synthetics • Caulks, Sealers, Putty, Sealing Agent • Coal Tars (Naphtha, Pitch)	Phenolics, Formaldehydes Phenolics, Formaldehydes Asbestos, Phenolics Formaldehydes Benzene, Phenols, Naphthalene
Cleaners	• Polishes (Metal, Ceramic, Tile) • Etching Agents • Cleaners, Ammonia, Lye, Caustic Sodas • Bleaching Agents • Chromate Salts	Metals Metals Acidity/Alkalinity Acidity/Alkalinity Chromium
Plumbing	• Solder (Lead, Tin), Flux (Zinc Chloride) • Pipe Fitting (Cut Shavings) • Galvanized Metals (Nails, Fences) • Electric Wiring	Lead, Copper, Zinc, Tin Copper Zinc Copper, Lead
Painting	• Paint Thinner, Acetone, MEK, Stripper • Paints, Lacquers, Varnish, Enamels • Turpentine, Gum Spirit, Solvents • Sanding, Stripping • Paints (Pigments), Dyes	VOC's Metals, Phenolics, Mineral Spirits VOC's Metals Metals
Woods	• Sawdust • Particle Board Dusts (Formaldehyde) • Treated Woods	Solid Waste Formaldehyde Copper, Creosote
Masonry & Concrete	• Dusts (Brick, Cement) • Colored Chalks (Pigments) • Glazing Compounds • Cleaning Surfaces	Acidity, Sediments Metals Asbestos Acidity
Floors and Walls	• Flashing • Drywall • Tile Cutting (Ceramic Dust) • Adhesives[1]	Copper, Aluminum Dusts Minerals
Remodeling and Demolition	• Insulation • Venting Systems • Brick, Cement, Saw, Drywall	Asbestos Aluminum, Zinc Dusts
Air Conditioning and Heating	• Insulation • Coolant Reservoirs • Adhesives[1]	Asbestos Freon

Category	Possible Products	Potential Pollutants
Yard Operations And Maintenance	• Vehicle and Machinery Maintenance • Gasoline, Oils, Additives • Marking Paints (Sprays) • Grading, Earth Moving • Portable Toilets • Fire Hazard Control (Herbicides) • Health and Safety • Wash Waters	Oil, Grease, Coolants Bezene & Derivatives, Oils & Grease Vinyl Chloride, Metals Erosion (Sediments) BOD, Disinfectants (Spills) Sodium Arsenite, Di-nitro Compounds, Rodenticides, Insecticides, Herbicides, Concrete, Greases, BOD
Landscaping and Earth Moving	• Planting, Plant Maintenance • Excavation, Tilling • Masonry & Concrete[1] • Trees and Shrubs • Exposing Natural Lime or Mineral Deposits • Soils Additives • Re-vegetation of Graded Areas	Pesticides, Herbicides, Nutrients, Erosion (Sediments) Solid Wastes Acidity/Alkalinity, Metals Aluminum Sulfate, Sulfur Fertilizers
Materials Storage	• Waste Storage (Used Oils, Solvents, Etc.) • Hazardous Waste Containment • Raw Material Piles	Spills, Leaks, Polluted discharge Spills, Leaks, Polluted discharge Dusts, Sediments, Polluted discharge

[1] See above categories

VOC = Volatile Organic Compounds
BOD = Biochemical Oxygen Demand

I. Spill Prevention and Control

BMP WM-4 (Appendix C)

Prevention and control of spills minimizes or eliminates the discharge of hazardous and non-hazardous materials to waterways. Employees and subcontractors shall be familiar with potential environmental impacts resulting from the materials they are handling. Good Housekeeping practices shall be implemented to reduce the potential of on-site storm water pollution. These practices include the use of secondary containment, and designating specific areas for equipment maintenance. This practice will be applied to all solid and liquid materials, including, but not limited to: fuels, lubricants, other petroleum distillates, paints, solvents, cement, mortar, soil stabilizers, and fertilizers. In addition, this practice will be applied to storage areas for chemicals and/or hazardous substances, fuel areas, and vehicles/equipment transporting and handling chemicals and other hazardous substances.

Construction sites located near natural watercourses, canals, and flumes are at highest risk of an uncontained spill contaminating surface waters. Chemical and/or hazardous materials storage and handling areas will be located away from natural watercourses, canals, and flumes. Chemical and/or hazardous materials will be stored in areas not susceptible to rain and secondary containment will be provided in case of leaks or spills. Any spills will be immediately cleaned up. Likewise, any contaminated soils and cleanup materials will be properly disposed. Fueling areas will be provided with secondary containment with enough capacity to contain a spill. Only a reputable, licensed company will be used to clean up large spills and dispose contaminated materials.

Verify weekly that sufficient spill control clean up materials are located near material storage, unloading and use areas, as well as fueling areas. Fueling areas and storage tanks will be inspected on a regular basis. Spill prevention and control plans will be updated and appropriate clean up materials stocked whenever changes occur in the types of materials used on site.

1. Minor Spills

Minor or "insignificant spills" shall be cleaned up immediately by the responsible parties. After contacting local emergency response agencies.

- Lodi Police Department- (209) 333-6727 - non-emergency
- Lodi Fire Department - (209) 333-6735 – non-emergency
- Regional Water Quality Control Board - (916) 464-3291

The following actions should be taken upon discovery of a minor spill:

- Immediate containment of the spill by constructing an earthen dike to capture material,
- Dry spills will be swept up, not washed or hosed down. Wet spills on impermeable surfaces should be absorbed, and any absorbent materials used in this practice will be properly disposed of. Wet spills on soil should be dug up and all contaminated soils properly disposed of,

- Covering the impacted area to avoid runoff if the spill occurs during a rain event;
- Accurately record all steps taken.

Spill records will be maintained on-site and will be included in the annual report to the Regional Water Quality Control Board.

2. Major Spills

On-site personnel should not attempt to control major spills until the appropriate and qualified emergency response staff have arrived at the site. In addition to the Lodi Police Department- (209) 333-6727, Lodi Fire Protection District - (209) 333-6735, Regional Water Quality Control Board (916) 464-3291, the State Office of Emergency Service (OES) at **800-852-7550** will be notified if a hazardous material spill occurs. For spills of federally reportable quantities, the contractor shall also notify the Nation Response Center (NRC) at 1-800-424-8802. A written report should be sent to all notified authorities. Failure to report major spills can result in significant fines and penalties.

J. Landscaping Activities

The project site will be landscaped. Landscape BMP's include, but are not limited to the following:

- Store stockpiles and landscaping materials under tarps to protect from wind and rain.
- Schedule landscaping-related grading and excavation for dry weather.
- Use check dams or ditches to divert runoff away from storm drains.
- Protect storm drains with sediment control measures.
- Minimize the use of chemicals:
    - Purchase less toxic alternatives
    - Purchase only amount necessary
    - Use only the minimum amount necessary
- Rinse all chemical containers, using rinse water as product. Recycle or dispose or rinsed containers in garbage.
- Check on disposal guidelines for chemicals used on site.
- Any paved areas and roadways where work is being conducted will be cleaned and swept at the end of every working day. Do not hose down paved areas with water.

K. Post-Construction Storm Water Management

Owner shall be responsible for ensuring all construction activity is completed as permitted, to implement permanent pollution prevention practices and to maintain permanent structural controls.

Final erosion and sediment control measures for final stabilization or exposed soil will be in place prior to final sign off of improvements. These controls are, but not limited to, the following:

Placement of seeding, mulching, hydro seeding, permanent turf on all unprotected soil surface, removal of debris form all drainage facilities, removal of temporary erosion and sediment control measures (if necessary), and the placement of any other permanent erosion and sediment control measure.

The following are the post-construction erosion and sediment control measures recommended to be used at this construction site after all construction is complete:

- Hydro Seeding
- Mulching
- Removal of debris from drain inlet bags
- Removal of temporary erosion sediment control measures.

J. Construction Storm Water Sampling and Analysis Guidance

1. Sedimentation Monitoring

NCPA Lodi Energy Center project site **does not border** a 303(d) listed water body and sampling for sedimentation, siltation or turbidity will not be necessary for this project. Storm water will discharge off the project site indirectly into White Slough and Bishop Cut

2. Non-visible Pollutant Monitoring and Sampling

There are no known existing potential pollutants on site.

Examples of materials found on construction sites (See Table 2.) include soil stabilizers, paint and fluids from vehicles. Any of these materials can end up in the storm water runoff and contain pollutants that pose a threat to water quality. Some of these potential pollutants leave a visible trace, oil and grease leaves a sheen in the water. For pollutants that are visible in runoff, the permit requires the discharger to perform a visual monitoring of the site and does not require sampling and analysis. The sampling and analysis requirements only apply to pollutants that do not leave a visible trace or are not associated with a visible tracer. Potential non-visible pollutants include increased pH, pesticides, and nutrients such as nitrogen or phosphorus.

Sampling and analysis is required when non-visible pollutants could "cause or contribute to an exceedance of water quality objectives in the receiving water."

The most effective way to avoid the sampling and analysis requirements, and to ensure permit compliance, is to avoid the exposure of construction materials to precipitation and storm water runoff.

It is recommended to keep all construction materials in a covered watertight shelter.

Some materials such as soil amendments, are designed to be used in a manner that will result in exposure to storm water. It is important to make sure these materials are applied according to the manufacturer's instructions at a time when they are unlikely to be washed away.

Other materials can be exposed when storage, waste disposal or application are not done in a manner protective of water quality or through accidental spillage. For these situations, sampling is required unless there is capture and containment of all storm water that has been exposed to pollutants. In cases where construction materials may be exposed to storm water but the storm water is contained, and is not allowed to run off the site, then sampling only needs to occur when inspections show the containment (BMP) failed or is breached and there is potential for exposure or discharge.

All construction sites must ensure that proper inspections are conducted throughout the duration of the project, and make sure that selected BMPs have been implemented, and are being maintained, and are effective in preventing potential pollutants from coming into contact with storm water runoff. Upon taking corrective measures of failed BMPs, it is advisable that field monitoring in the vicinity of the BMP be conducted to verify the pollutants are no longer in the storm water.

Sampling Locations

_____ sampling location(s) designated by grid number on SWP- _____ on the project site and the contractor's yard (has or have) been identified for the collection of samples of runoff form planned material and waste storage areas and from areas where non-visible pollutant producing operations are planned.

_____ sampling location(s) have been identified for the collection of samples of runoff that drain areas contaminated be historical usage of the site.

Sample location: grid number(s) _____ located on SWP-_____.

_____sampling location(s) have been identified for the collection of samples of runoff that drain areas where soil amendments/stabilizers that have the potential to alter pH or have unacceptable concentrations of non-visible pollutants will be applied.

Sample location: grid number(s)_____ located on SWP-_____.

_____ sampling location(s) have been identified for the collection of samples of run-on to the site with the potential to combine with discharges being sampled for non-visible pollutants. These samples would be expected to identify sources of potential non-visible pollutants that originate off the project site.

Sample location: grid number(s)_____ located on SWP-_____.

A location has been identified for the collection of un-contaminated sample of runoff as a background sample for comparison with the samples being analyzed for pollutants. This location was selected such that the sample will not have come in contact with (1) operational or storage areas associated with the materials, wastes and activities; (2) potential pollutants due to historical use of the site; (3) areas which soil amendments/stabilizers that have the potential to alter pH levels or have unacceptable concentrations of non-visible pollutants have been applied; or (4) disturbed soils areas.

Sample location: grid number(s)_____ located on SWP-_____.

Table 2. Potential Non-visible Pollutants

The following table represents potential sources of non-visible pollutants that are common to most construction sites. This list is not meant to be inclusive but to provide direction to construction site operators.

Category	Potential Pollutant Source	Water Quality Indicator	Field Analysis	Laboratory Analysis
Line Flushing	Chlorinated water	Residual chlorine	X - Colormetic Kit	X
Portable Toilets	Bacteria, disinfectants	Total/fecal coliform	X	X
Portland Concrete & Masonry Products	Masonry Products	pH, alkalinity	X	X
	Sealant(MMA)	Methyl methacrylate		X
	Ash, slag, sand, waste	Akm Ca, Vanadium, Zn		X
	Curing compounds	PH, VOC, SVOC	X- pH	X
Painting	Resins	COD, SVOC		X
	Thinners	VOC, COD		X
	Paint Strippers	VOC, SVOC		X
	Solvents	COD, VOC, SVOC		X
	Lacquers, varnish, enamels, turpentine	COD, VOC,SVOC		X
	Sealants	COD		X
Cleaning	Acids	pH	X	X
	Bleaches	Residual chlorine	X	X
	TSP	Phosphate	X	X
	Solvents	VOC, SVOC		X
Landscaping	Pesticides/Herbicides	Contaminate specific		X
	Fertilizers	Phosphate, TKN, NO_3, TOC, COD	X- NO_3	X
	Lime	pH, alkalinity	X	X
	Aluminum sulfate, sulfur	Al, TDS, sulfate	X-sulfate	X
Treated Wood	ACZA,CCA,ACA	As, Cr, Cu, Zn		X
	Cu Naphthenate	Cu		X

Category	Potential Pollutant Source	Water Quality Indicator	Field Analysis	Laboratory Analysis
Soil Amendments & Stabilization Products	Gypsum	pH, Ca, sulfate, Al, Br, Mn, Va	X- pH, sulfate	X
	Polymer/Copolymer	TKN, No_3, BOD, COD, DOC, sulfate, Ni	X-sulfate	X
	Lignin Sulfonate	Alkalinity, TDS	X	X
	Psyllium	COD, TOC		X
	Guar/Plant Gums	COC, TOC, Ni		X
Adhesives	Adhesives	COD, Phenols, SVOC		X
Dust Palliative Products	Salts	Chloride, TDS, cations	X-chloride	X
Vehicle	Batteries	pH, lead	X-pH	X

Example Situations that Require Sampling and Analysis for Non-Visible Pollutants

- Where construction materials and compounds are stored or used in such a way that they may come in contact with storm water.
- For construction projects that utilize soil amendments that can come in contact with storm water runoff. Contact the appropriate Regional Board to determine acceptable concentration(s) of the material(s) in question).
- When a leak or spill occurs prior to a storm event and is not fully contained and cleaned-up.
- When a leak or spill occurs during a storm event and it cannot immediately be isolated and/or cleaned-up, and the possibility of an off-site discharge exists.
- When during regular inspections of stockpiles, it is discovered that cover and containment BMPs have been compromised and storm water comes in contact with stockpiled materials resulting in runoff discharging into a storm drain system or water body.
- When material storage BMPs have been compromised, breached, or has failed.

If visual inspection of storm water BMPs used to contain non-visible pollutants at a construction site indicates that a BMP has failed or been compromised then field monitoring of the storm water from the site for non-visible pollutants is required. Any BMP that has failed or found breached should be immediately repaired or replaced. Where the site's storm water test results significantly exceed the background sample concentrations, BMPs need to be evaluated to determine what is causing the difference.

Examples of Situations that do not Require Sampling and Analysis for Non-Visible Pollutants

- Where construction takes place entirely during a period of time when there are no rainfall events. Timing construction to occur outside of the rainy season is the most effective BMP.
- Where a construction project is "self-contained", meaning that the project generates no runoff or any potential discharges containing pollutants, including no potential for tracking sediment off-site form vehicle tires, and not potential for discharging products of wind erosion.
- Where construction materials and compounds are kept or used so that they are not in contact with storm water (e.g., in water-tight containers, under a water-tight roof, inside a building, etc.)
- Where for specific pollutants, the BMPs implemented at the construction site fully contain the exposed pollutants (e.g., bermed concrete washout area).
- For building, landscaping and BMP materials that are in their final constructed or in-place form or are designed for exposure (e.g., fence materials, support structures and equipment that will remain exposed at the completion of the project, etc.)
- Where pollutants may have been spilled or released on site, but have been properly cleaned-up and storm water exposure has been eliminated prior to a storm event.
- For stockpiles of construction materials for which both cover and/or containment BMPs have been properly implemented to protect them from run-on and from contributing pollutants to storm water.

3. Sampling Procedures

The collection and handling of storm water runoff samples requires care to ensure the integrity and validity of the samples. Special documentation, Chain-of-Custody (COC) form, must follow the sample from the collection through the analysis process. Additional documentation to track other information of interest, e.g. field conditions, or required field measurements may also be used. This type of information is recorded on a field tracking form.

Only personnel trained in water quality sampling procedures should collect storm water samples.

Determine sampling methods and locations in advance of the runoff event in order to provide sufficient time to gather supplies and equipment necessary to sample and plan for safe access by the sampling personnel.

Both field and/or analytical methods can be used to meet the Permit requirements. Field techniques have the advantage of providing immediate results, however, there are only a limited number of analyses that can be done in the field. Analytical laboratories can analyze for a wide range of parameters, but the data my take several weeks or longer to get back.

Samples on the project site will be collected by the following contractor sampling personnel:

Name/ Telephone Number: _____

Name/ Telephone Number: _____

or

The following lab or environmental consultant will collect samples on the project site:

Company Name: _____

Address: _____

Telephone No.: _____

Contact Person: _____

Samples will be collected by placing a separate lab-provided sample container directly into a stream of water downgradient and within the close proximity to the potential non-visible pollutant discharge location. This separate lab-provided sample container will be used to collect water which will be transferred to sample bottles for laboratory analysis. The upgradient and uncontaminated background samples shall be collected first prior to collecting the downgradient to minimize cross-contamination. The sampling personnel will collect the water upgradient of where they are standing. Once the separate lab-provided sample container is filled, the water sample will be poured directly into sample bottles provided by the laboratory for the analyst(s) being monitored. Sample bottles will be filled completely.

To maintain sample integrity and prevent cross-contamination, sampling collection personnel will:

- Wear a clean pair of surgical gloves prior to the collection and handling of each sample at each location.
- Not contaminate the inside of the sample bottle by allowing it to come into contact with any material other that the water sample.
- Discard sample bottles or sample lids that have been dropped onto the ground prior to sample collection.
- Not leave the cooler lid open for an extended period of time once the samples are placed inside.
- Not sample near a running vehicle where exhaust fumes may impact the sample.
- Not touch, the exposed end of a sampling tube, if applicable.
- Avoid allowing rain water to drip from rain gear or other surfaces into sample bottles.
- Not eat, smoke, or drink during sample collection.
- Not sneeze or cough in the direction of an open sample bottle.
- Minimize the exposure of the samples to direct sunlight, as sunlight bay cause biochemical transformation of the sample.
- Decontaminate sampling equipment prior to sample collection using a TSP-soapy water wash, distilled water rinse, and final rinse with distilled water.

Immediately following collection, sample bottles for laboratory analytical testing will capped, labeled, documented on a Chain of Custody form provided be the analytical laboratory, sealed in a re-sealable storage bag, placed in an ice-chilled cooler, at as near to 40 degrees as possible, and delivered within 24 hours to one of the following California state-certified laboratories found on this list:

http://www.swrcb.ca.gov/stormwtr/gen_const.html#const_permit

Company Name:
Address:

Telephone No.:

4. Sample Documentation Procedures

All original data documented on sample bottle identification labels; Chain-of-Custody forms, Sampling Activity Logs, and Inspection Checklists will be recorded using waterproof ink. These will be considered accountable documents. If an error is made on an accountable document, the individual will make corrections by lining through the error and entering the correct information. The erroneous information will not be obliterated. All corrections will be initialed and dated.

Sampling and field analysis activities will be documented using the following:

Sample Bottle Identification Labels: Sampling personnel will attach an identification label to each sample bottle. At a minimum the following information will be recorded on the label, as appropriate:

- Project name
- Project number
- Sample identification number and location (grid number) from SWP-1.
- Collection date/time
- Analysis constituent

Sampling Activity Logs: A log of sampling events will identify:

Sampling Date	Sampling Time	Sample ID Grid ____ SWP-1	Analysis Constituent	Names of Sampling Personnel	Weather Conditions	Field Analysis Results	Other Pertinent Data

Chain-of-Custody forms: All samples to be analyzed by a laboratory will be accompanied by a COC form provided by the laboratory. Only the sample collectors will sign the COC form over to the lab. A Chain-of-Custody form can be found in Appendix A.

Field Instruments: For samples collected for field analysis, collection, analysis and equipment calibration will be in accordance with field instrument manufacturer's specifications. A Field Instrument Date Sheet can be found in Appendix A.

5. Sampling and Analysis Records

Field and analytical data must be kept in the SWPPP until the Notice of Terminations is filed and approved. Other documents associated with the sampling program, such as calibration charts, field-tracking forms, chains of custody, training records of samplers, laboratory certification information also needs to be kept.

6. Data Evaluation

Corrective action will be initiated where non-visible pollutant sample test results indicate that the construction site's storm water discharges may cause or contribute to a water quality exceedance in the receiving water. This can be determined by comparing the construction site's storm water test results with the background sample.

When the site's storm water test results significantly exceeds the background concentrations, the BMPs must be evaluated to determine what is causing the difference. Possible solutions may include repairing the existing BMPs, evaluation alternative BMPs that could be implemented, and/or implementing additional BMPs (cover and/or containment) which further limit or eliminate contact between storm water and non-visible pollutant sources at your site. Where contact cannot be reduced or eliminated, storm water that comes in contact with the non-visible pollutant source should be retained on-site and not allowed to be discharged to the storm drainage system or a water body. RWQCB should be contacted to determine whether it is permissible to discharge the retained storm water. It is advisable to conduct additional sampling during the next runoff event after corrective measures have been implemented to demonstrate and document that the problems have been corrected.

Appendix A - Sampling Data Forms

Field Equipment Checklist

Storm Kit Equipment List		Storm Mobilization Equipment List	
☐	First aid kit	☐	Storm kit
☐	Keys (to gates and to enclosures)	☐	Waterproof log books/log sheets
☐	Flashlights (2) - hand held and head mounted	☐	Paper towels
☐	Maps	☐	D.I. water squirt bottles
☐	Large flat screwdriver	☐	Ice scoop
☐	Small flat screwdriver	☐	Chain of custody forms
☐	Umbrella - large size	☐	Appropriate number of composite bottles with mesh carriers and buckets
☐	Alkaline batteries for flashlights	☐	Appropriate number of grab sample bottles
☐	Write in the rain" pens (2), waterproof markers-fine point (2)	☐	Bottle labels
☐	Spare sample bottle labels	☐	Coolers and ice
☐	Desiccant (for samplers and flow meters)	☐	Grab pole, rope and duct tape
☐	Diagonal cutters	☐	Laboratory-provided blank water
☐	Electrical tape	☐	Cellular phone
☐	Cable ties (assorted sizes)	☐	Personal extra change of clothes
☐	Utility knife	☐	Lighting
☐	Zip-lock baggies (assorted sizes)	☐	Personal rain gear
☐	Gloves - powder free nitrile	☐	Hard hats and orange safety vests
☐	Duct tape	☐	Traffic cones/signs
☐	Rubber bands	☐	Sampling Plan/Health and Safety Plan

SAMPLING KIT

Your sampling kit should include the following items:

QUANTITY	ITEM	USE
1	Sampling guidance document	Sampling instructions for sampler.
1	Chain-of Custody Record	Legal document used to track samples, Identifies sampling facility, sample location, date and time sampled and analyzed.
1	Cooler	For storage and shipment of samples to laboratory.
1-5	Blue Ice packs	To keep samples cool while shipping. Freeze upon receiving cooler.
1-2 Pairs	Latex or Vinyl Gloves	To protect both sample and sampler from contaminates.
1	Ziploc Bag	To keep chain-of-custody dry.
1	1 liter poly wide mouth sample bottles	For shipping samples to laboratory.
1	40 ml poly wide mouth sample bottle	Shipping samples "VOA's" (i.e. gas degreaser) to laboratory.
Sheet	Bubble wrap	To protect bottles against damage during shipping. You may require additional packing materials.
1	pH ribbon (litmus paper)	Used to sample storm water and determine the alkalinity/acidity or pH.
1	Wide mouth plastic collection bottle	Wide mouth bottle for easy collection of storm water. Use to fill sample bottles.

pH Ribbon

Commonly known as "litmus paper" is used to determine pH (acidity/alkalinity) of Aqueous Solutions. There are a number of elements that could be present on a construction site that will provide high or low pH Aqueous Solution once in contact with storm water runoff, such as Cutting Oil Emulsions, Organic and Inorganic Salts, Drilling Mud, etc.

Field-testing procedure for pH in storm water runoff:

- Withdraw and tear off approximately 2 inches of ribbon.
- Immerse ribbon in the solution/runoff to be tested.
- Remove and promptly compare with specimen color on dispenser to determine corresponding pH.

Field tests do not require the sampler to fill out a chain-of-custody, however a Storm Event Sampling Record must be filled out and amended to the site specific document and/or SWPPP.

In the event of high pH detection (higher than 8) immediately stop/minimize (always assess safety conditions) the discharge and call the Regional Water Quality Control Board – Central Valley Region at (916) 464-3291 for consulting.

STORM EVENT SAMPLING RECORD
Project/Site Name:
Project/Site Address:
Contact Person:
Reason(s) for obtaining sample(s) and constituants sampling For:
"Rationale" for obtaining "Uncontaminated sample"
Date:
Print Name:
Signature:

FIELD INSTRUMENT DATA SHEET

Instrument Used: (use additional form for each instrument)

Make: Model:

Last Calibrated
Date:

Time:

Reading at:

First Reading:

Second Reading:

Third Reading:

Result of Filed-Test:

Comments:

Date:

Print Name:

Signature:

CALIFORNIA LABORATORY SERVICES — CHAIN OF CUSTODY — CLS ID. NO. _____

Report To:	Client Job Number	ANALYSIS REQUESTED	FIELD CONDITIONS:
	Destination Laboratory		
	X CLS (916) 638-7301 3249 Fitzgerald Road Rancho Cordova, CA 95742 www.californialab.com		COMPOSITE:
Project Manager	☐ OTHER		
Project Name			
Sampled By			
Job Description			
Site Location			

DATE	TIME	SAMPLE IDENTIFICATION	MATRIX	CONTAINER NO.	CONTAINER TYPE	Preservatives	TURNAROUND TIME IN DAYS 1	2	5	10	SPECIAL INSTRUCTIONS

SUSPECTED CONSTITUENTS | SAMPLE RETENTION TIME | PRESERVATIVES (1) HCL (2) HNO_3 (3) = COLD (4)

RELINQUISHED BY (Signature)	PRINT NAME/COMPANY	DATE/TIME	RECEIVED BY (Signature)	PRINT NAME/COMPANY

RECEIVED AT LAB BY: | DATE/TIME: | CONDITIONS/COMMENTS:

SHIPPED BY: ☐ FED EX ☐ UPS ☐ OTHER _____ AIR BILL # _____

CHAIN OF CUSTODY RECORD

COC No. _____

Company Submitting Samples	Project Name:	LABORATORY
Street Attn:		Street Contact:
City, State Zip code		City, State Zip code
Phone number Fax:	Project No:	Phone number Fax:

Event: *Sampled By:*

	SAMPLE IDENTIFICATION	Date	Time	# of Containers	Container Type	Matrix: Composite Water	Matrix: Water (Grab)	Matrix: Other	pH (EPA 150.1)	Specific Conductance (EPA 120.1)	Hardness (EPA 130.2)	TSS (EPA 160.2)	Nitrate-N (EPA 300)	TKN (EPA 351.3)	Total Phosphorous (EPA 365.3)	Total Metals (Cu/Pb/Zn EPA 200.8)	Diss. Metals (Cu/Pb/Zn EPA 200.8)	TPH-Gasoline (EPA 8015M)	Fecal Coliform			SPECIAL INSTRUCTIONS/ COMMENTS
									7	7	2	7	7	3	3	2	6	7	7			< Preservative Type
1.																						1) Measure pH and specific conductance upon receipt
2.																						2) Filter and acidify dissolved metals upon receipt
3.																						3) Perform MS/MSD on designated sample for all
4.																						analyses except for conventionals and bacteria
5.																						
6.																						Composite Splitting — Bottles
7.																						pH/Spec. Cond. — 1 L Plastic
8.																						TSS — 1 L Plastic
9.																						Hardness — 200 mL Plastic
10.																						TKN/Phosp. — 1L Plastic
11.																						Nitrate-N — 500mL Plastic
12.																						Total Cu, Pb, Zn — 500mL Plastic
13.																						Dissolved Cu, Pb, Zn — 500mL Plastic
14																						

Relinquished By (sign/print)	Company	Date	Time	Received By (sign/print)	Company
/				/	
/				/	
/				/	

Preservative Type:	Turnaround Time:	Remarks (by laboratory):
1. HCL 2. HNO3 3. H2SO4 4. NaHSO4 5. Other 6. Filter & acidify 7. Ice	10/30 days (fax/final)	
Container Type:	**Reporting Level:**	
VOA Vials: VO Plastic: PL Glass: GL	QC Sum + EDD	

Pollutant Testing Guidance Table [1]

Category	Construction Site Material	Visually Observable?	Pollutant Indicators [2]	Suggested Analyses Field [3]	Laboratory
Asphalt Products (Sections 37, 39, 92, 93, 94, and Special Provisions)	Hot Asphalt	Yes - Rainbow Surface or Brown Suspension	Visually Observable - No Testing Required		
	Asphalt Emulsion				
	Liquid Asphalt (tack coat)				
	Cold Mix				
	Crumb Rubber	Yes, Black Solid Material	Visually Observable - No Testing Required		
	Asphalt Concrete (Any Type)	Yes - Rainbow Surface or Brown Suspension	Visually Observable - No Testing Required		
Cleaning Products	Acids	No	pH Acidity Anions (acetic acid, phosphoric acid, sulfuric acid, nitric acid, hydrogen chloride)	HACH pH Test Kit or pH Meter HACH Acidity Test Kit	EPA 150.1 (pH) SM 2310B (Acidity) EPA 300.0 (Anion)
	Bleaches	No	Residual Chlorine	HACH Chlorine Test Kit	SM 4500-CL G (Res. Chlorine)
	Detergents	Yes - Foam	Visually Observable - No Testing Required		
	TSP	No	Phosphate	HACH Phosphate Test Kit	EPA 365.3 (Phosphate)
	Solvents	No	VOC	None	EPA 601/602 or EPA 624 (VOC)
			SVOC	None	EPA 625 (SVOC)

Portland Concrete Cement & Masonry Products (Section 27, 28, 29, 40, 41, 42, 49, 50, 51, 53, 63, 65, 72, 73, 80, 81, 83, 90, and Special Provisions)	Portland Cement (PCC)	Yes - Milky Liquid	Visually Observable - No Testing Required		
	Masonry products	No	pH	HACH pH Test Kit or pH Meter	EPA 150.1 (pH)
			Alkalinity	HACH Alkalinity Test Kit	SM 2320 (Alkalinity)
	Sealant (Methyl Methacrylate - MMA)	No	**Methyl Methacrylate**	None	EPA 625 (SVOC)
			Cobalt		EPA 200.8 (Metal)
			Zinc		
	Incinerator Bottom Ash Bottom Ash Steel Slag Foundry Sand Fly Ash Municipal Solid Waste Ash	No	**Aluminum** **Calcium** **Vanadium** Zinc	HACH Calcium Test Kit	EPA 200.8 (Metal) EPA 200.7 (Calcium)
	Mortar	Yes - Milky Liquid	Visually Observable - No Testing Required		
	Concrete Rinse Water	Yes - Milky Liquid	Visually Observable - No Testing Required		
	Non-Pigmented Curing Compounds	No	Acidity	HACH Acidity Test Kit or pH Meter HACH Alkalinity Test Kit	SM 2310B (Acidity)
			Alkalinity		SM 2320 (Alkalinity)
			pH		EPA 150.1 (pH)
			VOC		EPA 601/602 or EPA 624 (VOC)
			SVOC		EPA 625

Landscaping and Other Products (Section 20, 24, and Special Provisions)	Aluminum Sulfate	No	Aluminum	TDS Meter HACH Sulfate Test Kit	EPA 200.8 (Metal)
			TDS		EPA 160.1 (TDS)
			Sulfate		EPA 300.0 (Sulfate)
	Sulfur-Elemental	No	**Sulfate**	HACH Sulfate Test Kit	EPA 300.0 (Sulfate)
	Fertilizers-Inorganic [4]	No	**Nitrate**	HACH Nitrate Test Kit	EPA 300.0 (Nitrate)
			Phosphate	HACH Phosphate Test Kit	EPA 365.3 (Phosphate)
			Organic Nitrogen	None	EPA 351.3 (TKN)
			Potassium	None	EPA 200.8 (Metal)
	Fertilizers-Organic	No	TOC	HACH Nitrate Test Kit	EPA 415.1 (TOC)
			Nitrate		EPA 300.0 (Nitrate)
			Organic Nitrogen		EPA 351.3 (TKN)
			COD		EPA 410.4 (COD)
	Natural Earth (Sand, Gravel, and Topsoil)	Yes - Cloudiness and turbidity	Visually Observable - No Testing Required		
	Herbicide	No	Herbicide	None	Check lab for specific herbicide
	Pesticide		**Pesticide**		Check lab for specific pesticide
	Lime		Alkalinity	HACH pH Test Kit or pH Meter HACH Alkalinity Test Kit	SM 2320 (Alkalinity)
			pH		EPA 150.1 (pH)

Contaminated Soil [5]	Aerially Deposited Lead [3]	No	**Lead**	None	EPA 200.8 (Metal)
	Petroleum	Yes - Rainbow Surface Sheen and Odor	Visually Observable - No Testing Required		
	Other	No	**Contaminant Specific**	Contaminant Specific	Contaminant Specific
Line Flushing Products	Chlorinated Water	No	**Total Chlorine**	HACH Chlorine Test Kit	SM 4500-CL G (Res. Chlorine)
Adhesives	Adhesives	No	COD	None	EPA 410.4 (COD)
			Phenols	HACH Phenol Test Kit	EPA 420.1 (Phenol)
			SVOC	None	EPA 625 (SVOC)
Painting Products (Section 12-3.08, 20-2.32, 50-1.05, 59, 91, and Special Provisions)	Paint	Yes	Visually Observable - No Testing Required		
	Paint Strippers	No	VOC	None	EPA 601/602 or EPA 624 (VOC)
			SVOC		EPA 625 (SVOC)
	Resins	No	COD	None	EPA 410.4 (COD)
			SVOC		EPA 625 (SVOC)
	Sealants	No	COD	None	EPA 410.4 (COD)
	Solvents	No	COD	None	EPA 410.4 (COD)
			VOC		EPA 601/602 or EPA 624 (VOC)
			SVOC		EPA 625 (SVOC)

	Lacquers, Varnish, Enamels, & Turpentine	No	COD	None	EPA 410.4 (COD)
			VOC		EPA 601/602 or EPA 624 (VOC)
			SVOC		EPA 625 (SVOC)
	Thinners	No	VOC	None	EPA 601/602 or EPA 624 (VOC)
			COD		EPA 410.4 (COD)
Portable Toilet Waste Products	Portable Toilet Waste	Yes	Visually Observable - No Testing Required		
Soil Amendment/Stabilization Products	Polymer/Copolymer [6,7]	No	Organic Nitrogen	None	EPA 351.3 (TKN)
			BOD	None	EPA 405.1 (BOD)
			COD	None	EPA 410.4 (COD)
			DOC	None	EPA 415.1 (DOC)
			Nitrate	HACH Nitrate Test Kit	EPA 300.0 (Nitrate)
			Sulfate	HACH Sulfate Test Kit	EPA 300.0 (Sulfate)
			Nickel	None	EPA 200.8 (Metal)
	Straw/Mulch	Yes - Solids	Visually Observable - No Testing Required		
	Lignin Sulfonate	No	Alkalinity	HACH Alkalinity Test Kit	SM 2320 (Alkalinity)
			TDS	TDS Meter	EPA 160.1 (TDS)
	Psyllium	No	COD	None	EPA 410.4 (COD)
			TOC	TDS Meter	EPA 415.1 (TOC)

	Guar/Plant Gums	No	COD	None	EPA 410.4 (COD)
			TOC		EPA 415.1 (TOC)
			Nickel		EPA 200.8 (Metal)
	Gypsum	No	pH	HACH SW-1 Test Kit or pH Meter	EPA 150.1 (pH)
			Calcium	HACH Calcium Test Kit HACH Sulfate Test Kit	EPA 200.8 (Metal) EPA 200.7 (Calcium) EPA 300.0 (Sulfate)
			Sulfate		
			Aluminum		
			Barium		
			Manganese		
			Vanadium		
Dust Palliative Products (Section 18)	Salts (Magnesium Chloride, Calcium Chloride, and Natural Brines)	No	Chloride	HACH Chloride Test Kit	EPA 300.0 (Chloride)
			TDS	TDS Meter	EPA 160.1 (TDS)
			Cations (sodium, magnesium, calcium)	None	EPA 200.7 (Cations)
Treated Wood Products (Section 57, 58, 80-3.01B(2), and Special Provisions)	Ammoniacal-Copper-Zinc-Arsenate (ACZA) Copper-Chromium-Arsenic (CCA) Ammoniacal-Copper-Arsenate (ACA) Copper Naphthenate	No	Arsenic	HACH Total Chromium Test Kit	EPA 200.8 (Metal)
			Total Chromium		
			Copper		
			Zinc		
	Creosote	Yes - Rainbow Surface or Brown Suspension	Visually Observable - No Testing Required		

Vehicle	Antifreeze and Other Vehicle Fluids	Yes - Colored Liquid	Visually Observable - No Testing Required		
	Batteries	No	Sulfate	HACH Sulfate Test Kit	EPA 300.0 (Sulfate)
			Lead	None	EPA 200.8 (Metal)
			pH	HACH pH Test Kit or pH Meter	EPA 150.1 (pH)
	Fuels, Oils, Lubricants	Yes - Rainbow Surface Sheen and Odor	Visually Observable - No Testing Required		

Notes:

1 If specific pollutant is known, analyze only for that specific pollutant. See MSDS to verify.

2 For each construction material, test for one of the pollutant indicators. **Bolded** pollutant indicates lowest analysis cost or best indicator. However, the composition of the specific construction material, if known, is the first criterion for selecting which analysis to use.

3 See www.hach.com for some of the test kits.

4 If the type of inorganic fertilizer is unknown, analyze for all pollutant indicators listed.

5 Only if special handling requirements are required in the Standard Special Provisions for aerial deposited lead.

6 If used with a dye or fiber matrix, it is considered visually observable and no testing is required.

7 Based upon research conducted by Caltrans, the following copolymers/polymers do not discharge pollutants and water quality sampling and analysis is not required: Super Tak™, M-Binder™, Fisch Stik™, Pro40dc™, Fisch-Bond™, and Soil Master WR™.

Acronyms:

BOD - Biochemical Oxygen Demand
COD - Chemical Oxygen Demand
DOC – Dissolved Organic Carbon
EPA - Environmental Protection Agency
HACH - Worldwide company that provides advanced analytical systems and technical support for water quality testing
SM - Standard Method
SVOC - Semi-Volatile Organic Compounds
TDS - Total Dissolved Solids
TKN - Total Kjeldahl Nitrogen
TOC - Total Organic Carbon

TSP - Tri-Sodium Phosphate
VOC - Volatile Organic Compounds

References:

Construction Storm Water Sampling and Analysis Guidance Document, California Stormwater Quality Task Force, October 2001.
Environmental Impact of Construction and Repair Materials on Surface and Ground Waters, Report 448, National Cooperative Highway Research Program, 2001
Soil Stabilization for Temporary Slopes, Environmental Programs, California Department of Transportation, October 1, 1999.
Statewide Storm Water Management Plan, Division of Environmental Analysis, California Department of Transportation, April 2002.
Statewide Storm Water Quality Practice Guidelines, Environmental Program, California Department of Transportation, August 2000.
Soil Stabilization for Temporary Slopes and District 7 Erosion Control Pilot Study, June 2000.
Stormwater Monitoring Protocols, Guidance Manual, California Department of Transportation, May 2000.

C. Nature of Fill Material and Existing Data

The project site is in a natural state prior to construction activities.

Existing site features that, as a result of past usage, may contribute pollutants to storm water (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, leaked onto the construction site) include:

- At this time there are no known site features, other than sediment, which may contribute pollutants to storm water.

Per the Geotechnical Feasibility Study – Prepared by Carlton Engineering, Dated July 29, 2008. It is anticipated that some of the materials generated from on-site excavations will be suitable for use as engineered fill behind structures, or to raise site grades, provided the rock content is low enough to allow formation of a well-compacted soil matrix. Import material to be used as engineered fill should be free of organic material and meet the specifications as listed in a design level Geotechnical Engineering Study.

D. Existing (pre-construction) Control Measures

The following are existing (pre-construction) control measures encountered within the project site:

- Existing vegetation
- Existing Storm Drain utility (culverts)
- _____

Appendix B - General Permit

FACT SHEET
FOR
WATER QUALITY ORDER 99-08-DWQ

STATE WATER RESOURCES CONTROL BOARD (SWRCB)
901 P STREET, SACRAMENTO, CALIFORNIA 95814

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT FOR
STORM WATER DISCHARGES ASSOCIATED WITH
CONSTRUCTION ACTIVITY (GENERAL PERMIT)

BACKGROUND

In 1972, the Federal Water Pollution Control Act (also referred to as the Clean Water Act [CWA]) was amended to provide that the discharge of pollutants to waters of the United States from any point source is unlawful unless the discharge is in compliance with an NPDES permit. The 1987 amendments to the CWA added Section 402(p) which establishes a framework for regulating municipal and industrial storm water discharges under the NPDES Program. On November 16, 1990, the U.S. Environmental Protection Agency (USEPA) published final regulations that establish storm water permit application requirements for specified categories of industries. The regulations provide that discharges of storm water to waters of the United States from construction projects that encompass five (5) or more acres of soil disturbance are effectively prohibited unless the discharge is in compliance with an NPDES Permit. Regulations (Phase II Rule) that became final on December 8, 1999 expand the existing NPDES program to address storm water discharges from construction sites that disturb land equal to or greater than one (1) acre and less than five (5) acres (small construction activity). The regulations require that small construction activity, other than those regulated under an individual or Regional Water Quality Control Board General Permit, must be permitted no later than March 10, 2003.

While federal regulations allow two permitting options for storm water discharges (individual permits and General Permits), the SWRCB has elected to adopt only one statewide General Permit at this time that will apply to all storm water discharges associated with construction activity, except from those on Tribal Lands, in the Lake Tahoe Hydrologic Unit, and those performed by the California Department of Transportation (Caltrans). Construction on Tribal Lands is regulated by an USEPA permit, the Lahontan Regional Water Control Board adopted a separate NPDES permit for the Lake Tahoe Hydrologic Unit, and the SWRCB adopted a separate NPDES permit for Caltrans projects. This General Permit requires all dischargers where construction activity disturbs one acre or more, to:

1. Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) which specifies Best Management Practices (BMPs) that will prevent all construction pollutants from contacting storm water and with the intent of keeping all products of erosion from moving off site into receiving waters.

2. Eliminate or reduce nonstorm water discharges to storm sewer systems and other waters of the nation.

3. Perform inspections of all BMPs.

This General Permit shall be implemented and enforced by the nine California Regional Water Quality Control Boards (RWQCBs).

The General Permit accompanying this fact sheet regulates storm water runoff from construction sites. Regulating many storm water discharges under one permit will greatly reduce the otherwise overwhelming administrative burden associated with permitting individual storm water discharges. Dischargers shall submit a Notice of Intent (NOI) to obtain coverage under this General Permit. It is expected that as the storm water program develops, the RWQCBs may issue General Permits or individual permits containing more specific permit provisions. When this occurs, those dischargers will no longer be regulated by this General Permit.

On August 19, 1999, the State Water Resources Control Board (SWRCB) reissued the General Construction Storm Water Permit (Water Quality Order 99-08-DWQ referred to as "General Permit"). The San Francisco BayKeeper, Santa Monica BayKeeper, San Diego BayKeeper, and Orange Coast Keeper filed a petition for writ of mandate challenging the General Permit in the Superior Court, County of Sacramento. The Court issued a judgment and writ of mandate on September 15, 2000. The Court directed the SWRCB to modify the provisions of the General Permit to require permittees to implement specific sampling and analytical procedures to determine whether Best Management Practices (BMPs) implemented on a construction site are: (1) preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired for sediment or silt, and (2) preventing other pollutants, that are known or should be known by permittees to occur on construction sites and that are not visually detectable in storm water discharges, from causing or contributing to exceedances of water quality objectives. The monitoring provisions in the General Permit have been modified pursuant to the court order.

TYPES OF CONSTRUCTION ACTIVITY COVERED BY THIS GENERAL PERMIT

Construction activity subject to this General Permit includes clearing, grading, disturbances to the ground such as stockpiling, or excavation that results in soil disturbances of at least one acre of total land area. Construction activity that results in soil disturbances of less than one acre is subject to this General Permit if the construction activity is part of a larger common plan of development that encompasses one or more acres of soil disturbance or if there is significant water quality impairment resulting from the activity. Construction activity does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility, nor does it include emergency construction activities required to protect public health and safety. Dischargers should confirm with the local RWQCB whether or not a particular routine maintenance activity is subject to this General Permit.

A construction project which includes a dredge and/or fill discharge to any jurisdictional surface water (e.g., wetland, channel, pond, or marine water) will also need a CWA Section 404 permit

from the U.S. Army Corps of Engineers and a CWA Section 401 Water Quality Certification from the RWQCB/SWRCB. Storm water discharges from dredge spoil placement which occurs outside of Corps jurisdiction (upland sites) and are part of construction activity which disturbs one or more acres of land are covered by this general permit. Proponents of construction projects which disturb one or more acres of land within the jurisdictional boundaries of a CWA Section 404 permit should contact the local RWQCB to determine the applicability of this permit to the project.

NOTIFICATION REQUIREMENTS

It is the responsibility of the landowner to obtain coverage under this General Permit prior to commencement of construction activities. To obtain coverage, the landowner must file an NOI with a vicinity map and the appropriate fee with the SWRCB. In addition, coverage under this permit shall not occur until the applicant develops an adequate SWPPP for the project. Section A of the General Permit outlines the required contents of a SWPPP. For proposed construction activity on easements or on nearby property by agreement or permission, the entity responsible for the construction activity shall file an NOI and filing fee and shall be responsible for development of the SWPPP, all of which must occur prior to commencement of construction activities.

A separate NOI shall be submitted to the SWRCB for each construction site. Owners of new construction shall file an NOI prior to the commencement of construction. Owners of an ongoing construction site that is covered under the previous General Construction Permit (WQ Order No.92-08-DWQ) (1) shall continue to implement their existing SWPPP and monitoring program and (2) shall implement any necessary revisions to their SWPPP in a timely manner but in no case later than 90-calender days from adoption of this General Permit in accordance with Section A of this General Permit.

The NOI requirements of the General Permit are intended to establish a mechanism which can be used to clearly identify the responsible parties, locations, and scope of operations of dischargers covered by the General Permit and to document the discharger's knowledge of the requirements for a SWPPP.

The NOI must be sent to the following address:

State Water Resources Control Board
Division of Water Quality
Storm Water Permit Unit
P.O. Box 1977
Sacramento, CA 95812-1977

The total annual fee is the current base fee plus applicable surcharges.

When construction is complete or ownership has been transferred, dischargers shall file a Notice of Termination with the RWQCB certifying that all State and local requirements have been met in accordance with Special Provisions for Construction Activity, C.7, of the General Permit.

Dischargers who fail to obtain coverage under this General Permit for storm water discharges to surface waters will be in violation of the CWA and the California Water Code.

CONSTRUCTION ACTIVITY NOT COVERED BY THIS GENERAL PERMIT

This General Permit does not apply to storm water discharges from (1) those areas on Tribal Lands; (2) the Lake Tahoe Hydrologic Unit; (3) construction under one acre, unless part of a larger common plan of development or sale; (4) projects covered by an individual NPDES Permit for storm water discharges associated with construction activity; and (5) landfill construction that is subject to the general industrial permit.

Storm water discharges in the Lake Tahoe Hydrologic Unit are regulated by a separate permit(s) adopted by the California Regional Water Quality Control Board, Lahontan Region (LRWQCB). USEPA regulates storm water discharges on Tribal Lands. Permit applications for storm water discharges that will be conducted in the Lake Tahoe Hydrologic Unit must be submitted directly to the LRWQCB.

DESCRIPTION OF GENERAL PERMIT CONDITIONS

The following is a brief description of the major provisions of the General Permit and the basis for the General Permit.

Prohibitions

This General Permit authorizes the discharge of storm water to surface waters from construction activities that result in the disturbance of one or more acres of land. It prohibits the discharge of materials other than storm water and authorized non-storm water discharges and all discharges which contain a hazardous substance in excess of reportable quantities established at 40 Code of Federal Regulations (CFR) 117.3 or 40 CFR 302.4 unless a separate NPDES Permit has been issued to regulate those discharges. In addition, this General Permit contains provisions that uphold discharge prohibitions contained in water quality control plans, as implemented through the nine RWQCBs.

Effluent Limitations

Permits for storm water discharges associated with construction activity shall meet all applicable provisions of Sections 301 and 402 of the CWA. These provisions require controls of pollutant discharges that utilize best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT) to reduce pollutants and any more stringent controls necessary to meet water quality standards.

It is not feasible at this time for the SWRCB to establish numeric effluent limitations. The reasons why it is not feasible to establish numeric effluent limitations are discussed in detail in SWRCB Order Nos. WQ 91-03 and WQ 91-04. Therefore, the effluent limitations contained in this General Permit are narrative and include the requirement to implement appropriate BMPs.

The BMPs shall primarily emphasize source controls such as erosion control and pollution prevention methods. The discharger shall also install structural controls, as necessary, such as sediment control which will constitute BAT and BCT and will achieve compliance with water quality standards. The narrative effluent limitations constitute compliance with the requirements of the CWA.

Elimination or reduction of nonstorm water discharges is a major goal of this General Permit. Nonstorm water discharges include a wide variety of sources, including improper dumping, spills, or leakage from storage tanks or transfer areas. Nonstorm water discharges may contribute a significant pollutant load to receiving waters. Measures to control spills, leakage, and dumping and to prevent illicit connections during construction shall be addressed through structural as well as non-structural BMPs.

This General Permit prohibits the discharge of materials other than storm water and authorized nonstorm water discharges. It is recognized that certain nonstorm water discharges may be necessary for the completion of construction projects. Such discharges include, but are not limited to irrigation of vegetative erosion control measures, pipe flushing and testing, street cleaning, and dewatering. Such discharges are allowed by this General Permit provided they are not relied upon to clean up failed or inadequate construction or post-construction BMPs designed to keep materials onsite. These authorized nonstorm water discharges shall (1) be infeasible to eliminate, (2) comply with BMPs as described in the SWPPP, and (3) not cause or contribute to a violation of water quality standards. Additionally, these discharges may be required to be permitted by the local RWQCB (e.g., some RWQCBs have adopted General Permits for dewatering discharges). This General Permit is performance-based to the extent that it prohibits the discharge of storm water that causes or threatens to cause pollution, contamination, or nuisance; but it also allows the owner/developer to determine the most economical, effective, and possibly innovative BMPs.

The requirements of this General Permit are intended to be implemented on a year-round basis, not just during the part of the year when there is a high probability of a precipitation event which results in storm water runoff. The permit should be implemented at the appropriate level and in a proactive manner during all seasons while construction is ongoing.

Weather and storm predictions or weather information concerning the 10-year, 6-hour storm event and mean annual rainfall can be obtained by calling the Western Regional Climate Center at 775-674-7010 or via the internet at www.wrcc.dri.edu/precip.html and/or www.wrcc.dri.edu/pcpnfreq.html.

Receiving Water Limitations Language

The receiving water limitations language is fundamentally different from the language adopted in the SWRCB General Industrial Activities Storm Water Permit on April 17, 1997. Construction related activities which cause or contribute to an exceedance of water quality standards must be corrected immediately and cannot wait for the RWQCB to approve a plan of action to correct. The dynamic nature of construction activity allows the discharger the ability to more quickly identify and correct the source of the exceedances. Therefore, the owner is

required to take immediate corrective action and to provide a report to the appropriate RWQCB within
14-calendar days of the violation describing the corrective action.

Storm Water Pollution Prevention Plan (SWPPP)

This General Permit requires development and implementation of a SWPPP. This document emphasizes the use of appropriately selected, correctly installed and maintained pollution reduction BMPs. This approach provides the flexibility necessary to establish BMPs which can effectively address source control of pollutants during changing construction activities.

All dischargers shall prepare and implement a SWPPP prior to disturbing a site. The SWPPP must be implemented at the appropriate level to protect water quality at all times throughout the life of the project. Nonstorm water BMPs must be implemented year round. The SWPPP shall remain on the site while the site is under construction, commencing with the initial mobilization and ending with the termination of coverage under the permit.

The SWPPP has two major objectives: (1) to help identify the sources of sediment and other pollutants that affect the quality of storm water discharges and (2) to describe and ensure the implementation of BMPs to reduce or eliminate sediment and other pollutants in storm water as well as nonstorm water discharges. The SWPPP shall include BMPs which address source control and, if necessary, shall also include BMPs which address pollutant control.

Required elements of a SWPPP include: (1) site description addressing the elements and characteristics specific to the site, (2) descriptions of BMPs for erosion and sediment controls, (3) BMPs for construction waste handling and disposal, (4) implementation of approved local plans, (5) proposed post-construction controls, including description of local post-construction erosion and sediment control requirements, and (6) nonstorm water management.

To ensure that the preparation, implementation, and oversight of the SWPPP is sufficient for effective pollution prevention, individuals responsible for creating, revising, overseeing, and implementing the SWPPP should participate in applicable training programs and document such training in the SWPPP.

SWPPPs are reports that are available to the public under Section 308(b) of the CWA and will be made available by the RWQCB upon request.

Monitoring Program

Another major feature of the General Permit is the development and implementation of a monitoring program. All dischargers are required to conduct inspections of the construction site prior to anticipated storm events and after actual storm events. During extended storm events, inspections must be made during each 24-hour period. The goals of these inspections are (1) to identify areas contributing to a storm water discharge; (2) to evaluate whether measures to reduce pollutant loadings identified in the SWPPP are adequate and properly installed and functioning in accordance with the terms of the General Permit; and (3) whether additional control practices or corrective maintenance activities are needed. Equipment, materials, and

workers must be available for rapid response to failures and emergencies. All corrective maintenance to BMPs shall be performed as soon as possible, depending upon worker safety.

Each discharger shall certify annually that the construction activities are in compliance with the requirements of this General Permit. Dischargers who cannot certify annual compliance shall notify the appropriate RWQCB. A well-developed monitoring program will provide a good method for checking the effectiveness of the SWPPP.

Retention of Records

The discharger is required to retain records of all monitoring information, copies of all reports required by this General Permit, and records of all data used to complete the NOI for all construction activities to be covered by the General Permit for a period of at least three years from the date generated. This period may be extended by request of the SWRCB and/or RWQCB. With the exception of reporting noncompliance to the appropriate RWQCB, dischargers are not required to submit the records, except upon specific request by the RWQCB.

FACT SHEET
FOR
WATER QUALITY ORDER 99-08-DWQ

STATE WATER RESOURCES CONTROL BOARD (SWRCB)
1001 I STREET, SACRAMENTO, CALIFORNIA 95814

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT FOR
STORM WATER DISCHARGES ASSOCIATED WITH
CONSTRUCTION ACTIVITY (GENERAL PERMIT): Sampling and Analysis

Contents

1.0 **Introduction**
- 1.1 Organization
- 1.2 Background
  - 1.2.1 Water Quality Standards or Objectives
  - 1.2.2 Non-Visible Pollutant Sampling
  - 1.2.3 Sediment-Impaired Water Bodies
- 1.3 Purpose of Sampling and Analysis

2.0 **Sampling Program for Pollutants Not Visually Detectable in Storm Water**
- 2.1 What the Permit Says About Sampling
- 2.2 Deciding When to Sample
- 2.3 Deciding What Constituents to Sample For: What are Pollutants Which are "Known or Should be Known" to Occur on a Construction Site?
- 2.4 Deciding Where to Sample
- 2.5 Types of Test Methods?
- 2.6 Deciding How Often to Sample
- 2.7 Identification of Pollutant Sources
- 2.8 Examples of When Sampling and Analysis for Non-Visible Pollutants is Not Required
- 2.9 Examples of When Sampling and Analysis is Required
- 2.10 Do I need to Sample Storm Water Flows Diverted Around My Project for Non-Visible Pollutants?
- 2.11 Deciding How to Sample
- 2.12 How to Use Your Sampling Data
  - 2.12.1 How to Analyze your Data
  - 2.12.2 Coordinating Visual Observations With Sampling Results
  - 2.12.3 What to Do If The Data Show a Potential Problem
- 2.13 Retention of Data

3.0 Sampling Program for Sedimentation/Siltation
- 3.1 What the Permit Says About Sampling

3.2 Deciding When to Sample
3.3 Deciding What Constituent(s) Require Sampling
3.4 Deciding Where to Sample
3.5 What are the Applicable Water Quality Standards
3.6 Deciding How to Sample
3.7 How to Use Your Data
3.7.1 How to Analyze Your Data
3.7.2 Sources of Sediment, Silt and Turbidity In a Construction Discharge
3.7.3 What to Do If Your Data Shows a Statistically Significant Increase Downstream of the Discharge
3.8 Retention of Data
4.0 Sampling Procedures
5.0 Definitions
6.0 Sources of Further Assistance
7.0 Explanation of Sampling and Analysis Requirements
7.1 Requirement for Compliance with Water Quality Standards
7.2 Background Contamination
7.3 Parameters to Sample for to Determine the Presence of Non-Visible Pollutants in Runoff
7.4 The Watershed Approach to Storm Water Permitting
7.5 References and Record for this Guidance Document
Laboratory Requirements for Storm Water Monitoring of Sediment, Siltation and/or Turbidity

List of Figures

1.1 Evaluating Your Site for Sediment Sampling
1.2 Evaluating Your Site for Non-Visible Pollutant Sampling
1.2.1 Evaluating Your Site for Historical Pollutants
1.2.2 Evaluating Your Site for Non-Visible Pollutant Run-on
1.2.3 Evaluating Your Site for Construction Non-Visible Pollutants
4-1 Outline for a Typical Storm Water Sampling and Analysis Plan

Appendices

A Water Quality Objectives for Suspended Materials, Setteable Materials, Sediment and Turbidity

1.0 Introduction

This document is an amendment to the Fact Sheet to the State Water Resources Control Board's (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated With Construction Activity (CGP). This Permit was modified in 2001 by Resolution No. 2001-046, "*Modification of Water Quality Order 99-08-DWQ State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) General Permit For Storm Water Discharges Associated With Construction Activity (CGP)*". The modifications to the CGP require that a sampling and analysis strategy and sampling schedule for certain discharges from construction activity be developed and kept with the project's Storm Water Pollution Prevention Plan (SWPPP). The sampling and analysis requirements are found in Section B, paragraphs 7 and 8, of the CGP. Paragraph 7 concerns monitoring for sedimentation/siltation or turbidity and Paragraph 8 concerns monitoring for pollutants that are not visually detectable in storm water. Where required, a sampling and analysis strategy and sampling schedule must be developed regardless of the time of the year that construction occurs.

This document only addresses the modifications and is intended to facilitate the proper implementation of the sampling and analysis requirements. It provides information on when sampling and analysis is required, how to perform sampling and analysis, what conclusions may be drawn from the sampling and analysis results, and it explains the rationale for the required sampling.

SWRCB staff developed this document with consideration of comments from interested persons, including the California Stormwater Quality Association, the Building Industry Legal Defense Foundation, the California Building Industry Association, the San Francisco BayKeeper, the Santa Monica BayKeeper, the San Diego BayKeeper, and the Orange County CoastKeeper. It is based on the CGP, two orders issued by the Sacramento Superior Court in response to a challenge to the CGP, Clean Water Act provisions, regulations, guidance documents and permits issued by the federal Environmental Protection Agency, and other documents submitted by interested persons. A full record has been compiled and is available for inspection or copying upon request. A draft guidance document was circulated for public comment and a hearing was held prior to issuance of this final guidance document.

Although sampling and analysis will be required at many construction sites, it will not be required at all construction sites. It is the responsibility of dischargers to evaluate the construction project and, where required, to develop a site-specific sampling and analysis strategy in compliance with the CGP requirements. For further guidance please contact your local Regional Water Quality Control Board (RWQCB).

The sampling and analysis requirements supplement, but do not replace, the visual monitoring program required by Section B of the CGP. All construction projects must continue the visual monitoring program including inspections before predicted rain events, during extended rain events, and following rain events that produce runoff.

This document provides guidance on complying with the sampling and analysis requirements of the CGP. It does not in any way change these requirements or guarantee compliance with the CGP. The permit has many other requirements such as development of a SWPPP,

implementation of Best Management Practices (BMP) programs, and visual monitoring that are not addressed in this document.

1.1 Organization

Section 1: general information and background on the sampling and requirements.

Section 2: non-visible pollutant sampling and analysis.

Section 3: sediment, silt and turbidity sampling and analysis.

Section 4: sampling and analysis procedures.

Section 5: definitions.

Section 6: contact list and additional sources of information.

Section 7: general explanation of and rationale for the sampling and analysis requirements; citations to other documents that form the basis for the SWRCB's conclusions.

1.2 Background

The SWRCB adopted the CGP on August 19, 1999. The CGP is an NPDES permit that implements section 402(p)(2)(B) of the federal Clean Water Act. The San Francisco BayKeeper, Santa Monica BayKeeper, San Diego BayKeeper, and Orange County CoastKeeper filed a petition for writ of mandate challenging numerous aspects of the CGP in the Superior Court, County of Sacramento.

On September 15, 2000, the Court issued a judgment and writ of mandate that upheld most provisions of the CGP, but directed the SWRCB to modify the provisions of the CGP to require permittees to implement specific sampling and analytical procedures to determine whether BMPs implemented on a construction site are:

(1) preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired (Clean Water Act Section 303(d) List [303(d) List]) for sediment, silt, or turbidity; and

(2) preventing other pollutants that are known or should be known by permittees to occur on construction sites and that can not be visually observed or detected in storm water discharges, from causing or contributing to exceedances of water quality objectives.

The monitoring, sampling and analysis provisions in the CGP were modified pursuant to the court order and issued as Resolution No. 2001-046, adopted by the SWRCB on April 26, 2001.

On December 27, 2001, the Court issued an Order Enforcing Writ of Mandate. In that order, the Court acknowledged that the permit had been modified, but required further actions by the SWRCB. Issuance of this fact sheet amendment is intended to respond to the Court's further instructions. In general, the Court expressed concern that certain aspects of the modifications might be ambiguous and might result in misinterpretation by dischargers. This amendment is

intended to avoid such potential ambiguities and misinterpretations and to help explain the requirements and provide suggestions for compliance.

1.2.1 Water Quality Standards or Objectives

The Receiving Water Limitations in the CGP require the SWPPP be designed and implemented so that storm water discharges and authorized non-storm water discharges do not cause or contribute to an exceedance of any applicable water quality standard. (CGP, Receiving Water Limitation B.2.) The modifications to the monitoring program require sampling and analysis procedures to help determine whether BMPs installed and maintained in accordance with the SWPPP are preventing pollutants in discharges from the construction site from causing or contributing to exceedance of water quality standards. In making these determinations, it is necessary to understand what are the applicable water quality standards.

Water quality standards consist of the designation of beneficial uses of surface waters and the adoption of ambient criteria necessary to protect those uses. (40 CFR §131.3(i)) When adopted by the SWRCB or a RWQCB, the criteria are termed "water quality objectives." (Water Code §13241; the terms are used interchangeably here.) If storm water runoff from construction sites contains pollutants, there is a risk that those pollutants could enter surface waters and cause or contribute to exceedance of water quality standards. For that reason, dischargers should be aware of the applicable water quality standards in their receiving waters. (The best method to ensure compliance with receiving water limitations is to implement BMPs that prevent pollutants from contact with storm water or from leaving the construction site in runoff).

In California, water quality standards are published in the Basin Plans adopted by each RWQCB, the California Toxics Rule (CTR), the National Toxics Rule (NTR), and the Ocean Plan. One way to determine the applicable standards for the receiving water for your runoff is to contact staff from the appropriate RWQCB. (See the contact list in Section 6 of this guidance.)

The SWRCB intends in the future to augment its internet site to further facilitate access to water quality standards. In the interim, dischargers can determine the applicable water quality standards by contacting RWQCB staff or from one of the following sources. The actual plans that contain the water quality standards can be viewed at the site of the appropriate RWQCB for Basin Plans (http://www.waterboards.ca.gov/regions.html), the SWRCB site for statewide plans (http://www.waterboards.ca.gov/plnspols/index.html), or the US Environmental Protection Agency (USEPA) regulations for the NTR and CTR (40 CFR Title 131). Basin Plans and statewide plans are also available by mail from the appropriate RWQCB or the SWRCB. The USEPA regulations are available at http://www.epa.gov/. Additional information concerning Water Quality Standards can be accessed through http://www.waterboards.ca.gov/stormwtr/gen_const.html

1.2.2 Non-Visible Pollutant Sampling

The monitoring requirements in the CGP require sampling and analysis for pollutants that are not visually detectable in storm water discharges, which are or should be known to occur on the construction site, and which could cause or contribute to an exceedance of water quality objectives. As is explained below, the situations where non-visible pollutants may occur in runoff from a construction site are limited. Where such non-visible pollutants are known or

should be known to be present and have the potential to contact runoff and to contribute to an exceedence of a water quality objective, sampling and analysis is required.

A variety of materials are used in construction or are present on construction sites. Examples of such materials include soil stabilizers, paint, and fluids from vehicles. Any of these materials can end up in the storm water runoff and contain pollutants that pose a threat to water quality. Some of these potential pollutants will leave a visible trace. For example, sediment turns water brown and oil and grease leave a sheen. Other pollutants will discolor the runoff or leave a residue or film. For pollutants that are visible in runoff, the CGP requires the discharger to perform visual monitoring of the site and does not require sampling and analysis. The sampling and analysis requirements only apply to pollutants that do not leave a visible trace or are not associated with a visible tracer. Examples of such potential non-visible pollutants include increased pH, pesticides, and nutrients such as nitrogen or phosphorus.

The presence or use of a material on the construction site does not always mean that dischargers must sample for it in runoff. The CGP requires sampling and analysis when non-visible pollutants could "cause or contribute to an exceedance of water quality objectives in the receiving water." The most effective way to avoid the sampling and analysis requirements, and to ensure permit compliance, is to avoid the exposure of construction materials to precipitation and storm water runoff. Materials that are not exposed do not have the potential to enter storm water runoff, and therefore do not need to be sampled for in runoff. Preventing contact between storm water and construction materials is one of the most important BMPs at any construction site. Manage any potential pollutants on the site in such a way that the exposure of the pollutant to rainfall or storm water is minimized or eliminated.

Elimination of exposure of pollutants at construction sites is not always possible. Some materials, such as soil amendments, are designed to be used in a manner that will result in exposure to storm water. In these cases, it is important to make sure that these materials are applied according to the manufacturer's instructions at a time when they are unlikely to be washed away. Other materials can be exposed when storage, waste disposal or application are not done in a manner protective of water quality or through accidental spillage. For these situations, sampling is required unless there is capture and containment of all storm water that has been exposed to pollutants. In cases where construction materials may be exposed to storm water but the storm water is contained, and is not allowed to run off the site, then sampling only needs to occur when inspections show the containment failed or is breached and there is potential for exposure or discharge.

Many common good housekeeping BMPs already limit exposure to most materials. Improving these practices to prevent exposure is a better approach to preventing pollution of runoff and will limit the amount of sampling and analysis. Improved BMPs may be less costly than an ongoing sampling and analysis program.

The first step in managing potential pollutants at a construction site is the implementation of well thought out BMP programs that are designed to minimize the mobilization of pollutants such as sediment and to minimize the exposure of storm water to pollutants. The next important step is an aggressive program of inspections both on a regular basis and before and after storms. The inspection program must also be accompanied by an equally aggressive BMP maintenance

program. The receiving water is protected when appropriate BMPs are implemented, inspected and maintained. The role of sampling is to support the visual inspection of the site when necessary.

1.2.3 Sediment-Impaired Water Bodies

Certain lakes, streams, rivers, creeks and other bodies of water in California have been determined by the SWRCB to be impaired by one or more pollutants. (This listing is required by Clean Water Act section 303(d).) One of the pollutants that can trigger a listing is sediment, termed variously as sedimentation, siltation, sediment, or turbidity. The water bodies listed for sediment in California are included in Attachment 3 to the CGP. Additional discharges of sediment to a sediment-impaired water body could contribute to the exceedance of a water quality standard for that pollutant. Following listing of impaired waters, RWQCBs adopt total maximum daily loads (TMDLs) that may include waste load allocations for the impairing pollutant. Effluent limitations in NPDES permits must be consistent with the assumptions and requirements of waste load allocations (40 CFR section 122.44(d)(1)(vii)(B)), and adoption of TMDLs could result in specific requirements in the CGP or an individual or watershed-wide construction permit. Pending completion of TMDLs for sediment-impaired waters, it is necessary to ensure that sediment discharges from construction sites do not cause or contribute to exceedances of water quality. To that end, the modifications require sampling and analysis of discharges from construction activity that directly enters a water body listed in Attachment 3 to the CGP as impaired for sediment. This requirement is generally only applicable to a handful of construction projects each year.

To obtain the latest list of 303(d) water bodies, visit the SWRCB's Web site at http://www.waterboards.ca.gov/.

1.3 Purpose of Sampling and Analysis

The primary method of determining compliance with the CGP is visual inspections. The permit requires regular inspections as well as pre-storm and post-storm inspections to determine if there are areas where storm water can be or has been exposed to pollutants. It is possible to see if there is erosion and movement of soil, or if construction materials, chemicals and waste are exposed. This is the best way to determine if the site is in compliance. In some cases, verification of this compliance through sampling and analysis is appropriate. The purpose of the sampling and analysis requirements is to support the visual observation program and to provide information that can be used to help determine whether the BMPs employed on a construction site are effective in preventing construction site pollutants from causing or contributing to exceedances of water quality objectives in the receiving waters. The modifications to the CGP contain two categories of sampling and analysis requirements, which are illustrated in Figures 1-1 and 1.2.1-4:

Monitoring for non-visible pollutants at any site where the relevant triggering conditions occur. This monitoring is required at any site where there is exposure and where a discharge can cause or contribute to exceedence of a water quality objective, not just those that discharge to water bodies that are listed for a particular pollutant; and

Monitoring for sediment in storm water discharged directly to water bodies listed as impaired for sediment/siltation, sediment, or turbidity on the SWRCB's 303(d) list of water bodies.

The sampling and analysis results are not conclusive proof of compliance or non compliance with the permit. Specifically, Receiving Water Limitations in the CGP provide that the SWPPP must be designed and implemented so that storm water discharges shall not cause or contribute to exceedance of any applicable water quality standards. These provisions also require implementation of corrective measures, and revision of the SWPPP and monitoring requirements if storm water discharges do cause or contribute to an exceedance of an applicable water quality standard. USEPA has pointed out the difficulties and limitations of using sampling in storm water permits as a measure of compliance. (57 Fed. Reg. 11394, 11402) While sampling and analysis, as required by the CGP, may be a useful tool in pointing to areas of concern, it is of limited use in the storm water context and must be used as a diagnostic tool rather than as conclusive evidence of compliance or non-compliance with the CGP.

Determine if You Must Perform Sampling and Analysis for Sediment, Silt, or Turbidity

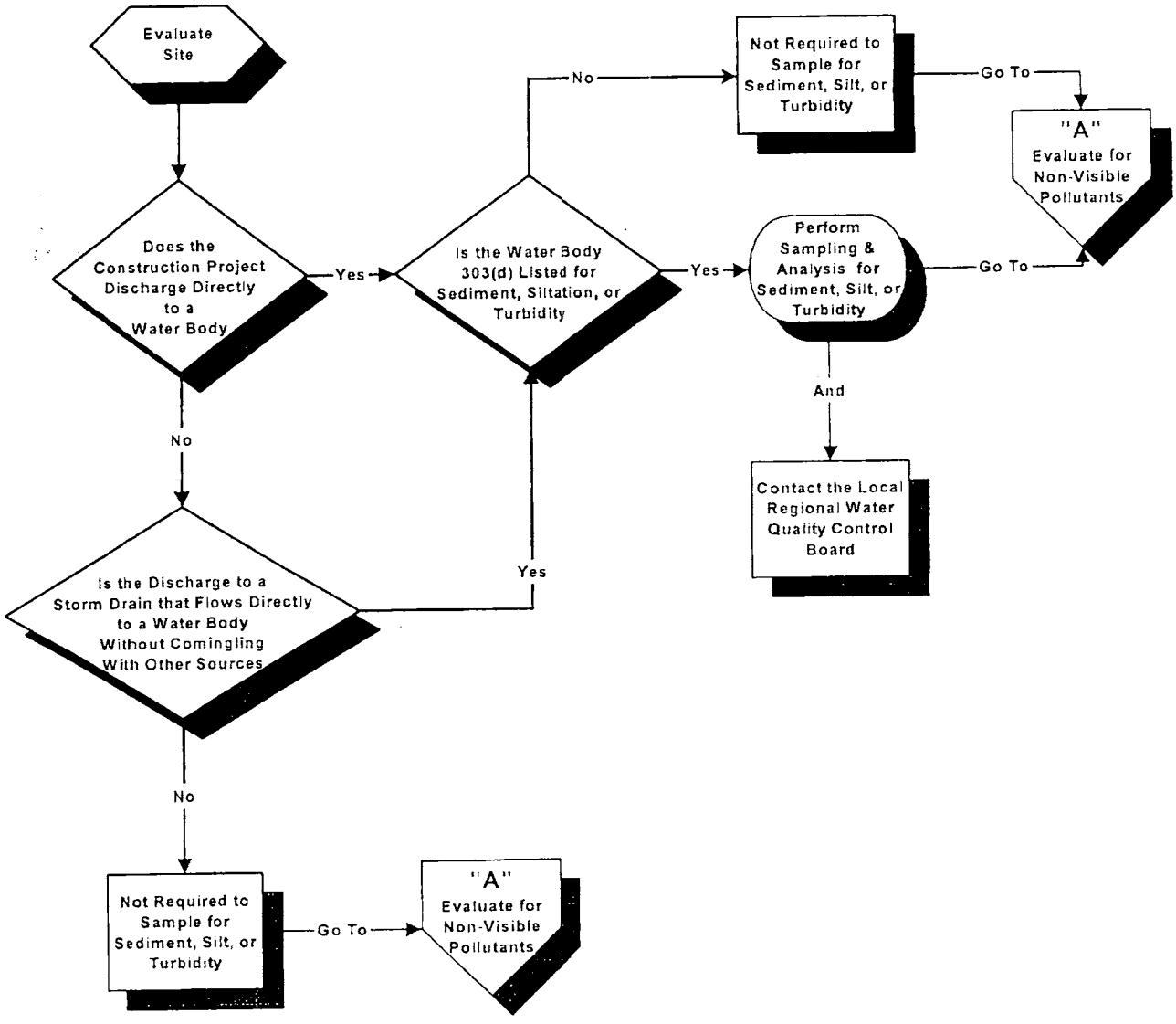


Figure 1.1

Evaluate Site for Non-Visible Pollutants and Determine if You Must Perform Sampling & Analysis for Non-Visible Pollutants

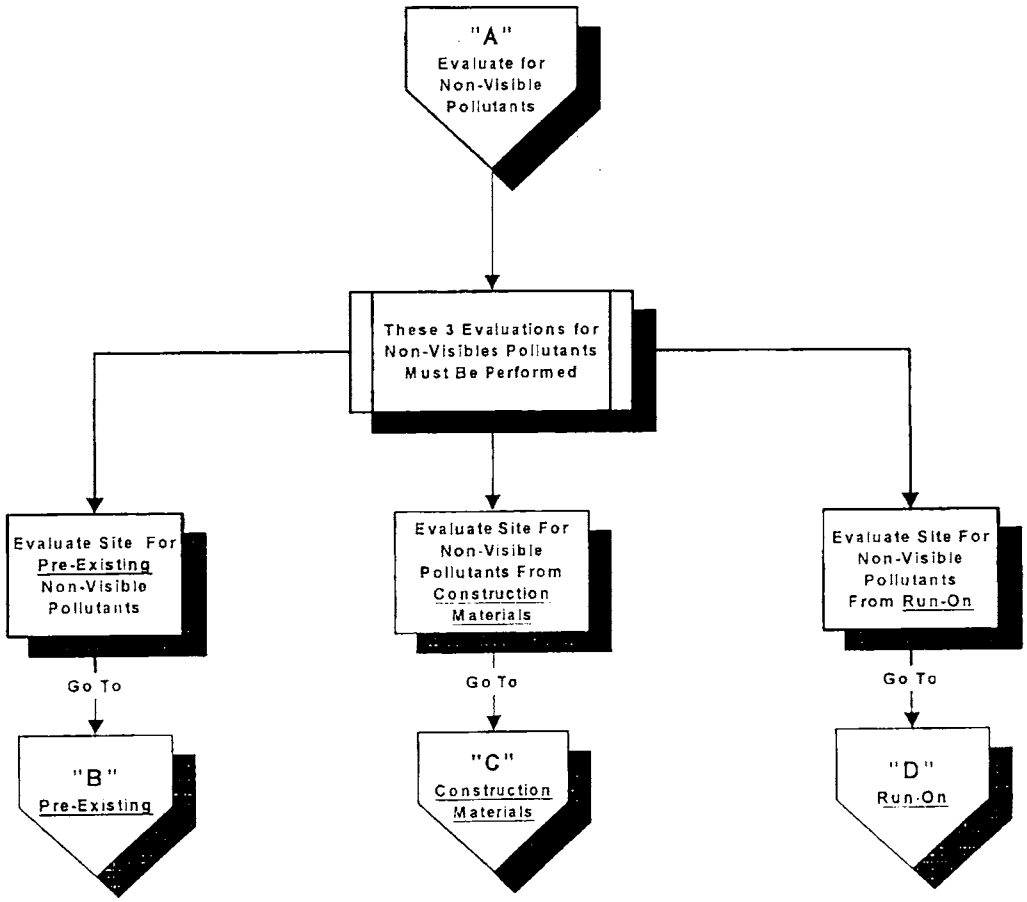


Figure 1.2

Determine If You Must Perform Sampling and Analysis (S&A) for Pre-Existing Non-Visible Pollutants

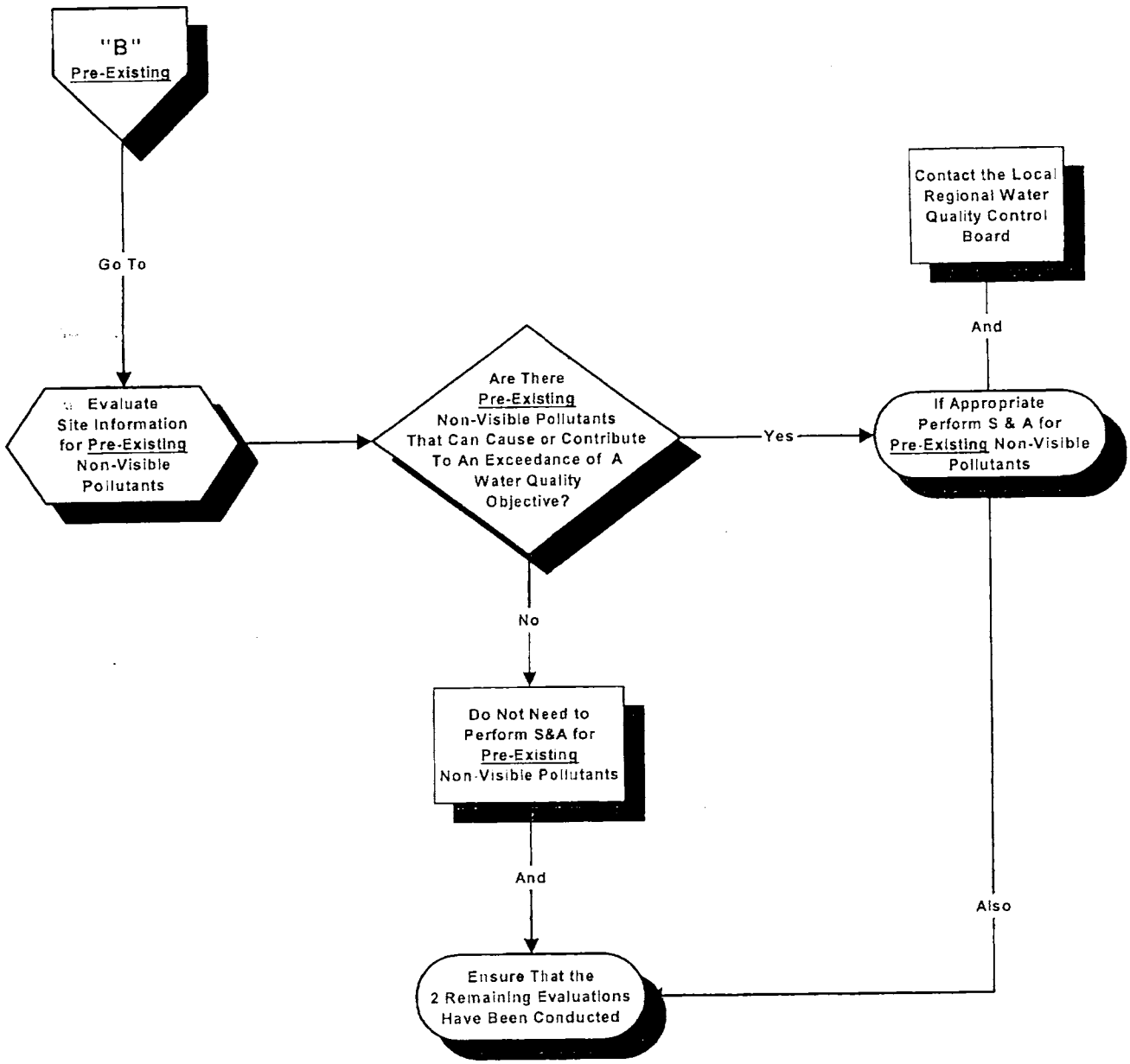


Figure 1.2.1

Determine If You Must Perform Sampling and Analysis (S&A) for Non-Visible Pollutants From Construction Material

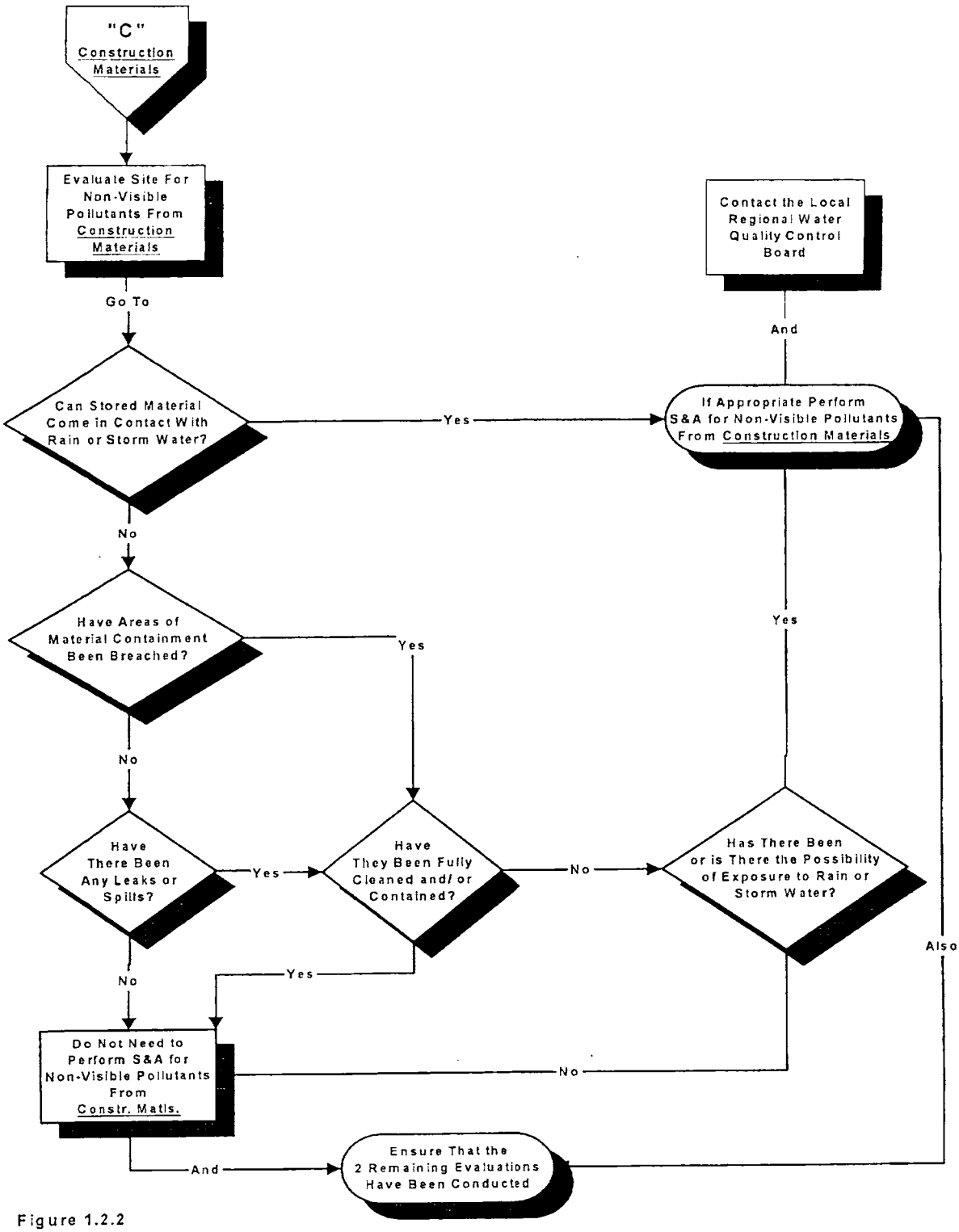


Figure 1.2.2

Determine If You Must Perform Sampling and Analysis (S&A) for Non-Visible Pollutants From Run-On

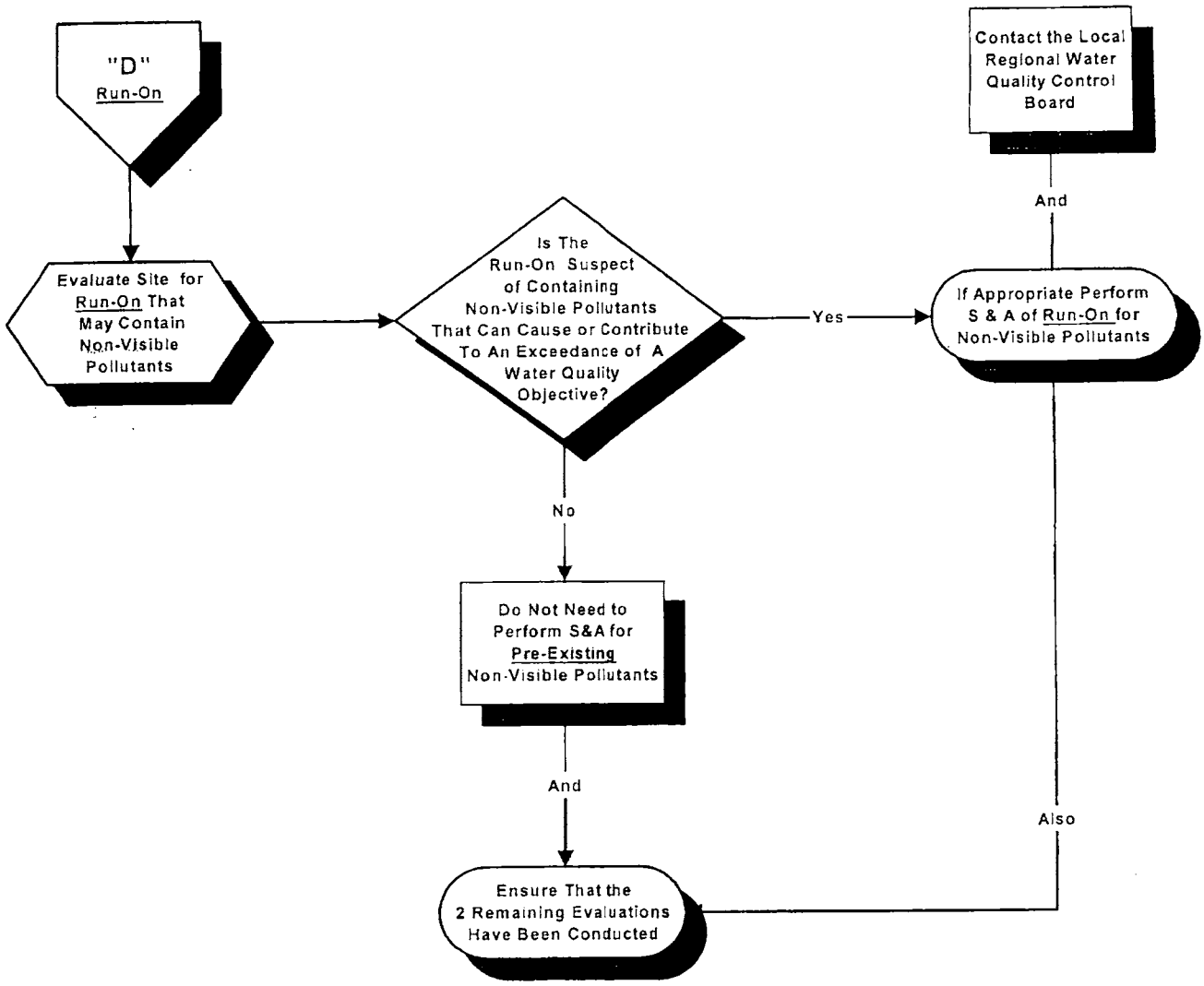


Figure 1.2.3

2.0 Sampling Program for Pollutants Not Visually Detectable in Storm Water

The CGP requires sampling and analysis for pollutants not visually detectable in runoff, but which could cause or contribute to an exceedance of water quality objectives in the receiving water. Sample for a constituent if there is reason to expect that it may be in the discharge, regardless of whether or not it is causing or contributing to an exceedence of a water quality objective. First attempt to eliminate the exposure of construction materials to prevent pollution of storm water and thus to limit the requirement for sampling and analysis. Many construction materials, including soil amendments, fertilizers, pesticides, and even things like fencing and wood products, are intended for use outdoors. For such materials, minimize pollutant discharge through implementation of appropriate BMPs. If exposure to these products can contribute pollutants to the runoff at levels that could cause or contribute to exceedance of a water quality objective, then sampling is still required, even if they are used correctly.

2.1 What the Permit Says about Sampling

The CGP requires that a sampling and analysis program be developed and conducted for pollutants which:

- Are not visually detectable in storm water discharges,
- Are known or should be known to occur on the construction site, and
- Could cause or contribute to an exceedance of water quality objectives in the receiving water.

Include all pollutants identified in this way in this sampling and analysis strategy and identify them in the SWPPP (as required by Sections A. 5. b. and A. 5. c. of the CGP). The CGP states that the SWPPP must identify a strategy for conducting the sampling and analysis, including the frequency and location(s) at which sampling will be conducted.

Sample for pollutants that would not be visible in runoff if:

- Visual inspections (required before, during and after storm events) indicate that there has been a breach, malfunction, leakage or spill from a BMP that could result in the discharge of pollutants in storm water and the pollutants would not be visually detectable; or
- Storm water comes into contact with soil amendments, other exposed materials, or other on site sources of pollution.

2.2 Deciding When to Sample

Conduct proper inspections throughout the duration of the project to make sure that appropriately selected BMPs have been implemented, are being maintained, and are effective. Sample if non-visible pollutants that are known or should be known to occur on the construction site "could cause or contribute to an exceedance of water quality objectives in the receiving water." As discussed in this document, there are numerous receiving water standards found in different documents, including narrative water quality objectives in basin plans. For that reason,

and because of the difficulties associated with linking a discharge from a construction site to exceedance of water quality standards in the receiving waters, conduct sampling and analysis whenever the above conditions are met.

If a determination is made that sampling is needed, collect storm water runoff samples regardless of the time of year, status of the construction site, or day of the week. Collect samples during the first two hours of runoff (during daylight hours). Storm water inspections and sample collections are required even during non-working days (including weekends and holidays).

2.3 Deciding What Constituents to Sample for: What are Pollutants Which are "Known or Should be Known " to Occur on a Construction Site?

Pollutants can be considered to be known or should be known to occur on the construction site if they are currently in use or are present as a result of previous land uses. This includes materials that:

- are being used in the construction activities
- are stored on the construction site
- were spilled during construction operations and not cleaned up
- were stored (or used) in a manner that presented the potential for a release of the materials during past land use activities
- were spilled during previous land use activities and not cleaned up
- were applied to the soil as part of past land use activities.

Construction material inventories and the project SWPPP should provide adequate information on materials currently in use or proposed for use on the construction site.

Develop a list of potential pollutants based on a review of potential sources identified in your SWPPP (required by CGP sections A.5.b. and A.5.c.), which will include construction related materials, soil amendments, soil treatments, and historic contamination. Review existing environmental and real estate documentation to determine the potential for pollutants to be present on the construction site as a result of past land use activities. Good sources of information on previously existing pollution and past land uses include Environmental Assessments, Initial Studies, Environmental Impact Reports or Environmental Impact Statements prepared under the requirements of the National Environmental Policy Act or the California Environmental Quality Act, and Phase 1 Assessments prepared for property transfers. In some instances, the results of soil chemical analyses may be available and can provide additional information on potential contamination.

Identify from this list those pollutants that would not be visible in storm water discharges. These are the constituents that you will likely have to sample for in runoff if the materials are

exposed to storm water. Consult with your analytical laboratory or water quality chemist to determine if there are field tests or indicator parameters that can be used.

2.4 Deciding Where to Sample

Sample at all discharge locations that drain the areas from which the pollutants may have entered the runoff and at locations that have not come in contact with the pollutants (reference sampling). This allows a comparison of reference samples with the sample(s) collected from storm water suspected of containing construction-related pollutants. The collection of this sample is important in the interpretation of the potentially contaminated sample because it provides information on the characteristics of the storm water without the exposure. For example, if storm water were to come in contact with hydrated lime products, the indicator parameter for pollution would be an elevated pH. The storm water could also be polluted with other materials or minerals, but the elevated pH will provide information necessary for the discharger to make further determinations as to the cause. In this case, a sample of storm water from the same storm event that did *not* come in contact with the hydrated lime would provide an understanding of what the pH of the uncontaminated storm water was in relation to the polluted storm water.

A more accurate background sample would have also contacted the soil and vegetation of the area, further isolating the lime as the source of the elevated pH. This gives the discharger the necessary information to take immediate steps to detain the polluted storm water or to minimize or eliminate the exposure. Describe the sampling procedure, location and rationale for obtaining the reference sample of storm water in the SWPPP.

Identify sampling locations that provide information on both the runoff quality that is affected by material storage, historic contamination or other exposed potential pollutants, and the background runoff quality (i.e., reference sample). Material storage may be confined to a small area of the project while historic contamination or exposed materials, such as soil amendments, may be widespread throughout the construction site. For this reason, the sampling locations identified for these two types of potential pollutants may be different.

- Collect samples at locations identified in your SWPPP and in areas identified by visual observations/inspections where there has been a BMP failure or breach and which can be safely accessed.
- Collect samples from a location that is not affected by material storage activities or by runoff as a background or reference location.
- For a widespread potential pollutant, select sampling locations at the perimeter of your site, where storm water is unaffected by your activities and compare this to areas that are affected by your activities on the site. Describe the sampling procedure, the location, and the rationale for selecting these locations in the SWPPP.

If the "reference sample" is taken from on-site and it turns out to be carrying a high level of pollutants this should trigger an evaluation of this drainage area. Are there previously

undetected sources of pollutants? It may turn out that additional BMPs may be necessary on this portion of the site or that the discharge must be managed or contained.

If the "reference sample" is taken from off site and it turns out to be carrying a high level of pollutants take a sample on site to determine if the same pollutants are on site and must be managed.

2.5 Types of Test Methods?

The CGP requires sampling of non-visible pollutants that "could cause or contribute to an exceedance of water quality objectives in the receiving waters". Unlike sediment, for which there are a limited number of applicable water quality objectives, the applicable water quality standards for "non-visible" pollutants will depend on the material and its chemical makeup. This guidance document contains information on what pollutants may occur on construction sites and which water quality standards may be associated with those pollutants. The best assurance of complying with the receiving water limitations is to prevent or reduce runoff of all polluting substances from construction sites through implementation of effective BMPs.

The sampling and analysis language recognizes that sampling and laboratory analysis, in and of itself, does not protect water quality. Rather, field identification and detection of the source of pollution, followed by timely action is ultimately what will protect the receiving waters. Because of the short-term nature of construction, and the use of different materials during the construction period, laboratory sampling will not generally provide the information needed in an adequate time frame. It is preferable to use field-sampling techniques that can provide immediate information and allow a timely solution.

For this reason, the sampling and analysis language for non-visible pollutants contemplates field sampling using indicator parameters. The correct indicator parameter can provide a quick and immediate indication of contamination of storm water to known materials stored or used on a construction site. Field test kits and devices have been commercially available for decades and widely used for water quality applications. As an example, test strips to evaluate for ammonia, phosphate, chlorine, copper, iron, nitrate, nitrite, and low and high range pH are readily commercially available. Manufacturers and distributors provide technical support as well as training to their customers.

2.6 Deciding How Often to Sample

Determine the frequency of sampling for non-visible pollutants based on the exposure of pollutant sources. Sample runoff when BMPs do not effectively prevent or reduce exposure of a non-visible pollutant source to storm water. Sample runoff when inspections identify a BMP failure, which exposed pollutants to storm water. If spills are thoroughly cleaned up and the contaminated material is isolated, eliminating exposure to storm water runoff, sampling is not required. For instances when the potential for previously existing pollution is identified, perform laboratory screening analysis during the first one or two storm events of the season to determine if the potential pollutant is running off the construction site. If construction activity will disturb or mobilize such potential pollutant sources, take samples to determine if the pollutants are being mobilized by the construction activity.

2.7 Identification of Pollutant Sources

Information about various construction pollutant sources can be viewed by following the instructions posted on the swrcb.ca.gov web site. In addition, various discharger groups have also produced information that may be useful for determining pollutants sources and sampling parameters for runoff from construction activity. These include a "Pollutant Testing Guidance Table" that lists construction materials, describes whether they would be visible in runoff, and lists pollutant indicators, which will be available on the swrcb.ca.gov/stormwtr/gen_const.html web site

2.8 Examples of When Sampling and Analysis for Non-Visible Pollutants Is Not Required

Sampling and analysis is not required under the following conditions. However, a contingency sampling strategy should be prepared in the event of an accidental discharge.

- Where construction takes place entirely during a period of time when there are no rainfall events. Timing construction to occur outside of the rainy season is the most effective BMP.
- Where a construction project is "self-contained", meaning that the project generates no runoff or any potential discharges containing pollutants, including no potential for tracking sediment off-site from vehicle tires, and no potential for discharging products of wind erosion.
- Where construction materials and compounds are kept or used so that they are not in contact with storm water (e.g., in water-tight containers, under a water-tight roof, inside a building, etc.).
- Where for specific pollutants, the BMPs implemented at the construction site fully contain the exposed pollutants (e.g., bermed concrete washout area).
- For building, landscaping and BMP materials that are in their final constructed or in-place form or are designed for exposure (e.g., fence materials, support structures and equipment that will remain exposed at the completion of the project, etc.).
- Where pollutants may have been spilled or released on site, but have been properly cleaned-up and storm water exposure has been eliminated prior to a storm event.
- For stockpiles of construction materials for which both cover and/or containment BMPs have been properly implemented to protect them from run-on and from contributing pollutants to storm water .

2.9 Examples of When Sampling and Analysis Is Required

Sampling and analysis is required when non-visible pollutants have the potential to contact storm water and run off the construction site into a storm drainage system or water body at levels that may cause or contribute to exceedance of water quality standards. Some examples of this situation are:

- Where construction materials and compounds are stored or applied such that they may come in contact with storm water runoff.

- For construction projects that utilize soil amendments or soil treatments that can come in contact with storm water runoff. (If you have independent test data available that demonstrates that the soil amendments cannot result in concentration levels in storm water discharges that will cause or contribute to exceedance of applicable water quality standards, sampling and analysis may not be required. Contact the appropriate RWQCB to determine acceptable concentration(s) of the material(s) in question.)

- When a leak or spill occurs that is not fully contained and cleaned prior to a storm event.

- When a leak or spill occurs, during a storm event, and it cannot immediately be isolated and/or cleaned-up, and the possibility of an off-site discharge exists.

- When, during regular inspections, it is discovered that cover and containment BMPs have been compromised and storm water comes in contact with materials resulting in runoff discharging into a storm drain system or water body.

- When material storage BMPs have been compromised, breached, or have failed.

2.10 Do I Sample Storm Water Flows Diverted Around My Project for Non-Visible Pollutants?

Dischargers may be faced with a situation where the disturbed area of their construction site is adjacent to a large area that historically has drained across their site. This happens most frequently in foothill situations where schools or commercial development is undertaken alongside an existing roadway, adjacent to a large undisturbed area. In such a situation, calculate the anticipated volume of the flow in order to size a diversion structure to divert the (usually) clean storm water around or though the site. (CGP section A.5.b.1.) It is unwise to allow a large volume of water to wash across a disturbed area. Not only would the run-on cause erosion and remove the soil from the project, but also the discharge would be turbid and violate the Permit requirements. To the extent that the discharger does allow run-on of polluted water to flow across the site, and contaminants in the run-on are not visible, the sampling and analysis requirements apply. Additionally, the CGP (section A. 5. b.) requires that the RWQCB be contacted in the above situation.

The requirement to divert run-on does not authorize the creation of a new point source of pollutants, however. If the run-on contains pollutants from pre-existing pollution in the watershed, the discharger is responsible to determine this before planning the diversion. Should a discharger divert contaminated water around the site and allow it to enter surface waters, this permit does not authorize such discharge and the discharger should be aware that a separate NPDES permit may be required. (See, *Committee to Save Mokelumne River v. East Bay Municipal Utility District* (9th Cir. 1993) 13 F.3d 305, 309.) If you are planning on diverting flows from entering your site and you suspect that they contain pollutants, contact your local RWQCB for advice.

2.11 Deciding How to Sample

- Only personnel trained in water quality sampling procedures should collect storm water samples.
- Determine sampling methods and locations in advance of the runoff event in order to provide sufficient time to gather the supplies and equipment necessary to sample and plan for safe access by the sampling personnel.
- General guidance for sampling procedures is provided in Section 4 of this document.

2.12 How to Use Your Sampling Data

2.12.1 How to Analyze Your Data

Initiate corrective action where non-visible pollutant sample test results indicate presence of pollutants in the construction site storm water runoff. This can be determined by comparing your construction site's storm water test results with the background sample. BMPs must be used to control offsite discharge of any pollutant (e.g., pesticides) that is not naturally occurring, regardless of background levels of that pollutant.

Where your site's storm water test concentrations for naturally occurring substances are considerably above (or, in the case of pH, considerably above or below) the background concentrations, or where other pollutants are found, evaluate the BMPs to determine the cause. Initiate corrective action by repairing, replacing or suplementing the BMPs on your site. Conduct additional sampling during the next runoff event after corrective actions are implemented to demonstrate and document that the problems have been corrected.

This permit does not contain benchmarks. However, method of data analysis for naturally occurring substances employs a similar concept: determining whether the results are "considerably above" the background levels. The term "considerably above" is based upon guidance contained in USEPA's Multi-Sector General Permit, which does use benchmarks. These benchmarks are not numeric storm water effluent limits, are not related or necessarily protective of any specific receiving water, and exceedances of these benchmarks are not automatically considered permit violations. When sample results exceed one or more of the benchmarks, the USEPA recommends dischargers reevaluate the effectiveness of their BMPs and develop, when appropriate, additional BMPs. The use of such benchmark values is a scientifically valid indicator of the presence of pollutants associated with construction activity in the runoff. Since the non-visual pollutants that may occur on construction sites may be similar in type and cause to those on industrial sites, it is valid to use USEPA's approach here. Where a parameter in a sample is being evaluated, and a benchmark is available, the benchmark may be used for comparison purposes. (USEPA does not require any sampling and analysis in its construction permits, and therefore does not have benchmarks for construction activities.)

2.12.2 Coordinating Visual Observations with Sampling Results

If visual inspection of storm water BMPs used to contain or otherwise manage (i.e., filter or treat) non-visible pollutants at a construction site indicates that a BMP has failed or been compromised, then field monitoring of any impacted storm water from the site for non-visible pollutants is required. Of course, immediately repair or replace any BMP that has been visually inspected and found breached or compromised. If feasible, contain the polluted discharge and prevent it from being discharged off site. After taking steps to correct the failed BMP, conduct field monitoring in the vicinity of the BMP to verify that pollutants are no longer in the storm water.

The intent of conducting field monitoring for non-visible pollutants is to obtain an immediate indication if storm water that is discharging from a site has been polluted. An immediate indication of a polluted discharge requires an immediate response in the form of backtracking from the point of discharge to find the source and take appropriate measures to prevent a recurrence of a polluted discharge.

2.12.3 What To Do If The Data Show a Potential Problem

If your data shows a problem, follow the reporting requirements as shown in the CGP Receiving Water Limitations. In addition, take the following steps as soon as possible:

- Identify the source
- Repair or replace any BMP that has failed
- Maintain any BMP that is not functioning properly due to lack of maintenance
- Evaluate whether additional or alternative BMPs should be implemented

If sampling and analysis during subsequent storm events shows that there is still a problem, then repeat the steps above until the analytical results of "upstream" and "downstream" samples are relatively comparable.

Where your site's storm water results show test concentrations considerably above (or below) background concentrations, evaluate the BMPs to determine what is causing the difference. Possible solutions may include repairing the existing BMPs, evaluating alternative BMPs that could be implemented, and/or implementing additional BMPs (cover and/or containment) which further limit or eliminate contact between storm water and non-visible pollutant sources at your site. Where contact cannot be reduced or eliminated, retain storm water that has come in contact with the non-visible pollutant source on-site and do not allow it to discharge to the storm drainage system or to a water body. Contact your RWQCB to determine whether it is permissible to discharge the retained storm water. Conduct additional sampling during the next runoff event after corrective actions are implemented to demonstrate and document that the problems have been corrected.

2.13 Retention of Data

Keep results of field measurements and laboratory analyses with the SWPPP, which is required to be kept on the project site until the Notice of Termination (NOT) is filed and approved by the

appropriate RWQCB. Keep field training logs, Chain-Of-Custody (COC) forms and other documentation relating to sampling and analysis with the project's SWPPP. Records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated or after project completion.

3.0 Sampling Program for Sedimentation/Siltation

3.1 What the Permit Says About Sampling

Soils, sediments, and fine (suspended) particles that result from grading and earthwork activities and soil erosion from disturbed, un-stabilized land areas are potentially significant sources of storm water pollution at construction sites. The CGP requires construction sites to develop, implement and maintain an effective combination of erosion control and sediment control BMPs to prevent soils, sediments, debris and solids fine enough to remain suspended from leaving the construction site and moving into receiving waters at levels above preconstruction levels.

The CGP requires that a visual survey of the site be done before, during and after a storm. If the visual survey indicates either the potential for a discharge of sediment laden water or that sediment is being discharged, steps must be taken to repair or augment the BMPs to prevent the discharge as soon as possible. Discharge of sediment above predevelopment levels is not allowed.

The CGP requires sampling and analysis for sediment/silt or turbidity when the construction site runoff discharges directly into a water body that is impaired by sedimentation/siltation, sediment, or turbidity (that is, the water body is on the 303(d) list for one or more of these pollutants.) A key point is that the discharge of storm water runoff must directly enter the impaired water body or impaired segment of a water body. Construction site runoff that flows through a tributary or storm drainage system and is commingled with other sources of flow, is not considered a direct discharge even if the flow eventually enters an impaired water body. (See the definition of direct discharge in Section 5 for further details.)

The CGP requires that the SWPPP identify a strategy for conducting the sampling and analysis, including the frequency at which sampling will be conducted. The SWPPP must also describe:

- the location(s) of direct discharges from construction activities to a water body listed on the SWRCB's 303(d) list for sedimentation/siltation, sediment and/or turbidity;
- the designated sampling location(s) in the listed water body representing the prevailing conditions up-stream of the discharge; and
- the designated sampling location(s) in the listed water body representing the prevailing conditions down-stream of the discharge.
- the sampling design which describes the sampling devices used; the sample size; the number of samples to be taken at each location, the laboratory protocol employed; and, if applicable, the statistical test used to determine if the upstream/downstream samples differ to a statistically significant degree.

3.2 Deciding When to Sample

- Dischargers must perform sampling if the storm water runoff directly discharges from the construction site to a 303(d) listed water body.

- Dischargers must collect samples during the first two hours of discharge (runoff) from storm events which result in a direct discharge to any 303(d) listed water body. But samples need only be collected during daylight hours (sunrise to sunset).

- Dischargers must collect samples regardless of the time of year, status of the construction site, or day of the week. Samples should be taken during the first two hours of a storm event. Storm water inspections and sample collections are required even during non-working days (including weekends and holidays). Samples must be taken from the same storm event for comparison, concentrations are not comparable across storm events.

- Dischargers do not need to perform upstream/downstream sample collection for more than four (4) rain events per month.

3.3. Deciding What Constituent(s) Require Sampling

- If the water body is listed as impaired for sedimentation or siltation, analyze samples for Setteable Solids (mL/L) and Total Suspended Solids (mg/L) according to USEPA 160.2 and USEPA 160.5, respectively. Samples may be analyzed for suspended sediment concentration (SSC) according to ASTM D3977-97 instead of or in addition to Total Suspended Solids and Setteable Solids.

- If the water body is listed as impaired for turbidity, analyze samples for turbidity per USEPA 180.1 or analyze in the field using a correctly calibrated turbidity meter.

- It is very important that consistent sampling and analysis methods are used for all sampling locations.

Table 3-1 shows general sample handling and laboratory requirements for sediment sampling.

Table 3-1
LABORATORY REQUIREMENTS[1] FOR STORM WATER MONITORING OF SEDIMENT, SILTATION AND/OR TURBIDITY

Parameters	Analytical Method	Target Method Detection Limit	Minimum Sample Volume [2]	Container	Preservative	Holding Time
Total Suspended Solids (TSS) [2]	EPA 160.2	1 mg/L	100 mL	500 mL polypropylene	Store in ice or refrigerator at 4°C (39.2°F)	7 days
Setteable Solids (SS)	EPA 160.5	0.1 mL/L/hour	1 liter	1 liter mL polypropylene	Store in ice or refrigerator at 4°C (39.2°F)	48 hours
Suspended Sediment Concentration (SSC) [3]	ASTM D 3977-97	Contact Laboratory	200 mL	Contact Laboratory	Store in ice or refrigerator at 4°C (39.2°F)	7 days
Turbidity	EPA 180.1	1 NTU	100 mL	500 mL polypropylene or glass	Store in ice or refrigerator at 4°C (39.2°F), Dark	48 hours

1 The data in this table is a summary of recommended laboratory requirements. For specific USEPA regulatory requirements, consult the sampling and analysis requirements found in 40 CFR 136.

2 Minimum sample volume recommended. Specific volume requirements will vary by laboratory; please check with your laboratory when setting up bottle orders.

3 Use either TSS or SSC, or both, for suspended solids analysis. Upstream and downstream samples should be analyzed by the same method.

3.4 Deciding Where to Sample

In-stream sampling is required, both upstream and downstream of the discharge. The CGP does not require that the effluent be sampled. However, effluent sampling is recommended. Take both upstream and downstream samples within the actual flow of the waterbody. Collect samples at the following locations:

- Sample the 303(d) listed water body upstream of the construction site discharge in a location representative of the sediment load present in the water body before it is impacted by discharge from the construction site.
- Sample the 303(d) listed water body at a point immediately downstream of the last point of discharge from the construction site.

Additionally, for the purpose of interpreting the results of the samples collected from the 303(d) listed water body, collect and analyze samples of the actual discharge from the construction site (effluent sample) prior to it being commingled in the receiving water. This sample can be used to verify whether the source of the sediment in-stream is emanating from the construction discharge. Remember that samples should only be collected from safely accessible locations.

In general, sample away from the bank in or near the main current. Avoid collecting samples directly from ponded, sluggish, or stagnant water. Be careful when collecting water upstream or downstream of confluences or point sources to minimize problems caused by backwater effects or poorly mixed flows. Note that samples collected directly downstream from a bridge can be contaminated from the bridge structure or runoff from the road surface.

Choose the upstream location in water that appears to represent the nature of the flow in the stream.

Downstream samples should represent the receiving water mixed with flow from the construction site. For instance if the flow from the site can be observed by either a color or a flow difference, collect the downstream sample from within the affected water.

3.5 What Are the Applicable Water Quality Standards

The CGP requires sampling of runoff from construction sites that discharge directly to 303(d) listed water bodies to demonstrate that discharges do not contribute to the impairment of the receiving water. Each of the listed waters is subject to water quality objectives in a RWQCB Basin Plan for sediments and solids or for turbidity. The applicable water quality objectives for each RWQCB are listed in Appendix A to this guidance document.

3.6 Deciding How to Sample

- Only personnel trained in water quality sampling procedures should collect storm water samples.

- Determine sampling methods and locations in advance of the runoff event in order to provide sufficient time to gather the supplies and equipment necessary to sample and plan for safe access by the sampling crew(s) and document them in the SWPPP.

- General guidance for sampling procedures is provided in Section 4 of this document.

3.7 How to Use Your Data

3.7.1 How to Analyze Your Data

While it is desirable for sediment concentrations from a site to be as low as possible, the amount that a site can contribute is determined by a TMDL analysis and in the absence of an implemented TMDL, the instream concentrations below the point of discharge cannot be significantly different from the upstream concentrations.

In order to allow for meaningful analysis of the data, it is necessary to establish a statistical framework for it. When sampling a body of water, it is unlikely that two samples, even taken next to each other, will have the same concentration of a pollutant. This is referred to as variability. Concentrations will vary from sample to sample, but the difference between them may not be meaningful. In order to obtain a statistically meaningful set of samples, it is necessary to determine how many samples will be necessary, the greater the variability between samples, the larger the number of samples (N) will be required. This may require that the water body be sampled before the start of construction to determine the variability. Collect sufficient numbers of samples (N) during each storm event monitored to represent the prevailing conditions of both locations (upstream and downstream). Depending upon which statistical test is used, and the variability between the samples, N will usually be more than a single sample. When comparing samples from a single storm event, a range of readings will be obtained. Almost all samples from that source will fall into that range. The likely range of readings can be expressed through the use of a statistical confidence interval for the parameter being sampled. Confidence intervals are expressed as probabilities, such as 95% confidence or 97% confidence. The size of a confidence interval will be determined by the variability in the samples from the single source and the number of samples collected.

Once the sampling is completed and results returned from the laboratory, compare the concentration of the appropriate parameter (see Section 2.3 Deciding What Constituents to Sample for)) derived from the upstream samples to the concentration of the same parameter from the downstream samples (from the same storm event). It is expected that every sample will be different. (This would be true even if there were not construction activities, in light of the variability of stream conditions, explained above.) Rather, compare the samples to see if there is a statistically significant difference between the central tendency (arithmetic mean, geometric mean, median, etc.) of the upstream samples and the downstream samples.

Estimate the magnitude of the difference in the central tendency between the upstream and downstream concentration values. The null hypothesis to be tested is: The difference between the downstream central tendency and the upstream central tendency is less than or equal to zero. The minimum acceptable confidence interval shall be 90%. Using the data, calculate a one-sided lower confidence limit (LCL) on the difference in central tendencies. If the numeric value of zero

is contained within the confidence interval (LCL), then you cannot reject the null hypothesis, and you would conclude that no impairment has occurred. If, however, the data indicates that the downstream central tendencies are significantly higher than the upstream, you cannot accept the null hypothesis. In this case there is the presumption that the discharges are contributing to the existing impairment.

If you did take samples of the effluent, and those samples are not consistent with the conclusion that the discharge is contributing to the existing impairment, take steps to determine what other source(s) is causing the increase in the downstream sampling. If you can show that there is a different source than your discharge, you should contact the appropriate RWQCB.

The hypothesis, sampling methodology, confidence interval, and statistical tests and assumptions must be defensible to the RWQCB. Since construction sites that discharge *directly* into impaired water bodies are not common in California, the local RWQCB will likely ask to review the SWPPP and the sampling and analysis strategy prior to construction activity.

3.7.2 Sources of sediment, silt and turbidity in a construction discharge

Conditions or areas on a site that may be causing sediment, silt, and/or turbidity in your storm water runoff may include:

- Exposed soil areas with inadequate erosion control measures
- Active grading areas
- Poorly stabilized slopes
- Lack of perimeter sediment controls
- Areas of concentrated flow on unprotected soils
- Poorly maintained erosion and sediment control measures
- Unprotected soil stockpiles
- Failure of an erosion or sediment control measure
- Unprotected Clayey soils

3.7.3 What To Do If Your Data Shows a Statistically Significant Increase Downstream of the Discharge

The CGP requires that BMPs be implemented on the construction site to prevent a net increase of sediment load in storm water discharges relative to pre-construction levels. Although the upstream reference (background) sample may not be representative of pre-construction levels at your site, it will provide a basis for comparison with the sample taken downstream of the construction site.

If the statistical tests of the upstream and downstream samples indicate an increase in silt, sediment and/or turbidity, follow the reporting requirements as shown in the Receiving Water Limitations of the CGP. If you have collected samples of the discharge from your site, use these results to help identify if it is your project that is discharging sediment into the receiving water. It is recommended that the following steps be taken as soon as possible.

- Identify the source of the silt, sediment or turbidity
- Review effectiveness of existing erosion control BMPs. The sediment may be coming from locations at the construction site where existing erosion control BMPs have been reduced in effectiveness. These BMPs should be evaluated to determine whether they are in need of maintenance.
- Review effectiveness of existing sediment control BMPs. The sediment may be coming from locations at the construction site where existing sediment control BMPs have been reduced in effectiveness. These BMPs should be evaluated to determine whether they are in need of maintenance.
- Look for evidence that there are too few sediment and erosion control BMPs. In inspecting the site, sources of sediment that either do not have BMPs or for which the BMPs appear to be insufficient in number or type may be identified.
- Repair or replace any BMP that has failed or is in need of maintenance
- Evaluate whether additional or alternative BMPs should be implemented to provide an effective combination of erosion and sediment control measures on the site. Do not rely solely on perimeter sediment controls, particularly where there are fine-grained soils (such as silts or clays) on the site. Implement erosion controls (source controls) that keep the soil in place, even on temporary slopes and rough graded areas, wherever possible and as necessary to prevent sediment from leaving the site.

If sampling and analysis during subsequent storm events shows that there is still a statistically significant difference, then repeat the steps above until the analytical results of the upstream concentration samples are within the confidence interval.

3.8 Retention of Data

Keep results of field measurements and laboratory analyses with the SWPPP, which is required to be kept on the project site until the NOT is filed and approved by the appropriate RWQCB. Keep training logs, Chain-Of-Custody (COC) forms and other documentation relating to sampling and analysis with the project's SWPPP. All records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated or after project completion.

4.0 Sampling Procedures

The collection and handling of storm water runoff samples requires care to ensure the integrity and validity of the samples. A Chain of Custody (COC) form, must follow the sample from the

collection through the analysis process. Additional documentation to track other information of interest, e.g. field conditions, or required field measurements may also be used. This type of information is recorded on a field tracking form.

Collect all samples with care to ensure that the sample is representative of the runoff being tested, use the correct type of container, preserve samples in accordance with the test method's specifications, and store at the appropriate temperature until delivered to an analytical laboratory. Some types of samples have very short holding times and must be analyzed before this holding time is exceeded. Sample handling requirements and documentation form the basis of your sampling quality assurance program.

Before starting any sampling program, contact the analytical laboratory that you plan to use to analyze your samples. Make sure to select a laboratory that will provide you with the support that you need, such as, properly cleaned and preserved sampling containers and COC forms. Some laboratories can assist in identifying courier services available to transport samples to the laboratory, or may be able to provide sampling service for you. Work out all of these details in advance of sample collection. Consult the analytical laboratory on what additional samples will be required for quality assurance and quality control purposes.

Both field and/or analytical analysis methods can be used to meet the Permit requirements. Field techniques have the advantage of providing immediate results, however, there are only a limited number of analyses that can be done in the field. Analytical laboratories can analyze for a wide range of parameters, but the data may take several weeks or longer to get back.

Some constituents (e.g. pH) can be evaluated in the field with special equipment. Field samples must be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Field equipment must be used by trained staff and the equipment must be calibrated and maintained according to the manufacturer's specifications.

Laboratory analyses should be conducted by a laboratory that is currently accredited by the California Department of Health Services Environmental Laboratory Accreditation Program (ELAP). Analyses must be conducted in accordance with 40 CFR Part 136.

You may refer to the California Department of Transportation (Caltrans) *Guidance Manual: Stormwater Monitoring Protocols (Second Edition), July 2000* to assist you in developing a sampling and analysis program. This document may be downloaded from the Caltrans Website, at

http://www.dot.ca.gov/hq/construc/stormwater/SamplingGuidanceManual.pdf

Figure 4-1 is an outline for a typical comprehensive storm water sampling and analysis plan. As some laboratories may have specific requirements for sample collection and handling, specific information or requirements on your samples should be checked with your laboratory.

1 PROJECT OVERVIEW/DESCRIPTION
- 1.1 Description of why the project is being conducted
- 1.2 Description of who is conducting the project
- 1.3 General scope of monitoring activities
- 1.4 Project organization/roles and responsibilities

2 MONITORING SITES
- 2.1 Site location (map)
- 2.2 Written driving directions
- 2.3 Site access instructions (gates, locks, keys, combinations)
- 2.4 Notification procedures

3 ANALYTICAL CONSTITUENTS
- 3.1 List of constituents for sampling and analysis (including sample collection methods, container type, volume required, preservation and laboratory performing analysis)

4 DATA QUALITY OBJECTIVES (DQOs)
- 4.1 Analytical reporting limits
- 4.2 Analytical precision, accuracy and completeness

5 FIELD EQUIPMENT MAINTENANCE
- 5.1 Equipment calibration
- 5.2 Equipment maintenance
- 5.3 Equipment cleaning (bottles/lids/tubing)

6 MONITORING PREPARATION AND LOGISTICS
- 6.1 Weather tracking
- 6.2 Storm selection criteria
- 6.3 Storm action levels
- 6.4 Communications/notification procedures
- 6.5 Sample bottle order
- 6.6 Sample bottle labeling
- 6.7 Field equipment preparation

7 SAMPLE COLLECTION, PRESERVATION AND DELIVERY
- 7.1 Sample collection methods
- 7.2 Field measurement methods
- 7.3 Field equipment list
- 7.4 Sample containers, preservation and handling
- 7.5 QA/QC sample collection methods
- 7.6 Sample labeling (site names, codes, etc.)
- 7.7 Composite sample splitting
- 7.8 Forms and procedures for documenting sample collection and field measurements
- 7.9 Laboratory communication procedures
- 7.10 Sample shipping/delivery, chain-of-custody

8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)
- 8.1 Field procedures for QA/QC sample collection

9 LABORATORY SAMPLE PREPARATION AND ANALYTICAL METHODS
- 9.1 Laboratory sample preparation procedures
- 9.2 Analytical constituent table (including analytical methods, holding times and reporting limits)

10 DATA MANAGEMENT AND REPORTING PROCEDURES
- 10.1 Analytical data validation
- 10.2 Electronic data transfer
- 10.3 Filing of electronic and hard copy data
- 10.4 Reports

APPENDICES
- A Clean Sampling Techniques
- B Health and Safety Plan

Figure 4-1 Outline for a Typical Storm Water Sampling and Analysis Plan

5.0 Definitions

Chain of Custody (COC) Form
The COC Form is a form used to track sample handling as samples progress from sample collection to the analytical laboratory. The COC is then used to track the resulting analytical data from the laboratory to the client. COC forms can be obtained from an analytical laboratory upon request.

Direct Discharge
Direct discharge means storm water runoff that flows from a construction site directly into a 303(d) water body listed for sedimentation, siltation, or turbidity. Storm water runoff from the construction site is considered a direct discharge to a 303(d) listed water body unless it first flows through:

1) A municipal separate storm sewer system (MS4) that has been formally accepted by and is under control and operation of a municipal entity;

2) A separate storm water conveyance system where there is co-mingling of site storm water with off-site sources; or

3) A tributary or segment of a water body that is not listed on the 303d list before reaching the 303d listed water body or segment.

Discharger
The discharger is the person or entity subject to the CGP.

Electrical Conductivity (EC)
EC is a measure of the ability of water to carry an electric current. This ability depends on the presence of ions, their concentration, valence, mobility and temperature. EC measurements can give an estimate of the variations in the dissolved mineral content of storm water in relation to receiving waters.

Field Measurements
Field measurements refers to water quality testing performed in the field with portable field-testing kits or meters.

Field Tracking Form (FTF)
The FTF is a form that serves as a guide to sampling crews to obtain sampling information and to prescribe and document sample collection information in the field. The FTF usually contains sample identifiers, sampling locations, requested analyses, Quality Control (QC) sample identifiers, special instructions, and field notes.

Holding Time
Holding time is specified by the analytical method and is the elapsed time between the time the sample is collected and the time the analysis must be initiated.

pH

The pH is universally used to express the intensity of the acid or alkaline condition of a water sample. The pH of natural waters tends to range between 6 and 9, with neutral being 7. Extremes of pH can have deleterious effects on aquatic systems.

Reference Sample

A sample taken from an undisturbed part of the construction site or from an undisturbed site immediately upstream from a construction site. The reference sample is used for comparison with samples taken from the active construction site. It is the same set of samples that is referred to as an uncontaminated sample in the Permit.

Sampling and Analysis Plan

A document that describes how the samples will be collected and under what conditions, where and when the samples will be collected, what the sample will be tested for, what test methods and detection limits will be used, and what methods/procedures will be maintained to ensure the integrity of the sample during collection, storage, shipping and testing (i.e., quality assurance/quality control protocols).

Sediment

Sediment is solid particulate matter, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Sedimentation/Siltation

Sedimentation/siltation is the process of sediment/silt deposition.

Setteable Solids

The setteable solids (SS) test measures the solid material that can be settled within a water column during a specified time frame. This typically is tested by placing a water sample into an Imhoff settling cone and allowing the solids to settle by gravity. Results are reported either as a volume (mL/L) or a weight (mg/L).

Silt

Silt are soil particles between 0.05mm and 0.002mm in size. (For the purposes of its use here, it also includes clay, which is categorized by a particle size less than 0.002mm.)

Soil Amendment

Any material that is added to the soil to change its chemical properties, engineering properties, or erosion resistance that could become mobilized by storm water. Certain soil amendments may not be visible in site runoff. Soil amendments likely to fall in this category include lime, cementitious binders, chlorides, emulsions, polymers, soil stabilizers, and tackifiers applied as a stand-alone treatment (i.e., without mulch). Even some of these products may bind with the soil, and thus be visible. In contrast, plant fibers (such as straw or hay), wood and recycled paper fibers (such as mulches and matrices), bark or wood chips, green waste or composted organic materials, and biodegradable or synthetic blanket fibers are soil amendments that are likely to be visible in storm water runoff.

Suspended Sediment Concentration (SSC)

The suspended sediment concentration (SSC) test measures the concentration of suspended solid material in a water sample by measuring the dry weight of all of the solid material from a known volume of a collected water sample. Results are reported in mg/L.

Total Suspended Solids (TSS)

Suspended solids in a water sample include inorganic substances, such as soil particles and organic substances, such as algae, aquatic plant/animal waste, particles related to industrial/sewage waste, etc. The total suspended solids test (TSS) test measures the concentration of suspended solids in water by measuring the dry weight of a solid material contained in a known volume of a sub-sample of a collected water sample. Results are reported in mg/L.

Turbidity

Cloudiness of water quantified by the degree to which light traveling through a water column is scattered by the suspended organic and inorganic particles it contains. The scattering of light increases with a greater suspended load. Turbidity is commonly measured in Nephelometric Turbidity Units (NTU).

6.0 Sources of Further Assistance

Regional Water Quality Control Boards

Regional Water Quality Control Board	Address	Contact Name E-mail	Telephone/Fax
NORTH COAST REGION	5550 Skylane Blvd., Suite A Santa Rosa, CA 95403	John Short shorj@rb1.swrcb.ca.gov	(707) 576-2065 FAX: (707) 523-0135
SAN FRANCISCO BAY REGION	1515 Clay St., Suite 1400 Oakland, CA 94612	Mark Johnson stu36@rb2.swrcb.ca.gov	(510) 622-2493 FAX: (510) 622-2460
CENTRAL COAST REGION	895 Aerovista Place., Suite 101 San Luis Obispo, CA 93401	Jennifer Bitting jbitting@rb3.swrcb.ca.gov	(805) 549-3334 FAX: (805) 543-0397
LOS ANGELES REGION	320 W. 4th St., Suite 200 Los Angeles, CA 90013	Ejigu Soloman (Ventura County) esoloman@rb4.swrcb.ca.gov	213) 576-6727 FAX: (213) 576-6686
CENTRAL VALLEY REGION Sacramento Office	11020 Sun Center Drive, #200 Rancho Cordova, CA 95670	Sue McConnell mcconns@rb5s.swrcb.ca.gov George Day DayG@rb5s.swrcb.ca.gov Dannas Berchtold BerchtD@rb5s.swrcb.ca.gov Rich Muhl MuhlR@rb5s.swrcb.ca.gov	(916) 464-4798 FAX: (916) 464-4681 (916) 464-6404 FAX: (916) 464-4681 (916) 464-4683 FAX: (916) 464-4681 (916) 464-4749 FAX: (916) 464-4681
CENTRAL VALLEY REGION Fresno Branch Office	E. Street Fresno, CA 93706	Brian Erlandsen ErlandsenB@rb5f.swrcb.ca.gov	(559) 445-6046 FAX: (559) 445-5910
CENTRAL VALLEY REGION Redding Branch Office	415 Knollcrest Dr. Redding, CA 96002	Carole Crowe crowec@rb5r.swrcb.ca.gov	(530) 224-4849 FAX: (530) 224-4857
LAHONTAN REGION South Lake Tahoe Office	2501 Lake Tahoe Blvd. South Lake Tahoe, CA 96150	Jason Churchill Jchurchill@rb6s.swrcb.ca.gov	(530) 542-5571 FAX: (530) 544-2271
LAHONTAN REGION Victorville Office	15428 Civic Dr., Suite 100 Victorville, CA 92392	Doug Feay Dfeay@rb6v.swrcb.ca.gov Ted Saari Tsaari@rb6v.swrcb.ca.gov	(760) 241-7353 FAX: (760) 241-7308 (760) 241-7407

Regional Water Quality Control Board	Address	Contact Name E-mail	Telephone/Fax
COLORADO RIVER BASIN REGION	73-720 Fred Waring Dr., Suite 100 Palm Desert, CA 92260	Abdi Haile haila@rb7.swrcb.ca.gov Rosalyn Fleming flemr@rb7.swrcb.ca.gov	(760) 776-8939 FAX: (760) 341-6820 (760) 776-8939 FAX: (760) 341-6820
SANTA ANA REGION	3737 Main St., Suite 500 Riverside, CA 92501-3339	Michael Roth (Riverside County) mroth@rb8.swrcb.ca.gov Aaron Buck (Orange County) abuck@rb8.swrcb.ca.gov Muhammad Bashir (San Bernardino County) mbashir@rb8.swrcb.ca.gov	(909) 320-2027 FAX: (909) 781-6288 (909) 782-4469 FAX: (909) 781-6288 (909) 320-6396 FAX: (909) 781-6288
SAN DIEGO REGION	9174 SkyPark Court, Suite 100 San Diego, CA 92123	Benjamin Tobler Toblb@rb9.swrcb.ca.gov Eric Becker Becke@rb9.swrcb.ca.gov Ben Neill Neilb@rb9.swrcb.ca.gov	(858) 467-3272 (858) 492-1785 (858) 467-2983 FAX: (858) 571-6972

State Water Resources Control Board
Division of Water Quality
Storm Water Permit Section
P.O. Box 1977
Sacramento, CA 95812-1977
Construction Inquiry Line: (916) 341-5537
Web Site: http://www.waterboards.ca.gov/
e-mail: stormwater@waterboards.ca.gov

How to Obtain a List of State Certified Laboratories
http://www.dhs.ca.gov/ps/ls/elap/html/lablist_county.htm

Other Useful Web Sites

California Stormwater Quality Association http://www.casqa.org/

California Department of Transportation
Environmental Program http://www.dot.ca.gov/hq/env/index.htm

Storm Water Management Program http://www.dot.ca.gov/hq/env/stormwater/

7.0 Explanation of Sampling and Analysis Requirements

The sampling and analysis provisions were added to the CGP in response to the writ of mandate issued in *San Francisco BayKeeper v. California State Water Resources Control Board* (Sacramento County Superior Court, No. 99CS01929). The SWRCB has now been directed to provide explanation and direction for dischargers subject to the sampling and analysis requirements. One issue that is at the heart of this direction is that the SWRCB must explain how dischargers should interpret the results of the required sampling and analysis in deciding whether they are in compliance with the permit's receiving water limitations requirements. In essence, can the sampling and analysis results be used to provide a reliable answer to the question whether the discharge is causing or contributing to exceedance of water quality standards? As is explained below, the answer is a qualified "yes," in that the results must by used in concert with other information and in accordance with a logical process exercising best professional judgment. The results from the sampling and analysis will provide information regarding whether or not the BMPs are effective, and may provide some evidence of causing or contributing to exceedance of water quality standards. But the sampling and analysis requirements in a storm water permit are ultimately a diagnostic tool, and are not a guaranteed method of determining compliance with the receiving water limitations.

7.1 Requirement for Compliance With Water Quality Standards

The SWRCB is well aware of the requirement that it must issue industrial storm water permits, including the CGP, with requirements that require "strict compliance" with water quality standards. (CWA §402(p)(3)(A).) It is also aware that USEPA has concluded that in general it is not appropriate or legally required to include numeric, water quality-based effluent limitations in storm water permits. (40 CFR 122.44(k)(2).) In addition, we note that USEPA does not require sampling and analysis in industrial storm water permits (40 CFR §122.44(i)(4)) and it has elected not to include any sampling or analysis requirements in its own recently issued general construction permit. (See, http://cfpub.epa.gov/npdes/stormwater/cgp.cfm.) USEPA has explained the limitations of sampling and analysis in industrial storm water permits. (See, 57 Fed. Reg. 11394 et seq. (1992).)

USEPA has addressed the relationship between BMPs and water quality standards, and has determined that almost all storm water discharges can be adequately controlled to meet water quality standards through BMPs. (NPDES Storm Water Program Questions and Answers, 1/21/04.) USEPA states that to evaluate effectiveness, NPDES permits may at the discretion of the permitting authority require visual inspections, evaluation of environmental indicators or measurable goals, effluent monitoring, or in-stream monitoring. (*Id.*) USEPA has made clear, both in its regulations and its guidance documents, that monitoring requirements are not necessary to enforce compliance with water quality standards. (In fact, neither EPA nor any state we are aware of has chosen to include monitoring requirements equivalent to, or more robust than, those already in place in the CGP.) Certainly, there is no legal requirement that the permitting authority must "prove" that a specific monitoring result is conclusive evidence of exceedance of a water quality standard. USEPA has conducted studies and modeling showing that existing permit programs as of 2003 were already capable of controlling approximately 80-90% of sediment runoff from construction sides, and that more stringent rules would remove

only 1% more. (USEPA Withdrawal of Proposed Effluent Limitation Guideline for Construction Industry, Volume 69, Federal Register 22472 et seq., April 26, 2004.) In conducting its state equivalency analysis, USEPA evaluated all states' programs, including California's, and determined that these were adequate and that further requirements were not mandated for compliance with federal law.

In USEPA's analysis of monitoring for construction (EPA-821-R-02-007), it concludes that planning monitoring for storm water is not possible because the flows are highly variable and temporarily stochastic. USEPA also notes that several of the criteria that could be used have special measurement problems because they are based on trapping efficiency, which is very difficult to measure. The most commonly used measurements, such as TSS, also have problems because to measure average or peak TSS it is necessary to measure TSS in the effluent over the duration of the outflow hydrograph as well as the flow rate. This requires that multiple samples be taken and that the samples be centered around the peak discharge. This is time consuming and difficult since the timing of an event and the timing of the peak discharge are not known beforehand. The average concentration is a weighted concentration, using flow rate as a weighting function.

USEPA also conducted an extensive evaluation of the literature to identify pollutants present in storm water discharges from construction sites. They found that while the literature contains extensive information on pollutants present in storm water discharges from urban areas, there were little data available on pollutants present in storm water discharges from construction sites during the active construction phase, other than for sediment, TSS and turbidity. USEPA was not able to identify sufficient data in the literature to warrant development of controls specific to pollutants other than sediment, TSS and turbidity in storm water discharges from construction sites. Some literature suggests that pollutants adhere to sediment, so that regulating TSS should also act as a control for other pollutants.

USEPA also evaluated the inclusion of organics, pesticides, and bacteria as potential pollutants of concern, but the literature indicated that control of these pollutants through conventional storm water management strategies is potentially much more difficult, and that there are little data linking their presence in storm water discharges directly with new land development activities. Source control (implementation of BMPs) may factor greatly into controlling these pollutant sources.

Permit compliance is based on the degree of control that can be achieved using various levels of pollution control technology (BMPs), a visual inspection requirement, coupled with parameter sampling in the instances where exposure has been determined. A storm water sample for non-visible pollutants indicating contamination is not conclusive proof of either a receiving water violation or of compliance with the Permit. But, it should give the discharger enough information to eliminate the source, detain the discharge, improve the BMPs, or take whatever action is necessary to abate the problem.

In the case of a direct discharge of sediment to a water body listed as impaired by sediment, sampling downstream of the discharge that shows a statistically significant increase in sediment over the upstream monitoring is strong evidence that the discharge from the construction site is causing or contributing to the impairment. We have suggested, however, that dischargers who

conduct such sampling should also sample the effluent. They may use the results of such sampling to overcome this presumption should the effluent sampling not be consistent with the downstream results. The case of a direct discharge of sediment to a water body impaired by sediment is a far simpler case than discharges that are indirect, that contain pollutants for which there may be assimilative capacity, or that contain pollutants that may be diluted in the receiving water. In those cases there is no simple way to conclude from sampling and analysis whether an applicable water quality standard is impacted by the storm water discharge. Instead, the data are most useful in alerting the discharger to the need to review BMPs and source control and should trigger a visual inspection.

The final determination as to whether discharges are in compliance with water quality standards will be made by RWQCBs through enforcement and other compliance activities. The sampling and analysis results are relevant, as is visual inspection and evaluation of BMPs. This method of assessment is known as "best professional judgment" and is consistent with USEPA's approach to regulating storm water discharges. This is the appropriate and lawful method of regulation pending adoption of effluent limitation guidelines by USEPA. (CWA §301.) USEPAproposed such guidelines for construction sites, but decided against adopting effluent limitation guidelines for storm water discharges associated with construction activity. (Effluent Guidelines Construction and Development Fact Sheet: Final Action - Selection of Non-Regulatory Option; EPA 821-F-04-001; March 2004; final action is at Volume 69, Federal Register 22472 et seq., April 26, 2004.) In taking this Final Action, USEPA concluded that the current system that allows states to develop their own programs is adequate and will result in "significant improvements in water quality and in the control of discharges of construction site stormwater runoff." In conducting its investigation of existing programs, USEPA found that every state already has regulations and programs in place that incorporate most of the provisions that USEPA considered in its most stringent proposal. USEPA further states that the following components of a construction program are: (1) Require preparation of a SWPPP; (2) Require site inspections by dischargers on a regular basis; (3) Require a combination of erosion and sediment controls; and (3) Require stabilization of soils after construction. USEPA decided that the existing programs (which do not require monitoring) are adequate and that any further regulatory requirements imposed by USEPA would be too costly and "would provide only marginal environmental improvements over regulations already in place." USEPA further concluded that additional controls would make housing unaffordable. Even when USEPA initially proposed adopting an effluent limitation guideline, it rejected even considering any monitoring requirements. In discussing the option of requiring monitoring in construction permits, USEPA listed several concerns, including that a national monitoring requirement would be impractical and that monitoring receiving waters at most construction sites is infeasible. (Effluent Limitation Guidelines and New Source Performance Standards for the Construction and Development Category: Proposed Rule, 67 Federal Register 42644, 42658-9 (6/24/02).) USEPA concluded that: "All of these factors would add significant expense to the construction process, with little or no added assurance in the effectiveness of control measures or expected environmental benefits." (*Id.*)

7.2 Background Contamination

The Court asked the SWRCB to explain the need for background (reference) sampling for non-visual pollutants. In essence, the Court question is why is it relevant whether the construction activity "increased" the level of pollutants in the runoff if pre-existing pollutants in runoff could also be of concern. There are several responses to this question. First, the CGP is intended to be a permit for storm water discharges associated with construction activity. (CWA §402(p); construction that disturbs greater than one acre is considered an industrial activity (40 CFR §122.26(b)(14)(x) and (15).) At this time, Congress has determined that it is not appropriate to regulate storm water runoff in general, and that only specified types of storm water discharges are subject to permitting. In fact, even at industrial sites, only the portions of the site that are used for industrial activities are subject to permitting. (40 CFR §122.26(b)(14).) Second, the focus of the CGP is on BMPs, and assuring that they are effective in preventing pollutants associated with construction activity from entering receiving waters. Where there are pollutants entering receiving waters, the required action is, through the iterative process in the Receiving Water Limitations, to evaluate and improve BMPs. Eliminating the source of contamination is the most direct and desirable approach to regulating construction runoff.

Regardless of whether a construction site owner *could* be held liable for historical contaminants running off the site, the purpose of the "reference" sample is clear: the permit does not contain numeric effluent limitations and is based on the BMP approach.[1] The two samples compare whether the BMPs that have been installed to prevent the non-visible pollutants associated with construction activity from entering receiving waters are effective. If "control samples" were not taken, the use of sampling to help determine permit compliance would be thwarted. If BMPs, including good housekeeping (source control) BMPs, are properly installed and maintained, they will effectively control the transportation of most pollutants. The background sampling will verify this fact. It is noted that the permit does require identification of historical pollutants, including pollutants that are the result of past usage. (CGP section A.5.b.3.) Sampling for these pollutants is required if the construction activity (e.g., disturbance of soil impacted by prior use) result in the mobilization and runoff of these pollutants.

The Court stated that USEPA documents indicate that reference sample collection and comparison may be unsuitable for persistent bio-accumulative pollutants. (The court cited USEPA's Water Quality Guidance for the Great Lakes System: Supplementary Information Document (GLSID), at p. 63.) A California Court of Appeal recently had occasion to discuss the appropriate regulation of persistent bio-accumulative pollutants in NPDES permits. In *Communities for a Better Environment v. SWRCB* (2003) 109 Cal. App. 4th 1089 (hrg. denied), the court upheld a permit for a refinery that did not include final numeric effluent limitations for dioxins, which are bio-accumulative pollutants. The court upheld an approach relying on BMPs and a watershed approach to dealing with persistent bio-accumulative pollutants through other methods, such as a TMDL. The GLSID adopted by USEPA describes a watershed approach to controlling and eliminating persistent pollutants, which will include adoption of TMDLs. (See, GLSID at p. 247) It is not limited to adoption of NPDES permits, and does not even address

[1] The Court has upheld this approach. See, Ruling on Submitted Matter, *San Francisco BayKeeper v. California SWRCB*, p. 5-6.

construction storm water permits in the region. The reference on page 63 concerns the appropriate approaches for TMDLs, not for construction storm water permits. USEPA concludes in the GLSID that the TMDL process is the appropriate means of effectively addressing persistent bio-accumulative pollutants.

Pollutants such as the Persistent Bio-accumulative and Toxic chemicals (PBT) currently being addressed under USEPA's PBT initiative [2] are not closely associated with modern day construction activity. The listed pesticides could possibly be found, however, as historic pollutants in the soil if the construction site had been used for agriculture prior to the 1970s (the 1990s in the case of toxaphene). Information about PBTs can be found through http://www.waterboards.ca.gov/stormwtr/gen_const.html Persistent bio-accumulative pollutants are strongly associated with soils and soil particles, so an aggressive erosion and sediment control program combined with visual inspections is the most understandable and cost-effective approach to controlling the discharge of such pollutants from construction activity.

If the area that the construction site is located in has prior contamination from PBTs, such issues should be dealt with on a watershed-based approach, such as a TMDL for the particular pollutant. The Construction CGP is not intended to address such issues. On the other hand, the permit does require all dischargers to control soil erosion and the movement of products of erosion off the site via the storm water discharge. Mobilization of pesticide residue by construction activity may trigger sampling and analysis requirements.

7.3 Parameters to Sample for to Determine the Presence of Non-Visible Pollutants in Runoff

It has been suggested that construction dischargers should consult the CTR, and then design a sampling strategy to sample their discharge for all non-visible CTR pollutants based on the numerical values provided. The CTR pollutants and numerical limits, however, have limited relevance to construction activity or storm water pollution from construction sites. The CTR pollutants currently known to be used and commonly found on construction sites can be found through http://www.waterboards.ca.gov/stormwtr/gen_const.html.

Of greater concern for construction discharges are the pollutants found in materials used in large quantities throughout California and exposed throughout the rainy season such as cement, fly-ash, and other recycled materials or by-products of combustion. (But many of these materials may be visible in runoff, affecting color for example.) The water quality standards for these materials will depend on their composition. Some of the more common storm water pollutants from construction activity such as glyphosate (herbicides), diazinon and chlopyrifos (pesticides), nutrients (fertilizers), and molybdenum (lubricants) are not CTR pollutants. The use of diazinon and chlopyrifos is a common practice among landscaping professionals and may trigger sampling and analysis requirements if applications come into contact with storm water.

Other more common storm water contamination problems resulting from construction activity such as high pH values from cement and gypsum, high pH and TSS from wash waters and

[2] http://www.epa.gov/opptintr/pbt/aboutpbt.htm

chemical and fecal contamination from portable toilets are also not CTR pollutants. Some of these constituents do have numeric water quality objectives in individual Basin Plans, but many do not and are subject to narrative water quality standards such as not causing toxicity. This Fact Sheet provides direction on how to ascertain the applicable water quality standards for the receiving water. Of more use will be information the SWRCB will distribute upon completion of a contract with the University of California, which will list the most common pollutants, describe which construction materials they are associated with, and suggest parameters for sampling. At this time, dischargers are encouraged to discuss these issues with RWQCB staff and their own knowledgeable representative or Storm Water Quality Professionals..

7.4 The Watershed Approach to Storm Water Permitting

USEPA has endorsed a watershed approach to storm water permitting that focuses on BMPs in lieu of numeric effluent limitations and visual inspection and indicator monitoring in lieu of sampling for individual pollutant parameters. (Questions and Answers Regarding Implementation of an Interim Permitting Approach for Water Quality-Based Effluent Limitations in Storm Water Permits, 61 Fed. Reg. 57424 (11/6/96)). In a memorandum dated November 22, 2002, USEPA issued guidance on the interaction between storm water permits and TMDLs. The memorandum explains that, even in the case where a TMDL has been finalized and a wasteload allocation established for storm water discharges, the inclusion of numeric effluent limitations will be "rare." The memorandum therefore discusses monitoring requirements in BMP-based permits. It states that the monitoring should assess the effectiveness of the BMPs (i.e., appropriate monitoring is visual inspection) and *if monitoring for storm water is required,* it should be consistent with the state's watershed approach.

7.5 References and Record for this Guidance Document

In preparing this guidance document, the SWRCB has relied upon numerous background materials including federal statutes, regulations and guidance materials. These materials include Clean Water Act sections 303(d) and 402(p) and federal regulations implementing section 402(p) including 40 CFR sections 122.26, 122.44, 122.48, and Part 131. The SWRCB has also relied several guidance documents from USEPA. These include the preambles to the various storm water regulatory actions: 55 Fed. Reg. 47990 et seq. (11/16/90), 57 Fed. Reg. 11394 et seq. (4/2/92), and 64 Fed. Reg. 68722 et seq. The SWRCB has relied on the Porter-Cologne Water Quality Control Act (Water Code section 13000 et seq.), and implementing state regulations at Title 23, California Code of Regulations. The SWRCB has also relied on relevant court decisions, including: *Communities for a Better Environment v. SWRCB* (2003) 109 Cal. App. 4th 1089 (hrg. denied) (Water Boards have broad discretion in adopting effluent limitations for impaired waters). The SWRCB has also reviewed the recently-adopted USEPA general construction permit, published at http://cfpub.epa.gov/npdes/stormwater/cgp.cfm. and USEPA's decision not to adopt effluent limitations guidelines for storm water discharges from construction activities (Volume 69, Federal Register 22472 et seq., April 26, 2004) The SWRCB has also reviewed the USEPA multi-sector general permit for industrial activities (65 Fed. Reg. 64746 et seq. (10/30/00) and a general construction permit issued by USEPA Region IV (65 Fed. Reg 25122 et seq. (4/28/00). The record also contains submittals received by the SWRCB from

interested persons including the Keepers organizations, the Building Industry Legal Defense Foundation and the California Building Industry Association.

APPENDIX A
WATER QUALITY OBJECTIVES FOR SUSPENDED MATERIALS, SETTEABLE MATERIALS, SEDIMENT AND TURBIDITY

Below is a compilation of the water quality objectives for suspended materials, setteable material, sediment and turbidity as of August 2003 for each of the Regional Water Quality Control Boards. The water quality objectives are found in chapter 3 (unless otherwise noted) of the RWQCB's Basin Water Quality Control Plan (Basin Plan). Some of the weblinks go directly to Chapter 3 and others will go to the Basin Plan.

North Coast Regional Water Quality Control Board - Region 1

http://www.waterboards.ca.gov/rwqcb1/down/032202basin-plan.pdf

Suspended Material
Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Setteable Material
Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.

Sediment
The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity
Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.

San Francisco Bay Regional Water Quality Control Board - Region 2

http://www.waterboards.ca.gov/rwqcb2/Basin Plan/chap_3_bp.pdf

Sediment
The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.

Setteable Material
Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.

Suspended Material
Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU.

Central Coast Regional Water Quality Control Board - Region 3

http://www.waterboards.ca.gov/rwqcb3/BasinPlan/BP_text%5Cchapter_3%5CChapter3.htm

Suspended Material
Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Setteable Material
Waters shall not contain setteable material in concentrations that result in deposition of material that causes nuisance or adversely affects beneficial uses.

Sediment
The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

Increase in Turbidity attributable to controllable factors shall not exceed the following limits:

1. Where natural turbidity is between 0 and 50 Jackson Turbidity Units (JTU), increases shall not exceed 20 percent.
2. Where natural turbidity is between 50 and 100 JTU, increases shall not exceed 10 JTU
3. Where natural turbidity is greater than 100 JTU, increases shall not exceed 10 percent.

Allowable zones of dilution within which higher concentrations will be tolerated will be defined for each discharge in discharge permits.

Los Angeles Regional Water Quality Control Board - Region 4

http://www.waterboards.ca.gov/rwqcb4/html/meetings/tmdl/Basin_plan/el_doc/BP3 Water Quality Objectives.pdf

Solid, Suspended, or Setteable Materials
Waters shall not contain suspended or setteable material in concentrations that cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable factors shall not exceed the following limits:

Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%.

Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%.

Allowable zones of initial dilution within which higher concentrations will be tolerated may be defined for each discharge in specific Waste Discharge Requirements.

Central Valley Regional Water Quality Control Board - Region 5

Sacramento River and San Joaquin River Basins

http://www.waterboards.ca.gov/rwqcb5/available_documents/basin_plans/bsnplnab.pdf

Sediment
The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Setteable Material
Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.

Suspended Material
Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.
- Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
- Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

Exceptions to the above limits will be considered when a dredging operation can cause an increase in turbidity. In those cases, an allowable zone of dilution within which turbidity in excess of the limits may be tolerated will be defined for the operation and prescribed in a discharge permit.

For Folsom Lake (50) and American River (Folsom Dam to Sacramento River) (51), except for periods of storm runoff, the turbidity shall be less than or equal 10 NTUs. To the extent of any conflict with the general turbidity objective, the more stringent applies.

For Delta waters, the general objectives for turbidity apply subject to the following: except for periods of storm runoff, the turbidity of Delta waters shall not exceed 50 NTUs in the waters of the Central Delta and 150 NTUs in other Delta waters. Exceptions to the Delta specific objectives will be considered when a dredging operation can cause an increase in turbidity. In this case, an allowable zone of dilution within which turbidity in excess of limits can be tolerated will be defined for the operation and prescribed in a discharge permit.

Tulare Lake Basin

http://www.waterboards.ca.gov/rwqcb5/available_documents/basin_plans/bsnpln5c.pdf

Sediment
The suspended sediment load and suspended sediment discharge rate of waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Setteable Material
Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.

Suspended Material
Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

- Where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent.
- Where natural turbidity is equal to or between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
- Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

In determining compliance with the above limits, the Regional Water Board may prescribe appropriate averaging periods provided that beneficial uses will be fully protected.

Lahontan Regional Water Quality Control Board - Region 6

http://www.waterboards.ca.gov/rwqcb6/BPlan/Bplantxt.pdf

Sediment
The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect the water for beneficial uses.

Setteable Materials
Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or that adversely affects the water for beneficial uses. For natural high quality waters, the concentration of setteable materials shall not be raised by more that 0.1 milliliter per liter.

Suspended Materials
Waters shall not contain suspended materials in concentrations that cause nuisance or that adversely affects the water for beneficial uses. For natural high quality waters, the concentration of total suspended materials shall not be altered to the extent that such alterations are discernible at the 10 percent significance level.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10 percent.

Colorado River Basin Regional Water Quality Control Board - Region 7

http://www.waterboards.ca.gov/rwqcb7/documents/RB7Plan.pdf

Suspended Solids and Setteable Solids
Discharges of wastes or wastewater shall not contain suspended or setteable solids in concentrations which increase the turbidity of receiving waters, unless it can be demonstrated to the satisfaction of the RWQCB that such alteration in turbidity does not adversely affect beneficial uses.

Sediment
The suspended sediment load and suspended sediment discharge rate to surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

Santa Ana River Regional Water Quality Control Board - Region 8

http://www.waterboards.ca.gov/~rwqcb8/pdf/R8BPlan.pdf

(See Chapter 4)

Solids, Suspended and Setteable
Enclosed bays and estuaries shall not contain suspended or setteable solids in amounts which cause a nuisance or adversely affect beneficial uses as a result of controllable water quality factors.

Turbidity
Increases in turbidity which result from controllable water quality factors shall comply with the following:

Natural Turbidity	Maximum Increase
0-50 NTU	20%
50-100 NTU	10 NTU
Greater than 100 NTU	10%

All enclosed bay and estuaries of the region shall be free of changes in turbidity which adversely affect beneficial uses

San Diego Regional Water Quality Control Board - Region 9

http://www.waterboards.ca.gov/rwqcb9/programs/Chapter 3 Water Quality Objectives.pdf

Sediment
The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Suspended and Setteable Solids
Water shall not contain suspended and setteable solids in concentrations of solids that cause nuisance or adversely affect beneficial uses.

Turbidity
Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

Inland surface water shall not contain turbidity in excess of the numerical objectives described in Table 3-2. (This is reference to the Basin Plan; this table can be found via the weblink to the Region 9 Basin Plan).

Ground waters shall not contain turbidity in excess of the numerical objectives described in Table 3-3. (This is reference to the Basin Plan; this table can be found via the weblink to the Region 9 Basin Plan.)

The transparency of waters in lagoons and estuaries shall not be less than 50% of the depth at locations where measurement is made by means of a standard Secchi disk, except where lesser transparency is caused by rainfall runoff from undisturbed areas and dredging projects conducted in conformance with waste discharge requirements of the RWQCB. With these two exceptions, increases in turbidity attributable to controllable water quality factors shall not exceed the following limits:

Natural Turbidity	Maximum Increase
0- 50 NTU	20% over natural turbidity level
50 - 100 NTU	10 NTU
Greater than 100 NTU	10% over natural turbidity level

In addition, within San Diego Bay, the transparency of bay waters, insofar as it may be influenced by any controllable factor, either directly or through induced conditions, shall not be less that 8 feet in more than

20 percent of the readings in any zone, as measured by standard Secchi disk. Wherever the waster is less than 10 feet deep, the Secchi disk reading shall not be less than 80 percent of the depth in more than 20 percent of the readings in any zone.

STATE WATER RESOURCES CONTROL BOARD (SWRCB)
ORDER NO. 99 - 08 - DWQ
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT NO. CAS000002

WASTE DISCHARGE REQUIREMENTS (WDRS) FOR DISCHARGES OF STORM WATER RUNOFF ASSOCIATED WITH CONSTRUCTION ACTIVITY

The State Water Resources Control Board finds that:

1. Federal regulations for controlling pollutants in storm water runoff discharges were promulgated by the U.S. Environmental Protection Agency (USEPA) on November 16, 1990 (40 Code of Federal Regulations (CFR) Parts 122, 123, and 124). The regulations require discharges of storm water to surface waters associated with construction activity including clearing, grading, and excavation activities (except operations that result in disturbance of less than five acres of total land area and which are not part of a larger common plan of development or sale) to obtain an NPDES permit and to implement Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to reduce or eliminate storm water pollution.

   On December 8, 1999 federal regulations promulgated by USEPA (40CFR Parts 9, 122, 123, and 124) expanded the NPDES storm water program to include storm water discharges from municipal separate storm sewer systems (MS4s) and construction sites that were smaller than those previously included in the program. Federal regulation 40 CFR § 122.26(b)(15) defines small construction activity as including clearing, grading, and excavating that result in land disturbance of equal to or greater than one acre or less than five acres or is part of a larger common plan of development or sale. Permit applications for small construction activities are due by March 10, 2003.

2. This General Permit regulates pollutants in discharges of storm water associated with construction activity (storm water discharges) to surface waters, except from those areas on Tribal Lands; Lake Tahoe Hydrologic Unit; construction projects which disturb less than one acre, unless part of a larger common plan of development or sale; and storm water discharges which are determined ineligible for coverage under this General Permit by the California Regional Water Quality Control Boards (RWQCBs). Attachment 1 contains addresses and telephone numbers of each RWQCB office.

3. This General Permit does not preempt or supersede the authority of local storm water management agencies to prohibit, restrict, or control storm water discharges to separate storm sewer systems or other watercourses within their jurisdiction, as allowed by State and Federal law.

4. To obtain authorization for proposed storm water discharges to surface waters, pursuant to this General Permit, the landowner (discharger) must submit a Notice of Intent (NOI) with a vicinity map and the appropriate fee to the SWRCB prior to commencement of construction activities. In addition, coverage under this General Permit shall not occur until the applicant develops a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the requirements of Section A of this permit for the project. For proposed construction activity conducted on easements or on nearby property by agreement or permission, or by an owner or lessee of a mineral estate (oil, gas, geothermal, aggregate, precious metals, and/or industrial minerals) entitled to conduct the activities, the entity responsible for the construction activity must submit the NOI and filing fee and shall be responsible for development of the SWPPP.

5. If an individual NPDES Permit is issued to a discharger otherwise subject to this General Permit or if an alternative General Permit is subsequently adopted which covers storm water discharges regulated by this General Permit, the applicability of this General Permit to such discharges is automatically terminated on the effective date of the individual permit or the date of approval for coverage under the subsequent General Permit.

6. This action to adopt an NPDES permit is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21100, et seq.) in accordance with section 13389 of the California Water Code.

7. The SWRCB adopted the California Ocean Plan, and the RWQCBs have adopted and the SWRCB has approved Water Quality Control Plans (Basin Plans). Dischargers regulated by this General Permit must comply with the water quality standards in these Basin Plans and subsequent amendments thereto.

8. The SWRCB finds storm water discharges associated with construction activity to be a potential significant sources of pollutants. Furthermore, the SWRCB finds that storm water discharges associated with construction activities have the reasonable potential to cause or contribute to an excursion above water quality standards for sediment in the water bodies listed in Attachment 3 to this permit.

9. It is not feasible at this time to establish numeric effluent limitations for pollutants in storm water discharges from construction activities. Instead, the provisions of this General Permit require implementation of Best Management Practices (BMPs) to control and abate the discharge of pollutants in storm water discharges.

10. Discharges of non-storm water may be necessary for the completion of certain construction projects. Such discharges include, but are not limited to: irrigation of vegetative erosion control measures, pipe flushing and testing, street cleaning, and dewatering. Such discharges are authorized by this General Permit as long as they (a) do comply with Section A.9 of this General Permit, (b) do not cause or contribute to violation of any water quality standard, (c) do not violate any other provision of this

General Permit, (d) do not require a non-storm water permit as issued by some RWQCBs, and (e) are not prohibited by a Basin Plan. If a non-storm water discharge is subject to a separate permit adopted by a RWQCB, the discharge must additionally be authorized by the RWQCB permit.

11. Following adoption of this General Permit, the RWQCBs shall enforce the provisions herein including the monitoring and reporting requirements.

12. Following public notice in accordance with State and Federal laws and regulations, the SWRCB in a public meeting on June 8, 1998, heard and considered all comments. The SWRCB has prepared written responses to all significant comments.

13. This Order is an NPDES permit in compliance with section 402 of the Clean Water Act (CWA) and shall take effect upon adoption by the SWRCB provided the Regional Administrator of the USEPA has no objection. If the USEPA Regional Administrator objects to its issuance, the General Permit shall not become effective until such objection is withdrawn.

14. This General Permit does not authorize discharges of fill or dredged material regulated by the U.S. Army Corps of Engineers under CWA section 404 and does not constitute a waiver of water quality certification under CWA section 401.

15 The Monitoring Program and Reporting Requirements are modified in compliance with a judgment in the case of San Francisco BayKeeper, et al. v. State Water Resources Control Board. The modifications include sampling and analysis requirements for direct discharges of sediment to waters impaired due to sediment and for pollutants that are not visually detectable in runoff that may cause or contribute to an exceedance of water quality objectives.

16 Storm water discharges associated with industrial activity that are owned or operated by municipalities serving populations less than 100,000 people are no longer exempt from the need to apply for or obtain a storm water discharge permit. A temporary exemption, which was later extended by USEPA, was provided under section 1068(c) of the Intermodal Surface Transportation and Efficiency Act (ISTEA) of 1991. Federal regulation 40 CFR § 122.26(e)(1)(ii) requires the above municipalities to submit permit application by March 10, 2003.

17 This permit may be reopened and modified to include different monitoring requirements for small construction activity than for construction activity over five (5) acres.

IT IS HEREBY ORDERED that all dischargers who file an NOI indicating their intention to be regulated under the provisions of this General Permit shall comply with the following:

A. DISCHARGE PROHIBITIONS:

1. Authorization pursuant to this General Permit does not constitute an exemption to applicable discharge prohibitions prescribed in Basin Plans, as implemented by the nine RWQCBs.

2. Discharges of material other than storm water which are not otherwise authorized by an NPDES permit to a separate storm sewer system (MS4) or waters of the nation are prohibited, except as allowed in Special Provisions for Construction Activity, C.3.

3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance.

4. Storm water discharges regulated by this General Permit shall not contain a hazardous substance equal to or in excess of a reportable quantity listed in 40 CFR Part 117 and/or 40 CFR Part 302.

B. RECEIVING WATER LIMITATIONS:

1. Storm water discharges and authorized nonstorm water discharges to any surface or ground water shall not adversely impact human health or the environment.

2. The SWPPP developed for the construction activity covered by this General Permit shall be designed and implemented such that storm water discharges and authorized nonstorm water discharges shall not cause or contribute to an exceedance of any applicable water quality standards contained in a Statewide Water Quality Control Plan and/or the applicable RWQCB's Basin Plan.

3. Should it be determined by the discharger, SWRCB, or RWQCB that storm water discharges and/or authorized nonstorm water discharges are causing or contributing to an exceedance of an applicable water quality standard, the discharger shall:

   a. Implement corrective measures immediately following discovery that water quality standards were exceeded, followed by notification to the RWQCB by telephone as soon as possible but no later than 48 hours after the discharge has been discovered. This notification shall be followed by a report within 14-calender days to the appropriate RWQCB, unless otherwise directed by the RWQCB, describing (1) the nature and cause of the water quality standard exceedance; (2) the BMPs currently being implemented; (3) any additional BMPs which will be implemented to

prevent or reduce pollutants that are causing or contributing to the exceedance of water quality standards; and (4) any maintenance or repair of BMPs. This report shall include an implementation schedule for corrective actions and shall describe the actions taken to reduce the pollutants causing or contributing to the exceedance.

b. The discharger shall revise its SWPPP and monitoring program immediately after the report to the RWQCB to incorporate the additional BMPs that have been and will be implemented, the implementation schedule, and any additional monitoring needed.

c. Nothing in this section shall prevent the appropriate RWQCB from enforcing any provisions of this General Permit while the discharger prepares and implements the above report.

C. SPECIAL PROVISIONS FOR CONSTRUCTION ACTIVITY:

1. All dischargers shall file an NOI and pay the appropriate fee for construction activities conducted at each site as required by Attachment 2: Notice of Intent--General Instructions.

2. All dischargers shall develop and implement a SWPPP in accordance with Section A: Storm Water Pollution Prevention Plan. The discharger shall implement controls to reduce pollutants in storm water discharges from their construction sites to the BAT/BCT performance standard.

3. Discharges of non-storm water are authorized only where they do not cause or contribute to a violation of any water quality standard and are controlled through implementation of appropriate BMPs for elimination or reduction of pollutants. Implementation of appropriate BMPs is a condition for authorization of non-storm water discharges. Non-storm water discharges and the BMPs appropriate for their control must be described in the SWPPP. Wherever feasible, alternatives which do not result in discharge of nonstorm water shall be implemented in accordance with Section A.9. of the SWPPP requirements.

4. All dischargers shall develop and implement a monitoring program and reporting plan in accordance with Section B: Monitoring Program and Reporting Requirements.

5. All dischargers shall comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies regarding discharges of storm water to separate storm sewer systems or other watercourses under their jurisdiction, including applicable requirements in municipal storm water management programs developed to comply with NPDES permits issued by the RWQCBs to local agencies.

6. All dischargers shall comply with the standard provisions and reporting requirements contained in Section C: Standard Provisions.

7. The discharger may terminate coverage for a portion of the project under this General Permit when ownership of a portion of this project has been transferred or when a phase within this multi-phase project has been completed. When ownership has transferred, the discharger must submit to its RWQCB a Change of Information Form (COI) Attachment 4 with revised site map and the name, address and telephone number of the new owner(s). Upon transfer of title, the discharger should notify the new owner(s) of the need to obtain coverage under this General Permit. The new owner must comply with provisions of Sections A. 2. (c) and
B. 2. (b) of this General Permit. To terminate coverage for a portion of the project when a phase has been completed, the discharger must submit to its RWQCB a COI with a revised map that identifies the newly delineated site.

8. The discharger may terminate coverage under this General Permit for a complete project by submitting to its RWQCB a Notice of Termination Form (NOT), and the post-construction BMPs plan according to Section A.10 of this General Permit. Note that a construction project is considered complete only when all portions of the site have been transferred to a new owner; or the following conditions have been met:

   a. There is no potential for construction related storm water pollution,

   b. All elements of the SWPPP have been completed,

   c. Construction materials and waste have been disposed of properly,

   d. The site is in compliance with all local storm water management requirements, and

   e. A post-construction storm water management plan is in place as described in the site's SWPPP.

9. This General Permit expires five years from the date of adoption.

D. REGIONAL WATER QUALITY CONTROL BOARD (RWQCB) AUTHORITIES:

1. RWQCBs shall:

   a. Implement the provisions of this General Permit. Implementation of this General Permit may include, but is not limited to requesting the submittal of SWPPPS, reviewing SWPPPs, reviewing monitoring reports, conducting compliance inspections, and taking enforcement actions.

   b. Issue permits as they deem appropriate to individual dischargers, categories of dischargers, or dischargers in a geographic area. Upon issuance of such permits by a RWQCB, the affected dischargers shall no longer be regulated by this General Permit.

2. RWQCBs may require, on a case-by-case basis, the inclusion of an analysis of potential downstream impacts on receiving waterways due to the permitted construction.

3. RWQCBs may provide information to dischargers on the development and implementation of SWPPPs and monitoring programs and may require revisions to SWPPPs and monitoring programs.

4. RWQCBs may require dischargers to retain records for more than three years.

5. RWQCBs may require additional monitoring and reporting program requirements including sampling and analysis of discharges to water bodies listed in Attachment 3 to this permit. Additional requirements imposed by the RWQCB should be consistent with the overall monitoring effort in the receiving waters.

6. RWQCBs may issue individual NPDES permits for those construction activities found to be ineligible for coverage under this permit.

CERTIFICATION

The undersigned. Administrative Assistant to the Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on August 19, 1999.

AYE:	James M. Stubchaer Mary Jane Forster John W. Brown Arthur G. Baggett, Jr.
NO:	None
ABSENT:	None
ABSTAIN:	None

/s/
Maureen Marché
Administrative Assistant to the Board

SECTION A: STORM WATER POLLUTION PREVENTION PLAN

1. Objectives

A Storm Water Pollution Prevention Plan (SWPPP) shall be developed and implemented to address the specific circumstances for each construction site covered by this General Permit. The SWPPP shall be certified in accordance with the signatory requirements of section C, Standard Provision for Construction Activities (9). The SWPPP shall be developed and amended or revised, when necessary, to meet the following objectives:

a. Identify all pollutant sources including sources of sediment that may affect the quality of storm water discharges associated with construction activity (storm water discharges) from the construction site, and

b. Identify non-storm water discharges, and

c. Identify, construct, implement in accordance with a time schedule, and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized nonstorm water discharges from the construction site during construction, and

d. Develop a maintenance schedule for BMPs installed during construction designed to reduce or eliminate pollutants after construction is completed (post-construction BMPs).

e. Identify a sampling and analysis strategy and sampling schedule for discharges from construction activity which discharge directly into water bodies listed on Attachment 3. (Clean Water Act Section 303(d) [303(d)] Water Bodies listed for Sedimentation).

f. For all construction activity, identify a sampling and analysis strategy and sampling schedule for discharges that have been discovered through visual monitoring to be potentially contaminated by pollutants not visually detectable in the runoff.

2. Implementation Schedule

a. For construction activity commencing on or after adoption of this General Permit. the SWPPP shall be developed prior to the start of soil-disturbing activity in accordance with this Section and shall be implemented concurrently with commencement of soil-disturbing activities.

b. Existing permittees engaging in construction activities covered under the terms of the previous General Construction Permit SWPPP (WQ Order No.92-08-DWQ) shall continue to implement their existing SWPPP and shall implement any

necessary revisions to their SWPPP in accordance with this Section of the General Permit in a timely manner, but in no case more than 90-calender days from the date of adoption of this General Permit.

c. For ongoing construction activity involving a change of ownership of property, the new owner shall review the existing SWPPP and amend if necessary, or develop a new SWPPP within 45-calender days.

d. Existing permittees shall revise their SWPPP in accordance with the sampling and analysis modifications prior to August 1, 2001. For ongoing construction activity involving a change of ownership the new owner shall review the existing SWPPP and amend the sampling and analysis strategy, if required, within 45 days. For construction activity commencing after the date of adoption, the SWPPP shall be developed in accordance with the modification language adopted.

3. Availability

The SWPPP shall remain on the construction site while the site is under construction during working hours, commencing with the initial construction activity and ending with termination of coverage under the General Permit.

4. Required Changes

a. The discharger shall amend the SWPPP whenever there is a change in construction or operations which may affect the discharge of pollutants to surface waters, ground waters, or a municipal separate storm sewer system (MS4). The SWPPP shall also be amended if the discharger violates any condition of this General Permit or has not achieved the general objective of reducing or eliminating pollutants in storm water discharges. If the RWQCB determines that the discharger is in violation of this General Permit, the SWPPP shall be amended and implemented in a timely manner, but in no case more than 14-calendar days after notification by the RWQCB. All amendments should be dated and directly attached to the SWPPP.

b. The RWQCB or local agency with the concurrence of the RWQCB may require the discharger to amend the SWPPP.

5. Source Identification

The SWPPP shall include: (a) project information and (b) pollutant source identification combined with an itemization of those BMPs specifically chosen to control the pollutants listed.

a. Project Information

(1) The SWPPP shall include a vicinity map locating the project site with respect to easily identifiable major roadways, geographic features, or landmarks. At a minimum, the map must show the construction site perimeter, the geographic features surrounding the site, and the general topography.

(2) The SWPPP shall include a site map(s) which shows the construction project in detail, including the existing and planned paved areas and buildings.

(a) At a minimum, the map must show the construction site perimeter; existing and proposed buildings, lots, roadways, storm water collection and discharge points; general topography both before and after construction; and the anticipated discharge location(s) where the storm water from the construction site discharges to a municipal storm sewer system or other water body.

(b) The drainage patterns across the project area must clearly be shown on the map, and the map must extend as far outside the site perimeter as necessary to illustrate the relevant drainage areas. Where relevant drainage areas are too large to depict on the map, map notes or inserts illustrating the upstream drainage areas are sufficient.

(c) Temporary on-site drainages to carry concentrated flow shall be selected to comply with local ordinances, to control erosion, to return flows to their natural drainage courses, and to prevent damage to downstream properties.

3. Information presented in the SWPPP may be represented either by narrative or by graphics. Where possible, narrative descriptions should be plan notes. Narrative descriptions which do not lend themselves to plan notes can be contained in a separate document which must be referenced on the plan.

b. Pollutant Source and BMP Identification

The SWPPP shall include a description of potential sources which are likely to add pollutants to storm water discharges or which may result in nonstorm water discharges from the construction site. Discharges originating from off-site which flow across or through areas disturbed by construction that may contain pollutants should be reported to the RWQCB.

The SWPPP shall:

(1) Show drainage patterns and slopes anticipated after major grading activities are completed. Runoff from off-site areas should be prevented from flowing through areas that have been disturbed by construction unless appropriate conveyance systems are in place. The amount of anticipated storm water run-on must be considered to determine the appropriateness of the BMPs chosen. Show all calculations for anticipated storm water run-on, and describe all BMPs implemented to divert off-site drainage described in section A. 5 a. (2) (c) around or through the construction project.

(2) Show the drainage patterns into each on-site storm water inlet point or receiving water. Show or describe the BMPs that will protect operational storm water inlets or receiving waters from contaminated discharges other than sediment discharges, such as, but not limited to: storm water with elevated pH levels from contact with soil amendments such as lime or gypsum; slurry from sawcutting of concrete or asphalt ;washing of exposed aggregate concrete; concrete rinse water; building washing operations; equipment washing operations; minor street washing associated with street delineation; and/or sealing and paving activities occurring during rains.

(3) Show existing site features that, as a result of known past usage, may contribute pollutants to storm water, (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, or leaked onto the construction site). Show or describe the BMPs implemented to minimize the exposure of storm water to contaminated soil or toxic materials.

(4) Show areas designated for the (a) storage of soil or waste, (b) vehicle storage and service areas, (c) construction material loading, unloading, and access areas, (d) equipment storage, cleaning, and maintenance areas.

(5) Describe the BMPs for control of discharges from waste handling and disposal areas and methods of on-site storage and disposal of construction materials and construction waste. Describe the BMPs designed to minimize or eliminate the exposure of storm water to construction materials, equipment, vehicles, waste storage areas, or service areas. The BMPs described shall be in compliance with Federal, State, and local laws, regulations, and ordinances.

(6) Describe all post-construction BMPs for the project, and show the location of each BMP on the map. (Post-construction BMPs consist of permanent features designed to minimize pollutant discharges, including sediment, from the site after construction has been completed.) Also, describe the agency or parties to be the responsible party for long-term maintenance of these BMPs.

(7) Show the locations of direct discharge from the construction site into a Section 303(d) list water body. Show the designated sampling locations in the receiving waters, which represent the prevailing conditions of the water bodies upstream of the construction site discharge and immediately downstream from the last point of discharge.

(8) Show the locations designated for sampling the discharge from areas identified in Section A. 5. b. (2), (3), and (4) and Section A. 5. c. (1) and (2). Samples shall be taken should visual monitoring indicate that there has been a breach, malfunction, leakage, or spill from a BMP which could result in the discharge in storm water of pollutants that would not be visually detectable, or if storm water comes into contact with soil amendments or other exposed materials or contamination and is allowed to be discharged. Describe the sampling procedure, location, and rationale for obtaining the uncontaminated sample of storm water.

c. Additional Information

(1) The SWPPP shall include a narrative description of pollutant sources and BMPs that cannot be adequately communicated or identified on the site map. In addition, a narrative description of preconstruction control practices (if any) to reduce sediment and other pollutants in storm water discharges shall be included.

(2) The SWPPP shall include an inventory of all materials used and activities performed during construction that have the potential to contribute to the discharge of pollutants other than sediment in storm water. Describe the BMPs selected and the basis for their selection to eliminate or reduce these pollutants in the storm water discharges.

(3) The SWPPP shall include the following information regarding the construction site surface area: the size (in acres or square feet), the runoff coefficient before and after construction, and the percentage that is impervious (e.g., paved, roofed, etc.) before and after construction.

(4) The SWPPP shall include a copy of the NOI, and the Waste Discharge Identification (WDID) number. Should a WDID number not be received from the SWRCB at the time construction commences, the discharger shall include proof of mailing of the NOI, e.g., certified mail receipt, copy of check, express mail receipt, etc.

(5) The SWPPP shall include a construction activity schedule which describes all major activities such as mass grading. paving, lot or parcel

improvements at the site and the proposed time frame to conduct those activities.

(6) The SWPPP shall list the name and telephone number of the qualified person(s) who have been assigned responsibility for prestorm, poststorm, and storm event BMP inspections; and the qualified person(s) assigned responsibility to ensure full compliance with the permit and implementation of all elements of the SWPPP, including the preparation of the annual compliance evaluation and the elimination of all unauthorized discharges.

6. Erosion Control

Erosion control, also referred to as "soil stabilization" is the most effective way to retain soil and sediment on the construction site. The most efficient way to address erosion control is to preserve existing vegetation where feasible, to limit disturbance, and to stabilize and revegetate disturbed areas as soon as possible after grading or construction. Particular attention must be paid to large mass-graded sites where the potential for soil exposure to the erosive effects of rainfall and wind is great. Mass graded construction sites may be exposed for several years while the project is being built out. Thus, there is potential for significant sediment discharge from the site to surface waters.

At a minimum, the discharger/operator must implement an effective combination of erosion and sediment control on all disturbed areas during the rainy season. These disturbed areas include rough graded roadways, slopes, and building pads. Until permanent vegetation is established, soil cover is the most cost-effective and expeditious method to protect soil particles from detachment and transport by rainfall. Temporary soil stabilization can be the single-most important factor in reducing erosion at construction sites. The discharger shall consider measures such as: covering with mulch, temporary seeding, soil stabilizers, binders, fiber rolls or blankets, temporary vegetation, permanent seeding, and a variety of other measures.

The SWPPP shall include a description of the erosion control practices, including a time schedule, to be implemented during construction to minimize erosion on disturbed areas of a construction site. The discharger must consider the full range of erosion control BMPs. The discharger must consider any additional site-specific and seasonal conditions when selecting and implementing appropriate BMPs. The above listed erosion control measures are examples of what should be considered and are not exclusive of new or innovative approaches currently available or being developed.

a. The SWPPP shall include:

(1) An outline of the areas of vegetative soil cover or native vegetation onsite which will remain undisturbed during the construction project.

(2) An outline of all areas of soil disturbance including cut or fill areas which will be stabilized during the rainy season by temporary or permanent erosion control measures, such as seeding, mulch, or blankets. etc.

(3) An outline of the areas of soil disturbance, cut, or fill which will be left exposed during any part of the rainy season, representing areas of potential soil erosion where sediment control BMPs are required to be used during construction.

(4) A proposed schedule for the implementation of erosion control measures.

b. The SWPPP shall include a description of the BMPs and control practices to be used for both temporary and permanent erosion control measures.

c. The SWPPP shall include a description of the BMPs to reduce wind erosion at all times, with particular attention paid to stock-piled materials.

7. Stabilization

(1) All disturbed areas of the construction site must be stabilized. Final stabilization for the purposes of submitting a NOT is satisfied when:

-All soil disturbing activities are completed AND EITHER OF THE TWO FOLLOWING CRITERIA ARE MET:

-A uniform vegetative cover with 70 percent coverage has been established OR:

-equivalent stabilization measures have been employed. These measures include the use of such BMPs as blankets, reinforced channel liners, soil cement, fiber matrices, geotextiles, or other erosion resistant soil coverings or treatments.

(2) Where background native vegetation covers less than 100 percent of the surface, such as in arid areas, the 70 percent coverage criteria is adjusted as follows: If the native vegetation covers 50 percent of the ground surface, 70 percent of 50 percent (.70 X .50=.35) would require 35 percent total uniform surface coverage.

8. Sediment Control

The SWPPP shall include a description or illustration of BMPs which will be implemented to prevent a net increase of sediment load in storm water discharge relative to preconstruction levels. Sediment control BMPs are required at appropriate locations along the site perimeter and at all operational internal inlets to the storm drain system at all times during the rainy season. Sediment control practices may include filtration devices and barriers (such as fiber rolls, silt fence, straw bale barriers, and gravel inlet filters) and/or settling devices (such as sediment traps or basins). Effective filtration devices, barriers, and settling devices shall be selected, installed and maintained properly. A proposed schedule for deployment of sediment control BMPs shall be included in the SWPPP. These are the most basic measures to prevent sediment from leaving the project site and moving into receiving waters. Limited exemptions may be authorized by the RWQCB when work on active areas precludes the use of sediment control BMPs temporarily. Under these conditions, the SWPPP must describe a plan to establish perimeter controls prior to the onset of rain.

During the nonrainy season, the discharger is responsible for ensuring that adequate sediment control materials are available to control sediment discharges at the downgrade perimeter and operational inlets in the event of a predicted storm. The discharger shall consider a full range of sediment controls, in addition to the controls listed above, such as straw bale dikes, earth dikes, brush barriers, drainage swales, check dams, subsurface drain, sandbag dikes, fiber rolls, or other controls. At a minimum, the discharger/operator must implement an effective combination of erosion and sediment control on all disturbed areas during the rainy season.

If the discharger chooses to rely on sediment basins for treatment purposes, sediment basins shall, at a minimum, be designed and maintained as follows:

Option 1: Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

Option 2: Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than three feet nor greater than five feet for safety reasons and for maximum efficiency.

OR

Option 3: Sediment basin(s) shall be designed using the standard equation:

$$As=1.2Q/Vs$$

Where: As is the minimum surface area for trapping soil particles of a certain size; Vs is the settling velocity of the design particle size chosen; and Q=C x I x A where Q is the discharge rate measured in cubic feet per second; C is the runoff coefficient; I is the precipitation intensity for the 10-year, 6-hour rain event and A is the area draining into the sediment basin in acres. The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01mm) particle. and the Vs used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than three feet nor greater than five feet for safety reasons and for maximum efficiency (two feet of storage, two feet of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the two feet of capacity;

OR

Option 4: The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

A sediment basin shall have a means for dewatering within 7-calendar days following a storm event. Sediment basins may be fenced if safety (worker or public) is a concern.

The outflow from a sediment basin that discharges into a natural drainage shall be provided with outlet protection to prevent erosion and scour of the embankment and channel.

The discharger must consider any additional site-specific and seasonal conditions when selecting and designing sediment control BMPs. The above listed sediment control measures are examples of what should be considered and are not exclusive of new or innovative approaches currently available or being developed.

The SWPPP shall include a description of the BMPs to reduce the tracking of sediment onto public or private roads at all times. These public and private roads shall be inspected and cleaned as necessary. Road cleaning BMPs shall be discussed in the SWPPP and will not rely on the washing of accumulated sediment or silt into the storm drain system.

9. Non-Storm Water Management

Describe all non-storm water discharges to receiving waters that are proposed for the construction project. Non-storm water discharges should be eliminated or reduced to the extent feasible. Include the locations of such discharges and descriptions of all BMPs designed for the control of pollutants in such discharges. Onetime discharges shall be monitored during the time that such discharges are occurring. A qualified person should be assigned the responsibility for ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems (consistent with BAT/BCT), and the name and contact number of that person should be included in the SWPPP document.

Discharging sediment-laden water which will cause or contribute to an exceedance of the applicable RWQCB's Basin Plan from a dewatering site or sediment basin into any receiving water or storm drain without filtration or equivalent treatment is prohibited.

10. Post-Construction Storm Water Management

The SWPPP shall include descriptions of the BMPs to reduce pollutants in storm water discharges after all construction phases have been completed at the site (Post-Construction BMPs). Post-Construction BMPs include the minimization of land disturbance, the minimization of impervious surfaces, treatment of storm water runoff using infiltration, detention/retention, biofilter BMPs, use of efficient irrigation systems, ensuring that interior drains are not connected to a storm sewer system, and appropriately designed and constructed energy dissipation devices. These must be consistent with all local post-construction storm water management requirements, policies, and guidelines. The discharger must consider site-specific and seasonal conditions when designing the control practices. Operation and maintenance of control practices after construction is completed shall be addressed, including short-and long-term funding sources and the responsible party.

11. Maintenance, Inspection, and Repair

The SWPPP shall include a discussion of the program to inspect and maintain all BMPs as identified in the site plan or other narrative documents throughout the entire duration of the project. A qualified person will be assigned the responsibility to conduct inspections. The name and telephone number of that person shall be listed in the SWPPP document. Inspections will be performed before and after storm events and once each 24-hour period during extended storm events to identify BMP effectiveness and implement repairs or design changes as soon as feasible depending upon field conditions. Equipment, materials, and workers must be available for rapid response to failures and emergencies. All corrective maintenance to BMPs shall be performed as soon as possible after the conclusion of each storm depending upon worker safety.

For each inspection required above, the discharger shall complete an inspection checklist. At a minimum, an inspection checklist shall include:

a. Inspection date.

b. Weather information: best estimate of beginning of storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall (inches).

c. A description of any inadequate BMPs.

d. If it is possible to safely access during inclement weather, list observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-storm water controls. Otherwise, list result of visual inspection at relevant outfall, discharge point, or downstream location and projected required maintenance activities.

e. Corrective actions required, including any changes to SWPPP necessary and implementation dates.

f. Inspectors name, title, and signature.

The dischargers shall prepare their inspection checklists using the inspection checklist form provided by the SWRCB or RWQCB or on forms that contain the equivalent information.

12. Training

Individuals responsible for SWPPP preparation, implementation, and permit compliance shall be appropriately trained, and the SWPPP shall document all training. This includes those personnel responsible for installation, inspection, maintenance, and repair of BMPs. Those responsible for overseeing, revising, and amending the SWPPP shall also document their training. Training should be both formal and informal, occur on an ongoing basis when it is appropriate and convenient, and should include training/workshops offered by the SWRCB, RWQCB, or other locally recognized agencies or professional organizations.

13. List of Contractors/Subcontractors

The SWPPP shall include a list of names of all contractors, (or subcontractors) and individuals responsible for implementation of the SWPPP. This list should include telephone numbers and addresses. Specific areas of responsibility of each subcontractor and emergency contact numbers should also be included.

14. Other Plans

This SWPPP may incorporate by reference the appropriate elements of other plans required by local, State, or Federal agencies. A copy of any requirements incorporated by reference shall be kept at the construction site.

15. Public Access

The SWPPP shall be provided, upon request, to the RWQCB. The SWPPP is considered a report that shall be available to the public by the RWQCB under section 308(b) of the Clean Water Act.

16. Preparer Certification

The SWPPP and each amendment shall be signed by the landowner (discharger) or his representative and include the date of initial preparation and the date of each amendment.

SECTION B: MONITORING PROGRAM AND REPORTING REQUIREMENTS

1. Required Changes

The RWQCB may require the discharger to conduct additional site inspections, to submit reports and certifications, or perform sampling and analysis.

2. Implementation

a. The requirements of this Section shall be implemented at the time of commencement of construction activity (see also Section A. 2. Implementation Schedule). The discharger is responsible for implementing these requirements until construction activity is complete and the site is stabilized.

b. For ongoing construction activity involving a change in ownership of property covered by this General Permit, the new owner must complete a NOI and implement the requirements of this Section concurrent with the change of ownership. For changes of information, the owner must follow instructions in C. 7. Special Provisions for Construction Activity of the General Permit.

3. Site Inspections

Qualified personnel shall conduct inspections of the construction site prior to anticipated storm events, during extended storm events, and after actual storm events to identify areas contributing to a discharge of storm water associated with construction activity. The name(s) and contact number(s) of the assigned inspection personnel shall be listed in the SWPPP. Pre-storm inspections are to ensure that BMPs are properly installed and maintained; post-storm inspections are to assure that the BMPs have functioned adequately. During extended storm events, inspections shall be required each 24-hour period. Best Management Practices (BMPs) shall be evaluated for adequacy and proper implementation and whether additional BMPs are required in accordance with the terms of the General Permit (see language in Section A. 11. Maintenance, Inspection, and Repair). Implementation of nonstorm water discharge BMPs shall be verified and their

effectiveness evaluated. One time discharges of non-storm water shall be inspected when such discharges occur.

4. Compliance Certification

Each discharger or qualified assigned personnel listed by name and contact number in the SWPPP must certify annually that construction activities are in compliance with the requirements of this General Permit and the SWPPP. This Certification shall be based upon the site inspections required in Item 3 of this Section. The certification must be completed by July 1 of each year.

5. Noncompliance Reporting

Dischargers who cannot certify compliance, in accordance with Item 4 of this Section and/or who have had other instances of noncompliance excluding exceedances of water quality standards as defined in section B. 3. Receiving Water Limitations Language, shall notify the appropriate RWQCB within 30 days. Corrective measures should be implemented immediately following discovery that water quality standards were exceeded. The notifications shall identify the noncompliance event, including an initial assessment of any impact caused by the event: describe the actions necessary to achieve compliance; and include a time schedule subject to the modifications by the RWQCB indicating when compliance will be achieved. Noncompliance notifications must be submitted within 30-calendar days of identification of noncompliance.

6. Monitoring Records

Records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated. With the exception of noncompliance reporting, dischargers are not required to submit these records.

7. Monitoring Program for Sedimentation/Siltation

Dischargers of storm water associated with construction activity that directly enters a water body listed in Attachment 3 shall conduct a sampling and analysis program for the pollutants (sedimentation/siltation or turbidity) causing the impairment. The discharger shall monitor for the applicable parameter. If the water body is listed for sedimentation or siltation, samples should be analyzed for Settleable Solids (ml/l) and Total Suspended Solids (mg/l). Alternatively or in addition, samples may be analyzed for suspended sediment concentration according to ASTM D3977-97. If the water body is listed for turbidity, samples should be analyzed for turbidity (NTU). Discharges that flow through tributaries that are not listed in Attachment 3 or that flow into Municipal Separate Storm Sewer Systems (MS4) are not subject to these sampling and analysis requirements. The sampling and analysis parameters and procedures must be designed to determine whether the BMPs installed and maintained prevent discharges of sediment from contributing to impairment in receiving waters.

Samples shall be collected during the first two hours of discharge from rain events which result in a direct discharge to any water body listed in Attachment 3. Samples shall be collected during daylight hours (sunrise to sunset). Dischargers need not collect more than four (4) samples per month. All samples shall be taken in the receiving waters and shall be representative of the prevailing conditions of the water bodies. Samples shall be collected from safely accessible locations upstream of the construction site discharge and immediately downstream from the last point of discharge.

For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specification. All field and/or laboratory analytical data shall be kept in the SWPPP document, which is to remain at the construction site at all times until a Notice of Termination has been submitted and approved.

8. Monitoring Program for Pollutants Not Visually Detectable in Storm Water

A sampling and analysis program shall be developed and conducted for pollutants which are not visually detectable in storm water discharges, which are or should be known to occur on the construction site, and which could cause or contribute to an exceedance of water quality objectives in the receiving water. Pollutants that should be considered for inclusion in this sampling and analysis program are those identified in Sections A.5.b. and A.5.c.

Construction materials and compounds that are not stored in water-tight containers under a water-tight roof or inside a building are examples of materials for which the discharger may have to implement sampling and analysis procedures. The goal of the sampling and analysis is to determine whether the BMPs employed and maintained on site are effective in preventing the potential pollutants from coming in contact with storm water and causing or contributing to an exceedance of water quality objectives in the receiving waters. Examples of construction sites that may require sampling and analysis include: sites that are known to have contaminants spilled or spread on the ground; sites where construction practices include the application of soil amendments, such as gypsum, which can increase the pH of the runoff; or sites having uncovered stockpiles of material exposed to storm water. Visual observations before, during, and after storm events may trigger the requirement to collect samples. Any breach, malfunction, leakage, or spill observed which could result in the discharge of pollutants to surface waters that *would* not be visually detectable in storm water shall trigger the collection of a sample of discharge. Samples shall be collected at all discharge locations which drain the areas identified by the visual observations and which can be safely accessed. For sites where sampling and analysis is required, personnel trained in water quality sampling procedures shall collect storm water samples. A sufficiently large sample of storm water that has not come in contact with the disturbed soil or the materials stored or used on-site

(uncontaminated sample) shall be collected for comparison with the discharge sample. Samples shall be collected during the first two hours of discharge from rain events that occur during daylight hours and which generate runoff.

The uncontaminated sample shall be compared to the samples of discharge using field analysis or through laboratory analysis. Analyses may include, but are not limited to, indicator parameters such as: pH, specific conductance, dissolved oxygen, conductivity, salinity, and TDS.

For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field discharge samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specification. All field and/or analytical data shall be kept in the SWPPP document, which is to remain at the construction site at all times until a *Notice of* Termination has been submitted and approved.

SECTION C: STANDARD PROVISIONS FOR CONSTRUCTION ACTIVITY

1. Duty to Comply

The discharger must comply with all of the conditions of this General Permit. Any permit noncompliance constitutes a violation of the Clean Water Act (CWA) and the Porter-Cologne Water Quality Control Act and is grounds for enforcement action and/or removal from General Permit coverage.

The discharger shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this General Permit has not yet been modified to incorporate the requirement.

2. General Permit Actions

This General Permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the discharger for a General Permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not annul any General Permit condition.

If any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under Section 307(a) of the CWA for a toxic pollutant which is present in the discharge and that standard or prohibition is more stringent than any limitation on the pollutant in this General Permit, this General Permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the dischargers so notified.

3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this General Permit.

4. Duty to Mitigate

The discharger shall take all responsible steps to minimize or prevent any discharge in violation of this General Permit, which has a reasonable likelihood of adversely affecting human health or the environment.

5. Proper Operation and Maintenance

The discharger shall at all times properly operate and maintain any facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with the conditions of this General Permit and with the requirements of Storm Water Pollution Prevention Plans (SWPPP). Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance may require the operation of backup or auxiliary facilities or similar systems installed by a discharger when necessary to achieve compliance with the conditions of this General Permit.

6. Property Rights

This General Permit does not convey any property rights of any sort or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor does it authorize any infringement of Federal, State, or local laws or regulations.

7. Duty to Provide Information

The discharger shall furnish the RWQCB, State Water Resources Control Board, or USEPA, within a reasonable time, any requested information to determine compliance with this General Permit. The discharger shall also furnish, upon request, copies of records required to be kept by this General Permit.

8. Inspection and Entry

The discharger shall allow the RWQCB, SWRCB, USEPA, and/or, in the case of construction sites which discharge through a municipal separate storm sewer, an authorized representative of the municipal operator of the separate storm sewer system receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the discharger's premises at reasonable times where a regulated construction activity is being conducted or where records must be kept under the conditions of this General Permit;

b. Access and copy at reasonable times any records that must be kept under the conditions of this General Permit;

c. Inspect at reasonable times the complete construction site, including any off-site staging areas or material storage areas, and the erosion/sediment controls; and

d. Sample or monitor at reasonable times for the purpose of ensuring General Permit compliance.

9. Signatory Requirements

a. All Notice of Intents (NOIs), Notice of Terminations (NOTs), SWPPPs, certifications, and reports prepared in accordance with this Order submitted to the SWRCB shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (a) a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or (b) the manager of the construction activity if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer, ranking elected official, or duly authorized representative. The principal executive officer of a Federal agency includes the chief executive officer of the agency or the senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of USEPA).

b. All SWPPPs, reports, certifications, or other information required by the General Permit and/or requested by the RWQCB, SWRCB, USEPA, or the local storm water management agency shall be signed by a person described above or by a duly authorized representative. A person is a duly authorized representative if:

(1) The authorization is made in writing by a person described above and retained as part of the SWPPP; or

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the construction activity, such as the position of manager, operator, superintendent, or position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position).

c. If an authorization is no longer accurate because a different individual or position has responsibility for the overall operation of the construction activity, a new authorization must be attached to the SWPPP prior to submittal of any reports, information, or certifications to be signed by the authorized representative.

10. Certification

Any person signing documents under Section C, Provision 9 above, shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, 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."

11. Anticipated Noncompliance

The discharger will give advance notice to the RWQCB and local storm water management agency of any planned changes in the construction activity which may result in noncompliance with General Permit requirements.

12. Penalties for Falsification of Reports

Section 309(c)(4) of the CWA provides that any person who knowingly makes any false material statement, representation, or certification in any record or other document submitted or required to be maintained under this General Permit, including reports of compliance or noncompliance shall upon conviction, be punished by a fine of not more than $10,000 or by imprisonment for not more than two years or by both.

13. Oil and Hazardous Substance Liability

Nothing in this General Permit shall be construed to preclude the institution of any legal action or relieve the discharger from any responsibilities, liabilities, or penalties to which the discharger is or may be subject to under Section 311 of the CWA.

14. Severability

The provisions of this General Permit are severable; and, if any provision of this General Permit or the application of any provision of this General Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this General Permit shall not be affected thereby.

15. Reopener Clause

This General Permit may be modified, revoked and reissued, or terminated for cause due to promulgation of amended regulations, receipt of USEPA guidance concerning regulated activities, judicial decision, or in accordance with 40 Code of Federal Regulations (CFR) 122.62, 122.63, 122.64, and 124.5.

16. Penalties for Violations of Permit Conditions

a. Section 309 of the CWA provides significant penalties for any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the CWA or any permit condition or limitation implementing any such section in a permit issued under Section 402. Any person who violates any permit condition of this General Permit is subject to a civil penalty not to exceed $27,500 per calendar day of such violation, as well as any other appropriate sanction provided by Section 309 of the CWA.

b. The Porter-Cologne Water Quality Control Act also provides for civil and criminal penalties which in some cases are greater than those under the CWA.

17. Availability

A copy of this General Permit shall be maintained at the construction site during construction activity and be available to operating personnel.

18. Transfers

This General Permit is not transferable. A new owner of an ongoing construction activity must submit a NOI in accordance with the requirements of this General Permit to be authorized to discharge under this General Permit. An owner who sells property covered

by this General Permit shall inform the new owner of the duty to file a NOI and shall provide the new owner with a copy of this General Permit.

19. Continuation of Expired Permit

This General Permit continues in force and effect until a new General Permit is issued or the SWRCB rescinds this General Permit. Only those dischargers authorized to discharge under the expiring General Permit are covered by the continued General Permit.

Attachment 1

SWRCB AND RWQCB CONTACT LIST

Division of Water Quality
P.O. Box 1977
Sacramento, CA 95812-1977
(916) 341-5537 FAX: (916) 341-5543
Web Page: http://www.waterboards.ca.gov/stormwtr/index.html
Email: stormwater@waterboards.ca.gov

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARDS

NORTH COAST REGION (1)
5550 Skylane Blvd, Ste. A
Santa Rose, CA 95403
(707) 576-2220 FAX: (707)523-0135
http://www.waterboards.ca.gov/rwqcb1

SAN FRANCISCO BAY REGION (2)
1515 Clay Street, Ste. 1400
Oakland, CA 94612
(510) 622-2300 FAX: (510) 622-2640
http://www.waterboards.ca.gov/rwqcb2

CENTRAL COAST REGION (3)
895 Aerovista Place, Ste 101
San Luis Obispo, CA 93401
(805) 549-3147 FAX: (805) 543-0397
http://www.waterboards.ca.gov/rwqcb3

LOS ANGELES REGION (4)
320 W. 4th Street, Ste. 200
Los Angeles, CA 90013
(213) 576-6600 FAX: (213) 576-6640
http://www.waterboards.ca.gov/rwqcb4

CENTRAL VALLEY REGION (5S)
11020 Sun Center Dr., #200
Rancho Cordova, CA 95670-6114
(916) 464-3291 FAX: (916) 464-4645
http:www.waterboards.ca.gov/rwqcb5

FRESNO BRANCH OFFICE (5F)
1685 E St.
Fresno, CA 93706
(559) 445-5116 FAX: (559) 445-5910
http://www.waterboards.ca.gov/rwqcb5

REDDING BRANCH OFFICE (5R)
415 Knollcrest Drive, Ste. 100
Redding, CA 96002
(530) 224-4845 FAX: (530) 224-4857
http://www.waterboards.ca.gov/rwqcb5

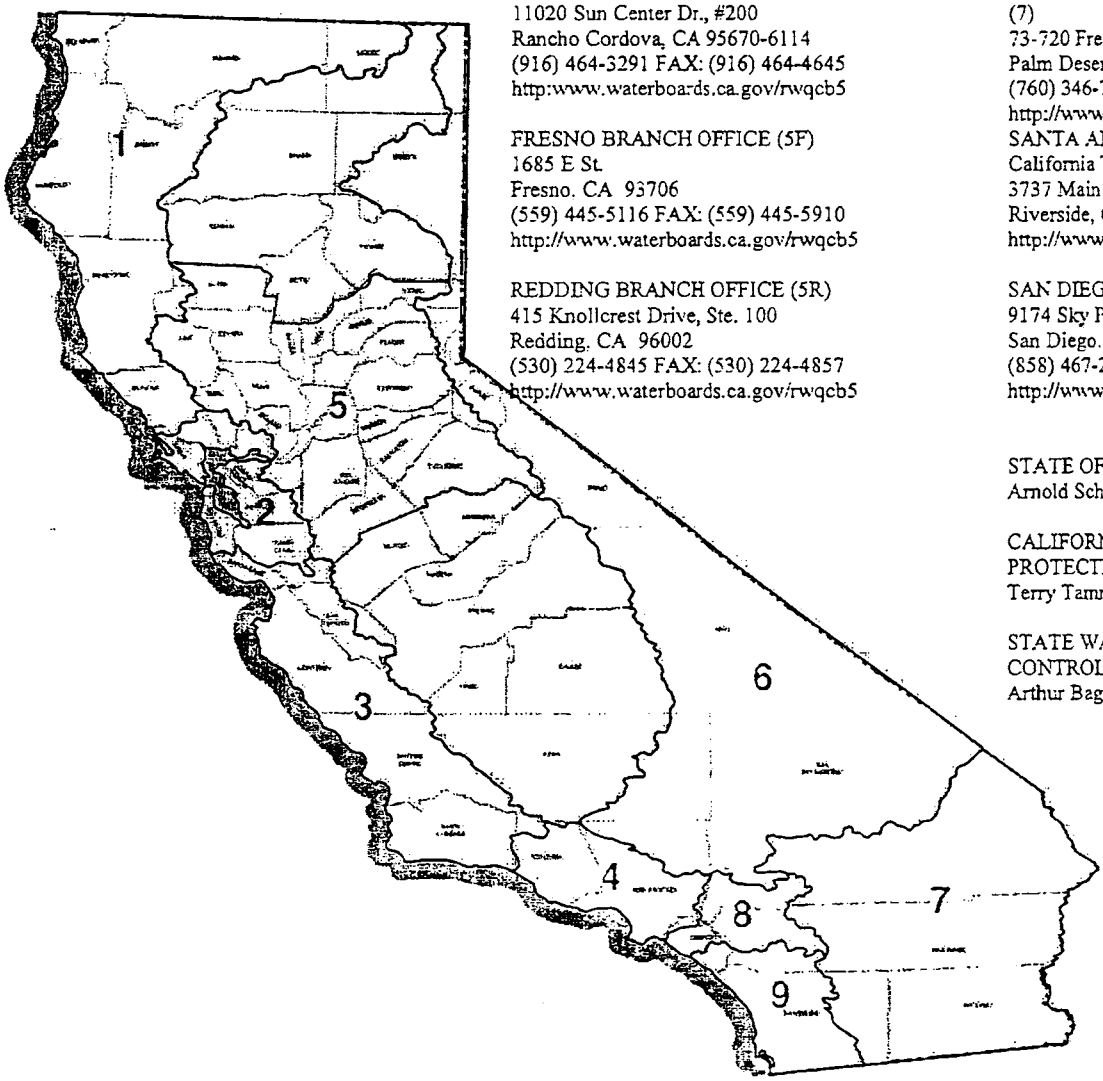
LAHONTAN REGION (6 SLT)
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
(530) 542-5400 FAX: (530) 544-2271
http://www.waterboards.ca.gov/rwqcb6

VICTORVILLE OFFICE (6V)
15428 Civic Drive, Ste. 100
Victorville, CA 92392-2383
(760) 241-6583 FAX: (760) 241-7308
http://www.waterboards.ca.gov/rwqcb6

COLORADO RIVER BASIN REGION (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491 FAX: (760) 341-6820
http://www.waterboards.ca.gov/rwqcb7

SANTA ANA REGION (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
http://www.waterboards.ca.gov/rwqcb8

SAN DIEGO REGION (9)
9174 Sky Park Court, Ste. 100
San Diego, CA 92123-4340
(858) 467-2952 FAX: (858) 571-6972
http://www.waterboards.ca.gov/rwqcb9



STATE OF CALIFORNIA
Arnold Schwarzenegger, Governor

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
Terry Tamminen, Secretary

STATE WATER RESOURCES CONTROL BOARD
Arthur Baggett Jr., Chairman

Appendix C - BMPs

Section 3
Erosion and Sediment Control BMPs

3.1 Erosion Control

Erosion control is any source control practice that protects the soil surface and prevents soil particles from being detached by rainfall, flowing water, or wind. Erosion control is also referred to as soil stabilization. Erosion control consists of preparing the soil surface and implementing one or more of the BMPs shown in Table 3-1, to disturbed soil areas.

Table 3-1 Erosion Control BMPs

BMP#	BMP Name
EC-1	Scheduling
EC-2	Preservation of Existing Vegetation
EC-3	Hydraulic Mulch
EC-4	Hydroseeding
EC-5	Soil Binders
EC-6	Straw Mulch
EC-7	Geotextiles & Mats
EC-8	Wood Mulching
EC-9	Earth Dikes and Drainage Swales
EC-10	Velocity Dissipation Devices
EC-11	Slope Drains
EC-12	Streambank Stabilization
EC-13	Polyacrylamide

All inactive soil-disturbed areas on the project site, and most active areas prior to the onset of rain, must be protected from erosion. Soil disturbed areas may include relatively flat areas as well as slopes. Typically, steep slopes and large exposed areas require the most robust erosion controls; flatter slopes and smaller areas still require protection, but less costly materials may be appropriate for these areas, allowing savings to be directed to the more robust BMPs for steep slopes and large exposed areas. To be effective, erosion control BMPs must be implemented at slopes and disturbed areas to protect them from concentrated flows.

Some erosion control BMPs can be used effectively to temporarily prevent erosion by concentrated flows. These BMPs, used alone or in combination, prevent erosion by intercepting, diverting, conveying, and discharging concentrated flows in a manner that prevents soil detachment and transport. Temporary concentrated flow conveyance controls may be required to direct run-on around or through the project in a non-erodible fashion. Temporary concentrated flow conveyance controls include the following BMPs:

- EC-9, Earth Dikes and Drainage Swales
- EC-10, Velocity Dissipation Devices
- EC-11, Slope Drains

3.2 Sediment Control

Sediment control is any practice that traps soil particles after they have been detached and moved by rain, flowing water, or wind. Sediment control measures are usually passive systems that rely on filtering or settling the particles out of the water or wind that is transporting them.

Sediment control practices include the BMPs listed in Table 3-2.

Table 3-2 Temporary Sediment Control BMPs

BMP#	BMP Name
SE-1	Silt Fence
SE-2	Sediment Basin
SE-3	Sediment Trap
SE-4	Check Dam
SE-5	Fiber Rolls
SE-6	Gravel Bag Berm
SE-7	Street Sweeping and Vacuuming
SE-8	Sandbag Barrier
SE-9	Straw Bale Barrier
SE-10	Storm Drain Inlet Protection
SE-11	Chemical Treatment

Sediment control BMPs include those practices that intercept and slow or detain the flow of stormwater to allow sediment to settle and be trapped. Sediment control practices can consist of installing linear sediment barriers (such as silt fence, sandbag barrier, and straw bale barrier); providing fiber rolls, gravel bag berms, or check dams to break up slope length or flow; or constructing a 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 soil stockpiles, and at other appropriate locations along the site perimeter.

A few BMPs may control both sediment and erosion, for example, fiber rolls and sand bag barriers. The authors of this handbook have classified these BMPs as either erosion control (EC) or sediment control (SC) based on the authors opinion on the BMPs most common and effective use.

Sediment control BMPs are most effective when used in conjunction with erosion control BMPs. The combination of erosion control and sediment control is usually the most effective means to prevent sediment from leaving the project site and potentially entering storm drains or receiving waters. Under most conditions, the General Permit requires that the discharger implement an effective combination of erosion and sediment controls.

Under limited circumstances, sediment control, alone may be appropriate. For example, applying erosion control BMPs to an area where excavation, filling, compaction, or grading is currently under way may not be feasible when storms come unexpectedly. Use of sediment controls by establishing perimeter control on these areas may be appropriate and allowable under the General Permit provided the following conditions are met.

- Weather monitoring is under way.
- Inactive soil-disturbed areas have been protected with an effective combination of erosion and sediment controls.

- An adequate supply of sediment control materials are stored on-site and there are sufficient forces of labor and equipment available to implement sediment controls on the active area prior to the onset of rain.
- The SWPPP adequately describes the methods to protect active areas.

3.3 Wind Erosion Control

Wind erosion control consists of applying water or other dust palliatives to prevent or alleviate dust nuisance. Wind erosion control best management practices (BMPs) are shown in Table 3-3.

Table 3-3 Wind Erosion Control BMPs

BMP#	BMP Name
WE-1	Wind Erosion Control

Other BMPs that are sometimes applied to disturbed soil areas in order to control wind erosion are BMPs EC-2 through EC-7, shown in Section 3.1 of this Manual. Be advised that many of the dust palliatives may contain compounds that have an unknown effect on stormwater. A sampling and analysis protocol to test for stormwater contamination from exposure to such compounds is required in the SWPPP.

3.4 Tracking Control BMPs

Tracking control consists of preventing or reducing the tracking of sediment off-site by vehicles leaving the construction area. Tracking control best management practices (BMPs) are shown in Table 3-4.

Table 3-4 Temporary Tracking Control BMPs

BMP #	BMP Name
TR-1	Stabilized Construction Entrance/ Exit
TR-2	Stabilized Construction Roadway
TR-3	Entrance/Outlet Tire Wash

Attention to control of tracking sediment off site is highly recommended, as dirty streets and roads near a construction site create a nuisance to the public and generate constituent complaints to elected officials and regulators. These complaints often result in immediate inspections and regulatory actions.

3.5 Erosion and Sediment Control BMP Fact Sheet Format

A BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the above activities are provided in Section 3.6.

The fact sheets also contain side bar presentations with information on BMP objectives, targeted constituents, removal effectiveness, and potential alternatives.

EC-xx Example Fact Sheet

Description and Purpose

Suitable Applications

Limitations

Implementation

Costs

Inspection and Maintenance

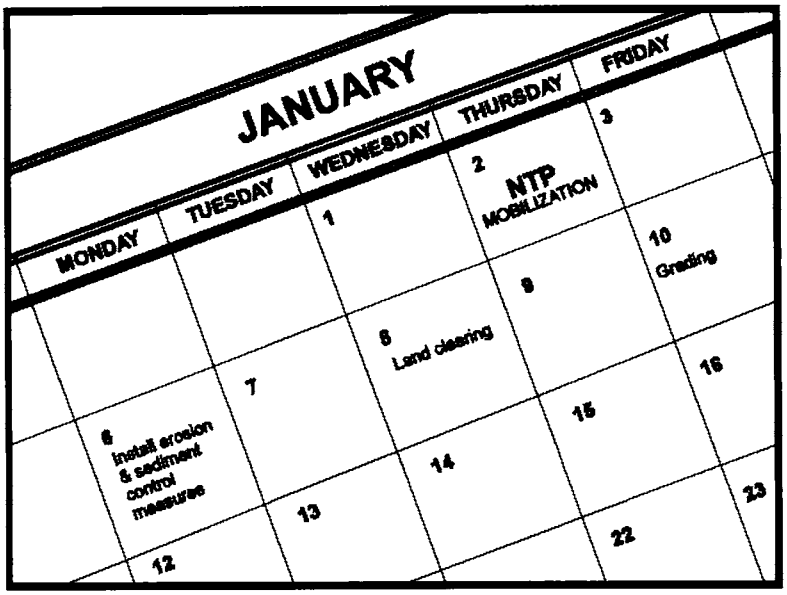
References

Figure 3-1
Example Fact Sheet

3.6 BMP Fact Sheets

BMP fact sheets for erosion, sediment, wind, and tracking controls follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusion in SWPPPs. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook web site at www.cabmphandbooks.com.

Scheduling EC-1



Objectives

EC	Erosion Control	☑
SE	Sediment Control	☒
TR	Tracking Control	☒
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Scheduling is the development of a written plan that includes sequencing of construction activities and the implementation of BMPs such as erosion control and sediment control while taking local climate (rainfall, wind, etc.) into consideration. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, and to perform the construction activities and control practices in accordance with the planned schedule.

Suitable Applications

Proper sequencing of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season. Use of other, more costly yet less effective, erosion and sediment control BMPs may often be reduced through proper construction sequencing.

Limitations

- Environmental constraints such as nesting season prohibitions reduce the full capabilities of this BMP.

Implementation

- Avoid rainy periods. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.
- Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates to soil

disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPPP.

- Include on the schedule, details on the rainy season implementation and deployment of:
  - Erosion control BMPs
  - Sediment control BMPs
  - Tracking control BMPs
  - Wind erosion control BMPs
  - Non-stormwater BMPs
  - Waste management and materials pollution control BMPs
- Include dates for activities that may require non-stormwater discharges such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, hydro-demolition, mortar mixing, pavement cleaning, etc.
- Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring utilities installation, etc., to minimize the active construction area during the rainy season.
  - Sequence trenching activities so that most open portions are closed before new trenching begins.
  - Incorporate staged seeding and re-vegetation of graded slopes as work progresses.
  - Schedule establishment of permanent vegetation during appropriate planting time for specified vegetation.
- Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation.
- Monitor the weather forecast for rainfall.
- When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain.
- Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry seasons by un-seasonal rainfall, wind, and vehicle tracking. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition.
- Apply permanent erosion control to areas deemed substantially complete during the project's defined seeding window.

Costs

Construction scheduling to reduce erosion may increase other construction costs due to reduced economies of scale in performing site grading. The cost effectiveness of scheduling techniques should be compared with the other less effective erosion and sedimentation controls to achieve a cost effective balance.

Inspection and Maintenance

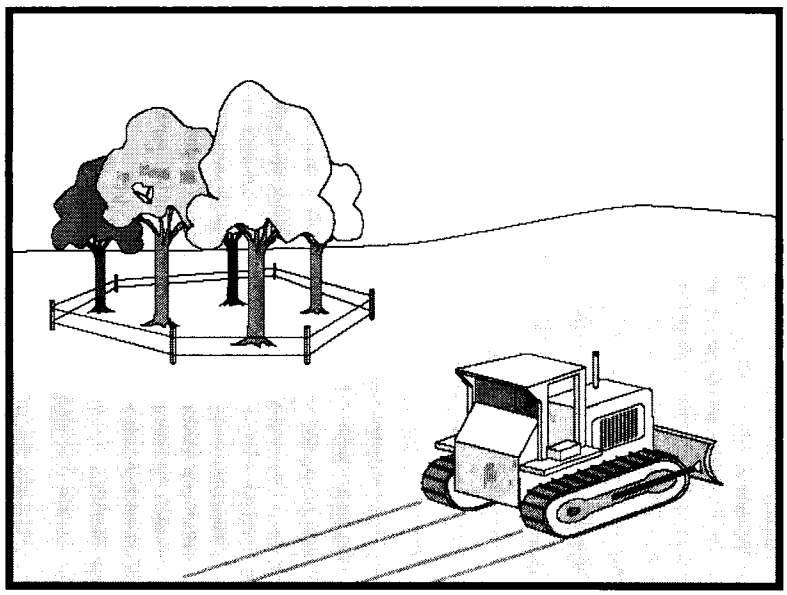
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005), U.S. Environmental Protection Agency, Office of Water, September 1992.

Preservation Of Existing Vegetation EC-2



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Suitable Applications

Preservation of existing vegetation is suitable for use on most projects. Large project sites often provide the greatest opportunity for use of this BMP. Suitable applications include the following:

- Areas within the site where no construction activity occurs, or occurs at a later date. This BMP is especially suitable to multi year projects where grading can be phased.
- Areas where natural vegetation exists and is designated for preservation. Such areas often include steep slopes, watercourse, and building sites in wooded areas.
- Areas where local, state, and federal government require preservation, such as vernal pools, wetlands, marshes, certain oak trees, etc. These areas are usually designated on the plans, or in the specifications, permits, or environmental documents.
- Where vegetation designated for ultimate removal can be temporarily preserved and be utilized for erosion control and sediment control.

EC-2 Preservation Of Existing Vegetation

Limitations

- Requires forward planning by the owner/developer, contractor, and design staff.
- Limited opportunities for use when project plans do not incorporate existing vegetation into the site design.
- For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development.

Implementation

The best way to prevent erosion is to not disturb the land. In order to reduce the impacts of new development and redevelopment, projects may be designed to avoid disturbing land in sensitive areas of the site (e.g., natural watercourses, steep slopes), and to incorporate unique or desirable existing vegetation into the site's landscaping plan. Clearly marking and leaving a buffer area around these unique areas during construction will help to preserve these areas as well as take advantage of natural erosion prevention and sediment trapping.

Existing vegetation to be preserved on the site must be protected from mechanical and other injury while the land is being developed. The purpose of protecting existing vegetation is to ensure the survival of desirable vegetation for shade, beautification, and erosion control. Mature vegetation has extensive root systems that help to hold soil in place, thus reducing erosion. In addition, vegetation helps keep soil from drying rapidly and becoming susceptible to erosion. To effectively save existing vegetation, no disturbances of any kind should be allowed within a defined area around the vegetation. For trees, no construction activity should occur within the drip line of the tree.

Timing

- Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other soil disturbing activities in areas where no construction activity is planned or will occur at a later date.

Design and Layout

- Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots.
  - Orange colored plastic mesh fencing works well.
  - Use appropriate fence posts and adequate post spacing and depth to completely support the fence in an upright position.
- Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass.
- Consider the impact of grade changes to existing vegetation and the root zone.
- Maintain existing irrigation systems where feasible. Temporary irrigation may be required.
- Instruct employees and subcontractors to honor protective devices. Prohibit heavy equipment, vehicular traffic, or storage of construction materials within the protected area.

Costs

There is little cost associated with preserving existing vegetation if properly planned during the project design, and these costs may be offset by aesthetic benefits that enhance property values. During construction, the cost for preserving existing vegetation will likely be less than the cost of applying erosion and sediment controls to the disturbed area. Replacing vegetation inadvertently destroyed during construction can be extremely expensive, sometimes in excess of $10,000 per tree.

Inspection and Maintenance

During construction, the limits of disturbance should remain clearly marked at all times. Irrigation or maintenance of existing vegetation should be described in the landscaping plan. If damage to protected trees still occurs, maintenance guidelines described below should be followed:

- Verify that protective measures remain in place. Restore damaged protection measures immediately.
- Serious tree injuries shall be attended to by an arborist.
- Damage to the crown, trunk, or root system of a retained tree shall be repaired immediately.
- Trench as far from tree trunks as possible, usually outside of the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentrations. If roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18 in. below the ground surface, and not below the tree center to minimize impact on the roots.
- Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill.
- Cleanly remove the ends of damaged roots with a smooth cut.
- Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots.
- If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged area as much as possible.
- Aerate soil that has been compacted over a trees root zone by punching holes 12 in. deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in. apart throughout the area of compacted soil under the tree crown.
- Fertilization
  - Fertilize stressed or damaged broadleaf trees to aid recovery.
  - Fertilize trees in the late fall or early spring.

- Apply fertilizer to the soil over the feeder roots and in accordance with label instructions, but never closer than 3 ft to the trunk. Increase the fertilized area by one-fourth of the crown area for conifers that have extended root systems.

- Retain protective measures until all other construction activity is complete to avoid damage during site cleanup and stabilization.

References

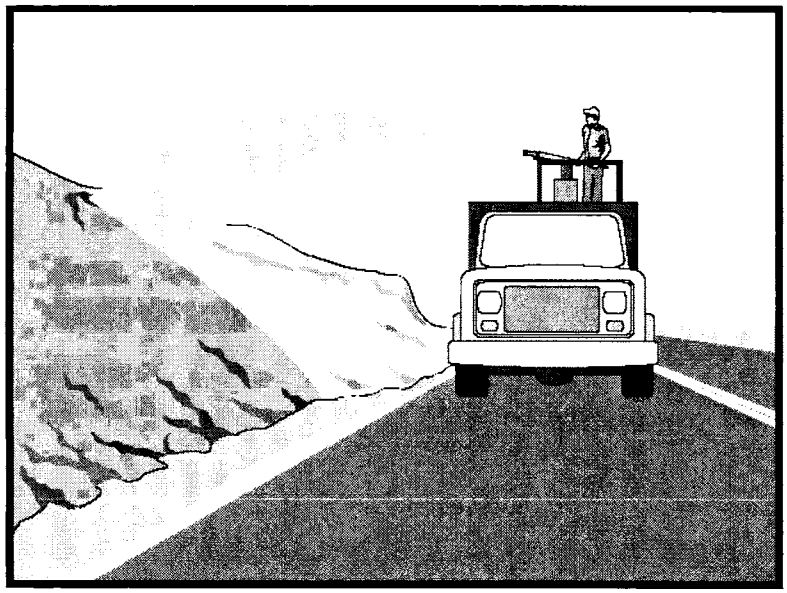
County of Sacramento Tree Preservation Ordinance, September 1981.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for The Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydraulic Mulch EC-3



Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-4 Hydroseeding
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Hydraulic mulch consists of applying a mixture of shredded wood fiber or a hydraulic matrix, and a stabilizing emulsion or tackifier with hydro-mulching equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.

Suitable Applications

Hydraulic mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

Wood fiber hydraulic mulches are generally short lived and need 24 hours to dry before rainfall occurs to be effective. May require a second application in order to remain effective for an entire rainy season.

Implementation

- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking. Track walking shall only be used where other methods are impractical.
- To be effective, hydraulic matrices require 24 hours to dry before rainfall occurs.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

- Paper based hydraulic mulches alone shall not be used for erosion control.

Hydraulic Mulches

Wood fiber mulch can be applied alone or as a component of hydraulic matrices. Wood fiber applied alone is typically applied at the rate of 2,000 to 4,000 lb/acre. Wood fiber mulch is manufactured from wood or wood waste from lumber mills or from urban sources.

Hydraulic Matrices

Hydraulic matrices include a mixture of wood fiber and acrylic polymer or other tackifier as binder. Apply as a liquid slurry using a hydraulic application machine (i.e., hydro seeder) at the following minimum rates, or as specified by the manufacturer to achieve complete coverage of the target area: 2,000 to 4,000 lb/acre wood fiber mulch, and 5 to 10% (by weight) of tackifier (acrylic copolymer, guar, psyllium, etc.)

Bonded Fiber Matrix

Bonded fiber matrix (BFM) is a hydraulically applied system of fibers and adhesives that upon drying forms an erosion resistant blanket that promotes vegetation, and prevents soil erosion. BFMs are typically applied at rates from 3,000 lb/acre to 4,000 lb/acre based on the manufacturer's recommendation. A biodegradable BFM is composed of materials that are 100% biodegradable. The binder in the BFM should also be biodegradable and should not dissolve or disperse upon re-wetting. Typically, biodegradable BFMs should not be applied immediately before, during or immediately after rainfall if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Costs

Average cost for installation of wood fiber mulch is $900/acre. Average cost for installation of BFM is $5,500/acre.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.

References

Controlling Erosion of Construction Sites Agricultural Information #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

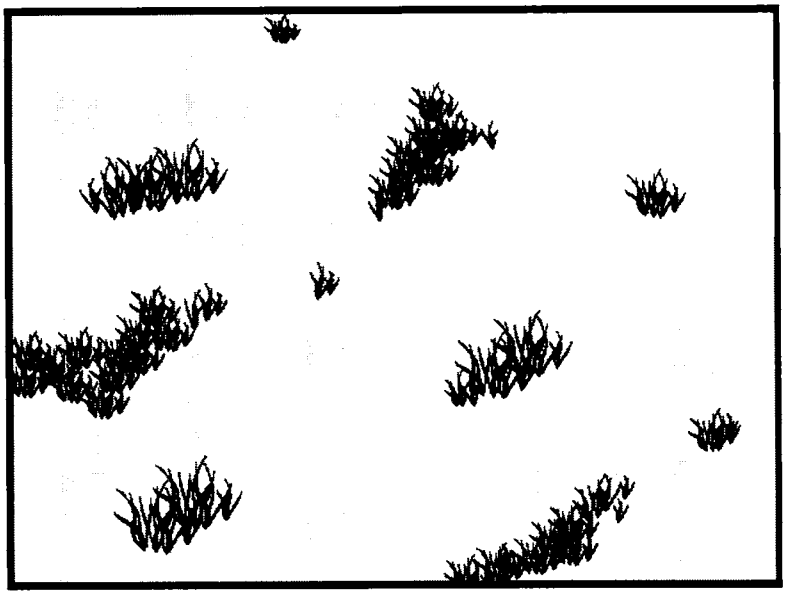
Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Hydroseeding EC-4



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Hydroseeding typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily protect exposed soils from erosion by water and wind.

Suitable Applications

Hydroseeding is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

Limitations

- Hydroseeding may be used alone only when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control. Otherwise, hydroseeding must be used in conjunction with mulching (i.e., straw mulch).
- Steep slopes are difficult to protect with temporary seeding.
- Temporary seeding may not be appropriate in dry periods without supplemental irrigation.
- Temporary vegetation may have to be removed before permanent vegetation is applied.
- Temporary vegetation is not appropriate for short term inactivity.

Implementation

In order to select appropriate hydroseeding mixtures, an evaluation of site conditions shall be performed with respect to:

- Soil conditions
- Site topography
- Season and climate
- Vegetation types
- Maintenance requirements
- Sensitive adjacent areas
- Water availability
- Plans for permanent vegetation

The local office of the U.S.D.A. Natural Resources Conservation Service (NRCS) is an excellent source of information on appropriate seed mixes.

The following steps shall be followed for implementation:

- Avoid use of hydroseeding in areas where the BMP would be incompatible with future earthwork activities and would have to be removed.
- Hydroseeding can be accomplished using a multiple step or one step process. The multiple step process ensures maximum direct contact of the seeds to soil. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil.
- Prior to application, roughen the area to be seeded with the furrows trending along the contours.
- Apply a straw mulch to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.
- All seeds shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed shall be pellet inoculated. Inoculant sources shall be species specific and shall be applied at a rate of 2 lb of inoculant per 100 lb seed.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer shall be pelleted or granular form.
- Follow up applications shall be made as needed to cover weak spots and to maintain adequate soil protection.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average cost for installation and maintenance may vary from as low as $300 per acre for flat slopes and stable soils, to $1600 per acre for moderate to steep slopes and/or erosive soils.

Hydroseeding		Installed Cost per Acre
High Density	Ornamentals	$400 - $1600
	Turf Species	$350
	Bunch Grasses	$300 - $1300
Fast Growing	Annual	$350 - $650
	Perennial	$300 - $800
Non-Competing	Native	$300 - $1600
	Non-Native	$400 - $500
Sterile	Cereal Grain	$500

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

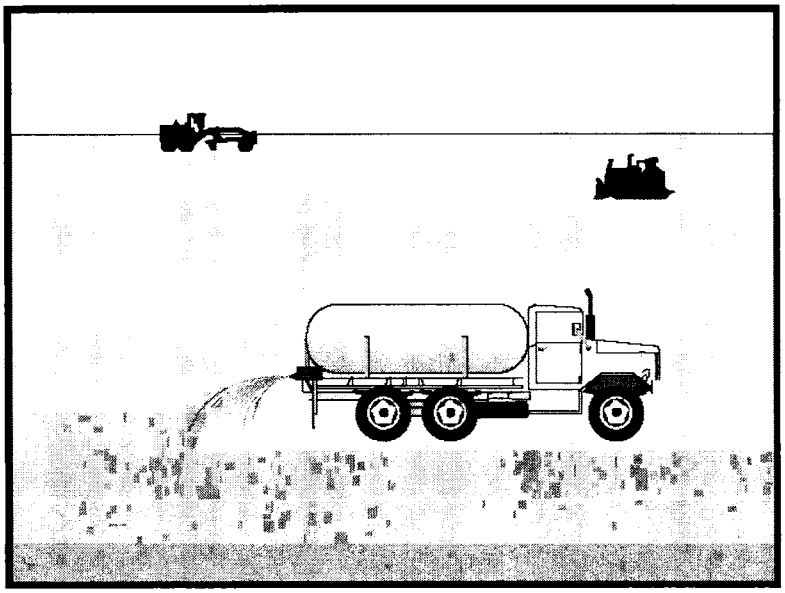
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Where seeds fail to germinate, or they germinate and die, the area must be re-seeded, fertilized, and mulched within the planting season, using not less than half the original application rates.
- Irrigation systems, if applicable, should be inspected daily while in use to identify system malfunctions and line breaks. When line breaks are detected, the system must be shut down immediately and breaks repaired before the system is put back into operation.
- Irrigation systems shall be inspected for complete coverage and adjusted as needed to maintain complete coverage.

References

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders EC-5



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water induced erosion of exposed soils on construction sites. Soil binders also prevent wind erosion.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring short term temporary protection. Because soil binders can often be incorporated into the work, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are also suitable for use on stockpiles.

Limitations

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer. Curing time may be 24 hours or longer. Soil binders may need reapplication after a storm event.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.

- Soil binders do not hold up to pedestrian or vehicular traffic across treated areas.
- Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted.
- Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- Soil binders may not cure if low temperatures occur within 24 hours of application.
- The water quality impacts of soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup.
- A sampling and analysis plan must be incorporated into the SWPPP as soil binders could be a source of non-visible pollutants.

Implementation

General Considerations

- Regional soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces. Soil binders should not pollute stormwater.
- Some soil binders may not be compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this BMP. Use Table 1 to select an appropriate soil binder. Refer to WE-1, Wind Erosion Control, for dust control soil binders.

Factors to consider when selecting a soil binder include the following:

- Suitability to situation - Consider where the soil binder 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 soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor for the listed soil binders.
- Soil types and surface materials - Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.
- 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 soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

Plant-Material Based (Short Lived) Binders

Guar: Guar is a non-toxic, biodegradable, natural galactomannan based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lb per 1,000 gallons. Recommended minimum application rates are as follows:

Application Rates for Guar Soil Stabilizer

Slope (H:V):	Flat	4:1	3:1	2:1	1:1
lb/acre:	40	45	50	60	70

Psyllium: Psyllium is composed of the finely ground muciloid coating of plantago seeds that is applied as a dry powder or in a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lb/acre, with enough water in solution to allow for a uniform slurry flow.

Starch: Starch is non-ionic, cold water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material Based (Long Lived) Binders

Pitch and Rosin Emulsion: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48%. The rosin should be a minimum of 26% of the total solids content. The soil stabilizer should be non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

- For clayey soil: 5 parts water to 1 part emulsion
- For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

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

Liquid Polymers of Methacrylates and Acrylates: This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100% acrylic emulsion blend of 40% solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.

Copolymers of Sodium Acrylates and Acrylamides: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient:

Slope Gradient (H:V)	lb/acre
Flat to 5:1	3.0 – 5.0
5:1 to 3:1	5.0 – 10.0
2:2 to 1:1	10.0 – 20.0

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 11lb/1,000 gal of water and applied at the rate of 5.0 lb/acre.

Hydro-Colloid Polymers: Hydro-Colloid Polymers are various combinations of dry flowable poly-acrylamides, copolymers and hydro-colloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

Cementitious-Based Binders

Gypsum: This is a formulated gypsum based product that readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86%. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Applying Soil Binders

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

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 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.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.
- For liquid agents:
  - Crown or slope ground to avoid ponding.
  - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd^2 or according to manufacturer's recommendations.
  - Apply solution under pressure. Overlap solution 6 to 12 in.
  - Allow treated area to cure for the time recommended by the manufacturer; typically at least 24 hours.
  - Apply second treatment before first treatment becomes ineffective, using 50% application rate.
  - In low humidities, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd^2.

Costs

Costs vary according to the soil stabilizer selected for implementation. The following are approximate costs:

Soil Binder	Cost per Acre
Plant-Material Based (Short Lived) Binders	$400
Plant-Material Based (Long Lived) Binders	$1,200
Polymeric Emulsion Blend Binders	$400 (1)
Cementitious-Based Binders	$800

(1) $1,200 for Acrylic polymers and copolymers

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- Reapply the selected soil binder as needed to maintain effectiveness.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Sedimentation and Erosion Control, An Inventory of Current Practices Draft, US EPA, April 1990.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

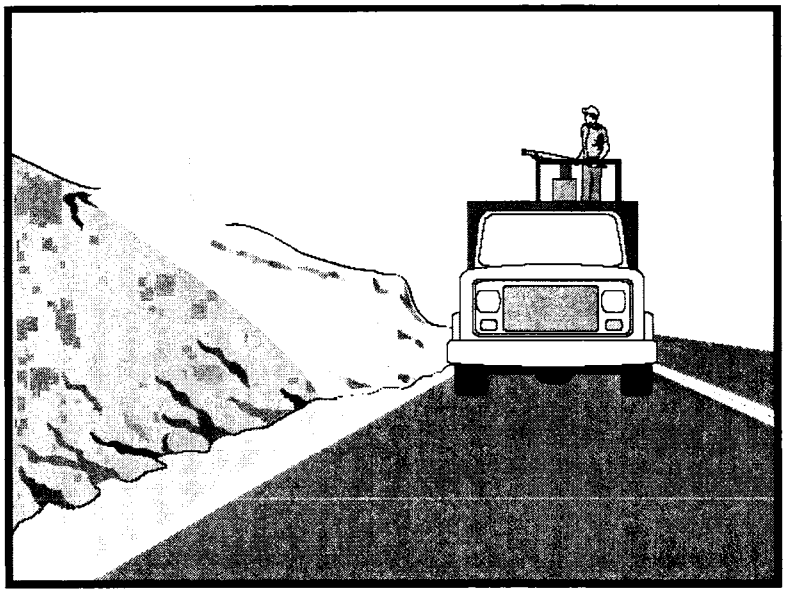
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Table 1 Properties of Soil Binders for Erosion Control

Evaluation Criteria	Binder Type			
	Plant Material Based (Short Lived)	Plant Material Based (Long Lived)	Polymeric Emulsion Blends	Cementitious-Based Binders
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 (1)	Varies (1)	Varies (1)	4,000 to 12,000 lbs/acre

(1) See Implementation for specific rates.

Straw Mulch EC-6



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-7 Geotextiles and Mats
EC-8 Wood Mulching

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a tackifier stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Suitable Applications

Straw mulch is suitable for soil disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch is typically used for erosion control on disturbed areas until soils can be prepared for permanent vegetation. Straw mulch is also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment.

Limitations

- Availability of straw and straw blowing equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- There is a potential for introduction of weed seed and unwanted plant material.
- When straw blowers are used to apply straw mulch, the treatment areas must be within 150 ft of a road or surface capable of supporting trucks.
- Straw mulch applied by hand is more time intensive and potentially costly.

- Wind may limit application of straw and blow straw into undesired locations.
- May have to be removed prior to permanent seeding or prior to further earthwork.
- "Punching" of straw does not work in sandy soils, necessitating the use of tackifiers.

Implementation

- Straw shall be derived from wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw shall be used.
- A tackifier is the preferred method for anchoring straw mulch to the soil on slopes.
- Crimping, punch roller-type rollers, or track walking may also be used to incorporate straw mulch into the soil on slopes. Track walking shall only be used where other methods are impractical.
- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Straw mulch with tackifier shall not be applied during or immediately before rainfall.
- In San Diego, use of straw near wood framed home construction has been frowned on by the Fire Marshall.

Application Procedures

- Apply straw at a minimum rate of 4,000 lb/acre, either by machine or by hand distribution.
- Roughen embankments and fill rills before placing the straw mulch by rolling with a crimping or punching type roller or by track walking.
- Evenly distribute straw mulch on the soil surface.
- Anchor straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating). Alternatively, use a tackifier to adhere straw fibers.
- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - On small areas, a spade or shovel can be used to punch in straw mulch.
  - On slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be "punched" into the ground using a knife blade roller or a straight bladed coulter, known commercially as a "crimper".
  - On small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextile pins or wooden stakes as described in EC-7, Geotextiles and Mats.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier shall be selected based on longevity and ability to hold the fibers in place. A tackifier is

typically applied at a rate of 125 lb/acre. In windy conditions, the rates are typically 180 lb/acre.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is $2,500 per acre. Application by hand is more time intensive and potentially costly.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives.
- Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas.
- Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

References

Controlling Erosion of Construction Sites, Agricultural Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

Guides for Erosion and Sediment Control in California, USDA Soils Conservation Service, January 1991.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

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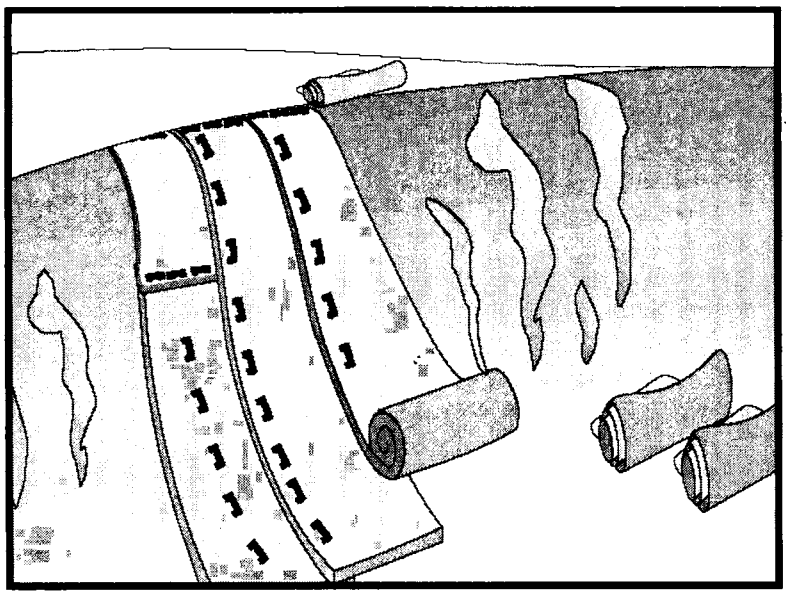
Geotextiles and Mats EC-7



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	3
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-6 Straw Mulch
EC-8 Wood Mulching

Description and Purpose

Mattings of natural materials are used to cover the soil surface to reduce erosion from rainfall impact, hold soil in place, and absorb and hold moisture near the soil surface. Additionally, matting may be used to stabilize soils until vegetation is established.

Suitable Applications

Mattings are commonly applied on short, steep slopes where erosion hazard is high and vegetation will be slow to establish. Mattings are also used on stream banks where moving water at velocities between 3 ft/s and 6 ft/s are likely to wash out new vegetation, and in areas where the soil surface is disturbed and where existing vegetation has been removed. Matting may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). Erosion control matting should be considered when the soils are fine grained and potentially erosive. These measures should be considered in the following situations.

- Steep slopes, generally steeper than 3:1 (H:V)
- Slopes where the erosion potential is high
- Slopes and disturbed soils where mulch must be anchored
- Disturbed areas where plants are slow to develop
- Channels with flows exceeding 3.3 ft/s

- Channels to be vegetated
- Stockpiles
- Slopes adjacent to water bodies of Environmentally Sensitive Areas (ESAs)

Limitations

- Properly installed mattings provide excellent erosion control but do so at relatively high cost. This high cost typically limits the use of mattings to areas of concentrated channel flow and steep slopes.
- Mattings are more costly than other BMP practices, limiting their use to areas where other BMPs are ineffective (e.g. channels, steep slopes).
- Installation is critical and requires experienced contractors. The contractor should install the matting material in such a manner that continuous contact between the material and the soil occurs.
- Geotextiles and Mats may delay seed germination, due to reduction in soil temperature.
- Blankets and mats are generally not suitable for excessively rocky sites or areas where the final vegetation will be mowed (since staples and netting can catch in mowers).
- Blankets and mats must be removed and disposed of prior to application of permanent soil stabilization measures.
- Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.
- Plastic results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.
- The use of plastic should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until alternative measures, such as seeding and mulching, may be installed.
- Geotextiles, mats, plastic covers, and erosion control covers have maximum flow rate limitations; consult the manufacturer for proper selection.
- Not suitable for areas that have heavy foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.

Implementation

Material Selection

Organic matting materials have been found to be effective where re-vegetation will be provided by re-seeding. The choice of matting should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

The following natural and synthetic mattings are commonly used:

Geotextiles

- Material should be a woven polypropylene fabric with minimum thickness of 0.06 in., minimum width of 12 ft and should have minimum tensile strength of 150 lbs (warp), 80 lbs (fill) in conformance with the requirements in ASTM Designation: D 4632. The permittivity of the fabric should be approximately 0.07 sec^{-1} in conformance with the requirements in ASTM Designation: D4491. The fabric should have an ultraviolet (UV) stability of 70 percent in conformance with the requirements in ASTM designation: D4355. Geotextile blankets must be secured in place with wire staples or sandbags and by keying into tops of slopes to prevent infiltration of surface waters under geotextile. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Geotextiles may be reused if they are suitable for the use intended.

Plastic Covers

- Plastic sheeting should have a minimum thickness of 6 mils, and must 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 should be at least a 12 in. to 24 in. overlap of all seams. Edges should be embedded a minimum of 6 in. in soil.

- All sheeting must be inspected periodically after installation and after significant rainstorms to check for erosion, undermining, and anchorage failure. Any failures must be repaired immediately. If washout or breakages occur, the material should 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 should be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

  - **Excelsior** (curled wood fiber) blanket material should consist of machine produced mats of curled wood excelsior with 80 percent of the fiber 6 in. or longer. The excelsior blanket should be of consistent thickness. The wood fiber must be evenly distributed over the entire area of the blanket. The top surface of the blanket should be covered with a photodegradable extruded plastic mesh. The blanket should be smolder resistant without the use of chemical additives and should be non-toxic and non-injurious to plant and animal life. Excelsior blankets should be furnished in rolled strips, a minimum of 48 in. wide, and should have an average weight of 0.8 lb/yd^2, ±10 percent, at the time of manufacture. Excelsior blankets must be secured in place with wire staples. Staples

should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- **Straw blanket** should be machine produced mats of straw with a lightweight biodegradable netting top layer. The straw should be attached to the netting with biodegradable thread or glue strips. The straw blanket should be of consistent thickness. The straw should be evenly distributed over the entire area of the blanket. Straw blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should 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 must be secured to the ground with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Coconut fiber blanket** should be a machine produced mat of 100 percent coconut fiber with biodegradable netting on the top and bottom. The coconut fiber should be attached to the netting with biodegradable thread or glue strips. The coconut fiber blanket should be of consistent thickness. The coconut fiber should be evenly distributed over the entire area of the blanket. Coconut fiber blanket should be furnished in rolled strips with a minimum of 6.5 ft wide, a minimum of 80 ft. long and a minimum of 0.5 lb/yd^2. Coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should 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 must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Straw coconut fiber blanket** should be machine produced mats of 70 percent straw and 30 percent coconut fiber with a biodegradable netting top layer and a biodegradable bottom net. The straw and coconut fiber should be attached to the netting with biodegradable thread or glue strips. The straw coconut fiber blanket should be of consistent thickness. The straw and coconut fiber should be evenly distributed over the entire area of the blanket. Straw coconut fiber blanket should be furnished in rolled strips a minimum of 6.5 ft wide, a minimum of 80 ft long and a minimum of 0.5 lb/yd^2. Straw coconut fiber blankets must be secured in place with wire staples. Staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.

- Non-biodegradable RECPs are typically composed of polypropylene, polyethylene, nylon or other synthetic fibers. In some cases, a combination of biodegradable and synthetic fibers is used to construct the RECP. Netting used to hold these fibers together is typically non-biodegradable as well.

- **Plastic netting** is a lightweight biaxially oriented netting designed for securing loose mulches like straw or paper to soil surfaces to establish vegetation. The netting is photodegradable. The netting is supplied in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Plastic mesh** is an open weave geotextile that is composed of an extruded synthetic fiber woven into a mesh with an opening size of less than ¼ in. It is used with re-vegetation or may be used to secure loose fiber such as straw to the ground. The material is supplied in rolled strips, which must be secured to the soil with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Synthetic fiber with netting** is a mat that is composed of durable synthetic fibers treated to resist chemicals and ultraviolet light. The mat is a dense, three dimensional mesh of synthetic (typically polyolefin) fibers stitched between two polypropylene nets. The mats are designed to be re-vegetated and provide a permanent composite system of soil, roots, and geomatrix. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Bonded synthetic fibers** consist of a three dimensional geomatrix nylon (or other synthetic) matting. Typically it has more than 90 percent open area, which facilitates root growth. It's tough root reinforcing system anchors vegetation and protects against hydraulic lift and shear forces created by high volume discharges. It can be installed over prepared soil, followed by seeding into the mat. Once vegetated, it becomes an invisible composite system of soil, roots, and geomatrix. The material is furnished in rolled strips that must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

- **Combination synthetic and biodegradable RECPs** consist of biodegradable fibers, such as wood fiber or coconut fiber, with a heavy polypropylene net stitched to the top and a high strength continuous filament geomatrix or net stitched to the bottom. The material is designed to enhance re-vegetation. The material is furnished in rolled strips, which must be secured with U-shaped staples or stakes in accordance with manufacturers' recommendations.

Site Preparation

- Proper site preparation is essential to ensure complete contact of the blanket or matting with the soil.
- Grade and shape the area of installation.
- Remove all rocks, clods, vegetation or other obstructions so that the installed blankets or mats will have complete, direct contact with the soil.
- Prepare seedbed by loosening 2 to 3 in. of topsoil.

Seeding

Seed the area before blanket installation for erosion control and revegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket

installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

Fertilize and seed in accordance with seeding specifications or other types of landscaping plans. When using jute matting on a seeded area, apply approximately half the seed before laying the mat and the remainder after laying the mat. The protective matting can be laid over areas where grass has been planted and the seedlings have emerged. Where vines or other ground covers are to be planted, lay the protective matting first and then plant through matting according to design of planting.

Check Slots

Check slots are made of glass fiber strips, excelsior matting strips or tight folded jute matting blanket or strips for use on steep, highly erodible watercourses. The check slots are placed in narrow trenches 6 to 12 in. deep across the channel and left flush with the soil surface. They are to cover the full cross section of designed flow.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the friable seedbed made free from clods, rocks, and roots. The surface should be compacted and finished according to the requirements of the manufacturer's recommendations.
- Mechanical or manual lay down equipment should be capable of handling full rolls of fabric and laying the fabric smoothly without wrinkles or folds. The equipment should meet the fabric manufacturer's recommendations or equivalent standards.

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.
- Wire staples should be made of minimum 11 gauge steel wire and should be U-shaped with 8 in. legs and 2 in. crown.
- Metal stake pins should be 0.188 in. diameter steel with a 1.5 in. steel washer at the head of the pin, and 8 in. in length.
- Wire staples and metal stakes should be driven flush to the soil surface.

Installation on Slopes

Installation should 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 2 to 3 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 should be placed down the center and staggered with the staples placed along the edges. Steep slopes, 1:1 (H:V) to 2:1 (H:V), require a minimum of 2 staples/yd^2. Moderate slopes, 2:1 (H:V) to 3:1 (H:V), require a minimum of 1 ½ staples/yd^2.

Installation in Channels

Installation should 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 trenches 4 in. deep and 4 in. wide along each side of the installation to bury edges of matting, whenever possible extend matting 2 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 3 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 3 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 to 30 ft. intervals in lieu of excavated check slots.
- Staple shingled lap spliced ends a minimum of 12 in. apart on 12 in. intervals.
- Place edges of outside mats in previously excavated longitudinal slots; anchor using prescribed staple pattern, backfill, and compact soil.
- Anchor, fill, and compact upstream end of mat in a 12 in. by 6 in. terminal trench.

- Secure mat to ground surface using U-shaped wire staples, geotextile pins, or wooden stakes.
- Seed and fill turf reinforcement matting with soil, if specified.

Soil Filling (if specified for turf reinforcement)

- Always consult the manufacturer's recommendations for installation.
- Do not drive tracked or heavy equipment over mat.
- Avoid any traffic over matting if loose or wet soil conditions exist.
- Use shovels, rakes, or brooms for fine grading and touch up.
- Smooth out soil filling just exposing top netting of mat.

Temporary Soil Stabilization Removal

- Temporary soil stabilization removed from the site of the work must be disposed of if necessary.

Costs

Relatively high compared to other BMPs. Biodegradable materials: $0.50 - $0.57/yd^2. Permanent materials: $3.00 - $4.50/yd^2. Staples: $0.04 - $0.05/staple. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		Installed Cost per Acre
Biodegradable	Jute Mesh	$6,500
	Curled Wood Fiber	$10,500
	Straw	$8,900
	Wood Fiber	$8,900
	Coconut Fiber	$13,000
	Coconut Fiber Mesh	$31,200
	Straw Coconut Fiber	$10,900
Non-Biodegradable	Plastic Netting	$2,000
	Plastic Mesh	$3,200
	Synthetic Fiber with Netting	$34,800
	Bonded Synthetic Fibers	$50,000
	Combination with Biodegradable	$32,000

Source: Caltrans Guidance for Soil Stabilization for Temporary Slopes, Nov. 1999

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- If washout or breakage occurs, re-install the material after repairing the damage to the slope or channel.
- Make sure matting is uniformly in contact with the soil.
- Check that all the lap joints are secure.
- Check that staples are flush with the ground.
- Check that disturbed areas are seeded.

References

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service, January 1991.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

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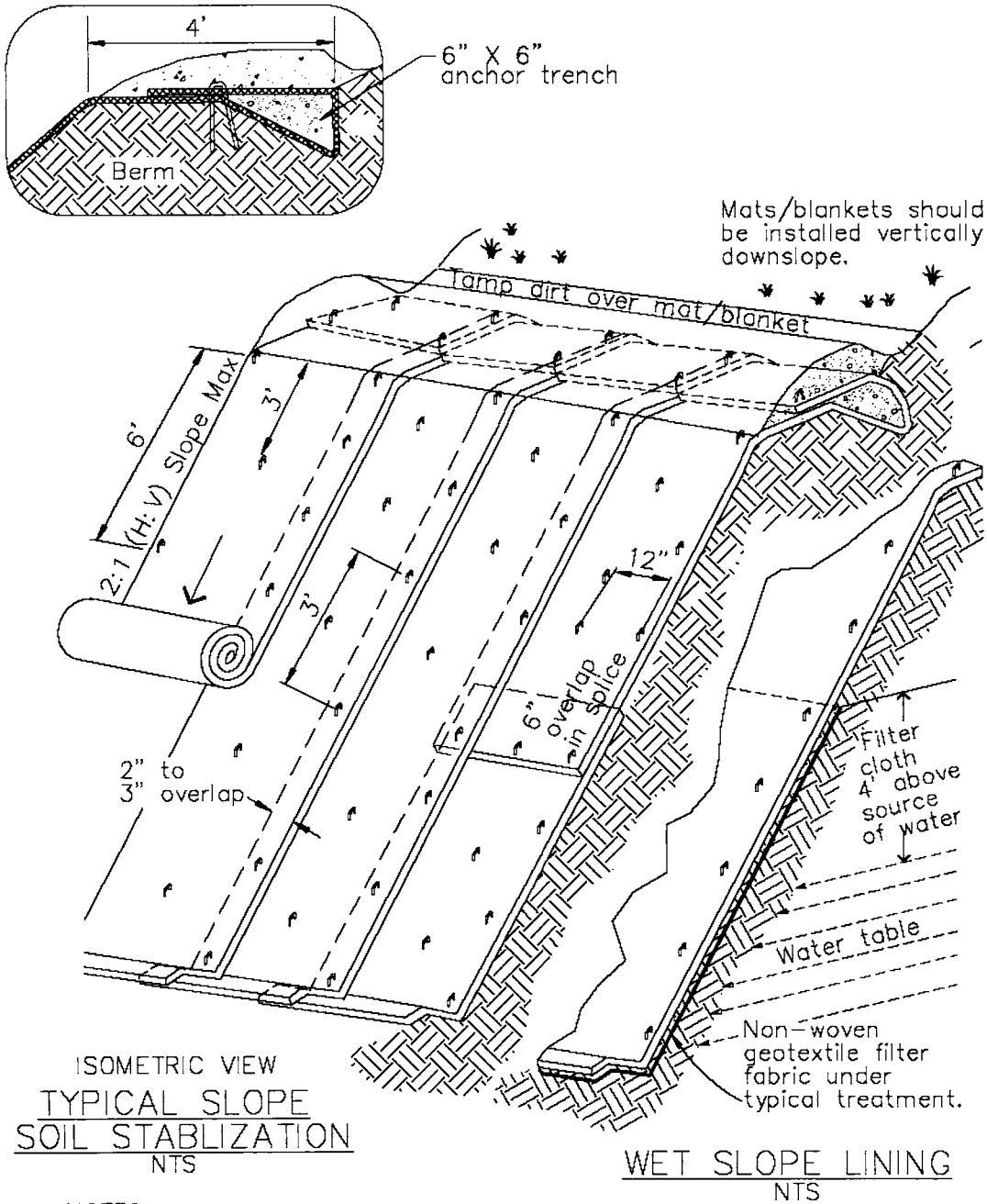


ISOMETRIC VIEW

TYPICAL SLOPE SOIL STABLIZATION

NTS

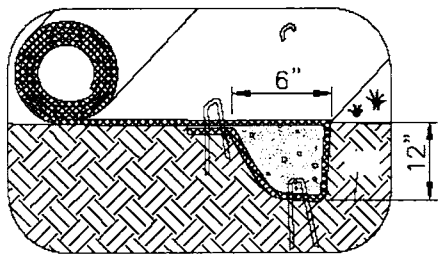
WET SLOPE LINING

NTS

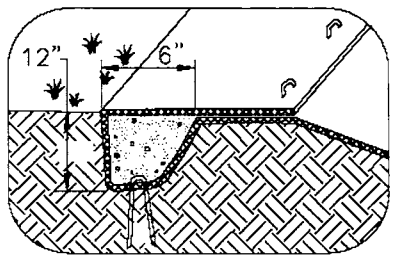
NOTES:

1. Slope surface shall be free of rocks, clods, sticks and grass. Mats/blankets shall have good soil contact.
2. Lay blankets loosely and stake or staple to maintain direct contact with the soil. Do not stretch.
3. Install per manufacturer's recommendations

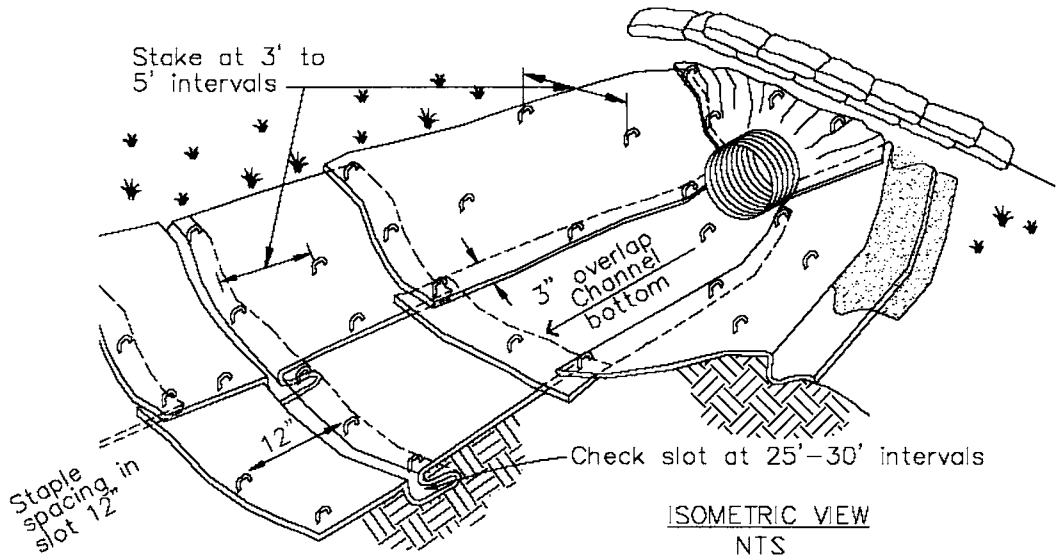
TYPICAL INSTALLATION DETAIL



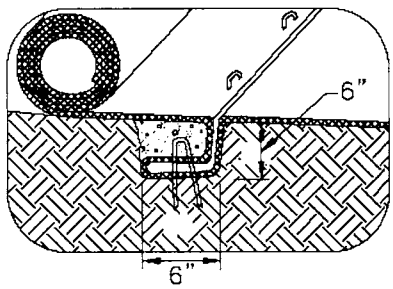
INITIAL CHANNEL ANCHOR TRENCH
NTS



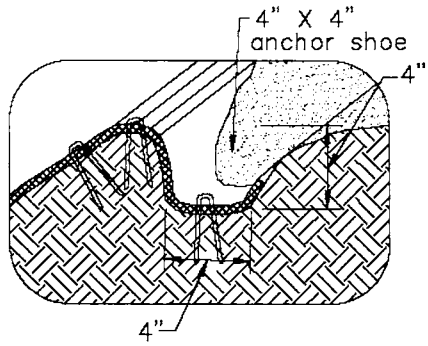
TERMINAL SLOPE AND CHANNEL ANCHOR TRENCH
NTS



ISOMETRIC VIEW
NTS



INTERMITTENT CHECK SLOT
NTS

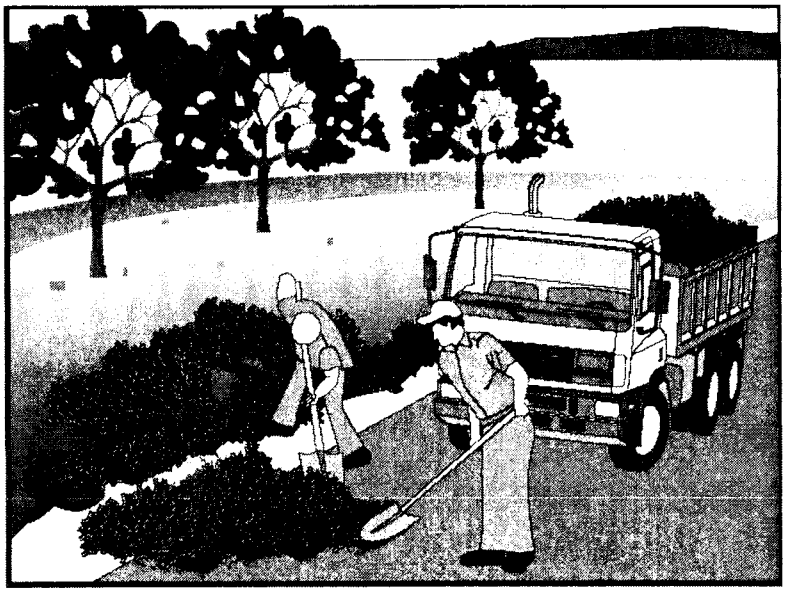


LONGITUDINAL ANCHOR TRENCH
NTS

NOTES:
1. Check slots to be constructed per manufacturers specifications.
2. Staking or stapling layout per manufacturers specifications.
3. Install per manufacturer's recommendations

TYPICAL INSTALLATION DETAIL

Wood Mulching EC-8



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch
EC-4 Hydroseeding
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats

Description and Purpose

Wood mulching consist of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Suitable Applications

Wood mulching is suitable for disturbed soil areas requiring temporary protection until permanent stabilization is established.

Limitations

- Not suitable for use on slopes steeper than 3:1 (H:V). Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter.
- Wood mulch and compost may introduce unwanted species.
- Not suitable for areas exposed to concentrated flows.
- May need to be removed prior to further earthwork.

Implementation

Mulch Selection

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned or future uses.

Application Procedures

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such

as 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 methods are highlighted here:

- Green Material: This type of mulch is produced by the recycling of vegetation trimmings such as grass, shredded shrubs, and trees. Methods of application are generally by hand although pneumatic methods are available.
  - Green material can be used as a temporary ground cover with or without seeding.
  - The green material should be evenly distributed on site to a depth of not more than 2 in.
- Shredded Wood: Suitable for ground cover in ornamental or revegetated plantings.
  - Shredded wood/bark is conditionally suitable. See note under limitations.
  - Distribute by hand or use pneumatic methods.
  - Evenly distribute the mulch across the soil surface to a depth of 2 to 3 in.
- Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation, etc.

Costs

Average annual cost for installation and maintenance (3-4 months useful life) is around $4,000 per acre, but cost can increase if the source is not close to the project site.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.
- Regardless of the mulching technique selected, the key consideration in inspection and maintenance 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 should last the length of time the site will remain barren or until final re-grading and revegetation.
- Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance should focus on longevity and integrity of the mulch.
- Reapply mulch when bare earth becomes visible.

References

Controlling Erosion of Construction Sites Agriculture Information Bulletin #347, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) (formerly Soil Conservation Service – SCS).

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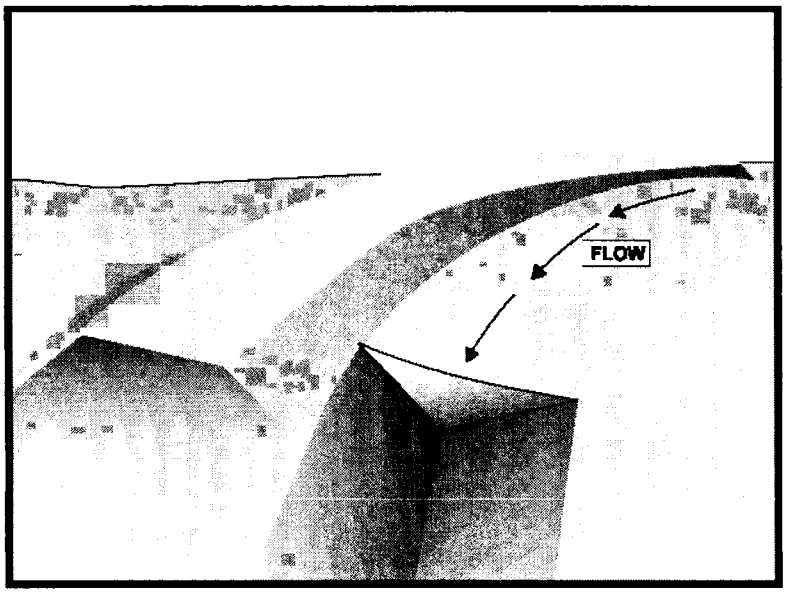
Earth Dikes and Drainage Swales EC-9



Objectives		
EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

An earth dike is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dikes and drainage swales are used to divert off site runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Suitable Applications

Earth dikes and drainage swales are suitable for use, individually or together, where runoff needs to be diverted from one area and conveyed to another.

- Earth dikes and drainage swales may be used:
  - To convey surface runoff down sloping land
  - To intercept and divert runoff to avoid sheet flow over sloped surfaces
  - To divert and direct runoff towards a stabilized watercourse, drainage pipe or channel
  - To intercept runoff from paved surfaces
  - Below steep grades where runoff begins to concentrate
  - Along roadways and facility improvements subject to flood drainage

- At the top of slopes to divert runon from adjacent or undisturbed slopes
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows
- Divert sediment laden runoff into sediment basins or traps

Limitations

Dikes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted stormwater may cause downstream flood damage.
- Dikes should not be constructed of soils that may be easily eroded.
- Regrading the site to remove the dike may add additional cost.
- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.
- Earth dikes/drainage swales are not suitable as sediment trapping devices.
- It 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.

Implementation

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off site and from undisturbed areas away from disturbed areas and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff. A dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope (see EC-11, Slope Drains). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and

compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

General

- Care must be applied to correctly size and locate earth dikes, drainage swales. Excessively steep, unlined dikes, and swales are subject to erosion and gully formation.
- Conveyances should be stabilized.
- Use a lined ditch for high flow velocities.
- Select flow velocity based on careful evaluation of the risks due to erosion of the measure, soil types, overtopping, flow backups, washout, and drainage flow patterns for each project site.
- Compact any fills to prevent unequal settlement.
- Do not divert runoff onto other property without securing written authorization from the property owner.
- When possible, install and utilize permanent dikes, swales, and ditches early in the construction process.
- Provide stabilized outlets.

Earth Dikes

Temporary earth dikes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dikes should be installed in the following manner:

- All dikes should be compacted by earth moving equipment.
- All dikes should have positive drainage to an outlet.
- All dikes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.
- The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap (SE-3) or Sediment Basin (SE-2) when either the dike channel or the drainage area above the dike are not adequately stabilized.

- Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
- If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

Channel Grade	Riprap Stabilization
0.5-1.0%	4 in. Rock
1.1-2.0%	6 in. Rock
2.1-4.0%	8 in. Rock
4.1-5.0%	8 in. -12 in. Riprap

- The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
- Filter cloth may be used to cover dikes in use for long periods.
- Construction activity on the earth dike should be kept to a minimum.

Drainage Swales

Drainage swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

- No more than 5 acres may drain to a temporary drainage swale.
- Place drainage swales above or below, not on, a cut or fill slope.
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 in.
- Side slopes should be 2:1 or flatter.
- Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.
- The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.
- Compact any fill material along the path of the swale.

- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats (EC-7) may provide immediate stabilization.
- Irrigation may be required to establish sufficient vegetation to prevent erosion.
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.
- Construct the drainage swale with a positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Costs

- Cost ranges from $15 to $55 per ft for both earthwork and stabilization and depends on availability of material, site location, and access.
- Small dikes: $2.50 - $6.50/linear ft; Large dikes: $2.50/yd^3.
- The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive, as they are quickly formed during routine earthwork.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.
- 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 should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction

References

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company, 1986.

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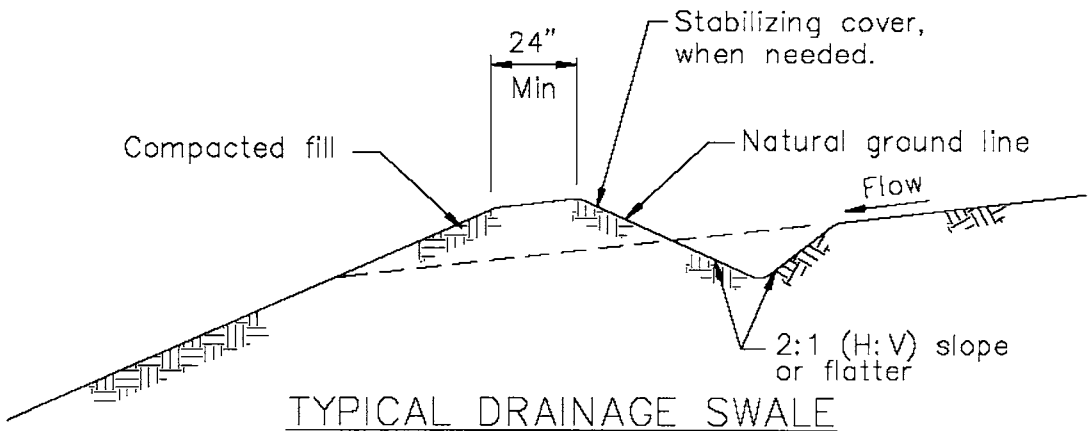
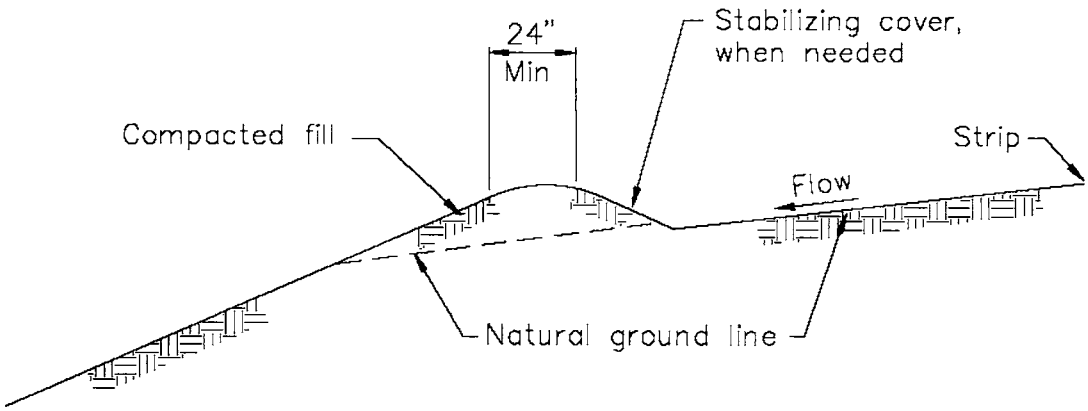


TYPICAL DRAINAGE SWALE
NOT TO SCALE

NOTES:

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



TYPICAL EARTH DIKE
NOT TO SCALE

Velocity Dissipation Devices EC-10

Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Outlet protection is a physical device composed of rock, grouted riprap, or concrete rubble, which is placed at the outlet of a pipe or channel to prevent scour of the soil caused by concentrated, high velocity flows.

Suitable Applications

Whenever discharge velocities and energies at the outlets of culverts, conduits, or channels are sufficient to erode the next downstream reach. This includes temporary diversion structures to divert runon during construction.

- These devices may be used at the following locations:
  - Outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits, or channels.
  - Outlets located at the bottom of mild to steep slopes.
  - Discharge outlets that carry continuous flows of water.
  - Outlets subject to short, intense flows of water, such as flash floods.
  - Points where lined conveyances discharge to unlined conveyances

Limitations

- Large storms or high flows can wash away the rock outlet protection and leave the area susceptible to erosion.

- Sediment captured by the rock outlet protection may be difficult to remove without removing the rock.
- Outlet protection may negatively impact the channel habitat.
- Grouted riprap may break up in areas of freeze and thaw.
- If there is not adequate drainage, and water builds up behind grouted riprap, it may cause the grouted riprap to break up due to the resulting hydrostatic pressure.

Implementation

General

Outlet protection is needed where discharge velocities and energies at the outlets of culverts, conduits or channels are sufficient to erode the immediate downstream reach. This practice protects the outlet from developing small eroded pools (plange pools), and protects against gully erosion resulting from scouring at a culvert mouth.

Design and Layout

As with most channel design projects, depth of flow, roughness, gradient, side slopes, discharge rate, and velocity should be considered in the outlet design. Compliance to local and state regulations should also be considered while working in environmentally sensitive streambeds. General recommendations for rock size and length of outlet protection mat are shown in the rock outlet protection figure in this BMP and should be considered minimums. The apron length and rock size gradation are determined using a combination of the discharge pipe diameter and estimate discharge rate: Select the longest apron length and largest rock size suggested by the pipe size and discharge rate. Where flows are conveyed in open channels such as ditches and swales, use the estimated discharge rate for selecting the apron length and rock size. Flows should be same as the culvert or channel design flow but never the less than the peak 5 year flow for temporary structures planned for one rainy season, or the 10 year peak flow for temporary structures planned for two or three rainy seasons.

- There are many types of energy dissipaters, with rock being the one that is represented in the attached figure.
- Best results are obtained when sound, durable, and angular rock is used.
- Install riprap, grouted riprap, or concrete apron at selected outlet. Riprap aprons are best suited for temporary use during construction. Grouted or wired tied rock riprap can minimize maintenance requirements.
- Rock outlet protection is usually less expensive and easier to install than concrete aprons or energy dissipaters. It also serves to trap sediment and reduce flow velocities.
- Carefully place riprap to avoid damaging the filter fabric.
  - Stone 4 in. to 6 in. may be carefully dumped onto filter fabric from a height not to exceed 12 in.
  - Stone 8 in. to 12 in. must be hand placed onto filter fabric, or the filter fabric may be covered with 4 in. of gravel and the 8 in. to 12 in. rock may be dumped from a height not to exceed 16 in.

- Stone greater than 12 in. shall only be dumped onto filter fabric protected with a layer of gravel with a thickness equal to one half the D_{50} rock size, and the dump height limited to twice the depth of the gravel protection layer thickness.

- 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.

- Outlets on slopes steeper than 10 percent should have additional protection.

Costs

Costs are low if material is readily available. If material is imported, costs will be higher. Average installed cost is $150 per device.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect apron for displacement of the riprap and damage to the underlying fabric. Repair fabric and replace riprap that has washed away. If riprap continues to wash away, consider using larger material.

- Inspect for scour beneath the riprap and around the outlet. Repair damage to slopes or underlying filter fabric immediately.

- Temporary devices should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

References

County of Sacramento Improvement Standards, Sacramento County, May 1989.

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursztynsky, P.E., McGraw Hill Book Company, 1986.

Handbook of Steel Drainage & Highway Construction, American Iron and Steel Institute, 1983.

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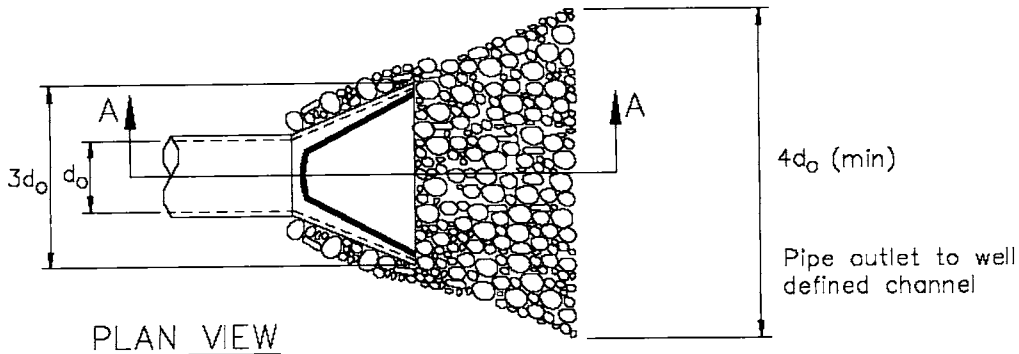
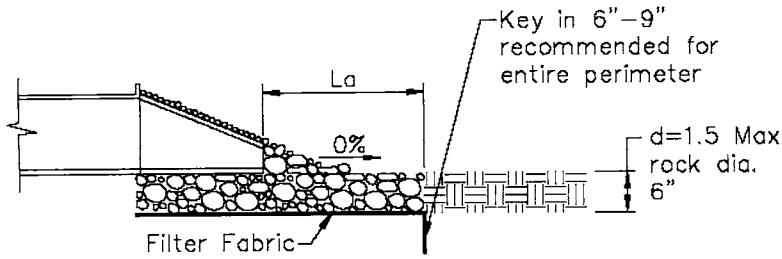


PLAN VIEW



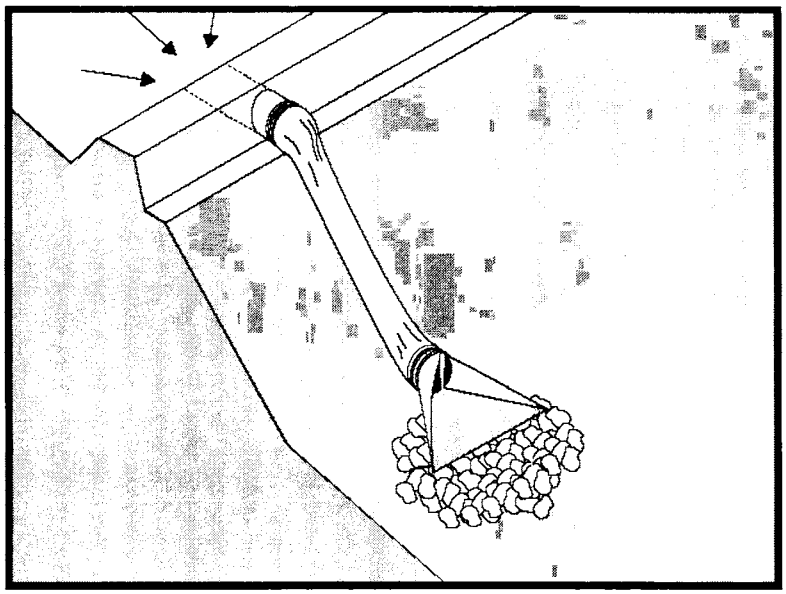
SECTION A–A

Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS

Slope Drains

EC-11



Objectives

EC	Erosion Control	☑
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ Primary Objective

☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-9 Earth Dike, Drainage Swales

Description and Purpose

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

Suitable Applications

- Where concentrated flow of surface runoff must be conveyed down a slope in order to prevent erosion.
- Drainage for top of slope diversion dikes or swales.
- Drainage for top of cut and fill slopes where water can accumulate.
- Emergency spillway for a sediment basin.

Limitations

Installation is critical for effective use of the pipe slope drain to minimize potential gully erosion.

- Maximum drainage area per slope drain is 10 acres. (For large areas use a paved chute, rock lined channel, or additional pipes.)
- Severe erosion may result when slope drains fail by overtopping, piping, or pipe separation.

  - During large storms, pipe slope drains may become clogged or over charged, forcing water around the pipe and causing extreme slope erosion.
  - If the sectional downdrain is not sized correctly, the runoff can spill over the drain sides causing gully erosion and potential failure of the structure.
- Dissipation of high flow velocities at the pipe outlet is required to avoid downstream erosion.

Implementation

General

The slope drain is applicable for any construction site where concentrated surface runoff can accumulate and must be conveyed down the slope in order to prevent erosion. The slope drain is effective because it prevents the stormwater from flowing directly down the slope by confining all the runoff into an enclosed pipe or channel. Due to the time lag between grading slopes and installation of permanent stormwater collection systems and slope stabilization measures, temporary provisions to intercept runoff are sometimes necessary. Particularly in steep terrain, slope drains can protect unstabilized areas from erosion.

Installation

The slope drain may be a rigid pipe, such as corrugated metal, a flexible conduit, or a lined terrace drain with the inlet placed on the top of a slope and the outlet at the bottom of the slope. This BMP typically is used in combination with a diversion control, such as an earth dike or drainage swale at the top of the slope.

The following criteria must be considered when siting slope drains.

- Permanent structures included in the project plans can often serve as construction BMPs if implemented early. However, the permanent structure must meet or exceed the criteria for the temporary structure.
- Inlet structures must be securely entrenched and compacted to avoid severe gully erosion.
- Slope drains must be securely anchored to the slope and must be adequately sized to carry the capacity of the design storm and associated forces.
- Outlets must be stabilized with riprap, concrete or other type of energy dissipator, or directed into a stable sediment trap or basin. See EC-10, Velocity Dissipation Devices.
- Debris racks are recommended at the inlet. Debris racks located several feet upstream of the inlet can usually be larger than racks at the inlet, and thus provide enhanced debris protection and less plugging.
- Safety racks are also recommended at the inlet and outlet of pipes where children or animals could become entrapped.
- Secure inlet and surround with dikes to prevent gully erosion and anchor pipe to slope.
- When using slope drains, limit drainage area to 10 acres per pipe. For larger areas, use a rock lined channel or a series of pipes.

- Size to convey at least the peak flow of a 10-year storm. The design storm is conservative due to the potential impact of system failures.
- Maximum slope generally limited to 2:1 (H:V) as energy dissipation below steeper slopes is difficult.
- Direct surface runoff to slope drains with interceptor dikes. See BMP EC-9, Earth Dikes and Drainage Swales. Top of interceptor dikes should be 12 in. higher than the top of the slope drain.
- Slope drains can be placed on or buried underneath the slope surface.
- Recommended materials include both metal and plastic pipe, either corrugated or smooth wall. Concrete pipe can also be used.
- When installing slope drains:
  - Install slope drains perpendicular to slope contours.
  - Compact soil around and under entrance, outlet, and along length of pipe.
  - Securely anchor and stabilize pipe and appurtenances into soil.
  - Check to ensure that pipe connections are watertight.
  - Protect area around inlet with filter cloth. Protect outlet with riprap or other energy dissipation device. For high energy discharges, reinforce riprap with concrete or use reinforced concrete device.
  - Protect outlet of slope drains using a flared end section when outlet discharges to a flexible energy dissipation device.
  - A flared end section installed at the inlet will improve flow into the slope drain and prevent erosion at the pipe entrance. Use a flared end section with a 6 in. minimum toe plate to help prevent undercutting. The flared section should slope towards the pipe inlet.

Design and Layout

The capacity for temporary drains should be sufficient to convey at least the peak runoff from a 10-year rainfall event. The pipe size may be computed using the Rational Method or a method established by the local municipality. Higher flows must be safely stored or routed to prevent any offsite concentration of flow and any erosion of the slope. The design storm is purposely conservative due to the potential impacts associated with system failures.

As a guide, temporary pipe slope drains should not be sized smaller than shown in the following table:

Minimum Pipe Diameter (Inches)	Maximum Drainage Area (Acres)
12	1.0
18	3.0
21	5.0
24	7.0
30	10.0

Larger drainage areas can be treated if the area can be subdivided into areas of 10 acres or less and each area is treated as a separate drainage. Drainage areas exceeding 10 acres must be designed by a Registered Civil Engineer and approved by the agency that issued the grading permit.

Materials:

Soil type, rainfall patterns, construction schedule, local requirements, and available supply are some of the factors to be considered when selecting materials. The following types of slope drains are commonly used:

- **Rigid Pipe:** This type of slope drain is also known as a pipe drop. The pipe usually consists of corrugated metal pipe or rigid plastic pipe. The pipe is placed on undisturbed or compacted soil and secured onto the slope surface or buried in a trench. Concrete thrust blocks must be used when warranted by the calculated thrust forces. Collars should be properly installed and secured with metal strappings or watertight collars.
- **Flexible Pipe**: The flexible pipe slope drain consists of a flexible tube of heavy-duty plastic, rubber, or composite material. The tube material is securely anchored onto the slope surface. The tube should be securely fastened to the metal inlet and outlet conduit sections with metal strappings or watertight collars.
- **Section Downdrains**: The section downdrain consists of pre-fabricated, section conduit of half round or third round material. The sectional downdrain performs similar to a flume or chute. The pipe must be placed on undisturbed or compacted soil and secured into the slope.
- **Concrete-lined Terrace Drain:** This is a concrete channel for draining water from a terrace on a slope to the next level. These drains are typically specified as permanent structures and, if installed early, can serve as slope drains during construction, which should be designed according to local drainage design criteria.

Costs

- Cost varies based on pipe selection and selected outlet protection.

Corrugated Steel Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$19.60 per LF
15"	$22.00
18"	$26.00
24"	$32.00
30"	$50.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12"	$24.50
14"	$49.00
16"	$51.00
18"	$54.00
20"	$66.00
24"	$93.00
30"	$130.00

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect outlet for erosion and downstream scour. If eroded, repair damage and install additional energy dissipation measures. If downstream scour is occurring, it may be necessary to reduce flows being discharged into the channel unless other preventative measures are implemented.
- Insert inlet for clogging or undercutting. Remove debris from inlet to maintain flows. Repair undercutting at inlet and if needed, install flared section or rip rap around the inlet to prevent further undercutting.
- Inspect pipes for leakage. Repair leaks and restore damaged slopes.
- Inspect slope drainage for accumulations of debris and sediment.
- Remove built up sediment from entrances and outlets as required. Flush drains if necessary; capture and settle out sediment from discharge.

- Make sure water is not ponding onto inappropriate areas (e.g., active traffic lanes, material storage areas, etc.).
- Pipe anchors must be checked to ensure that the pipe remains anchored to the slope. Install additional anchors if pipe movement is detected.

References

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National Association of Home Builders (NAHB). Stormwater Runoff & Nonpoint Source Pollution Control Guide for Builders and Developers. National Association of Home Builders, Washington, D.C., 1995

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

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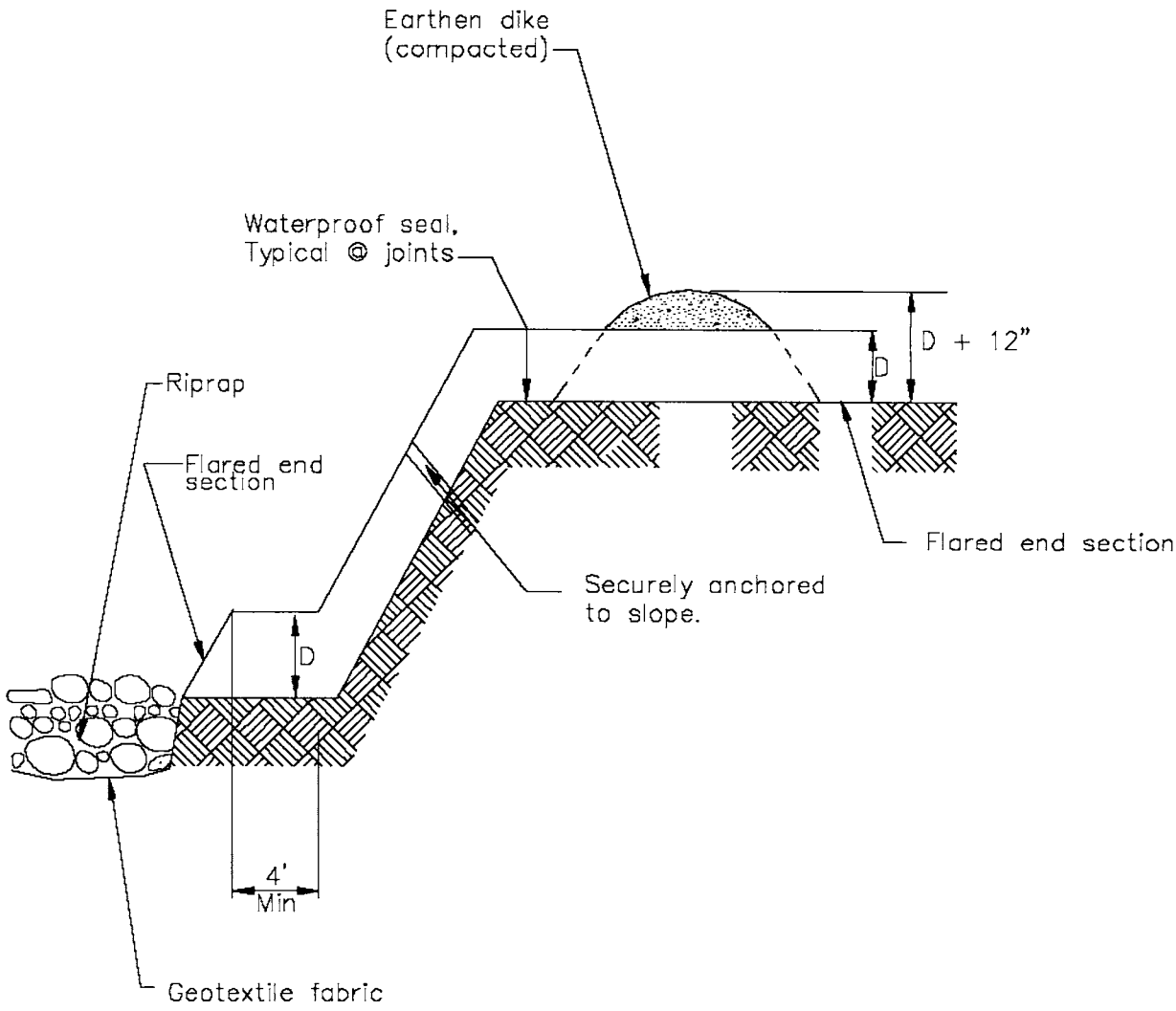
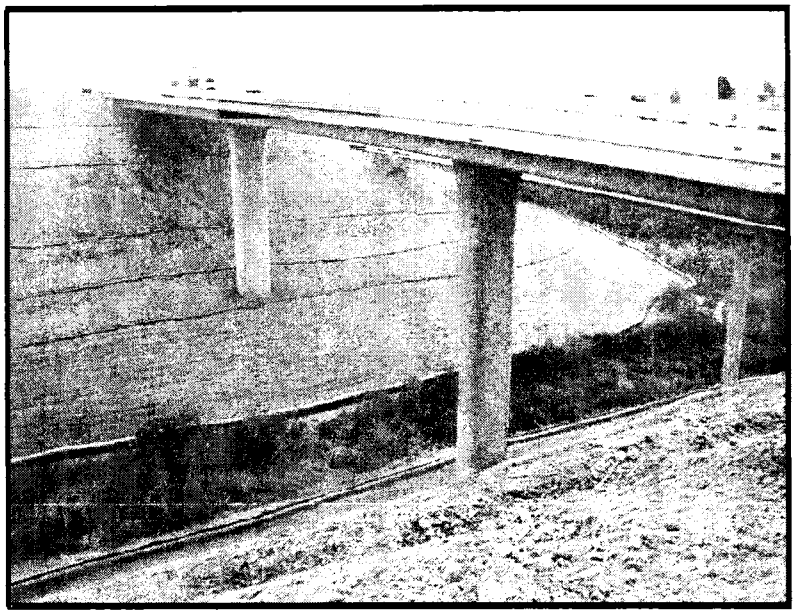


TYPICAL SLOPE DRAIN
NOT TO SCALE

Streambank Stabilization EC-12



Objectives

EC	Erosion Control	☑
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

Combination of erosion and sediment controls.

Description and Purpose

Stream channels, streambanks, and associated riparian areas are dynamic and sensitive ecosystems that respond to changes in land use activity. Streambank and channel disturbance resulting from construction activities can increase the stream's sediment load, which can cause channel erosion or sedimentation and have adverse affects on the biotic system. BMPs can reduce the discharge of sediment and other pollutants to minimize the impact of construction activities on watercourses. Streams on the 303(d) list and listed for sediment may require numerous measures to prevent any increases in sediment load to the stream.

Suitable Applications

These procedures typically apply to all construction projects that disturb or occur within stream channels and their associated riparian areas.

Limitations

Specific permit requirements or mitigation measures such as Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game supercede the guidance in this BMP.

- If numerical based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required. Streams listed as 303(d) impaired for sediment, silt, or turbidity, are required to conduct sampling

to verify that there is no net increase in sediment load due to construction activities.

Implementation

Planning

- Proper planning, design, and construction techniques can minimize impacts normally associated with in stream construction activities. Poor planning can adversely affect soil, fish, wildlife resources, land uses, or land users. Planning should take into account: scheduling; avoidance of in-stream construction; minimizing disturbance area and construction time period; using pre-disturbed areas; selecting crossing location; and selecting equipment.

Scheduling

- Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with EC-1, Scheduling. Scheduling considerations will be different when working near perennial streams vs. ephemeral streams and are as follows.

- When in-stream construction is conducted in a perennial stream, work should optimally be performed during the rainy season. This is because in the summer, any sediment-containing water that is discharged into the watercourse will cause a large change in both water clarity and water chemistry. During the rainy season, there is typically more and faster flowing water in the stream so discharges are diluted faster. However, should in-stream work be scheduled for summer, establishing an isolation area, or diverting the stream, will significantly decrease the amount of sediment stirred up by construction work. Construction work near perennial streams should optimally be performed during the dry season (see below).

- When working in or near ephemeral streams, work should be performed during the dry season. By their very nature, ephemeral streams are usually dry in the summer, and therefore, in-stream construction activities will not cause significant water quality problems. However, when tying up the site at the end of the project, wash any fines (see Washing Fines) that accumulated in the channel back into the bed material, to decrease pollution from the first rainstorm of the season.

- When working near ephemeral or perennial streams, erosion and sediment controls (see silt fences, straw bale barriers, etc.) should be implemented to keep sediment out of stream channel.

Minimize Disturbance

- Minimize disturbance through: selection of the narrowest crossing location; limiting the number of equipment trips across a stream during construction; and, minimizing the number and size of work areas (equipment staging areas and spoil storage areas). Place work areas at least 50 ft from stream channel. Field reconnaissance should be conducted during the planning stage to identify work areas.

Use of Pre-Disturbed Areas

- Locate project sites and work areas in areas disturbed by prior construction or other activity when possible.

Selection of Project Site

- Avoid steep and unstable banks, highly erodible or saturated soils, or highly fractured rock.
- Select project site that minimizes disturbance to aquatic species or habitat.

Equipment Selection

- Select equipment that reduces the amount of pressure exerted on the ground surface, and therefore, reduces erosion potential and/or use overhead or aerial access for transporting equipment across drainage channels. Use equipment that exerts ground pressures of less than 5 or 6 lb/in^2, where possible. Low ground pressure equipment includes: wide or high flotation tires (34 to 72 in. wide); dual tires; bogie axle systems; tracked machines; lightweight equipment; and, central tire inflation systems.

Streambank Stabilization

Preservation of Existing Vegetation

- Preserve existing vegetation in accordance with EC-2, Preservation of Existing Vegetation. In a streambank environment, preservation of existing vegetation provides the following benefits.

Water Quality Protection

- Vegetated buffers on slopes trap sediment and promote groundwater recharge. The buffer width needed to maintain water quality ranges from 15 to 100 ft. On gradual slopes, most of the filtering occurs within the first 30 ft. Steeper slopes require a greater width of vegetative buffer to provide water quality benefits.

Streambank Stabilization

- The root system of riparian vegetation stabilizes streambanks by increasing tensile strength in the soil. The presence of vegetation modifies the moisture condition of slopes (infiltration, evapo transpiration, interception) and increases bank stability.

Riparian Habitat

- Buffers of diverse riparian vegetation provide food and shelter for riparian and aquatic organisms. Minimizing impacts to fisheries habitat is a major concern when working near streams and rivers. Riparian vegetation provides shade, shelter, organic matter (leaf detritus and large woody debris), and other nutrients that are necessary for fish and other aquatic organisms. Buffer widths for habitat concerns are typically wider than those recommended for water quality concerns (100 to 1500 ft).
- When working near watercourses, it is important to understand the work site's placement in the watershed. Riparian vegetation in headwater streams has a greater impact on overall water quality than vegetation in downstream reaches. Preserving existing vegetation upstream is necessary to maintain water quality, minimize bank failure, and maximize riparian habitat, downstream of the work site.

Limitations

- Local county and municipal ordinances regarding width, extent and type of vegetative buffer required may exceed the specifications provided here; these ordinances should be investigated prior to construction.

Streambank Stabilization Specific Installation

- As a general rule, the width of a buffer strip between a road and the stream is recommended to be 50 ft plus four times the percent slope of the land, measured between the road and the top of stream bank.

Hydraulic Mulch

- Apply hydraulic mulch on disturbed streambanks above mean high water level in accordance with EC-3, Hydraulic Mulch to provide temporary soil stabilization.

Limitations

- Do not place hydraulic mulch or tackifiers below the mean high water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication (eutrophication is an algal bloom caused by excessively high nutrient levels in the water).

Hydroseeding

- Hydroseed disturbed streambanks in accordance with EC-4, Hydroseeding.

Limitations

- Do not place tackifiers or fertilizers below the mean high water level, as these materials could wash into the channel and impact water quality or possibly cause eutrophication.

Soil Binders

- Apply soil binders to disturbed streambanks in accordance with EC-5, Soil Binders.

Limitations

- Do not place soil binders below the mean high water level. Soil binder must be environmentally benign and non-toxic to aquatic organisms.

Straw Mulch

- Apply straw mulch to disturbed streambanks in accordance with EC-6, Straw Mulch.

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 and Mats

- Install geotextiles and mats as described in EC-7, Geotextiles and Mats, 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. 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

- Convey, intercept, or divert runoff from disturbed streambanks using EC-9, Earth Dikes and Drainage Swales.

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 velocity dissipation devices (EC-10) must be placed at outlets to minimize erosion and scour.

Velocity Dissipation Devices

- Place velocity dissipation devices at outlets of pipes, drains, culverts, slope drains, diversion ditches, swales, conduits or channels in accordance with EC-10, Velocity Dissipation Devices.

Slope Drains

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

Limitations

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

Streambank Sediment Control

Silt Fences

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

Fiber Rolls

- Install fiber rolls in accordance with SE-5, Fiber Rolls, 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, fiber rolls should be used in conjunction with other sediment control methods such as SE-1, Silt Fence or SE-9 Straw Bale Barrier. Install silt fence, straw bale barrier, or other erosion control method along toe of slope above the high water level.

Gravel Bag Berm

- A gravel bag berm or barrier can be utilized to intercept and slow the flow of sediment laden sheet flow runoff in accordance with SE-6, Gravel Bag Berm. 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.

Straw Bale Barrier

- Install straw bale barriers in accordance with SE-9, Straw Bale Barrier, to control sediment. Straw bale barriers should only be installed where sediment laden water can pond, thus allowing the sediment to settle out. Install a silt fence in accordance with SE-1, Silt Fence,

on down slope side of straw bale barrier closest to stream channel to provide added sediment control.

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 BMP.

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 aesthetics 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 20gauge (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 and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Reshape berms as needed and replace lost or dislodged rock, and filter fabric.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

K-rail

Description and Purpose

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

Barriers are placed end to end in a pre-designed configuration and gravel filled bags are used at the toe of the barrier and 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 K-rail method should not be used to dewater a project site, as the barrier is not watertight.

Implementation

- Refer to NS-5, Clear Water Diversion, for implementation requirements.

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)

- **Padding** - Padding laid in the stream below the work site may trap some solids that are deposited in the stream during construction. After work is done, the padding is removed from the stream, and placed on the bank to assist in re-vegetation.

- **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 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 stream fines that were brought to the surface of the channel bed during restoration, back into the interstitial spaces of the gravel and cobbles.

- The purpose of this technique is to reduce or eliminate the discharge of sediment from the channel bottom during the first seasonal flow. Sediment should not be allowed into stream channels; however, occasionally in-channel restoration work will involve moving or otherwise disturbing fines (sand and silt sized particles) that are already in the stream, usually below bankfull discharge elevation. Subsequent re-watering of the channel can result in a plume of turbidity and sedimentation.

- This technique washes the fines back into the channel bed. Bedload materials, including gravel cobbles, boulders and those fines, are naturally mobilized during higher storm flows. This technique is intended to delay the discharge until the fines would naturally be mobilized.

Appropriate Applications

- This technique should be used when construction work is required in channels. It is especially useful in intermittent or ephemeral streams in which work is performed "in the dry", and which subsequently become re-watered.

Limitations

- The stream must have sufficient gravel and cobble substrate composition.

- The use of this technique requires consideration of time of year and timing of expected stream flows.

- The optimum time for the use of this technique is in the fall, prior to winter flows.

- Consultation with, and approval from the Department of Fish and Game and the Regional Water Quality Control Board may be required.

Implementation

- Apply sufficient water to wash fines, but not cause further erosion or runoff.

- Apply water slowly and evenly to prevent runoff and erosion.

- Consult with Department of Fish and Game and the Regional Water Quality Control Board for specific water quality requirements of applied water (e.g. chlorine).

Inspection and Maintenance

- None necessary

Costs

Cost may vary according to the combination of practices implemented.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).

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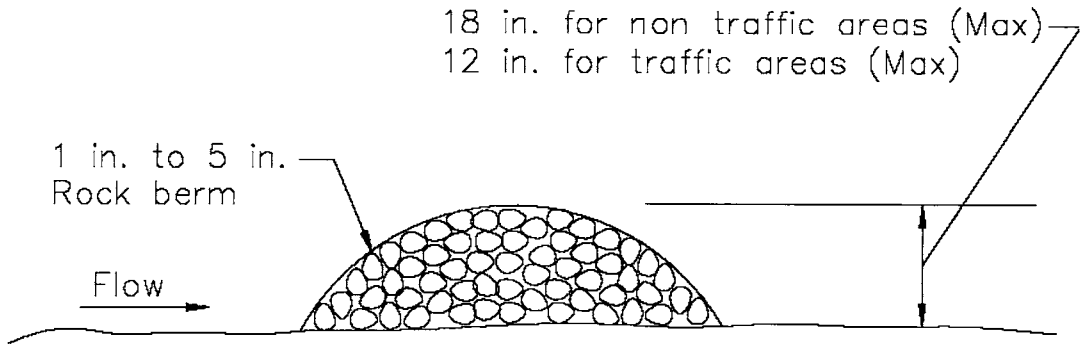

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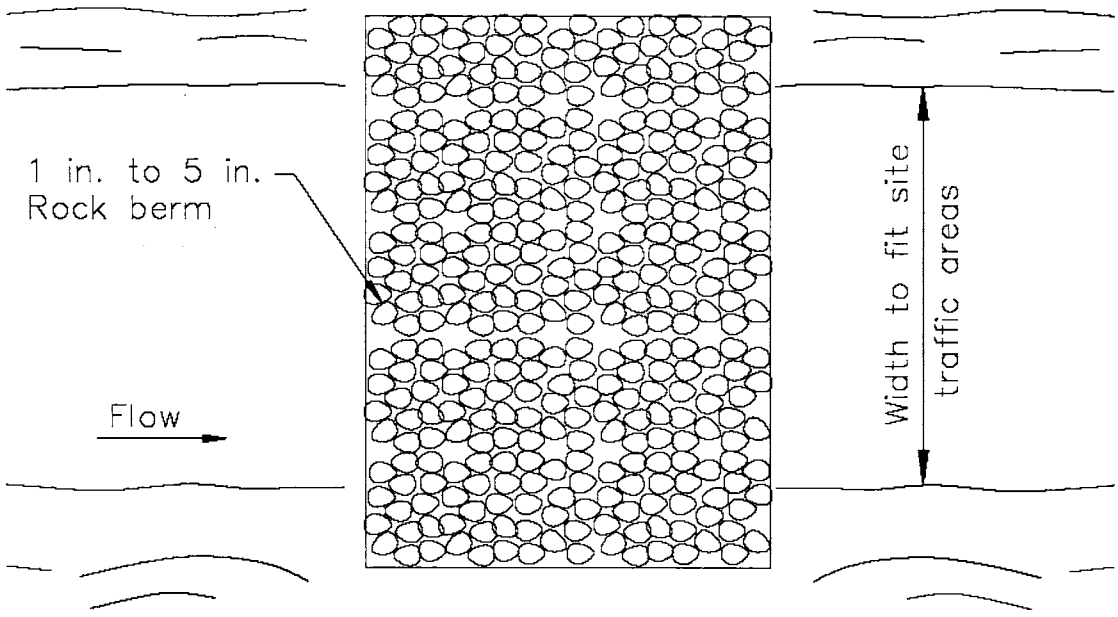
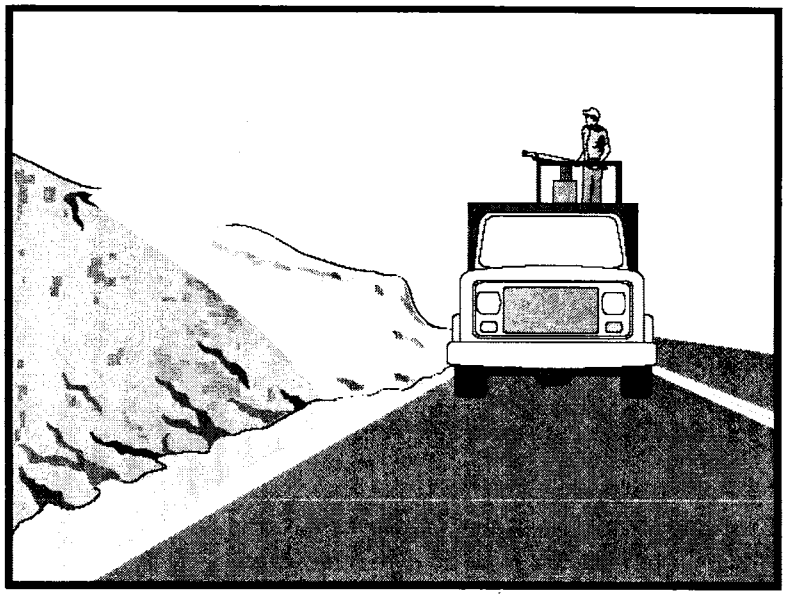


PLAN

TYPICAL ROCK FILTER
NOT TO SCALE

Polyacrylamide

EC-13



Objectives

EC	Erosion Control
SE	Sediment Control
TR	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control

Legend:

☑ Primary Objective

☑ Secondary Objective

Targeted Constituents

- Sediment
- Nutrients
- Trash
- Metals
- Bacteria
- Oil and Grease
- Organics

Potential Alternatives

None

Description and Purpose

Polyacrylamide (PAM) is a chemical that can be applied to disturbed oils at construction sites to reduce erosion and improve settling of suspended sediment.

PAM increases the soil's available pore volume, thus increasing infiltration and reducing the quantity of stormwater runoff that can cause erosion. Suspended sediments from PAM treated soils exhibit increased flocculation over untreated soils. The increased flocculation aids in their deposition, thus reducing stormwater runoff turbidity and improving water quality.

Suitable Applications

PAM is suitable for use on disturbed soil areas that discharge to a sediment trap or sediment basin. PAM is typically used in conjunction with other BMPs to increase their performance.

PAM can be applied to the following areas:

- Rough graded soils that will be inactive for a period of time.
- Final graded soils before application of final stabilization (e.g., paving, planting, mulching).
- Temporary haul roads prior to placement of crushed rock surfacing.
- Compacted soil road base.
- Construction staging, materials storage, and layout areas.

- Soil stockpiles.
- Areas that will be mulched.

Limitations

- There is limited experience in California with use of PAM for erosion and sediment control.
- PAM shall not be directly applied to water or allowed to enter a water body.
- Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
- PAM will work when applied to saturated soil but is not as effective as applications to dry or damp soil.
- Some PAMs are more toxic and carcinogenic than others. Only the most environmentally safe PAM products should be used.
- The specific PAM copolymer formulation must be anionic. **Cationic PAM shall not be used in any application because of known aquatic toxicity problems**. Only the highest drinking water grade PAM, certified for compliance with ANSI/NSF Standard 60 for drinking water treatment, will be used for soil applications.
- PAM designated for erosion and sediment control should be "water soluble" or "linear" or "non-cross linked".
- A sampling and analysis plan must be incorporated into the SWPPP as PAM may be considered to be a source of non-visible pollutants.

Implementation

General

PAM shall be used in accordance with the following general guidance:

- Pam shall be used in conjunction with other BMPs and not in place of other BMPs, including both erosion controls and sediment controls.
- Stormwater runoff from PAM treated soils should pass through a sediment control BMP prior to discharging to surface waters.
  - When the total drainage area is greater than or equal to 5 acres, PAM treated areas shall drain to a sediment basin.
  - Areas less than 5 acres shall drain to sediment control BMPs, such as a sediment trap, or a minimum of 3 check dams per acre. The total number of check dams used shall be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam shall be spaced evenly in the drainage channel. Through which stormwater flows are discharged off site.
- Do not add PAM to water discharging from site.

- On PAM treated sites, the use of silt fence and fiber rolls shall be maximized to limit the discharges of sediment to sediment traps and sediment basins.
- All areas not being actively worked one should be covered and protected from rainfall. PAM should not be the only cover BMP used.
- PAM can be applied to wet soil, but dry soil is preferred due to less sediment loss.
- Keep the granular PAM supply out of the sun. Granular PAM loses its effectiveness in three months after exposure to sunlight and air.
- Proper application and re-application plans are necessary to ensure total effectiveness of PAM usage.
- PAM, combined with water, is very slippery and can be a safety hazard. Care must be taken to prevent spills of PAM powder onto paved surfaces. During an application of PAM, prevent over spray from reaching pavement, as pavement will become slippery. If PAM powder gets on skin or clothing, wipe it off with a rough towel rather than washing with water this only makes cleanup messier and longer.
- Recent high interest in PAM has resulted in some entrepreneurial exploitation of the term "polymer". All PAMs are polymer, but not all polymers are PAM, and not all PAM products comply with ANSI/NSF Standard 60. PAM use shall be reviewed and approved by the local permitting authority.
- The PAM anionic charge density may vary from 2-30%; a value of 18% is typical. Studies conducted by the United States Department of Agriculture (USDA)/ Agricultural Research Service (ARS) demonstrated that soil stabilization was optimized by using very high molecular weight (12-15 mg/mole), highly anionic (>20% hydrolosis) PAM.
- PAM tackifiers are available and being used in place of guar and alpha plantago. Typically, PAM tackifiers should be used at a rate of no more than 0.5-1 lb per 1,000 gallons of water in hydro mulch machine. Some tackifier product instructions say to use at a rate of 3-5 lbs per acre, which can be too much. In addition, pump problems can occur at higher rates due to increased viscosity.

Preferred Application Method

PAM may be applied in dissolved form with water, or it may be applied in dry, granular, or powered form. The preferred application method is the dissolved form.

PAM is to be applied at a maximum rate of ½ pound PAM per 1000 gallons water per 1 acre of bare soil. Table 1 and Figure 1 can be used to determine the PAM and water application rate for a disturbed soil area. Higher concentrations of PAM **do not** provide any additional effectiveness.

Table 1 PAM and Water Application Rates		
Disturbed Area (acre)	PAM (lbs)	Water (gallons)
0.50	0.25	500
1.00	0.50	1,000
1.50	0.75	1,500
2.00	1.00	2,000
2.50	1.25	2,500
3.00	1.50	3,000
3.50	1.75	3,500
4.00	2.00	4,000
4.50	2.25	4,500
5.00	2.50	5,000

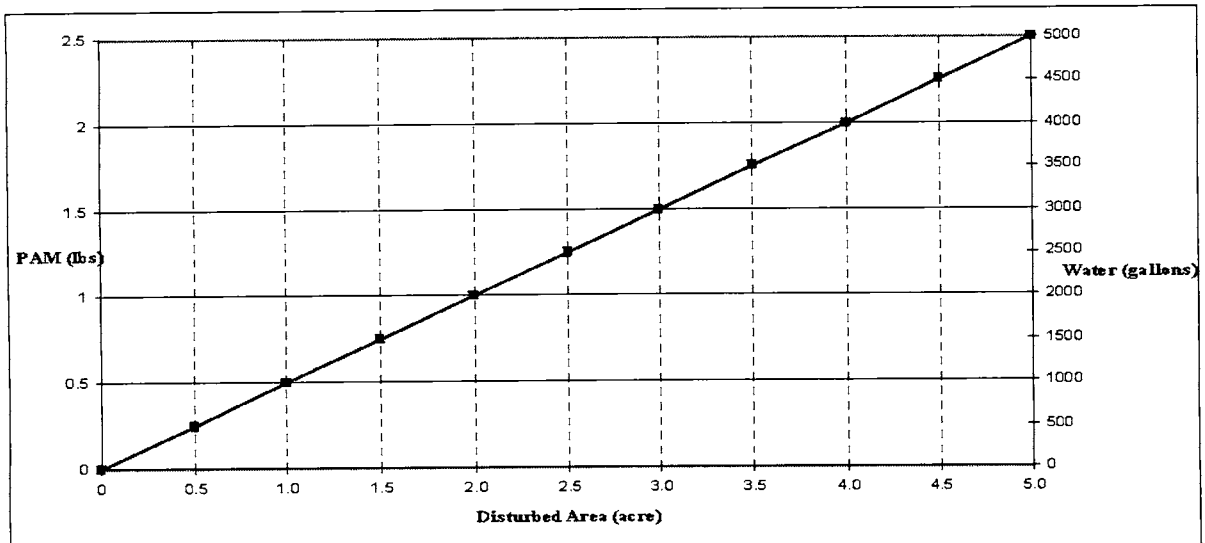


Figure 1 - PAM and Water Application Rates

- Pre-measure the area where PAM is to be applied and calculate the amount of product and water necessary to provide coverage at the specified application rate (1/2 pound PAM/1000 gallons/acre).
- PAM has infinite solubility in water, but dissolves very slowly. Dissolve pre-measured dry granular PAM with a known quantity of clean water in a bucket several hours or overnight. Mechanical mixing will help dissolve the PAM. Always add PAM to water – not water to PAM.

- Pre-fill the water truck about 1/8 full with water. The water does not have to be potable, but it must have relatively low turbidity – in the range of 20 NTU or less.
- Add the dissolved PAM and water mixture to the truck.
- Fill the water truck to specified volume for the amount of PAM to be applied.
- Spray the PAM/water mixture onto dry soil until the soil surface is uniformly and completely wetted.

Alternate Application Method

PAM may also be applied as a powder at the rate of 5 lbs per acre. This must be applied on a day that is dry. For areas less than 5-10 acres, a hand held "organ grinder" fertilizer spreader set to the smallest setting will work. Tractor mounted spreaders will work for larger areas.

Costs

- PAM: $1.30 - $5.50/lb (material cost only).

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.
- PAM must be reapplied on actively worked areas after a 48-hour period if PAM is to remain effective.
- Reapplication is not required unless PAM treated soil is disturbed or unless turbidity levels show the need for an additional application.
- If PAM treated soil is left undisturbed a reapplication may be necessary after two months.
- More PAM applications may be required for steep slopes, silty and clayey soils (USDA Classification Type "C" and "D" soils), long grades, and high precipitation areas.
- When PAM is applied first to bare soil and then covered with straw, a reapplication may not be necessary for several months.
- Discharges from PAM treated areas must be monitored for non-visible pollutants.

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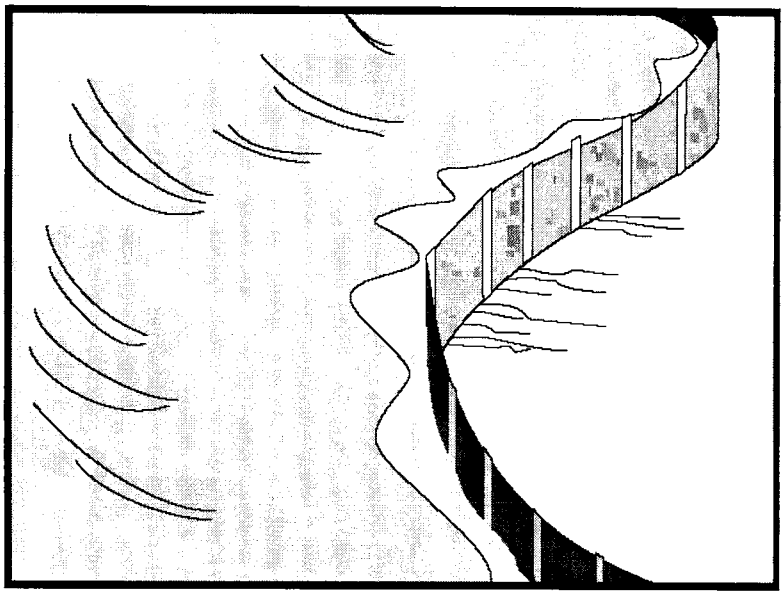
Silt Fence SE-1



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Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-9 Straw Bale Barrier

Description and Purpose

A silt fence is made of a filter fabric that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They should also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion. Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows. Silt fences are most effective when used in combination with erosion controls. Suitable applications include:

- Along the perimeter of a project.
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Below other small cleared areas.

Limitations

- Do not use in streams, channels, drain inlets, or anywhere flow is concentrated.

- Do not use in locations where ponded water may cause flooding.
- Do not place fence on a slope, or across any contour line. If not installed at the same elevation throughout, silt fences will create erosion.
- Filter fences will create a temporary sedimentation pond on the upstream side of the fence and may cause temporary flooding. Fences not constructed on a level contour will be overtopped by concentrated flow resulting in failure of the filter fence.
- Improperly installed fences are subject to failure from undercutting, overlapping, or collapsing.
  - Not effective unless trenched and keyed in.
  - Not intended for use as mid-slope protection on slopes greater than 4:1 (H:V).
  - Do not allow water depth to exceed 1.5 ft at any point.

Implementation

General

A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap sediment by intercepting and detaining small amounts of sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

Silt fences are preferable to straw bale barriers in many cases. Laboratory work at the Virginia Highway and Transportation Research Council has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. While the failure rate of silt fences is lower than that of straw bale barriers, there are many instances where silt fences have been improperly installed. The following layout and installation guidance can improve performance and should be followed:

- Use principally in areas where sheet flow occurs.
- Don't use in streams, channels, or anywhere flow is concentrated. Don't use silt fences to divert flow.
- Don't use below slopes subject to creep, slumping, or landslides.
- Select filter fabric that retains 85% of soil by weight, based on sieve analysis, but that is not finer than an equivalent opening size of 70.
- Install along a level contour, so water does not pond more than 1.5 ft at any point along the silt fence.
- The maximum length of slope draining to any point along the silt fence should be 200 ft or less.
- The maximum slope perpendicular to the fence line should be 1:1.

- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 ft² of ponding area should be provided for every acre draining to the fence.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence.
- Leave an undisturbed or stabilized area immediately down slope from the fence where feasible.
- Silt fences should remain in place until the disturbed area is permanently stabilized.

Design and Layout

Selection of a filter fabric is based on soil conditions at the construction site (which affect the equivalent opening size (EOS) fabric specification) and characteristics of the support fence (which affect the choice of tensile strength). The designer should specify a filter fabric that retains the soil found on the construction site yet that it has openings large enough to permit drainage and prevent clogging. The following criteria is recommended for selection of the equivalent opening size:

1. If 50 percent or less of the soil, by weight, will pass the U.S. Standard Sieve No. 200, select the EOS to retain 85 % of the soil. The EOS should not be finer than EOS 70.
2. For all other soil types, the EOS should be no larger than the openings in the U.S. Standard Sieve No. 70 except where direct discharge to a stream, lake, or wetland will occur, then the EOS should be no larger than Standard Sieve No. 100.

To reduce the chance of clogging, it is preferable to specify a fabric with openings as large as allowed by the criteria. No fabric should be specified with an EOS smaller than U.S. Standard Sieve No. 100. If 85% or more of a soil, by weight, passes through the openings in a No. 200 sieve, filter fabric should not be used. Most of the particles in such a soil would not be retained if the EOS was too large and they would clog the fabric quickly if the EOS were small enough to capture the soil.

The fence should be supported by a plastic or wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Filter fabric material should contain ultraviolet inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 °F to 120 °F.

- Layout in accordance with attached figures.
- For slopes steeper than 2:1 (H:V) and that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to install additional protection immediately adjacent to the bottom of the slope, prior to installing silt fence. Additional protection may be a chain link fence or a cable fence.
- For slopes adjacent to sensitive receiving waters or Environmentally Sensitive Areas (ESAs), silt fence should be used in conjunction with erosion control BMPs.

Materials

- Silt fence fabric should be woven polypropylene with a minimum width of 36 in. and a minimum tensile strength of 100 lb force. The fabric should conform to the requirements in ASTM designation D4632 and should have an integral reinforcement layer. The reinforcement layer should be a polypropylene, or equivalent, net provided by the manufacturer. The permittivity of the fabric should be between 0.1 sec^{-1} and 0.15 sec^{-1} in conformance with the requirements in ASTM designation D4491.

- Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable.

- Staples used to fasten the fence fabric to the stakes should be not less than 1.75 in. long and should be fabricated from 15 gauge or heavier wire. The wire used to fasten the tops of the stakes together when joining two sections of fence should be 9 gauge or heavier wire. Galvanizing of the fastening wire will not be required.

- There are new products that may use prefabricated plastic holders for the silt fence and use bar reinforcement instead of wood stakes. If bar reinforcement is used in lieu of wood stakes, use number four or greater bar. Provide end protection for any exposed bar reinforcement.

Installation Guidelines

Silt fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- A trench should be excavated approximately 6 in. wide and 6 in. deep along the line the proposed silt fence.

- Bottom of the silt fence should be keyed-in a minimum of 12 in.

- Posts should be spaced a maximum of 6 ft apart and driven securely into the ground a minimum of 18 in. or 12 in. below the bottom of the trench.

- When standard strength filter fabric is used, a plastic or wire mesh support fence should be fastened securely to the upslope side of posts using heavy–duty wire staples at least 1 in. long. The mesh should extend into the trench. When extra-strength filter fabric and closer post spacing are used, the mesh support fence may be eliminated. Filter fabric should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, filter cloth should be spliced together only at a support post, with a minimum 6 in. overlap and both ends securely fastened to the post.

- The trench should be backfilled with compacted native material.

- Construct silt fences with a setback of at least 3 ft from the toe of a slope. Where a silt fence is determined to be not practicable due to specific site conditions, the silt fence may be constructed at the toe of the slope, but should be constructed as far from the toe of the slope as practicable. Silt fences close to the toe of the slope will be less effective and difficult to maintain.

- 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 barrier; in no case should the reach exceed 500 ft.

Costs

- Average annual cost for installation and maintenance (assumes 6 month useful life): $7 per lineal foot ($850 per drainage acre). Range of cost is $3.50 - $9.10 per lineal foot.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Repair undercut silt fences.
- Repair or replace split, torn, slumping, or weathered fabric. The lifespan of silt fence fabric is generally 5 to 8 months.
- Silt fences that are damaged and become unsuitable for the intended purpose should be removed from the site of work, disposed of, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Silt fences should be left in place until the upstream area is permanently stabilized. Until then, the silt fence must be inspected and maintained.
- Holes, depressions, or other ground disturbance caused by the removal of the silt fences should be backfilled and repaired.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group-Working Paper, USEPA, April 1992.

Sedimentation and Erosion Control Practices, and Inventory of Current Practices (Draft), UESPA, 1990.

Southeastern Wisconsin Regional Planning Commission (SWRPC). Costs of Urban Nonpoint Source Water Pollution Control Measures. Technical Report No. 31. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI. 1991

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

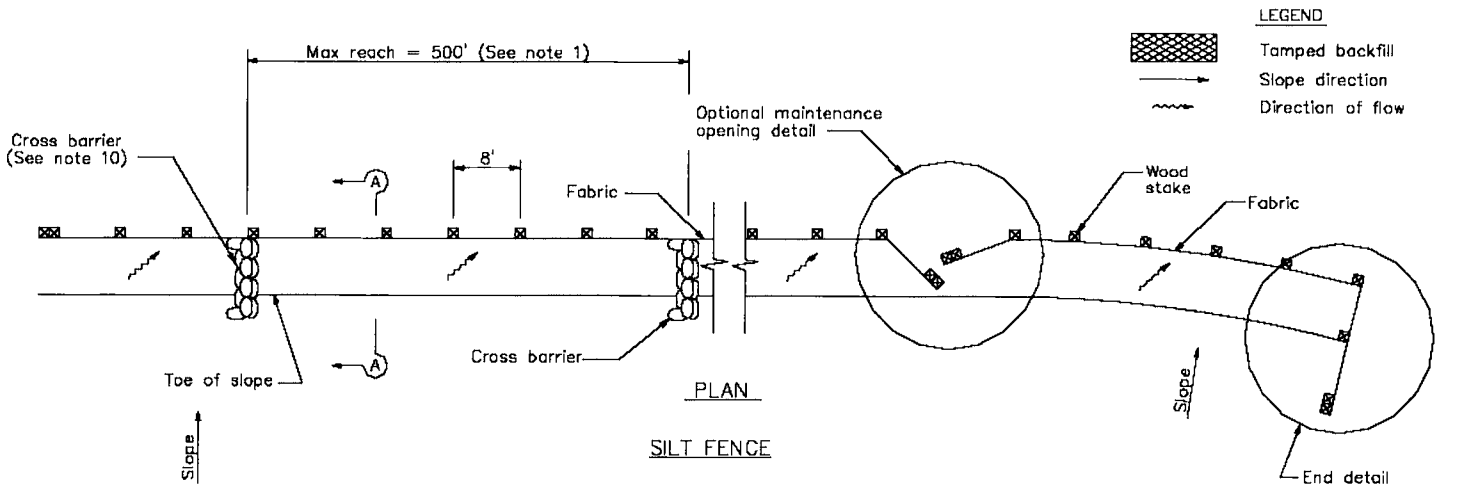
Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

U.S. Environmental Protection Agency (USEPA). Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. U.S. Environmental Protection Agency, Office of Water, Washington, DC, 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Silt Fence

SE-1

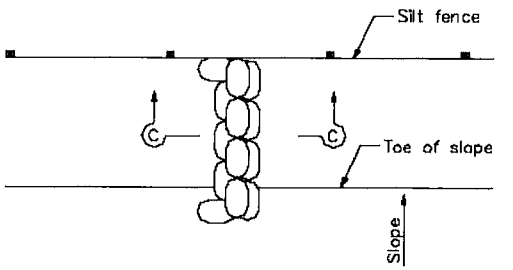


PLAN

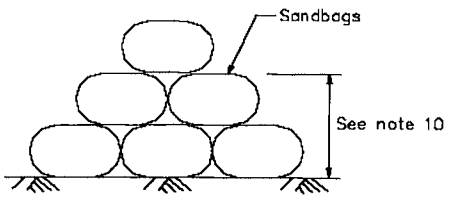
SILT FENCE

NOTES

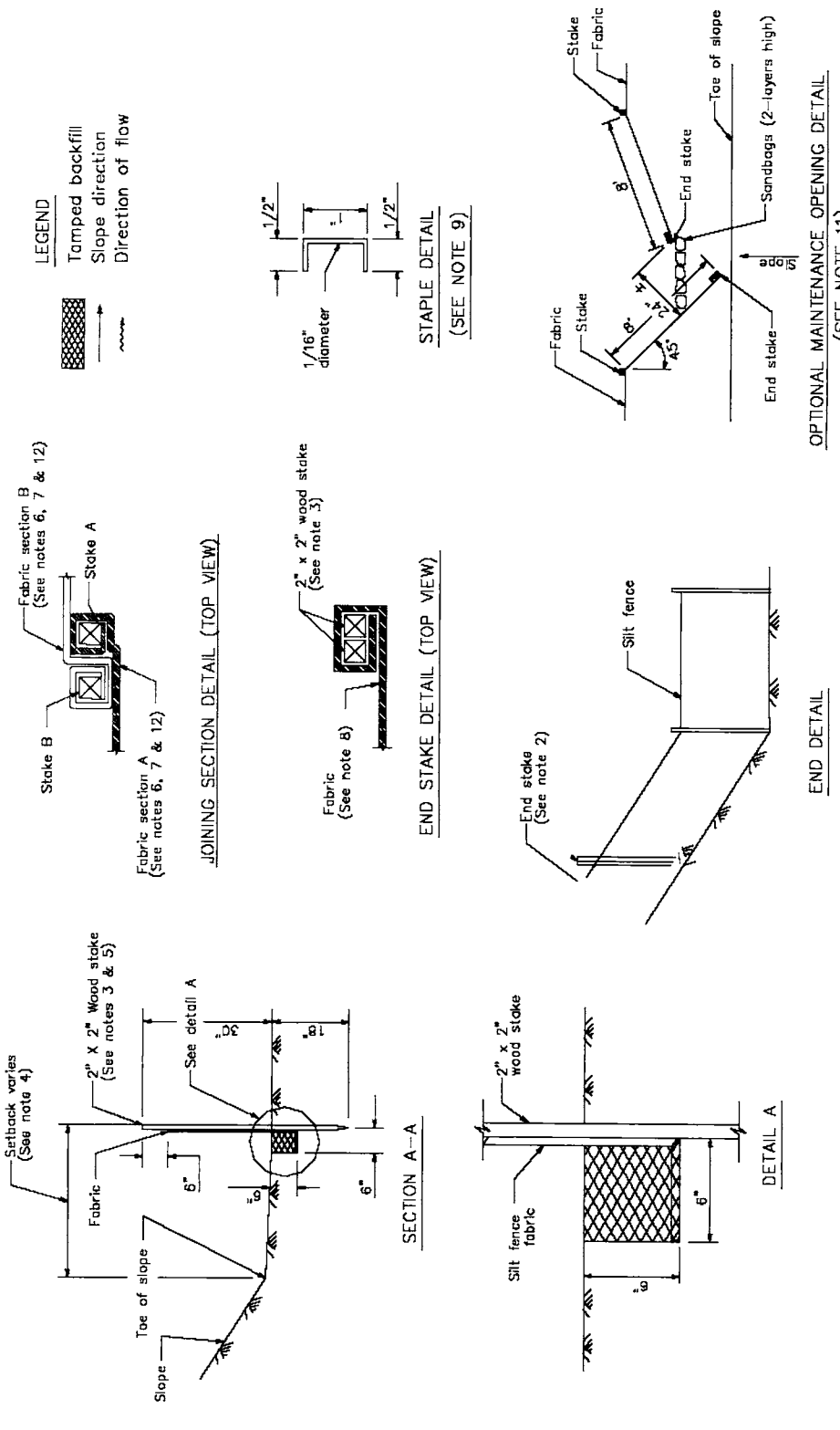
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. The last 8'–0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to fit field condition.
5. Stakes shall be spaced at 8'–0" maximum and shall be positioned on downstream side of fence.
6. Stakes to overlap and fence fabric to fold around each stake one full turn. Secure fabric to stake with 4 staples.
7. Stakes shall be driven tightly together to prevent potential flow–through of sediment at joint. The tops of the stakes shall be secured with wire.
8. For end stake, fence fabric shall be folded around two stakes one full turn and secured with 4 staples.
9. Minimum 4 staples per stake. Dimensions shown are typical.
10. Cross barriers shall be a minimum of 1/3 and a maximum of 1/2 the height of the linear barrier.
11. Maintenance openings shall be constructed in a manner to ensure sediment remains behind silt fence.
12. Joining sections shall not be placed at sump locations.
13. Sandbag rows and layers shall be offset to eliminate gaps.



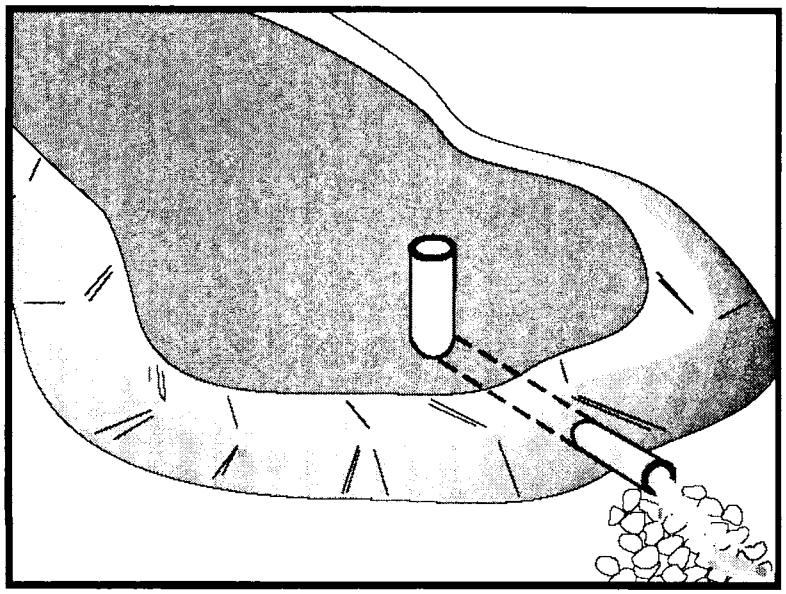
CROSS BARRIER DETAIL



SECTION C–C


LEGEND
Tamped backfill
Slope direction
Direction of flow
1/2"
1/16" diameter
1/2"
STAPLE DETAIL
(SEE NOTE 9)
Stake
Fabric
8'
End stake
Toe of slope
Sandbags (2-layers high)
Fabric
Stake
8'
4'
2'
45°
End stake
OPTIONAL MAINTENANCE OPENING DETAIL
(SEE NOTE 11)
Fabric section B
(See notes 6, 7 & 12)
Stake A
Stake B
Fabric section A
(See notes 6, 7 & 12)
JOINING SECTION DETAIL (TOP VIEW)
2" x 2" wood stake
(See note 3)
Fabric
(See note 8)
END STAKE DETAIL (TOP VIEW)
Silt fence
End stake
(See note 2)
END DETAIL
Setback varies
(See note 4)
2" X 2" Wood stake
(See notes 3 & 5)
See detail A
Fabric
8"
6"
18"
6"
Toe of slope
Slope
SECTION A-A
2" x 2"
wood stake
Silt fence
fabric
6"
DETAIL A

Sediment Basin SE-2



Objectives

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-3 Sediment Trap (for smaller areas)

Description and Purpose

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

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres
- At the outlet of large disturbed watersheds, as necessary
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of

public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- Generally, sediment basins are limited to drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this handbook are only practically effective in removing sediment down to about the medium silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical treatment is used in addition to the sediment basin.
- Sites with very fine sediments (fine silt and clay) may require longer detention times for effective sediment removal.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from Division of Safety of Dams.
- Standing water may cause mosquitoes or other pests to breed.
- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure with a design life of 12 to 28 months in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to divert runoff to the basin inlet.

Many development projects in California will be required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins trap 70-80 % of the sediment that flows into them if designed according to this handbook. Therefore, they should be used in conjunction with erosion control practices such as

temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. The best locations are generally low areas. Drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). The basin must not be located in a stream but it should be located to trap sediment-laden runoff before it enters the stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

- Construct before clearing and grading work begins when feasible.
- Do not locate in a stream.
- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.
- Large basins are subject to state and local dam safety requirements.
- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.
- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

Design

Sediment basins must be designed in accordance with Section A of the State of California NPDES General Permit for Stormwater Discharges Associated with Construction Activities (General Permit) where sediment basins are the only control measure proposed for the site. If there is insufficient area to construct a sediment basin in accordance with the General Permit requirements, then the alternate design standards specified herein may be used.

Sediment basins designed per the General Permit shall be designed as follows:

Option 1:

Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

Option 2:

Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet (133 yd^3) of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The

length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency.

OR

Option 3:
Sediment basin(s) shall be designed using the standard equation:

$$As=1.2Q/Vs \quad \text{(Eq. 1)}$$

Where:

As = Minimum surface area for trapping soil particles of a certain size

Vs = Settling velocity of the design particle size chosen

Q = C I A

Where

Q = Discharge rate measured in cubic feet per second

C = Runoff coefficient

I = Precipitation intensity for the 10-year, 6-hour rain event

A = Area draining into the sediment basin in acres

The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the *Vs* used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the 2 ft of capacity.

OR

Option 4:
The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

Other design considerations are:

- The volume of the settling zone should be sized to capture runoff from a 2-year storm or other appropriate design storms specified by the local agency. A detention time of 24 to 40 hours should allow 70 to 80 % of sediment to settle.
- The basin volume consists of two zones:
  - A sediment storage zone at least 1 ft deep.
  - A settling zone at least 2 ft deep.
- The length to settling depth ratio (L/SD) should be less than 200.
- Sediment basins are best used in conjunction with erosion controls. Sediment basins that will be used as the only means of treatment, without upstream erosion and sediment controls, must be designed according to the four options required by the General Permit (see Options 1-4 above). Sediment basins that are used in conjunction with upstream erosion and sediment controls should be designed to have a capacity equivalent to 67 yd^3 of sediment storage per acre of contributory area.
- The length of the basin should be more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet.
- The depth must be no less than 3 ft.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- Basins should be designed to drain within 72 hours following storm events. If a basin fails to drain within 72 hours, it must be pumped dry.
- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.
  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.
- Rock or vegetation should be used to protect the basin inlet and slopes against erosion.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.

- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- Basin inlets should be located to maximize travel distance to the basin outlet.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen; although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.
- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 72 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 72-hour limit is specified to mitigate vector control concerns.
- The two most common outlet problems that occur are: (1) the capacity of the outlet is too great resulting in only partial filling of the basin and drawdown time less than designed for; and (2) the outlet clogs because it is not adequately protected against trash and debris. To avoid these problems, the following outlet types are recommended for use: (1) a single orifice outlet with or without the protection of a riser pipe, and (2) perforated riser. Design guidance for single orifice and perforated riser outlets follow:
  - *Flow Control Using a Single Orifice At The Bottom Of The Basin (Figure 1)*: The outlet control orifice should be sized using the following equation:

$$a = \frac{2A(H - Ho)^{0.5}}{3600CT(2g)^{0.5}} = \frac{(7x10^{-5})A(H - Ho)^{0.5}}{CT} \qquad \text{(Eq. 2)}$$

where:

a = area of orifice (ft^2)

A = surface area of the basin at mid elevation (ft^2)

C = orifice coefficient

T = drawdown time of full basin (hrs)

g = gravity (32.2 ft/s²)

H = elevation when the basin is full (ft)

Ho = final elevation when basin is empty (ft)

With a drawdown time of 40 hours, the equation becomes:

$$a = \frac{(1.75x10^{-6})A(H - Ho)^{0.5}}{C} \qquad \text{(Eq. 3)}$$

- *Flow Control Using Multiple Orifices (see Figure2):*

$$a_t = \frac{2A(h_{max})}{3600CT(2g[h_{max} - h_{centroid\ of\ orifices}])^{0.5}} \qquad \text{(Eq. 4)}$$

With terms as described above except:

a_t = total area of orifices

h_{max} = maximum height from lowest orifice to the maximum water surface (ft)

$h_{centroid\ of\ orifices}$ = height from the lowest orifice to the centroid of the orifice configuration (ft)

Allocate the orifices evenly on two rows; separate the holes by 3x hole diameter vertically, and by 120 degrees horizontally (refer to Figure 2).

Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

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

C = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or

C = 0.80 when the material is thicker than the orifice diameter

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.
- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

Average annual costs for installation and maintenance (2 year useful life) are:

- Basin less than 50,000 ft³: Range, $0.24 - $1.58/ft³. Average, $0.73 per ft³. $400 - $2,400, $1,200 average per drainage acre.
- Basin size greater than 50,000 ft³: Range, $0.12 – $0.48/ft³. Average, $0.36 per ft³. $200 - $800, $600 average per drainage acre.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at appropriate locations.
- Remove standing water from basin within 72 hours after accumulation.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

References

A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zones, Metropolitan Washington Council of Governments, March 1992.

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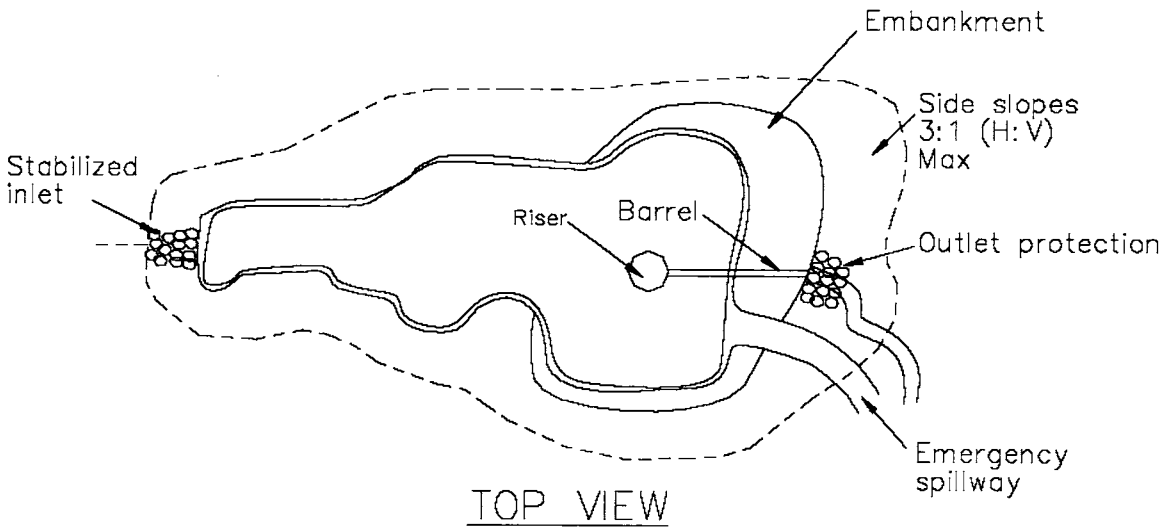
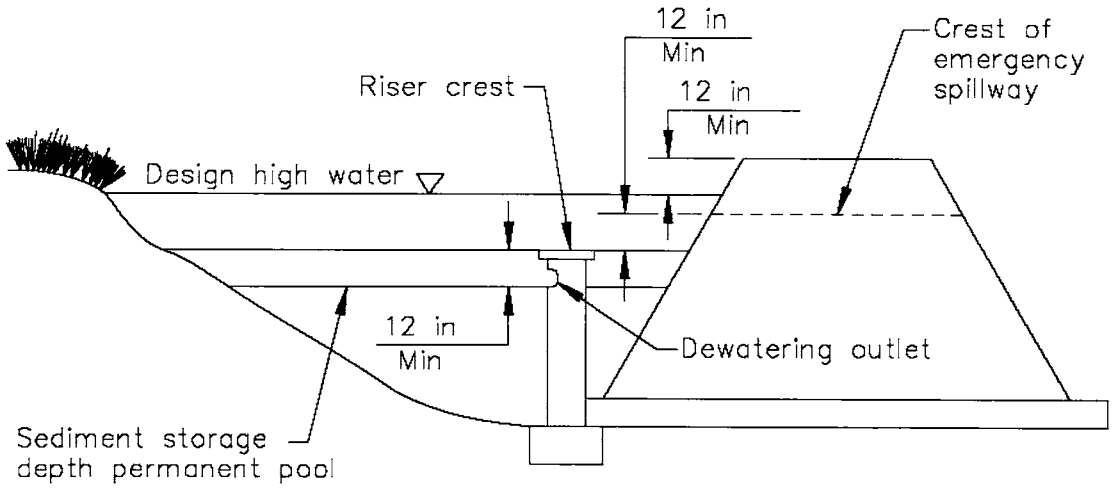


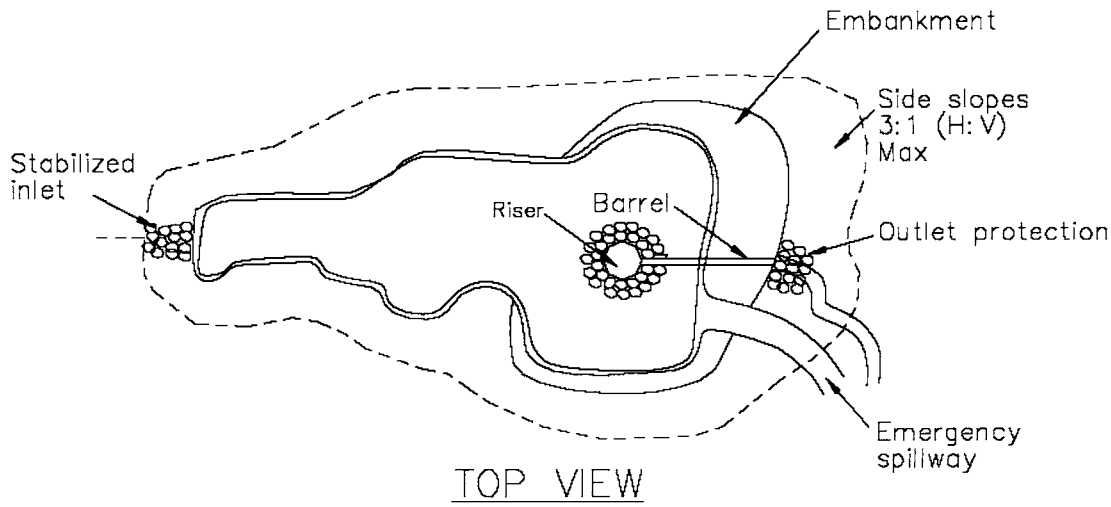
TOP VIEW



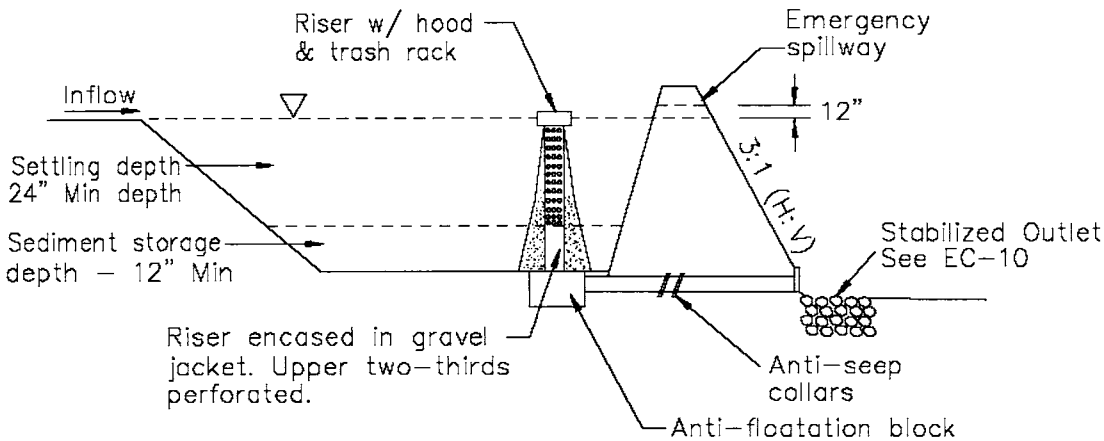
SIDE VIEW

NOTE:
This outlet provides no drainage for permanent pool.

FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
SINGLE ORIFICE DESIGN
NOT TO SCALE



TOP VIEW



SIDE VIEW

FIGURE 2: TYPICAL TEMPORARY SEDIMENT BASIN

MULTIPLE ORIFICE DESIGN

NOT TO SCALE

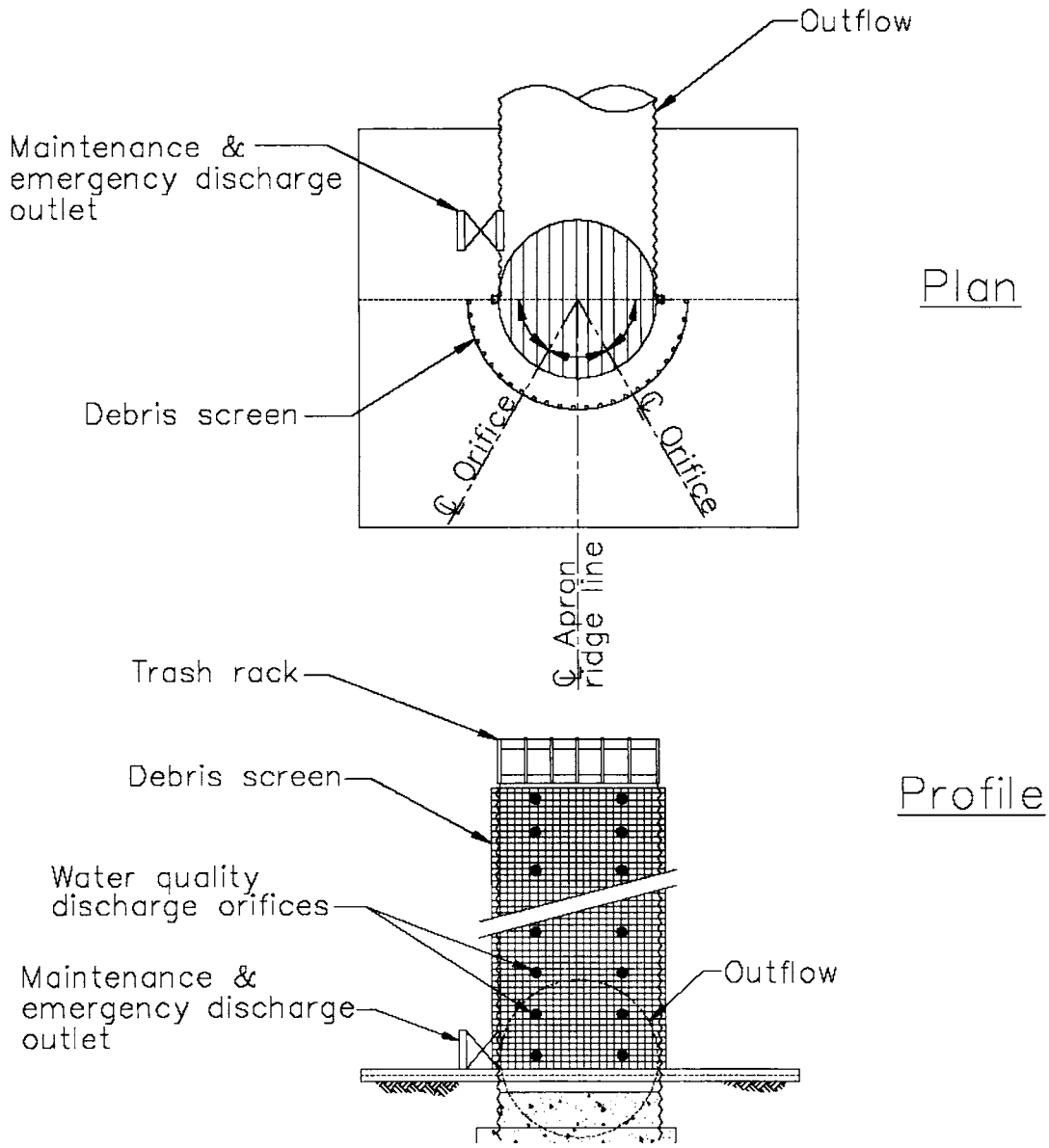
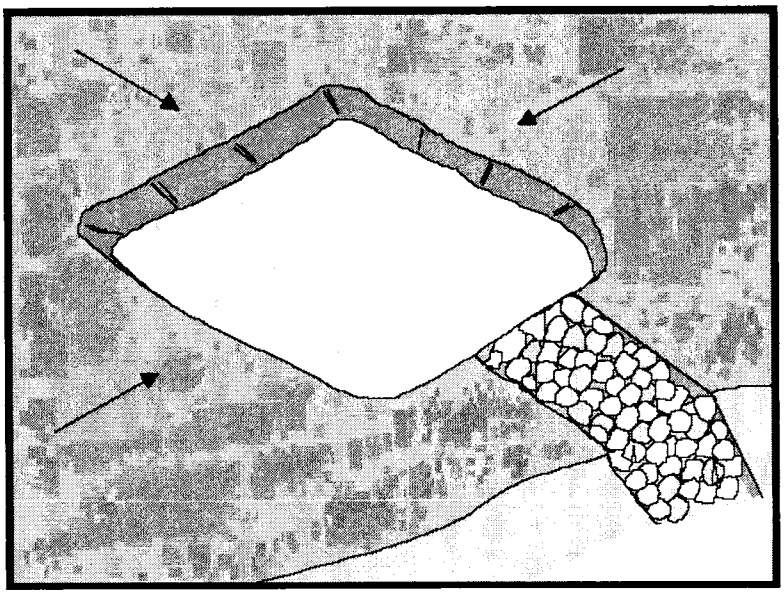


FIGURE 3: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE

Sediment Trap SE-3



Objectives

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-2 Sediment Basin (for larger areas)

Description and Purpose

A sediment trap is a containment area where sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out or before the runoff is discharged. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Suitable Applications

Sediment traps should be considered for use:

- At the perimeter of the site at locations where sediment-laden runoff is discharged offsite.
- At multiple locations within the project site where sediment control is needed.
- Around or upslope from storm drain inlet protection measures.
- Sediment traps may be used on construction projects where the drainage area is less than 5 acres. Traps would be placed where sediment-laden stormwater may enter a storm drain or watercourse. SE-2, Sediment Basins, must be used for drainage areas greater than 5 acres.
- As a supplemental control, sediment traps provide additional protection for a water body or for reducing sediment before it enters a drainage system.

Limitations

- Requires large surface areas to permit infiltration and settling of sediment.
- Not appropriate for drainage areas greater than 5 acres.
- Only removes large and medium sized particles and requires upstream erosion control.
- Attractive and dangerous to children, requiring protective fencing.
- Conducive to vector production.
- Should not be located in live streams.

Implementation

Design

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately six months to one year and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to SE-2, Sediment Basins, or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed of, such as in fill areas onsite, or removal to an approved offsite dump. Sediment traps used as perimeter controls should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. However, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks:

- Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
- Restrict basin side slopes to 3:1 or flatter.

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see SE-2, Sediment Basin). As a rule of thumb, the larger the basin volume the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a 2-year storm is a common design criteria for a sediment trap. The sizing criteria below assume that this runoff volume is 0.042 acre-ft/acre (0.5 in. of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California:

- Locate sediment traps as near as practical to areas producing the sediment.
- Trap should be situated according to the following criteria: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where failure would not cause loss of life or property damage, and (3) to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area.
- Trap should be sized to accommodate a settling zone and sediment storage zone with recommended minimum volumes of 67 yd^3/acre and 33 yd^3/acre of contributing drainage area, respectively, based on 0.5 in. of runoff volume over a 24-hour period. In many cases, the size of an individual trap is limited by available space. Multiple traps or additional volume may be required to accommodate specific rainfall, soil, and site conditions.
- Traps with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and traps capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the trap outlet and bypass structures.
- The outlet pipe or open spillway must be designed to convey anticipated peak flows.
- Use rock or vegetation to protect the trap outlets against erosion.
- Fencing should be provided to prevent unauthorized entry.

Installation

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a small embankment. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainage ways. The following steps must be followed during installation:

- The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
- The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.
- All cut-and-fill slopes should be 3:1 or flatter.
- When a riser is used, all pipe joints must be watertight.
- When a riser is used, at least the top two-thirds of the riser should be perforated with 0.5 in. diameter holes spaced 8 in. vertically and 10 to 12 in. horizontally. See SE-2, Sediment Basin.
- When an earth or stone outlet is used, the outlet crest elevation should be at least 1 ft below the top of the embankment.

- When crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

Costs

Average annual cost per installation and maintenance (18 month useful life) is $0.73 per ft^3 ($1,300 per drainage acre). Maintenance costs are approximately 20% of installation costs.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect outlet area for erosion and stabilize if required.
- Inspect trap banks for seepage and structural soundness, repair as needed.
- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Inspect fencing for damage and repair as needed.
- Inspect the sediment trap for area of standing water during every visit. Corrective measures should be taken if the BMP does not dewater completely in 72 hours or less to prevent vector production.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.
- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.
- BMPs that require dewatering shall be continuously attended while dewatering takes place. Dewatering BMPs shall be implemented at all times during dewatering activities.

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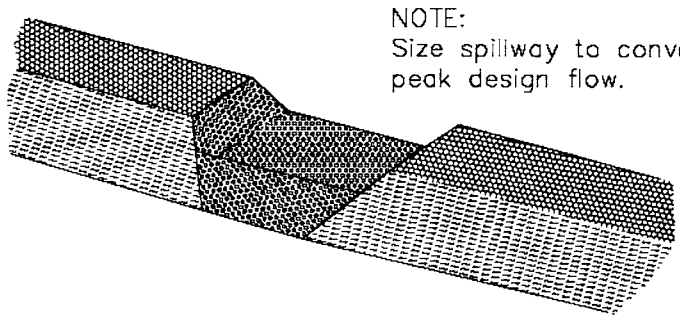
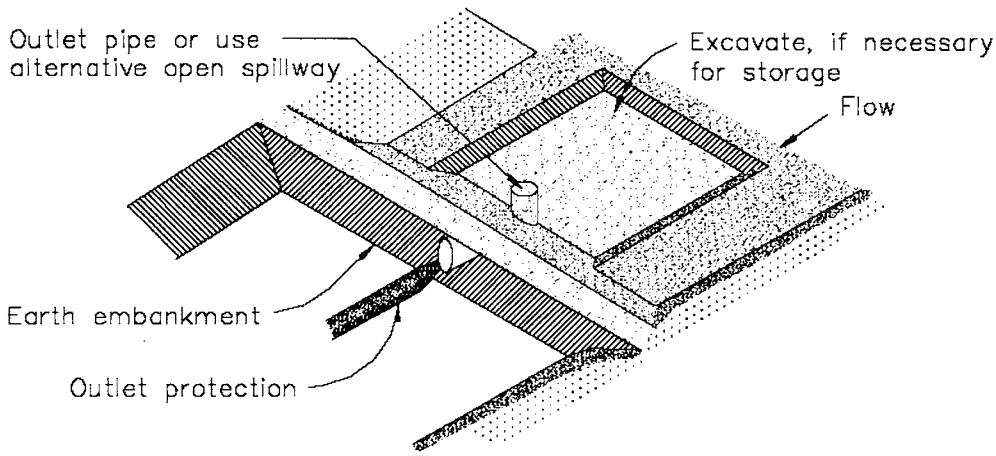
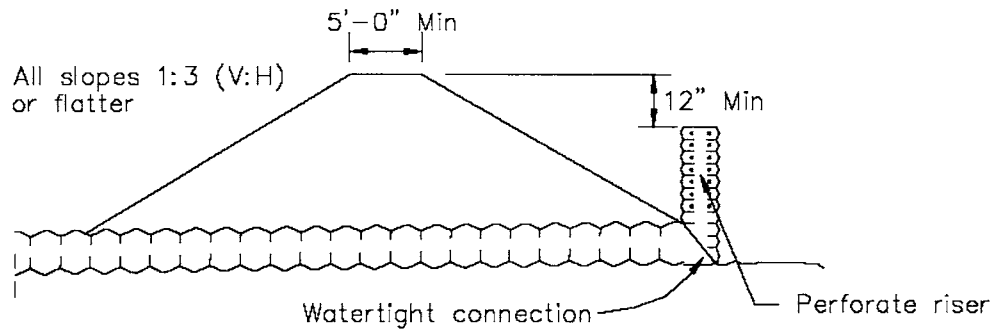


TYPICAL OPEN SPILLWAY



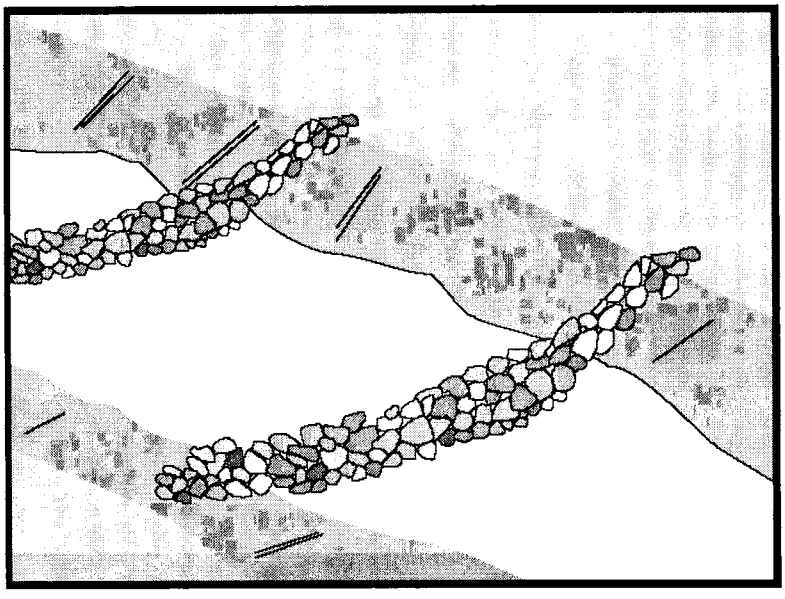


EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE

Check Dams

SE-4



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ Primary Objective

☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing the velocity of flowing water, allowing sediment to settle and reducing erosion.

Suitable Applications

Check dams may be appropriate in the following situations:

- To promote sedimentation behind the dam.
- To prevent erosion by reducing the velocity of channel flow in small intermittent channels and temporary swales.
- In small open channels that drain 10 acres or less.
- In steep channels where stormwater runoff velocities exceed 5 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.

Limitations

- Not to be used in live streams or in channels with extended base flows.

- Not appropriate in channels that drain areas greater than 10 acres.
- Not appropriate in channels that are already grass-lined unless erosion is expected, as installation may damage vegetation.
- Require extensive maintenance following high velocity flows.
- Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Reduced slopes reduce the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Use of check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A sediment trap (SE-3) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout

Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity must be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, there are several options:

- Don't use check dams. Consider alternative BMPs.
- Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam. The center section of the dam should be lower than the edge sections so that the check dam will direct flows to the center of the ditch or swale.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products manufactured specifically for use as check dams are also being used, and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Straw bales can also be used for check dams and can work if correctly installed; but in practice, straw bale check dams have a high failure rate. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam must completely span the ditch

or swale to prevent washout. The rock used must be large enough to stay in place given the expected design flow through the channel.

Log check dams are usually constructed of 4 to 6 in. diameter logs. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

Gravel bag and sandbag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet.

Manufactured products should be installed in accordance with the manufacturer's instructions.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:

- Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.
- Check dams should be placed at a distance and height to allow small pools to form between each check dam.
- Backwater from a downstream check dam should reach the toes of the upstream check dam.
- A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap must be cleaned following each storm event.
- High flows (typically a 2-year storm or larger) should 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 should be removed when grass has matured sufficiently to protect the ditch or swale.
- Gravel bags may be used as check dams with the following specifications:

Materials

Gravel bags used for check dams should conform to the requirements of SE-6, Gravel Bag Berms. Sandbags used for check dams should conform to SE-8, Sandbag Barrier. Fiber rolls used for check dams should conform to SE-5, Fiber Rolls. Straw bales used for check dams should conform to SE-9, Straw Bale Barrier.

Installation

- Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.
- Tightly abut bags and stack according to detail shown in the figure at the end of this section. Gravel bags and sandbags should not be stacked any higher than 3 ft.
- Fiber rolls and straw bales must be trenched in and firmly staked in place.

Costs

Cost consists of only installation costs if materials are readily available. If material must be imported, costs may increase. For material costs, see SE-5, SE-6, SE-8 and SE-9.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Replace missing rock, bags, bales, etc. Replace bags or bales that have degraded or have become damaged.
- If the check dam is used as a sediment capture device, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

References

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Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

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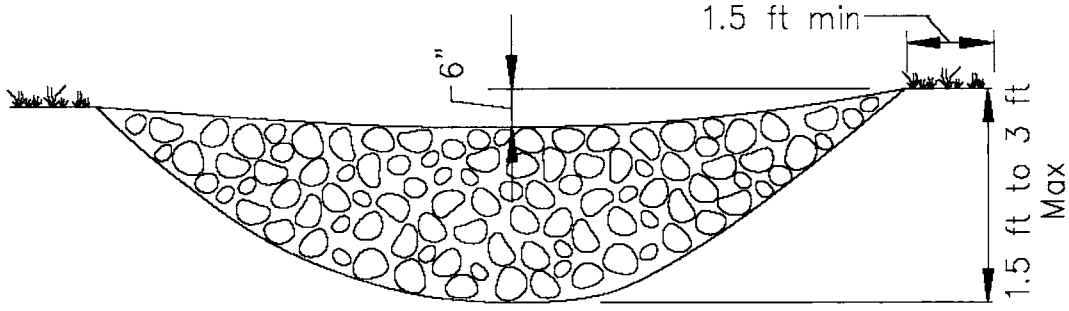
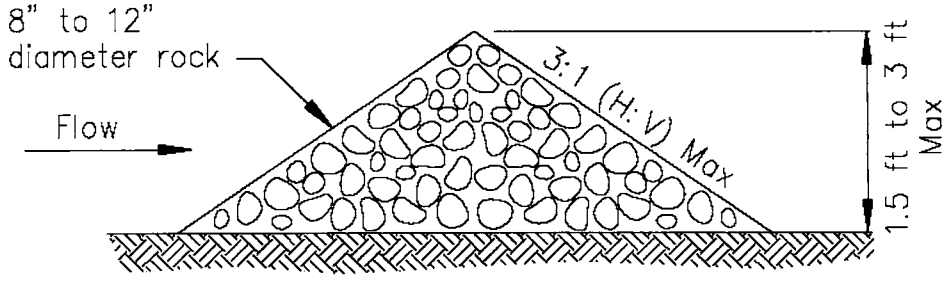
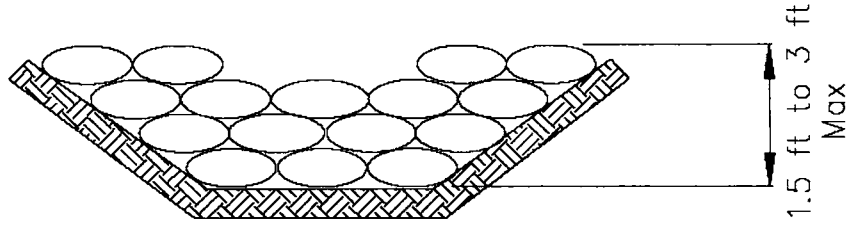


ELEVATION



TYPICAL ROCK CHECK DAM SECTION

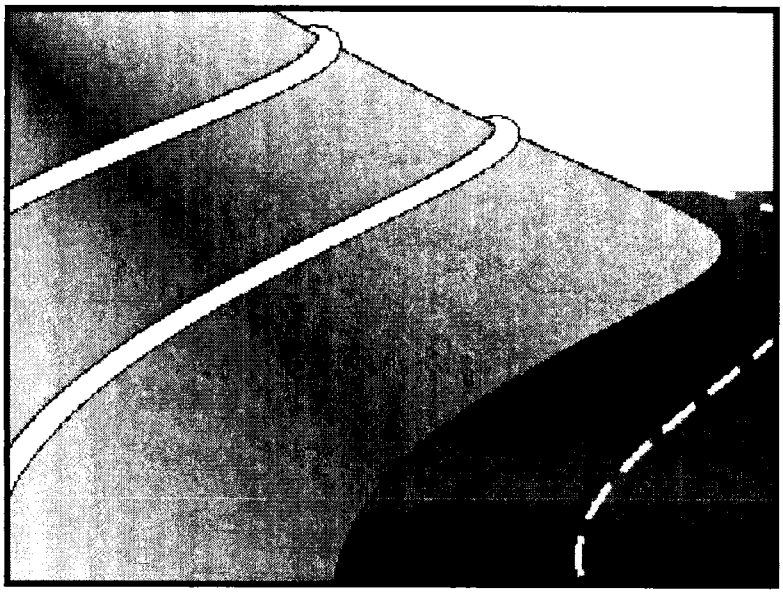
ROCK CHECK DAM
NOT TO SCALE



GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE

Fiber Rolls

SE-5



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ Primary Objective

☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-9 Straw Bale Barrier

Description and Purpose

A fiber roll consists of straw, flax, or other similar materials bound into a tight tubular roll. When fiber rolls are placed at the toe and on the face of slopes, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff. By interrupting the length of a slope, fiber rolls can also reduce erosion.

Suitable Applications

Fiber rolls may be suitable:

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the end of a downward slope where it transitions to a steeper slope
- Along the perimeter of a project
- As check dams in unlined ditches
- Down-slope of exposed soil areas
- Around temporary stockpiles

Limitations

- Fiber rolls are not effective unless trenched

- Fiber rolls at the toe of slopes greater than 5:1 (H:V) should be a minimum of 20 in. diameter or installations achieving the same protection (i.e. stacked smaller diameter fiber rolls, etc.).
- Difficult to move once saturated.
- If not properly staked and trenched in, fiber rolls could be transported by high flows.
- Fiber rolls have a very limited sediment capture zone.
- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

Implementation

Fiber Roll Materials

- Fiber rolls should be either prefabricated rolls or rolled tubes of erosion control blanket.

Assembly of Field Rolled Fiber Roll

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

Installation

- Locate fiber rolls on level contours spaced as follows:
  - Slope inclination of 4:1 (H:V) or flatter: Fiber rolls should be placed at a maximum interval of 20 ft.
  - Slope inclination between 4:1 and 2:1 (H:V): Fiber Rolls should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).
  - Slope inclination 2:1 (H:V) or greater: Fiber Rolls should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).
- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.
- Stake fiber rolls into a 2 to 4 in. deep trench with a width equal to the diameter of the fiber roll.
  - Drive stakes at the end of each fiber roll and spaced 4 ft maximum on center.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- If more than one fiber roll is placed in a row, the rolls should be overlapped, not abutted.

Removal

- Fiber rolls are typically left in place.

- If fiber rolls 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.

Costs

Material costs for fiber rolls range from $20 - $30 per 25 ft roll.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Repair or replace split, torn, unraveling, or slumping fiber rolls.
- If the fiber roll is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage depth, usually one-half the distance between the top of the fiber roll and the adjacent ground surface. Sediment removed during maintenance may be incorporated into earthwork on the site of disposed at an appropriate location.
- If fiber rolls are used for erosion control, such as in a mini check dam, sediment removal should not be required as long as the system continues to control the grade. Sediment control BMPs will likely be required in conjunction with this type of application.

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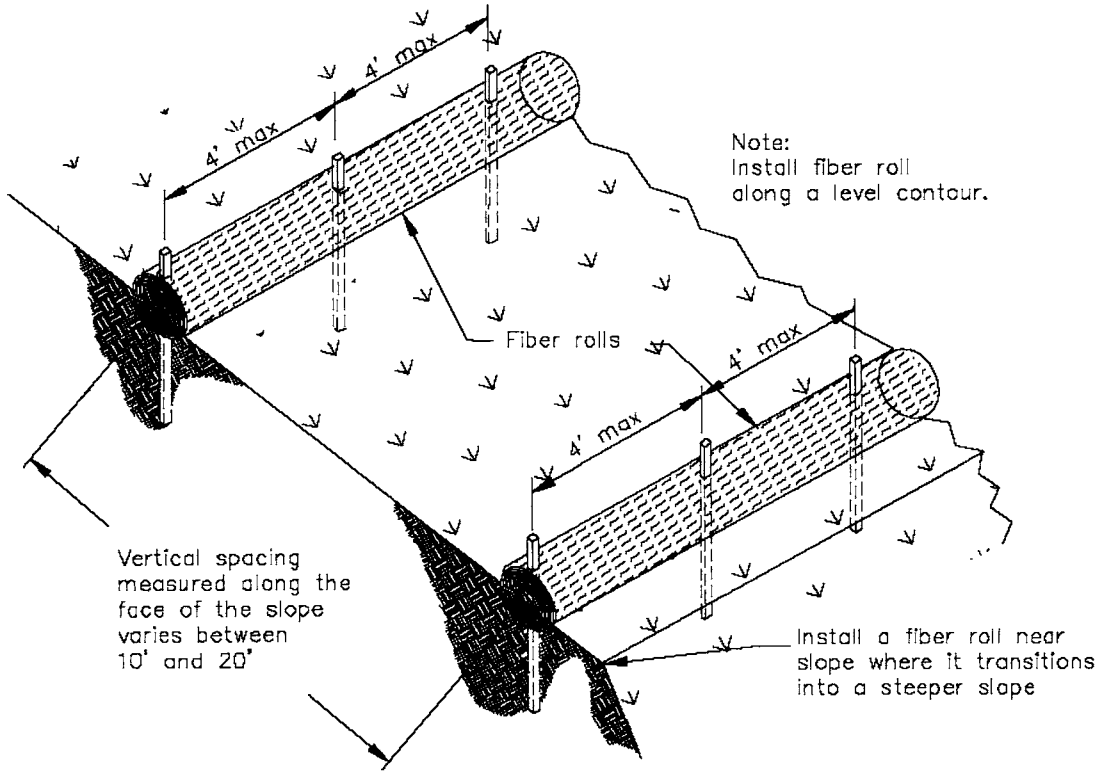
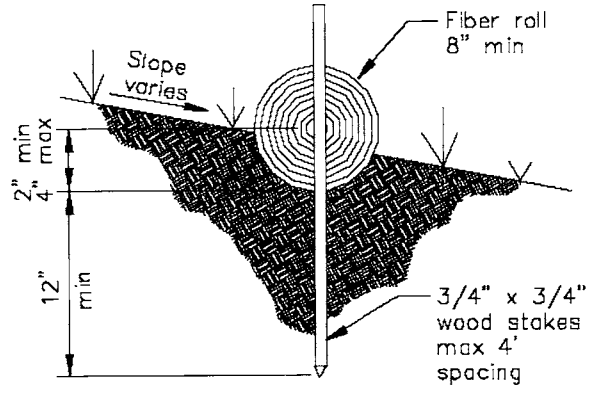
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



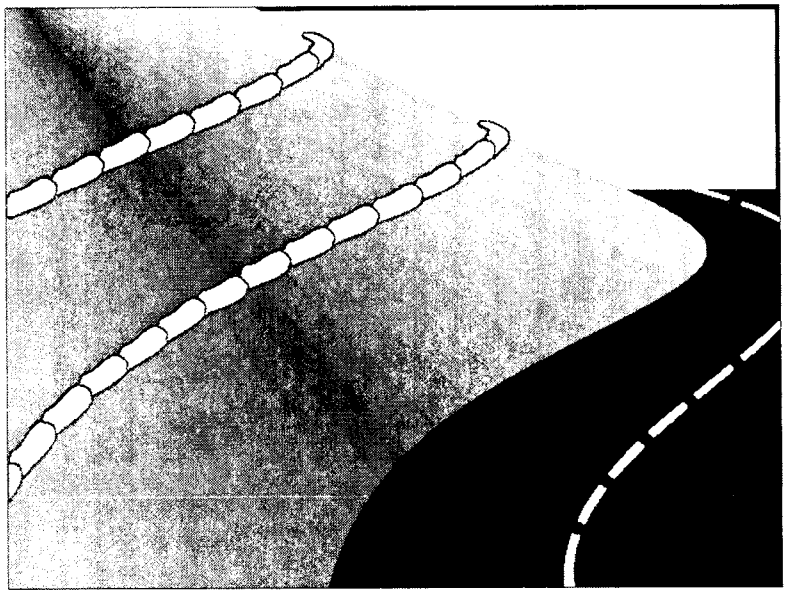
TYPICAL FIBER ROLL INSTALLATION
N.T.S.



ENTRENCHMENT DETAIL
N.T.S.

Gravel Bag Berm

SE-6



Objectives		
EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence
SE-5 Fiber Roll
SE-8 Sandbag Barrier
SE-9 Straw Bale Barrier

Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flows, preventing erosion.

Suitable Applications

Gravel bag berms may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:

- Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow
- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

- Gravel berms may be difficult to remove.
- Removal problems limit their usefulness in landscaped areas.
- Gravel bag berm may not be appropriate for drainage areas greater than 5 acres.
- Runoff will pond upstream of the filter, possibly causing flooding if sufficient space does not exist.
- Degraded gravel bags may rupture when removed, spilling contents.
- Installation can be labor intensive.
- Berms may have limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.

Implementation

General

A gravel bag berm consists of a row of open graded gravel–filled bags placed on a level contour. When appropriately placed, a gravel bag berm intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The open graded gravel in the bags is porous, which allows the ponded runoff to flow slowly through the bags, releasing the runoff as sheet flows. Gravel bag berms also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils. Gravel bag berms are similar to sand bag barriers, but are more porous.

Design and Layout

- Locate gravel bag berms on level contours.
  - Slopes between 20:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Gravel bags should be placed at a maximum interval of 25 ft (a closer spacing is more effective), with the first row placed the slope toe.
- Turn the ends of the gravel bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the gravel bag berm to allow ponding, and to provide room for sediment storage.

- For installation near the toe of the slope, consider moving the gravel bag barriers away from the slope toe to facilitate cleaning. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers.
- Drainage area should not exceed 5 acres.
- In Non-Traffic Areas:
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Top width = 12 in. minimum for one or two layer construction
  - Side slopes = 2:1 or flatter
- In Construction Traffic Areas:
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Top width = 12 in. minimum for one or two layer construction.
  - Side slopes = 2:1 or flatter.
- Butt ends of bags tightly
- On multiple row, or multiple layer construction, overlapp butt joints of adjacent row and row beneath.
- Use a pyramid approach when stacking bags.

Materials

- ***Bag Material:*** Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355.
- ***Bag Size:*** Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.
- ***Fill Material:*** Fill material should be 0.5 to 1 in. Class 2 aggregate base, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Gravel filter: Expensive, since off-site materials, hand construction, and demolition/removal are usually required. Material costs for gravel bags are average of $2.50 per empty gravel bag. Gravel costs range from $20-$35 per yd^3.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace gravel bags as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove gravel bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

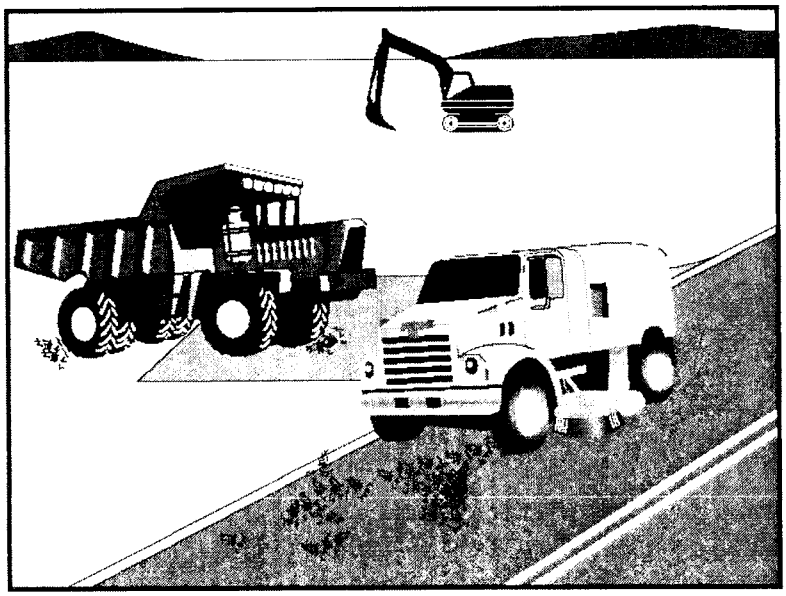
References

Handbook of Steel Drainage and Highway Construction, American Iron and Steel Institute, 1983.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Street Sweeping and Vacuuming SE-7



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TR	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.

- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.
- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

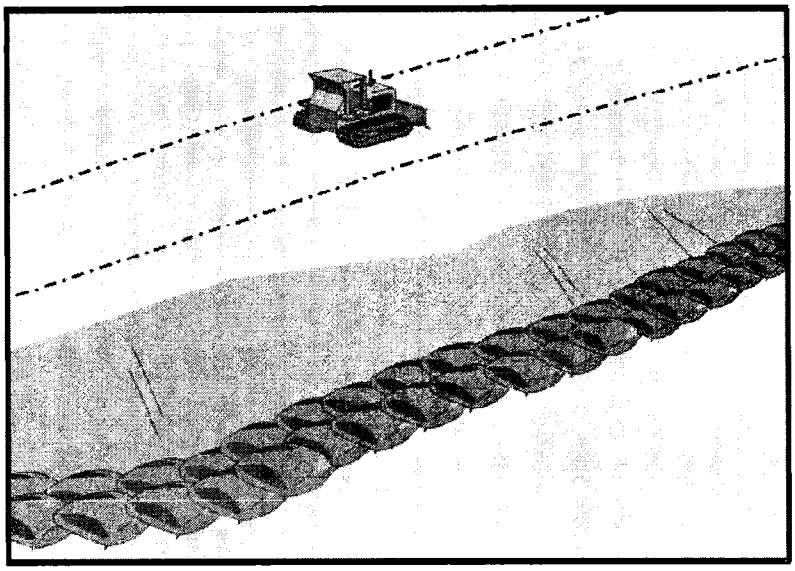
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Sandbag Barrier SE-8



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept sheet flows. Sandbag barriers pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-9 Straw Bale Barrier

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Barriers may have limited durability for long-term projects.
- When used to detain concentrated flows, maintenance requirements increase.
- Burlap should not be used for sandbags.

Implementation

General

A sandbag barrier consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. While the sand-filled bags are porous, the fine sand tends to quickly plug with sediment, limiting the rate of flow through the barrier. If a porous barrier is desired, consider SE-1, Silt Fence, SE-5, Fiber Rolls, SE-6, Gravel Bag Berms, or SE-9, Straw Bale Barriers. Sandbag barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed, sloped soils. Sandbag barriers are similar to ground bag berms, but less porous.

Design and Layout

- Locate sandbag barriers on a level contour.
  - Slopes between 20:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the slope toe.
  - Slopes 2:1 (H:V) or steeper: Sandbags should be placed at a maximum interval of 25 ft (a closer spacing is more effective), with the first row placed near the slope toe.
- Turn the ends of the sandbag barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sandbags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 5 acres.

- Stack sandbags at least three bags high.
- Butt ends of bags tightly.
- Overlapp butt joints of row beneath with each successive row.
- Use a pyramid approach when stacking bags.
- In non-traffic areas
  - Height = 18 in. maximum
  - Top width = 24 in. minimum for three or more layer construction
  - Side slope = 2:1 or flatter
- In construction traffic areas
  - Height = 12 in. maximum
  - Top width = 24 in. minimum for three or more layer construction.
  - Side slopes = 2:1 or flatter.

Materials

- ***Sandbag Material:*** Sandbag should be woven polypropylene, polyethylene or polyamide fabric, minimum unit weight of 4 ounces/yd^2, Mullen burst strength exceeding 300 lb/in^2 in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Use of burlap may not acceptable in some jurisdictions.
- ***Sandbag Size:*** Each sand-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.
- ***Fill Material:*** All sandbag fill material should be non-cohesive, Class 1 or Class 2 permeable material free from clay and deleterious material.

Costs

Sandbag barriers are more costly, but typically have a longer useful life than other barriers. Empty sandbags cost $0.25 - $0.75. Average cost of fill material is $8 per yd^3. Pre-filled sandbags are more expensive at $1.50 - $2.00 per bag.

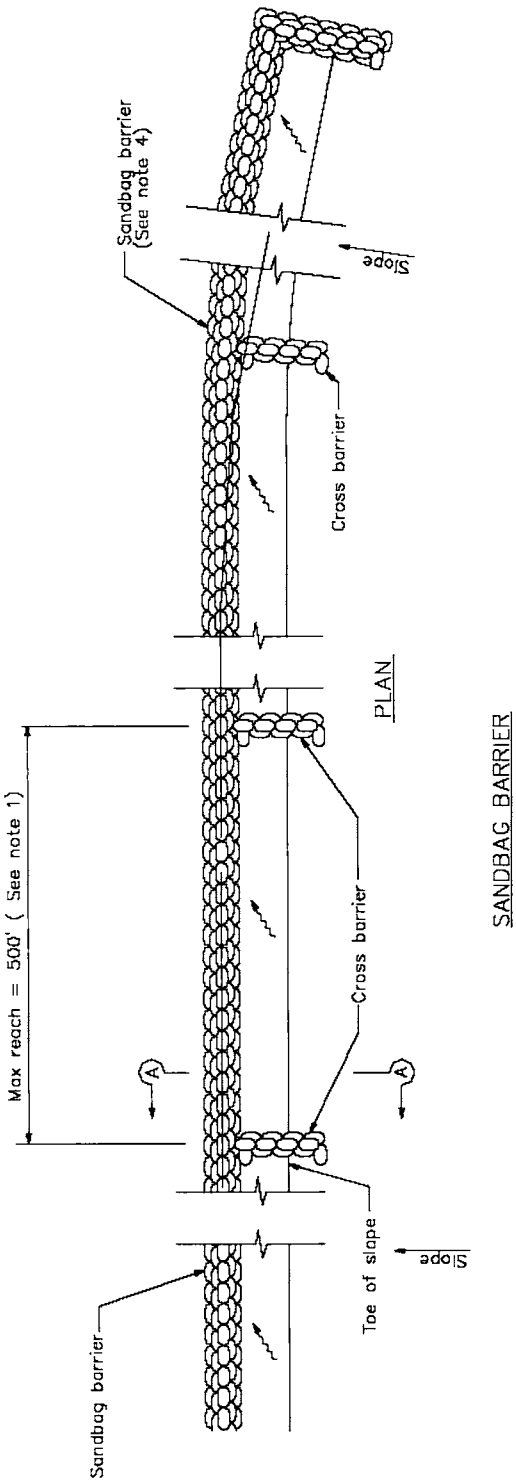
Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.
- Reshape or replace sandbags as needed.

- Repair washouts or other damage as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove sandbags when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

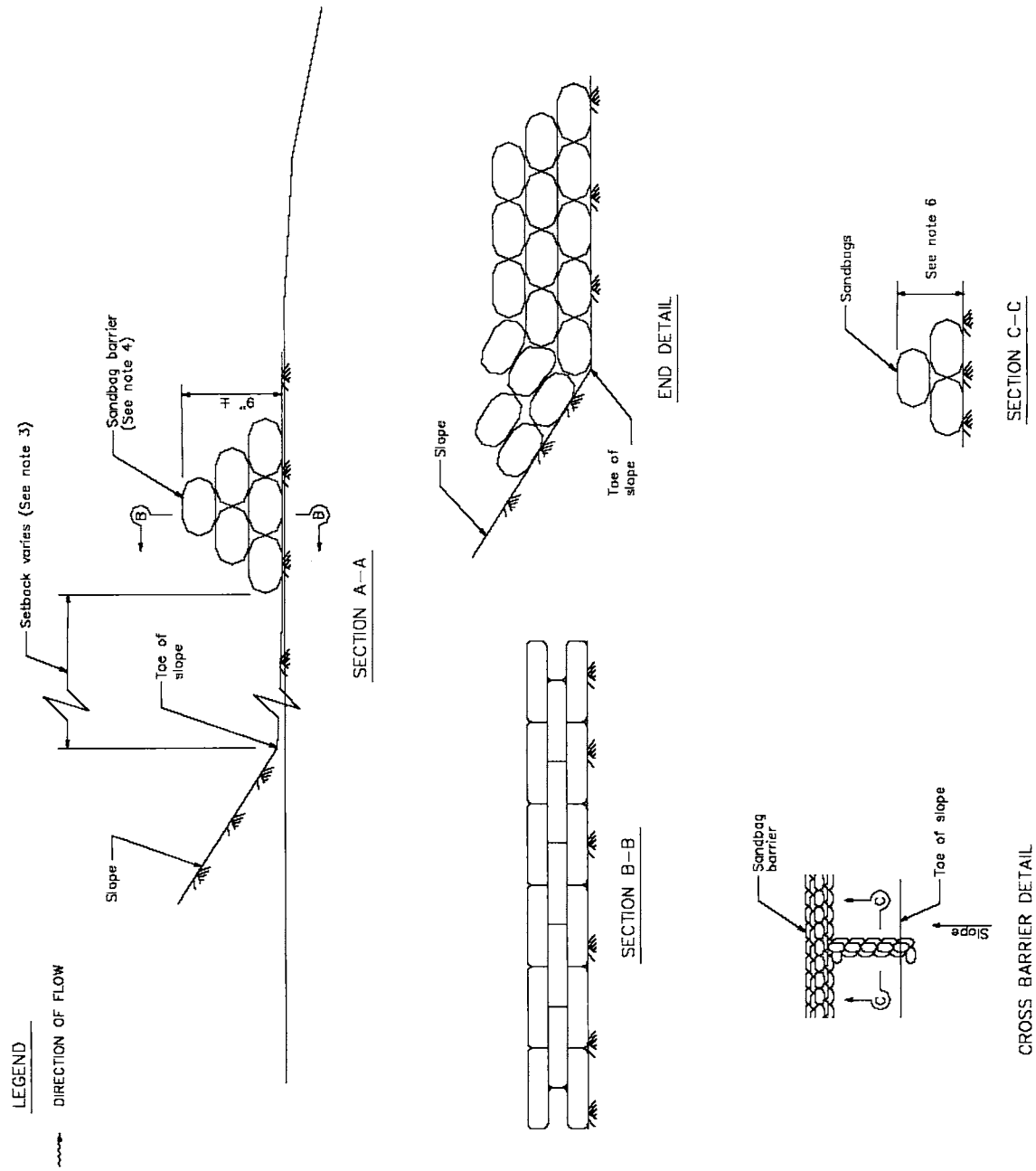
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



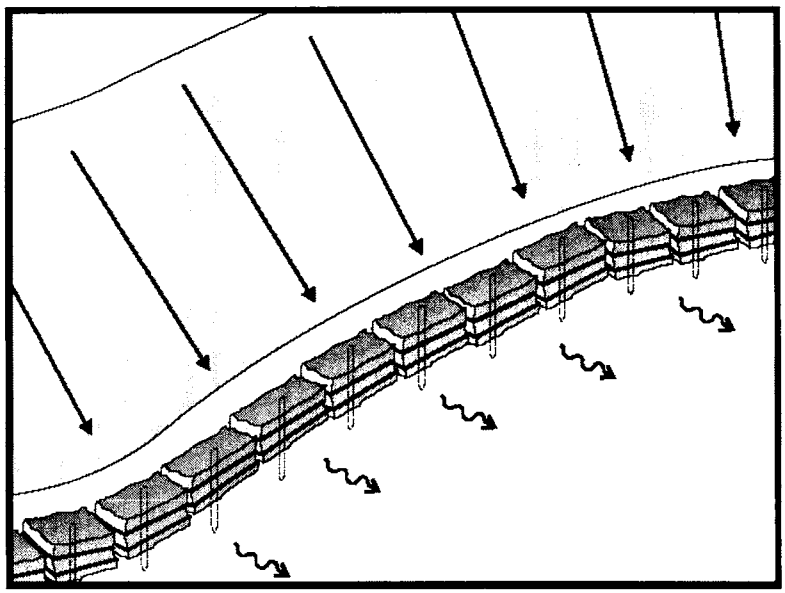
SANDBAG BARRIER

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. Place sandbags tightly.
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum of 3 bags high.
5. The end of the barrier shall be turned up slope.
6. Cross barriers shall be a min of 1/2 and a max of 2/3 the height of the linear barrier.
7. Sandbag rows and layers shall be staggered to eliminate gaps.


LEGEND
DIRECTION OF FLOW
Setback varies (See note 3)
Sandbag barrier (See note 4)
H
.6
Toe of slope
Slope
B
B
SECTION A-A
Slope
Toe of slope
END DETAIL
SECTION B-B
Sandbags
See note 6
SECTION C-C
Sandbag barrier
Toe of slope
Slope
C
C
CROSS BARRIER DETAIL

Straw Bale Barrier SE-9



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence
SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier

Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet- flow runoff, allowing sediment to settle out.

Suitable Applications

Straw bale barriers may be suitable:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - As sediment traps at culvert/pipe outlets
  - Below other small cleared areas
  - Along the perimeter of a site
  - Down slope of exposed soil areas
  - Around temporary stockpiles and spoil areas
  - Parallel to a roadway to keep sediment off paved areas
  - Along streams and channels
- As linear erosion control measure:
  - Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow

- At the top of slopes to divert runoff away from disturbed slopes
- As check dams across mildly sloped construction roads

Limitations

Straw bale barriers:

- Are not to be used for extended periods of time because they tend to rot and fall apart
- Are suitable only for sheet flow on slopes of 10 % or flatter
- Are not appropriate for large drainage areas, limit to one acre or less
- May require constant maintenance due to rotting
- Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
- Cannot be made of bale bindings of jute or cotton
- Require labor-intensive installation and maintenance
- Cannot be used on paved surfaces
- Should not to be used for drain inlet protection
- Should not be used on lined ditches
- May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

- Locate straw bale barriers on a level contour.
  - Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.
  - Slopes greater than 10:1 (H:V): Not recommended.

- Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.
- Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.
- Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.
- Maximum flow path to the barrier should be limited to 100 ft.
- Straw bale barriers should consist of two parallel rows.
  - Butt ends of bales tightly
  - Stagger butt joints between front and back row
  - Each row of bales must be trenched in and firmly staked
- Straw bale barriers are limited in height to one bale laid on its side.
- Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.
- See attached figure for installation details.

Materials

- ***Straw Bale Size:*** Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.
- ***Bale Bindings:*** Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.
- ***Stakes:*** Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Costs

Straw bales cost $5 - $7 each. Adequate labor should be budgeted for installation and maintenance.

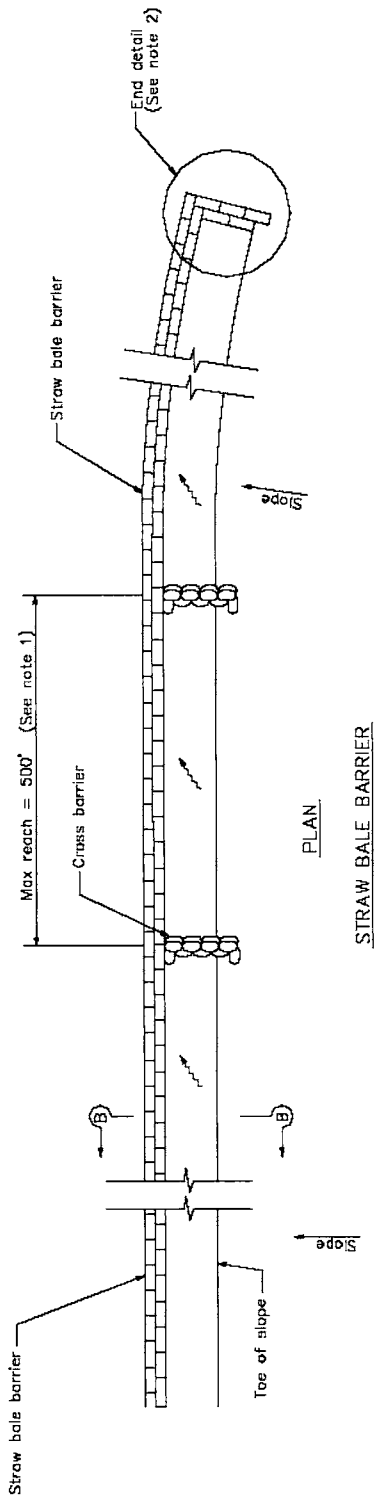
Inspection and Maintenance

Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.
- Replace or repair damaged bales as needed.
- Repair washouts or other damages as needed.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.
- Remove straw bales when no longer needed. Remove sediment accumulation, and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



PLAN

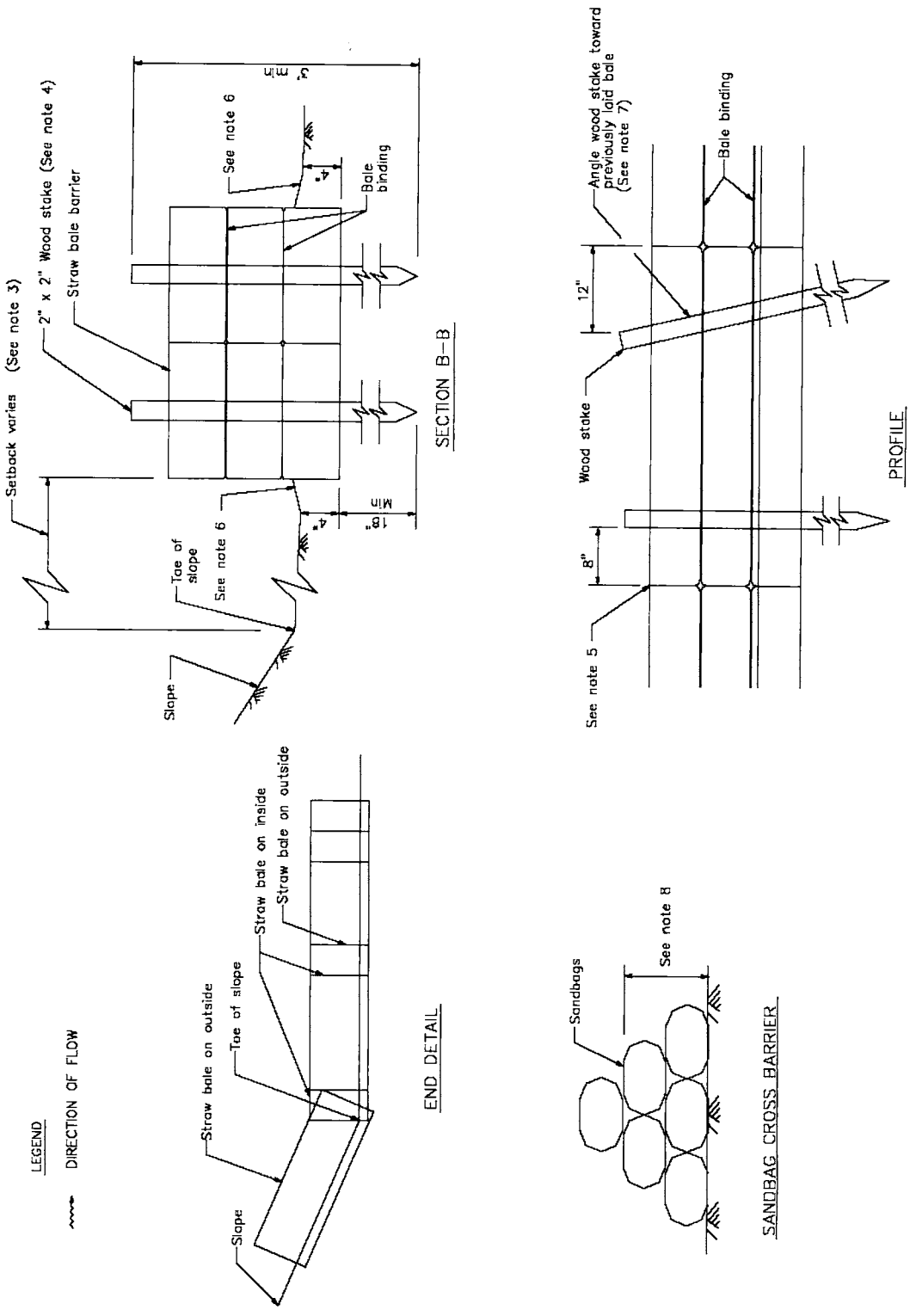
STRAW BALE BARRIER

LEGEND

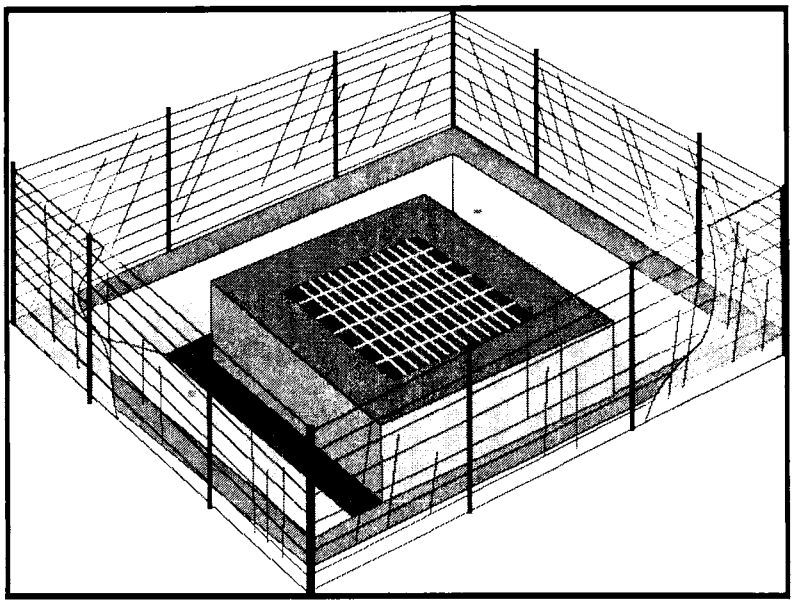
DIRECTION OF FLOW

NOTES

1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. The end of barrier shall be turned up slope.
3. Dimension may vary to fit field condition.
4. Stake dimensions are nominal.
5. Place straw bales tightly together.
6. Tamp embedment spoils against sides of installed bales.
7. Drive angled wood stake before vertical stake to ensure tight abutment to adjacent bale.
8. Sandbag cross barriers should be a min of 1/2 and a max of 2/3 the height of the linear barrier.
9. Sandbag rows and layers should be offset to eliminate gaps.


Setback varies (See note 3)
2" x 2" Wood stake (See note 4)
Straw bale barrier
See note 6
Bale binding
Min 3"
4"
Min 18"
Tae of slope
See note 6
Slope
SECTION B-B
Angle wood stake toward previously laid bale (See note 7)
Bale binding
12"
Wood stake
8"
See note 5
PROFILE
Straw bale on inside
Straw bale on outside
Straw bale on outside
Toe of slope
Slope
END DETAIL
Sandbags
See note 8
SANDBAG CROSS BARRIER
LEGEND
DIRECTION OF FLOW

Storm Drain Inlet Protection SE-10



Objectives

EC	Erosion Control	
SE	Sediment Control	☑
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence
SE-5 Fiber Rolls
SE-6 Gravel Bag Berm
SE-8 Sandbag Barrier
SE-9 Straw Bale Barrier

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction.

Suitable Applications

Every storm drain inlet receiving sediment-laden runoff should be protected.

Limitations

- Drainage area should not exceed 1 acre.
- Straw bales, while potentially effective, have not produced in practice satisfactory results, primarily due to improper installation.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Inlet protection usually requires other methods of temporary protection to prevent sediment-laden stormwater and non-stormwater discharges from entering 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 onsite sediment trapping techniques in conjunction with inlet protection.

- Frequent maintenance is required.
- For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Large amounts of sediment may enter the storm drain system when storm drains are installed before the upslope drainage area is stabilized, or where construction is adjacent to an existing storm drain. In cases of extreme sediment loading, the storm drain itself may clog and lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Inlet protection methods not presented in this handbook should be approved by the local stormwater management agency.

Design and Layout

Identify existing and 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.

- Limit upstream drainage area to 1 acre maximum. For larger drainage areas, use SE-2, Sediment Basin, or SE-3, Sediment Trap, upstream of the inlet protection device.
- The key to successful and safe use of storm drain inlet protection devices is to know where runoff will pond or be diverted.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the

inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Four types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Filter Fabric Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Filter Fabric Fence*** - The filter fabric fence (Type 1) protection is shown in the attached figure. Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place filter fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes must be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.
  5. Backfill the trench with gravel or compacted earth all the way around.
- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - The excavated drop inlet sediment trap (Type 2) is shown in the attached figures. Install filter fabric fence in

accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area.

- ***DI Protection Type 3 - Gravel bag*** - The gravel bag barrier (Type 3) is shown in the figures. Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability.

  1. Use sand bag made of geotextile fabric (not burlap) and fill with 0.75 in. rock or 0.25 in. pea gravel.
  2. Construct on gently sloping street.
  3. Leave room upstream of barrier for water to pond and sediment to settle.
  4. Place several layers of sand bags – overlapping the bags and packing them tightly together.
  5. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter*** - The block and gravel filter (Type 4) is shown in the figures. Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place filter fabric over the wire mesh.
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

Costs

- Average annual cost for installation and maintenance (one year useful life) is $200 per inlet.

Inspection and Maintenance

- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

- Filter Fabric Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes 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 stakes.

- Gravel Filters. If the gravel becomes clogged with sediment, it must be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.

- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site ore disposed at an appropriate location.

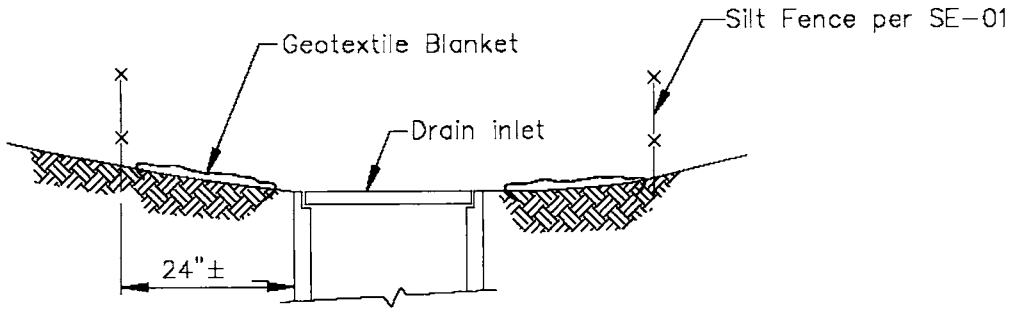
- Remove storm drain inlet protection once the drainage area is stabilized.

  - Clean and regrade area around the inlet and clean the inside of the storm drain inlet as it must be free of sediment and debris at the time of final inspection.

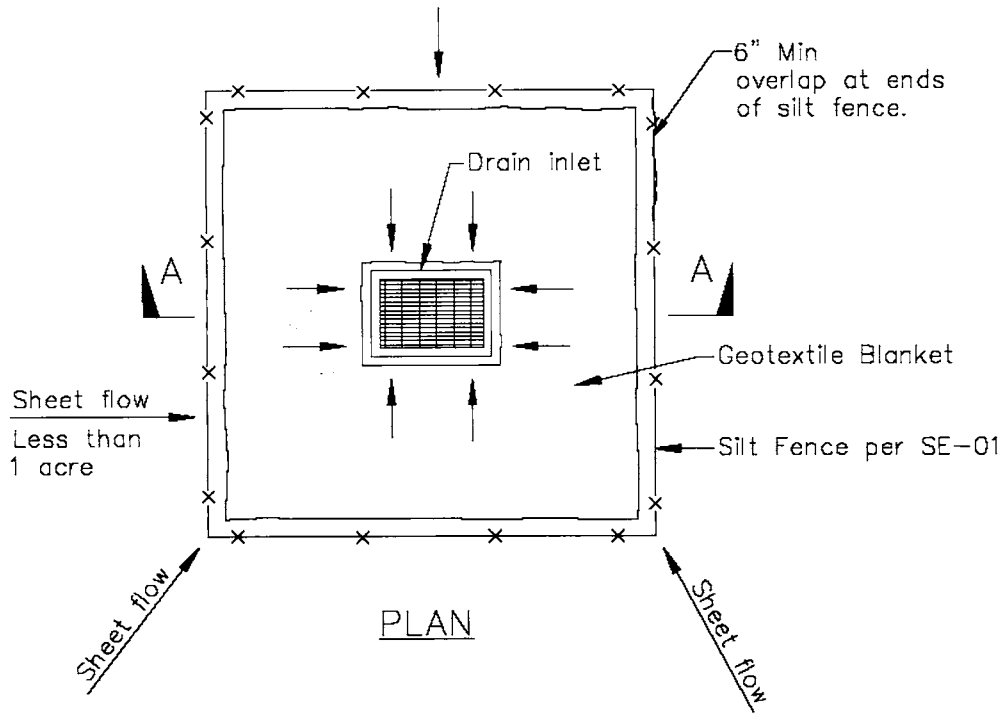
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.



SECTION A–A



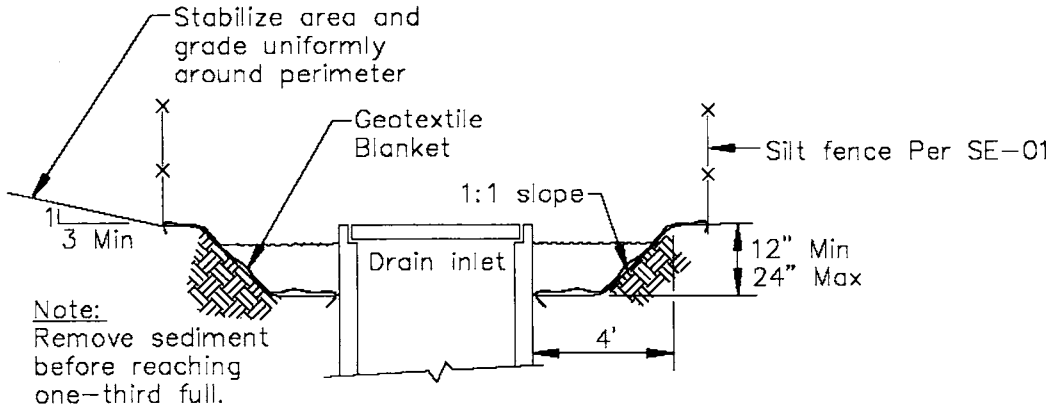
PLAN

DI PROTECTION TYPE 1
NOT TO SCALE

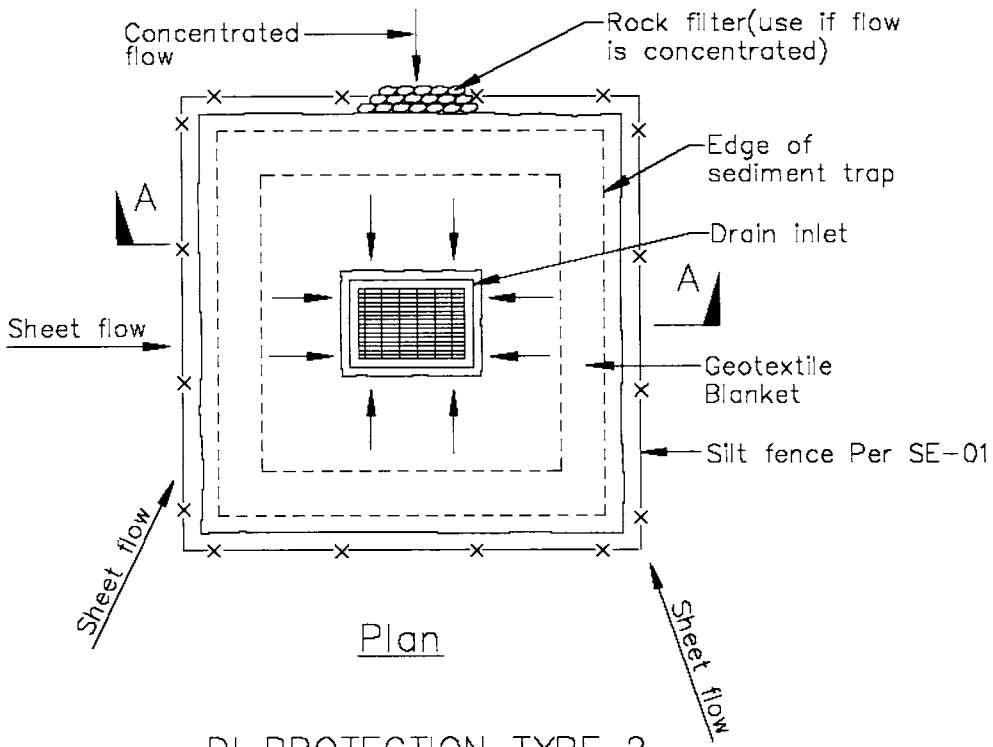
NOTES:

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 SE-10



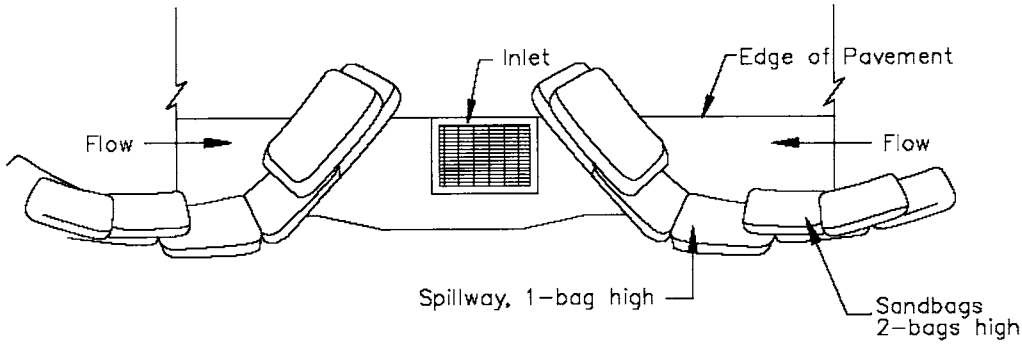
Section A-A



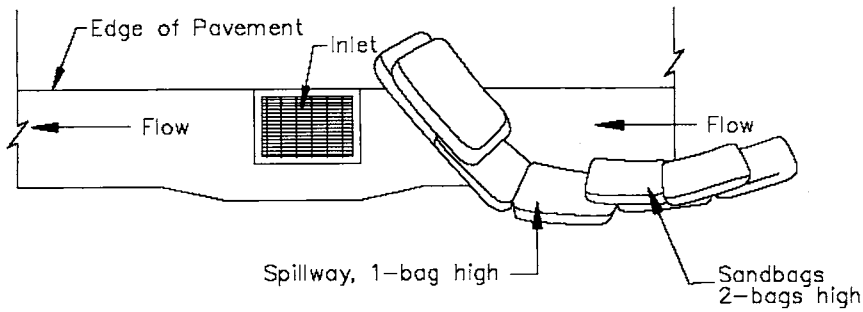
Plan

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.



TYPICAL PROTECTION FOR INLET ON SUMP

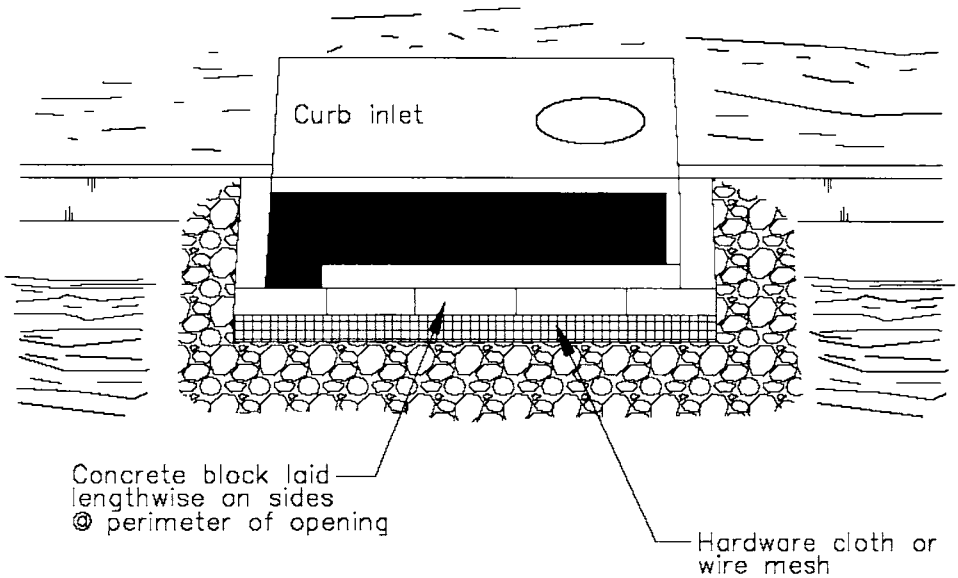


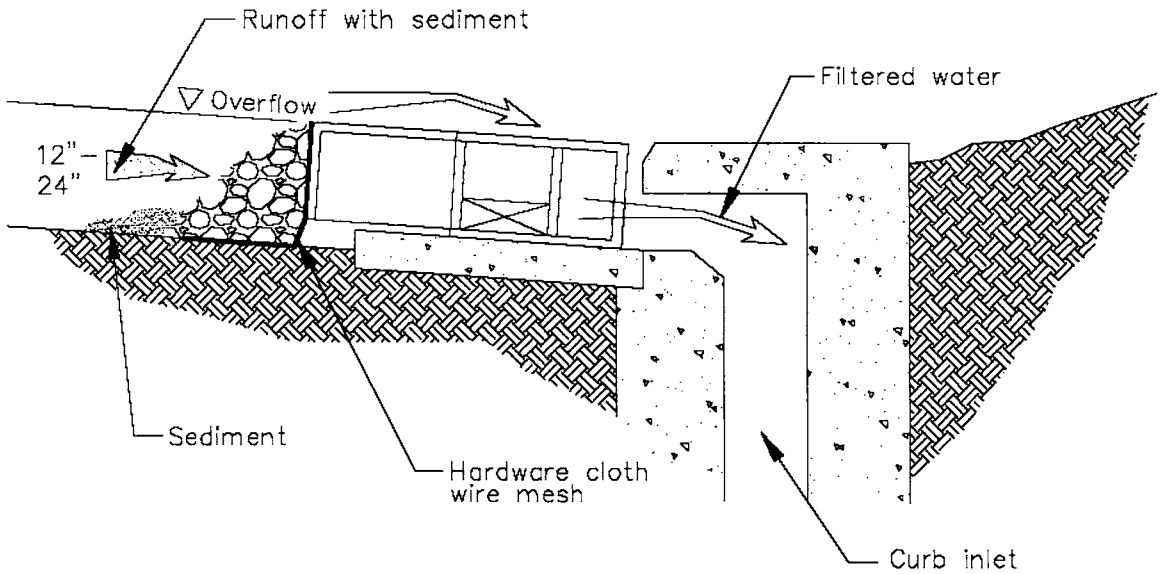
TYPICAL PROTECTION FOR INLET ON GRADE

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.

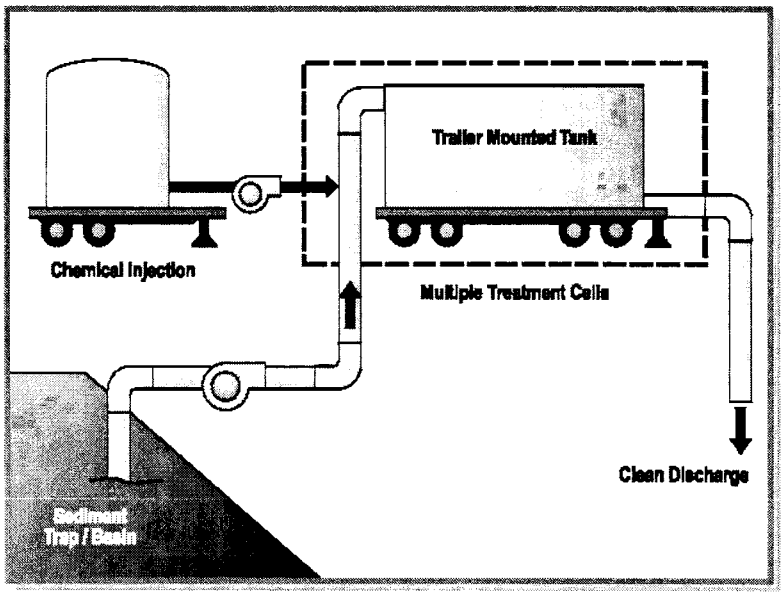
DI PROTECTION TYPE 3
NOT TO SCALE





DI PROTECTION – TYPE 4
NOT TO SCALE

Chemical Treatment SE-11



Objectives

EC	Erosion Control
SE	Sediment Control
TR	Tracking Control
WE	Wind Erosion Control
NS	Non-Stormwater Management Control
WM	Waste Management and Materials Pollution Control

Legend:

☑ Primary Objective

☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Chemical treatment includes the application of chemicals to stormwater to aid in the reduction of turbidity caused by fine suspended sediment.

Suitable Applications

Chemical treatment can reliably provide exceptional reductions of turbidity and associated pollutants and should be considered where turbid discharges to sensitive wastes cannot be avoided using other BMPs. Typically, chemical use is limited to waters with numeric turbidity standards.

Limitations

The use of chemical treatment must have the advanced approval of the Regional Water Quality Control Board.

- Chemical Treatment of stormwater is relatively new and unproven technology in California.
- BMP has not been used often in California
- Petroleum based polymers should not be used
- Requires sediment basin or trailer mounted unit for chemical application
- Batch treatment required, flow through continuous treatment not allowed
- Requires large area

- Limited discharge rates depending on receiving water body
- Labor intensive operation and maintenance
- Requires monitoring for non-visible pollutants

Implementation

Turbidity is difficult to control once fine particles are suspended in stormwater runoff from a construction site. Sedimentation ponds are effective at removing larger particulate matter by gravity settling, but are ineffective at removing smaller particulates such as clay and fine silt. Sediment ponds are typically designed to remove sediment no smaller than medium silt (0.02 mm). Chemical treatment may be used to reduce the turbidity of stormwater runoff. Very high turbidities can be reduced to levels comparable to what is found in streams during dry weather.

Criteria for Chemical Treatment Product Use

Chemically treated stormwater discharged from construction sites must be non-toxic to aquatic organisms. The following protocol should be used to evaluate chemicals proposed for stormwater treatment at construction sites. Authorization to use a chemical in the field based on this protocol does not relieve the applicant from responsibility for meeting all discharge and receiving water criteria applicable to a site.

- Treatment chemicals must be approved by EPA for potable water use.
- Petroleum-based polymers are prohibited.
- Prior to authorization for field use, jar tests should be conducted to demonstrate that turbidity reduction necessary to meet the receiving water criteria could be achieved. Test conditions, including but not limited to raw water quality and jar test procedures, should be indicative of field conditions. Although these small-scale tests cannot be expected to reproduce performance under field conditions, they are indicative of treatment capability.
- Prior to authorization for field use, the chemically treated stormwater should be tested for aquatic toxicity. Applicable state or local Whole Effluent Toxicity Testing and Limits, should be used. Testing should use stormwater from the construction site at which the treatment chemical is proposed for use or a water solution using soil from the proposed site.
- The proposed maximum dosage should be at least a factor of five lower than the no observed effects concentration (NOEC).
- The approval of a proposed treatment chemical should be conditional, subject to full-scale bioassay monitoring of treated stormwater at the construction site where the proposed treatment chemical is to be used.
- Treatment chemicals that have already passed the above testing protocol do not need to be reevaluated. Contact the RWQCB for a list of treatment chemicals that may be approved for use.

Treatment System Design Considerations

The design and operation of a chemical treatment system should take into consideration the factors that determine optimum, cost-effective performance. It may not be possible to fully

incorporate all of the classic concepts into the design because of practical limitations at construction sites. Nonetheless, it is important to recognize the following:

- The right chemical must be used at the right dosage. A dosage that is either too low or too high will not produce the lowest turbidity. There is an optimum dosage rate. This is a situation where the adage "adding more is always better" is not the case.
- The coagulant must be mixed rapidly into the water to insure proper dispersion.
- Experience has found that sufficient flocculation occurs in the pipe leading from the point of chemical addition to the settling or sediment basin.
- Since the volume of the basin is a determinant in the amount of energy per unit volume, the size of the energy input system can be too small relative to the volume of the basin.
- Care must be taken in the design of the withdrawal system to minimize outflow velocities and to prevent floc discharge. The discharge should be directed through a physical filter such as vegetated swale that would catch any unintended floc discharge.
- A pH-adjusting chemical should be added into the sediment basin to control pH. Experience shows that the most common problem is low pH.

Treatment System Design

Chemical treatment systems should be designed as batch treatment systems using either ponds or portable trailer-mounted tanks. Flow-through continuous treatment systems are not allowed at this time.

A chemical treatment system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), a sediment basin or sediment trap, pumps, a chemical feed system, treatment cells, and interconnecting piping.

The treatment system should use a minimum of two lined treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be basins, traps or tanks. Portable tanks may also be suitable for some sites.

The following equipment should be located in an operation shed:

- The chemical injector
- Secondary contaminant for acid, caustic, buffering compound, and treatment chemical
- Emergency shower and eyewash
- Monitoring equipment which consists of a pH meter and a turbidimeter

Sizing Criteria

The combination of the sediment basin or other holding area and treatment capacity should be large enough to treat stormwater during multiple day storm events. See SE-2, Sediment Basin, for design criteria. Bypass should be provided around the chemical treatment system to

accommodate extreme storm events. Runoff volume should be calculated using the Rational Method. Primary settling should be encouraged in the sediment basin/storage pond. A forebay with access for maintenance may be beneficial.

There are two opposing considerations in sizing the treatment cells. A larger cell is able to treat a larger volume of water each time a batch is processed. However, the larger the cell the longer the time required to empty the cell. A larger cell may also be less effective at flocculation and therefore require a longer settling time. The simplest approach to sizing the treatment cell is to multiply the allowable discharge flow rate times the desired drawdown time. A 4-hour drawdown time allows one batch per cell per 8-hour work period, given 1 hour of flocculation followed by 2 hours of settling.

The permissible discharge rate governed by potential downstream effect can be used to calculate the recommended size of the treatment cells. The following discharge flow rate limits apply absent any local requirements:

- If the discharge is direct or indirect to a stream, the discharge flow rate should not exceed 50 percent of the peak flow rate for all events between the 2-year and the 10-year, 24-hour event.
- If discharge is occuring during a storm event equal to or greater than the 10-year storm the allowable discharge rate is the peak flow rate of the 10-year, 24-hour event.
- Discharge to a stream should not increase the stream flow rate by more than 10 percent.
- If the discharge is directly to a lake or major receiving water there is no discharge flow limit.
- If the discharge is to a municipal storm drainage system, the allowable discharge rate may be limited by the capacity of the public system. It may be necessary to clean the municipal storm drainage system prior to the start of the discharge to prevent scouring solids from the drainage system.
- Runoff rates may be calculated using the Rational Method, unless another method is required by the local flood control agency or agency that issued the grading permit.

Costs

Costs for chemical treatment may be significant due to equipment required and cost of chemicals. The cost is offset by the ability to reduce some use of other onsite erosion control BMPs and the reuse of equipment (e.g., pumps and dosing equipment). The incremental cost is generally less than 1% of the total construction costs.

Inspection and Maintenance

Chemical treatment systems must be operated and maintained by individuals with expertise in their use. Chemical treatment systems should be monitored continuously while in use.

The following monitoring should be conducted. Test results should be recorded on a daily log kept on site.

Operational Monitoring

- pH conductivity (as a surrogate for alkalinity), turbidity, and temperature of the untreated stormwater
- Total volume treated and discharged
- Discharge time and flow rate
- Type and amount of chemical used for pH adjustment
- Amount of polymer used for treatment
- Settling time

Compliance Monitoring

- pH and turbidity of the treated stormwater
- pH and turbidity of the receiving water

Bio-monitoring

Treated stormwater should be tested for acute (lethal) toxicity. Bioassays should be conducted by a laboratory accredited by the State of California. **The performance standard for acute toxicity is no statistically significant difference in survival between the control and 100 percent chemically treated stormwater.**

Acute toxicity tests should be conducted with the following species and protocols:

- Fathead minnow, Pimephales promelas (96 hour static-renewal test, method: EPA/600/4-90/027F). Rainbow trout, Oncorhynchus mykiss (96 hour static-renewal test, method: EPA/600/4-90/027F) may be used as a substitute for fathead minnow.
- Daphnid, Ceriodaphnia dubia, Daphnia pulex, or Daphnia magna (48 hour static test, method: EPA/600/4-90/027F).

All toxicity tests should meet quality assurance criteria and test conditions in the most recent versions of the EPA test method.

Bioassays should be performed on the first five batches and on every tenth batch thereafter or as otherwise approved by the RWQCB. Failure to meet the performance standard should be immediately reported to the RWQCB.

Discharge Compliance:

Prior to discharge, each batch of treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits may be established by the water quality standards or a site-specific discharge permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity must be within 5 NTUs of the background turbidity. Background is measured in the receiving water, upstream from the treatment process discharge point. pH must be within the range of 6.5 to 8.5 standard units and not cause a change in the pH of the receiving water of more than 0.2 standard units. It is often

possible to discharge treated stormwater that has a lower turbidity than the receiving water and that matches the pH.

Treated stormwater samples and measurements should be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water should not be taken from the treatment pond to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training:

Each contractor who intends to use chemical treatment should be trained by an experienced contractor on an active site for at least 40 hours.

Standard BMPs:

Erosion and sediment control BMPs should be implemented throughout the site to prevent erosion and discharge of sediment.

Sediment Removal and Disposal

- Sediment should be removed from the storage or treatment cells as necessary. Typically, sediment removal is required at least once during a wet season and at the decommissioning of the cells. Sediment remaining in the cells between batches may enhance the settling process and reduce the required chemical dosage.

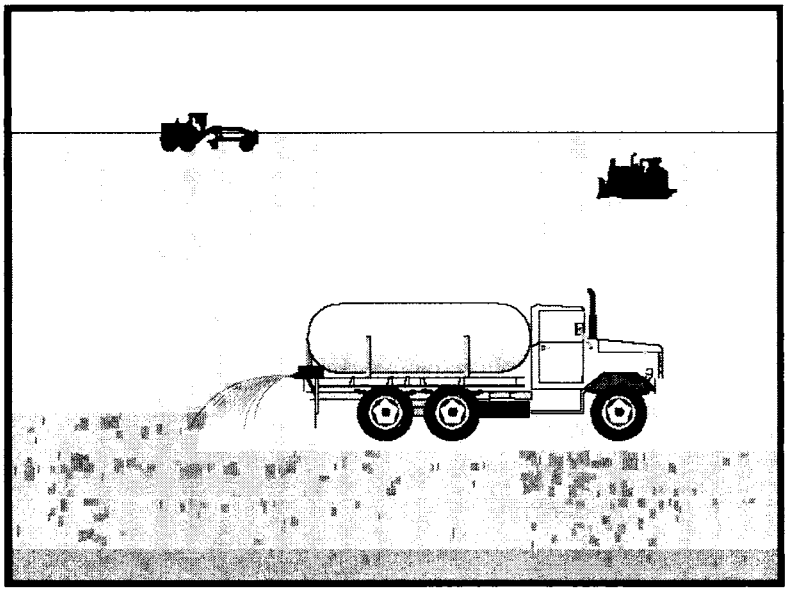
- Sediment may be incorporated into the site away from drainages.

References

Stormwater Management Manual for Western Washington, Volume II – Construction Stormwater Pollution Prevention, Washington State Department of Ecology, August 2001.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Wind Erosion Control WE-1



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	☑
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Wind erosion or dust control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

Suitable Applications

Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- Sediment tracking onto paved roads
- Soils and debris storage piles
- Batch drop from front-end loaders
- Areas with unstabilized soil
- Final grading/site stabilization

Limitations

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective.
- Over watering may cause erosion.

- Oil or oil-treated subgrade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil.
- Effectiveness depends on soil, temperature, humidity, and wind velocity.
- Chemically treated sub grades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- Asphalt, as a mulch tack or chemical mulch, requires a 24-hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

Implementation

General

California's Mediterranean climate, with short wet seasons and long hot dry seasons, allows the soils to thoroughly dry out. During these dry seasons, construction activities are at their peak, and disturbed and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment.

Dust control, as a BMP, is a practice that is already in place for many construction activities. Los Angeles, the North Coast, and Sacramento, among others, have enacted dust control ordinances for construction activities that cause dust to be transported beyond the construction project property line.

Recently, the State Air Resources Control Board has, under the authority of the Clean Air Act, started to address air quality in relation to inhalable particulate matter less than 10 microns (PM-10). Approximately 90 percent of these small particles are considered to be dust. Existing dust control regulations by local agencies, municipal departments, public works department, and public health departments are in place in some regions within California.

Many local agencies require dust control in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. The following are measures that local agencies may have already implemented as requirements for dust control from contractors:

- Construction and Grading Permits: Require provisions for dust control plans.
- Opacity Emission Limits: Enforce compliance with California air pollution control laws.
- Increase Overall Enforcement Activities: Priority given to cases involving citizen complaints.
- Maintain Field Application Records: Require records of dust control measures from contractor;
- Stormwater Pollution Prevention Plan: (SWPPP): Integrate dust control measures into SWPPP.

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table shows dust control practices that can be applied to site conditions that cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph, and controlling the number and activity of vehicles on a site at any given time.

SITE CONDITION	DUST CONTROL PRACTICES								
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Silt Fences	Temporary Gravel Construction Entrances/Equipment Wash Down	Haul Truck Covers	Minimize Extent of Disturbed Area
Disturbed Areas not Subject to Traffic	X	X	X	X	X				X
Disturbed Areas Subject to Traffic			X	X	X		X		X
Material Stock Pile Stabilization			X	X		X			X
Demolition			X				X	X	
Clearing/ Excavation			X	X		X			X
Truck Traffic on Unpaved Roads			X	X	X		X	X	
Mud/Dirt Carry Out					X		X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (EC-1, Scheduling).
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering.
- Identify and stabilize key access points prior to commencement of construction.
- Minimize the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site.
- Water should 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 should be equipped with a positive means of shutoff.
- Unless water is applied by means of pipelines, at least one mobile unit should 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 California Department of Health Services water reclamation criteria and the Regional Water Quality Control Board requirements. Non-potable water should not be conveyed in tanks or drain pipes that will be used to convey potable water and there should be no connection between potable and non-potable supplies. Non-potable tanks, pipes, and other conveyances should be marked, "NON-POTABLE WATER - DO NOT DRINK."
- Materials applied as temporary soil stabilizers and soil binders also generally provide wind erosion control benefits.
- Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize inactive construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. If chemical stabilization is used, the chemicals should not create any adverse effects on stormwater, plant life, or groundwater.

Costs

Installation costs for water and chemical dust suppression are low, but annual costs may be quite high since these measures are effective for only a few hours to a few days.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Check areas protected to ensure coverage.
- Most dust control measures require frequent, often daily, or multiple times per day attention.

References

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

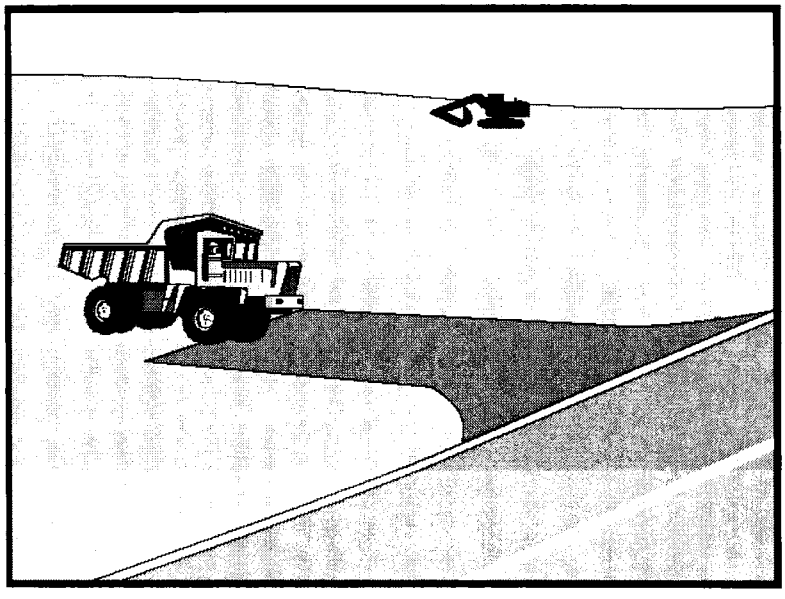
California Air Pollution Control Laws, California Air Resources Board, 1992.

Caltrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative".

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stabilized Construction Entrance/Exit TC-1



Objectives		
EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

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

Suitable Applications

Use at construction sites:

- Where dirt or mud can be tracked onto public roads.
- Adjacent to water bodies.
- Where poor soils are encountered.
- Where dust is a problem during dry weather conditions.

Limitations

- Entrances and exits require periodic top dressing with additional stones.
- This BMP should be used in conjunction with street sweeping on adjacent public right of way.
- Entrances and exits should be constructed on level ground only.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

Implementation

General

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. NPDES permits require that appropriate measures be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout

- Construct on level ground where possible.
- Select 3 to 6 in. diameter stones.
- Use minimum depth of stones of 12 in. or as recommended by soils engineer.
- Construct length of 50 ft minimum, and 30 ft minimum width.
- Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.
- Provide ample turning radii as part of the entrance.
- Limit the points of entrance/exit to the construction site.
- Limit speed of vehicles to control dust.
- Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.
- Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.
- Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.
- Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth, or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.
- Designate combination or single purpose entrances and exits to the construction site.
- Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.
- Implement SE-7, Street Sweeping and Vacuuming, as needed.
- All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.
- Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.
- Keep all temporary roadway ditches clear.
- Check for damage and repair as needed.
- Replace gravel material when surface voids are visible.
- Remove all sediment deposited on paved roadways within 24 hours.
- Remove gravel and filter fabric at completion of construction

Costs

Average annual cost for installation and maintenance may vary from $1,200 to $4,800 each, averaging $2,400 per entrance. Costs will increase with addition of washing rack, and sediment trap. With wash rack, costs range from $1,200 - $6,000 each, averaging $3,600 per entrance.

References

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas, USEPA Agency, 2002.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April 1992.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

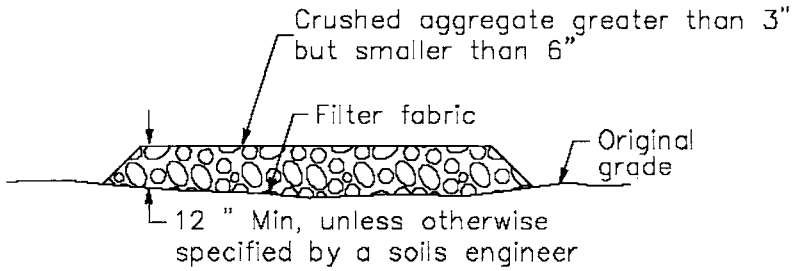
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Stabilized Construction Entrance/Exit TC-1



SECTION B–B
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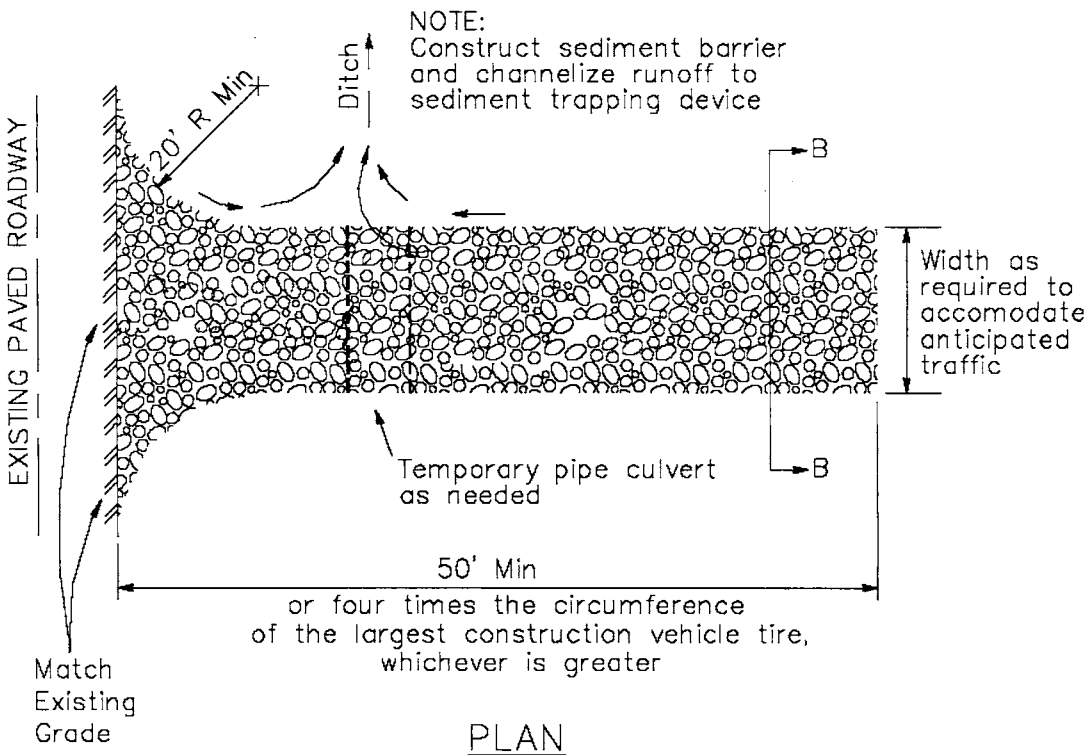

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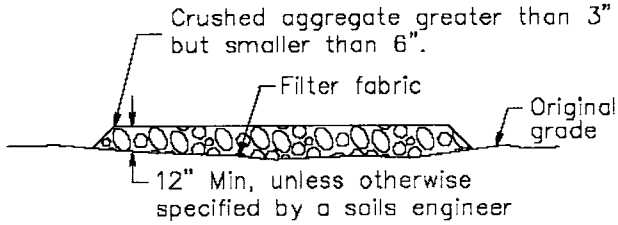
Stabilized Construction Entrance/Exit TC-1



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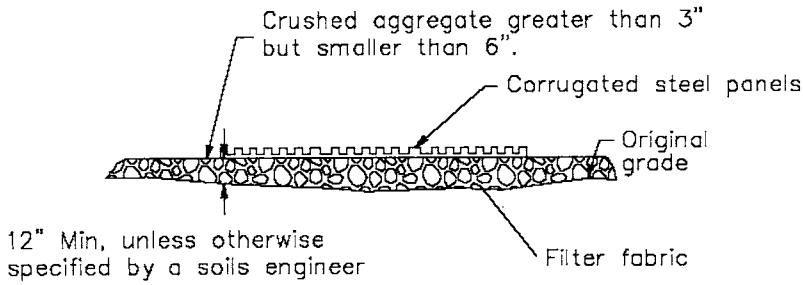
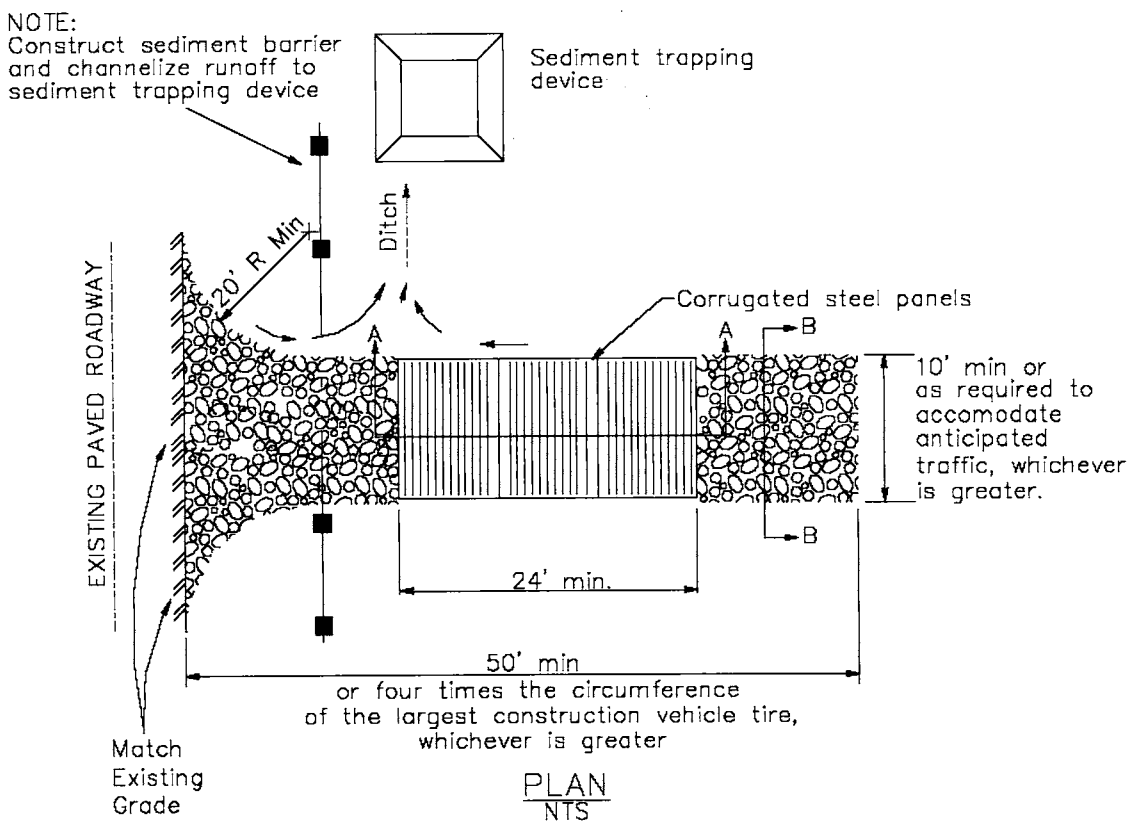


SECTION A–A
NOT TO SCALE



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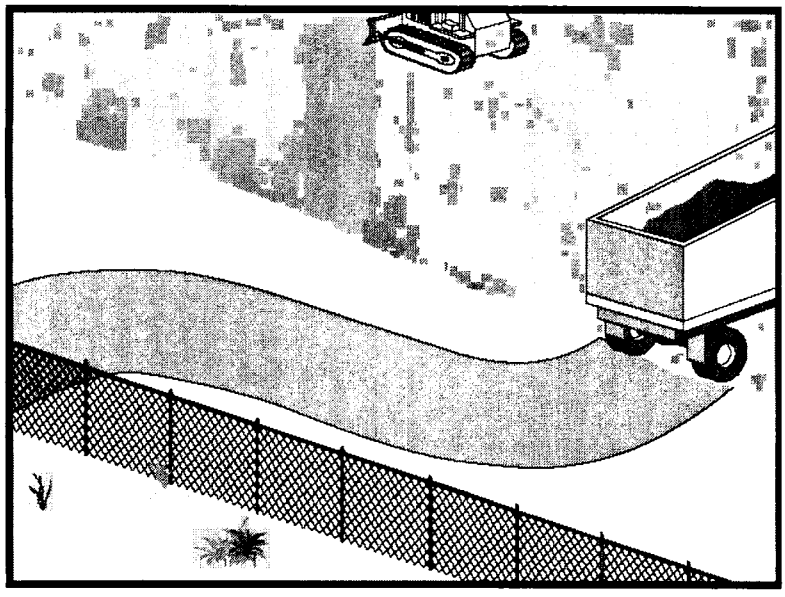
Stabilized Construction Roadway TC-2



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

Suitable Applications

This BMP should be applied for the following conditions:

- Temporary Construction Traffic:
  - Phased construction projects and offsite road access
  - Construction during wet weather
- Construction roadways and detour roads:
  - Where mud tracking is a problem during wet weather
  - Where dust is a problem during dry weather
  - Adjacent to water bodies
  - Where poor soils are encountered

Limitations

- The roadway must be removed or paved when construction is complete.

- Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See WE-1, Wind Erosion Control.
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.
- Materials will likely need to be removed prior to final project grading and stabilization.
- Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system (SE-10, Storm Drain Inlet Protection). In addition, the following criteria should be considered.

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15%.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (WE-1, Wind Erosion Control).
- Properly grade roadway to prevent runoff from leaving the construction site.
- Design stabilized access to support heaviest vehicles and equipment that will use it.

- Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.
- Coordinate materials with those used for stabilized construction entrance/exit points.
- If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, impact weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep all temporary roadway ditches clear.
- When no longer required, remove stabilized construction roadway and re-grade and repair slopes.
- Periodically apply additional aggregate on gravel roads.
- Active dirt construction roads are commonly watered three or more times per day during the dry season.

Costs

Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay. No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

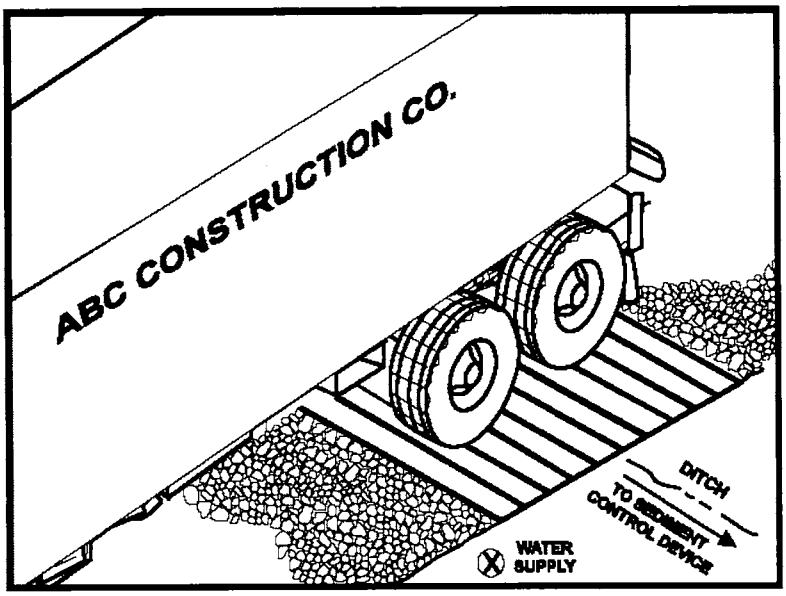
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Virginia Erosion and Sedimentation Control Handbook, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, 1991.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency, November 1988.

Entrance/Outlet Tire Wash TC-3



Objectives

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

TC-1 Stabilized Construction Entrance/Exit

Description and Purpose

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

Suitable Applications

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

Limitations

- The tire wash requires a supply of wash water.
- A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.
- Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation

- Incorporate with a stabilized construction entrance/exit. See TC-1, Stabilized Construction Entrance/Exit.
- Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.
- Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

- Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.
- Use hoses with automatic shutoff nozzles to prevent hoses from being left on.
- Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.
- Implement SC-7, Street Sweeping and Vacuuming, as needed.

Costs

Costs are low for installation of wash rack.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.
- Inspect routinely for damage and repair as needed.

References

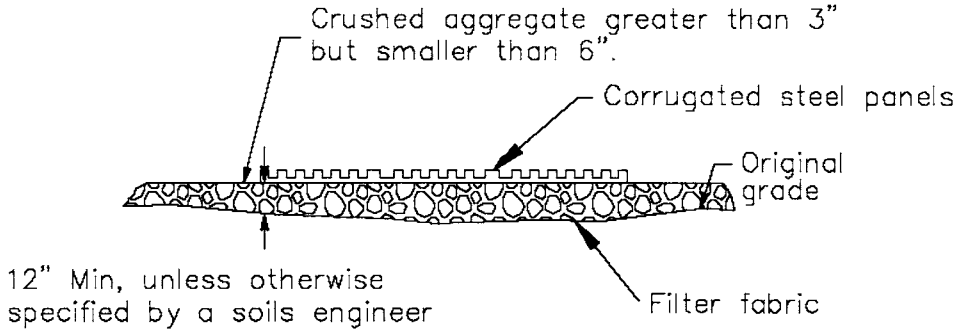
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



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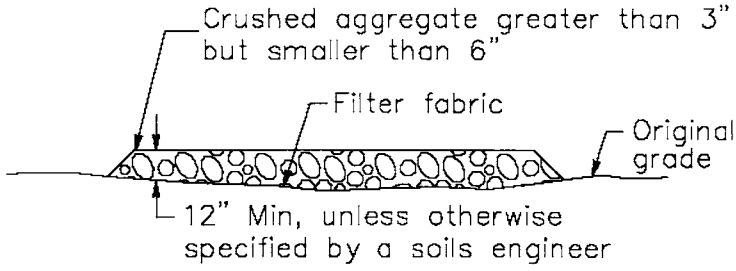

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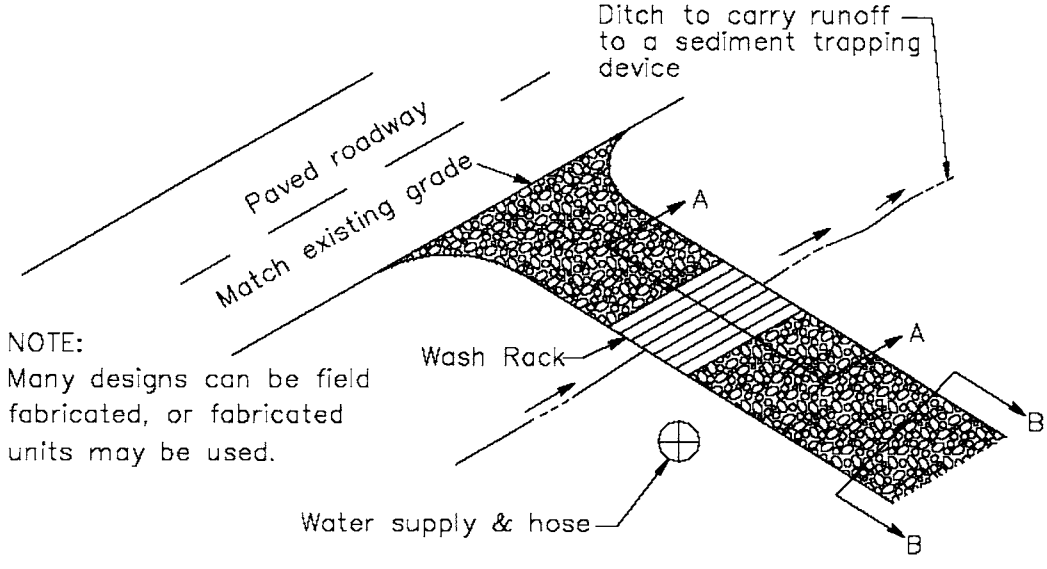


TYPICAL TIRE WASH
NOT TO SCALE

Section 4
Non-Stormwater Management and Material Management BMPs

4.1 Non-Stormwater Management BMPs

The Construction General Permit prohibits the discharge of materials other than stormwater and authorized non-stormwater discharges. It is recognized that certain non-stormwater discharges may be necessary for the completion of construction projects. Such discharges include but are not limited to irrigation of vegetative erosion control measures, pipe flushing and testing, and street cleaning.

Non-stormwater management BMPs are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source or eliminating off-site discharge. These practices involve day-to-day operations of the construction site and are usually under the control of the contractor. These BMPs are also referred to as "good housekeeping practices" which involve keeping a clean, orderly construction site.

Non-stormwater management BMPs also include procedures and practices designed to minimize or eliminate the discharge of pollutants from vehicle and equipment cleaning, fueling, and maintenance operations to stormwater drainage systems or to watercourses.

Table 4-1 lists the non-stormwater management BMPs. All these BMPs must be implemented depending on the conditions and applicability of deployment described as part of the BMP.

Table 4-1 Non-Stormwater Management BMPs

BMP#	BMP Name
NS-1	Water Conservation Practices
NS-2	Dewatering Operations
NS-3	Paving and Grinding Operations
NS-4	Temporary Stream Crossing
NS-5	Clear Water Diversion
NS-6	Illicit Connection/Discharge
NS-7	Potable Water/Irrigation
NS-8	Vehicle and Equipment Cleaning
NS-9	Vehicle and Equipment Fueling
NS-10	Vehicle and Equipment Maintenance
NS-11	Pile Driving Operations
NS-12	Concrete Curing
NS-13	Concrete Finishing
NS-14	Material and Equipment Use
NS-15	Demolition Adjacent to Water
NS-16	Temporary Batch Plants

It is recommended that owners and contractors be vigilant regarding implementation of these BMPs, including making their implementation a condition of continued employment, and part of all prime and subcontract agreements. By doing so, the chance of inadvertent violation by an uncaring individual can be prevented, potentially saving thousands of dollars in fines and project delays. Also, if procedures are not properly implemented and/or if BMPs are compromised then the discharge is subject to sampling and analysis requirements contained in the General Permit.

4.2 Waste Management & Materials Pollution Control BMPs

Waste management and materials pollution control BMPs, like non-stormwater management BMPs, are source control BMPs that prevent pollution by limiting or reducing potential pollutants at their source before they come in contact with stormwater. These BMPs also involve day-to-day operations of the construction site, are under the control of the contractor, and are additional "good housekeeping practices" which involve keeping a clean, orderly construction site.

Table 4-2 Waste Management & Materials Pollution Control BMPs

BMP#	BMP Name
WM-1	Material Delivery and Storage
WM-2	Material Use
WM-3	Stockpile Management
WM-4	Spill Prevention and Control
WM-5	Solid Waste Management
WM-6	Hazardous Waste Management
WM-7	Contaminated Soil Management
WM-8	Concrete Waste Management
WM-9	Sanitary/ Septic Waste Management
WM-10	Liquid Waste Management

Waste management consists of implementing procedural and structural BMPs for handling, storing, and disposing of wastes generated by a construction project. The objective is to prevent the release of waste materials into stormwater runoff or discharges through proper management of the following types of wastes:

- Solid
- Sanitary
- Concrete
- Hazardous
- Equipment – related wastes

Materials pollution control (also called materials handling) consists of implementing procedural and structural BMPs in the handling, storing, and the use of construction materials. The BMPs are intended to prevent the release of pollutants during stormwater and non-stormwater discharges. The objective is to prevent or reduce the opportunity for contamination of stormwater runoff from construction materials by covering and/or providing secondary containment of storage areas, and by taking adequate precautions when handling materials. These controls must be implemented for all applicable activities, material usage, and site conditions.

Table 4-2 lists the waste management and materials pollution control BMPs. It is important to note that these BMPs should be implemented depending on the conditions/applicability of deployment described as part of the BMP.

4.3 Fact Sheet Format

A BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 4-1. Completed fact sheets for each of the above activities are provided in Section 4.4.

The fact sheets also contain side bar presentations with information on BMP objectives, targeted constituents, removal effectiveness, and potential alternatives.

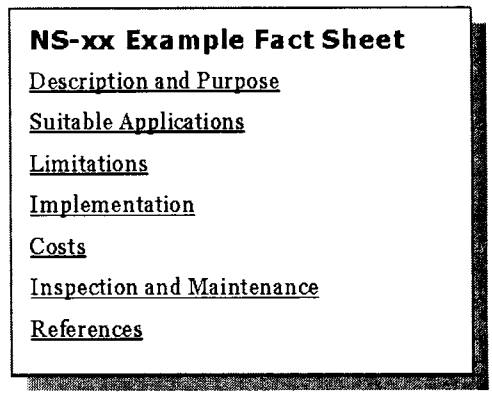
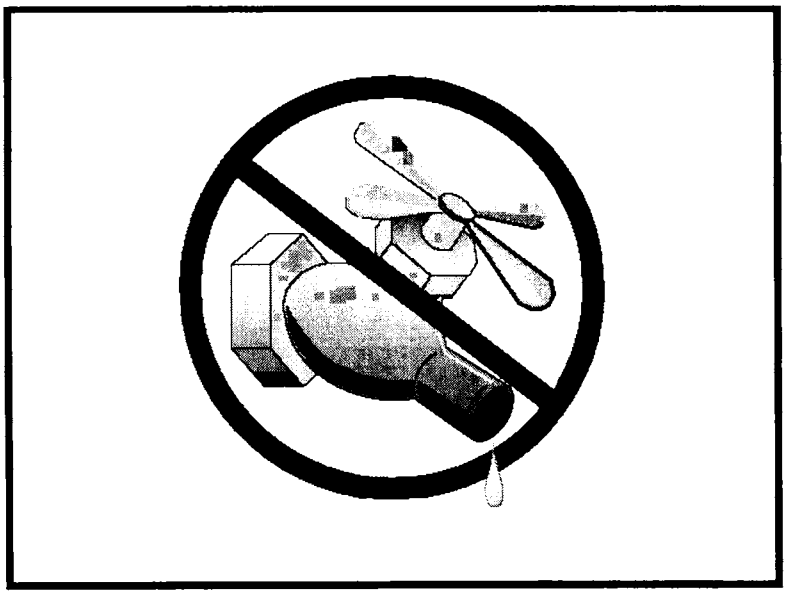


Figure 4-1
Example Fact Sheet

4.4 BMP Fact Sheets

BMP Fact Sheets for non-stormwater management and waste management and materials pollution control follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusions in SWPPPs. Fresh copies of the fact sheets can be individually downloaded from the Caltrans Stormwater BMP Handbook website at http://www.cabmphandbooks.com.

Water Conservation Practices NS-1



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.

- Direct construction water runoff to areas where it can soak into the ground or be collected and reused.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

Costs

The cost is small to none compared to the benefits of conserving water.

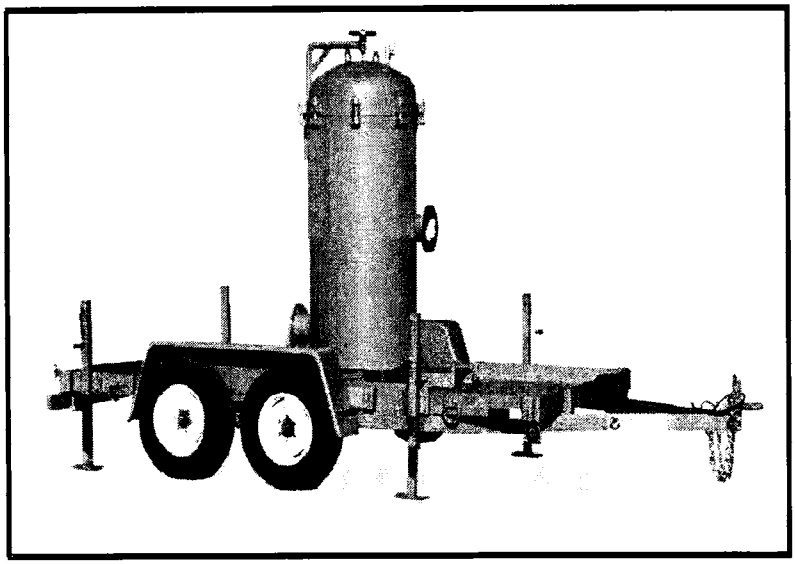
Inspection and Maintenance

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.
- Repair water equipment as needed to prevent unintended discharges.
  - Water trucks
  - Water reservoirs (water buffalos)
  - Irrigation systems
  - Hydrant connections

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Dewatering Operations NS-2



Objectives		
EC	Erosion Control	
SE	Sediment Control	☒
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Description and Purpose

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

Suitable Applications

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

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

Limitations

- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this best management practice (BMP) address sediment only.
- The controls detailed in this BMP only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Dewatering operations will require, and must comply with, applicable local permits.

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

SE-9: Straw Bale Barrier

- Avoid dewatering discharges where possible by using the water for dust control, by infiltration, etc.

Implementation

- Dewatering non-stormwater cannot be discharged without prior notice to and approval from the Regional Water Quality Control Board (RWQCB) and local stormwater management agency. This includes stormwater that is co-mingled with groundwater or other non-stormwater sources. Once the discharge is allowed, appropriate BMPs must be implemented to ensure the discharge complies with all permit requirements and regional and watershed-specific requirements.
- RWQCB may require a separate NPDES permit prior to the dewatering discharge of non-stormwater. These permits will have specific testing, monitoring, and discharge requirements and can take significant time to obtain.
- The flow chart shown in Figure 1 should be utilized to guide dewatering operations.
- The owner will coordinate monitoring and permit compliance.
- Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges must not cause erosion at the discharge point.

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

Sediment Basin (see also SE-2)

Description:

- A sediment basin is a temporary basin with a controlled release structure that is formed by excavation or construction of an embankment to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment basins are generally larger than Sediment Traps (SE-3).

Appropriate Applications:

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

Implementation:

- Excavation and construction of related facilities is required.
- Temporary sediment basins must be fenced if safety is a concern.
- Outlet protection is required to prevent erosion at the outfall location.

Maintenance:

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

Sediment Trap (See also SE-3)

Description:

- A sediment trap is a temporary basin formed by excavation and/or construction of an earthen embankment across a waterway or low drainage area to detain sediment-laden runoff and allow sediment to settle out before discharging. Sediment traps are generally smaller than Sediment Basins (SE-2).

Appropriate Applications:

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

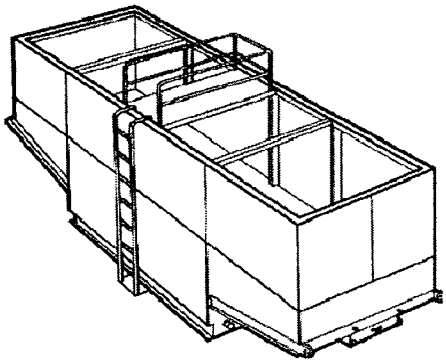
Implementation:

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

Maintenance:

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

Weir Tanks



Description:

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

Appropriate Applications:

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

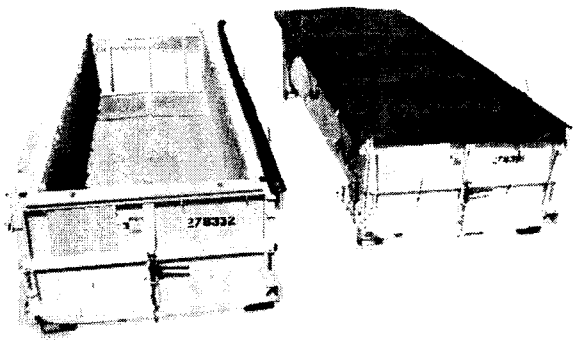
Implementation:

- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

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

Dewatering Tanks



Description:

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

Appropriate Applications:

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

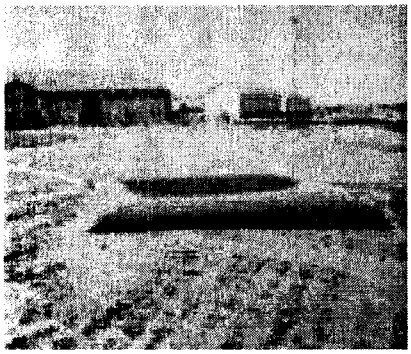
Implementation:

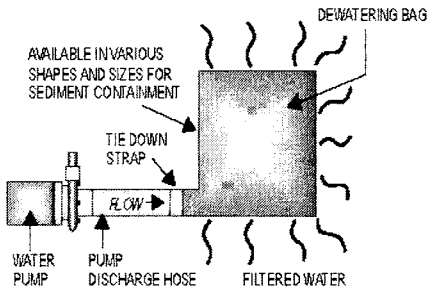
- Tanks are delivered to the site by the vendor, who can provide assistance with set-up and operation.
- Tank size will depend on flow volume, constituents of concern, and residency period required. Vendors should be consulted to appropriately size tank.

Maintenance:

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

Gravity Bag Filter





Description:

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

Appropriate Applications:

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

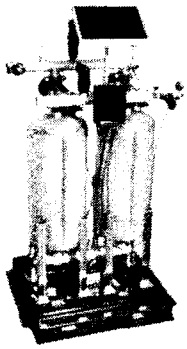
Implementation:

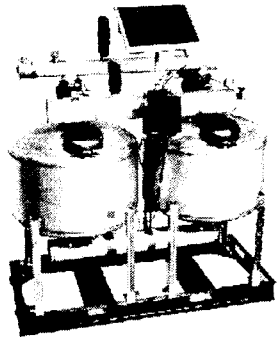
- Water is pumped into one side of the bag and seeps through the bottom and sides of the bag.
- A secondary barrier, such as a rock filter bed or straw/hay bale barrier, is placed beneath and beyond the edges of the bag to capture sediments that escape the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier is required.
- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.
- The bag is disposed of offsite.

Sand Media Particulate Filter





Description:

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

Appropriate Applications:

- Effective for the removal of trash, gravel, sand, and silt and some metals, as well as the reduction of biochemical oxygen demand (BOD) and turbidity.
- Sand filters can be used for stand-alone treatment or in conjunction with bag and cartridge filtration if further treatment is required.
- Sand filters can also be used to provide additional treatment to water treated via settling or basic filtration.

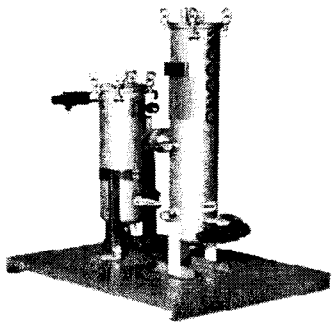
Implementation:

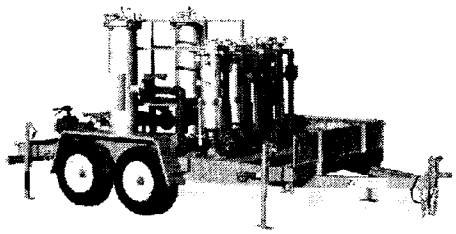
- The filters require delivery to the site and initial set up. The vendor can provide assistance with installation and operation.

Maintenance:

- The filters require regular service to monitor and maintain the level of the sand media. If subjected to high loading rates, filters can plug quickly.
- Venders generally provide data on maximum head loss through the filter. The filter should be monitored daily while in use, and cleaned when head loss reaches target levels.
- If cleaned by backwashing, the backwash water may need to be hauled away for disposal, or returned to the upper end of the treatment train for another pass through the series of dewatering BMPs.

Pressurized Bag Filter





Description:

- A pressurized bag filter is a unit composed of single filter bags made from polyester felt material. The water filters through the unit and is discharged through a header. Vendors provide bag filters in a variety of configurations. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

Appropriate Applications:

- Effective for the removal of sediment (sand and silt) and some metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Oil absorbent bags are available for hydrocarbon removal.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

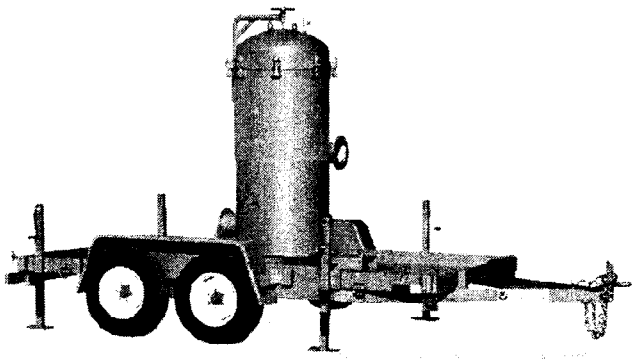
Implementation:

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

Maintenance:

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

Cartridge Filter



Description:

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

Appropriate Applications:

- Effective for the removal of sediment (sand, silt, and some clays) and metals, as well as the reduction of BOD, turbidity, and hydrocarbons. Hydrocarbons can effectively be removed with special resin cartridges.
- Filters can be used to provide secondary treatment to water treated via settling or basic filtration.

Implementation:

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

Maintenance:

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

Costs

- Sediment controls are low to high cost measures depending on the dewatering system that is selected. Pressurized filters tend to be more expensive than gravity settling, but are often more effective. Simple tanks are generally rented on a long-term basis (one or more months) and can range from $360 per month for a 1,000 gallon tank to $2,660 per month for a 10,000 gallon tank. Mobilization and demobilization costs vary considerably.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Unit-specific maintenance requirements are included with the description of each unit.
- Sediment removed during the maintenance of a dewatering device may be either spread onsite and stabilized, or disposed of at a disposal site as approved by the owner.
- Sediment that is commingled with other pollutants must be disposed of in accordance with all applicable laws and regulations and as approved by the owner.

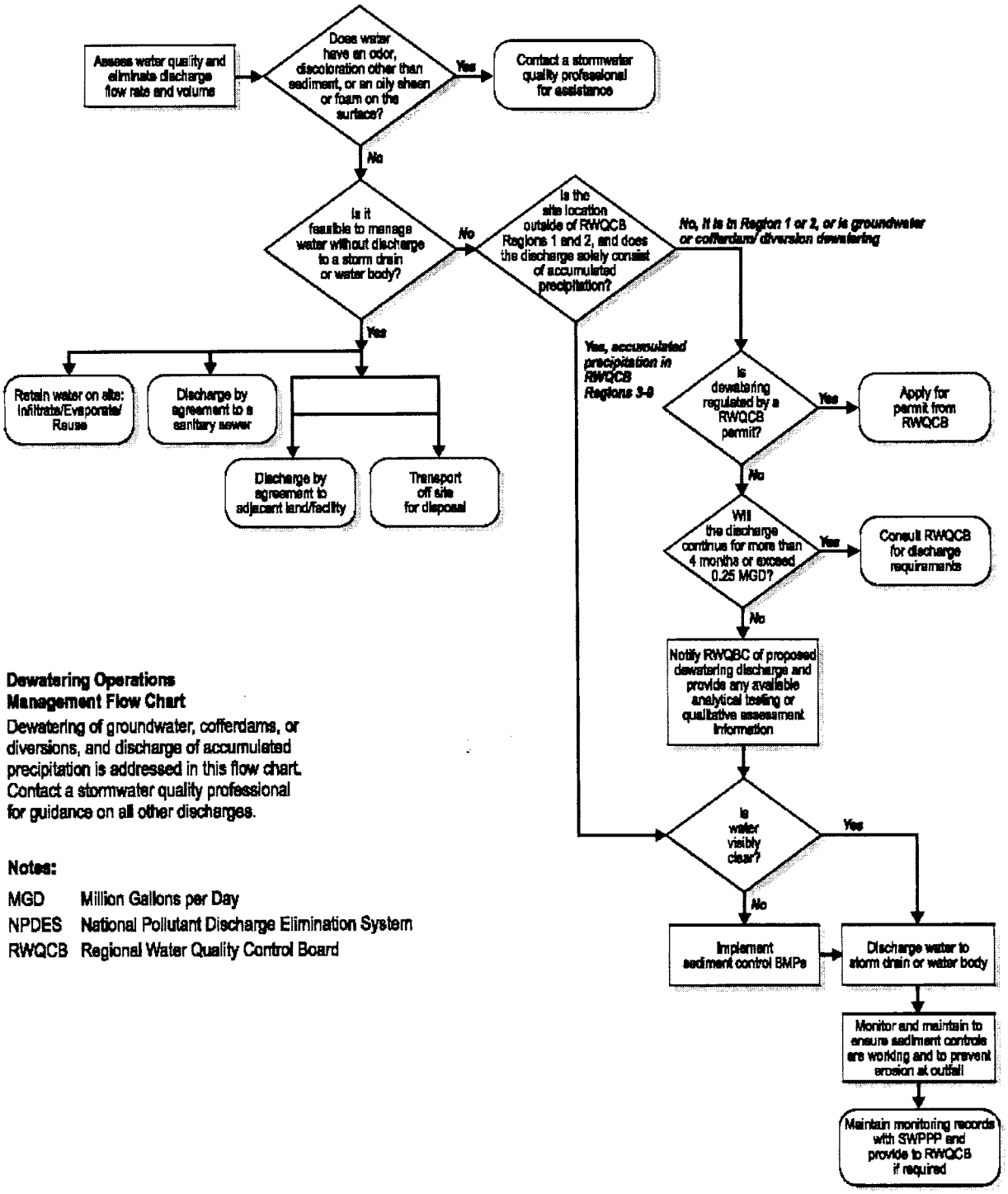
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Labor Surcharge & Equipment Rental Rates, April 1, 2002 through March 31, 2003, California Department of Transportation (Caltrans).



Dewatering Operations Management Flow Chart

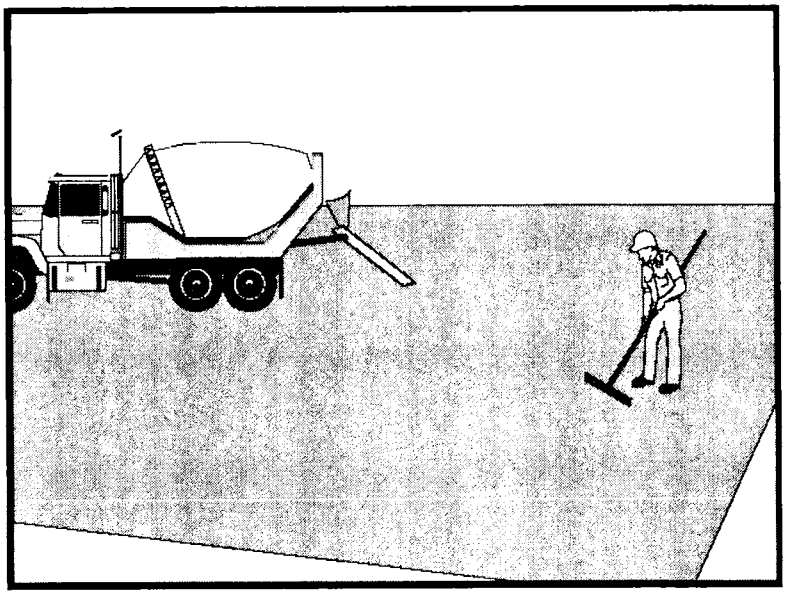
Dewatering of groundwater, cofferdams, or diversions, and discharge of accumulated precipitation is addressed in this flow chart. Contact a stormwater quality professional for guidance on all other discharges.

Notes:

MGD Million Gallons per Day
NPDES National Pollutant Discharge Elimination System
RWQCB Regional Water Quality Control Board

Figure 1
Operations Flow Chart

Paving and Grinding Operations NS-3



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☒

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

Suitable Applications

These procedures are implemented where paving, surfacing, resurfacing, or sawcutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

Limitations

- Finer solids are not effectively removed by filtration systems.
- Paving opportunities may be limited during wet weather.

Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is in the forecast.
- Train employees and sub-contractors in pollution prevention and reduction.
- Store materials away from drainage courses to prevent stormwater runon (see WM-1, Material Delivery and Storage).

- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or to trap and filter sediment.
- If paving involves an onsite mixing plant, follow the stormwater permitting requirements for industrial activities.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses, These materials should be stored consistent with WM-3, Stockpile Management.
- Disposal of PCC and AC waste should be in conformance with WM-8, Concrete Waste Management.

Saw Cutting, Grinding, and Pavement Removal

- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- When paving involves AC, the following steps should be implemented to prevent the discharge of grinding residue, uncompacted or loose AC, tack coats, equipment cleaners, or unrelated paving materials:
  - AC grindings, pieces, or chunks used in embankments or shoulder backing must not be allowed to enter any storm drains or watercourses. Install silt fence until structure is stabilized or permanent controls are in place. Examples of temporary perimeter controls can be found in EC-9, Earth Dikes and Drainage Swales; SE-1, Silt Fence; or SE-5, Fiber Rolls.
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
  - Any AC chunks and pieces used in embankments must be placed above the water table and covered by at least 1 ft of material.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine, should not be allowed to flow across the pavement, and should not be left on the surface of the pavement. See also WM-8, Concrete Waste Management, and WM-10, Liquid Waste Management.
- Dig out activities should not be conducted in the rain.
- Collect dig out material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.
- If dig out material cannot be recycled, transport the material back to an approved storage site.

Asphaltic Concrete Paving

- If paving involves asphaltic cement concrete, follow these steps:

- Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks. Vacuum or sweep loose sand and gravel and properly dispose of this waste by referring to WM-5, Solid Waste Management.

- Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.

Portland Cement Concrete Paving

- Do not wash sweepings from exposed aggregate concrete into a storm drain system. Collect and return to aggregate base stockpile or dispose of properly.

- Allow aggregate rinse to settle. Then, either allow rinse water to dry in a temporary pit as described in WM-8, Concrete Waste Management, or pump the water to the sanitary sewer if allowed by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate must not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized.

- Drainage inlet structures and manholes should be covered with filter fabric during application of seal coat, tack coat, slurry seal, and fog seal.

- Seal coat, tack coat, slurry seal, or fog seal should not be applied if rainfall is predicted to occur during the application or curing period.

Paving Equipment

- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See NS-10, Vehicle and Equipment Maintenance, WM-4, Spill Prevention and Control, and WM-10, Liquid Waste Management.

- Substances used to coat asphalt transport trucks, and asphalt spreading equipment should not contain soap and should be non-foaming and non-toxic.

- Use only non-toxic substances to coat asphalt transport trucks and asphalt spreading equipment.

- Paving equipment parked onsite should be parked over plastic to prevent soil contamination.

- Clean asphalt coated equipment offsite whenever possible. When cleaning dry, hardened asphalt from equipment, manage hardened asphalt debris as described in WM-5, Solid Waste Management. Any cleaning onsite should follow NS-8, Vehicle and Equipment Cleaning.

Thermoplastic Striping

- Thermoplastic striper and pre-heater equipment shutoff valves should be inspected to ensure that they are working properly to prevent leaking thermoplastic from entering drain inlets, the stormwater drainage system, or watercourses.
- Pre-heaters should be filled carefully to prevent splashing or spilling of hot thermoplastic. Leave six inches of space at the top of the pre-heater container when filling thermoplastic to allow room for material to move when the vehicle is deadheaded.
- Do not pre-heat, transfer, or load thermoplastic near drain inlets or watercourses.
- Clean truck beds daily of loose debris and melted thermoplastic. When possible, recycle thermoplastic material.

Raised/Recessed Pavement Marker Application and Removal

- Do not transfer or load bituminous material near drain inlets, the stormwater drainage system, or watercourses.
- Melting tanks should be loaded with care and not filled to beyond six inches from the top to leave room for splashing when vehicle is deadheaded.
- When servicing or filling melting tanks, ensure all pressure is released before removing lids to avoid spills.
- On large-scale projects, use mechanical or manual methods to collect excess bituminous material from the roadway after removal of markers.

Costs

- All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

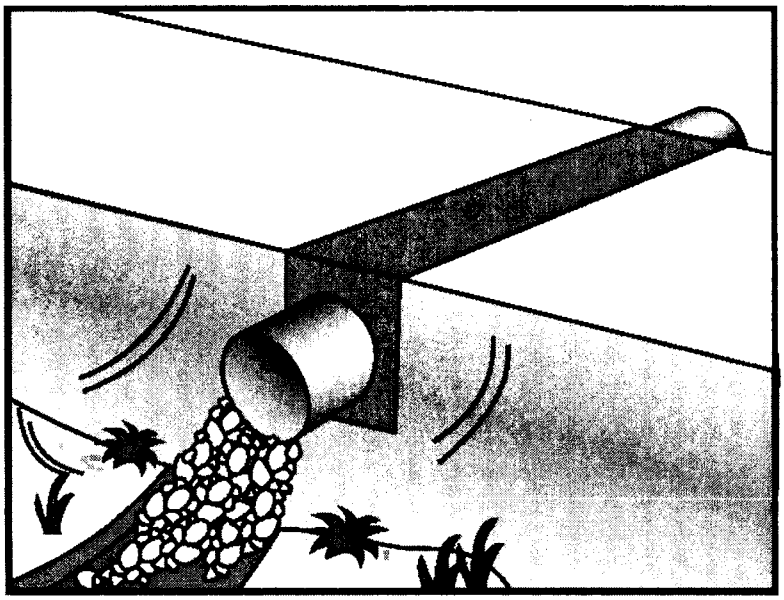
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Hot Mix Asphalt-Paving Handbook AC 150/5370-14, Appendix I, U.S. Army Corps of Engineers, July 1991.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Temporary Stream Crossing NS-4



Objectives

EC	Erosion Control	☒
SE	Sediment Control	☒
TR	Tracking Control	☒
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

A temporary stream crossing is a temporary culvert, ford or bridge placed across a waterway to provide access for construction purposes for a period of less than one year. Temporary access crossings are not intended to maintain traffic for the public. The temporary access will eliminate erosion and downstream sedimentation caused by vehicles.

Suitable Applications

Temporary stream crossings should be installed at all designated crossings of perennial and intermittent streams on the construction site, as well as for dry channels that may be significantly eroded by construction traffic.

Temporary streams crossings are installed at sites:

- Where appropriate permits have been secured (404 Permits, and 401 Certifications)
- Where construction equipment or vehicles need to frequently cross a waterway
- When alternate access routes impose significant constraints
- When crossing perennial streams or waterways causes significant erosion
- Where construction activities will not last longer than one year

- Where appropriate permits have been obtained for the stream crossing

Limitations

The following limitations may apply:

- Installation and removal will usually disturb the waterway.
- Installation may require Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game. If numerical-based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required.
- Installation may require dewatering or temporary diversion of the stream. See NS-2, Dewatering Operations and NS-5, Clear Water Diversion.
- Installation may cause a constriction in the waterway, which can obstruct flood flow and cause flow backups or washouts. If improperly designed, flow backups can increase the pollutant load through washouts and scouring.
- Use of natural or other gravel in the stream for construction of Cellular Confinement System (CCS) ford crossing will be contingent upon approval by fisheries agencies.
- Ford crossings may degrade water quality due to contact with vehicles and equipment.
- May be expensive for a temporary improvement.
- Requires other BMPs to minimize soil disturbance during installation and removal.
- Fords should only be used in dry weather.

Implementation

General

The purpose of this BMP is to provide a safe, erosion-free access across a stream for construction equipment. Minimum standards and specifications for the design, construction, maintenance, and removal of the structure should be established by an engineer registered in California. Temporary stream crossings may be necessary to prevent construction equipment from causing erosion of the stream and tracking sediment and other pollutants into the stream.

Temporary stream crossings are used as access points to construction sites when other detour routes may be too long or burdensome for the construction equipment. Often heavy construction equipment must cross streams or creeks, and detour routes may impose too many constraints such as being too narrow or poor soil strength for the equipment loadings. Additionally, the contractor may find a temporary stream crossing more economical for light-duty vehicles to use for frequent crossings, and may have less environmental impact than construction of a temporary access road.

Location of the temporary stream crossing should address:

- Site selection where erosion potential is low.

- Areas where the side slopes from site runoff will not spill into the side slopes of the crossing.

The following types of temporary stream crossings should be considered:

- **Culverts** – A temporary culvert is effective in controlling erosion but will cause erosion during installation and removal. A temporary culvert can be easily constructed and allows for heavy equipment loads.
- **Fords** - Appropriate during the dry season in arid areas. Used on dry washes and ephemeral streams, and low-flow perennial streams. CCS, a type of ford crossing, is also appropriate for use in streams that would benefit from an influx of gravels. A temporary ford provides little sediment and erosion control and is ineffective in controlling erosion in the stream channel. A temporary ford is the least expensive stream crossing and allows for maximum load limits. It also offers very low maintenance. Fords are more appropriate during the dry ice season and in arid areas of California.
- **Bridges** - Appropriate for streams with high flow velocities, steep gradients and where temporary restrictions in the channel are not allowed.

Design

During the long summer construction season in much of California, rainfall is infrequent and many streams are dry. Under these conditions, a temporary ford may be sufficient. A ford is not appropriate if construction will continue through the winter rainy season, if summer thunderstorms are likely, or if the stream flows during most of the year. Temporary culverts and bridges should then be considered and, if used, should be sized to pass a significant design storm (i.e., at least a 10-year storm). The temporary stream crossing should be protected against erosion, both to prevent excessive sedimentation in the stream and to prevent washout of the crossing.

Design and installation requires knowledge of stream flows and soil strength. Designs should be prepared under direction of, and approved by, a registered civil engineer and for bridges, a registered structural engineer. Both hydraulic and construction loading requirements should be considered with the following:

- Comply with any special requirements for culvert and bridge crossings, particularly if the temporary stream crossing will remain through the rainy season.
- Provide stability in the crossing and adjacent areas to withstand the design flow. The design flow and safety factor should be selected based on careful evaluation of the risks due to over topping, flow backups, or washout.
- Install sediment traps immediately downstream of crossings to capture sediments. See SE-3, Sediment Trap.
- Avoid oil or other potentially hazardous materials for surface treatment.
- Culverts are relatively easy to construct and able to support heavy equipment loads.
- Fords are the least expensive of the crossings, with maximum load limits.

- CCS crossing structures consist of clean, washed gravel and cellular confinement system blocks. CCS are appropriate for streams that would benefit from an influx of gravel; for example, salmonid streams, streams or rivers below reservoirs, and urban, channelized streams. Many urban stream systems are gravel-deprived due to human influences, such as dams, gravel mines, and concrete channels.
- CCS allow designers to use either angular or naturally occurring rounded gravel, because the cells provide the necessary structure and stability. In fact, natural gravel is optimal for this technique, because of the habitat improvement it will provide after removal of the CCS.
- A gravel depth of 6 to 12 in. for a CCS structure is sufficient to support most construction equipment.
- An advantage of a CCS crossing structure is that relatively little rock or gravel is needed, because the CCS provides the stability.
- Bridges are generally more expensive to design and construct, but provide the least disturbance of the streambed and constriction of the waterway flows.

Construction and Use

- Stabilize construction roadways, adjacent work area, and stream bottom against erosion.
- Construct during dry periods to minimize stream disturbance and reduce costs.
- Construct at or near the natural elevation of the streambed to prevent potential flooding upstream of the crossing.
- Install temporary erosion control BMPs in accordance with erosion control BMP fact sheets to minimize erosion of embankment into flow lines.
- Any temporary artificial obstruction placed within flowing water should only be built from material, such as clean gravel or sandbags, that will not introduce sediment or silt into the watercourse.
- Temporary water body crossings and encroachments should be constructed to minimize scour. Cobbles used for temporary water body crossings or encroachments should be clean, rounded river cobble.
- Vehicles and equipment should not be driven, operated, fueled, cleaned, maintained, or stored in the wet or dry portions of a water body where wetland vegetation, riparian vegetation, or aquatic organisms may be destroyed.
- The exterior of vehicles and equipment that will encroach on the water body within the project should be maintained free of grease, oil, fuel, and residues.
- Drip pans should 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.

- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate soil stabilization measures.

- Riparian vegetation, when removed pursuant to the provisions of the work, should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble must be removed upon completion of project activities.

- Conceptual temporary stream crossings are shown in the attached figures.

Costs

Caltrans Construction Cost index for temporary bridge crossings is $45-$95/ft^2.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two week intervals in the non-rainy season to verify continued BMP implementation.

- Check for blockage in the channel, sediment buildup or trapped debris in culverts, blockage behind fords or under bridges

- Check for erosion of abutments, channel scour, riprap displacement, or piping in the soil

- Check for structural weakening of the temporary crossings, such as cracks, and undermining of foundations and abutments

- Remove sediment that collects behind fords, in culverts, and under bridges periodically

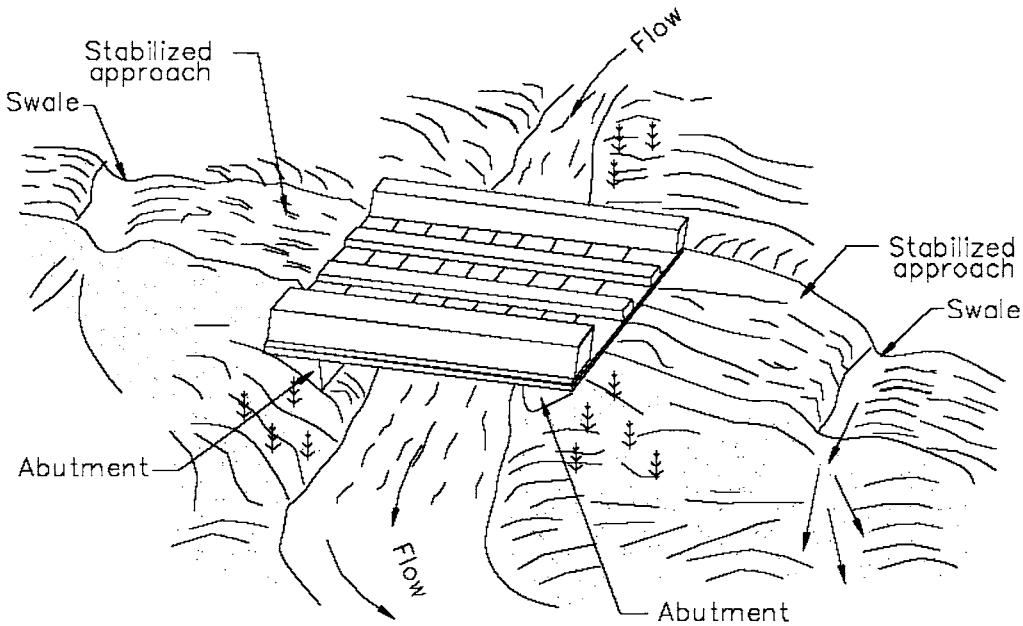
- Replace lost or displaced aggregate from inlets and outlets of culverts and cellular confinement systems

- Remove temporary crossing promptly when it is no longer needed

References

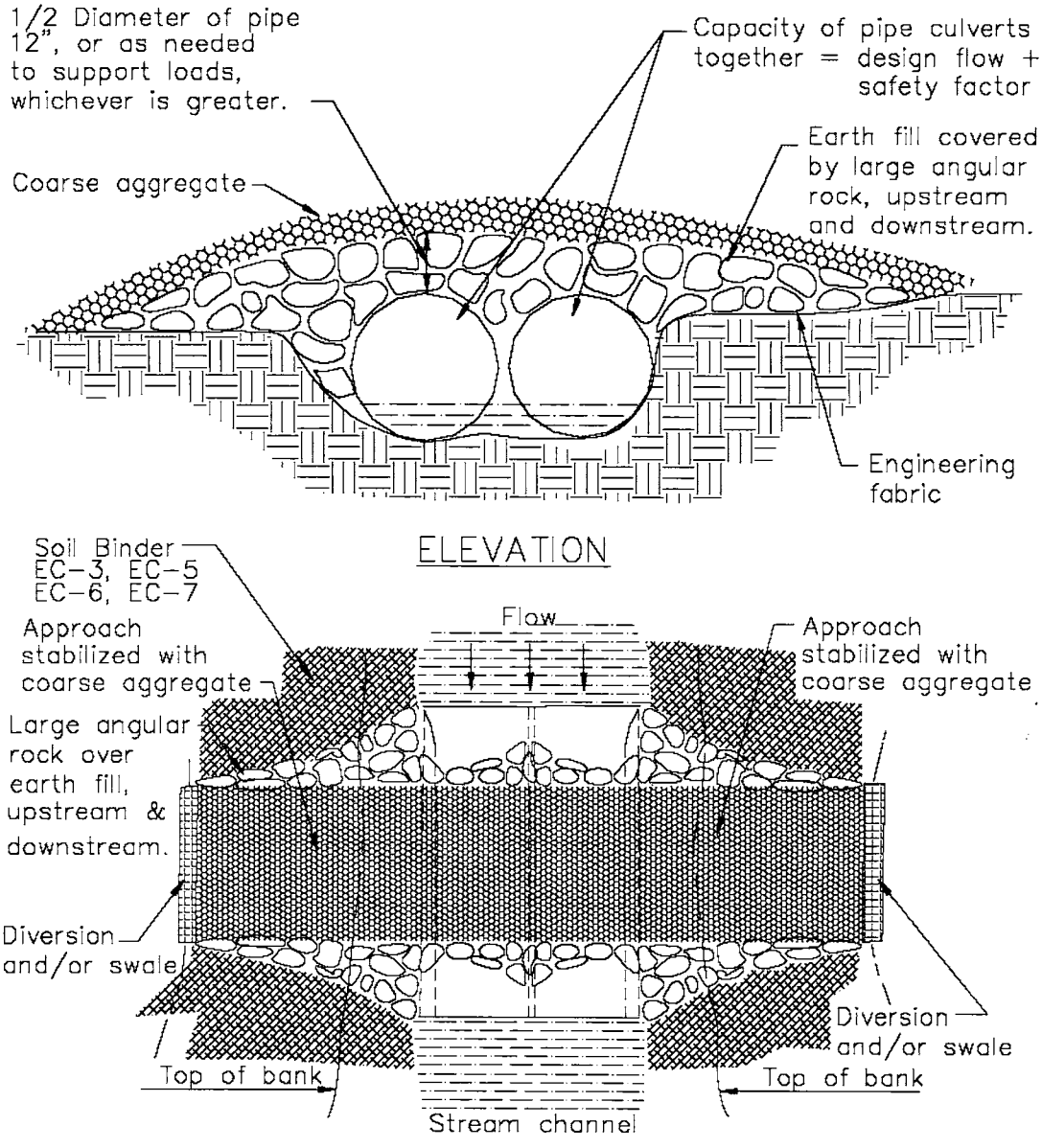
California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

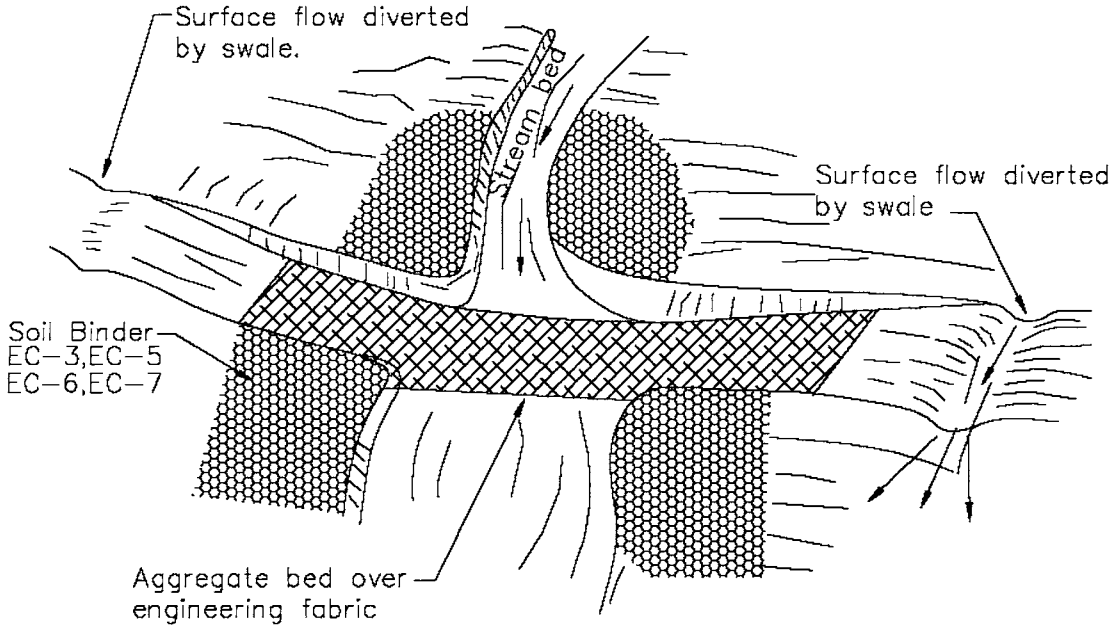


NOTE:
Surface flow of road diverted by swale and/or dike.

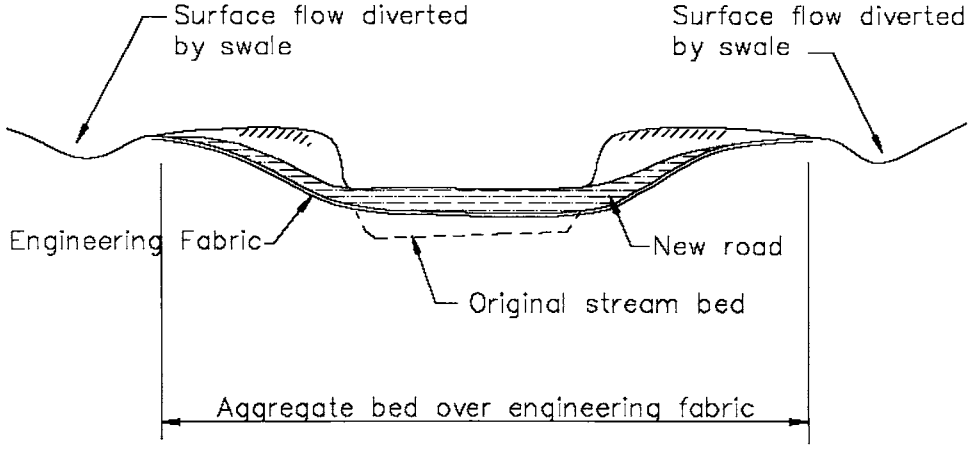
TYPICAL BRIDGE CROSSING
NOT TO SCALE



TYPICAL CULVERT CROSSING
NOT TO SCALE

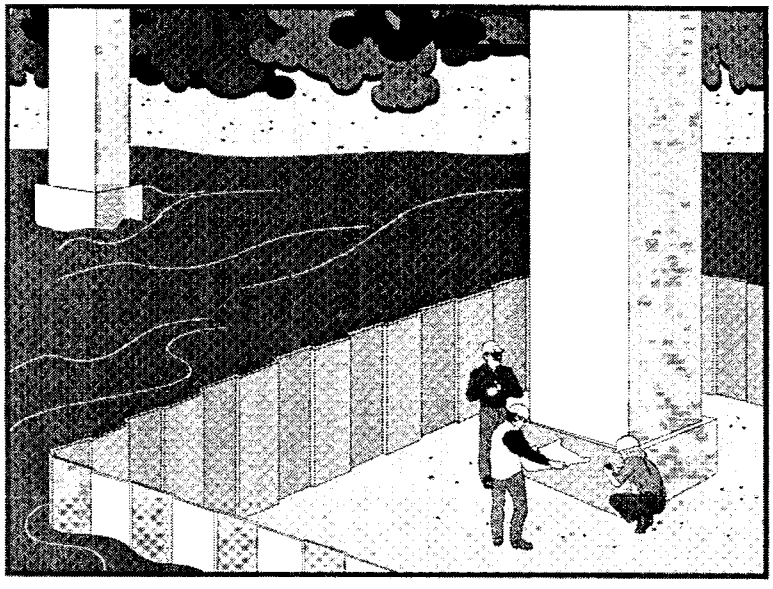


Aggregate approch
1:5 (V:H) Maximum slope on road



TYPICAL FORD CROSSING
NOT TO SCALE

Clear Water Diversion NS-5



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Clear water diversion consists of a system of structures and measures that intercept clear surface water runoff upstream of a project, transport it around the work area, and discharge it downstream with minimal water quality degradation from 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. Structures commonly used as part of this system include diversion ditches, berms, dikes, slope drains, rock, gravel bags, wood, aqua barriers, cofferdams, filter fabric or turbidity curtains, drainage and interceptor swales, pipes, or flumes.

Suitable Applications

A clear water diversion is typically implemented where appropriate permits (1601 Agreement) have been secured and work must be performed in a flowing 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 heavy pipe (called a "flume") with a trench

excavated under it, is appropriate for the diversion of streams less than 20 ft wide, with flow rates less than 100 cfs.

- Clear water diversions incorporating clean washed gravel may be appropriate for use in salmonid spawning streams.

Limitations

- Diversion and encroachment activities will usually disturb the waterway during installation and removal of diversion structures.
- Installation may require Regional Water Quality Control Board (RWQCB) 401 Certification, U.S. Army Corps of Engineers 404 permit and approval by California Department of Fish and Game. If numerical-based water quality standards are mentioned in any of these and other related permits, testing and sampling may be required.
- Diversion and encroachment activities may constrict the waterway, which can obstruct flood 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 not appropriate in channels where there is insufficient stream flow to support aquatic species in the area dewatered as a result of the diversion.
- Diversion or isolation activities are inappropriate in deep water unless designed or reviewed by an engineer registered in California.
- Diversion or isolation activities should not completely dam stream flow.
- Dewatering and removal may require additional sediment control or water treatment. See NS-2, Dewatering Operations.
- Not appropriate if installation, maintenance, and removal of the structures will disturb sensitive aquatic species of concern.

Implementation

General

- Implement guidelines presented in NS-17, Streambank Stabilization to minimize impacts to streambanks.
- Where working areas encroach on flowing streams, barriers adequate to prevent the flow of muddy water into streams should be constructed and maintained between working areas and streams. During construction of the barriers, muddying of streams should be held to a minimum.
- Diversion structures must be adequately designed to accommodate fluctuations in water depth or flow volume due to tides, storms, flash floods, etc.
- Heavy equipment driven in wet portions of a water body to accomplish work should be completely clean of petroleum residue, and water levels should be below the fuel tanks, gearboxes, and axles of the equipment unless lubricants and fuels are sealed such that inundation by water will not result in discharges of fuels, oils, greases, or hydraulic fluids.

- 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 should 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, should be positioned over drip pans.
- When any artificial obstruction is being constructed, maintained, or placed in operation, sufficient water should, at all times, be allowed to pass downstream to maintain aquatic life.
- Equipment should not be parked below the high water mark unless allowed by a permit.
- Disturbance or removal of vegetation should not exceed the minimum necessary to complete operations. Precautions should be taken to avoid damage to vegetation by people or equipment. Disturbed vegetation should be replaced with the appropriate erosion control measures.
- Riparian vegetation approved for trimming as part of the project should be cut off no lower than ground level to promote rapid re-growth. Access roads and work areas built over riparian vegetation should be covered by a sufficient layer of clean river run cobble to prevent damage to the underlying soil and root structure. The cobble should be removed upon completion of project activities.
- Drip pans should 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 1 hour.
- Where possible, avoid or minimize diversion and encroachment impacts by scheduling construction during periods of low flow or when the stream is dry. Scheduling should also consider seasonal releases of water from dams, fish migration and spawning seasons, and water demands due to crop irrigation.
- Construct diversion structures with materials free of potential pollutants such as soil, silt, sand, clay, grease, or oil.

Temporary Diversions and Encroachments

- Construct diversion channels in accordance with EC-9, Earth Dikes and Drainage Swales.
- In high flow velocity areas, stabilize slopes of embankments and diversion ditches using an appropriate liner, in accordance with EC-7, Geotextiles and Mats, or use rock slope protection.
- Where appropriate, use natural streambed materials such as large cobbles and boulders for temporary embankment and 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 EC-10, Velocity Dissipation Devices.

Temporary Dry Construction Areas

- When dewatering behind temporary structures to create a temporary dry construction area, such as cofferdams, 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 NS-2, Dewatering Operations.
- Any substance used to assemble or maintain diversion structures, such as form oil, should be non-toxic and non-hazardous.
- Any material used to minimize seepage underneath diversion structures, such as grout, should be non-toxic, non-hazardous, and as close to a neutral pH as possible.

Comparison of Diversion and Isolation Techniques:

- Gravel bags are relatively inexpensive, but installation and removal can be labor intensive. It is also difficult to dewater the isolated area. Sandbags should not be used for this technique in rivers or streams, as sand should never be put into or adjacent to a stream, even if encapsulated in geotextile.
- Gravel Bag Berms (SE-6) used in conjunction with an impermeable membrane are cost effective, 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 if approved in the permit. Only clean, washed gravel should be used for both the gravel bag and gravel berm techniques.
- Cofferdams are relatively expensive, but frequently allow full dewatering. Also, many options now available are relatively easy to install.
- 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.
- K-rails are an isolation method that does not allow full dewatering, but can be used in small to large watercourses, and in fast-water situations.
- A relatively inexpensive isolation method is filter fabric isolation. This method involves placement of gravel bags or continuous berms to 'key-in' the fabric, and subsequently staking the fabric in place. This method should be used in relatively calm water, and can be used in smaller streams. Note that this is not a dewatering method, but rather a sediment isolation method.
- Turbidity curtains should be used where sediment discharge to a stream is unavoidable. They can also be used for in-stream construction, when dewatering an area is not required.
- When used in watercourses or streams, cofferdams must be used in accordance with permit requirements.
- Manufactured diversion structures should be installed following manufacturer's specifications.

- Filter fabric and turbidity curtain isolation installation methods can be found in the specific technique descriptions that follow.

Filter Fabric Isolation Technique

Definition and Purpose

A filter 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 filter fabric, gravel bags, and steel t-posts.

Appropriate Applications

- Filter 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.
- Filter fabric isolation is relatively inexpensive. 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 may be spread out and left as salmonid spawning habitat if approved in the permit. 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 method should be used in relatively calm water, and can be used in smaller streams. This is not a dewatering method, but rather a sediment isolation method.
- Water levels inside and outside the fabric curtain must be about the same, as differential heads will cause the curtain to collapse.

Limitations

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

Design and Installation

- For the filter 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 filter 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. If a sandbag splits open in a watercourse, the sand could cause a decrease in water quality, and could bury sensitive aquatic habitat.
- 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 18 ft for ease of handling (otherwise, it gets too heavy to move).

- 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 silt fence 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.
- 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

- Immediately repair any gaps, holes or scour.
- Remove and properly dispose of sediment buildup.
- Remove BMP upon completion of construction activity. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

Turbidity Curtain Isolation Technique

Definition and Purpose

A turbidity curtain is a 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.

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, 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 sediment 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 resuspension of particles and by accidental dumping by the removal equipment.

Design and Installation

- 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 filter fabric may be used for the bottom 1 ft.

- The top of the curtain should consist of flexible flotation buoys, and the bottom should be held down by a load line incorporated into the curtain fabric. The fabric should be a brightly colored impervious mesh.
- The curtain should be held in place by anchors placed at least every 100 ft.
- 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.
- Consideration must be given to the probable outcome of the removal procedure. It must be determined 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 trapped by the turbidity curtain only be removed if there has been a significant change in the original contours of the affected area in the watercourse.
- Particles should always be allowed to settle for a minimum of 6 to 12 hours prior to their removal or prior to removal of the turbidity curtain.

Maintenance and Inspection:

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

K-rail River Isolation

Definition and Purpose

This temporary sediment control or stream isolation method uses K-rails 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 at their abutting ends to seal and prevent movement of sediment beneath or through the barrier walls.

Appropriate Applications

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

- This technique is also useful at the toe of embankments, and cut or fill slopes.

Limitations

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

Design and Installation

- To create a floor for the K-rail, move large rocks and obstructions. Place washed gravel and gravel-filled bags to create a level surface for K-rails to sit. Washed gravel should always be used.
- Place the bottom two K-rails adjacent to each other, and parallel to the direction of flow; fill the center portion with gravel bags. Then place the third K-rail on top of the bottom two. There should be sufficient gravel bags between the bottom K-rails such that the top rail is supported by the gravel. Place plastic sheeting around the K-rails, and secure at the bottom with gravel bags.
- Further support can be added by pinning and cabling the K-rails together. Also, large riprap and boulders can be used to support either side of the K-rail, especially where there is strong current.

Inspection and Maintenance:

- The barrier should be inspected and any leaks, holes, or other problems should be addressed immediately.
- Sediment should be allowed to settle for at least 6 to 12 hours prior to removal of sediment, and for 6 to 12 hours prior to removal of the barrier.

Stream Diversions

The selection of which stream diversion technique to use will depend upon the type of work involved, physical characteristics of the site, and the volume of water flowing through the project.

Advantages of a Pumped Diversion

- Downstream sediment transport can be nearly eliminated.
- Dewatering 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

- Flow volume is limited by pump capacity.
- A pumped diversion requires 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

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

Disadvantages of Excavated Channels and Flumes

- 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.

Design and Installation

- Installation guidelines will vary based on existing site conditions and type of diversion used.
- Pump capacity must be sufficient for design flow.
- A standby pump is required in case a primary pump fails.
- 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.

Inspection and Maintenance

- Pumped diversions require 24 hour monitoring of pumps.
- Inspect embankments and diversion channels 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. Remove holes, gaps, or scour.
- Upon completion of work, the diversion or isolation structure should be removed and flow should be redirected through the new culvert or back into the original stream channel. Recycle or reuse if applicable.
- Revegetate areas disturbed by BMP removal if needed.

Costs

Costs of clear water diversion vary considerably and can be very high.

Inspection and Maintenance

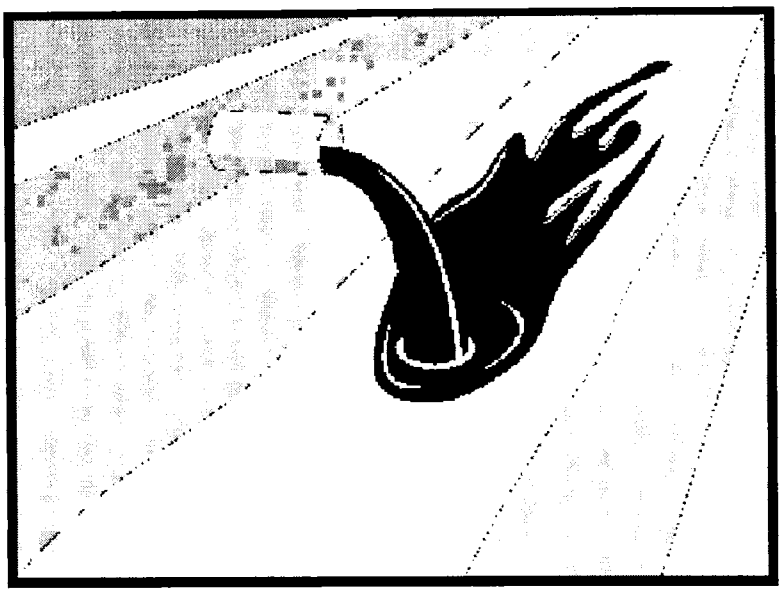
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Refer to BMP-specific inspection and maintenance requirements.

References

California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October, 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Illicit Connection/Discharge NS-6



Description and Purpose

Procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Illicit connection/discharge and reporting is applicable anytime an illicit connection or discharge is discovered or illegally dumped material is found on the construction site.

Limitations

Illicit connections and illegal discharges or dumping, for the purposes of this BMP, refer to discharges and dumping caused by parties other than the contractor. If pre-existing hazardous materials or wastes are known to exist onsite, they should be identified in the SWPPP and handled as set forth in the SWPPP.

Implementation

Planning

- Review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- Inspect site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions and notify the owner.

Objectives		
EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives
None

- Inspect site regularly during project execution for evidence of illicit connections, illegal dumping or discharges.
- Observe site perimeter for evidence for potential of illicitly discharged or illegally dumped material, which may enter the job site.

Identification of Illicit Connections and Illegal Dumping or Discharges

- **General** – unlabeled and unidentifiable material should be treated as hazardous.
- **Solids** - Look for debris, or rubbish piles. Solid waste dumping often occurs on roadways with light traffic loads or in areas not easily visible from the traveled way.
- **Liquids** - signs of illegal liquid dumping or discharge can include:
  - Visible signs of staining or unusual colors to the pavement or surrounding adjacent soils
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Abnormal water flow during the dry weather season
- **Urban Areas** - Evidence of illicit connections or illegal discharges is typically detected at storm drain outfall locations or at manholes. Signs of an illicit connection or illegal discharge can include:
  - Abnormal water flow during the dry weather season
  - Unusual flows in sub drain systems used for dewatering
  - Pungent odors coming from the drainage systems
  - Discoloration or oily substances in the water or stains and residues detained within ditches, channels or drain boxes
  - Excessive sediment deposits, particularly adjacent to or near active offsite construction projects
- **Rural Areas** - Illicit connections or illegal discharges involving irrigation drainage ditches are detected by visual inspections. Signs of an illicit discharge can include:
  - Abnormal water flow during the non-irrigation season
  - Non-standard junction structures
  - Broken concrete or other disturbances at or near junction structures

Reporting

Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery. For illicit connections or discharges to the storm drain system, notify the local stormwater management agency. For illegal dumping, notify the local law enforcement agency.

Cleanup and Removal

The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the local stormwater management agency for further information.

Costs

Costs to look for and report illicit connections and illegal discharges and dumping are low. The best way to avoid costs associated with illicit connections and illegal discharges and dumping is to keep the project perimeters secure to prevent access to the site, to observe the site for vehicles that should not be there, and to document any waste or hazardous materials that exist onsite before taking possession of the site.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect the site regularly to check for any illegal dumping or discharge.
- Prohibit employees and subcontractors from disposing of non-job related debris or materials at the construction site.
- Notify the owner of any illicit connections and illegal dumping or discharge incidents at the time of discovery.

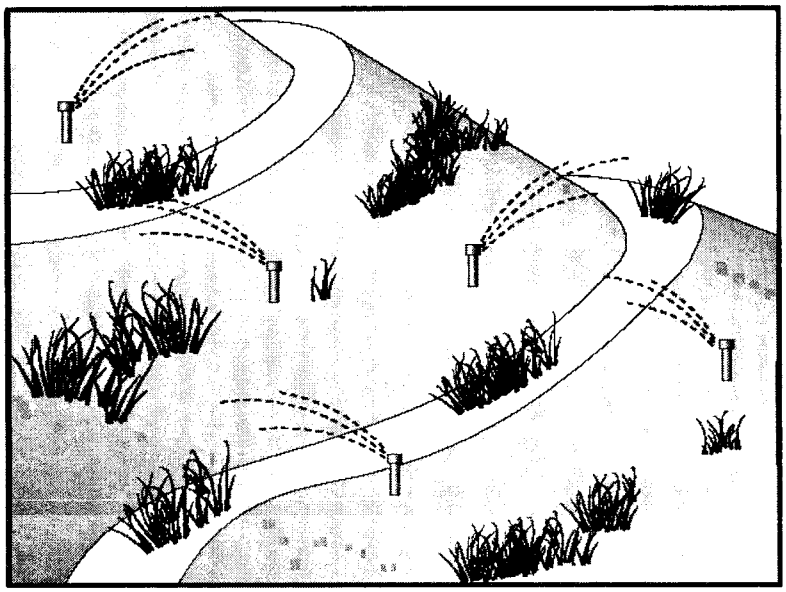
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Potable Water/Irrigation NS-7



Description and Purpose

Potable Water/Irrigation consists of practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing.

Suitable Applications

Implement this BMP whenever potable water or irrigation water discharges occur at or enter a construction site.

Limitations

None identified.

Implementation

- Direct water from offsite sources around or through a construction site, where feasible, in a way that minimizes contact with the construction site.
- Discharges from water line flushing should be reused for landscaping purposes where feasible.
- Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow.
- Protect downstream stormwater drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.

Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

- Inspect irrigated areas within the construction limits for excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used and to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.

Costs

Cost to manage potable water and irrigation are low and generally considered to be a normal part of related activities.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Repair broken water lines as soon as possible.
- Inspect irrigated areas regularly for signs of erosion and/or discharge.

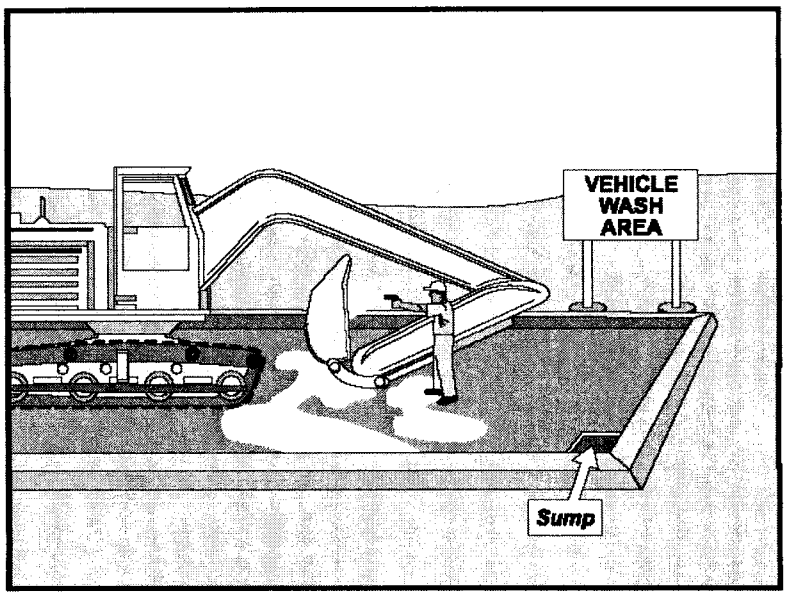
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle and Equipment Cleaning NS-8



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Vehicle and equipment cleaning procedures and practices eliminate or reduce the discharge of pollutants to stormwater from vehicle and equipment cleaning operations. Procedures and practices include but are not limited to: using offsite facilities; washing in designated, contained areas only; eliminating discharges to the storm drain by infiltrating the wash water; and training employees and subcontractors in proper cleaning procedures.

Suitable Applications

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

Limitations

Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades. Sending vehicles/equipment offsite should be done in conjunction with TR-1, Stabilized Construction Entrance/Exit.

Implementation

Other options to washing equipment onsite include contracting with either an offsite or mobile commercial washing business. These businesses may be better equipped to handle and dispose of the wash waters properly. Performing this work offsite can also be economical by eliminating the need for a separate washing operation onsite.

If washing operations are to take place onsite, then:

- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning onsite. Steam cleaning can generate significant pollutant concentrates.
- Cleaning of vehicles and equipment with soap, solvents or steam should not occur on the project site unless resulting wastes are fully contained and disposed of. Resulting wastes should not be discharged or buried, and must be captured and recycled or disposed according to the requirements of WM-10, Liquid Waste Management or WM-6, Hazardous Waste Management, depending on the waste characteristics. Minimize use of solvents. Use of diesel for vehicle and equipment cleaning is prohibited.
- All vehicles and equipment that regularly enter and leave the construction site must be cleaned offsite.
- When vehicle and equipment washing and cleaning must occur onsite, and the operation cannot be located within a structure or building equipped with appropriate disposal facilities, the outside cleaning area should have the following characteristics:
  - Located away from storm drain inlets, drainage facilities, or watercourses
  - Paved with concrete or asphalt and bermed to contain wash waters and to prevent runon and runoff
  - Configured with a sump to allow collection and disposal of wash water
  - No discharge of wash waters to storm drains or watercourses
  - Used only when necessary
- When cleaning vehicles and equipment with water:
  - Use as little water as possible. High-pressure sprayers may use less water than a hose and should be considered
  - Use positive shutoff valve to minimize water usage
  - Facility wash racks should discharge to a sanitary sewer, recycle system or other approved discharge system and must not discharge to the storm drainage system, watercourses, or to groundwater

Costs

Cleaning vehicles and equipment at an offsite facility may reduce overall costs for vehicle and equipment cleaning by eliminating the need to provide similar services onsite. When onsite cleaning is needed, the cost to establish appropriate facilities is relatively low on larger, long-duration projects, and moderate to high on small, short-duration projects.

Inspection and Maintenance

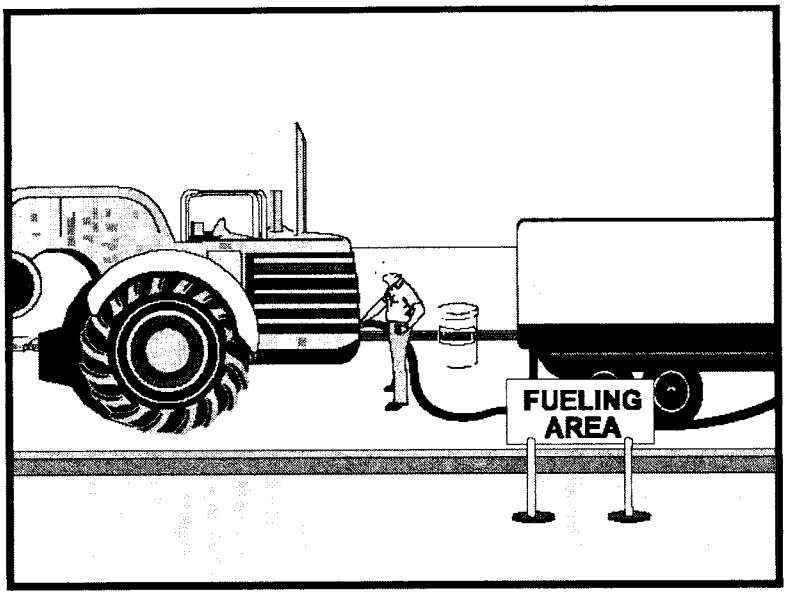
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspection and maintenance is minimal, although some berm repair may be necessary.
- Monitor employees and subcontractors throughout the duration of the construction project to ensure appropriate practices are being implemented.
- Inspect sump regularly and remove liquids and sediment as needed.
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Swisher, R.D. Surfactant Biodegradation, Marcel Decker Corporation, 1987.

Vehicle and Equipment Fueling NS-9



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Vehicle equipment fueling procedures and practices are designed to prevent fuel spills and leaks, and reduce or eliminate contamination of stormwater. This can be accomplished by using offsite facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors in proper fueling procedures.

Suitable Applications

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

Limitations

Onsite vehicle and equipment fueling should only be used where it is impractical to send vehicles and equipment offsite for fueling. Sending vehicles and equipment offsite should be done in conjunction with TR-1, Stabilized Construction Entrance/ Exit.

Implementation

- Use offsite fueling stations as much as possible. These businesses are better equipped to handle fuel and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate fueling area at a site.
- Discourage "topping-off" of fuel tanks.

- Absorbent spill cleanup materials and spill kits should be available in fueling areas and on fueling trucks, and should be disposed of properly after use.
- Drip pans or absorbent pads should be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Use absorbent materials on small spills. Do not hose down or bury the spill. Remove the adsorbent materials promptly and dispose of properly.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and large excavators, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- When fueling must take place onsite, designate an area away from drainage courses to be used. Fueling areas should be identified in the SWPPP.
- Dedicated fueling areas should be protected from stormwater runon and runoff, and should be located at least 50 ft away from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Protect fueling areas with berms and dikes to prevent runon, runoff, and to contain spills.
- Nozzles used in vehicle and equipment fueling should be equipped with an automatic shutoff to control drips. Fueling operations should not be left unattended.
- Use vapor recovery nozzles to help control drips as well as air pollution where required by Air Quality Management Districts (AQMD).
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks.

Costs

- All of the above measures are low cost except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.

Inspection and Maintenance

- Vehicles and equipment should be inspected each day of use for leaks. Leaks should be repaired immediately or problem vehicles or equipment should be removed from the project site.
- Keep ample supplies of spill cleanup materials onsite.
- Immediately clean up spills and properly dispose of contaminated soil and cleanup materials.

References

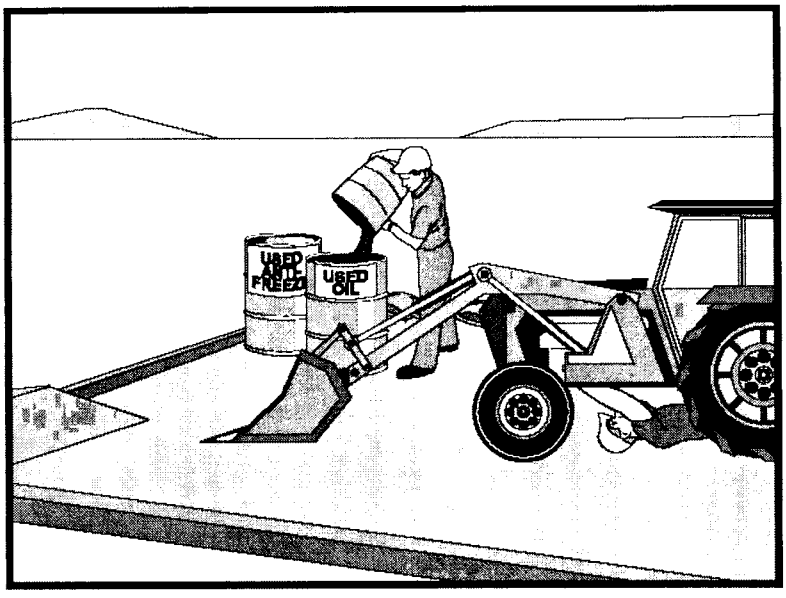
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Vehicle & Equipment Maintenance NS-10



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the contamination of stormwater resulting from vehicle and equipment maintenance by running a "dry and clean site". The best option would be to perform maintenance activities at an offsite facility. If this option is not available then work should be performed in designated areas only, while providing cover for materials stored outside, checking for leaks and spills, and containing and cleaning up spills immediately. Employees and subcontractors must be trained in proper procedures.

Suitable Applications

These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair. Sending vehicles/equipment offsite should be done in conjunction with TR-1, Stabilized Construction Entrance/Exit.

Outdoor vehicle or equipment maintenance is a potentially significant source of stormwater pollution. Activities that can contaminate stormwater include engine repair and service, changing or replacement of fluids, and outdoor equipment storage and parking (engine fluid leaks). For further information on vehicle or equipment servicing, see NS-8, Vehicle and Equipment Cleaning, and NS-9, Vehicle and Equipment Fueling.

NS-10 Vehicle & Equipment Maintenance

Implementation

- Use offsite repair shops as much as possible. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work offsite can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur onsite, use designated areas, located away from drainage courses. Dedicated maintenance areas should be protected from stormwater runon and runoff, and should be located at least 50 ft from downstream drainage facilities and watercourses.
- Drip pans or absorbent pads should be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- All fueling trucks and fueling areas are required to have spill kits and/or use other spill protection devices.
- Use adsorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- Inspect onsite vehicles and equipment daily at startup for leaks, and repair immediately.
- Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic and transmission fluids. Provide secondary containment and covers for these materials if stored onsite.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- Drip pans or plastic sheeting should 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 1 hour.
- For long-term projects, consider using portable tents or covers over maintenance areas if maintenance cannot be performed offsite.
- Consider use of new, alternative greases and lubricants, such as adhesive greases, for chassis lubrication and fifth-wheel lubrication.
- Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.
- Do not place used oil in a dumpster or pour into a storm drain or watercourse.
- Properly dispose of or recycle used batteries.
- Do not bury used tires.
- Repair leaks of fluids and oil immediately.

Vehicle & Equipment Maintenance NS-10

Listed below is further information if you must perform vehicle or equipment maintenance onsite.

Safer Alternative Products

- Consider products that are less toxic or hazardous than regular products. These products are often sold under an "environmentally friendly" label.
- Consider use of grease substitutes for lubrication of truck fifth-wheels. Follow manufacturers label for details on specific uses.
- Consider use of plastic friction plates on truck fifth-wheels in lieu of grease. Follow manufacturers label for details on specific uses.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, trichloroethane, or methylene chloride. Many of these cleaners are listed in California Toxic Rule as priority pollutants. These materials are harmful and must not contaminate stormwater. They must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check the list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling and Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous wastes separate, do not mix used oil solvents, and keep chlorinated solvents (like,-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around. Provide cover and secondary containment until these materials can be removed from the site.

Oil filters can be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Costs

All of the above are low cost measures. Higher costs are incurred to setup and maintain onsite maintenance areas.

NS-10 Vehicle & Equipment Maintenance

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Keep ample supplies of spill cleanup materials onsite.
- Maintain waste fluid containers in leak proof condition.
- Vehicles and equipment should be inspected on each day of use. Leaks should be repaired immediately or the problem vehicle(s) or equipment should be removed from the project site.
- Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

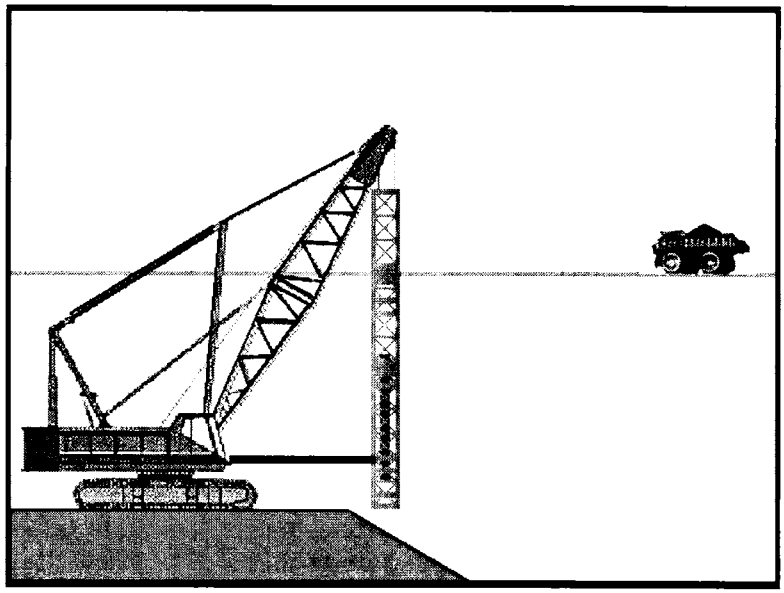
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Pile Driving Operations NS-11



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

The construction and retrofit of bridges and retaining walls often include driving piles for foundation support and shoring operations. Driven piles are typically constructed of precast concrete, steel, or timber. Driven sheet piles are also used for shoring and cofferdam construction. Proper control and use of equipment, materials, and waste products from pile driving operations will reduce or eliminate the discharge of potential pollutants to the storm drain system, watercourses, and waters of the United States.

Suitable Applications

These procedures apply to all construction sites near or adjacent to a watercourse or groundwater where permanent and temporary pile driving (impact and vibratory) takes place, including operations using pile shells as well as construction of cast-in-steel-shell and cast-in-drilled-hole piles.

Limitations

None identified.

Implementation

- Use drip pans or absorbent pads during vehicle and equipment operation, maintenance, cleaning, fueling, and storage. Refer to NS-8, Vehicle and Equipment Cleaning, NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.

- Have spill kits and cleanup materials available at all locations of pile driving. Refer to WM-4, Spill Prevention and Control.
- Equipment that is stored or in use in streambeds, or on docks, barges, or other structures over water bodies should be kept leak free.
- Park equipment over plastic sheeting or equivalent where possible. Plastic is not a substitute for drip pans or absorbent pads. The storage or use of equipment in streambeds or other bodies of water must comply with all applicable permits.
- Implement other BMPs as applicable, such as NS-2, Dewatering Operations, WM-5, Solid Waste Management, WM-6, Hazardous Waste Management, and WM-10, Liquid Waste Management.
- When not in use, store pile-driving equipment away from concentrated flows of stormwater, drainage courses, and inlets. Protect hammers and other hydraulic attachments from runon and runoff by placing them on plywood and covering them with plastic or a comparable material prior to the onset of rain.
- Use less hazardous products, e.g., vegetable oil, when practicable.

Costs

All of the above measures can be low cost.

Inspection and Maintenance

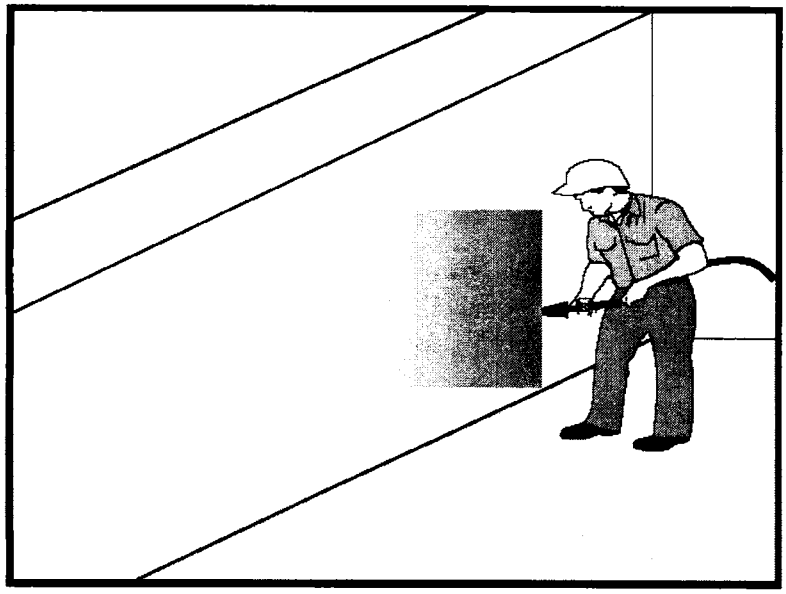
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Inspect equipment every day at startup and repair equipment as needed (i.e., worn or damaged hoses, fittings, and gaskets). Recheck equipment at shift changes or at the end of the day and scheduled repairs as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Concrete Curing NS-12



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Concrete curing is used in the construction of structures such as bridges, retaining walls, pump houses, large slabs, and structured foundations. Concrete curing includes the use of both chemical and water methods. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. Proper procedures reduce or eliminate the contamination of stormwater runoff during concrete curing.

Suitable Applications

Suitable applications include all projects where Portland Cement Concrete (PCC) and concrete curing chemicals are placed where they can be exposed to rainfall, runoff from other areas, or where runoff from the PCC will leave the site.

Limitations

None identified.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.
- Minimize the drift of chemical cure as much as possible by applying the curing compound close to the concrete surface. Apply an amount of compound that covers the surface, but does not allow any runoff of the compound.

- Use proper storage and handling techniques for concrete curing compounds. Refer to WM-1, Material Delivery and Storage.
- Protect drain inlets prior to the application of curing compounds.
- Refer to WM-4, Spill Prevention and Control.

Water Curing for Bridge Decks, Retaining Walls, and other Structures

- Direct cure water away from inlets and watercourses to collection areas for infiltration or other means of removal in accordance with all applicable permits.
- Collect cure water at the top of slopes and transport or dispose of water in a non-erodible manner. See EC-9 Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.
- Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

Costs

All of the above measures are generally low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Ensure that employees and subcontractors implement appropriate measures for storage, handling, and use of curing compounds.
- Inspect cure containers and spraying equipment for leaks.

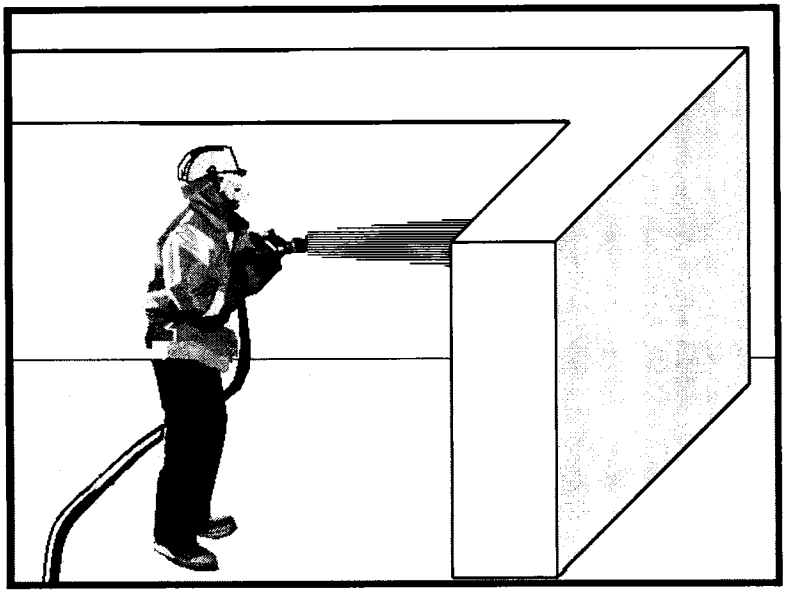
References

Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Concrete Finishing NS-13



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Concrete finishing methods are used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Methods include sand blasting, shot blasting, grinding, or high pressure water blasting. Stormwater and non-stormwater exposed to concrete finishing by-products may have a high pH and may contain chemicals, metals, and fines. Proper procedures and implementation of appropriate BMPs can minimize the impact that concrete-finishing methods may have on stormwater and non-stormwater discharges.

Suitable Applications

These procedures apply to all construction locations where concrete finishing operations are performed.

Limitations

None identified.

Implementation

- Collect and properly dispose of water from high-pressure water blasting operations.
- Collect contaminated water from blasting operations at the top of slopes. Transport or dispose of contaminated water while using BMPs such as those for erosion control. Refer to EC-9, Earth Dikes and Drainage Swales, EC-10, Velocity Dissipation Devices, and EC-11, Slope Drains.

- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering). Refer to NS-2 De-Watering Operations.
- Protect inlets during sandblasting operations. Refer to SE-10, Storm Drain Inlet Protection.
- Refer to WM-8, Concrete Waste Management for disposal of concrete based debris.
- Minimize the drift of dust and blast material as much as possible by keeping the blasting nozzle close to the surface.
- When blast residue contains a potentially hazardous waste, refer to WM-6, Hazardous Waste Management.

Costs

These measures are generally of low cost.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sweep or vacuum up debris from sandblasting at the end of each shift.
- At the end of each work shift, remove and contain liquid and solid waste from containment structures, if any, and from the general work area.

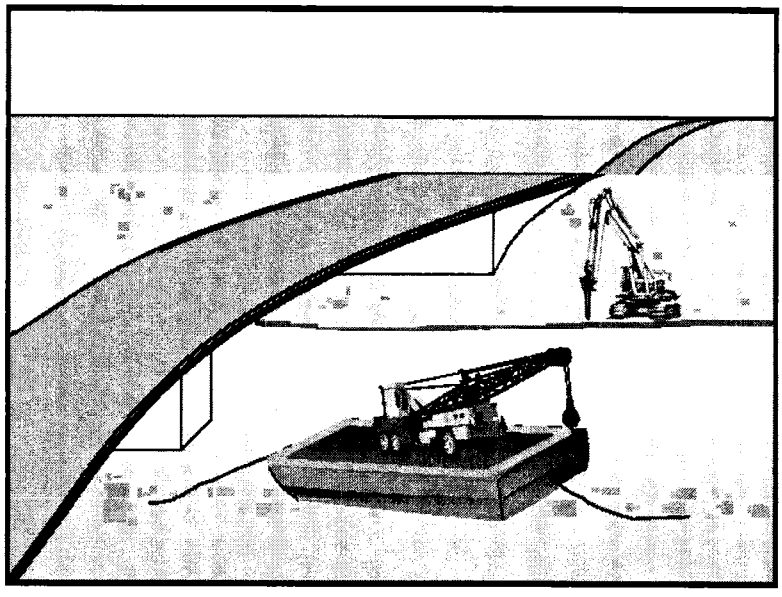
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Material Over Water NS-14



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Procedures for the proper use, storage, and disposal of materials and equipment on barges, boats, temporary construction pads, or similar locations, that minimize or eliminate the discharge of potential pollutants to a watercourse.

Suitable Applications

Applies where materials and equipment are used on barges, boats, docks, and other platforms over or adjacent to a watercourse including waters of the United States. These procedures should be implemented for construction materials and wastes (solid and liquid), soil or dredging materials, or any other materials that may cause or contribute to exceedances of water quality standards.

Limitations

Dredge and fill activities are regulated by the US Army Corps of Engineers and Regional Boards under Section 404/401 of the Clean Water Act.

Implementation

- Refer to WM-1, Material Delivery and Storage and WM-4, Spill Prevention and Control.
- Use drip pans and absorbent materials for equipment and vehicles and ensure that an adequate supply of spill clean up materials is available.
- Drip pans should be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies

when the vehicle or equipment is expected to be idle for more than 1 hour.

- Maintain equipment in accordance with NS-10, Vehicle and Equipment Maintenance. If a leaking line cannot be repaired, remove equipment from over the water.
- Provide watertight curbs or toe boards to contain spills and prevent materials, tools, and debris from leaving the barge, platform, dock, etc.
- Secure all materials to prevent discharges to receiving waters via wind.
- Identify types of spill control measures to be employed, including the storage of such materials and equipment. Ensure that staff is trained regarding the use of the materials, deployment and access of control measures, and reporting measures.
- In case of spills, contact the local Regional Board as soon as possible but within 48 hours.
- Refer to WM-5, Solid Waste Management (non-hazardous) and WM-6, Hazardous Waste Management. Ensure the timely and proper removal of accumulated wastes
- Comply with all necessary permits required for construction within or near the watercourse, such as Regional Water Quality Control Board, U.S. Army Corps of Engineers, Department of Fish and Game or and other local permitting.
- Discharges to waterways should be reported to the Regional Water Quality Control Board immediately upon discovery. A written discharge notification must follow within 7 days. Follow the spill reporting procedures contained in SWPPP.

Costs

These measures are generally of low to moderate cost. Exceptions are areas for temporary storage of materials, engine fluids, or wastewater pump out.

Inspection and Maintenance

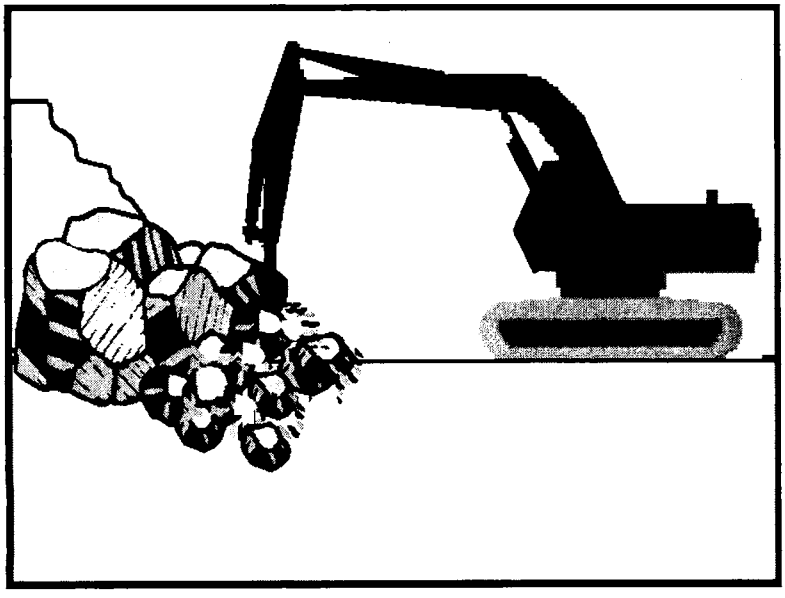
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Ensure that employees and subcontractors implement the appropriate measures for storage and use of materials and equipment.
- Inspect and maintain all associated BMPs and perimeter controls to ensure continuous protection of the water courses, including waters of the United States.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Demolition Adjacent to Water NS-15



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Procedures to protect water bodies from debris and wastes associated with structure demolition or removal over or adjacent to watercourses.

Suitable Applications

Full bridge demolition and removal, partial bridge removal (barrier rail, edge of deck) associated with bridge widening projects, concrete channel removal, or any other structure removal that could potentially affect water quality.

Limitations

None identified.

Implementation

- Refer to NS-5, Clear Water Diversion, to direct water away from work areas.
- Use attachments on construction equipment such as backhoes to catch debris from small demolition operations.
- Use covers or platforms to collect debris.
- Platforms and covers are to be approved by the owner.
- Stockpile accumulated debris and waste generated during demolition away from watercourses and in accordance with WM-3, Stockpile Management.
- Ensure safe passage of wildlife, as necessary.

- Discharges to waterways shall be reported to the Regional Water Quality Control Board immediately upon discovery. A written discharge notification must follow within 7 days. Follow the spill reporting procedures in the SWPPP.
- For structures containing hazardous materials, i.e., lead paint or asbestos, refer to BMP WM-6, Hazardous Waste Management. For demolition work involving soil excavation around lead-painted structures, refer to WM-7, Contaminated Soil Management.

Costs

Cost may vary according to the combination of practices implemented.

Inspection and Maintenance

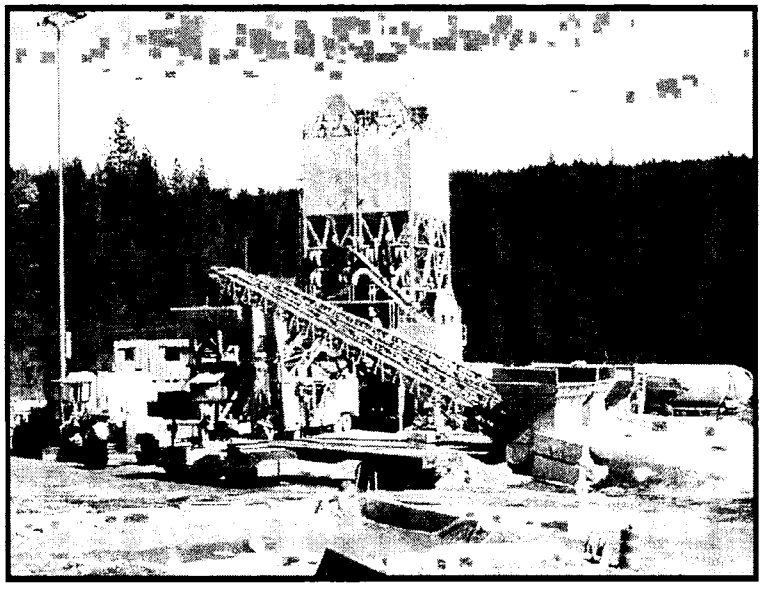
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Any debris-catching devices shall be emptied regularly. Collected debris shall be removed and stored away from the watercourse and protected from runon and runoff.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Temporary Batch Plants NS-16



Objectives

EC	Erosion Control	
SE	Sediment Control	
TR	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

The construction of roads, bridges, retaining walls, and other large structures in remote areas, often requires temporary batch plant facilities to manufacture Portland Cement Concrete (PCC) or asphalt cement (AC). Temporary batch plant facilities typically consist of silos containing fly ash, lime, and cement; heated tanks of liquid asphalt; sand and gravel material storage areas; mixing equipment; above ground storage tanks containing concrete additives and water; and designated areas for sand and gravel truck unloading, concrete truck loading, and concrete truck washout. Proper control and use of equipment, materials, and waste products from temporary batch plant facilities will reduce the discharge of potential pollutants to the storm drain system or watercourses, reduce air emissions, and mitigate noise impacts.

Suitable Applications

These procedures typically apply to construction sites where temporary batch plant facilities are used.

Limitations

The General Permit for discharges of stormwater associated with industrial activities may be applicable to temporary batch plants.

Specific permit requirements or mitigation measures such as Air Resources Board (ARB), Air Quality Management District (AQMD), Air Pollution Control District (APCD), Regional Water Quality Control Board (RWQCB), county ordinances and city

ordinances may require alternative mitigation measures for temporary batch plants.

Implementation

Planning

Implementation steps are as follows:

- Temporary batch plants may be subject to the General Industrial NPDES permit. To comply with the permit, a Notice of Intent (NOI) must be submitted to the State Water Resource Control Board.
- Proper planning, design, and construction of temporary batch plants should be implemented to minimize potential water quality, air pollution, and noise impacts associated with temporary batch plants.
- BMPs and a Sampling and Analysis Plan (SAP) must be included in the project Stormwater Pollution Prevention Plan (SWPPP). BMPs must be implemented, inspected, and maintained.
- Temporary batch plants should be managed to comply with AQMD Statewide Registration Program and/or local AQMD Portable Equipment Registration requirements.
- Construct temporary batch plants down-wind of existing developments whenever possible.
- Placement of access roads should be planned to mitigate water and air quality impacts.

Layout and Design

- Temporary batch plants should be properly located and designed to mitigate water quality impacts to receiving water bodies. Batch plants should be located away from watercourses, drainage courses, and drain inlets. Batch plants should be located to minimize the potential for stormwater runon onto the site.
- Temporary batch plant facilities (including associated stationary equipment and stockpiles) should be located at least 300 ft from any recreational area, school, residence, or other structure not associated with the construction project.
- Construct continuous interior AC or PCC berms around batch plant equipment (mixing equipment, silos, concrete drop points, conveyor belts, admixture tanks, etc.) to facilitate proper containment and cleanup of releases. Rollover or flip top curb or dikes should be placed at ingress and egress points.
- Direct runoff from the paved or unpaved portion of the batch plant into a sump and pipe to a lined washout area or dewatering tank.
- Direct stormwater and non-stormwater runoff from unpaved portions of batch plant facility to catchment ponds or tanks.
- Construct and remove concrete washout facilities in accordance with WM-8, Concrete Waste Management.

- Layout of a typical batch plant and associated BMP is located at the end of this BMP fact sheet.

Operational Procedures

- Washout of concrete trucks should be conducted in a designated area in accordance with WM-8, Concrete Waste Management.
- Do not dispose of concrete into drain inlets, the stormwater drainage system, or watercourses.
- Equipment washing should occur in a designated area in accordance with WM-8, Concrete Waste Management. Washing equipment, tools, or vehicles to remove PCC shall be conducted in accordance with NS-7, Potable Water/Irrigation, and NS-8, Vehicle and Equipment Cleaning.
- All dry material transfer points should be ducted through a fabric or cartridge type filter unless there are no visible emissions from the transfer point.
- Equip all bulk storage silos, including auxiliary bulk storage trailers, with fabric or cartridge type filter(s).
- Maintain silo vent filters in proper operating condition.
- Equip silos and auxiliary bulk storage trailers with dust-tight service hatches.
- Fabric dust collection system should be capable of controlling 99 percent of the particulate matter.
- Fabric dust collectors (except for vent filters) should be equipped with an operational pressure differential gauge to measure the pressure drop across the filters.
- All transfer points should be equipped with a wet suppression system to control fugitive particulate emissions unless there are no visible emissions.
- All conveyors should be covered, unless the material being transferred results in no visible emissions.
- There should be no visible emissions beyond the property line, while the equipment is being operated.
- Collect dust emissions from the loading of open-bodied trucks at the drip point of dry batch plants, or dust emissions from the drum feed for central mix plants.
- Equip silos and auxiliary bulk storage trailers with a visible and/or audible warning mechanism to warn operators that the silo or trailer is full.
- All open-bodied vehicles transporting material should be loaded with a final layer of wet sand and the truck shall be covered with a tarp to reduce emissions.

Tracking Control

- Plant roads (batch truck and material delivery truck roads) and areas between stockpiles and conveyor hoppers should be stabilized (TR-2, Stabilized Construction Roadway), watered (WE-1, Wind Erosion Control), treated with dust-suppressant chemicals, or paved with a cohesive hard surface that can be repeatedly swept, maintained intact, and cleaned as necessary to control dust emissions.
- Trucks should not track PCC from plants onto public roads. Use appropriate practices from TR-1, Stabilized Construction Entrance/Exit to prevent tracking.

Materials Storage

- WM-1, Material Delivery and Storage, should be implemented at all batch plants using concrete components or compounds. An effective strategy is to cover and contain materials.
- WM-2, Material Use should be conducted in a way to minimize or eliminate the discharge of materials to storm drain system or watercourse.
- Ensure that finer materials are not dispersed into the air during operations, such as unloading of cement delivery trucks.
- Stockpiles should be covered and enclosed with perimeter sediment barriers per WM-3, Stockpile Management. Uncovered stockpiles should be sprinkled with water and/or dust-suppressant chemicals as necessary to control dust emissions, unless the stockpiled material results in no visible emissions. An operable stockpile watering system should be onsite at all times.
- Store bagged and boxed materials on pallets and cover on non-working days prior to rain.
- Minimize stockpiles of demolished PCC by recycling them in a timely manner.
- Provide secondary containment for liquid materials (WM-1). Containment should provide sufficient volume to contain precipitation from a 25-year storm plus 10% of the aggregate volume of all containers or plus 100% of the largest container, whichever is greater.
- Handle solid and liquid waste in accordance with WM-5, Solid Waste Management, WM-10, Liquid Waste Management, and WM-8, Concrete Waste Management.
- Maintain adequate supplies of spill cleanup materials and train staff to respond to spills per WM-4, Spill Prevention and Control.
- Immediately clean up spilled cement and fly ash and contain or dampen so that dust or emissions from wind erosion or vehicle traffic are minimized.

Equipment Maintenance

- Equipment should be maintained to prevent fluid leaks and spills per NS-9, Vehicle and Equipment Fueling, and NS-10, Vehicle and Equipment Maintenance.
- Maintain adequate supplies of spill cleanup materials and train staff to respond to spills per WM-4, Spill Prevention and Control.

- Incorporate other BMPs such as WM-5, Solid Waste Management, WM-6, Hazardous Waste Management, and WM-10, Liquid Waste Management.

Costs

Costs will vary depending on the size of the facility and combination of BMPs implemented.

Inspection and Maintenance

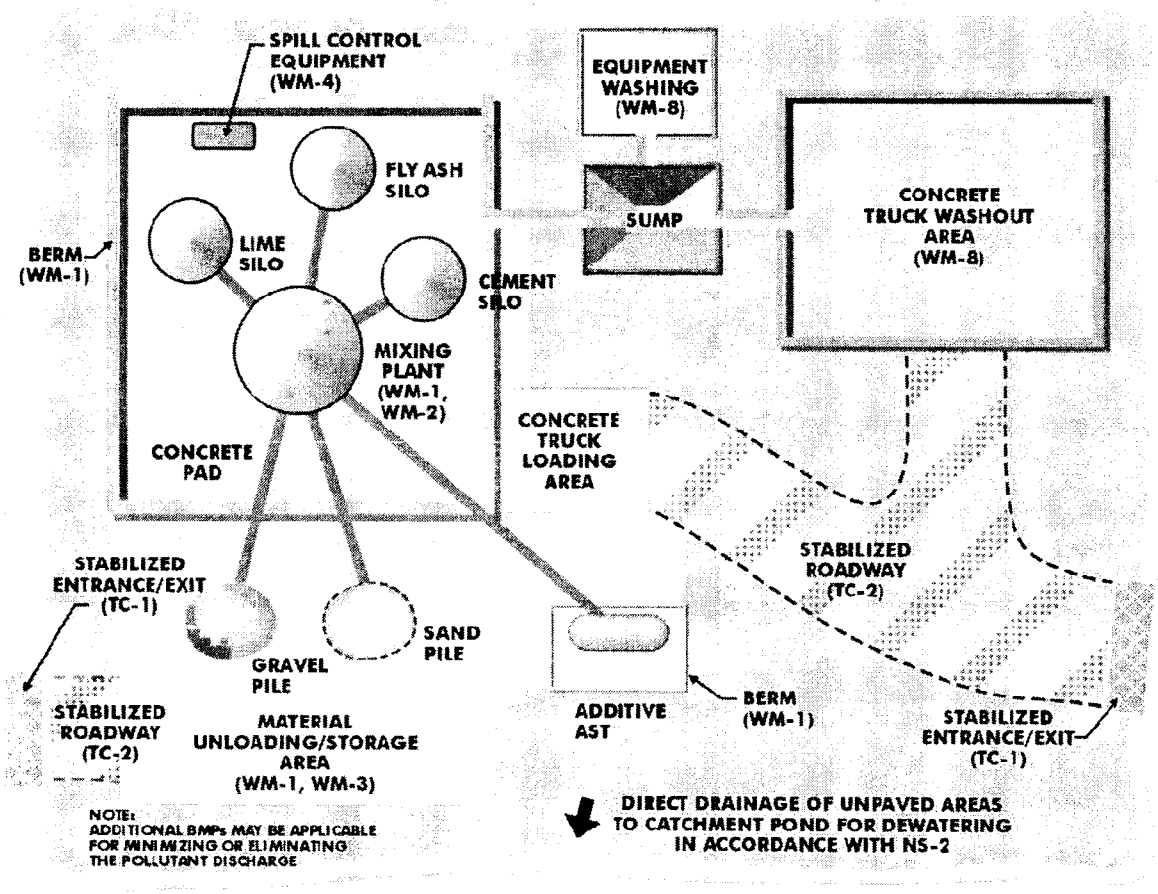
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).
- Inspect and maintain Stabilized Construction Entrance/Exit (TR-1) as needed.
- Inspect and maintain stabilized haul roads as needed.
- Inspect and maintain materials and waste storage areas as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

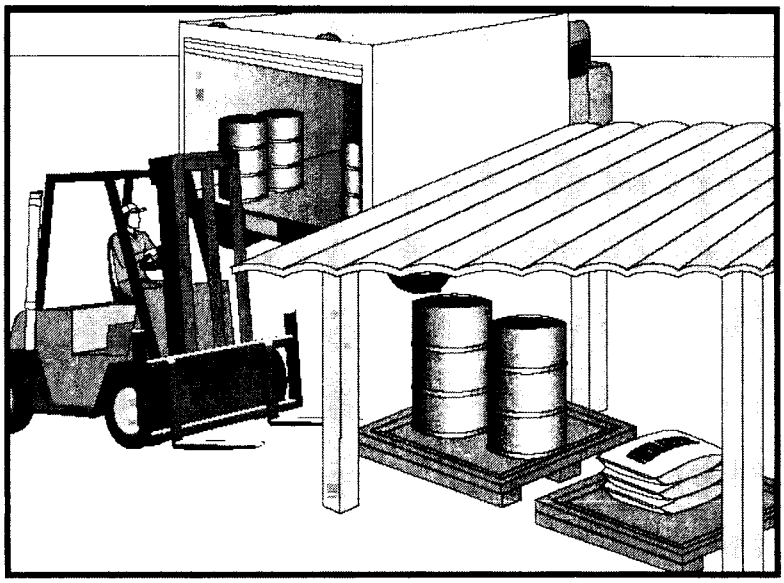
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

NS-16 Temporary Batch Plants



Typical Temporary Batch

Material Delivery and Storage WM-1



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease
- Asphalt and concrete components

- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Temporary storage area should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located near the construction entrances, away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area which will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.
- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the rainy season, consider storing materials in a covered area. Store materials in secondary containments such as earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.

- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Chemicals should be kept in their original labeled containers.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, each temporary containment facility should be covered during non-working days, prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.
- Stockpiles should be protected in accordance with WM-3, Stockpile Management.
- Materials should be stored indoors within existing structures or sheds when available.
- Proper storage instructions should be posted at all times in an open and conspicuous location.
- An ample supply of appropriate spill clean up material should be kept near storage areas.
- Also see WM-6, Hazardous Waste Management, for storing of hazardous materials.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.
- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.
- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.
- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Keep an ample supply of spill cleanup materials near the storage area.
- Keep storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

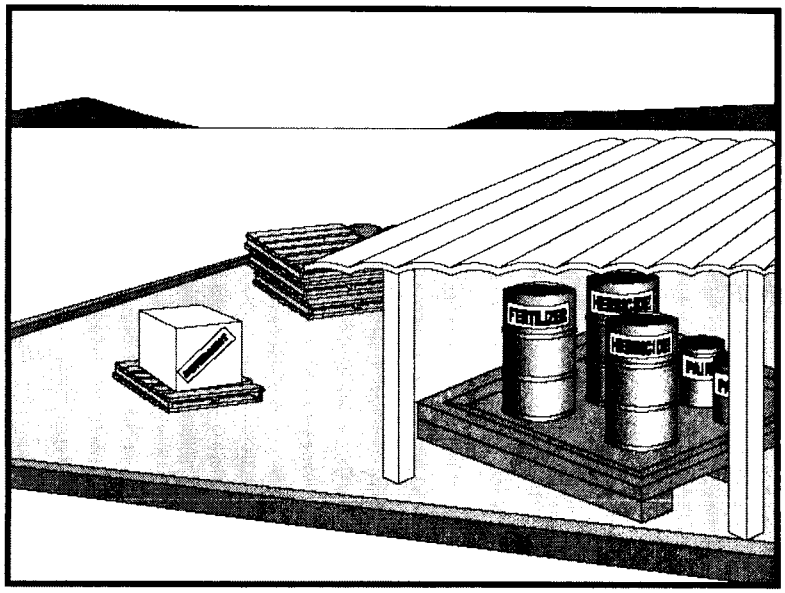
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Material Use

WM-2



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ Primary Objective

☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products, minimizing hazardous material use onsite, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for use at all construction projects. These procedures apply when the following materials are used or prepared onsite:

- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease
- Asphalt and other concrete components
- Other hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

Safer alternative building and construction products may not be available or suitable in every instance.

Implementation

The following steps should be taken to minimize risk:

- Minimize use of hazardous materials onsite.
- Follow manufacturer instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Train personnel who use pesticides. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct onsite inspections.
- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydro seeding. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains.
- Train employees and subcontractors in proper material use.
- Supply Material Safety Data Sheets (MSDS) for all materials.
- Dispose of latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths, when thoroughly dry and are no longer hazardous, with other construction debris.
- Do not remove the original product label; it contains important safety and disposal information. Use the entire product before disposing of the container.
- Mix paint indoors or in a containment area. Never clean paintbrushes or rinse paint containers into a street, gutter, storm drain, or watercourse. Dispose of any paint thinners, residue, and sludge(s) that cannot be recycled, as hazardous waste.
- For water-based paint, clean brushes to the extent practicable, and rinse to a drain leading to a sanitary sewer where permitted, or into a concrete washout pit or temporary sediment trap. For oil-based paints, clean brushes to the extent practicable, and filter and reuse thinners and solvents.
- Use recycled and less hazardous products when practical. Recycle residual paints, solvents, non-treated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible. Reduce or eliminate use of hazardous materials onsite when practical.

- Require contractors to complete the "Report of Chemical Spray Forms" when spraying herbicides and pesticides.
- Keep an ample supply of spill clean up material near use areas. Train employees in spill clean up procedures.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two–week intervals in the non-rainy season to verify continued BMP implementation.
- Maintenance of this best management practice is minimal.
- Spot check employees and subcontractors throughout the job to ensure appropriate practices are being employed.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

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Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management WM-3

Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Stockpile Management procedures and practices are designed to reduce or eliminate air and stormwater pollution from stockpiles of soil, paving materials such as portland cement concrete (PCC) rubble, asphalt concrete (AC), asphalt concrete rubble, aggregate base, aggregate sub base or pre-mixed aggregate, asphalt minder (so called "cold mix" asphalt), and pressure treated wood.

Suitable Applications

Implement in all projects that stockpile soil and other materials.

Limitations

None identified.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- Locate stockpiles a minimum of 50 ft away from concentrated flows of stormwater, drainage courses, and inlets.
- Protect all stockpiles from stormwater runon using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, sandbag, gravel bags, or straw bale barriers.

- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.

Protection of Non-Active Stockpiles

Non-active stockpiles of the identified materials should be protected further as follows:

Soil stockpiles

- During the rainy season, soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.
- During the non-rainy season, soil stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- During the rainy season, the stockpiles should be covered or protected with a temporary perimeter sediment barrier at all times.
- During the non-rainy season, the stockpiles should be covered or protected with a temporary perimeter sediment barrier prior to the onset of precipitation.

Stockpiles of "cold mix"

- During the rainy season, cold mix stockpiles should be placed on and covered with plastic or comparable material at all times.
- During the non-rainy season, cold mix stockpiles should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Stockpiles/Storage of pressure treated wood with copper, chromium, and arsenic or ammonical, copper, zinc, and arsenate

- During the rainy season, treated wood should be covered with plastic or comparable material at all times.
- During the non-rainy season, treated wood should be covered with plastic or comparable material at all times and cold mix stockpiles should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Protection of Active Stockpiles

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

- All stockpiles should be protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" should be placed on and covered with plastic or comparable material prior to the onset of precipitation.

Costs

All of the above are low cost measures.

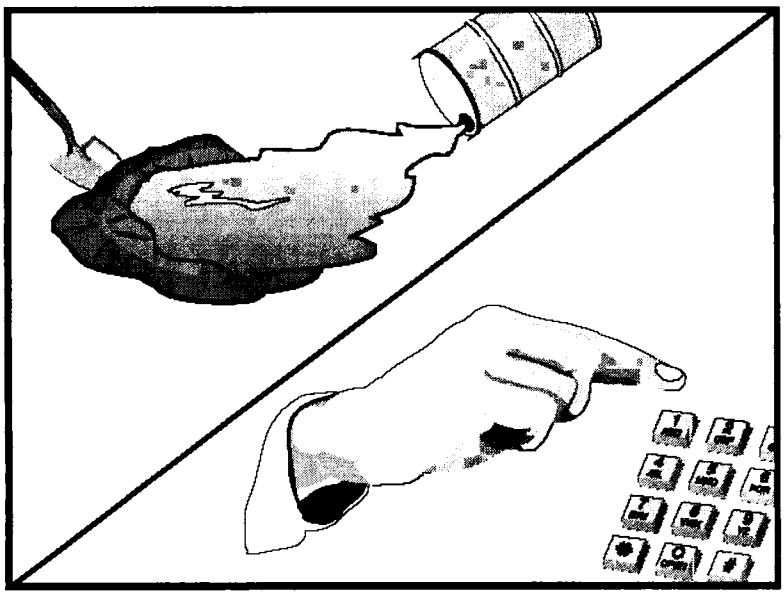
Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Spill Prevention and Control WM-4



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

This BMP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored on the construction site, including the following materials:

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals

- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The following steps will help reduce the stormwater impacts of leaks and spills:

Education

- Be aware that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or wash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with WM-10, Liquid Waste Management.
- Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
- Keep waste storage areas clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Spills should be cleaned up immediately:
  - Contain spread of the spill.
  - Notify the project foreman immediately.
  - If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
  - If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
  - If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:
  - Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
  - Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.
  - For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
  - Notification should first be made by telephone and followed up with a written report.
  - The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
  - Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or water can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.
- Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

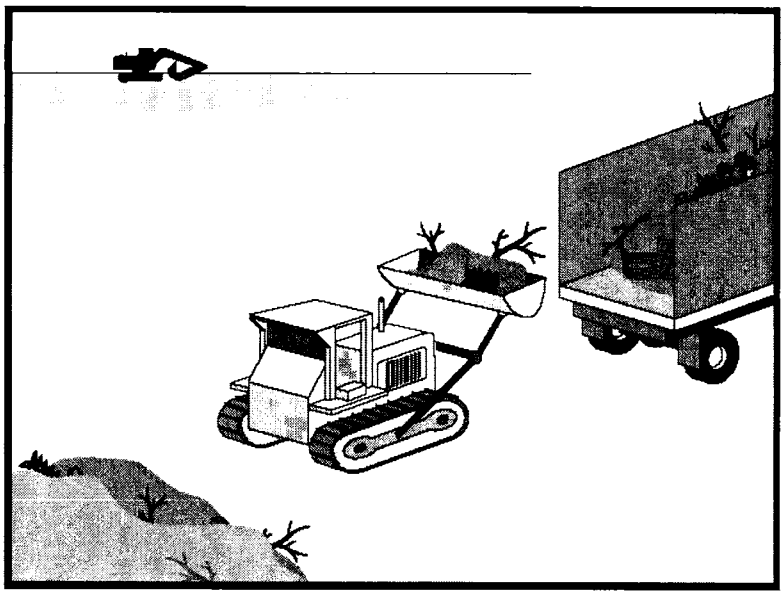
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Solid Waste Management WM-5



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials

- Highway planting wastes, including vegetative material, plant containers, and packaging materials

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.

- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.
- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Inspect construction waste area regularly.
- Arrange for regular waste collection.

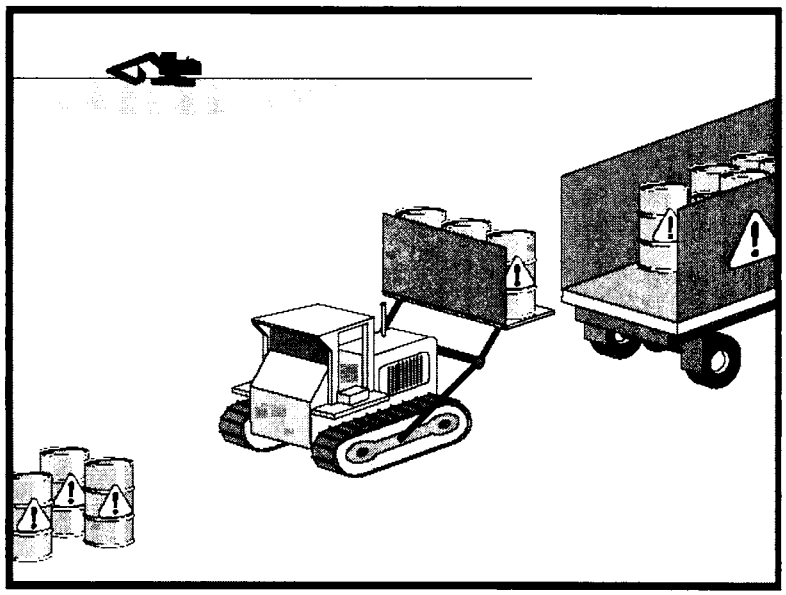
References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Objectives

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Asphalt Products
- Concrete Curing Compounds
- Pesticides
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts 110, 117, 261, or 302

In addition, sites with existing structures may contain wastes, which must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transportation, and disposal of hazardous wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The following steps will help reduce stormwater pollution from hazardous wastes:

Material Use

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172, 173, 178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:
  - Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
  - Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.
  - Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.
  - Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums should not be overfilled and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- The following actions should be taken with respect to temporary contaminant:
  - Ensure that adequate hazardous waste storage volume is available.
  - Ensure that hazardous waste collection containers are conveniently located.
  - Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
  - Minimize production or generation of hazardous materials and hazardous waste on the job site.
  - Use containment berms in fueling and maintenance areas and where the potential for spills is high.
  - Segregate potentially hazardous waste from non-hazardous construction site debris.
  - Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

- Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
- Place hazardous waste containers in secondary containment.
- Do not allow potentially hazardous waste materials to accumulate on the ground.
- Do not mix wastes.
- Use all of the product before disposing of the container.
- Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid waste.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous waste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two week intervals in the non-rainy season to verify continued BMP implementation.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous waste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous waste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.
- Hazardous spills should be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.

- The National Response Center, at (800) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous waste manifests should be provided.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

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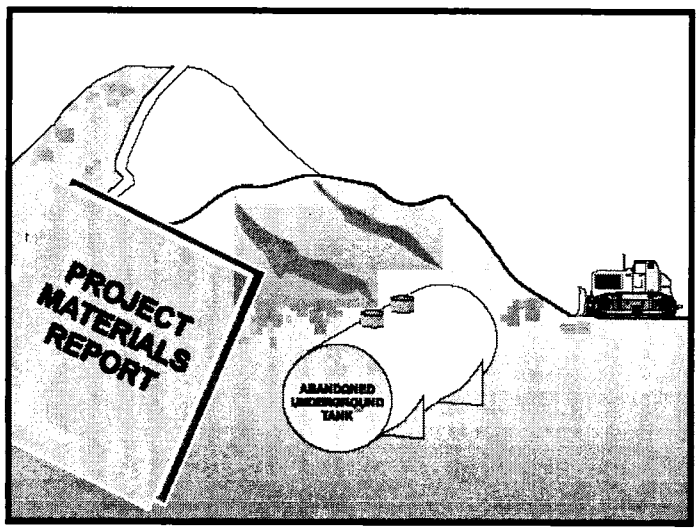
Contaminated Soil Management WM-7



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

Suitable Applications

Contaminated soil management is implemented on construction projects in highly urbanized or industrial areas where soil contamination may have occurred due to spills, illicit discharges, aerial deposition, past use and leaks from underground storage tanks.

Limitations

Contaminated soils that cannot be treated onsite must be disposed of offsite by a licensed hazardous waste hauler. The presence of contaminated soil may indicate contaminated water as well. See NS-2, Dewatering Operations, for more information.

The procedures and practices presented in this BMP are general. The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered onsite.

Implementation

Most owners and developers conduct pre-construction environmental assessments as a matter of routine. Contaminated soils are often identified during project planning and development with known locations identified in the plans, specifications and in the SWPPP. The contractor should review applicable reports and investigate appropriate call-outs in the plans, specifications, and

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives
None

SWPPP. Recent court rulings holding contractors liable for cleanup costs when they unknowingly move contaminated soil highlight the need for contractors to confirm a site assessment is completed before earth moving begins.

The following steps will help reduce stormwater pollution from contaminated soil:

- Conduct thorough, pre-construction inspections of the site and review documents related to the site. If inspection or reviews indicated presence of contaminated soils, develop a plan before starting work.
- Look for contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
- Prevent leaks and spills. Contaminated soil can be expensive to treat and dispose of properly. However, addressing the problem before construction is much less expensive than after the structures are in place.
- The contractor may further identify contaminated soils by investigating:
  - Past site uses and activities
  - Detected or undetected spills and leaks
  - Acid or alkaline solutions from exposed soil or rock formations high in acid or alkaline forming elements
  - Contaminated soil as evidenced by discoloration, odors, differences in soil properties, abandoned underground tanks or pipes, or buried debris.
  - Suspected soils should be tested at a certified laboratory.

Education

- Have employees and subcontractors complete a safety training program which meets 29 CFR 1910.120 and 8 CCR 5192 covering the potential hazards as identified, prior to performing any excavation work at the locations containing material classified as hazardous.
- Educate employees and subcontractors in identification of contaminated soil and on contaminated soil handling and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).

Handling Procedures for Material with Aerially Deposited Lead (ADL)

- Materials from areas designated as containing (ADL) may, if allowed by the contract special provisions, be excavated, transported, and used in the construction of embankments and/or backfill.
- Excavation, transportation, and placement operations should result in no visible dust.
- Caution should be exercised to prevent spillage of lead containing material during transport.

- Quality should be monitored during excavation of soils contaminated with lead.

Handling Procedures for Contaminated Soils

- Minimize onsite storage. Contaminated soil should be disposed of properly in accordance with all applicable regulations. All hazardous waste storage will comply with the requirements in Title 22, CCR, Sections 66265.250 to 66265.260.
- Test suspected soils at an approved certified laboratory.
- Work with the local regulatory agencies to develop options for treatment or disposal if the soil is contaminated.
- Avoid temporary stockpiling of contaminated soils or hazardous material.
- Take the following precautions if temporary stockpiling is necessary:
  - Cover the stockpile with plastic sheeting or tarps.
  - Install a berm around the stockpile to prevent runoff from leaving the area.
  - Do not stockpile in or near storm drains or watercourses.
- Remove contaminated material and hazardous material on exteriors of transport vehicles and place either into the current transport vehicle or into the excavation prior to the vehicle leaving the exclusion zone.
- Monitor the air quality continuously during excavation operations at all locations containing hazardous material.
- Procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work, including registration for transporting vehicles carrying the contaminated material and the hazardous material.
- Collect water from decontamination procedures and treat or dispose of it at an appropriate disposal site.
- Collect non-reusable protective equipment, once used by any personnel, and dispose of at an appropriate disposal site.
- Install temporary security fence to surround and secure the exclusion zone. Remove fencing when no longer needed.
- Excavate, transport, and dispose of contaminated material and hazardous material in accordance with the rules and regulations of the following agencies (the specifications of these agencies supersede the procedures outlined in this BMP):
  - United States Department of Transportation (USDOT)
  - United States Environmental Protection Agency (USEPA)
  - California Environmental Protection Agency (CAL-EPA)

- California Division of Occupation Safety and Health Administration (CAL-OSHA)
- Local regulatory agencies

Procedures for Underground Storage Tank Removals

- Prior to commencing tank removal operations, obtain the required underground storage tank removal permits and approval from the federal, state, and local agencies that have jurisdiction over such work.
- To determine if it contains hazardous substances, arrange to have tested, any liquid or sludge found in the underground tank prior to its removal.
- Following the tank removal, take soil samples beneath the excavated tank and perform analysis as required by the local agency representative(s).
- The underground storage tank, any liquid or sludge found within the tank, and all contaminated substances and hazardous substances removed during the tank removal and transported to disposal facilities permitted to accept such waste.

Water Control

- All necessary precautions and preventive measures should be taken to prevent the flow of water, including ground water, from mixing with hazardous substances or underground storage tank excavations. Such preventative measures may consist of, but are not limited to, berms, cofferdams, grout curtains, freeze walls, and seal course concrete or any combination thereof.
- If water does enter an excavation and becomes contaminated, such water, when necessary to proceed with the work, should be discharged to clean, closed top, watertight transportable holding tanks, treated, and disposed of in accordance with federal, state, and local laws.

Costs

Prevention of leaks and spills is inexpensive. Treatment or disposal of contaminated soil can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Arrange for contractor's Water Pollution Control Manager, foreman, and/or construction supervisor to monitor onsite contaminated soil storage and disposal procedures.
- Monitor air quality continuously during excavation operations at all locations containing hazardous material.
- Coordinate contaminated soils and hazardous substances/waste management with the appropriate federal, state, and local agencies.

- Implement WM-4, Spill Prevention and Control, to prevent leaks and spills as much as possible.

References

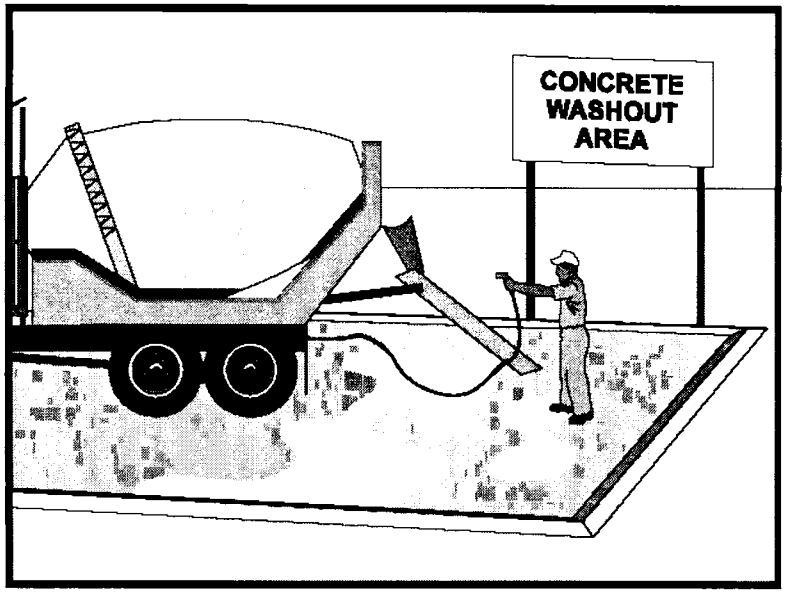
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Concrete Waste Management WM-8



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants to stormwater from concrete waste by conducting washout offsite, performing onsite washout in a designated area, and training employee and subcontractors.

Suitable Applications

Concrete waste management procedures and practices are implemented on construction projects where:

- Concrete is used as a construction material or where concrete dust and debris result form demolition activities
- Slurries containing portland cement concrete (PCC) or asphalt concrete (AC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition
- Concrete trucks and other concrete-coated equipment are washed onsite
- Mortar-mixing stations exist
- See also NS-8, Vehicle and Equipment Cleaning

Limitations

- Offsite washout of concrete wastes may not always be possible.

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Discuss the concrete management techniques described in this BMP (such as handling of concrete waste and washout) with the ready-mix concrete supplier before any deliveries are made.
- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete.
- Perform washout of concrete trucks offsite or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - Locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste.
  - Wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed properly.
- Avoid creating runoff by draining water to a bermed or level area when washing concrete to remove fine particles and expose the aggregate.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile or dispose in the trash.

Education

- Educate employees, subcontractors, and suppliers on the concrete waste management techniques described herein.
- Arrange for contractor's superintendent or representative to oversee and enforce concrete waste management procedures.

Concrete Slurry Wastes

- PCC and AC waste should not be allowed to enter storm drains or watercourses.
- PCC and AC waste should be collected and disposed of or placed in a temporary concrete washout facility.
- A sign should be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

- Below grade concrete washout facilities are typical. Above grade facilities are used if excavation is not practical.
- A foreman or construction supervisor should monitor onsite concrete working tasks, such as saw cutting, coring, grinding and grooving to ensure proper methods are implemented.
- Saw-cut PCC slurry should not be allowed to enter storm drains or watercourses. Residue from grinding operations should be picked up by means of a vacuum attachment to the grinding machine. Saw cutting residue should not be allowed to flow across the pavement and should not be left on the surface of the pavement. See also NS-3, Paving and Grinding Operations; and WM-10, Liquid Waste Management.
- Slurry residue should be vacuumed and disposed in a temporary pit (as described in OnSite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below) and allowed to dry. Dispose of dry slurry residue in accordance with WM-5, Solid Waste Management.

Onsite Temporary Concrete Washout Facility, Transit Truck Washout Procedures

- Temporary concrete washout facilities should be located a minimum of 50 ft from storm drain inlets, open drainage facilities, and watercourses. Each facility should be located away from construction traffic or access areas to prevent disturbance or tracking.
- A sign should be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.
- Temporary concrete washout facilities should be constructed above grade or below grade at the option of the contractor. Temporary concrete washout facilities should be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- Temporary washout facilities should have a temporary pit or bermed areas of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.
- Washout of concrete trucks should be performed in designated areas only.
- Only concrete from mixer truck chutes should be washed into concrete wash out.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed of offsite.
- Once concrete wastes are washed into the designated area and allowed to harden, the concrete should be broken up, removed, and disposed of per WM-5, Solid Waste Management. Dispose of hardened concrete on a regular basis.
- Temporary Concrete Washout Facility (Type Above Grade)
  - Temporary concrete washout facility (type above grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and

minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

- Straw bales, wood stakes, and sandbag materials should conform to the provisions in SE-9, Straw Bale Barrier.
- Plastic lining material should be a minimum of 10 mil in polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- Temporary Concrete Washout Facility (Type Below Grade)
  - Temporary concrete washout facilities (type below grade) should be constructed as shown on the details at the end of this BMP, with a recommended minimum length and minimum width of 10 ft. The quantity and volume should be sufficient to contain all liquid and concrete waste generated by washout operations.
  - Lath and flagging should be commercial type.
  - Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

Removal of Temporary Concrete Washout Facilities

- When temporary concrete washout facilities are no longer required for the work, the hardened concrete should be removed and disposed of. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and disposed of.
- Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities should be backfilled and repaired.

Costs

All of the above are low cost measures.

Inspection and Maintenance

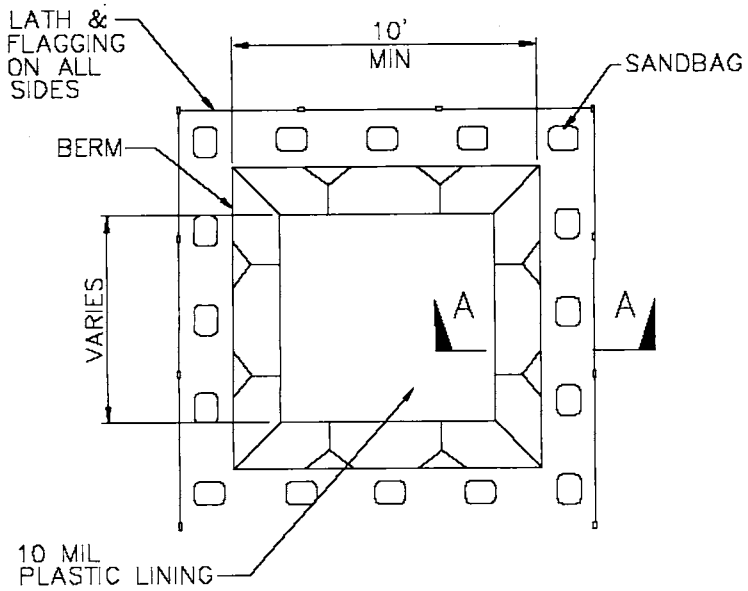
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Temporary concrete washout facilities should 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 should include removing and disposing of hardened concrete and returning the facilities to a functional condition. Hardened concrete materials should be removed and disposed of.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

References

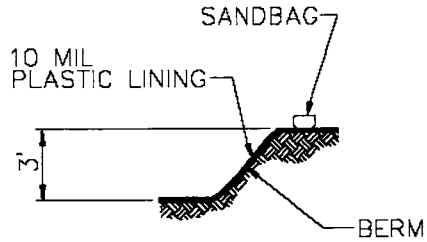
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

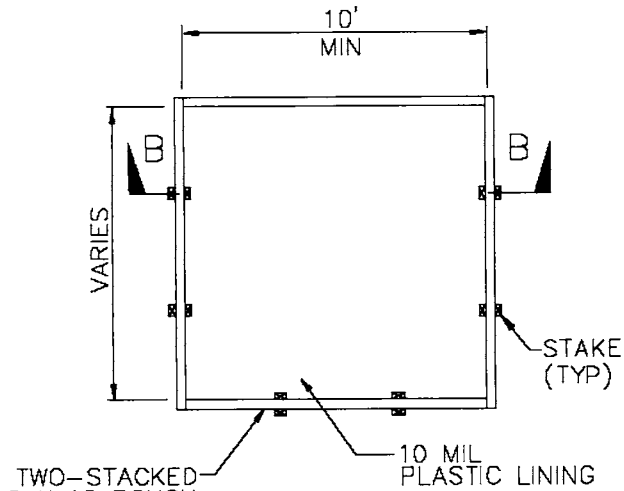
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



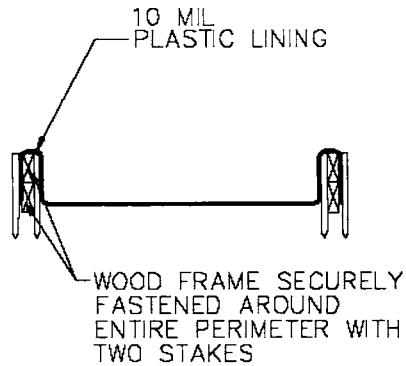
PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"

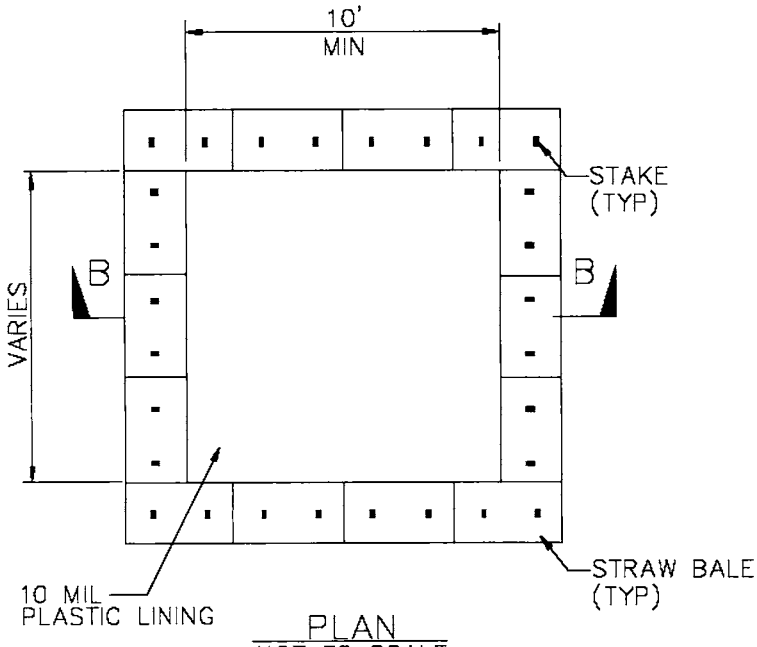


SECTION B–B
NOT TO SCALE

NOTES

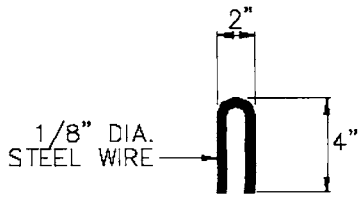
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Concrete Waste Management WM-8

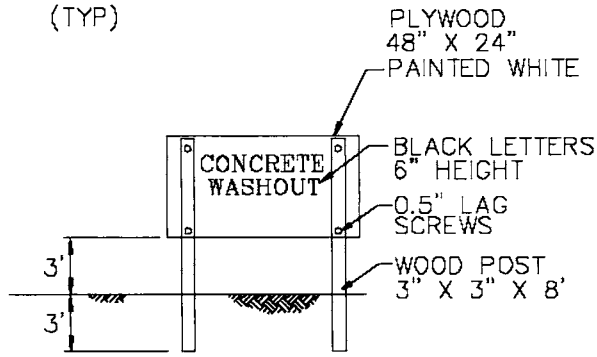


PLAN
NOT TO SCALE

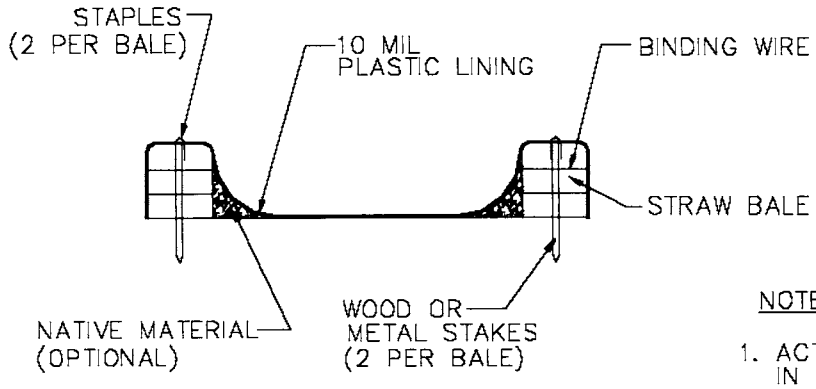
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)

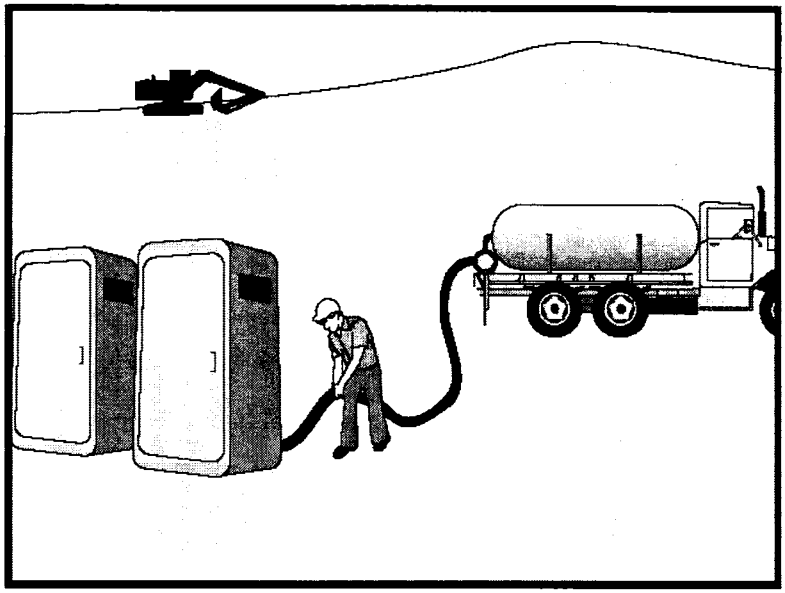


SECTION B–B
NOT TO SCALE

NOTES

1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

Sanitary/Septic Waste Management WM-9



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	
Nutrients	☑
Trash	☑
Metals	
Bacteria	☑
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Proper sanitary and septic waste management prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

Suitable Applications

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Limitations

None identified.

Implementation

Sanitary or septic wastes should be treated or disposed of in accordance with state and local requirements. In many cases, one contract with a local facility supplier will be all that it takes to make sure sanitary wastes are properly disposed.

Storage and Disposal Procedures

- Temporary sanitary facilities should be located away from drainage facilities, watercourses, and from traffic circulation. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.
- Wastewater should not be discharged or buried within the project site.

- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, should comply with the local health agency, city, county, and sewer district requirements.
- Only reputable, licensed sanitary and septic waste haulers should be used.
- Sanitary facilities should be located in a convenient location.
- Untreated raw wastewater should never be discharged or buried.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an onsite disposal system (OSDS), such as a septic system, local health agency requirements must be followed.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.

Education

- Educate employees, subcontractors, and suppliers on sanitary and septic waste storage and disposal procedures.
- Educate employees, subcontractors, and suppliers of potential dangers to humans and the environment from sanitary and septic wastes.
- Instruct employees, subcontractors, and suppliers in identification of sanitary and septic waste.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.

Costs

All of the above are low cost measures.

Inspection and Maintenance

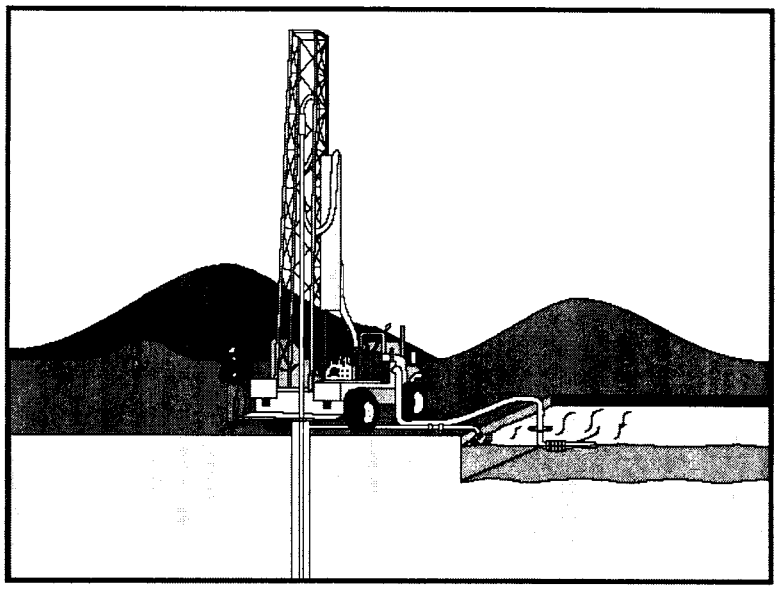
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.
- Arrange for regular waste collection.
- If high winds are expected, portable sanitary facilities must be secured with spikes or weighed down to prevent over turning.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Liquid Waste Management WM-10



Objectives		
EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:
☑ Primary Objective
☒ Secondary Objective

Targeted Constituents	
Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Liquid waste management includes procedures and practices to prevent discharge of pollutants to the storm drain system or to watercourses as a result of the creation, collection, and disposal of non-hazardous liquid wastes.

Suitable Applications

Liquid waste management is applicable to construction projects that generate any of the following non-hazardous by-products, residuals, or wastes:

- Drilling slurries and drilling fluids
- Grease-free and oil-free wastewater and rinse water
- Dredgings
- Other non-stormwater liquid discharges not permitted by separate permits

Limitations

- Disposal of some liquid wastes may be subject to specific laws and regulations or to requirements of other permits secured for the construction project (e.g., NPDES permits, Army Corps permits, Coastal Commission permits, etc.).
- Liquid waste management does not apply to dewatering operations (NS-2 Dewatering Operations), solid waste management (WM-5, Solid Waste Management), hazardous

wastes (WM-6, Hazardous Waste Management), or concrete slurry residue (WM-8, Concrete Waste Management).

- Typical permitted non-stormwater discharges can include: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; flows from riparian habitats and wetlands; and discharges or flows from emergency fire fighting activities.

Implementation

General Practices

- Instruct employees and subcontractors how to safely differentiate between non-hazardous liquid waste and potential or known hazardous liquid waste.
- Instruct employees, subcontractors, and suppliers that it is unacceptable for any liquid waste to enter any storm drainage device, waterway, or receiving water.
- Educate employees and subcontractors on liquid waste generating activities and liquid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Verify which non-stormwater discharges are permitted by the statewide NPDES permit; different regions might have different requirements not outlined in this permit.
- Apply NS-8, Vehicle and Equipment Cleaning for managing wash water and rinse water from vehicle and equipment cleaning operations.

Containing Liquid Wastes

- Drilling residue and drilling fluids should not be allowed to enter storm drains and watercourses and should be disposed of.
- If an appropriate location is available, drilling residue and drilling fluids that are exempt under Title 23, CCR § 2511(g) may be dried by infiltration and evaporation in a containment facility constructed in conformance with the provisions concerning the Temporary Concrete Washout Facilities detailed in WM-8, Concrete Waste Management.
- Liquid wastes generated as part of an operational procedure, such as water-laden dredged material and drilling mud, should be contained and not allowed to flow into drainage channels or receiving waters prior to treatment.
- Liquid wastes should be contained in a controlled area such as a holding pit, sediment basin, roll-off bin, or portable tank.
- Containment devices must be structurally sound and leak free.
- Containment devices must be of sufficient quantity or volume to completely contain the liquid wastes generated.

- Precautions should be taken to avoid spills or accidental releases of contained liquid wastes. Apply the education measures and spill response procedures outlined in WM-4, Spill Prevention and Control.

- Containment areas or devices should not be located where accidental release of the contained liquid can threaten health or safety or discharge to water bodies, channels, or storm drains.

Capturing Liquid Wastes

- Capture all liquid wastes that have the potential to affect the storm drainage system (such as wash water and rinse water from cleaning walls or pavement), before they run off a surface.

- Do not allow liquid wastes to flow or discharge uncontrolled. Use temporary dikes or berms to intercept flows and direct them to a containment area or device for capture.

- Use a sediment trap (SE-3, Sediment Trap) for capturing and treating sediment laden liquid waste or capture in a containment device and allow sediment to settle.

Disposing of Liquid Wastes

- A typical method to handle liquid waste is to dewater the contained liquid waste, using procedures such as described in NS-2, Dewatering Operations, and SE-2, Sediment Basin, and dispose of resulting solids per WM-5, Solid Waste Management.

- Methods of disposal for some liquid wastes may be prescribed in Water Quality Reports, NPDES permits, Environmental Impact Reports, 401 or 404 permits, and local agency discharge permits, etc. Review the SWPPP to see if disposal methods are identified.

- Liquid wastes, such as from dredged material, may require testing and certification whether it is hazardous or not before a disposal method can be determined.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management.

- If necessary, further treat liquid wastes prior to disposal. Treatment may include, though is not limited to, sedimentation, filtration, and chemical neutralization.

Costs

Prevention costs for liquid waste management are minimal. Costs increase if cleanup or fines are involved.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

- Remove deposited solids in containment areas and capturing devices as needed and at the completion of the task. Dispose of any solids as described in WM-5, Solid Waste Management.
- Inspect containment areas and capturing devices and repair as needed.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Appendix D - Drainage Study

PRELIMINARY
DRAINAGE STUDY

For the proposed
NCPA – Lodi Energy Center
Lodi, CA

Project No. 6300-03-08
June 2008
Revised October 2008

Prepared for:
WorleyParsons
2330 East Bidwell
Folsom, CA 95630

CARLTON
Engineering Inc.

I. PROJECT INTRODUCTION

The project site is located on 12751 North Thornton Road, west of Highway 5 in Lodi, CA (see Appendix for Vicinity Map). The property has no frontage along North Thornton Road. A private dirt road extending from North Thornton Road provides access to the site (under Highway 5). The project site is bounded by the existing White Slough Water Pollution Control Plan to the north, south and east, and the existing Phase I development of NCPA Lodi Energy Center facility to the west.

The proposed development is located at the southern portion of the parcel, APN 055-130-16 in San Joaquin County. Of the 162-acre parcel, only approximately five acres will be affected by the proposed project improvements.

The existing buildings and majority of the equipment for the Phase I development are to remain. A portion of the existing equipment and underground utilities serving the existing facility will be relocated. New building and equipment will be constructed on the site. The improvements will include a variety of above ground equipment, cooling towers, associated roadway for access, underground utilities and at least one building that will be used for water treatment.

II. OBJECTIVE

This report outlines the existing and proposed hydraulic and hydrologic conditions associated with the proposed improvements. The information and calculations presented in this report follow the requirements of the City of Lodi through use of the rational method outlined in the "City of Lodi Design Standards – City of Lodi Department of Public Works," May 1991. Pre-development and Post-development drainage peak flows are to be determined and compared to establish whether onsite drainage detention is necessary according to the City's requirements.

III. HYDROLOGY

The hydrologic analysis was performed and analyzed with rational method as set forth in the Section 3 of the City of Lodi Design Standards. The runoff coefficient, C, for the pavement and open area are based on the recommendation from the City's Design Standards. A runoff coefficient for the crushed stone gravel is assumed to be 0.70. Rainfall intensity, "I," which is associated with the time of concentration, "T_c", was obtained from the City of Lodi Standard Plan 606 (see Appendix).

Runoff from the project site is primarily drained via a proposed underground storm drain system. Components of the drainage system include drain inlets, storm drain pipes, oversize storm drain pipe for detention and concrete storm drain manhole with weir and orifice used as a flow control structure. The

proposed storm system is designed to connect to the existing culvert at the southwest corner of the project site (point of interest – see Shed Map DS-1 and DS-2 in Appendix). The design of each component takes into account the worst-case scenario, including pipe slope and runoff velocity.

A. PRE-CONSTRUCTION (EXISTING) CONDITIONS

The project site is currently a mainly open dirt area covered with moderate amount of seasonal grass and weed. The pre-construction high point of the site is located along the northern project boundary with an elevation of approximately 12.0 feet along the existing dirt road. The site then gradually flows towards the south into a depressed area with an approximate elevation of 5.0 feet. The depressed area is bisected by an existing paved access road for the existing facility. An existing culvert allows the runoff from the northern depressed area flow to the southern depressed area into a natural drainage swale along the southern project boundary (at approximate elevation of 3.5 feet to 4.0 feet). The low point of the site is located at an approximate elevation of 3.5 feet at the existing culvert at the southwest corner of the project site. Storm water runoff is assumed to exit the site via the existing culvert at the southwest corner of the project site (Point of Interest, as indicated on DS1).

The existing watershed area is depicted on "Pre-Development Drainage Shed Map - DS1" in Appendix. A composite runoff coefficient was computed with the assumption of a runoff coefficient of 0.7 for the crushed stone gravel area, 0.95 for asphaltic concrete pavement/concrete pad area and 0.20 for open area per recommendation from the City of Lodi Design Standards. The total peak runoff generated by the pre-development shed area is determined to be 1.41cfs, and the calculation is demonstrated on Shed Map - DS-1.

B. POST-CONSTRUCTION CONDITIONS

Proposed improvements to the site during construction includes removal of a portion of the existing asphaltic concrete pavement area and replace it with new asphalt pavement or crushed stone gravel, relocation of various equipment and underground utilities, construction of a new underground storm drain system and construction of concrete foundations for the new plant equipment.

The post-construction high point of the site is planned to be along the northern project boundary at an elevation of approximately 8.75 feet. The average site elevation after construction of the new facility is completed will be approximately 8.0 feet. In general, storm drain runoff is designed to drain from north to south.

Two series of drain inlets and pipes are planned on both sides of the main equipment foundation. The rainwater runoff will flow to the proposed drain inlets along the top of the compacted sub-base under the crush stone gravel. The grate of the drain inlets are set at 6" below the gravel finished pavement elevation to collect the runoff from the foundation sub-base. The proposed drive aisle along the west side of the main equipment foundation is designed to drain towards west into the existing drainage system. The edge of pavement between the asphaltic concrete pavement and the crushed stone gravel acts as a grade break. It is designed to be consistent with the existing drainage pattern.

The area surrounding the water treatment building is proposed to be paved with asphaltic concrete pavement and designed to drain north into the existing storm drain system to match the existing condition. The existing underground storm drain system will be slightly modified to accommodate the proposed new construction.

A crushed stone gravel section surrounding the cooling towers pad is also proposed. Drain inlet grates are set at 6" below the gravel section finished grade elevation to drain runoff at the sub-base level. Two sand-oil interceptors are designed to connect to the proposed storm drain systems to provide water quality measure. These interceptors are located on both ends of the cooling tower.

An oversize underground storm drain pipe and a concrete manhole with weir and orifice are also proposed along the south face of the cooling tower as a storm drain detention system. The post-construction storm drain runoff is designed to exit the project site via the existing culvert at the (Point of Interest, see Shed Map DS-1 and DS-2 in Appendix) to match with the existing drainage pattern.

Proposed watershed area is depicted on "Post-Development Drainage Shed Map – DS2" in Appendix. A composite runoff coefficient is computed with the same criteria as stated in the "Pre-construction (Existing) Conditions" section above. The total peak runoff generated by the post-construction shed area is determined to be 4.14cfs, and the calculation is demonstrated on DS-2.

IV. HYDRAULICS

A. DESIGN STORM FREQUENCY

Per the City of Lodi Design Standards, the drainage system will be designed to convey a 2-year storm with the water surface elevation contained within all pipes.

B. DESIGN STORM DURATION

The goal in storm drain design is to convey the maximum peak flow for a given design storm. In this case, the time of concentration is assumed to be 10 minutes for both pre- and post-construction conditions per the City of Lodi Design Standards minimum allowed time of concentration.

C. MINOR LOSSES

A Manning's "n" value of 0.013 is used for the proposed pipes per City of Lodi Design Standard. The minor losses for the transitions, junctions, bends, entrances and exits have not been considered as no new drainage pipes are being proposed.

V. SUMMARY

The total Pre- and Post-construction storm water runoff capacity exiting the site has been calculated and is summarized in Table 1. Locations of storm drain pipe ands inlet structures are shown on the conceptual grading and drainage plans attached in the Appendix.

Table 1: Summary of Peak Flows

	2-Year Storm Runoff (cfs)	10-Year Storm Runoff (cfs)
Pre-Construction	**1.61**	**2.84**
Post-Construction	**4.14**	**7.31**

As stated in Table 1 above, the proposed improvement will increase storm drain runoff due to the conversion of the existing pervious open area to the impervious cover. In order to ensure the downstream drainage system is not impacted by the proposed improvement, an onsite underground storm drain detention system is introduced. Such a detention system consists of an oversize storm drain pipe to provide storage capacity and a flow control manhole with emergency weir and orifice limit the runoff to pre-development level prior to exiting the site. A preliminary estimate of the required detention volume is determined to be 1240 cubic feet (equivalent to 253 linear feet of 30" storm drain pipe) according to the method provided by Erosion & Sediment Control Guidelines for Developing Areas of the Sierras prepared by the High Sierra RC&D Council (see Appendix). The detail designs and calculation for detention storage volume and the flow control device will be performed during construction document phase.

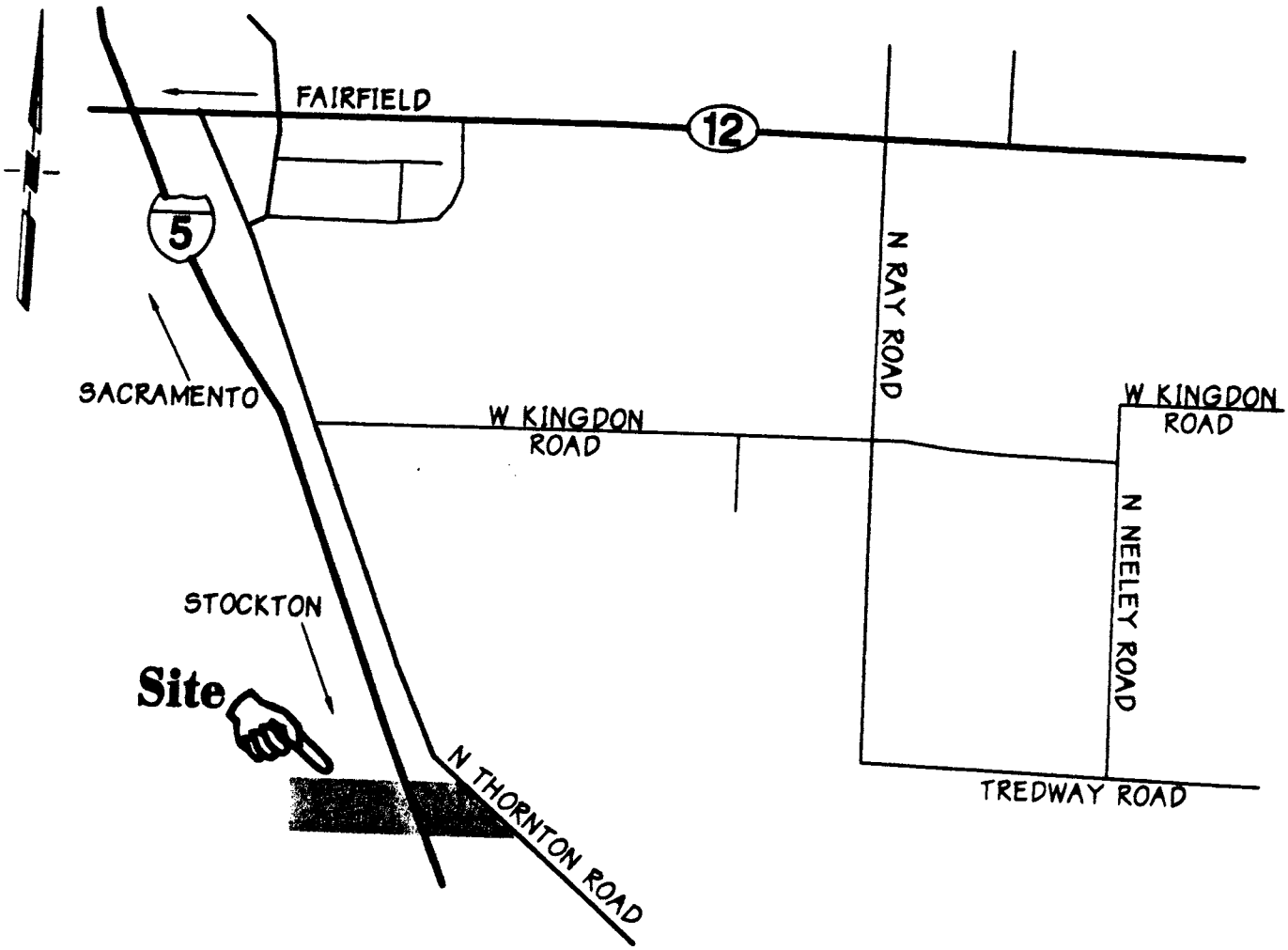
Since the post-development runoff is designed to stay at the pre-construction level prior to exiting the site, the downstream system should be of adequate capacity to handle the post-construction site runoff.

VI. APPENDIX

A. Vicinity Map
B. City of Lodi Standard Plan 606
C. Volume Design Calculation
D. Drainage Shed Map Exhibits DS1 and DS2
E. Erosion & Sediment Control Guidelines for Developing Areas of the Sierra by High Sierra RC&D Council, dated November 1981.

Vicinity Map

NTS



CITY OF LODI

PUBLIC WORKS DEPARTMENT

Rainfall Intensity

Tc = Time of Concentration in minutes (See Design Stds §3.200)
I = Rainfall Intensity in inches per hour, 2±yr storm
I = 5.51*(Tc)^(-0.63)

10YR I = 9.71*(Tc)^(-0.63)

Tc	I	Tc	I	Tc	I	Tc	I
10	1.29	40	0.54	90	0.32	240	0.17
11	1.22	41	0.53	95	0.31	245	0.17
12	1.15	42	0.52	100	0.30	250	0.17
13	1.09	43	0.52	105	0.29	255	0.17
14	1.04	44	0.51	110	0.29	260	0.17
15	1.00	45	0.50	115	0.28	265	0.16
16	0.96	46	0.49	120	0.27	270	0.16
17	0.92	47	0.49	125	0.26	275	0.16
18	0.89	48	0.48	130	0.26	280	0.16
19	0.86	49	0.47	135	0.25	285	0.16
20	0.83	50	0.47	140	0.24	290	0.15
21	0.81	51	0.46	145	0.24	295	0.15
22	0.79	52	0.46	150	0.23	300	0.15
23	0.76	53	0.45	155	0.23	305	0.15
24	0.74	54	0.45	160	0.23	310	0.15
25	0.73	55	0.44	165	0.22	315	0.15
26	0.71	56	0.44	170	0.22	320	0.15
27	0.69	57	0.43	175	0.21	325	0.14
28	0.68	58	0.43	180	0.21	330	0.14
29	0.66	59	0.42	185	0.21	335	0.14
30	0.65	60	0.42	190	0.20	340	0.14
31	0.63	61	0.41	195	0.20	345	0.14
32	0.62	62	0.41	200	0.20	350	0.14
33	0.61	63	0.41	205	0.19	355	0.14
34	0.60	64	0.40	210	0.19	360	0.14
35	0.59	65	0.40	215	0.19	365	0.13
36	0.58	70	0.38	220	0.18	370	0.13
37	0.57	75	0.36	225	0.18	375	0.13
38	0.56	80	0.35	230	0.18	380	0.13
39	0.55	85	0.34	235	0.18	385	0.13

Dr. KT	No.	Date	Revision	Appr.	Approved By:	STD PLAN
Ch. WS					F. Wally Sandelin 12/28/00	606
Date 12/00					City Engineer R.C.E. 39895 Date	

Mike Hauge

From: Chris Boyer [cboyer@lodi.gov] FROM CITY OF LODI
Sent: Wednesday, August 27, 2008 8:58 AM
To: Ernest Chan
Subject: FW: Rainfall Intensity Formula
Attachments: return Period Intensity.xls

This should help. Let me know if you need anything else.

Chris Boyer

From: Lyman M Chang
Sent: Wednesday, August 27, 2008 8:55 AM
To: Chris Boyer
Cc: Sharon Welch
Subject: Rainfall Intensity Formula

The I values shown on Standard Plan 606 for different storms are as follow:

5-year storm: I = 8.13 *(Tc)^(-0.63)
10-year storm: I = 9.71 *(Tc)^(-0.63) ←

Design Storm Volume – Per Erosion & Sediment control Guidelines for Developing Areas of the Sierras by High Sierra RC&D Council, November 1981

T_c = Time of Concentration (in hour)
T_p = Time of Peak = $0.6T_c$
T_b = Time Base = $2.67T_p$
V_d = 1800 (Q_d x T_b) = Design Storm Volume (ft^3)

Pre-Construction

Shed A (See Pre-Development Shed Map DS-1 in Appendix)

$\mathbf{V_{d\ (2\text{-}Yr)}}$ = 1800 x 1.61 cfs x $2.67T_p$ = 1800 x 1.61 cfs x 2.67 x $0.6T_c$
= 1800 x 1.61 cfs x 2.67 x 0.6 x 0.17 hr = **789 ft^3**
$\mathbf{V_{d\ (10\text{-}Yr)}}$ = 1800 x 2.84 cfs x $2.67T_p$ = 1800 x 2.84cfs x 2.67 x $0.6T_c$
= 1800 x 2.84 cfs x 2.67 x 0.6 x 0.17 hr = **1392 ft^3**

Post-Construction

Shed A (See Post-Development Shed Map DS-2 in Appendix)

$\mathbf{V_{d(2\text{-}Yr)}}$ = 1800 x 4.14 cfs x $2.67T_p$ = 1800 x 4.14 cfs x 2.67 x $0.6T_c$
= 1800 x 4.14 cfs x 2.67 x 0.6 x 0.17 hr = **2029 ft^3**
$\mathbf{V_{d(10\text{-}Yr)}}$ = 1800 x 7.31 cfs x $2.67T_p$ = 1800 x 7.31 cfs x 2.67 x $0.6T_c$
= 1800 x 7.31 cfs x 2.67 x 0.6 x 0.17 hr = **3583 ft^3**

2-Yr Volume of Detention:

Southwest Outlet (Point of Interest) = (Post Development Design Volume – Pre Development Design Volume) = 2029 ft^3 – 789 ft^3 = **1240 ft^3**, equivalent to **253LF 30" SD pipe**.

Erosion & Sediment Control Guidelines for Developing Areas of the Sierras

Prepared by the High Sierra RC&D Council

November 1981

APPENDICES

Appendix A - Rational Method for Peak Storm Runoff and Storn Runoff Volume
Figure 1 - Isohyetal Map
Figure 2 - Time of Concentration
Table 1 - Estimating "C"

Appendix B - Engineering Field Manual
Chapter 2 - Estimated Runoff
Supplement 1 - Estimated Runoff in California

A. Calculations for Peak Storm Runoff and Storm Runoff Volume

For sizing the components of various erosion control practices it is necessary to determine the peak runoff flow and the storm runoff volume. The Rational Method is used for calculating the peak storm runoff rate. An estimate of the runoff volume from the peak storm is made using the Triangular Hydrograph Method.

The rational method and the triangular hydrograph method are widely used and provide acceptable design flows for a large variety of applications.

The use of these methods should be limited to small watershed areas. It is anticipated that these methods will be used for watersheds less than one square mile in area. For areas greater than one square mile use SCS methods given in Appendix B.

Storm Runoff Rate by Rational Method

The basic equation in the rational formula is:

$Q = C\ I\ A$

Where
- Q = Peak Discharge, cubic feet per second
- C = Coefficient of runoff
- I = Average rainfall intensity, inches per hour for a given frequency and for a duration equal to the time of concentration (T_c)
- A = Drainage Area, acres

Peak Storm Runoff-The following procedure is used to calculate the peak storm runoff rate.

1. Using Figure 1 locate the project site with a section township and range description. Find the mean annual precipitation from the closest isohyetal contour.

2. Calculate the time of concentration (T_c)

   Using the following equation:(1)

   $$Tc = \left(\frac{11.9\ L}{H}\right)^{0.385}$$

   Where
   - Tc = time of concentration in hours
   - L = length of longest watercourse through watershed, in miles
   - H = elevation difference along longest watercourse, in feet

3. Enter Figure 2(2) at T_c calculated above, go vertically to desired storm frequency curve (10 yr., 25 yr., 100 yr.), then go horizontally to the mean annual precipitation determined in 1 above, read the intensity (I).

(1) "California Culvert Practice," California Highways and Public Works.
(2) "Loomis Basin Hydraulic Investigation Study."

4. Determine the area (A) of the watershed.

5. From Table 1, estimate the value of the coefficient of runoff (C). An example for determining "C" for improved and unimproved areas is given.

6. With "C", "I" and "A" calculate the peak storm runoff rate, (Q_p) in cubic feet per second (cfs).

$$Q = C\ I\ A$$

Design Storm Volume - The following procedure is used to calculate the design storm volume.

1. Determine mean annual precipitation, see step 1 for peak storm runoff.

2. Using design storm duration (D), enter Figure 2, go vertically to desired storm frequency curve (10-yr, 25-yr, 100-yr), then go horizontally to the mean annual precipitation determined in above 1, read the intensity (I).

3. Determine the area (A) of the watershed.

4. From Table 1 estimate the value of the coefficient of runoff (C).

5. With "C", "I", and "A" claculate the design storm peak flow rate (Q_D) in cubic feet per second.

$$Q = C\ I\ A$$

6. Calculate the time in hours from start of hydrograph rise to peak rate (T_p)

$$T_p = 0.5\ D = 0.6\ T_c \quad (3)$$

"D" and "T_c" have been determined above.

7. Calculate time base of hydrograph (T_b).

$$T_b = 2.67\ T_p \quad (3)$$

8. Determine design storm volume (V_D) in cubic feet

$$V_D = 1800\ (Q_D \times T_b)$$

Figure 3 gives a graphical representation of the relationship between T_p, T_b, Q_D and V_D. The area enclosed by the triangle represents the design storm volume.

(3) "Design of Small Dams", US. Bureau of Reclamation.

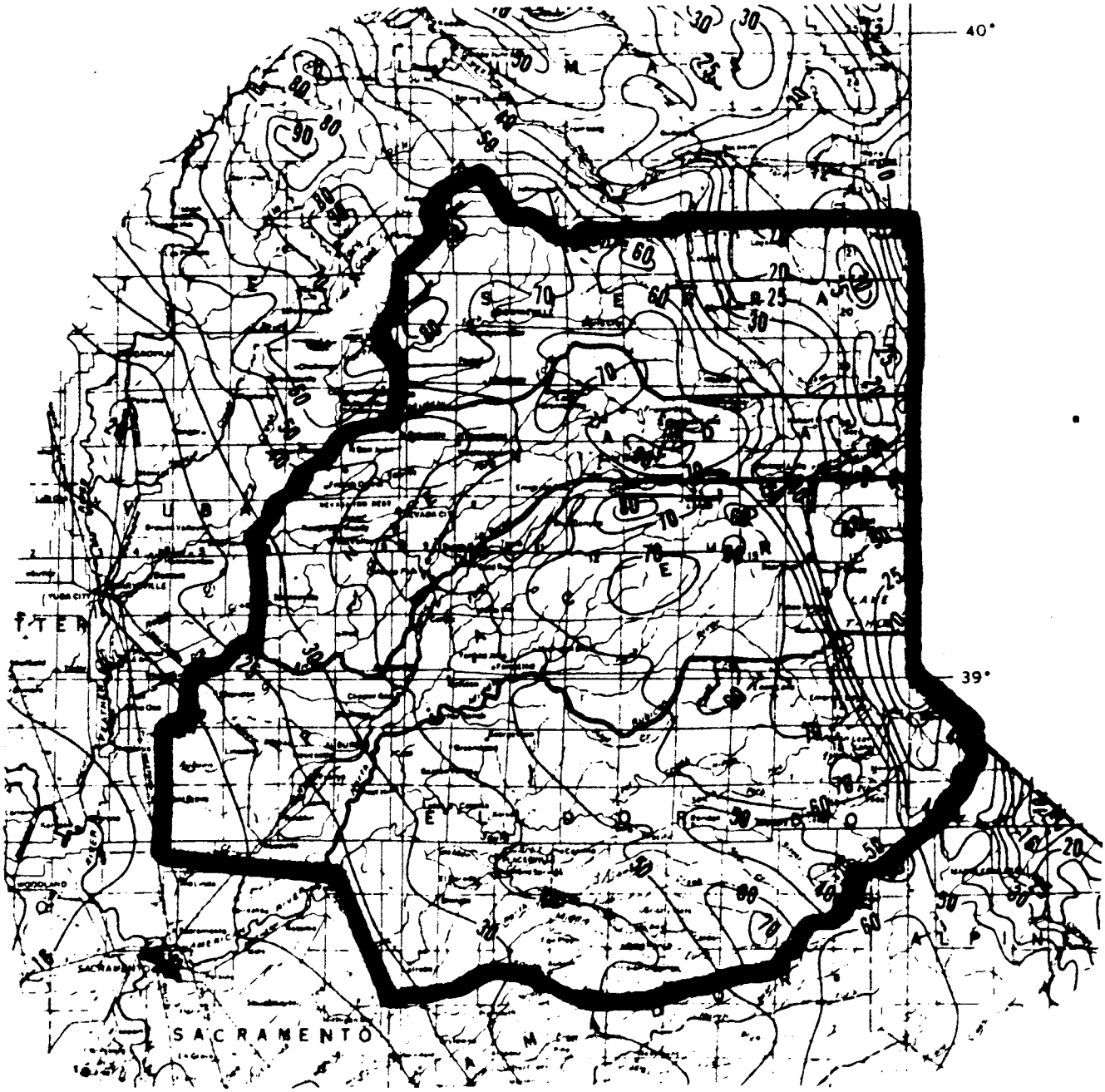


FIGURE 1 - ISOHYETAL MAP OF FOUR-COUNTY AREA

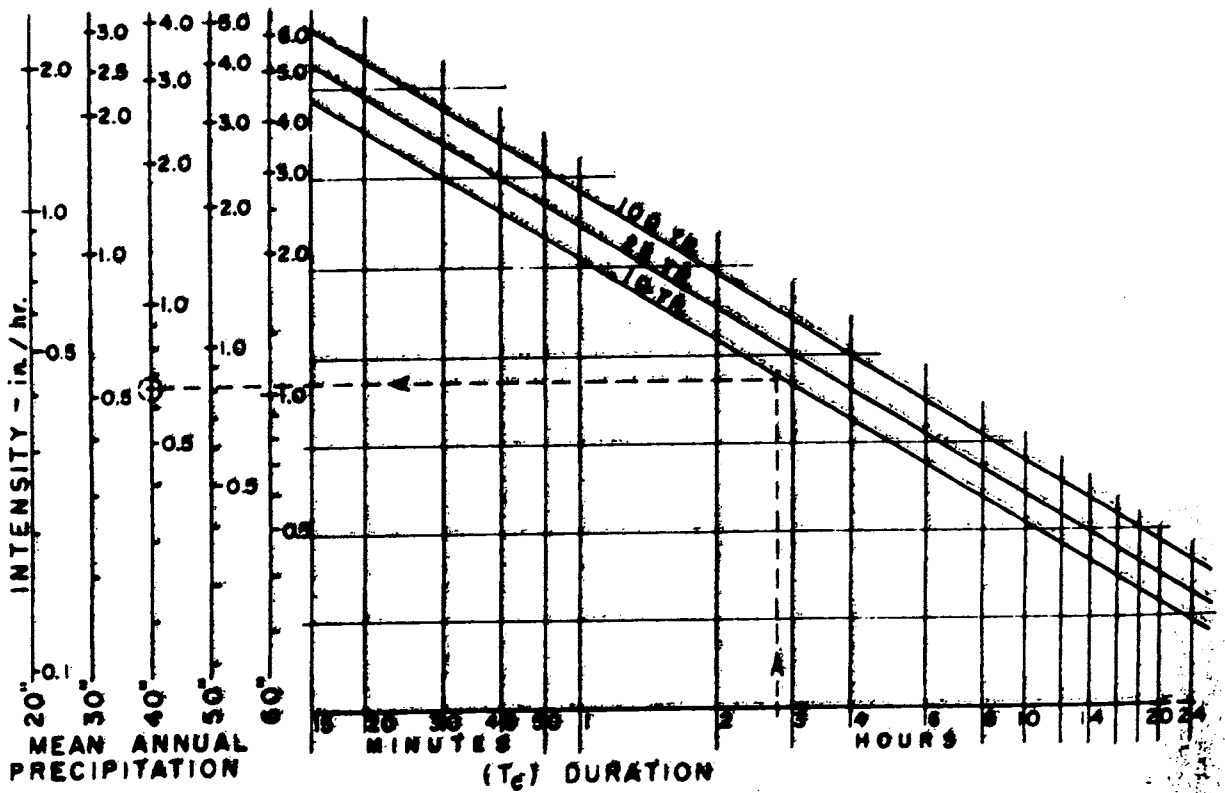


FIGURE 2 - TIME OF CONCENTRATION (Tc) VS. RAINFALL INTENSITY (I)

TABLE 1

ESTIMATING "C" IN RATIONAL FORMULA

UNIMPROVED AREAS

CONDITION	EXTREME	HIGH	MODERATE	LOW
Slope	.32 Above 30%	.24 10% = 30%	.17 5 - 10%	.11 0 - 5%
Surface permeability.	.14 Bare rock or very thin soil.	.10 Impervious clays, shallow soils.	.07 Well drained soils.	.05 Deep sand, volcanic ash.
Vegetation	.14 None or very sparse.	.10 Less than 20% covered with substantial growth.	.07 About 50% covered with heavy growth.	.05 90% covered with heavy growth, deep humus layer.
Surface	.11 Smooth soil, slick rock, drainage flow continuous.	.09 Roughened soil or rocks.	.07 Drainage flow interrupted, many ponds, lakes, marshes.	.05 Drainage flow arrested, large lakes, ponds, marshes

IMPROVED AREAS

Surface	C
Roof Surfaces	.90
Asphalt or Concrete Pavement, patios, driveways, streets, sidewalks	.85
Landscaped areas	.25
Gravel walks, roadways	.30

TABLE 1 (continued)

EXAMPLE 1: Unimproved

20% Slope	.24
Well drained soil	.07
Fair cover	.07
No ponds	.07

C = .45

EXAMPLE 2: Improved

20 acre tract

3 arces roof	@	.90
10 acres A. C. Pave.	@	.85
7 acres landscaped	@	.25

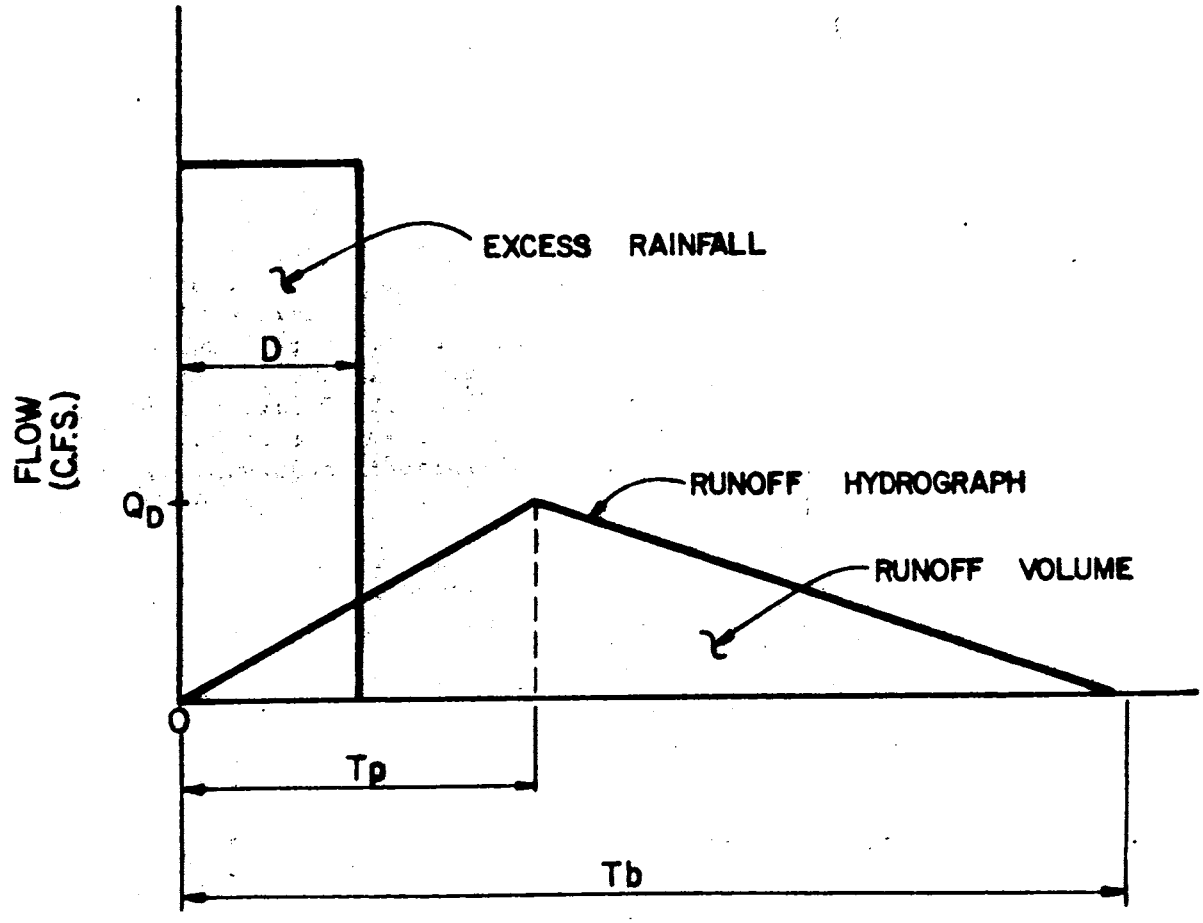
$$C=\frac{3 \times .90 + 10 \times .85 + 7 \times .25}{20} = 0.65$$

EXAMPLE 3: Combination

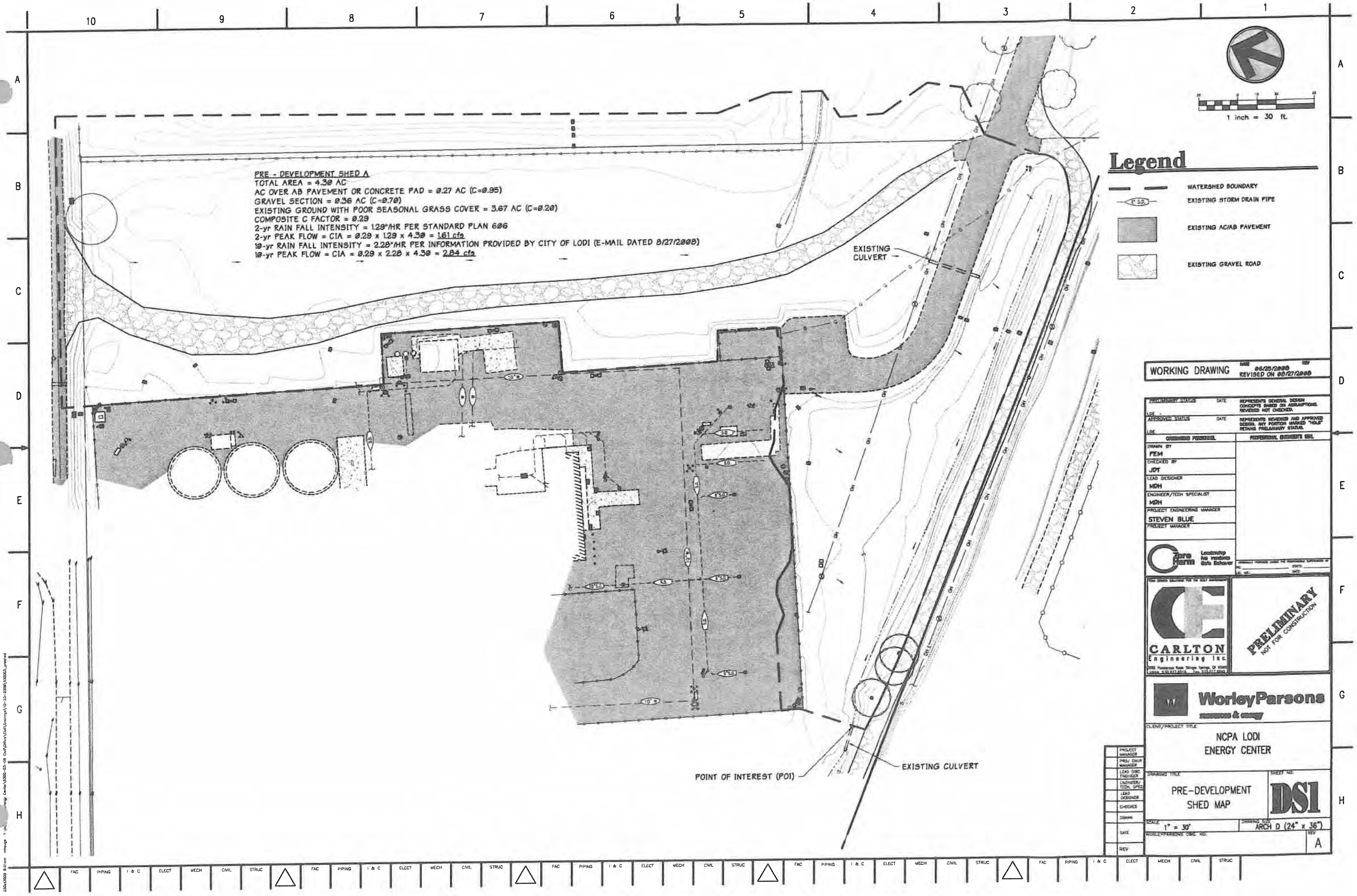
20 acre tract

5 acres improved	@ 0.65
15 acres unimproved	@ 0.45

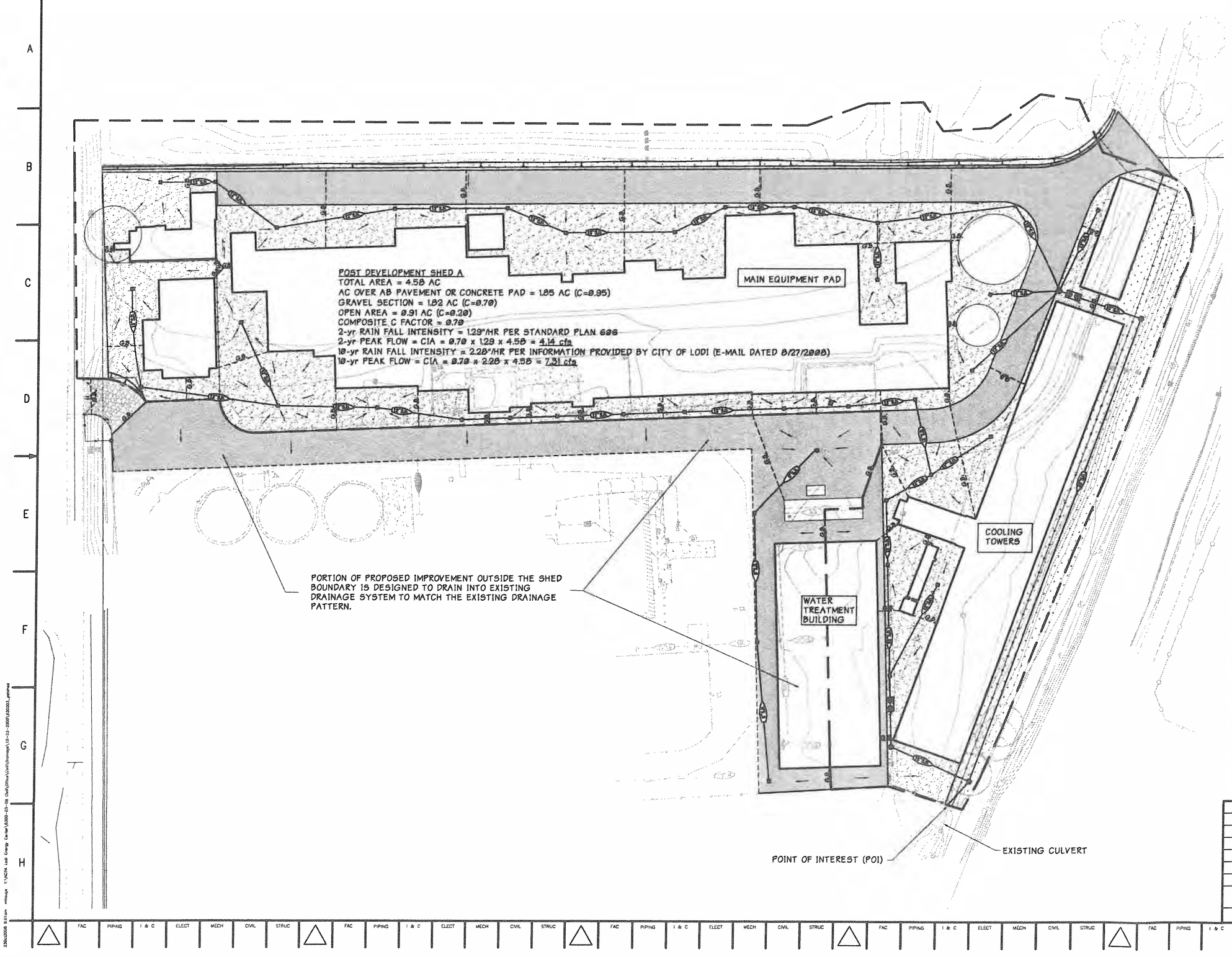
$$C=\frac{5 \times 0.65 + 15 \times 0.45}{20} = 0.50$$



EXAMPLE OF THE
TRIANGULAR HYDROGRAPH



PRE - DEVELOPMENT SHED A
TOTAL AREA = 4.30 AC
AC OVER AB PAVEMENT OR CONCRETE PAD = 0.27 AC (C=0.95)
GRAVEL SECTION = 0.36 AC (C=0.70)
EXISTING GROUND WITH POOR SEASONAL GRASS COVER = 3.67 AC (C=0.20)
COMPOSITE C FACTOR = 0.29
2-yr RAIN FALL INTENSITY = 1.29"/HR PER STANDARD PLAN 606
2-yr PEAK FLOW = CIA = 0.29 x 1.29 x 4.30 = 1.61 cfs
10-yr RAIN FALL INTENSITY = 2.28"/HR PER INFORMATION PROVIDED BY CITY OF LODI (E-MAIL DATED 8/27/2008)
10-yr PEAK FLOW = CIA = 0.29 x 2.28 x 4.30 = 2.84 cfs
EXISTING CULVERT
POINT OF INTEREST (POI)
EXISTING CULVERT
1 inch = 30 ft.
Legend
WATERSHED BOUNDARY
EXISTING STORM DRAIN PIPE
EXISTING AC/AB PAVEMENT
EXISTING GRAVEL ROAD
WORKING DRAWING
06/25/2008
REVISED ON 08/27/2008
PRELIMINARY STATUS
APPROVED STATUS
DRAWN BY
FEM
CHECKED BY
JDT
LEAD DESIGNER
MDH
ENGINEER/TECH SPECIALIST
MDH
PROJECT ENGINEERING MANAGER
STEVEN BLUE
PROJECT MANAGER
CARLTON Engineering Inc.
PRELIMINARY
NOT FOR CONSTRUCTION
WorleyParsons
CLIENT/PROJECT TITLE
NCPA LODI
ENERGY CENTER
DRAWING TITLE
PRE-DEVELOPMENT
SHED MAP
SHEET NO.
DS1
SCALE
1" = 30'
DRAWING SIZE
ARCH D (24" x 36")
REV
A



1 inch = 30 ft.

Legend

- WATERSHED BOUNDARY
- X" S.D. — PROPOSED STORM DRAIN PIPE
- PROPOSED AC/AB PAVEMENT
- PROPOSED 6" AGGREGATE PAVEMENT

WORKING DRAWING — DATE 08/25/2008 — REV — REVISED ON 08/27/2008

PRELIMINARY STATUS LDE -	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS LDE	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. any PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: PEM	
CHECKED BY: JDT	
LEAD DESIGNER: MDH	
ENGINEER/TECH SPECIALIST: MDH	
PROJECT ENGINEERING MANAGER: STEVEN BLUE	
PROJECT MANAGER	

Zero Harm — Leadership, No Incidents, Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: STATE:
LIC. NO.: DATE:

TEAM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

CARLTON Engineering Inc.
10183 Ponderosa Road, Shingle Springs, CA 95682
Voice 530.677.5515 Fax 530.677.5645

PRELIMINARY NOT FOR CONSTRUCTION

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
NCPA LODI
ENERGY CENTER

DRAWING TITLE
CONCEPTUAL
POST-DEVELOPMENT
DRAINAGE SHED MAP

SHEET NO: DS2

SCALE: 1" = 600'
DRAWING SIZE: ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.
REV: A

PROJECT MANAGER	
PROJ. ENGR MANAGER	
LEAD DISC ENGINEER	
ENGINEER/ TECH. SPEC	
LEAD DESIGNER	
CHECKED	
DRAWN	
DATE	
REV	

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

230x280DS 8.01cm mhauge Y:\NCPA Lodi Energy Center\65000-03-08 Civil\Office\LDC4\Drawings\10-23-2008\650003_planshd

Computation Sheet for Determining Runoff Coefficients

Total Limits of Work Site Area = 4.60 Acres (A)

Existing Site Conditions

Impervious Site Area [1] = 0.27 Acres (B)

Impervious Site Area Runoff Coefficient [2, 4] = 0.95 (C)

Pervious Site Area [3] = 4.03 Acres (D)

Pervious Site Area Runoff Coefficient [4] = 0.24 (E)

Existing Site Area Runoff Coefficient $\frac{(B \times C)+(D \times E)}{(A)}$ = 0.28 (F)

Proposed Site Conditions (after construction)

Impervious Site Area [1] = 1.85 Acres (G)

Impervious Site Area Runoff Coefficient [2, 4] = 0.95 (H)

Pervious Site Area [3] = 2.73 Acres (I)

Pervious Site Area Runoff Coefficient [4] = 0.53 (J)

Proposed Site Area Runoff Coefficient $\frac{(G \times H)+(I \times J)}{(A)}$ = 0.70 (K)

1. Includes paved areas, areas covered by buildings, and other impervious surfaces.
2. Use 0.95 unless lower or higher runoff coefficient can be verified.
3. Includes areas of vegetation, most unpaved or uncovered soil surfaces, and other pervious areas.
4. Refer to local Hydrology Manual for typical C values.

Computational Sheet for Determining Run-on Discharges

Existing Site Conditions

Area Runoff Coefficient		=	N/A	(A)
Area Rainfall Intensity		=	N/A in/hr	(B)
Drainage Area		=	N/A Acres	(C)
Site Area Run-on Discharge	(A) x (B) x (C)	=	N/A ft^3/sec	(D)

ATTACHMENT DA 5.15-2

Notice of Intent (Construction)

Linda S Adams
Secretary for
Environmental Protection

State Water Resources Control Board

Division of Water Quality
1001 I Street • Sacramento, California 95814 • (916) 341-5537
Mailing Address: P.O. Box 1977 • Sacramento, California • 95812-1977
FAX (916) 341-5543 • Internet Address: http://www.waterboards.ca.gov/stormwtr/index.html

Arnold Schwarzenegger
Governor

CHECKLIST FOR SUBMITTING A NOTICE OF INTENT

In order for the State Water Resources Control Board to expeditiously process your Notice of Intent (NOI), the following items must be submitted to either of the addresses indicated below:

1. ✓ NOI (please keep a copy for your files) with all applicable sections completed and original signature of the landowner or signatory agent;

2. ✓ Check made out to the "State Water Resources Control Board"
Fee is ($200 + $20/acre) plus 18.5% surcharge. See reverse for listing of fees by acre. The fee is based on the "Total Acres to be Disturbed" for the life of the project.

3. ✓ Site Map of the facility (see NOI instructions). DO NOT SEND BLUEPRINTS

U.S. Postal Service Address

State Water Resources Control Board
Division of Water Quality
Attn: Storm Water Section
P.O. Box 1977
Sacramento, CA 95812-1977

Overnight Mailing Address

State Water Resources Control Board
Division Of Water Quality
Attn: Storm Water, 15th Floor
1001 I Street
Sacramento, CA 95814

NOIs are processed in the order they are received. A NOI receipt letter will be mailed to the land owner within approximately two weeks. Incomplete NOI submittals will be returned to the landowner's address within the same timeframe and will specify the reason(s) for return. If you need a receipt letter by a specific date (for example, to provide to a local agency), we advise that you submit your NOI thirty (30) days prior to the date the receipt letter is needed.

Please do not call us to verify your NOI status. A copy of your NOI receipt letter will be available on our web page within twenty-four (24) hours of processing. Go to: http://www.waterboards.ca.gov/stormwtr/databases.html to retrieve an electronic copy of your NOI receipt letter. If you have any questions regarding this matter, please contact us at (916) 341-5537.

Acres	Fee	18.5% Surcharge	Total Fee
0	$200.00	$37	$237
1	$220.00	$41	$261
2	$240.00	$44	$284
3	$260.00	$48	$308
4	$280.00	$52	$332
5	$300.00	$56	$356
6	$320.00	$59	$379
7	$340.00	$63	$403
8	$360.00	$67	$427
9	$380.00	$70	$450
10	$400.00	$74	$474
11	$420.00	$78	$498
12	$440.00	$81	$521
13	$460.00	$85	$545
14	$480.00	$89	$569
15	$500.00	$93	$593
16	$520.00	$96	$616
17	$540.00	$100	$640
18	$560.00	$104	$664
19	$580.00	$107	$687
20	$600.00	$111	$711
21	$620.00	$115	$735
22	$640.00	$118	$758
23	$660.00	$122	$782
24	$680.00	$126	$806
25	$700.00	$130	$830
26	$720.00	$133	$853
27	$740.00	$137	$877
28	$760.00	$141	$901
29	$780.00	$144	$924
30	$800.00	$148	$948
31	$820.00	$152	$972
32	$840.00	$155	$995
33	$860.00	$159	$1,019
34	$880.00	$163	$1,043
35	$900.00	$167	$1,067
36	$920.00	$170	$1,090
37	$940.00	$174	$1,114
38	$960.00	$178	$1,138
39	$980.00	$181	$1,161
40	$1,000.00	$185	$1,185
41	$1,020.00	$189	$1,209
42	$1,040.00	$192	$1,232
43	$1,060.00	$196	$1,256
44	$1,080.00	$200	$1,280
45	$1,100.00	$204	$1,304
46	$1,120.00	$207	$1,327
47	$1,140.00	$211	$1,351
48	$1,160.00	$215	$1,375
49	$1,180.00	$218	$1,398
50	$1,200.00	$222	$1,422
51	$1,220.00	$226	$1,446
52	$1,240.00	$229	$1,469
53	$1,260.00	$233	$1,493
54	$1,280.00	$237	$1,517
55	$1,300.00	$241	$1,541
56	$1,320.00	$244	$1,564
57	$1,340.00	$248	$1,588
58	$1,360.00	$252	$1,612
59	$1,380.00	$255	$1,635
60	$1,400.00	$259	$1,659
61	$1,420.00	$263	$1,683
62	$1,440.00	$266	$1,706
63	$1,460.00	$270	$1,730
64	$1,480.00	$274	$1,754
65	$1,500.00	$278	$1,778
66	$1,520.00	$281	$1,801
67	$1,540.00	$285	$1,825
68	$1,560.00	$289	$1,849
69	$1,580.00	$292	$1,872
70	$1,600.00	$296	$1,896
71	$1,620.00	$300	$1,920
72	$1,640.00	$303	$1,943
73	$1,660.00	$307	$1,967
74	$1,680.00	$311	$1,991
75	$1,700.00	$315	$2,015
76	$1,720.00	$318	$2,038
77	$1,740.00	$322	$2,062
78	$1,760.00	$326	$2,086
79	$1,780.00	$329	$2,109
80	$1,800.00	$333	$2,133
81	$1,820.00	$337	$2,157
82	$1,840.00	$340	$2,180
83	$1,860.00	$344	$2,204
84	$1,880.00	$348	$2,228
85	$1,900.00	$352	$2,252
86	$1,920.00	$355	$2,275
87	$1,940.00	$359	$2,299
88	$1,960.00	$363	$2,323
89	$1,980.00	$366	$2,346
90	$2,000.00	$370	$2,370
91	$2,020.00	$374	$2,394
92	$2,040.00	$377	$2,417
93	$2,060.00	$381	$2,441
94	$2,080.00	$385	$2,465
95	$2,100.00	$389	$2,489
96	$2,120.00	$392	$2,512
97	$2,140.00	$396	$2,536
98	$2,160.00	$400	$2,560
99	$2,180.00	$403	$2,583
>100	$2,200.00	$407	$2,607

NOTICE OF INTENT (NOI) TO COMPLY WITH THE TERMS OF THE GENERAL PERMIT TO DISCHARGE STORM WATER ASSOCIATED WITH CONSTRUCTION ACTIVITY

GENERAL INSTRUCTIONS

Who Must Submit

Discharges of storm water associated with construction that results in the disturbance of one acre or more of land must apply for coverage under the General Construction Activities Storm Water Permit (General Permit). Construction activity which is a part of a larger common area of development or sale must also be permitted. (For example, if 4 acres of a 20-acre subdivision is disturbed by construction activities, and the remaining 16 acres is to be developed at a future date, the property owner must obtain a General Storm Water Permit for the 4-acre project). Construction activity includes, but is not limited to: clearing, grading, demolition, excavation, construction of new structures, and reconstruction of existing facilities involving removal and replacement that results in soil disturbance. This includes construction access roads, staging areas, storage areas, stockpiles, and any off-site areas which receive run-off from the construction project such as discharge points into a receiving water. Construction activity does not include routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility.

The owner of the land where the construction activity is occurring is responsible for obtaining a permit. Owners may obtain coverage under the General Permit by filing a NOI in accordance with the following instructions. Coverage for construction activity conducted on easements (e.g., pipeline construction) or on nearby properties by agreement or permission, or by an owner or lessee of a mineral estate (oil, gas, geothermal, aggregate, precious metals, and/or industrial minerals) entitled to conduct the activities, shall be obtained by the entity responsible for the construction activity. Linear construction projects which will have construction activity occurring in one or more than one Region should contact the State Water Resources Control Board at the number listed below prior to submitting an NOI application for specific information related to the use of the NOI form.

Construction Activity Not Covered By This General Permit

Storm water discharges in the Lake Tahoe Hydrologic Unit will be regulated by a separate permit(s) adopted by the California Regional Water Quality Control Board, Lahontan Region, and will not be covered under the State Water Resources Control Board's (SWRCB) General Permit. Storm water discharges on Indian Lands will be regulated by the U.S. Environmental Protection Agency.

Where to Apply

The NOI form, vicinity map, and appropriate fee must be mailed to the SWRCB at the following address:

State Water Resources Control Board
Division of Water Quality
Attn: Storm Water Permit Unit
P.O. Box 1977
Sacramento, CA 95812-1977

When to Apply

Property owners proposing to conduct construction activities subject to this General Permit must file a Notice of Intent prior to the commencement of construction activity.

Fees

The total annual fee is the current base fee plus applicable surcharges for all construction sites submitting an NOI. Checks should be made payable to: SWRCB.

Completing the Notice of Intent (NOI)

The submittal to obtain coverage under the General Permit must include a completed NOI Form (Notice of Intent, attached), a vicinity map, and the appropriate annual fee. The NOI must be completely and accurately filled out; the vicinity map and annual fee must be included with the NOI or the submittal is considered incomplete and will be rejected. A construction site is considered to be covered by the General Permit upon filing a complete NOI submittal, and implementation of a defensible Storm Water Pollution Prevention Plan (SWPPP). Upon receipt of a complete NOI submittal, each discharger will be sent a receipt letter containing the waste discharger's identification (WDID) number.

Questions?

If you have any questions on completing the NOI please call the SWRCB at (916) 341-5537.

NOI-LINE-BY-LINE INSTRUCTIONS

Please type or print when completing the NOI Form and vicinity map.

SECTION I--NOI STATUS

Mark one of the two boxes at the top portion of the NOI. Check box 1 if the NOI is being completed for new construction. Check box 2 if the NOI is being submitted to report changes for a construction site already covered by the General Permit. An example of a change that warrants a resubmittal of the NOI is a change of total area of the construction site. The permit is non-transferable, a change of ownership requires a Notice of Termination (NOT) submittal and a new NOI. Complete only those portions of the NOI that apply to the changes (the NOI must always be signed). If box 2 is checked, the WDID number must be included.

SECTION II--PROPERTY OWNER

Enter the construction site owner's official or legal name and address; contact person (if other than owner), title, and telephone number.

SECTION III--DEVELOPER / CONTRACTOR INFORMATION

Enter the name of the developer's (or general contractor's) official or legal name, address, contact person, title, and telephone number. The contact person should be someone who is familiar with the construction site and is responsible for compliance and oversight of the general permit.

SECTION IV-CONSTRUCTION PROJECT INFORMATION

Enter the project name, site address, county, city, (or nearest city if construction is occurring in an unincorporated area), zip code, and telephone number (if any) of the construction site. Include an emergency contact telephone or pager number. Construction site information should include latitude and longitude designations, tract numbers, and/or mile post markers, if applicable. The site contact person should be someone who is familiar with the project, site plans, SWPPP, and monitoring program. All NOIs must be accompanied by a vicinity map.

Part A: Enter the total size in acres of all areas associated with construction activity, including all access roads.

Part B: Enter the total size in acres of the area to be disturbed by construction activity and the percentage of the area listed in Part A above that this represents.

Part C: Enter the percentage of the site that is impervious (areas where water cannot soak into the ground, such as concrete, asphalt, rooftops, etc.) before and after construction.

Part D: Include tract numbers, if available.

Part E: Enter the mile post marker number at the project site location.

Part F: Indicate whether the construction site is part of a larger common plan of development or sale. For example, if the construction activity is occurring on a two-acre site which is within a development that is one acre or greater, answer yes.

Part G: Enter the name of the development (e.g. "Quail Ridge Subdivision", "Orange Valley Estates", etc.).

Part H: Indicate when construction will begin (month, day, year). When a NOI is being submitted due to a change in ownership, the commencement date should be the date the new ownership took effect.

Part I: Indicate the percentage of the total project area to be mass graded.

Part J: Enter the estimated completion dates for the mass grading activities and for the project completion.

Part K: Indicate the type(s) of construction taking place. For example, “Transportation” should be checked for the construction of roads; “Utility” should be checked for installation of sewer, electric, or telephone systems. Include a description of the major construction activities, (e.g., 20 single family homes, a supermarket, an office building, a factory, etc.)

SECTION V--BILLING ADDRESS

To continue coverage under the General Permit, the annual fee must be paid. Indicate where the annual fee invoice should be mailed by checking one of the following boxes:

Owner: sent to the owners address as it appears in Section II.

Developer/Contractor: sent to the developer's address as it appears in Section III.

Other: sent to a different address and enter that address in the spaces provided.

SECTION VI--REGULATORY STATUS

Indicate whether or not the site is subject to local erosion/sediment control ordinances. Indicate whether the erosion/sediment control plan designed to comply with the ordinance addresses the construction of infrastructure and structures in addition to grading. Identify the name and telephone number of the local agency, if applicable.

SECTION VII--RECEIVING WATER INFORMATION

Part A: Indicate whether the storm water runoff from the construction site discharges indirectly to waters of the United States, directly to waters of the United States, or to a separate storm drain system.

Indirect discharges include discharges that may flow overland across adjacent properties or rights-of-way prior to discharging into waters of the United States.

Enter the name of the owner/operator of the relevant storm drain system, if applicable. Storm water discharges directly to waters of the United States will typically have an outfall structure directly from the facility to a river, lake, creek, stream, bay, ocean, etc. Discharges to separate storm sewer systems are those that discharge to a collection system operated by municipalities, flood control districts, utilities, or similar entities.

Part B: Enter the name of the receiving water. Regardless of point of discharge, the owner must determine the receiving water for the construction site's storm water discharge. Enter the name of the receiving water.

SECTION VIII--IMPLEMENTATION OF NPDES PERMIT REQUIREMENTS

Part A: Indicate the status of the SWPPP, date prepared, or availability for review. Also indicate if a tentative construction schedule has been included in the SWPPP (the inclusion of a construction activity schedule is a mandatory SWPPP requirement).

Part B: Provide information concerning the status of the development of a monitoring program, a component of the SWPPP which outlines an inspection and maintenance schedule for the proposed Best Management Practices (BMPs). Provide name and phone number of program preparer.

Part C: Provide the name and phone numbers of the responsible party or parties designated to insure compliance with all elements of the General Permit and SWPPP.

SECTION IX--VICINITY MAP AND FEE

Provide a “to scale” or "to approximate scale" drawing of the construction site and the immediate surrounding area. Whenever possible, limit the map to an 8.5” x 11’ or 11" x 17" sheet of paper. At a minimum, the map must show the site perimeter, the geographic features surrounding the site, and general topography, and a north arrow. The map must also include the location of the construction project in relation to named streets, roads, intersections, or landmarks. A NOI containing a map which does not clearly indicate the location of the construction project will be rejected. Do not submit blueprints unless they meet the above referenced size limits.

SECTION X--CERTIFICATIONS

This section must be completed by the owner or signatory agent of the construction site*. The certification provides assurances that the NOI and vicinity map were completed in an accurate and complete fashion and with the knowledge that penalties exist for providing false information. Certification also requires the owner to comply with the provisions in the General Permit.

* For a corporation: a responsible corporate officer (or authorized individual). For a partnership or sole proprietorship: a general partner or the proprietor, respectively. For a municipality, State, Federal, or other public agency: either a principal executive officer, ranking elected official, or duly authorized representative.

State Water Resources Control Board

NOTICE OF INTENT

TO COMPLY WITH THE TERMS OF THE
GENERAL PERMIT TO DISCHARGE STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY (WQ ORDER No. 99-08-DWQ)

I. NOI STATUS (SEE INSTRUCTIONS)

MARK ONLY ONE ITEM 1. ☒ New Construction 2. ☐ Change of Information for WDID#

II. PROPERTY OWNER

Name	Contact Person		
City of Lodi	Rad Bartlam		
Mailing Address	Title		
221 W. Pine Street	Planner		
City	State	Zip	Phone
Lodi	CA	95240	(209) 333-6711

Owner Type (*check one*) 1.[ ] Private Individual 2.[ ]Business 3.[✓]Municipal 4.[ ]State 5.[ ]Federal 6.[ ]Other

III. DEVELOPER/CONTRACTOR INFORMATION

Developer/Contractor	Contact Person		
Northern California Power Agency (NCPA)	Ed Warner		
Mailing Address	Title		
651 Commerce Drive	Project Manager - Lodi Energy Center		
City	State	Zip	Phone
Roseville	CA	95678	(209) 333-6370

IV. CONSTRUCTION PROJECT INFORMATION

Site/Project Name	Site Contact Person		
Lodi Energy Center	Ed Warner		
Physical Address/Location	Latitude	Longitude	County
12751 North Thorton Road	38.05 °	121.23 °	San Joaquin (APN 055-130-016)
City (or nearest City)	Zip	Site Phone Number	Emergency Phone Number
Lodi	95242	(209) 728-1387	(209) 333-6373

A. Total size of construction site area: 37.6 Acres

B. Total area to be disturbed: 14.2 Acres (% of total 37.8)

C. Percent of site imperviousness (including rooftops):
Before Construction: 0 %
After Construction: 100 %

D. Tract Number(s): _____, _____

E. Mile Post Marker: _____

F. Is the construction site part of a larger common plan of development or sale?
☐ YES ☒ NO

G. Name of plan or development:

H. Construction commencement date: 03 /31 /2010

I. % of site to be mass graded: 100

J. Projected construction dates:
Complete grading: 03 /01 /2012 Complete project: 03 /31 /2012

K. Type of Construction (Check all that apply):

1. ☐ Residential 2. ☐ Commercial 3. ☐ Industrial 4. ☐ Reconstruction 5. ☐ Transportation
6. ☒ Utility Description: power generation facility 7. ☐ Other (Please List): _____

V. BILLING INFORMATION

SEND BILL TO:	Name	Contact Person	
☐ OWNER (as in II. above)	Northern California Power Agency (NCPA)	Ed Warner	
☐ DEVELOPER (as in III. above)	Mailing Address: 12751 North Thorton Road	Phone/Fax: (209) 333-6730	
☒ OTHER (enter information at right)	City: Lodi	State: CA	Zip: 95742

VI. REGULATORY STATUS

A. Has a local agency approved a required erosion/sediment control plan? ☐ YES ☒ NO

Does the erosion/sediment control plan address construction activities such as infrastructure and structures? ☒ YES ☐ NO

Name of local agency: to be approved by CA Energy Commission Phone: (916) 654-4287

B. Is this project or any part thereof, subject to conditions imposed under a CWA Section 404 permit of 401 Water Quality Certification? ☐ YES ☒ No

If yes, provide details: _____

VII. RECEIVING WATER INFORMATION

A. Does the storm water runoff from the construction site discharge to (Check all that apply):

1. ☒ **Indirectly to waters of the U.S.**
2. ☐ **Storm drain system - Enter owner's name:** _____
3. ☐ **Directly to waters of U.S. (e.g. , river, lake, creek, stream, bay, ocean, etc.)**

B. Name of receiving water: (river, lake, creek, stream, bay, ocean): Dredger Cut

VIII. IMPLEMENTATION OF NPDES PERMIT REQUIREMENTS

A. STORM WATER POLLUTION PREVENTION PLAN (SWPPP) (check one)

☐ A SWPPP has been prepared for this facility and is available for review: Date Prepared: ____/____/____ Date Amended: ____/____/____

☒ A SWPPP will be prepared and ready for review by (enter date): 09 / 30 / 2009

☐ A tentative schedule has been included in the SWPPP for activities such as grading, street construction, home construction, etc.

B. MONITORING PROGRAM

☒ A monitoring and maintenance schedule has been developed that includes inspection of the construction BMPs before anticipated storm events and after actual storm events and is available for review.

If checked above: A qualified person has been assigned responsibility for pre-storm and post-storm BMP inspections to identify effectiveness and necessary repairs or design changes ☒ YES ☐ NO

Name: Ed Warner Phone: (209) 333-6370

C. PERMIT COMPLIANCE RESPONSIBILITY

A qualified person has been assigned responsibility to ensure full compliance with the Permit, and to implement all elements of the Storm Water Pollution Prevention Plan including:

1. Preparing an annual compliance evaluation ☒ YES ☐ NO

Name: Ed Warner Phone: (209) 333-6370

2. Eliminating all unauthorized discharges ☒ YES ☐ NO

IX. VICINITY MAP AND FEE (must show site location in relation to nearest named streets, intersections, etc.)

Have you included a vicinity map with this submittal? ☒ YES ☐ NO

Have you included payment of the annual fee with this submittal? ☒ YES ☐ NO

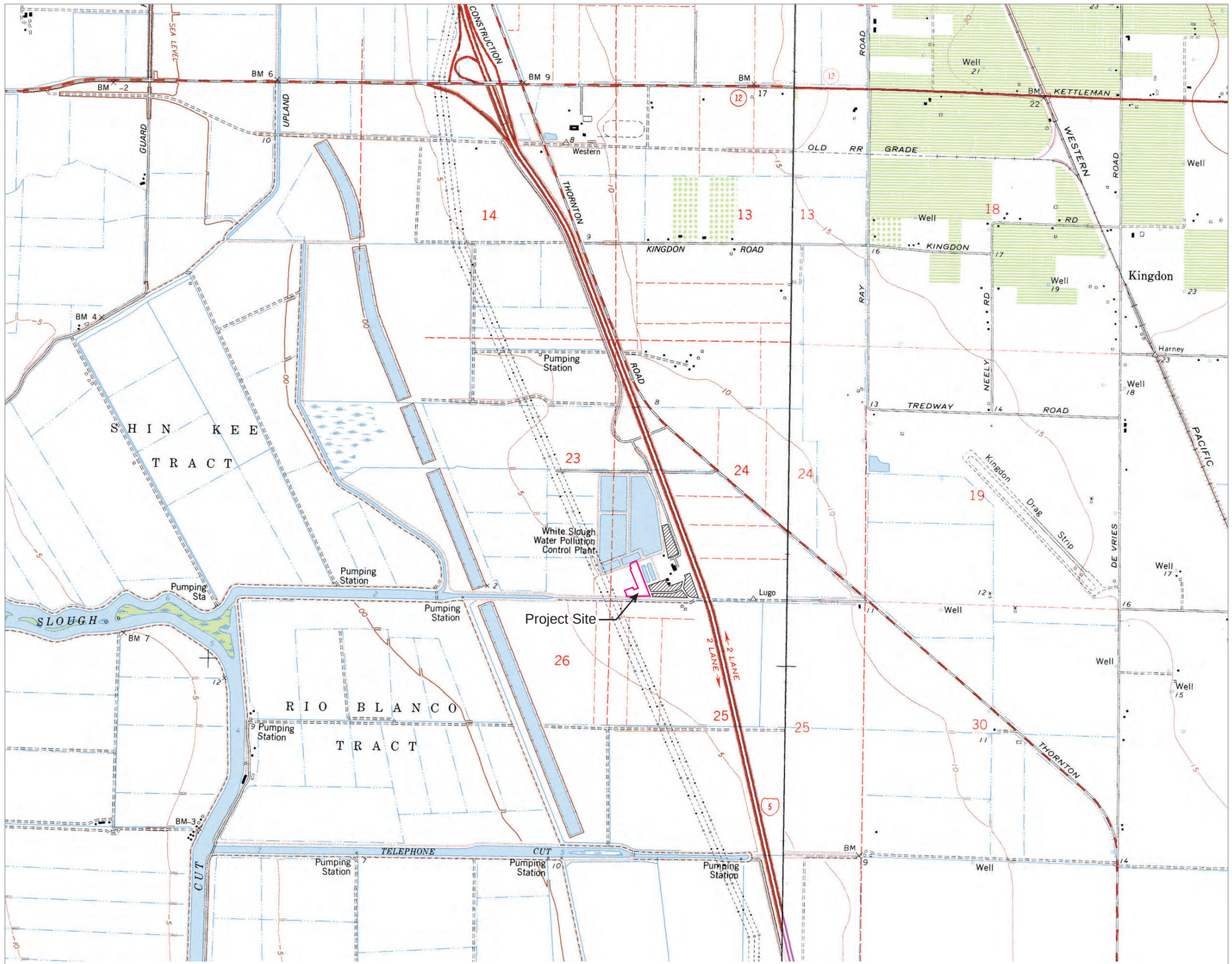
X. CERTIFICATIONS

"I certify under penalty of law that this document and all attachments were prepared under my direction and 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 or imprisonment. In addition, I certify that I have read the entire General Permit, including all attachments, and agree to comply with and be bound by all of the provisions, requirements, and prohibitions of the permit, including the development and implementation of a Storm Water Pollution Prevention Plan and a Monitoring Program Plan will be complied with."

Printed Name: Ed Warner

Signature: _____ **Date:** 10-21-08

Title: Project Manager



LEGEND

- Proposed Lay Down and/or Parking
- Proposed Plant Site

N

0 2,000 4,000

Feet

FIGURE 1
SITE MAP FOR NOI
LODI ENERGY CENTER
LODI, CALIFORNIA

ATTACHMENT DA 5.15-3

City of Lodi Stormwater Will-Serve Letter

CITY COUNCIL
JOANNE MOUNCE,
Mayor
LARRY D. HANSEN,
Mayor Pro Tempore
SUSAN HITCHCOCK
BOB JOHNSON
PHIL KATZAKIAN

CITY OF LODI

MUNICIPAL SERVICE CENTER
1331 SOUTH HAM LANE
P.O. BOX 3006
LODI, CALIFORNIA 95241-1910
(209) 333-6740
FAX (209) 333-6841
EMAIL pwdept@lodi.gov
http:\\www.lodi.gov

BLAIR KING,
City Manager

RANDI JOHL,
City Clerk

D. STEPHEN SCHWABAUER,
City Attorney

F. WALLY SANDELIN
Public Works Director

October 17, 2008

Ed Warner
NCPA
661 Commerce Dr
Roseville, CA 95678

SUBJECT: Terminal Storm Water Discharge to NCPA's

The City of Lodi has agreed to provide terminal storm water discharge to NCPA's Lodi Energy Center (LEC). NCPA has submitted an Application For Certification (AFC) with the California Energy Commission (CEC). This letter is to provide confirmation of this agreement.

The City of Lodi currently provides storm water service to NCPA's existing STIG facility. The City of Lodi has sufficient storage capacity to serve the proposed LEC. This agreement will not adversely affect any existing or future planned storm drainage requirements.

We trust that this addresses the CEC's request. If you need additional information, please do not hesitate to contact me at (209) 209-333-6740.

Sincerely,

Charles E. Swimley Jr., P.E.
Water Services Manager

CES/myn

cc: F. Wally Sandelin, Public Works Director
George Morrow, Electric Utility Director
D. Stephen Schwabauer, City Attorney

ATTACHMENT DA 5.15-4

Lab Analytical Results for the WPCF Domestic Water Well

THE TWINING LABORATORIES, INC.
EST. 1898
CALIFORNIA ELAP CERTIFICATE #1371

2527 Fresno Street
Fresno, CA 93721
(559) 268-7021 Phone
(559) 268-0740 Fax

City of Lodi	Project: Analytical Services	
1331 South Ham Lane	Project Number: -	**Reported:**
Lodi CA, 95242	Project Manager: Mike Schafer	03/30/07

WS PLANT WELL

7C15023-01 (Ground Water) Sampled:03/15/07 06:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes.
Inorganics									
Total Alkalinity as CaCO3	**400**	20	mg/L	1	T7C2210	03/22/07	03/23/07	SM 2320B	
Bicarbonate Alkalinity as HCO3	**490**	20	mg/L	1	T7C2210	03/22/07	03/23/07	SM 2320B	
Carbonate Alkalinity as CO3	ND	20	mg/L	1	T7C2210	03/22/07	03/23/07	SM 2320B	
Hydroxide Alkalinity as OH	ND	20	mg/L	1	T7C2210	03/22/07	03/23/07	SM 2320B	
Chloride	**130**	6.0	mg/L	3	T7C2001	03/20/07	03/20/07	EPA 300.0	
Color	ND	1.0	Color Units	1	T7C1516	03/15/07	03/15/07	SM2120B	
Cyanide (total)	ND	5.0	µg/L	1	T7C2009	03/22/07	03/23/07	SM4500CN-E	
Specific Conductance (EC)	**1100**	1.0	µS/cm	1	T7C1519	03/15/07	03/15/07	SM2510B	
Fluoride	ND	0.10	mg/L	1	T7C1602	03/16/07	03/16/07	EPA 300.0	
Hardness	**440**	0.66	mg equiv. CaCO3/L	1	[CALC]	03/23/07	03/27/07	[CALC]	
Langelier Index	**0.49**		SI	1	T7C2016	03/20/07	03/20/07	[CALC]	
Methylene Blue Active Substances	ND	0.050	mg/L	1	T7C1603	03/16/07	03/16/07	SM5540C	
Nitrate as NO3	**2.9**	2.0	mg/L	1	T7C1602	03/16/07	03/16/07	EPA 300.0	
Nitrite as NO2	ND	1.0	mg/L	1	T7C1602	03/16/07	03/16/07	EPA 300.0	
Threshold Odor Number	**4.0**	1.0	T.O.N.	1	T7C1516	03/15/07	03/15/07	SM2150B	
pH	**7.3**	0.10	pH Units	1	T7C1518	03/15/07	03/15/07	EPA 150.1	
Sulfate as SO4	**15**	2.0	mg/L	1	T7C1602	03/16/07	03/16/07	EPA 300.0	
Total Dissolved Solids	**660**	13	mg/L	1.33	T7C1913	03/19/07	03/23/07	EPA 160.1	
Turbidity	**0.50**	0.020	NTU	1	T7C1516	03/15/07	03/15/07	EPA 180.1	
Metals									
Aluminum	ND	0.050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Antimony	ND	2.0	µg/L	1	T7C2704	03/27/07	03/27/07	EPA 200.9	
Arsenic	**17**	2.0	µg/L	1	T7C2902	03/29/07	03/29/07	EPA 200.9	
Barium	**0.78**	0.010	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Beryllium	ND	0.0010	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Cadmium	ND	0.0010	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Calcium	**97**	0.10	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Chromium	ND	0.0050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Copper	ND	0.0050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Iron	**0.12**	0.10	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Lead	ND	2.0	µg/L	1	T7C2704	03/27/07	03/27/07	EPA 200.9	
Magnesium	**49**	0.10	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Manganese	**1.7**	0.0050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Mercury	ND	0.20	µg/L	1	T7C1904	03/19/07	03/19/07	EPA 245.1	

The results in this report apply to the samples analyzed in accordance with the chain custody document. This analytical report must be reproduced in its entirety.

THE TWINING LABORATORIES, INC.
EST. 1898
CALIFORNIA ELAP CERTIFICATE #1371

2527 Fresno Street
Fresno, CA 93721
(559) 268-7021 Phone
(559) 268-0740 Fax

City of Lodi	Project: Analytical Services	
1331 South Ham Lane	Project Number: -	**Reported:**
Lodi CA, 95242	Project Manager: Mike Schafer	03/30/07

WS PLANT WELL

7C15023-01 (Ground Water) Sampled:03/15/07 06:30

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes.
Metals									
Nickel	ND	0.0050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Potassium	**8.0**	1.0	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Selenium	ND	2.0	µg/L	1	T7C1604	03/16/07	03/16/07	SM3114B	
Silver	ND	0.0050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Sodium	**73**	1.0	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	
Thallium	ND	1.0	µg/L	1	T7C2704	03/27/07	03/27/07	EPA 200.9	
Zinc	ND	0.0050	mg/L	1	T7C2307	03/23/07	03/27/07	EPA 200.7	

Notes and Definitions

LM	LCS/LCSD were analyzed in place of MS/MSD.
ug/L	micrograms per liter (parts per billion concentration units)
mg/L	milligrams per kilogram (parts per million concentration units)
mg/kg	milligrams per liter (parts per million concentration units)
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

FGL ENVIRONMENTAL www.fglinc.com

CHAIN OF CUSTODY
AND ANALYSIS REQUEST DOCUMENT

ORIGINAL

CLIENT DETAILS — SECTION I

Client: N.C.P.A

☐ New Customer Customer Number: 3-11629

Address:

Phone: FAX:

E-Mail

Project name: WATER QUALITY MONITORING

Contact person: KEVIN

Billing Information (if different from above)

Name:

Address:

Phone: FAX:

E-Mail

Contact person:

Purchase order/contract/FGL quote number:

Pre Log Required: yes ____ Frequency: Monthly ☐ Weekly ☐ Quarterly ☐ Other ☐

SAMPLING — SECTION II

Sampler (s): JIMK

Comp Sampler Set up Date: Time:

Time: Mileage:

~~Shipping Charge:~~ S/C 25.00 Pickup Charge:

REPORT INFORMATION — SECTION III

Rush Analysis (surcharge will apply):

☐ 5 Day ☐ 4 Day ☐ 3 Day

☐ 2 Day ☐ 24 hour

Rush pre-approval by lab: ____ inital

Electronic Data Transfer: yes ____ no ____

If yes, To: State ____ Client ____ Other ____

Lab number: STK 850687

SAMPLE INFORMATION — SECTION IV

Sample Number	Location/Description	Date Sampled	Time Sampled	Type of Sampling: Composite(C) Grab(G)	Number of Containers	Type of Containers: (G) Glass (P) Plastic (V) VOA (MT) Metal Tube	(P) Potable (NP) Non-Potable	(SW) Surface Water (MW) Monitoring Well (GW) Ground Water (TB) Travel Blank (WW) Wastewater (DW) Drinking Water	(S) Soil (SLG) Sludge (SLD) Solid (O) Oil	BacT: (Sys) System (SRC) Source (W) Waste	BacT: Routine (ROUT) Repeat (RPT) Other (OTH) Replace (RPL)	(LT) Leaf Tissue (PET) Petiole Tissue (PRD) Produce	Preservative: (1) NaOH + ZnAc, (2) NaOH, (3) HCl, (4) H2SO4, (5) HNO3, (6) Na2S203, (7) Other	ANALYSES REQUESTED: QTION COLIVERT 18	FIELD CL FREE - ND
1	KITCHEN SINK	10/20/08	1042	G	1	P	P	DW		SYS	O		6	X	X

To Lab D/I:

REMARKS — SECTION V

CUSTODY — SECTION VI

Relinquished by and subject to the terms and conditions on the reverse of this document:

JIMK	Date 10/20/08	Time 1315	Relinquished by:	Date	Time
Received by: DS	Date 10/20/08	Time 1315	Received by:	Date	Time
Relinquished by:	Date	Time	Relinquished by:	Date	Time
Received by:	Date	Time	Received by:	Date	Time

CORPORATE OFFICE & LABORATORY
P.O. Box 272/853 Corporation Street
Santa Paula, CA 93061-0272
Tel: (805) 392-2000
FAX: (805) 525-4172

OFFICE & LABORATORY
2500 Stagecoach Road
Stockton, CA 95215
Tel: (209) 942-0182
FAX: (209) 942-0423

OFFICE & LABORATORY
563 E. Lindo Avenue
Chico, CA 95926
Tel: (530) 343-5818
FAX: (530) 343-3807

FIELD OFFICE
Visalia, California
Tel: (559) 734-9473
Mobile: (559) 737-2399
FAX (559) 734-8435

ENVIRONMENTAL

ANALYTICAL CHEMISTS

Northern California Power Agency
P.O. Box 1478
Lodi, CA 95241-1478
Customer ID: 3011629

October 21, 2008
STK0850687:1
Preliminary Coliform Bacteria Analysis
Project Name: Bacteriological Sampling
System Number:

Analytical Results

ID	Sample Description	Total	Fecal	Units	Method	Prep	Footnote
1	Kitchen Sink	**1.0**	**<1.0**	MPN/100ml	SM 9223B	Quanti Tray 18	

N/R Not Required MPN Most Probable Number A/P Absence/Presence SM 9223B E. Coli specific for Fecal

STK0850687-001 Kitchen Sink was Positive for Total Coliform but Absent for Fecal Coliform

Sample Handling Information

ID	Sample Number	Sample Description	Sample Type/Reason	Sampler	Employed By	Sampled
1	STK0850687-001	Kitchen Sink	System-Other	Jim Kavanaugh	FGL Environmental	2008-10-20 10:42

QA Information

ID	Sample Description	Cl Total/Free	Temp °C	Started	Finished	Contact	Contacted
1	Kitchen Sink	---/ND	---	2008-10-20 15:21 CTH	2008-10-21 MAM	Brad Rusk	2008-10-21 10:53

Analyses were performed using Standard Methods 20th edition. If you have any questions regarding your results, please call.

This is a Preliminary Report, the Final Report will follow in 14 days.

Reviewed and Approved By **Mike Ostrom**

Digitally signed by Mike Ostrom
Title: Laboratory Manager
Date: 2008-10-21

Corporate Offices & Laboratory
P.O. Box 272 / 853 Corporation Street
Santa Paula, CA 93061-0272
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CA NELAP Certification No. 01110CA
CA ELAP Certification No. 1573

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Field Office
Visalia, California
TEL: (559) 734-9473
FAX: (559) 734-8435
Mobile: (559) 737-2399

ATTACHMENT DA 5.15-5

City of Lodi Recycled Water Will-Serve Letter

CITY COUNCIL

JOHN BECKMAN, Mayor
SUSAN HITCHCOCK
Mayor Pro Tempore
LARRY D. HANSEN
BOB JOHNSON
JOANNE L. MOUNCE

CITY OF LODI

PUBLIC WORKS DEPARTMENT

CITY HALL, 221 WEST PINE STREET
P.O. BOX 3006
LODI, CALIFORNIA 95241-1910
(209) 333-6706
FAX (209) 333-6710
EMAIL pwdept@lodi.gov
http:\\www.lodi.gov

BLAIR KING
City Manager

SUSAN J. BLACKSTON
City Clerk

D. STEPHEN SCHWABAUER
City Attorney

RICHARD C. PRIMA, JR.
Public Works Director

November 29, 2005

Randall Blank, Environmental, Health & Safety Manager
Northern California Power Agency
P.O. Box 1478
Lodi, CA 95241

SUBJECT: Water Supply for NCPA Electric Generating Plant at Lodi White Slough Water Pollution Control Facility at 12745 North Thornton Road, Lodi, CA, 95242

The City of Lodi is pleased to confirm availability of water for a new NCPA Electric Generating Facility adjacent to the existing NCPA STIG Plant located on City property at its White Slough Water Pollution Control Facility. Pursuant to City Council approval on November 16, 2005, the City can provide recycled water meeting State of California Title 22 requirements for tertiary treatment, approximately 2.5 MGD (million gallons per day) peak, 1.7 MGD normal

Current City policy requires the applicant to fund/construct the improvements necessary to reliably serve your project. While the quantities of water described above are available to NCPA, distribution facilities may need to be modified to actually deliver the water. Construction of new or modification of existing storage facilities may also be necessary to provide reliability. In addition, regular service charges for recycled water, as established by the City, would apply.

The City of Lodi wishes to fully cooperate with you on this project and trusts that Lodi will be given favorable consideration in project participation allocations. We look forward to working with you on the various details to make this project a success for all.

Sincerely,

Richard C. Prima, Jr.
Public Works Director

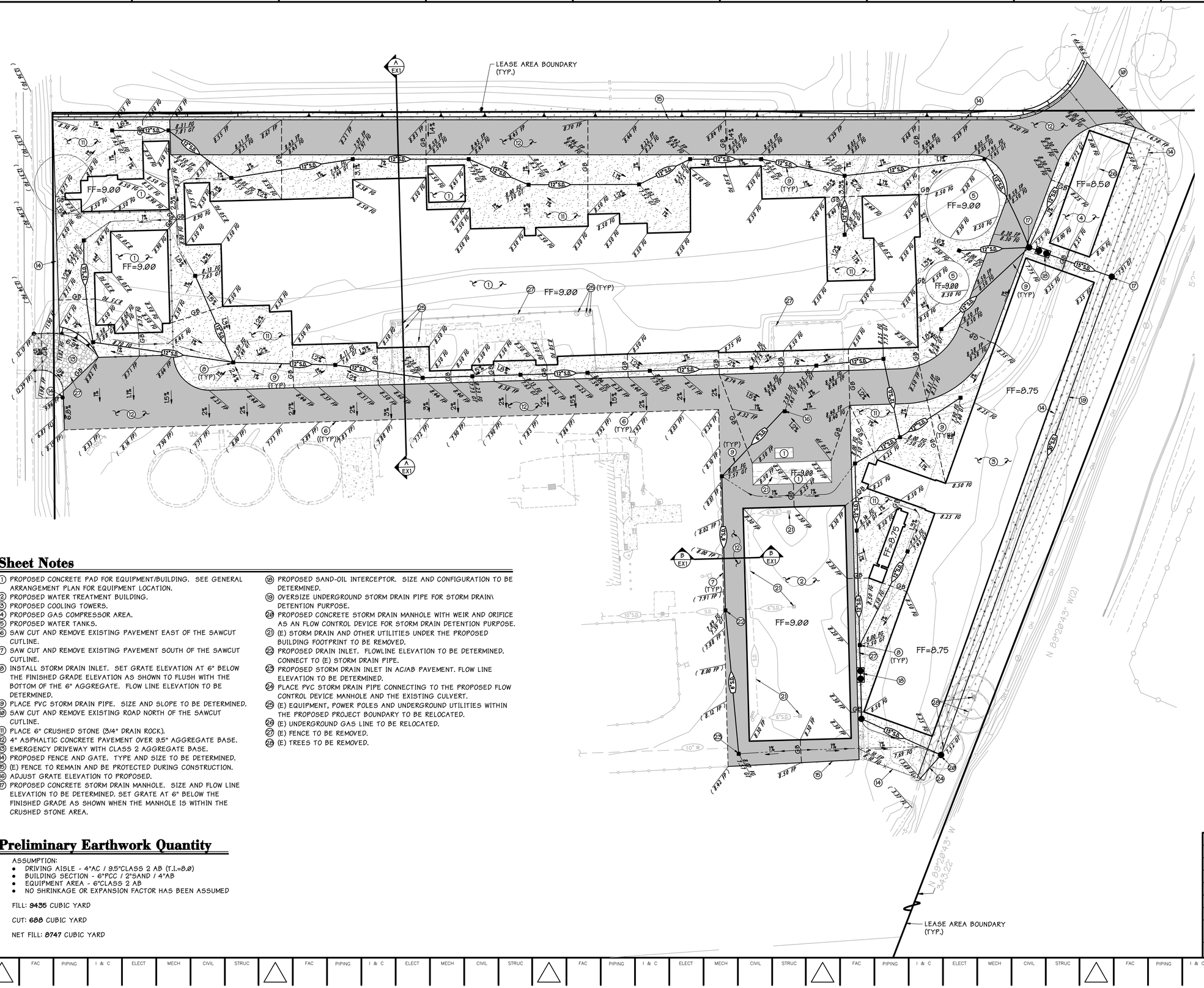
RCP/pmf

cc: Blair King, City Manager
David Dockham, Interim Electric Utility Director
Del Kerlin, Assistant Wastewater Treatment Superintendent

J:\WHITE SLOUGH\LNCPA_WILLSERVELETTERA.DOC

ATTACHMENT DA 5.15-6

Stormwater Drainage Figures



1 inch = 30 ft.

Legend

- DRIVE AISLE SECTION: 4" AC OVER 9.5" CLASS 2 AB
- 6" CRUSHED STONE (3/4" DRAIN ROCK)
- LANDSCAPE AREA
- CLASS 2 AGGREGATE BASE

Sheet Notes

1. PROPOSED CONCRETE PAD FOR EQUIPMENT/BUILDING. SEE GENERAL ARRANGEMENT PLAN FOR EQUIPMENT LOCATION.
2. PROPOSED WATER TREATMENT BUILDING.
3. PROPOSED COOLING TOWERS.
4. PROPOSED GAS COMPRESSOR AREA.
5. PROPOSED WATER TANKS.
6. SAW CUT AND REMOVE EXISTING PAVEMENT EAST OF THE SAWCUT CUTLINE.
7. SAW CUT AND REMOVE EXISTING PAVEMENT SOUTH OF THE SAWCUT CUTLINE.
8. INSTALL STORM DRAIN INLET. SET GRATE ELEVATION AT 6" BELOW THE FINISHED GRADE ELEVATION AS SHOWN TO FLUSH WITH THE BOTTOM OF THE 6" AGGREGATE. FLOW LINE ELEVATION TO BE DETERMINED.
9. PLACE PVC STORM DRAIN PIPE. SIZE AND SLOPE TO BE DETERMINED.
10. SAW CUT AND REMOVE EXISTING ROAD NORTH OF THE SAWCUT CUTLINE.
11. PLACE 6" CRUSHED STONE (3/4" DRAIN ROCK).
12. 4" ASPHALTIC CONCRETE PAVEMENT OVER 9.5" AGGREGATE BASE.
13. EMERGENCY DRIVEWAY WITH CLASS 2 AGGREGATE BASE.
14. PROPOSED FENCE AND GATE. TYPE AND SIZE TO BE DETERMINED.
15. (E) FENCE TO REMAIN AND BE PROTECTED DURING CONSTRUCTION.
16. ADJUST GRATE ELEVATION TO PROPOSED.
17. PROPOSED CONCRETE STORM DRAIN MANHOLE. SIZE AND FLOW LINE ELEVATION TO BE DETERMINED. SET GRATE AT 6" BELOW THE FINISHED GRADE AS SHOWN WHEN THE MANHOLE IS WITHIN THE CRUSHED STONE AREA.
18. PROPOSED SAND-OIL INTERCEPTOR. SIZE AND CONFIGURATION TO BE DETERMINED.
19. OVERSIZE UNDERGROUND STORM DRAIN PIPE FOR STORM DRAIN\ DETENTION PURPOSE.
20. PROPOSED CONCRETE STORM DRAIN MANHOLE WITH WEIR AND ORIFICE AS AN FLOW CONTROL DEVICE FOR STORM DRAIN DETENTION PURPOSE.
21. (E) STORM DRAIN AND OTHER UTILITIES UNDER THE PROPOSED BUILDING FOOTPRINT TO BE REMOVED.
22. PROPOSED DRAIN INLET. FLOWLINE ELEVATION TO BE DETERMINED. CONNECT TO (E) STORM DRAIN PIPE.
23. PROPOSED STORM DRAIN INLET IN AC/AB PAVEMENT. FLOW LINE ELEVATION TO BE DETERMINED.
24. PLACE PVC STORM DRAIN PIPE CONNECTING TO THE PROPOSED FLOW CONTROL DEVICE MANHOLE AND THE EXISTING CULVERT.
25. (E) EQUIPMENT, POWER POLES AND UNDERGROUND UTILITIES WITHIN THE PROPOSED PROJECT BOUNDARY TO BE RELOCATED.
26. (E) UNDERGROUND GAS LINE TO BE RELOCATED.
27. (E) FENCE TO BE REMOVED.
28. (E) TREES TO BE REMOVED.

Preliminary Earthwork Quantity

ASSUMPTION:
- DRIVING AISLE - 4"AC / 9.5"CLASS 2 AB (T.I.=8.0)
- BUILDING SECTION - 6"PCC / 2"SAND / 4"AB
- EQUIPMENT AREA - 6"CLASS 2 AB
- NO SHRINKAGE OR EXPANSION FACTOR HAS BEEN ASSUMED

FILL: **9435** CUBIC YARD

CUT: **688** CUBIC YARD

NET FILL: **8747** CUBIC YARD

WORKING DRAWING — DATE 06/25/2008 — REV

PRELIMINARY STATUS	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
LDE -		
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE		

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: PEM	
CHECKED BY: JDT	
LEAD DESIGNER: EC	
ENGINEER/TECH SPECIALIST: EC	
PROJECT ENGINEERING MANAGER: STEVEN BLUE	
PROJECT MANAGER:	

Zero Harm — Leadership No Incidents Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: _____ STATE: _____ LIC. NO.: _____ DATE: _____

ITEAM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

CARLTON Engineering Inc.
3883 Ponderosa Road, Shingle Springs, CA 95682
Voice 530.677.5515 Fax 530.677.6645

PRELIMINARY NOT FOR CONSTRUCTION

WorleyParsons resources & energy

CLIENT/PROJECT TITLE

NCPA LODI ENERGY CENTER

PROJECT MANAGER	
PROJ ENGR MANAGER	
LEAD DISC ENGINEER	
ENGINEER/ TECH. SPEC	
LEAD DESIGNER	
CHECKED	
DRAWN	
DATE	
REV	

DRAWING TITLE: CONCEPTUAL GRADING PLAN

SHEET NO: EX2

SCALE: 1" = 30' — DRAWING SIZE: ARCH D (24" x 36")

WORLEYPARSONS DWG. NO. — REV: A

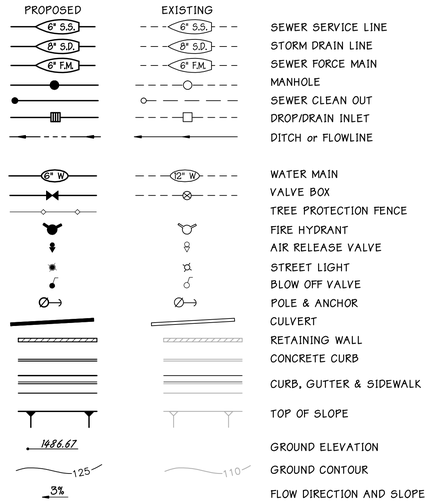
11/JUL/2008 9:34am abier V:\NCPA Lodi Energy Center\6300-03-08 Civil\Dwg\Exh\63003_EX2

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

Abbreviations

#	NUMBER
AB	AGGREGATE BASE
AC	ASPHALTIC CONCRETE
APN	ASSESSORS PARCEL NUMBER
ARV	AIR RELEASE VALVE
BC	BEGIN CURVE
BFP	BACKFLOW PREVENTER
BO	BLOW OFF
BOW	BOTTOM OF WALL
BVC	BEGIN VERTICAL CURVE
BW	BACK OF WALK
C/G	CURB AND GUTTER
CH	CHORD
CHL	CHORD LENGTH
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
CONC	CONCRETE
CR	CURB RETURN
DCV	DETECTOR CHECK VALVE
DI	DRAIN INLET
DWY	DRIVEWAY
E	ELECTRICAL
EC	END CURVE
ELV	ELEVATION
EP	EDGE OF PAVEMENT
EVC	END VERTICAL CURVE
(E)	EXISTING
FD	FIRE DEPARTMENT
FDC	FIRE DEPARTMENT CONNECTION
FF	FINISHED FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT
FL	FLOWLINE
FP	FINISHED PAVEMENT
FS	FINISHED SURFACE
G	GAS
GB	GRADE BREAK
GT	GRATE
GV	GATE VALVE
INTX	INTERSECTION
INV	INVERT
JP	JOINT POLE
JT	JOIN TRENCH
LF	LINEAR FEET
LT	LEFT
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
NTS	NOT TO SCALE
OC	ON CENTER
OH	OVERHEAD
OMP	OPEN METAL PIPE
PCC	PORTLAND CEMENT CONCRETE
PIV	POST INDICATOR VALVE
PL	PROPERTY LINE
POC	POINT OF CONNECTION
PP	POWER POLE
PRC	POINT OF REVERSE CURVE
PRVC	POINT OF REVERSE VERTICAL CURVE
PUE	PUBLIC UTILITIES EASEMENT
PVC	POLYVINYL CHLORIDE
PVI	POINT VERTICAL INTERSECTION
R	RADIUS
ROW	RIGHT OF WAY
RC	REVERSE CURVE
RT	RIGHT
RWS	RECYCLED WATER SERVICE
S=#	SLOPE PERCENTAGE
SCH	SCHEDULE
SD	STORM DRAIN
SD#	STANDARD DRAWING NUMBER
SDMH	STORM DRAIN MANHOLE
SP#	STANDARD PLAN NUMBER
SS	SANITARY SEWER
SSCO	SANITARY SEWER CLEAN OUT
SSMH	SANITARY SEWER MANHOLE
STA	STATION
SUBD.	SUBDIVISION
T	TELEPHONE
TBW	TOP BACK OF WALK
TC	TOP OF CURB
TOW	TOP OF WALL
TW	TOP OF WALK
(TYP)	TYPICAL
V	VAULT
VAR	VARIES
VC	VERTICAL CURVE
W	WATER
WM	WATER METER
WS	WATER SERVICE
WV	WATER VALVE

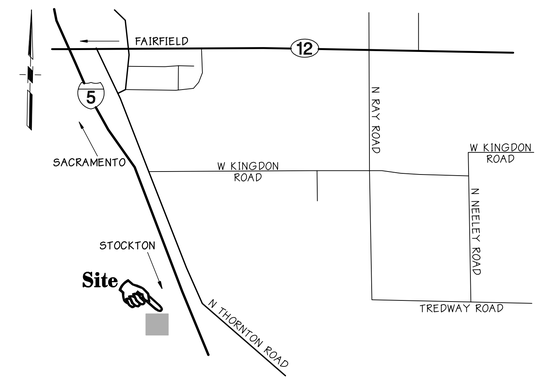
Symbols

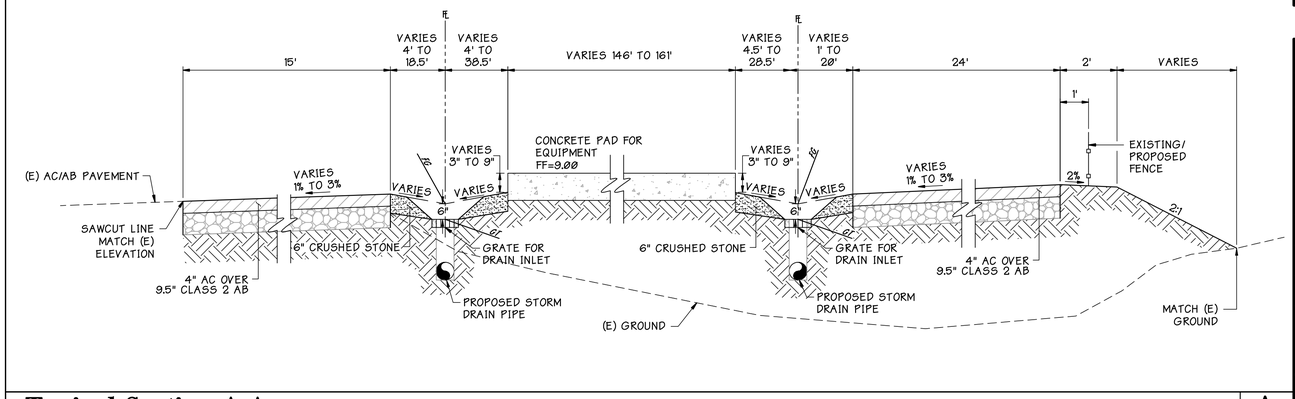


SEWER SERVICE LINE
STORM DRAIN LINE
SEWER FORCE MAIN
MANHOLE
SEWER CLEAN OUT
DROP/DRAIN INLET
DITCH or FLOWLINE
WATER MAIN
VALVE BOX
TREE PROTECTION FENCE
FIRE HYDRANT
AIR RELEASE VALVE
STREET LIGHT
BLOW OFF VALVE
POLE & ANCHOR
CULVERT
RETAINING WALL
CONCRETE CURB
CURB, GUTTER & SIDEWALK
TOP OF SLOPE
GROUND ELEVATION
GROUND CONTOUR
FLOW DIRECTION AND SLOPE

Vicinity Map

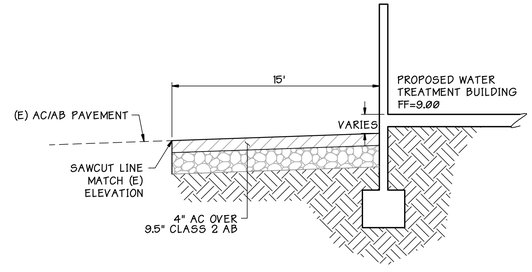
NTS





Typical Section A-A

NTS **A**



Typical Section B-B

NTS **B**

WORKING DRAWING — DATE 06/25/2008 — REV

PRELIMINARY STATUS	DATE	
LDE -		REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
LDE		

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: PEM	
CHECKED BY: JDT	
LEAD DESIGNER: EC	
ENGINEER/TECH SPECIALIST: EC	
PROJECT ENGINEERING MANAGER: STEVEN BLUE	
PROJECT MANAGER:	

Zero Harm — Leadership No Incidents Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: ____ STATE: ____
LIC. NO.: ____ DATE: ____

TEAM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

CARLTON Engineering Inc.
3883 Ponderosa Road, Shingle Springs, CA 95682
Voice 530.677.5515 Fax 530.677.6645

PRELIMINARY NOT FOR CONSTRUCTION

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
NCPA LODI ENERGY CENTER

DRAWING TITLE: NOTES AND DETAILS

SHEET NO: EX1

SCALE: N/A — DRAWING SIZE: ARCH D (24" x 36")

WORLEYPARSONS DWG. NO. — REV: A

PROJECT MANAGER	
PROJ ENGR MANAGER	
LEAD DISC ENGINEER	
ENGINEER/ TECH. SPEC	
LEAD DESIGNER	
CHECKED	
DRAWN	
DATE	
REV	

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

11/6/2008 9:34am dbier Y:\NCPA Lodi Energy Center\8300-03-08 Civil\DwgSet\8300103_EX1

ATTACHMENT DA 5.15-7

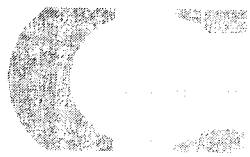
Preliminary Drainage Study

PRELIMINARY
DRAINAGE STUDY

For the proposed
NCPA – Lodi Energy Center
Lodi, CA

Project No. 6300-03-08
June 2008
Revised October 2008

Prepared for:
WorleyParsons
2330 East Bidwell
Folsom, CA 95630



CARLTON
Engineering Inc.

I. PROJECT INTRODUCTION

The project site is located on 12751 North Thornton Road, west of Highway 5 in Lodi, CA (see Appendix for Vicinity Map). The property has no frontage along North Thornton Road. A private dirt road extending from North Thornton Road provides access to the site (under Highway 5). The project site is bounded by the existing White Slough Water Pollution Control Plan to the north, south and east, and the existing Phase I development of NCPA Lodi Energy Center facility to the west.

The proposed development is located at the southern portion of the parcel, APN 055-130-16 in San Joaquin County. Of the 162-acre parcel, only approximately five acres will be affected by the proposed project improvements.

The existing buildings and majority of the equipment for the Phase I development are to remain. A portion of the existing equipment and underground utilities serving the existing facility will be relocated. New building and equipment will be constructed on the site. The improvements will include a variety of above ground equipment, cooling towers, associated roadway for access, underground utilities and at least one building that will be used for water treatment.

II. OBJECTIVE

This report outlines the existing and proposed hydraulic and hydrologic conditions associated with the proposed improvements. The information and calculations presented in this report follow the requirements of the City of Lodi through use of the rational method outlined in the "City of Lodi Design Standards – City of Lodi Department of Public Works," May 1991. Pre-development and Post-development drainage peak flows are to be determined and compared to establish whether onsite drainage detention is necessary according to the City's requirements.

III. HYDROLOGY

The hydrologic analysis was performed and analyzed with rational method as set forth in the Section 3 of the City of Lodi Design Standards. The runoff coefficient, C, for the pavement and open area are based on the recommendation from the City's Design Standards. A runoff coefficient for the crushed stone gravel is assumed to be 0.70. Rainfall intensity, "I," which is associated with the time of concentration, "T_c", was obtained from the City of Lodi Standard Plan 606 (see Appendix).

Runoff from the project site is primarily drained via a proposed underground storm drain system. Components of the drainage system include drain inlets, storm drain pipes, oversize storm drain pipe for detention and concrete storm drain manhole with weir and orifice used as a flow control structure. The

proposed storm system is designed to connect to the existing culvert at the southwest corner of the project site (point of interest – see Shed Map DS-1 and DS-2 in Appendix). The design of each component takes into account the worst-case scenario, including pipe slope and runoff velocity.

A. PRE-CONSTRUCTION (EXISTING) CONDITIONS

The project site is currently a mainly open dirt area covered with moderate amount of seasonal grass and weed. The pre-construction high point of the site is located along the northern project boundary with an elevation of approximately 12.0 feet along the existing dirt road. The site then gradually flows towards the south into a depressed area with an approximate elevation of 5.0 feet. The depressed area is bisected by an existing paved access road for the existing facility. An existing culvert allows the runoff from the northern depressed area flow to the southern depressed area into a natural drainage swale along the southern project boundary (at approximate elevation of 3.5 feet to 4.0 feet). The low point of the site is located at an approximate elevation of 3.5 feet at the existing culvert at the southwest corner of the project site. Storm water runoff is assumed to exit the site via the existing culvert at the southwest corner of the project site (Point of Interest, as indicated on DS1).

The existing watershed area is depicted on "Pre-Development Drainage Shed Map - DS1" in Appendix. A composite runoff coefficient was computed with the assumption of a runoff coefficient of 0.7 for the crushed stone gravel area, 0.95 for asphaltic concrete pavement/concrete pad area and 0.20 for open area per recommendation from the City of Lodi Design Standards. The total peak runoff generated by the pre-development shed area is determined to be 1.41cfs, and the calculation is demonstrated on Shed Map - DS-1.

B. POST-CONSTRUCTION CONDITIONS

Proposed improvements to the site during construction includes removal of a portion of the existing asphaltic concrete pavement area and replace it with new asphalt pavement or crushed stone gravel, relocation of various equipment and underground utilities, construction of a new underground storm drain system and construction of concrete foundations for the new plant equipment.

The post-construction high point of the site is planned to be along the northern project boundary at an elevation of approximately 8.75 feet. The average site elevation after construction of the new facility is completed will be approximately 8.0 feet. In general, storm drain runoff is designed to drain from north to south.

Two series of drain inlets and pipes are planned on both sides of the main equipment foundation. The rainwater runoff will flow to the proposed drain inlets along the top of the compacted sub-base under the crush stone gravel. The grate of the drain inlets are set at 6" below the gravel finished pavement elevation to collect the runoff from the foundation sub-base. The proposed drive aisle along the west side of the main equipment foundation is designed to drain towards west into the existing drainage system. The edge of pavement between the asphaltic concrete pavement and the crushed stone gravel acts as a grade break. It is designed to be consistent with the existing drainage pattern.

The area surrounding the water treatment building is proposed to be paved with asphaltic concrete pavement and designed to drain north into the existing storm drain system to match the existing condition. The existing underground storm drain system will be slightly modified to accommodate the proposed new construction.

A crushed stone gravel section surrounding the cooling towers pad is also proposed. Drain inlet grates are set at 6" below the gravel section finished grade elevation to drain runoff at the sub-base level. Two sand-oil interceptors are designed to connect to the proposed storm drain systems to provide water quality measure. These interceptors are located on both ends of the cooling tower.

An oversize underground storm drain pipe and a concrete manhole with weir and orifice are also proposed along the south face of the cooling tower as a storm drain detention system. The post-construction storm drain runoff is designed to exit the project site via the existing culvert at the (Point of Interest, see Shed Map DS-1 and DS-2 in Appendix) to match with the existing drainage pattern.

Proposed watershed area is depicted on "Post-Development Drainage Shed Map – DS2" in Appendix. A composite runoff coefficient is computed with the same criteria as stated in the "Pre-construction (Existing) Conditions" section above. The total peak runoff generated by the post-construction shed area is determined to be 4.14cfs, and the calculation is demonstrated on DS-2.

IV. HYDRAULICS

A. DESIGN STORM FREQUENCY

Per the City of Lodi Design Standards, the drainage system will be designed to convey a 2-year storm with the water surface elevation contained within all pipes.

B. DESIGN STORM DURATION

The goal in storm drain design is to convey the maximum peak flow for a given design storm. In this case, the time of concentration is assumed to be 10 minutes for both pre- and post-construction conditions per the City of Lodi Design Standards minimum allowed time of concentration.

C. MINOR LOSSES

A Manning's "n" value of 0.013 is used for the proposed pipes per City of Lodi Design Standard. The minor losses for the transitions, junctions, bends, entrances and exits have not been considered as no new drainage pipes are being proposed.

V. SUMMARY

The total Pre- and Post-construction storm water runoff capacity exiting the site has been calculated and is summarized in Table 1. Locations of storm drain pipe ands inlet structures are shown on the conceptual grading and drainage plans attached in the Appendix.

Table 1: Summary of Peak Flows

	2-Year Storm Runoff (cfs)	10-Year Storm Runoff (cfs)
Pre-Construction	**1.61**	**2.84**
Post-Construction	**4.14**	**7.31**

As stated in Table 1 above, the proposed improvement will increase storm drain runoff due to the conversion of the existing pervious open area to the impervious cover. In order to ensure the downstream drainage system is not impacted by the proposed improvement, an onsite underground storm drain detention system is introduced. Such a detention system consists of an oversize storm drain pipe to provide storage capacity and a flow control manhole with emergency weir and orifice limit the runoff to pre-development level prior to exiting the site. A preliminary estimate of the required detention volume is determined to be 1240 cubic feet (equivalent to 253 linear feet of 30" storm drain pipe) according to the method provided by Erosion & Sediment Control Guidelines for Developing Areas of the Sierras prepared by the High Sierra RC&D Council (see Appendix). The detail designs and calculation for detention storage volume and the flow control device will be performed during construction document phase.

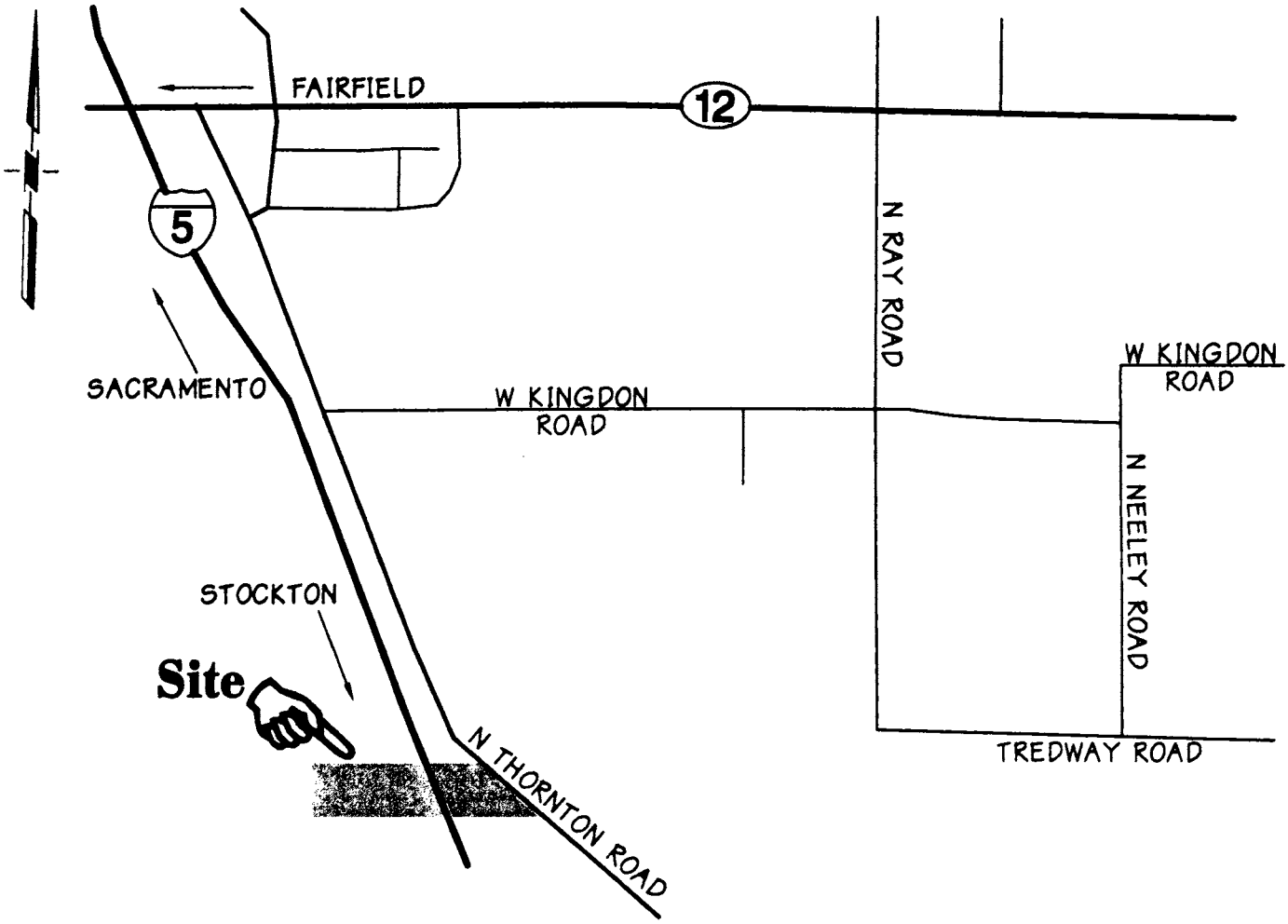
Since the post-development runoff is designed to stay at the pre-construction level prior to exiting the site, the downstream system should be of adequate capacity to handle the post-construction site runoff.

VI. APPENDIX

A. Vicinity Map
B. City of Lodi Standard Plan 606
C. Volume Design Calculation
D. Drainage Shed Map Exhibits DS1 and DS2
E. Erosion & Sediment Control Guidelines for Developing Areas of the Sierra by High Sierra RC&D Council, dated November 1981.

Vicinity Map

NTS



CITY OF LODI
PUBLIC WORKS DEPARTMENT

Rainfall Intensity

Tc = Time of Concentration in minutes (See Design Stds §3.200)
I = Rainfall Intensity in inches per hour, 2±yr storm
I = 5.51*(Tc)^(-0.63)

10YR I = 9.71*(Tc)^(-0.63)

Tc	I	Tc	I	Tc	I	Tc	I
10	1.29	40	0.54	90	0.32	240	0.17
11	1.22	41	0.53	95	0.31	245	0.17
12	1.15	42	0.52	100	0.30	250	0.17
13	1.09	43	0.52	105	0.29	255	0.17
14	1.04	44	0.51	110	0.29	260	0.17
15	1.00	45	0.50	115	0.28	265	0.16
16	0.96	46	0.49	120	0.27	270	0.16
17	0.92	47	0.49	125	0.26	275	0.16
18	0.89	48	0.48	130	0.26	280	0.16
19	0.86	49	0.47	135	0.25	285	0.16
20	0.83	50	0.47	140	0.24	290	0.15
21	0.81	51	0.46	145	0.24	295	0.15
22	0.79	52	0.46	150	0.23	300	0.15
23	0.76	53	0.45	155	0.23	305	0.15
24	0.74	54	0.45	160	0.23	310	0.15
25	0.73	55	0.44	165	0.22	315	0.15
26	0.71	56	0.44	170	0.22	320	0.15
27	0.69	57	0.43	175	0.21	325	0.14
28	0.68	58	0.43	180	0.21	330	0.14
29	0.66	59	0.42	185	0.21	335	0.14
30	0.65	60	0.42	190	0.20	340	0.14
31	0.63	61	0.41	195	0.20	345	0.14
32	0.62	62	0.41	200	0.20	350	0.14
33	0.61	63	0.41	205	0.19	355	0.14
34	0.60	64	0.40	210	0.19	360	0.14
35	0.59	65	0.40	215	0.19	365	0.13
36	0.58	70	0.38	220	0.18	370	0.13
37	0.57	75	0.36	225	0.18	375	0.13
38	0.56	80	0.35	230	0.18	380	0.13
39	0.55	85	0.34	235	0.18	385	0.13

Dr. KT	No.	Date	Revision	Appr.	Approved By: F. Wally Sandelin, City Engineer, R.C.E. 39895 — 12/28/00 Date	STD PLAN 606
Ch. WS						
Date 12/00						

Mike Hauge

From: Chris Boyer [cboyer@lodi.gov] FROM CITY OF LODI
Sent: Wednesday, August 27, 2008 8:58 AM
To: Ernest Chan
Subject: FW: Rainfall Intensity Formula
Attachments: return Period Intensity.xls

This should help. Let me know if you need anything else.

Chris Boyer

From: Lyman M Chang
Sent: Wednesday, August 27, 2008 8:55 AM
To: Chris Boyer
Cc: Sharon Welch
Subject: Rainfall Intensity Formula

The I values shown on Standard Plan 606 for different storms are as follow:

5-year storm: I = 8.13 *(Tc)^(-0.63)
10-year storm: I = 9.71 *(Tc)^(-0.63) ←

Design Storm Volume – Per Erosion & Sediment control Guidelines for Developing Areas of the Sierras by High Sierra RC&D Council, November 1981

T_c = Time of Concentration (in hour)
T_p = Time of Peak = $0.6T_c$
T_b = Time Base = $2.67T_p$
V_d = 1800 (Q_d x T_b) = Design Storm Volume (ft^3)

Pre-Construction

Shed A (See Pre-Development Shed Map DS-1 in Appendix)

$\mathbf{V_{d\ (2\text{-}Yr)}}$ = 1800 x 1.61 cfs x $2.67T_p$ = 1800 x 1.61 cfs x 2.67 x $0.6T_c$
= 1800 x 1.61 cfs x 2.67 x 0.6 x 0.17 hr = **789 ft^3**
$\mathbf{V_{d\ (10\text{-}Yr)}}$ = 1800 x 2.84 cfs x $2.67T_p$ = 1800 x 2.84cfs x 2.67 x $0.6T_c$
= 1800 x 2.84 cfs x 2.67 x 0.6 x 0.17 hr = **1392 ft^3**

Post-Construction

Shed A (See Post-Development Shed Map DS-2 in Appendix)

$\mathbf{V_{d(2\text{-}Yr)}}$ = 1800 x 4.14 cfs x $2.67T_p$ = 1800 x 4.14 cfs x 2.67 x $0.6T_c$
= 1800 x 4.14 cfs x 2.67 x 0.6 x 0.17 hr = **2029 ft^3**
$\mathbf{V_{d(10\text{-}Yr)}}$ = 1800 x 7.31 cfs x $2.67T_p$ = 1800 x 7.31 cfs x 2.67 x $0.6T_c$
= 1800 x 7.31 cfs x 2.67 x 0.6 x 0.17 hr = **3583 ft^3**

2-Yr Volume of Detention:

Southwest Outlet (Point of Interest) = (Post Development Design Volume – Pre Development Design Volume) = 2029 ft^3 – 789 ft^3 = **1240 ft^3**, equivalent to **253LF 30" SD pipe**.

Erosion & Sediment Control Guidelines for Developing Areas of the Sierras

Prepared by the High Sierra RC&D Council

November 1981

APPENDICES

Appendix A - Rational Method for Peak Storm Runoff and Storn Runoff Volume
Figure 1 - Isohyetal Map
Figure 2 - Time of Concentration
Table 1 - Estimating "C"

Appendix B - Engineering Field Manual
Chapter 2 - Estimated Runoff
Supplement 1 - Estimated Runoff in California

A. Calculations for Peak Storm Runoff and Storm Runoff Volume

For sizing the components of various erosion control practices it is necessary to determine the peak runoff flow and the storm runoff volume. The Rational Method is used for calculating the peak storm runoff rate. An estimate of the runoff volume from the peak storm is made using the Triangular Hydrograph Method.

The rational method and the triangular hydrograph method are widely used and provide acceptable design flows for a large variety of applications.

The use of these methods should be limited to small watershed areas. It is anticipated that these methods will be used for watersheds less than one square mile in area. For areas greater than one square mile use SCS methods given in Appendix B.

Storm Runoff Rate by Rational Method

The basic equation in the rational formula is:

$Q = C\ I\ A$

Where
- Q = Peak Discharge, cubic feet per second
- C = Coefficient of runoff
- I = Average rainfall intensity, inches per hour for a given frequency and for a duration equal to the time of concentration (T_c)
- A = Drainage Area, acres

Peak Storm Runoff-The following procedure is used to calculate the peak storm runoff rate.

1. Using Figure 1 locate the project site with a section township and range description. Find the mean annual precipitation from the closest isohyetal contour.

2. Calculate the time of concentration (T_c)

   Using the following equation:(1)

   $$Tc = \left(\frac{11.9\ L}{H}\right)^{0.385}$$

   Where
   - Tc = time of concentration in hours
   - L = length of longest watercourse through watershed, in miles
   - H = elevation difference along longest watercourse, in feet

3. Enter Figure 2(2) at T_c calculated above, go vertically to desired storm frequency curve (10 yr., 25 yr., 100 yr.), then go horizontally to the mean annual precipitation determined in 1 above, read the intensity (I).

(1) "California Culvert Practice," California Highways and Public Works.
(2) "Loomis Basin Hydraulic Investigation Study."

4. Determine the area (A) of the watershed.

5. From Table 1, estimate the value of the coefficient of runoff (C). An example for determining "C" for improved and unimproved areas is given.

6. With "C", "I" and "A" calculate the peak storm runoff rate, (Q_p) in cubic feet per second (cfs).

$$Q = C\ I\ A$$

Design Storm Volume - The following procedure is used to calculate the design storm volume.

1. Determine mean annual precipitation, see step 1 for peak storm runoff.

2. Using design storm duration (D), enter Figure 2, go vertically to desired storm frequency curve (10-yr, 25-yr, 100-yr), then go horizontally to the mean annual precipitation determined in above 1, read the intensity (I).

3. Determine the area (A) of the watershed.

4. From Table 1 estimate the value of the coefficient of runoff (C).

5. With "C", "I", and "A" claculate the design storm peak flow rate (Q_D) in cubic feet per second.

$$Q = C\ I\ A$$

6. Calculate the time in hours from start of hydrograph rise to peak rate (T_p).

$$T_p = 0.5\ D = 0.6\ T_c \quad (3)$$

"D" and "T_c" have been determined above.

7. Calculate time base of hydrograph (T_b).

$$T_b = 2.67\ T_p \quad (3)$$

8. Determine design storm volume (V_D) in cubic feet

$$V_D = 1800\ (Q_D \times T_b)$$

Figure 3 gives a graphical representation of the relationship between T_p, T_b, Q_D and V_D. The area enclosed by the triangle represents the design storm volume.

(3) "Design of Small Dams", US. Bureau of Reclamation.

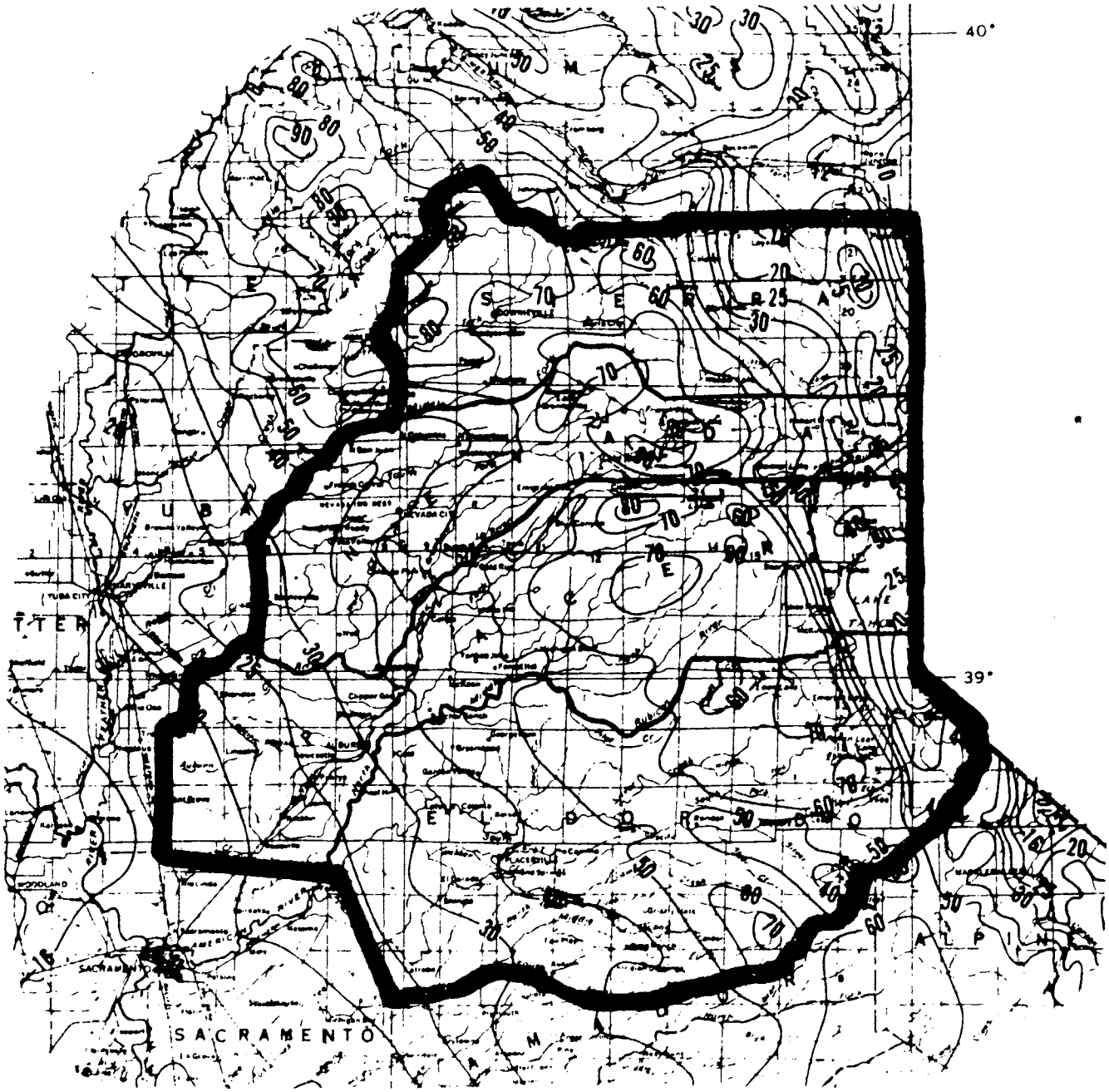


FIGURE 1 - ISOHYETAL MAP OF FOUR-COUNTY AREA

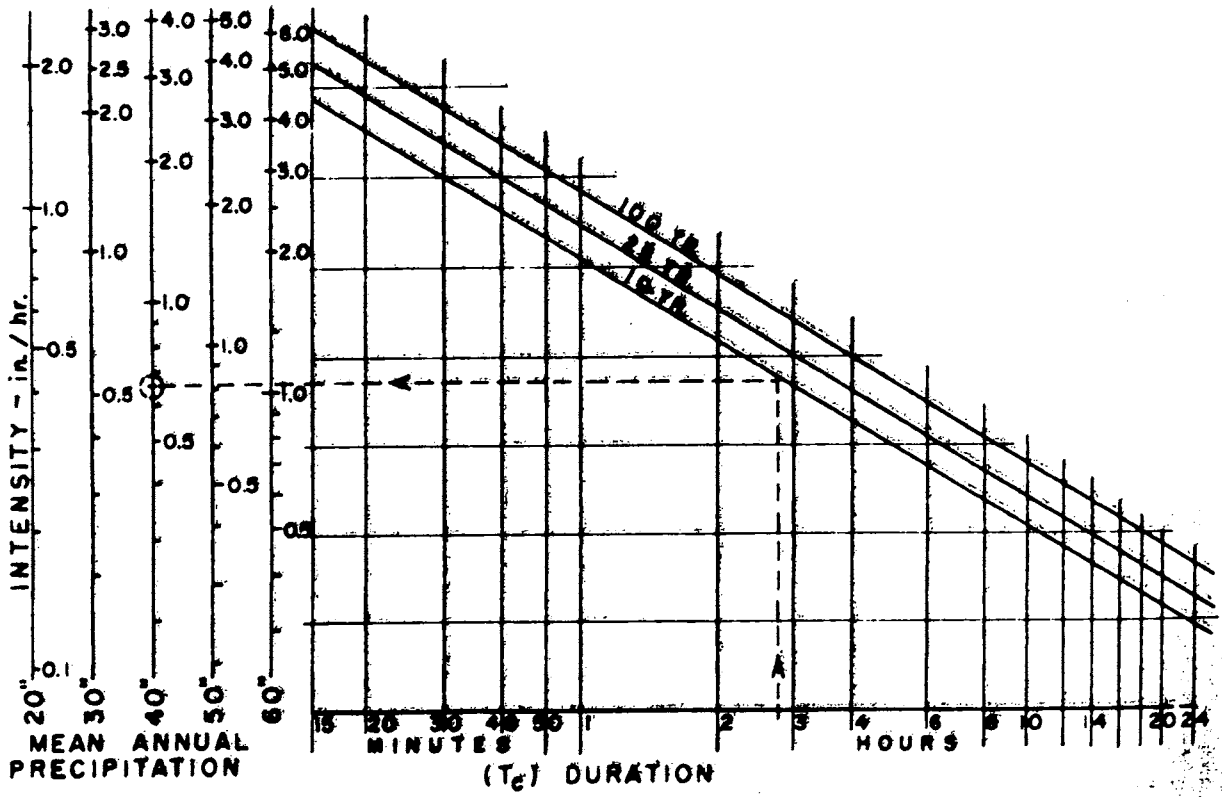


FIGURE 2 - TIME OF CONCENTRATION (Tc) VS. RAINFALL INTENSITY (I)

TABLE 1

ESTIMATING "C" IN RATIONAL FORMULA

UNIMPROVED AREAS

CONDITION	EXTREME	HIGH	MODERATE	LOW
Slope	.32 Above 30%	.24 10% = 30%	.17 5 - 10%	.11 0 - 5%
Surface permeability.	.14 Bare rock or very thin soil.	.10 Impervious clays, shallow soils.	.07 Well drained soils.	.05 Deep sand, volcanic ash.
Vegetation	.14 None or very sparse.	.10 Less than 20% covered with substantial growth.	.07 About 50% covered with heavy growth.	.05 90% covered with heavy growth, deep humus layer.
Surface	.11 Smooth soil, slick rock, drainage flow continuous.	.09 Roughened soil or rocks.	.07 Drainage flow interrupted, many ponds, lakes, marshes.	.05 Drainage flow arrested, large lakes, ponds, marshes

IMPROVED AREAS

Surface	C
Roof Surfaces	.90
Asphalt or Concrete Pavement, patios, driveways, streets, sidewalks	.85
Landscaped areas	.25
Gravel walks, roadways	.30

TABLE 1 (continued)

EXAMPLE 1: Unimproved

20% Slope	.24
Well drained soil	.07
Fair cover	.07
No ponds	.07
C =	.45

EXAMPLE 2: Improved

20 acre tract

3 arces roof	@	.90
10 acres A. C. Pave.	@	.85
7 acres landscaped	@	.25

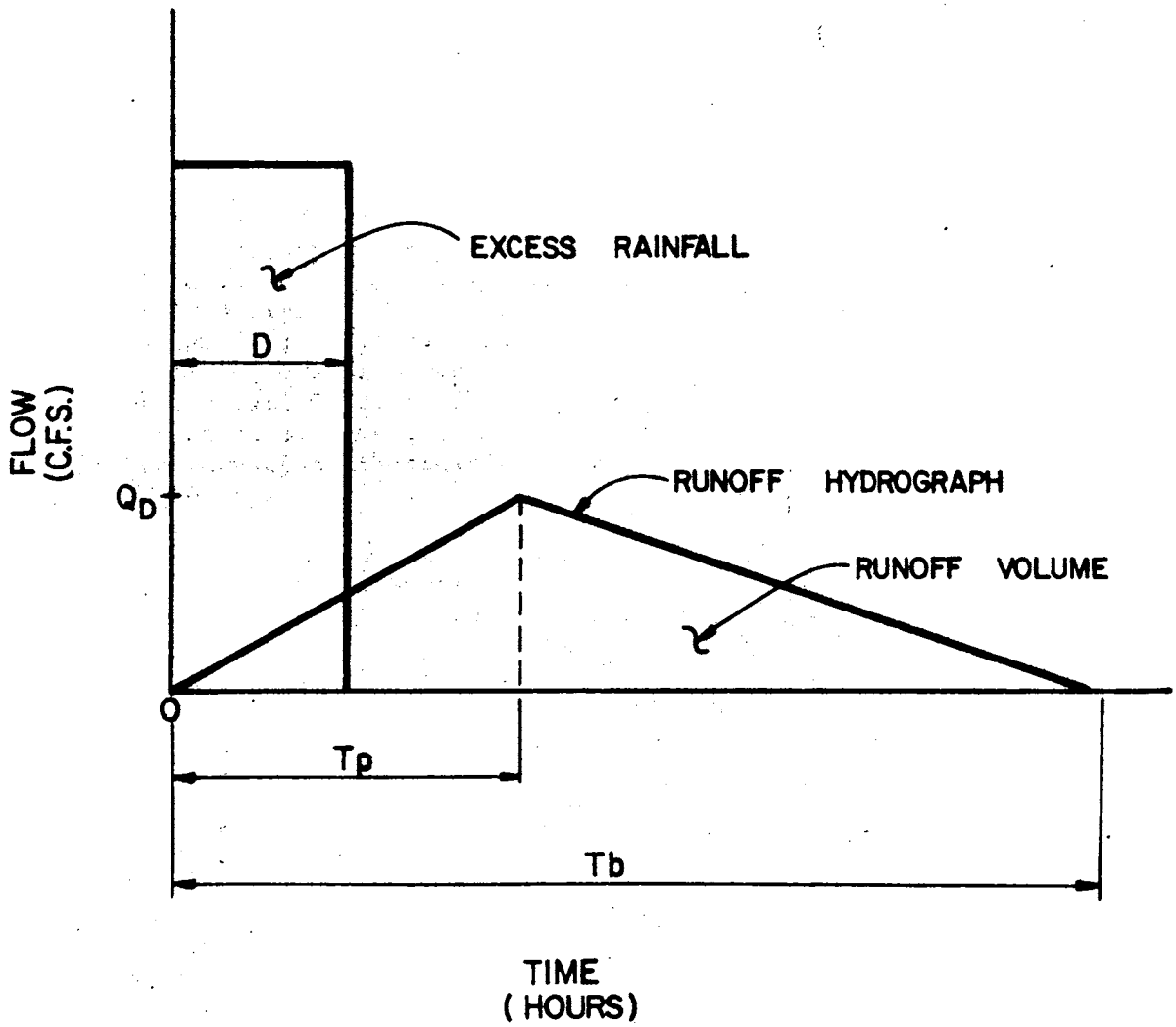
$$C = \frac{3 \times .90 + 10 \times .85 + 7 \times .25}{20} = 0.65$$

EXAMPLE 3: Combination

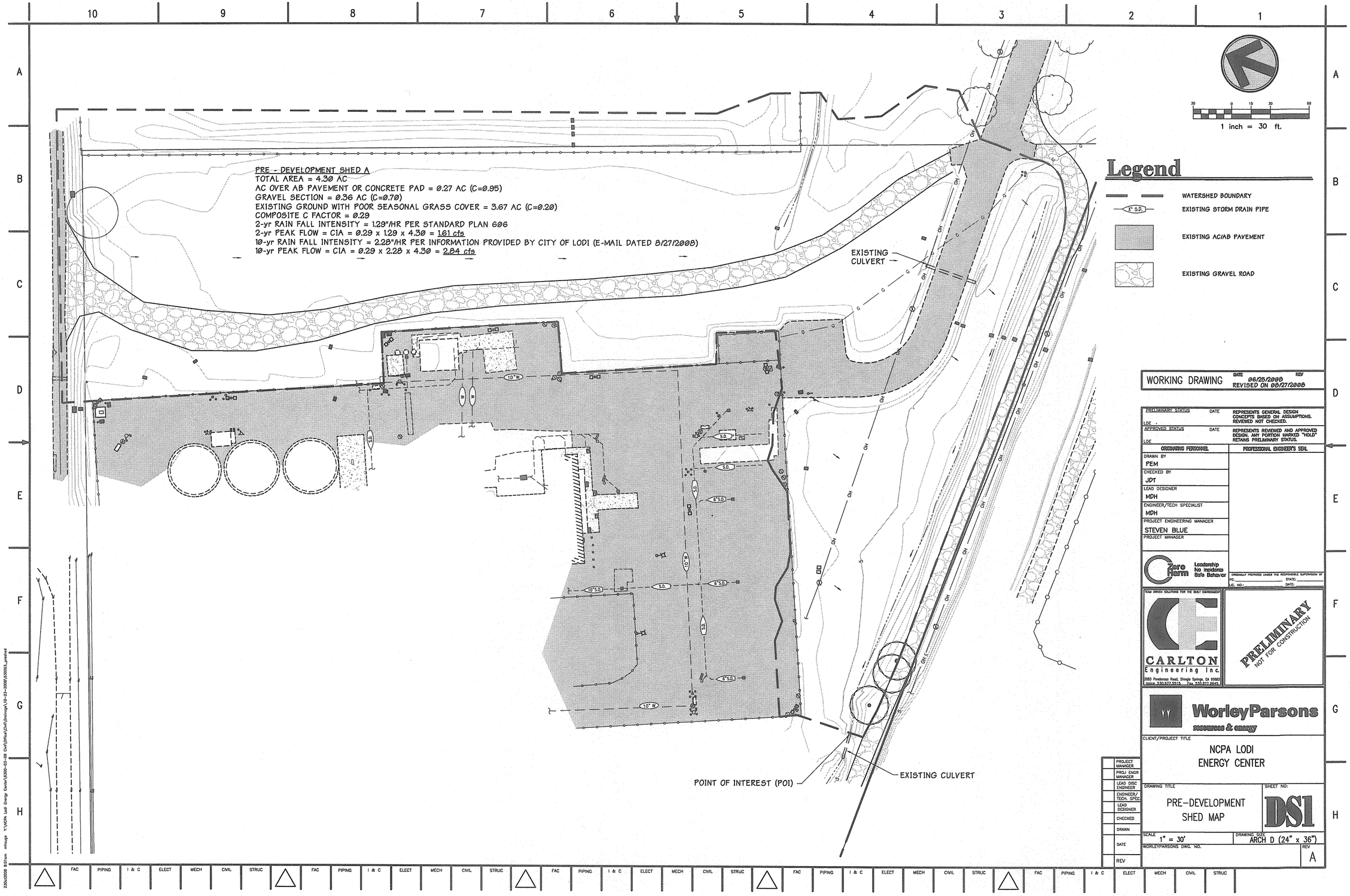
20 acre tract

5 acres improved	@ 0.65
15 acres unimproved	@ 0.45

$$C = \frac{5 \times 0.65 + 15 \times 0.45}{20} = 0.50$$



EXAMPLE OF THE TRIANGULAR HYDROGRAPH



WORKING DRAWING DATE 06/25/2008 REV REVISED ON 08/27/2008

PRELIMINARY STATUS LDE	DATE	REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS LDE	DATE	REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY PEM	
CHECKED BY JDT	
LEAD DESIGNER MDH	
ENGINEER/TECH SPECIALIST MDH	
PROJECT ENGINEERING MANAGER STEVEN BLUE	
PROJECT MANAGER	

Zero Harm Leadership No Incidents Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF PE: STATE: LIC. NO.: DATE:

TEAM DRIVEN SOLUTIONS FOR THE BUILT ENVIRONMENT

CARLTON Engineering Inc.
3883 Ponderosa Road, Shingle Springs, CA 95682
Voice 530.677.5515 Fax 530.677.6645

PRELIMINARY NOT FOR CONSTRUCTION

WorleyParsons resources & energy

CLIENT/PROJECT TITLE
NCPA LODI ENERGY CENTER

DRAWING TITLE
PRE-DEVELOPMENT SHED MAP

SHEET NO: DS1

SCALE 1" = 30'

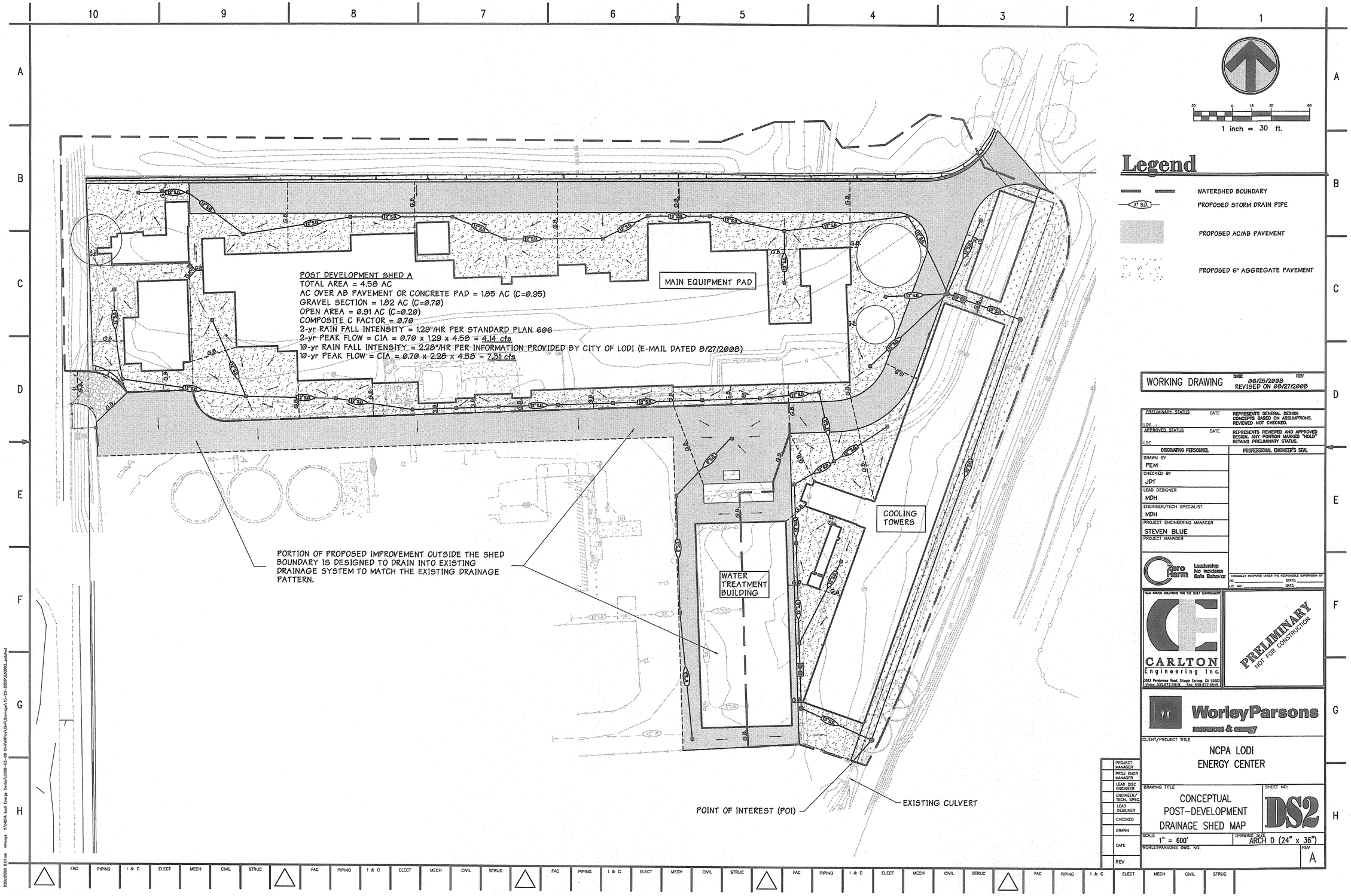
DRAWING SIZE ARCH D (24" x 36")

WORLEYPARSONS DWG. NO.

REV A

PROJECT MANAGER	
PROJ ENGR MANAGER	
LEAD DISC ENGINEER	
ENGINEER/ TECH. SPEC.	
LEAD DESIGNER	
CHECKED	
DRAWN	
DATE	
REV	

FAC PIPING I & C ELECT MECH CIVIL STRUC



POST DEVELOPMENT SHED A
TOTAL AREA = 4.58 AC
AC OVER AB PAVEMENT OR CONCRETE PAD = 1.85 AC (C=0.95)
GRAVEL SECTION = 1.82 AC (C=0.70)
OPEN AREA = 0.91 AC (C=0.20)
COMPOSITE C FACTOR = 0.70
2-yr RAIN FALL INTENSITY = 1.29"/HR PER STANDARD PLAN 606
2-yr PEAK FLOW = CIA = 0.70 x 1.29 x 4.58 = 4.14 cfs
10-yr RAIN FALL INTENSITY = 2.28"/HR PER INFORMATION PROVIDED BY CITY OF LODI (E-MAIL DATED 8/27/2008)
10-yr PEAK FLOW = CIA = 0.70 x 2.28 x 4.58 = 7.31 cfs
MAIN EQUIPMENT PAD
COOLING TOWERS
WATER TREATMENT BUILDING
PORTION OF PROPOSED IMPROVEMENT OUTSIDE THE SHED BOUNDARY IS DESIGNED TO DRAIN INTO EXISTING DRAINAGE SYSTEM TO MATCH THE EXISTING DRAINAGE PATTERN.
POINT OF INTEREST (POI)
EXISTING CULVERT
1 inch = 30 ft.
Legend
WATERSHED BOUNDARY
PROPOSED STORM DRAIN PIPE
PROPOSED AC/AB PAVEMENT
PROPOSED 6" AGGREGATE PAVEMENT
WORKING DRAWING
DATE 06/25/2008
REVISED ON 08/27/2008
PRELIMINARY STATUS
REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.
APPROVED STATUS
REPRESENTS REVIEWED AND APPROVED DESIGN. ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.
ORIGINATING PERSONNEL
PROFESSIONAL ENGINEER'S SEAL
DRAWN BY PEM
CHECKED BY JDT
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PROJECT MANAGER
Zero Harm
Leadership No Incidents Safe Behavior
CARLTON Engineering Inc.
PRELIMINARY NOT FOR CONSTRUCTION
WorleyParsons resources & energy
CLIENT/PROJECT TITLE
NCPA LODI ENERGY CENTER
DRAWING TITLE
CONCEPTUAL POST-DEVELOPMENT DRAINAGE SHED MAP
SHEET NO: DS2
SCALE 1" = 600'
DRAWING SIZE ARCH D (24" x 36")
WORLEYPARSONS DWG. NO.
REV A

ATTACHMENT DA 5.15-8

City of Lodi Stormwater Management Plan

CITY OF LODI

STORMWATER MANAGEMENT PROGRAM

Prepared by

BLACK & VEATCH
Corporation

January 2003

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 1-5

2. REPORT ORGANIZATION 2-9

3. INTRODUCTION 3-11

4. PHASE II NPDES PERMIT REQUIREMENTS 4-13

4.1. DISCUSSION OF REQUIRED BMPS 4-14
4.1.1. Public Education and Outreach 4-14
4.1.2. Public Participation/Involvement 4-14
4.1.3. Illicit Discharge Detection and Elimination 4-15
4.1.4. Construction Site Runoff Control 4-16
4.1.5. Post-Construction Runoff Control 4-16
4.1.6. Pollution Prevention/Good Housekeeping 4-17

5. DESCRIPTION OF EXISTING STORMWATER DRAINAGE AND COLLECTION SYSTEM 5-19

5.1. CITY OF LODI 5-19
5.2. CATCH BASINS AND MANHOLES 5-19
5.3. OUTLETS 5-19
5.4. DETENTION BASINS 5-21
5.5. PUMPING STATIONS 5-22
5.6. PIPE CONVEYANCE 5-22
5.7. WOODBRIDGE IRRIGATION DISTRICT CANAL 5-23
5.8. CAPACITY ISSUES 5-24

6. CONVEYANCE SYSTEM OPERATIONS AND MAINTENANCE PROCEDURES 6-25

6.1. PERSONNEL AND EQUIPMENT 6-25
6.2. INLETS AND MANHOLES 6-25
6.3. CATCH BASINS 6-25
6.4. PIPELINES 6-25
6.5. OUTLETS 6-25
6.6. STREET SWEEPING 6-26
6.7. PUMP STATIONS 6-26
6.8. DETENTION BASINS 6-26

7. BUDGET INFORMATION 7-27

7.1. BUDGET PROCEDURES 7-27
7.2. BUDGET SUMMARY 7-27

8. CURRENT BEST MANAGEMENT PRACTICES 8-29

8.1. LODI ALL EMERGENCY PREPAREDNESS EXPO 8-29
8.2. STORM DRAIN DETECTIVES 8-29
8.3. FACILITY DOCUMENTATION 8-30
8.4. LODI MUNICIPAL CODE 8-30
8.5. EROSION CONTROL FOR CONSTRUCTION 8-30
8.6. URBAN FORESTRY 8-31
8.7. MOKELUMNE RIVER WATERSHED OWNER'S MANUAL 8-31
8.8. STORM DRAIN LABELING 8-32
8.9. STORM DRAIN OUTLETS 8-32
8.10. HERITAGE PRIMARY SCHOOL CLEAN-UP 8-32

9. LODI STORMWATER MANAGEMENT CHALLENGES 9-33

9.1. CONSTRUCTION SITES 9-33

9.2. FLOATABLE DEBRIS 9-34

10. STORMWATER MANAGEMENT PROGRAM ELEMENTS 10-35

10.1. PHASE II NPDES COMPLIANCE STRATEGY 10-35
10.1.1.Public Education and Outreach 10-35
10.1.2.Public Participation/Involvement 10-36
10.1.3.Illicit Discharge Detection and Elimination 10-37
10.1.4.Construction Site Runoff Control 10-38
10.1.5.Post-Construction Runoff Control 10-39
10.1.6.Pollution Prevention/Good Housekeeping 10-41

11. PROGRAM COST SUMMARY 11-45

APPENDIX A ..... DESCRIPTION OF BMPS

APPENDIX B ..... STORMWATER SYSTEM MAPS

TABLE OF FIGURES

FIGURE 5-1 - OUTLET LOCATIONS 5-20

TABLE OF TABLES

TABLE 1-1 - CITY OF LODI BMPS AND POLLUTANTS ADDRESSED 1-6
TABLE 1-2 - GENERAL BMP DESCRIPTION 1-7
TABLE 1-3 – NPDES PHASE II CATEGORY-SPECIFIC BMPS 1-8
TABLE 3-1 - COMMON STORMWATER POLLUTANTS, SOURCES, AND POSSIBLE IMPACTS 3-11
TABLE 4-1 - NPDES PHASE II REQUIREMENTS 4-14
TABLE 5-1 - CITY CATCH BASINS AND MANHOLES 5-19
TABLE 5-2 - OUTLET LOCATION DESCRIPTION 5-21
TABLE 5-3 - STORM DRAIN SYSTEM BASIN DATA 5-21
TABLE 5-4 - CITY OF LODI STORMWATER PUMPS 5-22
TABLE 5-5 - STORM LINE LINEAL FOOTAGES. 5-23
TABLE 7-1 - 2001-2002 STORM DRAIN MAINTENANCE BUDGET 7-28
TABLE 8-1 - CITY OF LODI, STORM DRAIN DETECTIVES BUDGET 8-29
TABLE 10-5 - PUBLIC EDUCATION AND OUTREACH PROGRAM 10-36
TABLE 10-6 - PUBLIC INVOLVEMENT / PARTICIPATION PROGRAM 10-37
TABLE 10-7 - ILLICIT DISCHARGE DETECTION AND ELIMINATION PROGRAM 10-38
TABLE 10-8 - CONSTRUCTION SITE RUNOFF CONTROL PROGRAM 10-39
TABLE 10-9 - POST CONSTRUCTION STORM WATER MANAGEMENTO IN NEW AND REDEVELOPMENT 10-41
TABLE 10-10 - POLLUTION PREVENTION/GOOD HOUSEKEEPING 10-42
TABLE 11-1 - BMP IMPLEMENTATION COST 11-45

1. Executive Summary

Phase II of the National Pollutant Discharge Elimination System (NPDES) requires the City of Lodi, and all other small municipal separate storm sewer systems (MS4s) to obtain a permit for storm water discharges. The City is required to develop and implement a Stormwater Management Program (SMP) that describes best management practices (BMPs), measurable goals, and timetables for implementation in six program areas: public education and outreach, illicit discharge detection and elimination, public participation/involvement, construction site runoff control, post-construction runoff control, and pollution prevention/good housekeeping. Additionally, the MS4 must reduce its discharge of pollutants to the Maximum Extent Practicable (MEP) and perform inspections and monitoring. The following document is the City's SMP.

The BMPs chosen were determined through a series of meetings, both public and internal. Initially, City Staff met with Black & Veatch to discuss issues and project goals. Black & Veatch then developed a series of BMPs which initially were presented to staff and then to the general populous at a public meeting. No public comments were received following the meeting, and the SMP was finalized.

Table 1-1 relates key BMPs the City has chosen to implement and the pollutants they will be designed to address. The pollutant load reductions resulting from BMP implementation will help ensure that the City meets NPDES requirements and that the Mokelumne River water will be a protected source, suitable for drinking water supply for years to come.

Table 1-1 - City of Lodi BMPs and Pollutants Addressed

City of Lodi BMP	Category of Pollutant Addressed								
	Nutrients	Sediments	Organic Materials	Pathogens	Hydrocarbons	Metals	Synthetic Chemicals	Chlorides	Trash and Debris
BMP Inspection & Maintenance	✓	✓	✓	✓	✓	✓	✓	✓	✓
Classroom Education	✓	✓			✓		✓		✓
Community Car Washing	✓				✓				
Community Educational Efforts	✓	✓	✓	✓	✓	✓	✓	✓	✓
Community Hotline					✓	✓	✓		✓
Contractor/Inspector Training		✓							✓
Detention Ponds		✓	✓						✓
Disposal of Chlorinated Water							✓	✓	
Erosion Control for Construction	✓	✓			✓				✓
Floatable Debris Control Program					✓				✓
Grass-lined Swale	✓	✓	✓	✓					
Illicit Discharge Detection & Control Programs			✓	✓	✓	✓	✓		✓
Inlet/Outlet Protection		✓							
Lodi Municipal Code	✓	✓	✓	✓	✓	✓	✓	✓	✓
Storm Drain Cleaning		✓		✓					✓
Storm Drain Detectives	✓	✓	✓						✓
Street Cleaning	✓	✓	✓	✓	✓	✓		✓	✓
Urban Forestry	✓	✓							

Details of the BMPs and instructions on their implementation can be found in Appendix A to this report. Table 1-2 is a brief description of the BMPs.

Table 1-2 - General BMP Description

BMP	Discussion
BMP Inspection and Maintenance	BMP inspection is necessary to ensure BMPs are in proper working order. Generally, inspection and maintenance of BMPs can be categorized into two groups: expected routine maintenance and nonroutine (repair) maintenance.
Classroom Education	The classroom education BMP involves a variety of activities to promote stormwater awareness in local classrooms.
Community Car Washing	This practice involves educating the public, businesses, and municipal fleets regarding the water quality impacts of the outdoor washing of automobiles and how to avoid allowing polluted runoff to enter the storm drain system. The City has chosen to pay special attention to the potential impacts of fundraising type carwashes.
Community Educational Efforts	Community education is key to the success of the Plan. The program will address this BMP through a variety of means including pamphlets, local media, mailers, and classroom contact.
Community Hotline	Community hotlines provide a means for concerned citizens and agencies to contact the appropriate authority when they see water quality problems.
Contractor / Inspector Training	Ensuring that contractors and inspectors are properly trained is key to proper BMP implementation. Contractor training can be accomplished through municipally-sponsored training courses, or more informally through mandatory preconstruction or prewintering meetings and regular and final inspection visits to transfer information to contractors.
Detention Ponds	This BMP will ensure that the City continues to use existing detention basins in their stormwater protection strategy.
Disposal of Chlorinated Water	Chlorinated water discharged to surface waters has an adverse impact on local water quality. Proper disposal of chlorinated water can include dechlorination before discharge and/or discharge to the sanitary sewer system.
Erosion Control for Construction	Erosion control for construction will be approached through a variety of mechanisms including construction entrances, tire wash facilities, outlet protection, check dams, sediment barriers, inlet protection, and concrete washouts.
Floatable Debris Control Program	Floatable debris represents a significant source of pollution within the City. The City will begin by identifying the sources of floatable material in stormwater. The program will then be expanded to control the amount of material in the outflow of the system.
Grass-lined Swale	Grass-lined swales are a series of vegetated, open channels designed specifically to treat and attenuate stormwater runoff for a specified water quality volume.
Illicit Discharge Detection and Control Programs	The objective of an illicit discharge investigation program is to identify and eliminate the discharge of pollutants to the stormwater drainage system. Controlling illicit discharges provides important public health benefits as well as ecosystem protection.
Inlet/Outlet Protection	This BMP helps ensure pollutants will be stopped from entering the stormwater system and the natural environment.
Lodi Municipal Code	The current sections of the Lodi Municipal Code do not adequately address the Phase II requirements. For that reason substantial changes to the Code will be required.
Storm Drain Cleaning	Storm drain systems need to be cleaned regularly in order to maintain their ability to trap sediment and prevent flooding.
Storm Drain Detectives	Storm Drain Detectives is a collaborative effort of the City of Lodi Public Works Department, State Water Resources Control Board-Division of Water Quality, Lodi Lake Nature Area Docent Council, and four local high schools. Monthly monitoring of nine locations along the Mokelumne River and Lodi Lake is done trained volunteers.
Street Cleaning	This management practice involves employing pavement cleaning practices such as street sweeping on a regular basis to minimize pollutant export to receiving streams.
Urban Forestry	Urban forestry is the practice of establishing and maintaining trees and forests in and around towns and cities. Since trees absorb water, patches of forest and the trees that line streets can help provide some of the stormwater management required in an urban setting.

Specific BMPs and the Phase II NPDES requirements they fulfill are shown in Table 1-3.

Table 1-3 – NPDES Phase II Category-Specific BMPs

	NPDES Phase II Program Categories					
	Public Education and Outreach	**Public Participation/ Involvement**	**Illicit Discharge Detection and Elimination**	**Construction Site Runoff Control**	**Post-Construction Runoff Control**	**Pollution Prevention/ Good Housekeeping**
Lodi All Emergency Preparedness Expo	X	X				
Storm Drain Detectives	X	X	X			X
Storm Drain Labeling	X	X	X			X
Detention Ponds					X	X
City Design Standards				X	X	
Mokelumne River Watershed Owner's Manual	X	X				X
BMP Inspection and Maintenance			X	X	X	X
Check Dam				X		
Classroom Education	X	X				
Community Car Washing	X	X				X
Community Hotline	X	X	X			
Concrete Washout				X		
Construction Entrance				X		
Contractor/Inspector Training				X		
Disposal of Chlorinated Water			X			X
Dry Extended Detention Pond					X	X
Educational Pamphlets	X	X	X			X
Floatable Debris Control		X			X	X
Grass-lined Swale					X	X
Illicit Discharge Programs		X	X			
Inlet/Outlet Protection	X	X	X	X	X	X
Ordinance	X	X	X	X	X	X
Sand or Biofilter Bag Sediment Barriers				X		
Storm Drain Cleaning						X
Straw Bale or Roll Sediment Barriers				X		
Street Cleaning						X
Tire Wash Facility				X		
Stormwater Quality Video	X	X				X
Urban Forestry					X	

2. Report Organization

This report is organized as follows:

- Executive Summary
- Report Organization
- Introduction
- Phase II NPDES Permit Requirements
- Description of Existing Stormwater Drainage and Collection Systems
- Conveyance System Operations and Maintenance Procedures
- Budget Information
- Current Best Management Practices
- Lodi Stormwater Management Challenges
- Stormwater Management Program Elements
- Program Cost Summary

3. Introduction

The passage of the Clean Water Act (CWA) in 1972 has led to dramatic increases in the water quality of the Nation's streams and rivers; however, degraded water bodies still exist. According to the 1996 United States Environmental Protection Agency National Water Quality Inventory, approximately 40 percent of the U.S. waters surveyed are considered to be impaired by at least one of a wide variety of pollutants. Stormwater runoff represents a significant source of this contamination. Table 3-1 summarizes the pollutants commonly found in stormwater, their sources, and potential impacts.

Table 3-1 - Common stormwater pollutants, sources, and possible impacts

Pollutants	Common Sources	Possible Impacts
Nutrients: Nitrogen, Phosphorus	Animal waste, fertilizers, failing septic systems, atmospheric deposition, vehicular deposition	Algal growth, reduced clarity, other problems associated with eutrophication (oxygen deficits, release of nutrients and metals from sediments)
Sediments: Suspended in water column and deposited on bottom of water body	Construction sites, other disturbed and/or non-vegetated lands, eroding banks, road sand	Increased turbidity, reduced clarity, lower dissolved oxygen, deposition of sediments, smothering of aquatic habitats including spawning sites
Organic Materials	Leaves, grass clippings	Oxygen deficit in receiving waters, fish kills, turbidity
Pathogens: Bacteria and Viruses	Animal waste, failing septic systems, dumpsters	Human health risks associated with drinking supply, consumption of affected shellfish, and swimming beach contamination
Hydrocarbons: Oil and Grease, PAHs such as Napthalenes & Pyrenes	Industrial processes, automobile wear, emissions and fluid leaks, waste oil	Toxicity of water column and sediment, bioaccumulation through the food chain
Metals: Lead, Copper, Cadmium, Zinc, Mercury Chromium, Aluminum, others	Industrial processes, normal wear of auto brake linings and tires, automobile emissions and fluid leaks, metal roofs	Toxicity of water column and sediment, bioaccumulation in aquatic species and through the food chain, fish kills
Synthetic Chemicals: PCBs, Pesticides	Pesticides (herbicides, insecticides, fungicides, rodenticides), industrial processes	Toxicity of water column and sediment bioaccumulation through the food chain, fish kills
Chlorides	Leaching from naturally occurring sources, septic tanks, fertilizers, and pesticides	Toxicity of water column and sediment
Trash and Debris	Litter washed through storm drain networks, commercial parking lots adjacent to surface water, overflowing	Degradation of surface water aesthetics, threat to wildlife

Source: Adapted from Minnesota Urban Small Sites BMP Manual

The Mokelumne River drains a portion of the central western slope of the Sierra Nevada Mountains to the Sacramento Delta and serves as a source of water supply for a large portion of Northern California. The City drainage system is bounded by the Mokelumne River on the North; Harney Lane on the South; the CCT Railroad, Kettleman Lane and Highway 99 on the East; and the Woodbridge Irrigation District (WID) Canal and approximately 2,600 feet west of Sacramento Road on the West. The drainage area totals approximately 6,673 acres (10.4 sq. mi.). The population of the City is approximately 58,950.

As part of the Environmental Protection Agency's (EPA's) Phase II National Pollutant Discharge Elimination System (NPDES) requirements, Black & Veatch completed a Phase II permit application for the City. This document is the City of Lodi Stormwater Management Program (SMP) that has developed from the permit application. The SMP has three objectives: to minimize the impact of stormwater drainage on the residents of Lodi, to minimize the negative impacts of receiving water quality of the Mokelumne River, and to minimize the negative impacts on the fish and wildlife habitat.

In order to accomplish these objectives, the SMP is designed to reduce the discharge of stormwater pollutants to the Maximum Extent Practicable (MEP), protect water quality, and satisfy the appropriate water quality requirements of the Clean Water Act. The SMP includes the development of BMPs in each of six categories, an implementation schedule, and measurable goals to help the City ensure that the water discharged is of the highest quality that is economically possible.

Pollutants are deposited on the ground surface through a variety of urban activities and transported to nearby rivers and streams during periods of rainfall. Common pollutants found in stormwater and addressed by best management practices (BMPs) include pesticides, herbicides, microbiological contaminants, sediments, nutrients, and heavy metals. The Phase II program also places special emphasis on the need to protect stormwater from the pollutants introduced through construction site runoff. In compliance with the NPDES Phase II program, the City chose to address the introduction of contaminants through six general BMP categories outlined in Section 4 of this report.

4. Phase II NPDES Permit Requirements

The Summaries of Regulatory Requirements in this section are based on Federal Law and Draft Waste Discharge Requirements from the California State Water Resources Control Board. Before the SMP is implemented, a review of the final California Phase II NPDES Program Requirements should be completed when they are published. Following the review, the SMP should be modified as necessary.

The City will complete an individual permit to fulfill Phase II requirements. Individual permits are designed to be used by those entities with specific, unique problems that cannot be effectively dealt with under a general permit. They are required for Phase I "medium" and "large" municipal separate storm sewer systems (MS4s), but are not recommended by the EPA for Phase II program implementation. The permitee can submit an individual application for coverage by either the Phase II MS4 program or the Phase I MS4 program. For individual coverage under Phase II, the permitee must follow Phase II permit application requirements and provide an estimate of square mileage served by the system and any additional information requested by the NPDES permitting authority.

Operators of regulated small MS4s are required to submit the following information in their NOI or individual permit application:

- BMPs must specifically address each of the six minimum control measures as shown in Table 4-1 below.
- Measurable goals must be established and listed in the application for each minimum control measure
- Estimated timeframe in which actions to implement each measure will be undertaken, including interim milestones and frequency must be given
- Name(s) of the person(s) responsible for implementing or coordinating the stormwater program must be included.

Table 4-1 - NPDES Phase II Requirements

Public Education and Outreach	Distribute educational materials and perform outreach to inform citizens about the impacts polluted stormwater runoff discharges can have on water quality.
Public Participation/Involvement	Provide opportunities for citizens to participate in program development and implementation, including effectively publicizing public hearings and/or encouraging a citizen representative on a stormwater management panel.
Illicit Discharge Detection and Elimination	Develop and implement an ordinance making it illegal to convey non-stormwater discharges through the MS4, and prepare a plan to detect and eliminate illicit discharges to the storm sewer system (includes developing a system map and informing the community about hazards associated with illegal discharges and improper disposal of waste).
Construction Site Runoff Control	Develop, implement, and enforce an erosion and sediment control program for construction activities that disturb one or more acres of land. (Controls could include silt fences and temporary stormwater detention ponds.)
Post-Construction Runoff Control	Develop, implement, and enforce a program to address discharges of post-construction stormwater runoff from new development and redevelopment areas. Applicable controls could include preventive actions such as protecting sensitive areas (e.g., wetlands) or the use of structural BMPs such as grassed swales or porous pavement.
Pollution Prevention/Good Housekeeping	Develop and implement a program with the goal of preventing or reducing pollutant runoff from municipal operations. The program must include municipal staff training on pollution prevention measures and techniques (e.g., regular street sweeping, reduction in the use of pesticides or street salt, or frequent catch-basin cleaning).

Source: EPA Stormwater Phase II Final Rule Fact Sheet Series

4.1. Discussion of Required BMPs

4.1.1. Public Education and Outreach

An informed, knowledgeable community helps to ensure greater support and compliance and is crucial to the success of a stormwater management. It is noted that the summary of Regulatory Requirements is based on Federal Law and Draft Waste Discharge Requirements from the California State Water Resources Control Board. Before the program is implemented, a review of the final California Requirements should be completed.

4.1.1.1. Summary of Regulatory Requirements

The NPDES Phase II regulations require that the City implement a public education program to distribute educational materials to the community, or conduct equivalent outreach activities about the impacts of stormwater discharges on water bodies and steps the public can take to reduce pollutants in stormwater runoff.

4.1.2. Public Participation/Involvement

The EPA states that the public can provide valuable input and assistance to a regulated small MS4s Municipal Stormwater Management Program, and suggests the public be given opportunities to play roles in developing and implementing the program. Additionally, the EPA states that an active and involved community is crucial to the success of a Stormwater

Management Program because it allows for broader public support, shorter implementation schedules, a broader base of expertise, economic benefits, and a conduit to other programs.

4.1.2.1. Summary of Regulatory Requirements

When implementing a public involvement/participation program, the City of Lodi must, at a minimum, comply with state, tribal, and local public notice requirements. The City must also must make copies of the General Permit and Stormwater Management Program available to the public for review.

4.1.3. Illicit Discharge Detection and Elimination

Discharges from MS4s may frequently include wastes and wastewater from non-stormwater sources. Illicit discharges enter the system through either direct connections (e.g., wastewater piping either mistakenly or deliberately connected to the storm drain system) or indirect connections (e.g., infiltration into the MS4 from failed sanitary sewer systems, spills collected by drain outlets, or paint or used oil dumped directly into a drain). The result is untreated discharges that contribute high levels of pollutants, including heavy metals, toxics, oil and grease, solvents, nutrients, viruses, and bacteria to receiving waterbodies. EPA studies show pollutant levels from these illicit discharges are high enough to significantly degrade receiving water quality and threaten aquatic life, wildlife, and human health. It is important to note that limited data on the Mokelumne River indicates its water is relatively pure and minimally impacted by stormwater discharges.

4.1.3.1. Summary of Regulatory Requirements

To comply with NPDES Phase II program requirements, the City of Lodi must:

- Develop, implement, and enforce a program to detect and eliminate illicit discharges [as defined at Sec. 122.26(b)(2)] into the small MS4.
- If not already completed, develop a storm sewer system map, showing the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls.
- To the extent allowable under state, tribal or local law, effectively prohibit, through ordinance, or other regulatory mechanism, non-stormwater discharges into the municipal storm sewer system and implement appropriate enforcement procedures and actions.
- Develop and implement a plan to detect and address non-stormwater discharges, including illegal dumping, to the MS4 system.
- Inform public employees, businesses, and the general public of hazards associated with illegal discharges to the MS4 and improper disposal of waste.
- The City needs to address the following categories of non-stormwater discharges or flows (i.e., illicit discharges) only if they represent significant contributors of pollutants to the small MS4: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration [as defined at 40 CFR 35.2005(20)], uncontaminated pumped ground water, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, and street wash water.

(Discharges or flows from fire fighting activities are excluded from the effective prohibition against non-stormwater and need only be addressed where they are identified as significant sources of pollutants to waters of the United States.)

4.1.4. Construction Site Runoff Control

Polluted stormwater runoff from construction sites often flows to MS4s and is ultimately discharged into local rivers and streams. During a short period of time, construction sites can contribute more sediment to streams than can be deposited naturally during several decades. The resulting siltation and the contribution of other pollutants from construction sites, can cause physical, chemical, and biological harm to our nation's waters.

4.1.4.1. Summary of Regulatory Requirements

- The City must develop, implement, and enforce a program to reduce pollutants in stormwater runoff to the MS4 from construction activities that result in a land disturbance of one acre or larger. Reduction of stormwater discharges from construction activity disturbing less than one acre must be included in the program if that construction activity is part of a larger common plan of development or sale that would disturb one acre or more.
- The program must include the development and implementation of, at a minimum:
  - ♦ An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under state, tribal, or local law;
  - ♦ Requirements for construction site operators to implement appropriate erosion and sediment control (ESC) best management practices;
  - ♦ Requirements for construction site operators to control waste, such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste, at the construction site that may cause adverse impacts to water quality;
  - ♦ Procedures for site plan review which incorporate consideration of potential water quality impacts;
  - ♦ Procedures for receipt and consideration of information submitted by the public;
  - ♦ Procedures for site inspection and enforcement of control measures (grading permits);
  - ♦ A program to inspect construction sites and enforce actions against violators.

4.1.5. Post-Construction Runoff Control

Post-construction stormwater management is necessary in areas undergoing new development or redevelopment because runoff from these areas has been shown to significantly impact the quality of receiving waterbodies. Many studies indicate that prior planning and design for the minimization of pollutants in post-construction stormwater discharges is the most cost-effective approach to stormwater quality management.

4.1.5.1. Summary of Regulatory Requirements

- The City must develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or

sale, that discharge into the MS4. The program must ensure that controls are in place that would prevent or minimize water quality impacts.

- The City must:
  - ♦ Develop and implement strategies which include a combination of structural and/or non-structural best management practices (BMPs) appropriate for the community;
  - ♦ Use an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under state, tribal or local law;
  - ♦ Ensure adequate long-term operation and maintenance of BMPs.

4.1.6. Pollution Prevention/Good Housekeeping

The Pollution Prevention/Good Housekeeping measure requires the City of Lodi to examine and subsequently alter their own actions to help ensure a reduction in the amount and type of pollution that: (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm sewer systems. This measure, while primarily meant to improve or protect receiving water quality, can also result in a cost savings for the City by encouraging proper and timely maintenance of storm sewer systems, which will help avoid repair costs from damage caused by deterioration and neglect.

4.1.6.1. Summary of Regulatory Requirements

The City must develop and implement an operation and maintenance program that includes a training component which has the ultimate goal of preventing or reducing pollutant runoff from municipal operations. Using training materials that are available from the EPA, the State of California, or other organizations, the program must include employee training to prevent and reduce stormwater pollution from activities such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance.

5. Description of Existing Stormwater Drainage and Collection System

5.1. City of Lodi

The City of Lodi is located in the San Joaquin Valley approximately 6.5 miles north of Stockton and 35 miles south of Sacramento, adjacent to U.S. Highway 99. It covers an area of 10.4 square miles, and as of January 2001, its population was 58,950. The City provides municipal and public utilities, transportation, leisure, cultural, social services, and general government services. Included in the City's municipal services are stormwater and flood control.

The City maintains an intricate, gravity-based stormwater system built around a number of stormwater detention basins and disposal of runoff by pumping to the Woodbridge Canal, Lodi Lake, or the Mokelumne River. The detention basins are scattered throughout the City and are maintained as parks and recreational facilities during non-runoff periods. The following describes the City's current stormwater system and serves as the basis for the Stormwater Management Program.

5.2. Catch Basins and Manholes

Table 5-1 shows the total number of catch basins and manholes in the City's stormwater system for the past four years. On average, 33 catch basins and 28 manholes are added to the system each year.

Table 5-1 - City Catch Basins and Manholes

Year	Total Catch Basins	Total Manholes
1999-00	2,650	1,515
2000-01	2,682	1,545
2001-02	2,710	1,575
2002-03	2,750	1,600

5.3. Outlets

The City's stormwater drainage system includes 18 storm outlets to the Mokelumne River, Lodi Lake, or the Woodbridge Irrigation District Canal. Table 5-2 and Figure 5-1 identify the outlets and their locations throughout the City.

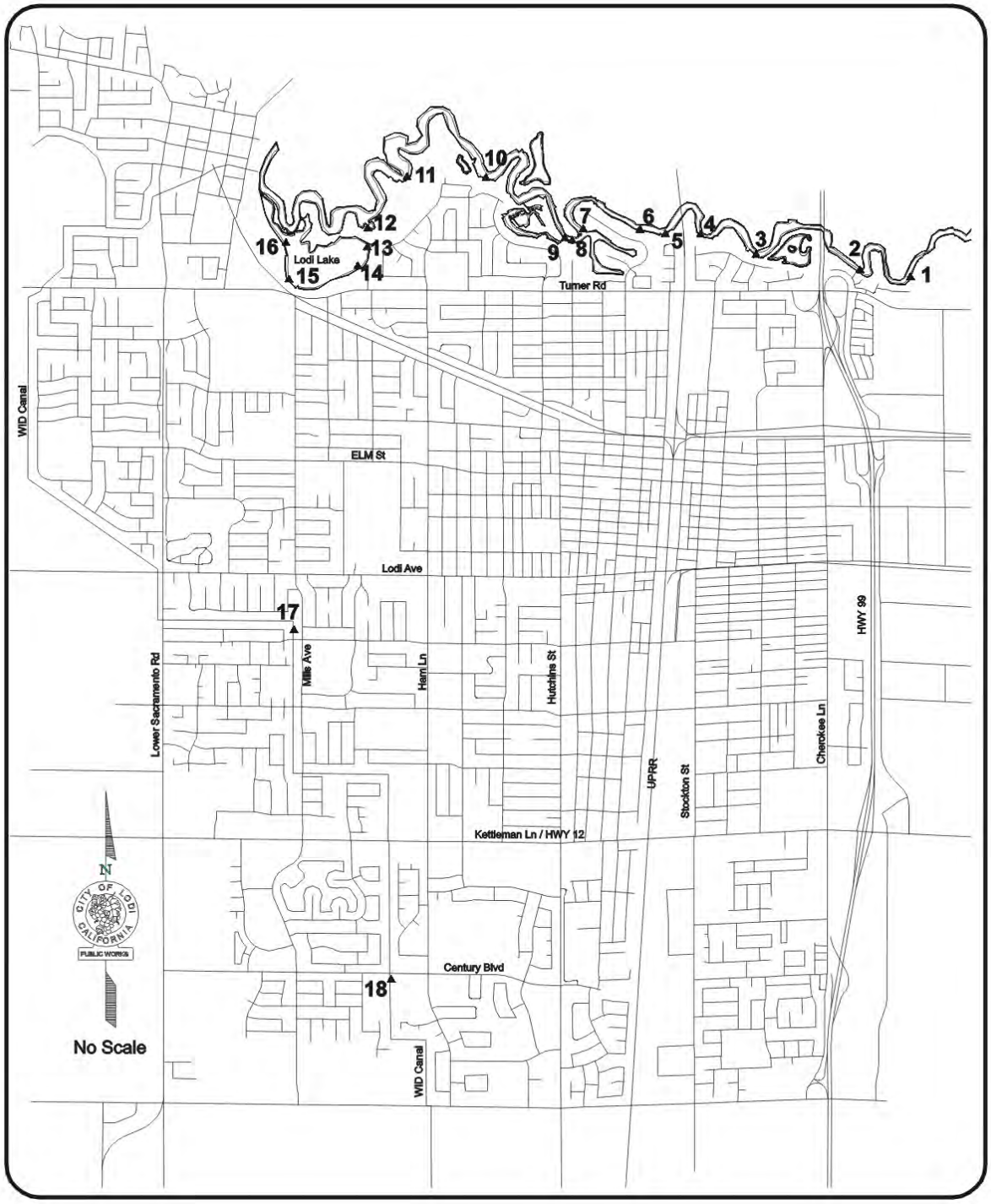

Figure 5-1 - Outlet Locations

Table 5-2 - Outlet Location Description

Outfall No.	Location	Diameter (in)
1	Cluff Avenue (adjacent to Central Valley Waste)	72
2	Mobile Home Park	30
3	317 Mokelumne River Drive	48
4	Awani Drive at Mokelumne River Drive	
5	Sacramento Street at River (Through RiverPointe Subdivision, #1872)	24
6	1202 Rivergate Drive	30
7	1335 Rivergate Drive	12
8	1051 Lincoln	30
9	1144 Edgewood Drive	18
10	1610 Edgewood Drive	21
11	Ham Lane at Lodi Lake Wilderness	36
12	Pump Station at Wilderness	
13	Edgewood Drive at Lodi Lake	21
14	Laurel Avenue at Lodi Lake	8
15	Lodi Lake Pump Station at Mills Avenue	
16	Lodi Lake North of Pump Station	54
17	Shady Acres	
18	Beckman Pump Station, Century Boulevard at Ham Lane	42

5.4. Detention Basins

Several stormwater detention basins are operated by the City to control runoff for events up to a 100-year storm. These detention basins also function as sports facilities (baseball fields, soccer fields, etc.), but their primary purpose is flood control. Table 5-3 summarizes the storm drain basins maintained by the City. A map of outlet locations is included in Appendix B.

Table 5-3 - Storm Drain System Basin Data

Basin/Park	Tributary Area (acres)	Site Land Area (acres)	Detention Capacity (ac.ft.)
A-1, Kofu	491	12[1]	41.5
A-2, Beckman	564	16.2[2]	60.0
B-1, Vinewood	964	16.0	41.5
B-2, Glaves[3]	450	13.2	31.1
C, Pixley[4]	*1,091*	*27.3*	*128.7*
D, Salas	790	21.0	94.0
E, Peterson	340	20.9	61.0
F (at Kettleman)	*369*	*30.0*	*68.5*
F (near Tokay)		*30.0*	*68.5*
G (DeBenedetti)	*866*	*46.3*	*202.0*
H (Discharge to River)	428		
I (Undeveloped)	320	*25.0*	
Total	**6,673**	**227.9**	**728.3**

***Italics* indicate future or partially complete facilities. [1]Kofu acreage includes park south to tennis courts, excludes Municipal Service Center (MSC) & MSC parking. [2]Beckman acreage excludes Fire Station. [3]Glaves Park formerly Twin Oaks Park. [4]Pixley volume does not include 7 ac. ft. in Beckman Rd. ditch**

5.5. Pumping Stations

Lodi's stormwater system is serviced by 45 storm pumps operating at 14 pumping stations, as detailed in Table 5-4. All pumping stations are electrically-powered. Backup auxiliary power is supplied by on-site diesel emergency generators at Lodi Lake, Shady Acres and Beckman Park. The generator at Beckman Park is sized to run concurrently both a well and storm pump located onsite. The City also maintains a portable generator for emergency use.

Table 5-4 - City of Lodi Stormwater Pumps

Station Name	Location	Pump No.	Horsepower	Installed
Salas Park	Near intersection of Century Boulevard and Stockton Street	1, 2	14	October 1983
Cluff Avenue	Near intersection of Cluff Avenue and East Pine Street	1, 2, 3, 4 5, 6	50 14	November 1983 November 1983
Kofu	1300 Block of South Ham Lane	1 2	7 20	February 1969 February 1969
Glaves	2400 Block Oxford Way at Allen Drive	1, 2	2	May 1968
Vinewood	1824 West Tokay Street	1 2, 3, 4	5 30	February, 1983 January, 1970
Lincoln	1050 Lincoln Avenue	1	20	July, 1971
Shady Acres	358 Shady Acres	1, 2, 3 4, 5	40 14	March, 1985 March, 1985
Beckman	1300 Block of Century Boulevard at Woodbridge Canal	1 2 3 4 5, 6 7, 8, 9	50 30 30 14 14 30	October, 1973 September, 1975 October, 1975 October, 1983 November, 1989 November, 1989
Lodi Lake	2003 West Turner	1 2 3, 4	35 50 50	March, 1985 May, 1968 September, 1968
Turner Road	Intersection of Turner Road and Railroad Underpass	1, 2, 3, 4	2	February, 1970
Peterson	Intersection of Evergreen and Elm	1, 2	14	September, 1958
Pixley		1, 2, 3	15	Future
Wilderness	Lodi Lake	1	5	April, 1976
Grape Bowl	Stockton	1	5	January, 1986

5.6. Pipe Conveyance

The City of Lodi maintains 110 miles of stormwater collection and conveyance piping. Lineal footages by pipe size are outlined in Table 5-5.

Table 5-5 - Storm line lineal footages.

Pipe Diameter (in)	Length (ft)
6	1,449
8	26,880
10	32,863
12	117,048
14	22,858
15	49,990
16	16,616
18	68,990
20	3,089
21	21,554
22	499
24	54,668
27	1,309
30	56,604
36	36,628
42	19,477
48	22,270
54	6,420
60	16,960
66	1,331
72	3,163
Total	**580,666 ft** **110 miles**

Updated 3-14-02

5.7. Woodbridge Irrigation District Canal

The WID Canal is the receiving water for a significant portion of the City's stormwater. The Storm Drainage Discharge Agreement (Agreement) between the City and WID serves as the governing document between the two entities and allows the City to discharge stormwater into WID Canals for 40 years. The City is limited to discharging 160 cubic feet per second (cfs), as a maximum winter discharge rate. The maximum winter rate per discharge site is 60 cfs. During the summer WID uses the canal for irrigation purposes. Therefore, the City's discharge rate is reduced to a maximum of 40 cfs total, not to exceed 20 cfs per discharge site. This can be increased by giving WID notice 12 hours prior to discharge. Under the Agreement, the City has the right to modify the existing Beckman and Shady Acres Pump Stations and to construct additional discharge points to accommodate the service area.

On Tuesday, May 14, 2002 Black & Veatch met with Anders (Andy) Christensen, WID General Manager, to discuss any concerns regarding disposal into WID canals. Andy feels that as long as the City is able to meet future water quality requirements and does not exceed the maximum allowed flow, the Agreement will work well. Currently, he feels the main water quality problems appear to be nitrates, most likely from lawn fertilizers, and suspended solids. Evidence of the problem, including algal blooms below City outlets, can be found in the canals following pumping of the City's stormwater.

5.8. Capacity Issues

The City has experienced localized flooding in the past. The 1700 block of Lockeford Street has been a particularly troublesome area. Recent system improvements may have eliminated this problem. Residential streets southwest of Peterson Park have also been identified as areas that experiences occasional flooding due to undersized pipes. In general, operation of the system has shown that the City's stormwater pumps and detention basins are adequate for the runoff volume in the system. No system-wide modeling has been completed to confirm and predict operation of the system as it expands.

6. Conveyance System Operations and Maintenance Procedures

6.1. Personnel and Equipment

The City has 2.25 Full Time Equivalent (FTE) employees during normal periods. Following a storm event the City assigns a crew to patrol, clean and monitor each of six storm patrol districts.

The City maintains the following equipment for stormwater maintenance

- Backhoe
- Small Camera
- Loader
- Pickup trucks/cars
- Rodding truck
- Root cutter
- Sewer cleaner (2)
- Sweeper (2)
- Trucks
- Video Inspection Van

6.2. Inlets and Manholes

City stormwater system inlets and manholes are opened and inspected at least once annually. At the time of inspection, the manholes are cleaned and maintained/repaired as necessary.

6.3. Catch Basins

Stormwater catch basins are inspected and cleaned by hand annually. Liquid from the basins is decanted into the sanitary sewer, and solids are sent to the municipal wastewater treatment facility and ultimately to a landfill.

6.4. Pipelines

The City maintains approximately 110 miles of stormwater pipeline within the City. The City's maintenance plan includes cleaning of system storm pipes. In 1999-2000, the City cleaned approximately 30 miles of storm line. In 2000-2001, 2001-2002, and 2002-2003, the City cleaned 35, 40, and 40 miles of storm drain, respectively. Resulting from this plan, most pipes in the system are cleaned about every three years.

6.5. Outlets

Stormdrain outfalls are inspected annually. During the inspection, pictures detailing the condition of the outlet are taken, outlet and area conditions are noted, and maintenance recommendations are made.

6.6. Street Sweeping

Street sweeping is a regular maintenance activity performed by City employees. In March 2002, the City hired an additional maintenance worker and purchased a new sweeping truck for the purpose of increasing street sweeping frequency. As a result street sweeping frequency approximately doubled and is currently scheduled as follows: residential areas are swept twice per month, parking lots and alleys are swept once per month, the downtown area is swept three times per week, and major roadways are swept once per week. The City also uses a sidewalk sweeper to remove debris from the downtown area.

The City is developing a plan to deal with vehicles that hinder street sweeping. At present, when the City is unable to sweep an area due to vehicles in the street, notices are left on the vehicles. If the parked vehicles continue to be a problem, letters will be sent to local property owners. If the problem continues, temporary "No Parking" signs will be placed in the area, and vehicles blocking access will be towed.

Private property owners are required to sweep their parking lots weekly.

6.7. Pump Stations

The City does not have specified operations and maintenance procedures for the pump stations. Maintenance procedures depend on need. The City is not recording hours spent annually maintaining pump stations.

6.8. Detention Basins

The City does not have specified operations and maintenance procedures for detention basins. Cleaning after a storm depends on the amount of debris, damage and need.

7. Budget Information

7.1. Budget Procedures

The City's fiscal year begins July 1st of each year and ends on June 30th of the following year. The budgeting procedure begins prior to June 1 when the City Manager submits to the City Council a proposed two-year operating budget for the fiscal year commencing the following July 1. Following a series of public hearings, the budget is legally enacted through passage of a resolution prior to July 1.

7.2. Budget Summary

Table 7-1 is a summary of the 2001-2002 storm drain maintenance budget. The total storm drain maintenance budget for 2001-2002 was $264,455.

Table 7-1 - 2001-2002 Storm Drain Maintenance Budget

Description	Budget
Salaries & Wages - Includes salary expenditures for Street Division personnel	$83,440
Overtime - Includes salary expenditures for Street Division employees working after normal working hours on storm patrol and repairing malfunctioning storm pumps.	$4,500
Incentive Pay - Includes expenditures for employees certified in various technical programs.	$1,200
Overhead	$23,080
Telephone - Includes expenditures for telephone lease lines used for monitoring eight existing storm drain pumping stations and a portion of the lease line used for answering service.	$5,000
Electricity - Includes expenditures for electricity used by the City's 14 storm drain pumping stations, which have an accumulative total of 45 pumps. Projected electricity is based on last year's average projection.	$21,600
Membership Dues - National stormwater associations.	$500
Business Expense - Includes expenditures associated with attending seminars on development of the Phase II National Pollutant Discharge Elimination System permit.	$300
Professional Services- Includes expenditures for Underground Service Alert and for sampling and testing stormwater discharges.	$1,000
Repairs to Machinery & Equipment - Includes expenditures for the repair of storm drain pumps and panels	$11,700
Sublet Service Contracts - Includes expenditures for cleaning the Woodbridge Irrigation District Canal at the Beckman and Shady Acres storm drain pumping stations, spraying the Beckman ditch by contract, and discing unimproved acreage by contract at Pixley and G storm drain basins.	$3,500
Special Departmental Materials - Includes expenditures for miscellaneous materials required to maintain catch basin assemblies, replacement of manhole covers with vent type covers, paint for pump motors and panels, locks on gates to structures and panels, replacement hose augers for Vactor to flush and clean storm drain lines, manholes and catch basins, and sandbags.	$5,000
Education & Training - Includes expenditures for education regarding stormwater regulations and the National Pollutant Discharge Elimination System	$4,000
Small Tools and Equipment - Includes expenditures for rods and wrenches	$1,500
Work by Others - Includes charges against the Storm System when other Divisions assist the Street Division.	$6,575
Other Equipment - Includes expenditures to replace pumps and electronic equipment to maintain storm system.	$10,000
Storm Drains - This function includes expenditures for repair of storm drain pump control systems.	$16,500
Special Payments - Includes expenditures for payments to Woodbridge Irrigation District for discharge of storm drain pumping stations into the Woodbridge Irrigation Canal.	$65,060
Total	**$264,455**

8. Current Best Management Practices

Along with the normal operations and maintenance procedures outlined above, the City implements other Best Management Practices (BMPs) outlined in this section.

8.1. Lodi All Emergency Preparedness Expo

The City sponsors and participates in the Lodi All Emergency Preparedness Expo. The Expo is a free event featuring workshops and presentations from various safety and emergency response organizations. It is designed to increase public awareness on a variety of issues, including stormwater awareness.

8.2. Storm Drain Detectives

In October 2000, the City of Lodi's Public Works Department began a local Citizen Monitoring Program of the Mokelumne River, where the City's storm drains enter the river. The "Storm Drain Detectives" is a collaborative effort of the City of Lodi Public Works Department, State Water Resources Control Board-Division of Water Quality, Lodi Lake Nature Area Docent Council, and four local high schools. Monthly monitoring of nine locations along the Mokelumne River and Lodi Lake is done by students and teachers, grades 7-12, and other volunteers who have been trained by a program coordinator. Students are often given school credit for participating in this program. Funding for the program comes from the City of Lodi's, Public Works Department. Sampling locations, monitoring results, and other program details can be found on the City of Lodi's web site at www.lodi.gov.

The Storm Drain Detectives Program was established in part to defer a fine against the City's Wastewater Treatment Plant and was fully funded by the City. In previous years, it has not received funding from CALFED or any outside source. However, beginning in May 2002, partial funding will be provided by a CALFED grant. The City's portion of the funding is shown in Table 8-1.

Table 8-1 - City of Lodi, Storm Drain Detectives Budget

	2000-01	2001-02	2002-2003	
			City Budget	CALFED Grant
Personnel Services	$6,000	$7,000	$7,000	
Conference Expense	$225	$300	$300	
Professional Services	$4,700	$2,700	$2,700	
Special Department Materials	$9,000	$3,000	$3,000	
Total	**$19,925**	**$13,000**	**$13,000**	**15,400**

8.3. Facility Documentation

The City maintains a detailed storm sewer system map showing the location of all outfalls and the names and locations of all waters that receive discharges from those outfalls. City maps also show the locations and sizes of pipes, and locations of pump stations, manholes, and inlets.

8.4. Lodi Municipal Code

Stormwater protection is currently dealt with in Title 13 Chapter 12 of the Lodi Municipal Code. The Code does not adequately address the requirements of the Phase II program. For that reason the City must develop a new section of the ordinance, or a separate ordinance, that will address the following NPDES Phase II requirements:

Draft RWQCB requirements state that the City must:

- Adopt an ordinance, policy, or regulatory mechanism to prohibit non-stormwater[1] discharges into the storm sewer system and implement appropriate enforcement procedures and actions, including conducting manufacturing and commercial facility inspections, to the extent allowable under federal, state or local law.
- Adopt, maintain, and enforce an ordinance, policy, or other regulatory mechanism to require erosion and sediment controls at the construction sites, as well as sanctions to ensure compliance, to the extent allowable under federal, state or local law.
- Adopt and enforce an ordinance, policy, or other regulatory mechanism that requires projects include the incorporation, and long-term operation and maintenance of appropriate long-term BMPs.

8.5. Erosion Control for Construction

Developers are required to address erosion control within construction plan submittals. Typical measures required on plans include:

- Construction vehicle access control
- Temporary berms/sandbags
- Material stockpile locations
- Sweeping schedules
- Hay wattles

1 The Draft Waste Discharge Requirements from the California State Water Resources Control Board makes allowances for certain authorized non-stormwater discharges. Authorized non-stormwater discharges are certain categories of discharges that are not composed of stormwater but are not found to pose a threat to water quality. They include: water line flushing; landscape irrigation; diverted stream flows; rising groundwaters; uncontaminated groundwater infiltration (as defined in 40 CFR §35.2005(20)) to separate storm sewers; uncontaminated pumped ground water; discharges from potable water sources; foundation drains; air conditioning condensate; irrigation water that is not reclaimed treated wastewater; springs; water from crawl space pumps; footing drains; lawn watering that is not reclaimed treated wastewater; individual residential car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; and discharges or flows from emergency fire fighting activities. It should be noted that the City must prohibit the above outlined discharges if they are found to cause or contribute to an exceedance of water quality standards or cause or threaten to cause a condition of nuisance or pollution.

- Installation and maintenance of catch basin filter screens
- Installation of front yard swales

During construction, the owner/developer is responsible for erosion control throughout the project. Typical provisions include:

- Removal of all sediment/soil deposited on existing paved roadways prior to leaving the work site, if possible, and in all cases within 24 hours.
- Plowing or ripping of all lot pads (rear of hinge line) prior to October 1 to a depth of 2 to 3 inches.
- Placement of "rock bags" at 200 to 300' intervals to isolate sediment prior to October 1 or threat of major rain prior to that date. Sediment to be removed weekly (or sooner, if large accumulation occurs or another storm is predicted).

8.6. Urban Forestry

Numerous environmental and stormwater benefits can be achieved through effective use of urban forestry. Trees can act as natural stormwater management areas by filtering particulate matter (pollutants, some nutrients, and sediment) and by adsorption of water. Urban forestry also reduces noise levels, provides recreational benefits, increases property values, and has been shown to reduce petty crime and vandalism rates.

The City of Lodi Public Works Department attempts to maintain and protect trees. The City is in the process of developing an Urban Forest Management Plan to assess the present condition of the urban forest, provide cost projections for future maintenance, assist with the budget process, and project and monitor changes in the forest over time. Not including those associated with Capital projects, the City plants approximately 250 trees a year and removes between 30 and 100 trees.

The City has submitted an application to be included in the Tree City USA program. The program requires the City to establish a Tree Board or Department, a Tree Care Ordinance, a Community Forestry Program with an annual budget of at least $2 per capita, and an Arbor Day Observance and Proclamation.

8.7. Mokelumne River Watershed Owner's Manual

The Mokelumne River Watershed Owner's Manual was developed by the Lower Mokelumne River Watershed Stewardship Plan Steering Committee to educate the public on the impacts of non-point sources of pollution on the River. The manual identifies common sources of pollution and outlines strategies that homeowners can take to minimize their impact. Chapters include: "Stormwater Management", "Household Wastewater", "Managing Household Hazardous Products", and "Yard and Garden Care".

8.8. Storm Drain Labeling

Through an Eagle Scout project, about 60% of the existing storm drain catch basins were labeled with placards indicating that water is discharged to the river and no dumping is allowed. Newly installed catch basins include placards.

8.9. Storm Drain Outlets

The City maintains an up-to-date map showing the location of all outfalls and the names and locations of all waters of the United States that receive discharges from those outfalls. The map is included in Appendix B of this report.

8.10. Heritage Primary School Clean-Up

October 28, 2002 is a Lodi Unified School District track change day which presents a problem for 9 teachers of 200 students who do not have available classroom space. On the day, students and teachers will work with the City to clean gutters in the area around the school. Each class will "adopt" a one square block area, cleaning up gutters and installing new storm drain labels if necessary. Garbage will be sorted, surveyed and disposed of at the school site. During the survey, door hangers will be distributed to inform the public of the importance of keeping the City clean. The City hopes to continue a similar program in future years.

9. Lodi Stormwater Management Challenges

9.1. Construction Sites

The City's erosion control requirements are extremely developer-friendly, requiring only a small level of effort relative to other comparable cities. However, the City's construction standards are not adequate to meet the requirements of the Phase II program. Current City erosion control requirements are minimal, designed mainly to deal with the public nuisance caused by sediment rather than protect receiving water. Phase II NPDES permit requirements will require the City to develop a much more comprehensive erosion control management plan. The City must find a way to implement the requirements of the new program in a manner that not only meets NPDES requirements, but also continues to meet the City's development goals.

The Draft Waste Discharge Requirements for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems, issued July 12, 2002 by the California State Water Resources Control Board, outlines the requirements the City must follow. The guidance requires the City to develop, implement, and enforce a program to ensure controls are in place that will prevent or minimize water quality impacts from stormwater runoff from construction sites. Within the permit area, the program must apply to all construction projects that disturb greater than or equal to one acre (including projects less than one acre that are part of a larger common plan of development or sale that would disturb more than one acre) and that discharges into the City's Small MS4. At a minimum, the City must:

1. Adopt, maintain, and enforce an ordinance, policy, or regulatory mechanism to require erosion and sediment controls at the construction sites, as well as sanctions to ensure compliance, to the extent allowable under federal, state or local law;
2. Require construction site operators to implement appropriate and effective erosion and sediment control BMPs that utilize Best Available Technology (BAT) economically achievable and the Best Conventional Pollutant Control Technology (BCT) to reduce or eliminate stormwater pollution;
3. Require construction site operators to control all pollutant sources at the construction site that may cause adverse impacts to water quality including, but not limited to, construction materials waste, discarded building materials, concrete truck washout, chemicals, fuel, litter, and sanitary waste;
4. Implement procedures for pre-construction site plan and BMP review that incorporate consideration of potential water quality impacts from construction activities;
5. Implement procedures for receipt of and response to information submitted by the public regarding stormwater runoff impacts due to construction projects; and
6. Implement procedures for site inspections and enforcement of control measures.

9.2. Floatable Debris

Control of floatable debris in stormwater has been identified as one of the areas on which the City would like to focus its efforts. Floatable debris comes from a variety of sources and can cause a variety of problems, such as lowered efficiency and hydraulic capacity, aesthetic degradation of waterways, possible toxic effects to local aquatic species, and damage to human health or property. The ultimate source of floatable debris in the City stormwater system is litter generated from the improper disposal of waste within the drainage area. Litter left anywhere in the City can ultimately enter the River or WID canal and is therefore a cause for concern. The City will approach the problem with a variety of BMPs, ranging from increased frequency of street sweeping to public education and mechanical separation, as discussed in Section 11.

10. Stormwater Management Program Elements

10.1. Phase II NPDES Compliance Strategy

The following outlines Phase II NPDES requirements, the City's permit compliance strategy, and the measurable goals the City has developed to meet the requirements. The requirements are summarized by minimum control measure.

10.1.1. Public Education and Outreach

The City will implement a two-tiered approach to public education communicating the importance of stormwater quality protection to both adults and children in the community. The program will need to be a partnership between the City and area schools.

Adults will be educated through a brochure or flyer included as a mailer with a utility bill from the City and available in City offices. These flyers will be delivered to customers by the end of 2003. The flyer will identify those BMPs that an individual family can implement to protect stormwater, and communicate the importance an individual family can have in protecting natural resources. Potential topics to be covered include:

- Automotive wastes
- Car washing
- Storage of pesticides
- Handling and use of pesticides
- Proper handing and disposal of pet and animal wastes
- Proper handing and disposal of grass clippings, leaves, and other yard waste

Following a brief educational session, local children will participate in a stormwater protection poster contest to be held annually at local schools. Following a brief educational session, local students will be encouraged to participate in a poster contest with a theme relating to stormwater protection.

Additional public contact will be made through appropriate media and may include presentations at a local theater or newspaper. The City recently agreed to participate in the production of a video aimed at stormwater quality in the Central Valley. This video will be used by the City as a public education tool.

Table 10-1 - Public Education and Outreach Program

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	STATUS
Bilingual Storm Water Education via flyers in utility bills.	Develop flyer and mail to members of the community (business and residential) three times during the permit term. Distribute to new residents when they sign up for utilities.	December 2003	
Elementary School Storm Water Education, Awareness and Poster Contest.	Develop school criteria to efficiently utilize school allotted time. Complete first round of presentations and poster contest on 50% of 5th graders per year.	December 2003 June 2004	
Participate in local events with a storm water information booth.	Prepare booth displays and materials, select appropriate venues and participate in events annually.	May 2004	
Participate in development of a storm water video to aid in school presentations.	7 minute video designed to target 5th - 6th graders. Show video with school presentations and at annual local events.	May 2003	
Citizen outreach via media: TV and radio commercials; newspaper articles and advertisements.	Collaboration among Shared Resource Committee- 120,000 media impressions per fiscal year.	June 2004	
Business outreach: Local Area	Collaboration among Shared Resource Committee- Develop priority list of businesses to target (e.g. auto repairs, landscape, maintenance, concrete contractors, restaurants, pool maintenance, carpet cleaners). Prepare business specific materials for outreach and implement distribution.	December 2004 June 2005	
Community Car Washes	Develop and distribute educational brochure on car wash requirements. Target fund raisers- schools, youth groups and locations used. Propose acceptable alternatives.	June 2005	
Storm Water Web Page	Develop and promote web page: track number of hits. Establish links to related programs. Update page quarterly. Monitor effectiveness.	September 2004	
Reduce Floatable Contaminants in Storm System	Identify sources of floatable debris from various methods; Students involved with collection at target areas. Sort debris from storm pump station cleanings. Target sources for reduction control measures.	June 2006	

10.1.2. Public Participation/Involvement

The City will involve the public in completing its storm drain labeling program in a manner similar to the Eagle Scout projects previously completed.

The City will establish a citizen reporting telephone number. The hotline will be advertised through the local media as a way for citizens to participate in protecting stormwater. A typical call to the hotline might report a parked automobile leaking fluid, fresh concrete wash-out dumped onto a City street, paint or oily sheen in the river, or organic debris (including pet waste)

in a drainage system or waterway. The City will then promptly respond and attempt to remedy the reported problem. A log of all reported incidents will be maintained and included in the annual NPDES compliance report to RWQCB.

The City will also continue to fund and look for additional grant funding opportunities for the Storm Drain Detectives Program.

Table 10-2 - Public Involvement / Participation Program

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	COMPLETE?
Citizen monitoring program: Storm Drain Detectives.	Monthly monitoring of nine locations along the Mokelumne River and Lodi Lake. This includes river water samples with lab results posted on web page.	June 2003	
Public stakeholders meeting / Citizen Panel.	Advertise and hold SWMP kick off meeting; Quarterly meetings thereafter if public interest warrants.	October 2003	
Storm water complaint hotline.	Establish hotline, advertise local media. Phone line and internet access from web page. Document reported incidents, respond within 48 hours, include info in annual report.	June 2004	
Storm Drain Labeling	Label 98% of storm drain inlets. Current design standards ensure new developments are labeled when installed. Effort to retrofit existing inlets have labeled 50% of 2,750 catch basins.	December 2005	
Community Clean up Programs	Annual trash and debris removal city wide. Focus on floatables getting into waterways. Find willing groups or individuals to participate Develop hazardous household waste collection efforts.	May 2004	

10.1.3. Illicit Discharge Detection and Elimination

The City will develop and implement a program to detect and eliminate illicit discharges into the storm sewer system. This program will be based on an updated stormwater protection ordinance, which will be developed in 2003 and put into place in 2004.

Table 10-3 - Illicit Discharge Detection and Elimination Program

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	COMPLETE?
Storm Drain System Map	Prepare and update annually MS4 map. Add watershed for each discharge point.	June 2003 June 2004	
Illicit Discharge Ordinance	Adopt ordinance to prohibit non-storm water discharges include parking lot owners to sweep weekly; identify how ordinance will be enforced.	November 2004	
Develop and Implement a plan to address non-storm water discharges and illegal dumping. Establish a system and procedure for enforcement of violations. Establish a tracking system for inspections and violations. Establish a City drop off point for household hazardous wastes	Use enforcement tools to: 1) Require illicit dischargers to immediately cease and desist discharging to receiving waters or storm system. 2) Remove illicit detections in 5 business days or less. 3) Require clean up and abatement to recover cost of the City to clean up and abate discharge.	January 2005	

10.1.4. Construction Site Runoff Control

The City will include in their Stormwater Protection Ordinance a section dedicated to construction site runoff control. Key BMPs to be enforced by the ordinance are listed below and detailed in the attachments to this report.

The ordinance will be structured in a manner that rewards compliance. Suggestions include requiring a deposit prior to construction. The deposit would then be used to pay for any fines that may result from improper construction practices. Funds remaining following completion of construction will be returned to the contractor. Probable requirements of the City of Lodi Stormwater Protection Ordinance include:

- Construction entrance
- Tire wash facility
- Outlet protection
- Check dams
- Straw sedimentation barriers
- Inlet protection
- Sand and biofilter bags
- Concrete washout
- Training

Details of each of the requirements can be found in the BMP package included in the Appendix.

Training on the program will be provided to City staff and contractors.

As part of the program, the City will also develop an inspection program to ensure contractors are following the requirements of the ordinance.

Table 10-4 - Construction Site Runoff Control Program

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	COMPLETE?
Construction Storm Water Ordinance	Develop ordinance. Adopt ordinance.	December 2003 December 2004	
Construction Storm Water training for site owners and developers.	Collaboration among Shared Resource Committee to develop the following: 1) Training materials. 2) Implement training program each fall	December 2003 December 2004	
Construction plan review for erosion and sediment controls.	Develop and implement procedures for site plan review.	December 2005	
Construction site inspections Develop procedures for inspection and performance of construction site pollution control measures -Develop inspection procedures/checklist for inspectors. -Establish a system and procedures for enforcement of violations. -Establish a tracking system for inspections and violations. Implement procedures for inspection and enforcement of control measures. -Train municipal inspectors on new requirements and implement inspection and enforcement procedures. -Conduct storm water inspections of construction sites > 1 acre, using criteria for establishing priority sites.	Develop inspection program Implement inspection program Designate municipal staff trained in construction site inspection. Construction sites > 1 acre inspected once per year. Priority sites inspected monthly during wet season (October thru April).	December 2003 December 2004	

10.1.5. Post-Construction Runoff Control

The City will continue to build detention ponds as the size of the City increases and stormwater detention needs grow. The City will also continue its urban forestry program. These and other structural and/or nonstructural BMPs will be required by the Stormwater Protection Ordinance. Potential BMPs are included in the attachments to this report and include BMP inspection and maintenance, grass lined swales, and floatable debris removal. The details of the program will

be identified in a Standard Urban Storm Water Mitigation Plan (SUSMP) that will apply to many discretionary development and redevelopment projects that fall into categories identified in Attachment 4 of the permit guidance.

Table 10-5 - Post Construction Storm Water Managemento in New and Redevelopment

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	COMPLETE?
Post construction storm water ordinance. Develop, implement and enforce an ordinance to address post-construction runoff from new development and redevelopment projects. -Draft and adopt ordinance. -Train municipal staff on post-construction requirements and conditions of approval.	Develop ordinance Adopt ordinance	December 2003 December 2005	
Standard Urban Storm Water Mitigation Plan (SUSMP) Develop and implement strategies which include a combination of structural and non-structural BMP's appropriate for the community. -Develop technical criteria for selected control strategies. -Develop guidance for post-construction BMP's. -Develop design review guidance for planning and public works departments -Ensure long-term operation and maintenance of BMP's.	Develop and implement strategies in compliance with attachment 4 of Small MS4 permit.	December 2005	
Revise City land use and zoning plan to consider storm water quality. Preserve open space.	Reduce percent of new impervious surfaces associated with new development projects, 10% in residential.	2006	

10.1.6. Pollution Prevention/Good Housekeeping

The City will operate the system in a manner that is consistent with the goals of the Pollution Prevention/ Good Housekeeping Minimum Control Measure.

Table 10-6 - Pollution Prevention/Good Housekeeping

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	COMPLETE?
Operation and maintenance program to prevent or reduce pollutant runoff from municipal operations (facilities and activities) -Survey departments and facilities for activities that may contribute pollutants. -Identify problem areas and corrective actions. -Develop procedures for implementing BMP's at facilities and during municipal activities.	Develop and implement program	July 2004	
Storm sewer inlet and manhole maintenance.	Inspection and cleanout of storm sewer inlets and manholes. Inventory inlets and manholes and document annual inspection and cleanout as necessary.	Annually	
Storm sewer catch basin maintenance.	Inspection and cleanout of catch basins Inventory catch basins and document annual inspection and cleanout as necessary	Annually	
Storm sewer pipeline maintenance.	Cleanout of storm sewer pipeline system over three years. Identify priority pipelines to be cleaned out every year prior to wet season.	Every three years Annually prior to wet season.	
Street sweeping.	Sweep residential streets twice per month. Sweep parking lots and alleys once per month. Sweep downtown area three times per week Sweep major roadways. Inventory and categorize streets; document street sweeping activities.	June 2003 July 2004	
Pump station maintenance	Clean out pump stations as necessary to prevent storm sewer backup and flooding. Identify priority pump stations to be cleaned out every year prior to wet season; clean remainder at an appropriate and specific interval.	July 2004	
Detention basin maintenance	Clean out and maintain detention basins as necessary to ensure proper function. Identify priority detention basins to be cleaned out	2004	

BMP	MEASURABLE GOAL	IMPLEMENTATION SCHEDULE	COMPLETE?
	every year prior to wet season; clean remainder at an appropriate and specified interval.		
Preserving open space associated with urban trees	Maintain and protect trees within City's urban forest.	Annually	
Residential and commercial green waste management	Ensure that green waste is set out for pickup and disposal is containerized with possible exception of a one time pickup in the fall. Schedule fall pickup around rain events to the extent practicable	December 2003	
Good housekeeping at, and inspection of, corporation yard(s)	Develop SWPPPs for corporation yards. Conduct monthly inspections.	Annually	
Municipal operations employee training	Develop and implement a training program for appropriate municipal operations employees. Provide training at least annually; document training topics and attendance.	July 2004	
Pesticide and fertilizer pollution prevention program	Develop and implement program for municipal employees that use these materials.	July 2004	
Spill prevention and response program	Develop and implement program	July 2004	
Municipal construction site pollution prevention	Ensure plans are reviewed and sites are inspected along with privately owned construction sites; ensure coverage under State permit, if applicable.	July 2004	

11. Program Cost Summary

The costs developed and discussed in this section are in addition to the costs required to operate and maintain the stormwater system. Programs the City currently funds as part of its stormwater program are assumed to continue and will require increased funding as determined in the City's budgeting process.

The total additional budget required for the project will be approximately $120,500 in 2003, $50,500 in 2004, $113,000 in 2005, $29,500 in 2006 and $29,000 in 2007.

Table 11-1 - BMP Implementation Cost

Year	BMP Description	Discussion	Additional Funding
2003	Bilingual stormwater protection brochures or flyers developed and distributed, school curricula developed	Many examples of both flyers and school curricula exist. The City will need to tailor the material to their specific issues and inform the general public.	$5,000-7000
	Establish citizen reporting hotline or an internet-accessible electronic form	Costs include a minimal number of City hours for website development. It is assumed that the City will continue to use its current complaint number as the stormwater hotline.	$1,000
	Increased participation in Storm Drain Detectives Program	Increased participation will most likely result from the growing awareness of stormwater issues that results from the program so only a minimal expenditure will be required.	$1,000
	Develop ordinance	Existing ordinances can be used as a base for the City's ordinance, however, public meetings and legal fees will result in a substantial cost.	$45,000
	Identify and evaluate non-stormwater discharge	The first phase of the program will involve completion of a study to determine the extent and probable discharge location.	$30,000
	Develop training materials for contractors	The cost associated with this task includes material costs and the cost to begin providing training.	$30,000
	Develop inspection program	It is assumed that the responsibilities of current inspectors can be expanded, meaning no additional personnel will be required.	$7,500
	Annual program review and record keeping	The cost of this goal includes a minimal amount of filing time and time required to complete the report.	$4,000

Year	BMP Description	Discussion	Additional Funding
2004	Begin annual poster contest and post winning bulletin boards around the City	The poster contest will require a minimal amount of supplies, prizes for winners and hours required for classroom presentations.	$2,000
	Continued costs associated with phone line or internet website	Periodic maintenance or additional advertisement will be necessary to ensure the phone line is effective.	$500
	Participate in development of stormwater quality video	The City's monitory contribution to the regional stormwater video may vary.	$1,000
	Begin program to identify sources of illicit discharges, including record keeping	Costs could vary substantially depending on results of preliminary investigation into sources.	$30,000
	Continued costs associated with contractor training program	Costs include time required to make presentation and purchase of more materials.	$5,000
	Begin inspecting construction sites and requiring stormwater BMP compliance	It is assumed that the responsibilities of current inspectors can be expanded meaning no additional personnel will be required.	$10,000
	Annual program review and record keeping	Cost includes a minimal amount of filing time and some the time required to complete the report.	$4,000
2005	Continue poster contest program	The poster contest will require a minimal amount of supplies, prizes for winners and hours required for classroom presentations	$2,000
	Continued costs associated with phone line or internet website	Periodic maintenance or additional advertisement will be necessary to ensure the phone line is effective.	$500
	Develop and implement community car wash plan	Car wash costs include time associated with educating the public and costs required to purchase appropriate devices.	$6,000
	Material in local media promoting hotline or internet-accessible electronic form	Actual material will most likely be developed as a part of other program elements. The cost of distributing the information will be minimal.	$500
	Continue illicit discharge detection program	Program costs are extremely difficult to define as program components have not yet been determined.	$30,000
	Eliminate detected illicit discharges	Project costs are nearly impossible to determine as the number and extent of illicit discharges are not known	$10,000
	Annual program review and record keeping	The cost of this goal includes a minimal amount of filing time and time required to complete the report.	$4,000
	Develop SUSMP	The details of the SUSMP program will be identified under this task.	$60,000
2006	Continue poster contest program	The poster contest will require a minimal amount of supplies, prizes for winners, and hours required for classroom presentations.	$2,000
	Implement program to reduce the dumping of pollutants down storm sewer drains	Program costs are extremely difficult to define as program components have not yet been determined.	$1,000
	Continued costs associated with phone line or internet website	Periodic maintenance or additional advertisement will be necessary to ensure the phone line is effective.	$500
	Floatable debris reduction program	Project costs could vary substantially. If other measures are effective in reducing the volume of floatable debris, costs could be significantly less.	$20,000
	Generate annual report to citizens on stormwater	The report will be closely tied to the annual program review.	$2,000
	Annual program review and record keeping	Cost includes a minimal amount of filing time and time required to complete the report.	$4,000

2007	Implement program to reduce the dumping of pollutants down storm sewer drains	Program costs are extremely difficult to define as program components have not yet been determined.	$1,000
	Continue poster contest program	The poster contest will require a minimal amount of supplies, prizes for winners, and hours required for classroom presentations.	$2,000
	Floatable debris reduction program	Project costs could vary substantially. If other measures are effective in reducing the volume of floatable debris, costs could be significantly less.	$20,000
	Generate annual report to citizens on stormwater	The report will be closely tied to the annual program review.	$2,000
	Annual program review and record keeping	Cost includes a minimal amount of filing time and time required to complete the report.	$4,000

ATTACHMENT DA 5.15-9

Letter from City of Lodi Regarding Recycled Water Availability

CITY COUNCIL
JOANNE MOUNCE, Mayor
LARRY D. HANSEN, Mayor Pro Tempore
SUSAN HITCHCOCK
BOB JOHNSON
PHIL KATZAKIAN

CITY OF LODI

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BLAIR KING, City Manager
RANDI JOHL, City Clerk
D. STEPHEN SCHWABAUER, City Attorney
F. WALLY SANDELIN Public Works Director

October 16, 2008

Ed Warner
NCPA
661 Commerce Dr
Roseville, CA 95678

Subject: Agreement to Serve Recycled Water to NCPA

The City of Lodi has agreed to serve recycled water to NCPA's Lodi Energy Center (LEC). NCPA has submitted an Application for Certification (AFC) with the California Energy Commission (CEC). We understand the CEC requested NCPA to provide additional information concerning the potential effects of project demand on the City of Lodi's recycled water supply on other users of recycled water, including, but not limited to, recycled water availability for other uses during construction and operation of the facility.

The City of Lodi currently serves NCPA's STIG facility, the San Joaquin County Mosquito and Vector Control facility, and adjacent City owned agricultural land with recycled water. As discussed in our letter dated November 29, 2005, the City of Lodi has sufficient capacity to serve the LEC. This commitment will not adversely affect any existing or future planned recycled water users.

We trust that this addresses the CEC's request. If you need additional information please do not hesitate to contact me at (209) 209-333-6740.

Sincerely,

Charles E. Swimley Jr., P.E.
Water Services Manager

CES/myn

cc: F. Wally Sandelin, Public Works Director
George Morrow, Electric Utility Director
D. Stephen Schwabauer, City Attorney