Addendum No:	03	**Issue Date:**	01/10/2025
Project:	Madison Elementary School – 2 Story Classroom Building	**To Drawings + Specifications dated**	12/06/2024
School District:	**Madera Unified School District**		
Prepared By:	PBK Architects, Inc. 7790 N Palm Avenue Fresno, California 93711		
PBK Project No:	230278		
DSA App No:	02-122191		

LICENSED ARCHITECT
MICHAEL R. SCHOEN
No. C-35165
RENEWAL DATE
FEB 28, 2025
STATE OF CALIFORNIA

NOTICE TO PROPOSERS

A. The following changes, omissions, and/or additions to the Project Manual and/or Drawings shall apply to proposals made for and to the execution of the various parts of the work affected thereby, and all other conditions shall remain the same.

B. Careful note of the Addendum shall be taken by all parties of interest so that the proper allowances may be made in strict accordance with the Addendum, and that all trades shall be fully advised in the performance of the work which will be required of them.

C. Bidder shall acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject Bidder to disqualification.

D. In case of conflict between Drawings, Project Manual, and this Addendum, this Addendum shall govern.

GENERAL ITEMS

3.1 Refer to **Stormwater Pollution Prevention Plan,** revise as follows:

- Add the Stormwater Pollution Prevention Plan (dated June 20, 2024) in its entirety (499 pages)

3.2 Refer to **HVAC Equipment Submittal- Madison ES,** revise as follows:

- Add the HVAC Equipment Submittal – Madison ES (dated June 13, 2024) in its entirety (39 pages)

3.3 Refer to **Pre Bid RFI Log,** revise as follows:

- Add the Pre Bid RFI Log (dated January 10, 2025) in its entirety (7 pages)

SPECIFICATIONS

3.4 Refer to Specification Section **01 57 23 Storm Water Pollution Prevention Plan (SWPPP),** revise as follows:

- Add Specification Section 01 57 23 Storm Water Pollution Prevention Plan (SWPPP) in its entirety (8 pages)

3.5 Refer to Specification Section **44 11 13 Fugitive Dust Control,** revise as follows:

- Add Specification Section 44 11 13 Fugitive Dust Control in its entirety (3 pages)

3.6 Refer to Specification Section **07 42 13 Metal Wall Panels,** revise as follows:

- Replace Specification Section 07 42 13 Metal Wall Panels in its entirety with attached (10 pages)

3.7 Refer to Specification Section **07 52 00 Modified Bitumen Membrane Roofing,** revise as follows:

- Replace Specification Section 07 52 00 Modified Bitumen Membrane Roofing in its entirety with attached (18 pages)

3.8 Refer to Specification Section **07 62 01 Coping System,** revise as follows:

- Add Specification Section 07 62 01 Coping System in its entirety (8 pages)

3.9 Refer to Specification Section **23 00 01 Heating, Ventilating and Air Conditioning**, revise as follows:

- Section 23 00 01 Paragraph 2.6, D. & Section 23 09 23, Paragraph 3.2, B.
- "i. Indoor units (IDU) connected to outdoor units (ODU) 1, 2 and 4 shall be provided with an optional interface for traditional thermostat at each indoor unit in lieu of wall mounted controllers. DDC/EMS Contractor shall provide field controller and room sensor to control unit and connect to DDC/EMS."

DRAWINGS

MECHANICAL

3.10 Refer to Sheet **M1.2 - First Floor Mechanical Piping Plan,** revise as follows:

- Added Pressure Differential Sensor locations for HP Unit Power Exhaust in each Zone.
- Removed additional EMS temperature sensor from ODU/IDU -1, 2 system to reflect revised specifications.
- Replace sheet with attached M1.2- First Floor Mechanical Piping Plan (1 pages)

3.11 Refer to Sheet **M1.4 – Second Floor Piping Plan,** revise as follows:

- Added Pressure Differential Sensor locations for HP Unit Power Exhaust in each Zone.

- Removed additional EMS temperature sensor from ODU/IDU -1, 2 system to reflect revised specifications.
- Replace sheet with attached M1.4– Second Floor Piping Plan (1 pages)

3.12 Refer to Sheet **M3.1 - Mechanical Schedules,** revise as follows:

- Removed excess Exhaust Fan Schedule. EF-1 for Kitchen Hood is the only Roof Top Exhaust Fan
- on project.
- Added Grille Schedule, Marks A-D
- Replace sheet with attached M3.1- Mechanical Schedules (1 pages)

3.13 Refer to Sheet **M4.2 - Mechanical Details,** revise as follows:

- Revised Detail C/M4.2 – Packaged HP Unit Diagram (Controls)
- Revised Detail D/M4.2 – Exhaust Fan Diagram (Controls)
- Revised Detail E/M4.2 – Split System Diagram, ODU/IDU – 3, 5, 6 (Controls)
- Revised Detail F/M4.2 – Energy Recovery Ventilation Diagram (Controls)
- Added Detail J/M4.2 – Split System Diagram, ODU/IDU – 1, 2, 4 (Controls)
- Replace sheet with attached M4.2 Mechanical Details (1 pages)

END OF ADDENDUM 03

STORMWATER POLLUTION PREVENTION PLAN

for

Madison Elementary School Modernization

Project Location:
Madera, CA

RISK LEVEL: 1

Legally Responsible Person (LRP):
Madera Unified School District
1205 S Madera Avenue
Rosalind Cox
559-675-454

Project Address:
109 Stadium Rd, Madera, CA 93637

SWPPP Prepared by:

Blair, Church & Flynn
CONSULTING ENGINEERS
Michael Gennaro
451 Clovis Avenue #200, Clovis, CA 93612

SWPPP Preparation Date:
June 20, 2024

WDID #	TBD
Application ID	571839

Estimate Construction Dates
August 1, 2024 – January, 31, 2026

Site Operation Hours
7 am to 5 pm, M-F

Contact	Name	Phone Number	License/Certification #
Qualified SWPPP Developer	Michael Gennaro	(559) 326-1400	#28547
Qualified SWPPP Practitioner			
QSP Trained Delegates			
QSP Trained Delegates			

Table of Contents

List of Appendices

List of Acronyms

AS	Approved Signatory
ATS	Active Treatment System
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practices
CFR	Code of Federal Regulations
CGP	NPDES 2022 CGP for Storm Water Discharges Associated with Construction Activities
COC	Chain of Custody
CPESC	Certified Professional in Erosion and Sediment Control
CPSWQ	Certified Professional in Storm Water Quality
CSMP	Construction Site Monitoring Plan
CWA	Clean Water Act
DAR	Duly Authorized Representative
DWQ	Division of Water Quality
EPA	Environmental Protection Agency
LRP	Legally Responsible Person
MRR	Monitoring and Reporting Requirements
MS4	Municipal Separate Storm Sewer System
NAL	Numeric Action Level
NEL	Numeric Effluent Limitation
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
PRDs	Permit Registration Documents
QPE	Qualifying Precipitation Event
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
RUSLE2	Revised Universal Soil Loss Equation, Version 2
RW	Receiving Water
RWQCB	Central Valley Regional Water Quality Control Board (Fresno Office)
SMARTS -	Storm Water Multi Application Reporting and Tracking System
SSC	Suspended Sediment Concentration
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
WDID	Waste Discharge Identification Number
WQO	Water Quality Objective

Qualified SWPPP Developer (QSD)

Approval and Certification of the Stormwater Pollution Prevention Plan

Project Name: Madison Elementary School Modernization

Project Number/ID: **TBD**

"This Stormwater Pollution Prevention Plan and its appendices were prepared under my direction to meet the requirements of the California Construction Stormwater General Permit (*Order No. 2022-0057-DWQ*). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below and will maintain up to date credentials for the duration of the project."

QSD Signature

June 20, 2024

Date

Michael Gennaro

QSD Name

28547

QSD Certificate Number

QSD, CPESC, Environmental Specialist at Blair, Church & Flynn Consulting Engineers

Title and Affiliation

(559) 326-1400

Telephone Number

mgennaro@bcf-engr.com

Email

Qualified SWPPP Practitioner (QSP)

Project Name: Madison Elementary School Modernization

Project Number/ID: **TBD**

The QSP identified below shall complete and oversee the implementation and documentation of the construction site monitoring plan elements (CSMP) contained in this Stormwater Pollution Prevention Plan and the California Construction Stormwater General Permit (*Order No. 2022-0057-DWQ*). The QSP shall complete all documentation truthfully and shall not misrepresent their qualifications or active certificate status while acting as the QSP for the Project.

TBD	
QSP Signature	*Date*
QSP Name	*QSP Certificate Number*
Title and Affiliation	*Telephone Number*
Email	

Amendment Log

Project Name: Madison Elementary School Modernization

Project Number/ID: **TBD**

Amendment No.	Date	Brief Description of Amendment (include section and page number)	Prepared and Approved By
			Name: QSD#
			Name: QSD#
			Name: QSD#

The SWPPP will be revised when:

- There is a 2022 CGP violation (2022 CGP Section VI.Q.1);
- There is a reduction or increase in total disturbed acreage (2022 CGP Section III.F.2. and F.4);
- BMPs are not effective and are not resulting in a reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges (2022 CGP Section VI.Q.1 and Attachment E Section III.C.5);
- There is a change in the project duration that changes the project Risk Type (2022 CGP Section III.F.1);
- Dischargers with projects where all construction activities (including passive treatment, active treatment systems, and/or active equipment) will be suspended for 30 days or more (2022 CGP Section III.G).

Section 1 SWPPP Requirements

1.1 INTRODUCTION

This Stormwater Pollution Prevention Plan (SWPPP) is designed to comply with California's *General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (2022 CGP),* State Water Resources Control Board (State Water Board) *Order No. 2022-0057-DWQ (NPDES No. CAS000002)* (Appendix R). This SWPPP has been prepared following the 2022 CGP SWPPP Template for Traditional Projects provided in the California Stormwater Quality Association (CASQA) Stormwater *Best Management Practice (BMP) Handbook: Construction* (CASQA 2023).

This project is considered a traditional construction project.

In accordance with the 2022 CGP, Section IV.O, this SWPPP is designed to address the following:

- Identification of all pollutants, their sources, and control mechanisms, including sources of sediment associated with all construction activities (e.g., sediment, paint, cement, stucco, cleaners, site erosion);
- Pollutant source assessments, including a list of potential pollutant sources and identification of site areas where additional BMPs are necessary to reduce or prevent pollutants in stormwater and authorized non-stormwater discharges, per the minimum requirements when developing the pollutant source assessment;
- Description of site-specific BMPs implemented to reduce or eliminate stormwater pollution;
- Where not otherwise required to be under a Regional Water Quality Control Board (Regional Water Board) permit, all non-stormwater discharges are identified and either eliminated, controlled, or treated;
- Site BMPs are effective and result in the reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges from construction activity to the Best Available Technology/Best Control Technology (BAT/BCT) standard; and;
- Stabilization BMPs are installed to reduce or eliminate pollutants after construction is completed are effective and maintained; and
- Calculations and design details, as well as BMP controls, are complete and correct.

The Madison Elementary School Modernization project (Project, or Site) comprises approximately 2.10 acres, of which 1.78 acres will be disturbed. The Project is located at 109 Stadium Rd, Madera, CA 93637 The property is owned and being developed by Madera Unified School District. The project's location is shown on the Site Maps in Appendix A.

The purpose of this project is to expand and modernize the existing Madison Elementary School. Currently the existing project site consist of a parking lot, sidewalk, a grass field, and a baseball field. The project will grade the existing fields and build three educational buildings surrounded by a concrete areas. The project will also renovate and expand parts of the existing parking lot and demolish the existing sidewalk to construct a bus drop off lane.

1.2 PERMIT REGISTRATION DOCUMENTS

Required Permit Registration Documents (PRDs) shall be submitted to the State Water Board via the Stormwater Multi Application and Report Tracking System (SMARTS) by the LRP or DAR. The project-specific PRDs include (2022 CGP Section III.A):

1. Notice of Intent (NOI);
2. Risk Level Determination (Construction Site Sediment and Receiving Water Risk Determination);
3. Site Drawings and Map;
4. SWPPP;
5. Applicable plans, calculations, and other supporting documentation for compliance with the Phase I or Phase II municipal separate storm sewer system (MS4) post construction requirements or the post-construction standards of the 2022 CGP:
    - Attachment or web-source containing the applicable Phase I or Phase II MS4 post construction requirements;
    - The post construction plans and calculations submitted to or approved by the applicable Phase I or Phase II MS4; and/or
    - Post-construction water balance calculation;
6. Dischargers proposing an alternate K-factor or LS-factor must submit documentation to support the site-specific factors, if applicable;
7. Active Treatment System (ATS) Plan, if applicable;
8. Passive Treatment Plan, if applicable;
9. Dewatering Plan, if applicable;
10. Annual Fee per the current 23 California Code of Regulations Chapter 9 fee schedule for National Pollutant Discharge Elimination System (NPDES) stormwater permits; and
11. Signed Certification Statement (LRP Certification is provided electronically with SMARTS PRD submittal).

Site Maps can be found in Appendix A. A copy of the submitted PRDs shall also be kept in Appendix B along with the Waste Discharge Identification (WDID) confirmation.

1.3 SWPPP AVAILABILITY AND IMPLEMENTATION

The SWPPP will be available at the construction site during working hours list on the title sheet and Section 7.5, while construction is occurring and shall be made available upon request by a federal, state, or municipal inspector. A current copy of the site-specific SWPPP and any site inspection reports required by the 2022 CGP may be kept in electronic format at the site so long as the information requested by a federal, state, or municipal inspector can be made available during an inspection. Legible maps in hard copy must be available at the site (2022 CGP Section IV.O.1.).

The SWPPP must be implemented at the appropriate level to protect water quality at all times throughout the life of the project. The SWPPP must remain on the site during construction activities, commencing with the initial mobilization and ending with the termination of coverage under the 2022 CGP.

1.4 SWPPP AMENDMENTS

The SWPPP will be revised when:

- If there is a 2022 CGP violation (2022 CGP Section VI.Q.1);
- There is a reduction or increase in total disturbed acreage (2022 CGP Section III.F.2 and F.4.);
- BMPs are not effective and are not resulting in a reduction or elimination of pollutants in stormwater discharges and authorized non-stormwater discharges (2022 CGP Section VI.Q.1 and Attachment D Section III.C.5);
- There is a change in the project duration that changes the project's risk level (2022 CGP Section III.F.1); or
- Dischargers with projects where all construction activities (including passive treatment, active treatment systems, and/or active equipment) will be suspended for 30 days or more (2022 CGP Section III.G.).

Additionally, the SWPPP will be amended when:

- There is a change in construction or operations that may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4) (2022 CGP Sections IV.O. and VI.Q.1); or

When deemed necessary by the QSD. The QSD has determined that the changes listed in Table 1-1 can be field determined by the QSP. All other changes will be made by the QSD as formal amendments to the SWPPP. Note that the 2022 CGP requires that the QSD revise the SWPPP to address potential problems identified by visual inspections, sampling data, comments from a QSP, or their own site observations (2022 CGP Section V.C.2.).

The following items shall be included in each amendment:

- Who requested the amendment;
- The location of proposed change;
- The reason for change;
- The original BMP(s) proposed, if any;
- The new BMP(s) proposed; and
- QSD certification.

SWPPP amendments will be logged at the front of the SWPPP and SWPPP Amendment QSD certifications will be located in Appendix C. The SWPPP text will be revised, replaced and/or hand annotated as necessary to properly convey the amendment. SWPPP amendments must be made by a QSD. The following changes have been designated by the QSD as "to be field determined" and constitute minor changes that the QSP may implement based on field conditions.

Table 1-1 List of Changes to be Field Determined

Candidate changes for field location or determination by QSP [(1)]	Indicates changes that may be field located or field determined by QSP/Delegates
Increase quantity of Erosion or Sediment Control Measures	☒ Yes ☐ No
Relocate/Add stockpiles or stored materials	☒ Yes ☐ No
Relocate/Add toilets – Shall include a containment tray	☒ Yes ☐ No
Relocate vehicle storage and/or fueling locations	☒ Yes ☐ No
Relocate concrete waste management facilities	☒ Yes ☐ No
Relocate areas for waste storage	☒ Yes ☐ No
Relocate water storage and/or water transfer location	☒ Yes ☐ No
Changes to access points (entrance/exits)	☒ Yes ☐ No
Change type of Erosion or Sediment Control Measures – Changes may only include BMPs indicated within Section 3.1 of this SWPPP	☒ Yes ☐ No
Changes to location of Erosion or Sediment Control Measures	☒ Yes ☐ No
Minor changes to schedule or phases	☒ Yes ☐ No
Changes in construction materials	☒ Yes ☐ No
(1) Any field changes not identified for field location or field determination by the QSP must be made as an amendment by the QSD.	

1.5 RETENTION OF RECORDS

Paper or electronic records of documents required by this SWPPP will be retained for a minimum of three years from the date generated or date submitted, whichever is later, for the following items:

- SWPPP;
- Visual monitoring reports;
- Sampling equipment calibration records;
- pH and turbidity sampling field sheets;
- Analytical laboratory reports; and
- QSP training records of Contractor staff for BMP implementation, installation, and maintenance
- QSP delegate training records, if applicable

These records will be available at the Site until construction is complete. Records assisting in the determination of compliance with the 2022 CGP will be made available within a reasonable time to the Regional Water Board, State Water Board, or U.S. Environmental Protection Agency (EPA) upon request. Requests by the Regional Water Board for retention of records for a period longer than three years will be adhered to.

1.6 REQUIRED REPORTING

Completed inspection checklists are not required to be submitted to the Regional Water Board. However, completed inspection checklists will be kept with the SWPPP on-site or electronically and provided to the LRP upon termination of the SWPPP. The 2022 CGP requires that permittees prepare, certify, and electronically submit an Annual Report no later than September 1 of each year. Reporting requirements are identified in 2022 CGP Section VI.P. Annual reports will be filed in SMARTS and in accordance with information required by the online forms.

Planned changes in site construction activities that may result in non-compliance with the 2022 CGP are required to be provided in writing to the Regional Water Board and local stormwater agency in advance of the changes.

If a 2022 CGP discharge violation occurs, the QSP will immediately notify the LRP. The LRP will include information on the violation with the Annual Report. Corrective measures will be implemented immediately following identification of the discharge or written notice of non-compliance from the Regional Board. Discharges and corrective actions must be documented and include the following items:

- The date, time, location, nature of operation, and type of unauthorized discharge;
- The cause or nature of the notice or order;
- The BMPs deployed before the discharge event, or prior to receiving notice or order; and
- The date of deployment and type of BMPs deployed after the discharge event, or after receiving the notice or order, including additional measures installed or planned to reduce or prevent re-occurrence.

The Project is located in the Central Valley (Fresno) Regional Water Quality Control Board which has no water bodies with TMDL NALs and/or NELs, so there are no applicable TMDL NALs and/or NELs for the Project.

The Project will not use an Active Treatment System so there are no applicable NELs for the Project.

The Regional Water Board will be notified via email 24 hours prior to the beginning of a planned dewatering discharge.

In the event of an emergency dewatering, the Regional Water Board and applicable MS4 are to be notified within 24 hours of a discharge occurring. An emergency is defined as the need to protect human life and health or prevent severe property damage.

Results of (pH and turbidity, etc.) monitoring will be electronically submitted through SMARTS for all field sampling results within 30 days of the completion of the precipitation event or within 10 days if the field sampling results demonstrate the exceedance of the pH and/or turbidity NALs.

See Section 7.7.4.5 for additional discussion of the reporting requirements including contacts for Regional Water Board and MS4 notifications.

The Project will not utilize Passive Treatment so there is no Passive Treatment Plan for the Project.

1.7 CHANGES TO PERMIT COVERAGE

The 2022 CGP allows for the reduction or increase of the total acreage covered under the 2022 CGP when: a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

Modified PRDs will be filed electronically through a Change of Information (COI) within 30 days of a reduction or increase in total disturbed area if a change in permit-covered acreage is to be sought. The SWPPP will be modified appropriately and will be logged at the front of the SWPPP. SWPPP Amendments QSD Certifications will be located in Appendix C. COIs submitted electronically via SMARTS can be found in Appendix D.

1.8 NOTICE OF TERMINATION

A Notice of Termination (NOT) must be submitted electronically by the LRP or DAR via SMARTS to terminate coverage under the 2022 CGP.

According to the requirements of 2022 CGP Section III.H.4., the one or more of the following final stabilization method will be used to satisfy final stabilization condition requirements:

- 70 percent final cover method supported by pre- and post-project photographs demonstrating stabilization.
- RUSLE or RUSLE2 method with computation proof supported by pre- and post-project photographs demonstrating stabilization.
- Custom method for which Regional Water Board approval has been obtained, supported by documentation required by the Regional Water Board and pre- and post- project photographs demonstrating stabilization.

The Regional Water Board will consider a construction site complete when the conditions of the 2022 CGP Section III.H., have been met.

The discharger is required to submit the following in SMARTS:

- NOT SMARTS Form;
- QSP-prepared final NOT inspection which includes the QSP name and valid QSP certificate number;
- Final site map with photo orientation references;
- Photos demonstrating final stabilization and the applicable post-construction BMPs and/or low impact development; and
- A long-term maintenance plan for the post-construction stormwater runoff BMPs and/or low impact development features being implemented.

According to the 2022 CGP, the NOT will be automatically approved within 30 calendar days after the date the NOT was submitted, unless, within the 30 calendar days the Regional Water Board notifies the discharger through SMARTS that the Notice of Termination has been denied, returned, or accepted for review (2022 CGP Section III.H.7).

Note: If an Annual Report has not been filed in the current reporting year, an Annual Report will need to be submitted prior to the NOT.

Section 2 Project Information

2.1 PROJECT AND SITE DESCRIPTION

2.1.1 Site Description

The Madison Elementary School Modernization project site is Risk Level 1, comprises approximately 2.10, and is located at 714 W Olive Ave (Madera, CA,)The project site is located approximately .5 miles southwest from Freeway ninety-nine. The project site is located approximately 2.2 miles southeast of the Fresno River and. The project is located at 36.95168, -120.06329 and is identified on the Site Map in Appendix A.

2.1.2 Existing Conditions

As of the initial date of this SWPPP, the project site is a portion of an existing elementary school, consisting of an athletic turf field area, baseball field, and a parking lot at the south of the site.

There are no known historical sources of potential contamination at the project site according to the Department of Toxic Substances Control (DTSC) *Envirostor* database (California Department of Toxic Substances Control, 2024).

2.1.3 Existing Drainage

The project site is relatively level with a slight slope to the east. The elevation of the project site ranges from 263 to 265 feet above mean sea level (msl). Surface drainage at the site currently flows to the west or east. Surface drainage that flows west is collected by four existing campus storm drain inlets connected to the campus underground stormwater conveyance system which connects to the City of Madera stormwater conveyance system. Surface drainage that flows east enters the curb and gutter of Santa Cruz Street where it is collected by a City of Madera stormwater drain inlet southwest of the site at the intersection of Maple Street and Santa Clara Street. All surface drainage from the existing site enters the City of Madera underground stormwater conveyance system that ultimately discharges to a City of Madera stormwater basin to the southwest of the site. Existing site topography, drainage patterns, and stormwater conveyance systems are shown on Site Maps Figure 2 in Appendix A.

The project discharges to City of Madera Stormwater Basin. The water quality impairments (303 (d) list and TMDLs identified in the 2022 CGP Table H-1 for the receiving waters are identified in the Table 2-1.

Table 2-1 Applicable 303(d) List Impairments and TMDLs

Receiving Water	Water Quality Impairment	
	303(d) list[1]	TMDL (2022 CGP Table H-1)
City of Madera Stormwater Basin	None	None

[1] (State Water Resources Control Board, 2022)

Additional compliance actions applicable to the project are discussed in more detail in Section 7.7.

2.1.4 Geology and Groundwater

Based off the data collected from the Geotech report and other resources, the site is underlain by near surface soils that consisted of sandy silt (Average thickness 7 ft), sandy clay (Average thickness 10ft) , and clayey sand (Average thickness 6 ft) .The surface soils are underlain by poorly graded sand with a maximum exploration depth of 51.5 feet

According to a groundwater monitoring well approximately 3 miles northwest (Site Code: 369923N1200825W003) with most recent measurements from August 27, 2023, groundwater occurs beneath the site at approximately 294 feet below ground surface. The groundwater gradient is south towards Main Canal Number 2. (California Department of Water resources, 2023).

2.1.5 Project Description

Project grading will occur on approximately 1.36 acres of the project, which comprises approximately seventy percent of the total area. The limits of grading are shown on Site Maps sheet 4 titled Earthwork in Appendix A. Grading will include both cut and fill activities, with the total graded material estimated to be 3,400 cubic yards. Approximately 1,600 cubic yards of fill material will be imported during grading activities. Soil will be stockpiled in the staging area located in the west area of the site as shown on Site Maps Construction Site Map/Figures 2 through 4 in Appendix A. Construction activities will not be phased.

Table 2-2 Construction Site Estimates

	Acres	Percent of Site
Total Construction site area	2.10	100
Area of disturbance	1.78	85
Area of grading	1.33	63

2.1.6 Developed Condition

Post-construction surface drainage can be summarized by four main area:

- Stormwater generated in the building area site will be collected by new drain inlets or roof drains and enter a new campus underground stormwater pipeline system. This system will outfall from a grate located in the curb gutter of Santa Cruz Street.
- Surface drainage at the south expanded and existing parking lot and along the east new drop-off roadway will convey east through valley gutters/curb gutters until entering Santa Cruz Street where it will convey south via curb and gutter.
- Stormwater generated at the north former staging area will be percolate into the re-vegetated grass field.

All stormwater generated from the developed site will discharge to the west curb gutter of Santa Cruz Street, convey south, turn west on Maple Street, and be collected by a an existing City curb-gutter stormwater inlet at the intersection of Maple Street and Santa Clara Street. This inlet connects to the City of Madera underground stormwater conveyance system which ultimately discharge to a City of Madera Stormwater basin southwest of the site south of Madera High School.

Post-construction drainage patterns and conveyance systems are presented on Site Maps Drainage Area and Sampling Site Map /Figure 4.i in Appendix A.

The changes of impervious areas/drainage patterns resulting from the Project and demonstration of the Project complying with the post-construction requirements of the local MS4 are presented in Appendix L

2.2 PERMITS AND GOVERNING DOCUMENTS

In addition to the 2022 CGP, the following documents have been taken into account while preparing this SWPPP:

- Regional Water Board requirements
- Basin Plan requirements
- Contract Documents
- Air Quality regulations and permits.
- State Water Board GeoTracker database (GeoTracker)
- Federal Endangered Species Act – Not applicable.
- National Historic Preservation Act/Requirements of the State Historic Preservation Office – Not applicable.
- State of California Endangered Species Act – Not applicable.
- Clean Water Act Section 401 Water Quality Certifications and 404 Permits – Not applicable.
- CA Department of Fish and Game 1600 Streambed Alteration Agreement – Not applicable.
- California Ocean Plan – Not applicable.

2.3 STORMWATER RUN-ON FROM OFFSITE AREAS

Stormwater run-on is anticipated only for the drop-off area from the curb-gutter of Santa Cruz street. Diverting stormwater from this curb-gutter is infeasible and would create a traffic hazard. The Contractor will complete demolition, grading, and paving of the bus drop-off area during months of low rainfall chance to avoid run-on to this disturbed run-on area. The Contractor will also place two gravel filter fabric gravel bags in a J-weir formation in the gutter of Santa Cruz Street south of the site to filter and slow stormwater run-off from the drop-off site area.

2.4 FINDINGS OF THE CONSTRUCTION SITE SEDIMENT AND RECEIVING WATER RISK DETERMINATION

A construction site risk assessment has been performed for the project and the resultant risk level is Risk Level 1. The factors used to calculate risk level were determined by the use of the standard methods in the CGP.

- The R-value was determined from EPA's *Rainfall Erosivity Factor Calculator for Small Construction S*ites at: https://lew.epa.gov/ in accordance with the State Water Board Guidance for multi-year projects at:

https://www.waterboards.ca.gov/water_issues/programs/stormwater/smarts/construction/docs/rfactor_guide.pdf,

- K and LS factors used were provided by SMARTS for the Project region.

The risk level is based on project duration, location, proximity to impaired receiving waters, and soil conditions. A copy of the Risk Level determination submitted on SMARTS with the PRDs is included in Appendix B.

Table 2-3 and Table 2-4 summarize the sediment and receiving water risk factors and document the sources of information used to derive the factors.

Table 2-3 Summary of Sediment Risk

RUSLE Factor	Value	Method for Establishing Value	
R	49.86	EPA's *Rainfall Erosivity Factor Calculator for Small Construction Sites*	
K	0.32	SWRCB K-Factor Map, Generated by SMARTS	
LS	0.20	SWRCB LS-Factor Map, Generated by SMARTS	
Total Predicted Sediment Loss (tons/acre)			**3.19**
Overall Sediment Risk Low Sediment Risk < 15 tons/ acre Medium Sediment Risk >= 15 and < 75 tons/acre High Sediment Risk >= 75 tons/acre			☒ **Low** ☐ **Medium** ☐ **High**

The project site discharges into the City of Madera underground stormwater conveyance system that ultimately discharge into the City of Madera Stormwater Basin.

Table 2-4 Summary of Receiving Water Risk

Receiving Water Name	303(d) Listed for Sediment Related Pollutant (1)	TMDL for Sediment Related Pollutant (1)	Beneficial Uses of COLD, SPAWN, and MIGRATORY (1)
City of Madera Stormwater Basin	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No
Overall Receiving Water Risk			☒ **Low** ☐ **High**
(1) If yes is selected for any option the Receiving Water Risk is High			

Risk Level 1 sites are subject to the narrative effluent limitations specified in the 2022 CGP and may be subject to numeric effluent limits for applicable TMDLs, dewatering activities, active treatment systems and passive treatment systems used on site. The narrative effluent limitations require stormwater discharges associated with construction activity to minimize or prevent pollutants in stormwater and authorized non-stormwater through the use of controls, structures, and best management practices (BMPs). This SWPPP has been prepared to address Risk Level 1 requirements (2022 CGP Attachment D).Projects that discharge to a water body and or watershed listed in Table H-2 are subject to both the narrative and numeric effluent limitations imposed by the TMDL requirements in Attachment H. There are no water bodies with TMDLs in the Central Valley Regional Water Quality Control Board region (the region of the Project), therefore the Project is not subject to any TMDL requirements.

Table 2-7 TMDL Numeric Action Levels, Numeric Effluent Limits

TMDL	Parameter	Unit	Numeric Action Level	Numeric Effluent Limit
None	NA	NA	NA	NA

2.5 CONSTRUCTION SCHEDULE

The site sediment risk was determined based on construction taking place between:

Estimate Project Start Date: August 1, 2024

Estimate Project End Date: January, 31, 2026

Modification or extension of the schedule (start and end dates) may affect risk determination and permit requirements. The LRP shall contact the QSD if the schedule changes during construction to address potential impact to the SWPPP. The estimated schedule for planned work can be found in Appendix E.

2.6 POTENTIAL CONSTRUCTION ACTIVITY AND POLLUTANT SOURCES

Appendix F includes a list of construction activities and associated materials that are anticipated to be used onsite as well as the pollutant source assessment form that was completed for the project. These activities and associated materials will or could potentially contribute pollutants, other than sediment, to stormwater runoff.

The anticipated activities and associated pollutants were used in Section 3 to select the BMPs for the project. Locations of anticipated pollutants and associated BMPs are shown on the Site Map in Appendix A.

Additionally, proper measures will be taken to ensure that trench spoils or any other soils disturbed during construction activities that are contaminated are not discharged with stormwater or non-stormwater discharges into storm drains or water bodies (except pursuant to a separate NPDES Permit). If contaminated soils are found on site, and the responsible party cannot be identified or fails to take action, soils will be sampled to determine proper handling and protect public safety. The appropriate local, State, and federal agencies along with the appropriate Regional Water Board will be notified when contaminated soils are observed.

For sampling requirements for non-visible pollutants associated with construction activity, please refer to Section 7.7.1. For a full and complete list of onsite pollutants, refer to the Safety Data Sheets (SDS), which are retained onsite at the construction trailer or are available electronically at the site.

2.7 TMDL REQUIREMENTS

Based on the project's receiving water and the pollutant source assessment, there are no applicable TMDLs for the Project.

Table 2-8 Project TMDLs

TMDL	Applicable Water Body/ Watershed	Pollutants	Additional TMDL-Related NAL or NEL	Compliance Actions
None	NA	NA	NA	NA

2.8 IDENTIFICATION OF NON-STORMWATER DISCHARGES

Non-stormwater discharges into storm drainage systems or waterways, which are not authorized under the 2022 CGP and listed in the SWPPP, or authorized under a separate NPDES permit, are prohibited.

Non-stormwater discharges that are authorized from this project site include the following:

- De-chlorinated potable water sources and non-potable water sources such as:
    - fire-fighting activity,
    - fire hydrant system flushing,
    - irrigation of vegetative erosion control measures,
    - uncontaminated water line flushing,
    - pipe flushing and testing,
    - air conditioning and compressor condensate,
    - water to control dust, uncontaminated groundwater or spring water from construction dewatering activities in compliance with Attachment J of the 2022 CGP
- Non-stormwater discharges that meet the following conditions:
    - The discharge is not routed through site areas with exposed soil, except for water used for dust control or to vegetation irrigation to stabilize areas.
    - The discharge does not cause or contribute to an exceedance of water quality standards in the receiving water.
    - The discharge complies with other applicable requirements of the 2022 CGP including applicable action levels, effluent limitations, and monitoring and reporting requirements.
    - The discharge is not prohibited by an applicable regional or statewide water quality control plan.
    - The discharge is in accordance with other applicable State and Regional Water Board permits; and

These authorized non-stormwater discharges will be managed with the stormwater and non-stormwater BMPs described in Section 3 of this SWPPP and will be minimized under the direction of the QSP. Additionally, the non-stormwater discharges not applicable to this project are still allowable granted they do not contact potential pollutant sources.

Activities at this site that may result in unauthorized non-stormwater discharges include:

- Debris and trash
    - In accordance with State Water Board Resolution 2015-0019, the Trash Provisions of the Water Quality Control Plan for Ocean Waters of California and the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California, as applicable to construction stormwater discharges.

- Wastewater from washout or cleanout of areas, structures or equipment with concrete, grout, stucco, paint, or other construction materials.
- Form-release oils and curing compounds.
- Fuels, oils, fluids, or other materials used in vehicle and equipment operation and maintenance.
- Soaps, solvents, or detergents (e.g., used in vehicle equipment washing or external building wash down); and
- Toxic or hazardous substances (e.g., asbestos, lead, mercury, or PCBs).

Steps will be taken, including the implementation of appropriate BMPs, to ensure that unauthorized discharges are eliminated, controlled, disposed, or treated on-site.

Discharges of construction materials and wastes, such as fuel or paint, resulting from dumping, spills, or direct contact with rainwater or stormwater runoff, are also prohibited.

2.9 REQUIRED SITE MAP INFORMATION

The construction project's Site Map(s) showing the project location, surface water boundaries, geographic features, construction site perimeter and general topography, locations of storm drain inlets that receive runoff from the project, and other requirements identified in 2022 CGP Sections IV.O.2. k. and l are located in Appendix A. Table 2-9 identifies Maps or Sheet Nos. where required elements are illustrated.

Table 2-9 Required Map Information

Included on Map/Plan Sheet No. (1)	Required Element
Pre-Earthwork Drawings	
All Figures	Site and project boundaries
Figure 2	Areas disturbed during geotechnical or other preconstruction investigation work
Figure 2	Existing roads and trails
Figure 2	Drainage areas
Figure 2	Discharge locations
Figure 2	Existing storm drain system if applicable
Figure 2	Proposed locations of storage areas for waste
Figure 2	Proposed locations of construction materials
Figure 2	Proposed locations of project staging areas
Figure 2	Proposed locations of stockpiles
Figure 2	Proposed locations of vehicles, equipment staging and vehicle maintenance
Figure 2	Proposed locations of loading/unloading materials
Figure 2	Proposed locations of site access (entrance/exits)

Table 2-9 Required Map Information

Included on Map/Plan Sheet No. (1)	Required Element
Figure 2	Proposed locations of fueling, water storage, water transfer for dust control
Figure 2	Proposed locations of demolition
Figure 2	Proposed locations of other construction support activities
Construction and Earthwork Drawing(s)	
Figures 3 and 4	Site layout (grading plans) including roads
Figures 3 and 4	Site and project boundaries
Figures 3 and 4	Drainage areas
Figures 3 and 4	Discharge locations
Figures 3 and 4	Sampling locations
Figures 3 and 4	Areas of soil disturbance (temporary or permanent)
Figures 3 and 4	Proposed active areas of soil disturbance (cut or fill)
Figures 3 and 4	Proposed locations of erosion control BMPs
Figures 3 and 4	Proposed locations of sediment control BMPs
Figures 3 and 4	Proposed locations of run-off BMPs
✓/NA	Temporary and/or permanent run-on conveyance (if applicable)
NA	Proposed locations of active treatment systems(s) (if applicable)
Figures 3 and 4	Proposed locations of storage areas for waste
Figures 3 and 4	Proposed locations of construction materials
Figures 3 and 4	Proposed locations of project staging areas
Figures 3 and 4	Proposed locations of stockpiles
Figures 3 and 4	Proposed locations of vehicles, equipment and vehicle maintenance
Figures 3 and 4	Proposed locations of loading/unloading materials
Figures 3 and 4	Proposed locations of site access (entrance/exits)
Figures 3 and 4	Proposed locations of fueling, water storage, water transfer for dust control
Figures 3 and 4	Proposed locations of demolition
Figures 3 and 4	Proposed locations of other construction support activities
Figures 3 and 4	Site-specific procedures to implement final stabilization BMPs as soon as reasonably practicable

Notes: (1) Indicate maps or drawings that information is included on (e.g., Vicinity Map, Site Map, Drainage Plans, Grading Plans, Progress Maps.)

Section 3 Best Management Practices

3.1 SCHEDULE FOR BMP IMPLEMENTATION

BMPs will be implemented as per the schedule indicated in Table 3-1.

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
Erosion Control BMPs	EC-1, Scheduling	Entire Site	From pre-construction until final stabilization.	Entirety of Project
	EC-2, Preservation of Existing Vegetation	Areas not planned for disturbance, or that can be planned to be disturbed later to minimize disturbed soil areas.	Start of Construction of Project and prior to each disturbance of a new area.	Entirety of Project
	EC-3, Hydraulic Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-4, Hydroseed	Areas not planned for disturbance for the next 14 days, areas for final stabilization.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-3 days of initial spraying and re-applied as needed.
	EC-5, Soil Binders	Areas not planned for disturbance for the next 14 days, inactive high dust generating areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-6, Straw Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial installation and re-applied as needed.
	EC-7, Geotextiles and Mats	Steep disturbed slopes, under trackout rocks, in disturbed stormwater conveyance channels.	Pre-earthwork (trackout installation), after completing grading of an area, pre-storm events, final stabilization.	As needed during on-going construction activities.
	EC-8, Wood Mulching	Areas planned for landscaping.	Final stabilization phase.	1-2 weeks.
	EC-9, Earth Dikes and Drainage Swales	At border of run-on areas or for anticipated disturbed flow concentration channels.	Prior to or early in grading phase to divert run-on. Ongoing based on QSPs during- and post-storm observations.	1-2 weeks of installation and ongoing maintenance.
	EC-10, Velocity Dissipation Devices	Designed stormwater outfalls/conveyance channels and observed temporary concentrated flow areas.	After completing construction of a new stormwater outfall. After disturbance of an existing concentrated flow channel or creation of a new channel.	1 week to install. Ongoing maintenance to remove accumulated sediment, trash, litter, etc.

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
	~~EC-11, Slope Drains~~	~~Designed slope drains.~~	~~After completing construction of a new drain and outfall.~~	~~1-3 weeks.~~
	~~EC-12, Streambank Stabilization~~	~~Stream banks, with applicable permits from USACE, SWRCB, and CDFW.~~	~~Prior to disturbing large upland areas that will increase stormwater discharge volume to stream.~~	~~1-2 weeks. Ongoing maintenance.~~
	EC-14, Compost Blanket	Areas not planned for disturbance for the next 14 days, final stabilization areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-3 weeks.
	EC-15, Soil Preparation-Roughening	Areas not planned for disturbance for the next 14 days, final stabilization areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-5 days for roughening. 1-2 weeks for soil amendments.
	EC-16, Non-Vegetative Stabilization	Areas requiring immediate stabilization, areas expected to be constantly disturbed (e.g. staging area, access routes), planned landscaping areas.	When disturbed soil areas require immediate stabilization (e.g. eroding slopes), when setting up staging area, final stabilization phase.	1 week. Ongoing maintenance.
Sediment Control BMPs	SE-1, Silt Fence	Flat areas below disturbed slopes. Site perimeter.	Prior to disturbing slopes. Prior to commencing grading (perimeter control).	1-2 weeks. Ongoing maintenance.
Sediment Control BMPs	~~SE-2, Sediment Basin~~	~~At designed sediment basin location for Project.~~	~~Prior to mass grading.~~	~~1-3 months. Ongoing maintenance.~~
Sediment Control BMPs	SE-3, Sediment Trap	Flat low areas receiving concentrated stormwater, especially prior to outfalls.	At start of grading.	1-5 days. Ongoing maintenance.
Sediment Control BMPs	SE-4, Check Dams	Concentrated flow channels.	Prior to upgrade land disturbance that discharges to flow channel. Immediately after disturbing flow channel.	1-2 days. Ongoing maintenance.
Sediment Control BMPs	SE-5, Fiber Rolls	Site/disturbed area perimeters, disturbed slope contours, around soil stockpiles.	Prior to grading of an area. Immediately after disturbing slopes. As needed around stockpiles.	1-2 weeks. Ongoing maintenance.
Sediment Control BMPs	SE-6, Gravel Bag Berm	Site/disturbed area perimeters, flat areas below disturbed slopes.	During Construction	1-2 days. Ongoing maintenance.
Sediment Control BMPs	SE-7, Street Sweeping	Internal paved site areas, off-site paved areas (site exists)	During Construction	Up-to twice per day, as needed.
Sediment Control BMPs	SE-8, Sandbag Barrier	Flat areas below disturbed slopes, along disturbed slope contours, stormwater diversion areas.	During Construction	1-2 days. Ongoing maintenance.

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
	~~SE-9, Straw Bale Barrier~~	~~Flat areas below disturbed slopes. Site perimeter.~~	~~Prior to disturbing slopes. Prior to commencing grading (perimeter control).~~	~~1-2 weeks. Ongoing maintenance.~~
	SE-10, Storm Drain Inlet Protection	Existing and new drain inlets	Prior to grading, immediately after installation of new drain inlets.	1-2 days. Frequent ongoing maintenance.
	~~SE-11, Active Treatment Systems~~	~~Per ATS plan.~~	~~Per ATS plan.~~	~~Per ATS plan.~~
	SE-12, Manufactured Linear Sediment Controls	Paved site perimeters, disturbed site perimeters, in flow channels as check structure, at flat areas below disturbed slopes.	Prior to grading and ongoing as needed.	1-2 weeks. Ongoing maintenance.
	SE-13, Compost Sock and Berm	Site/disturbed area perimeters, disturbed slope contours, drain inlets.	Prior to grading of an area. Immediately after disturbing slopes.	1-2 weeks. Ongoing maintenance.
	~~SE-14, Biofilter Bags~~	~~Areas needing immediate sediment control BMPs, including: perimeter controls, DI protections, and as a check dam.~~	~~During Construction~~	~~1 day. Ongoing maintenance and replacement.~~
Wind Erosion Control BMPs	WE-1, Wind Erosion Control	Disturbed site areas.	Every non-wet day of active construction.	2-4 times per day.
	EC-3, Hydraulic Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-4, Hydroseed	Areas not planned for disturbance for the next 14 days, areas for final stabilization.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-3 days of initial spraying and re-applied as needed.
	EC-5, Soil Binders	Areas not planned for disturbance for the next 14 days, inactive high dust generating areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial spraying and re-applied as needed.
	EC-6, Straw Mulch	Areas not planned for disturbance for the next 14 days.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days.	1-3 days of initial installation and re-applied as needed.
	EC-15, Soil Preparation-Roughening (roughening only)	Areas not planned for disturbance for the next 14 days, final stabilization areas.	After ceasing land disturbance for an area not planned for disturbance for the next 14 days; Final stabilization.	1-5 days for roughening.

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
Tracking Control BMPs	EC-16, Non-Vegetative Stabilization	Areas requiring immediate stabilization, areas expected to be constantly disturbed (e.g. staging area, access routes), planned landscaping areas.	When frequently disturbed soil areas (e.g. staging area) is contributing to significant dust generation.	1 week. Ongoing maintenance.
Tracking Control BMPs	TC-1, Stabilized Construction Entrance and Exit	Site exits/entrances approved by landowner and relevant city, county, or Caltrans.	Start of Construction, prior to grading.	1 week. Ongoing maintenance. May be relocated for new phases.
Tracking Control BMPs	TC-2, Stabilized Construction Roadway	Site exits/entrances approved by QSD, landowner, and relevant city, county, or Caltrans.	Start of Construction, prior to grading.	2-3 weeks. Ongoing sweeping.
Tracking Control BMPs	~~TC-3, Entrance/Outlet Tire Wash~~	~~Inside site adjacent to exits/entrances.~~	~~Start of Construction, prior to grading. As needed to supplement TC-1.~~	~~2-3 weeks. Ongoing maintenance.~~
Non-Stormwater Control BMPs	NS-1, Water Conservation Practices	All potable/non-potable water sources, and water holding equipment, valves, and hoses.	During Construction	Ongoing.
Non-Stormwater Control BMPs	NS-2, Dewatering Operation	Site locations impacted by pooled stormwater and non-stormwater.	After rain events or other non-stormwater accumulation.	1 day of de-watering per de-watering event.
Non-Stormwater Control BMPs	NS-3, Paving and Grinding Operation	Areas designated or paving/grinding and paving/grinding equipment, material, and waste storage locations.	During paving/grinding operations.	From start of paving equipment arriving on-site until paving equipment has left site. During grinding operations and waste management.
Non-Stormwater Control BMPs	~~NS-4, Temporary Stream Crossing~~	~~Designated crossing locations, with applicable permits from USACE, SWRCB, and CDFW.~~	~~Prior to stream crossing~~	~~1-3 weeks.~~
Non-Stormwater Control BMPs	~~NS-5, Clear Water Diversion~~	~~Work areas in water bodies.~~	~~Prior to construction in water bodies~~	~~1-4 weeks. Ongoing maintenance.~~
Non-Stormwater Control BMPs	NS-6, Illicit Connection-Illegal Discharge Connection	Entire site.	During Construction	Ongoing.

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
	NS-7, Potable Water Irrigation Discharge Detection	All potable/non-potable water sources and equipment.	During Construction	Immediately after installing irrigation system. Ongoing.
	NS-8, Vehicle and Equipment Cleaning	Designated and designed vehicle/equipment washing location.	Prior to any on-site vehicle and equipment washing.	1-2 weeks to construct. Ongoing when washing.
	NS-9, Vehicle and Equipment Fueling	Designated fueling location.	Prior to any on-site fuel tank arriving on-site.	1 day to install. Ongoing when fueling.
	NS-10, Vehicle and Equipment Maintenance	Designated vehicle and equipment maintenance location.	Prior to any on-site vehicle and equipment maintenance.	1 day to install. Ongoing when fueling.
	~~NS-11, Pile Driving Operations~~	~~Pile driving and equipment storage locations~~	~~Prior to pile driving equipment arriving on-site~~	~~1 day to install. Ongoing.~~
	NS-12, Concrete Curing	Concrete curing compound use and storage location.	Prior to concrete curing compound arriving on-site, during use, and ongoing while storing compound on-site.	1 day to install. Ongoing.
	NS-13, Concrete Finishing	Planned concrete finishing locations.	Prior to starting concrete finishing, during use, and while material is stored on-site	1 day to install. Ongoing.
	~~NS-14, Material Over Water~~	~~Planned work areas over water, with applicable permits from USACE, SWRCB, and CDFW.~~	~~Prior to work over water and during.~~	~~Ongoing.~~
	~~NS-15, Demolition Adjacent to Water~~	~~Planned demolition areas adjacent to water~~	~~Prior to start of demolition and during.~~	~~1-5 days to install. Ongoing~~
	~~NS-16, Temporary Batch Plants~~	~~Designated temporary batch plant location.~~	~~At start of construction of temporary batch plant and ongoing during operation and storage.~~	~~Planning prior to batch plant construction and ongoing until all materials are removed from site.~~
Constructi on Material	WM-1, Material Delivery and Storage	Designated delivery and storage location.	Prior to material delivery, during delivery, and ongoing for storage.	Entirety of project
	WM-2, Material Use	Planned locations for each unique material use.	Prior to and during material use.	Entirety of project

Table 3-1 BMP Implementation Schedule

	BMP	Location	Implementation	Duration
Waste Management Control BMPs	WM-3, Stockpile Management	Designated stockpile location and on-site soil source location.	Immediately after stockpiling materials. Prior to rain and wind events.	Entirety of project
	WM-4, Spill Prevention and Control	Entire site.	Initial spill training and ongoing.	Entirety of project
	WM-5, Solid Waste Management	Designated solid waste storage locations and solid waste generating areas/activities.	Prior to generation of solid waste and during all of construction	Entirety of project
	WM-6, Hazardous Waste Management	Designated hazardous waste storage locations and hazardous waste generating areas/activities.	Prior to construction activities and during all of construction	Entirety of project
	~~WM-7, Contaminated Soil Management~~	~~Identified contaminated soil locations.~~	~~Prior to disturbance of contaminated soil areas and ongoing until disposal of hazard soil and final stabilization of hazard soil location.~~	~~Ongoing until all hazard soil is removed from site or stabilized.~~
	WM-8, Concrete Waste Management	Planned concrete, stucco, cement, and mortar use and storage locations, including wastes.	Prior to concrete, stucco, cement, and mortar use. Ongoing while storing dry materials and wastes.	Ongoing when concrete, stucco, cement, mortar, and resulting wastes are on-site.
	WM-9, Sanitary-Septic Waste Management	Designated portable outhouse storage locations.	All of construction with weekly maintenance.	Entirety of project
	WM-10, Liquid Waste Management	Designated liquid waste storage locations and liquid waste generating areas/activities.	Prior to generation of liquid waste and while liquid waste is stored/being generated on-site.	Ongoing with liquid waste stored on-site.

Erosion and sediment controls are required by the 2022 CGP to provide effective reduction or elimination of sediment related pollutants in stormwater discharges and authorized non-stormwater discharges from the Site. Applicable BMPs are identified in this section for erosion control, sediment control, tracking control, and wind erosion control.

3.2.1 Erosion Control

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in stormwater runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles.

This construction project will implement the following practices to provide effective temporary and final erosion control during construction:

1. Preserve existing vegetation where required and when feasible.

2. The area of soil disturbing operations shall be controlled such that the Contractor is able to implement erosion control BMPs quickly and effectively.
3. Stabilize non-active areas within 14 days of cessation of construction activities or sooner if stipulated by local requirements.
4. Control erosion in concentrated flow paths by applying erosion control blankets, check dams, erosion control seeding, or alternate methods.
5. Prior to the completion of construction, apply permanent erosion control to remaining disturbed soil areas.

Sufficient erosion control materials shall be maintained onsite to allow implementation in conformance with this SWPPP.

The following erosion control BMP selection table, Table 3-2 indicates the BMPs that will be implemented to control erosion on the construction site. Fact Sheets for temporary erosion control BMPs are provided in Appendix G.

These temporary erosion control BMPs shall be implemented in conformance with the following guidelines and as outlined in the BMP Factsheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Table 3-2 Erosion Control BMPs

CASQA Fact Sheet	BMP Name	Considered for the Project[1]	BMP Used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
EC-1	Scheduling	✓	✓		
EC-2	Preservation of Existing Vegetation	✓	✓		
EC-3	Hydraulic Mulch	✓[2]	✓		
EC-4	Hydroseed	✓[2]	✓		
EC-5	Soil Binders	✓[2]	✓		
EC-6	Straw Mulch	✓[2]	✓		
EC-7	Geotextiles and Mats	✓[2]	✓		
EC-8	Wood Mulching	✓[2]	✓		
EC-9	Earth Dike and Drainage Swales	✓[3]	✓		
EC-10	Velocity Dissipation Devices	✓[3]	✓		
EC-11	Slope Drains	✓[3]		✓	There are no outfalls to slopes that require BMP.
EC-12	Stream Bank Stabilization	✓		✓	Project does not drain to stream.
EC-14	Compost Blankets	✓[2]		✓	Not necessary for Project with mild slopes.
EC-15	Soil Preparation-Roughening	✓	✓		
EC-16	Non-Vegetated Stabilization	✓[2]	✓		
WE-1	Wind Erosion Control	✓	✓		

[1] The 2022 CGP Fact Sheet Section I.R.1.d. through I.R.1.i.describes various BMPs that should be considered for use on the construction site.

[2] The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements.

[3] All run-on and runoff from the construction site shall be managed for Risk Level 2 and 3 and Risk Level 1 if the evaluation of quantity and quality of run-on and runoff deems them necessary or visual inspections show that the site requires these controls. Run-on from offsite shall be directed away from all disturbed areas, diversion of offsite flows may require design/analysis by a licensed civil engineer and/or additional environmental permitting.

EC-1 Scheduling

Scheduling is a critical BMP for every Project. The contractor shall continually reevaluate and adjust the Project construction schedule by considering current and expected site conditions, the upcoming forecast, and reasonably predictable long-term weather events.

- On a macro-level, scheduling to start a Project or mass grading in months with less rainfall amounts takes no products or labor to significantly reduce would-be periods of high erosion on a Project site. The contractor shall consider the average monthly rainfall of the Project location to decide when to start mass grading for the Project. If the Contractor decides to have large areas of disturbed soil during high rain fall periods, the Contractor shall utilize effective erosion and sediment controls to offset the higher erosion risk at the site.
- On a micro-level, scheduling additional land disturbance or use of polluting materials (asphalt concrete, concrete, stucco, painting, herbicide, fertilizer, etc.) when there is a forecast of no rain for a long period allows the contractor has time to complete the work of the Project and have time to install necessary BMPs and for polluting materials to cure, dry, stabilize, etc.. The contractor shall check the local NOAA forecast prior to disturbance of new soil areas and use of stormwater polluting materials that require time cure, dry, stabilize, etc.
- The contractor shall suspend non-emergency construction work during periods of extreme wind events over 40 MPH.
- The contractor shall minimize construction work at the job site during forecasted qualifying precipitation events as defined in the CGP and Section 7.3 of this SWPPP.

EC-2 Preservation of Existing Vegetation

The Contractor shall reduce the discharge of pollutants from the site by conserving as much of the existing vegetation as possible. If possible, vegetative buffer strips will be left adjacent to watercourses, impervious areas, drain inlets, and along the site perimeter. The purpose of minimizing the removal or injury of existing trees, vines, shrubs and grasses is that they naturally protect soil from erosion.

EC-3 Hydraulic Mulch

- The Contractor shall consider the application of hydraulic mulch to provide sediment control and temporary soil stabilization or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 3. Hydraulic mulch may be used in the following locations:
    - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
    - On soil stockpiles

<u>*Suitable Applications*</u>

- Hydraulic Mulch is a medium-durability erosion control BMP intended for temporarily stabilizing disturbed soil areas. This BMP typically includes a soil binder similar to EC-5, but also includes mulch material (typically wood fiber) to provide soil cover in addition to binding soil particles.
- Hydraulic mulch shall be considered to be installed to flat to mild slopes of disturbed soil areas not expected to receive vehicle traffic.
- Hydraulic mulch can typically be expected to be re-installed once over a rainy season.
- Hydraulic mulch be more effective (especially on slopes) when paired with EC-15 Soil Roughening and preparation (specifically track walking or soil scarification) or SE-4 Fiber rolls on slopes.
- Hydraulic mulch is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preparation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the

most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

Implementation

- Apply according to manufacturer recommendation.
- Prior to application, roughen embankment and fill areas by rolling with a crimping or punching type roller or by track walking up and down the slopes.
- To be effective, hydraulic matrices require 24 hours to dry before rainfall occurs.
- May require a second application in order to remain effective for an entire rainy season.
- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Paper based hydraulic mulches alone shall not be used for erosion control.

EC-4 Hydroseed

Hydroseeding is an erosion control that typically consists of applying a mixture of wood fiber, seed, fertilizer, and stabilizing emulsion with hydro-mulch equipment, to temporarily or permanently protect exposed soils from erosion by water and wind.

Apply to areas requiring temporary protection until permanent stabilization is established, and disturbed areas that will be re-disturbed following an extended period of inactivity.

- The Contractor shall consider the application of hydroseed to provide sediment control and temporary (or permanent) soil stabilization or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 3. Hydroseed may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
  - On soil stockpiles

To select the appropriate matrix, an evaluation of site conditions shall be performed with respect to:

- Soil conditions; maintenance requirements; site topography; sensitive adjacent areas; season and climate; water availability; seed mix; and plans for permanent vegetation.
- The Contractor shall consider the use of hydroseed for temporary or permanent stabilization of areas of soil disturbed by the Project that do not have any improvements in the landscaping plans.
  - When using hydroseed, the Contractor and QSP shall consider the need to implement the additional BMPs of EC-7 Geotextile Mats, EC-Soil Preperation and roughening (for roughening and nutrient soil amendments), and SC-4 Fiber Rolls for steep slopes.
- If hydroseeding is not selected, disturbed soil areas shall achieve final stabilization by other methods including:
  - hand or drill seeding in conjunction with temporary soil cover of EC-6 Straw Mulch or EC-3 Hydraulic Mulch as needed to promote moisture needed for germination.
- Hydroseeding is one possible temporary erosion control BMP. Other temporary erosion control BMP options to consider include EC-3 Hydro Mulch, EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preperation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per CGP Appendix D Section II.D.f.

Implementation

- Avoid use of hydro-seeding in areas that would be incompatible with future earthwork activities and would have to be removed.

- Hydro-seeding 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, hydro-seeding must be used in conjunction with mulching and sediment controls on disturbed slopes.
- Hydro-seeding 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 should 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 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.
- Commercial fertilizer shall conform to the requirements of the California Food and Agricultural Code. Fertilizer may be liquid, pellet or granular form.
- Follow up applications should 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.

EC-5 Soil Binders

- The Contractor shall consider the application of soil binders to provide sediment control and temporary (or permanent) soil stabilization or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 3. Soil binders may be used in the following locations:
  - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
- Soil binder is a relatively cheap and effective BMP for erosion control that can be installed quickly by the Contractor with minimal specialty equipment. Soil binder is appropriate for disturbed soil areas that will not experience vehicle traffic.
- Different soil binders should be considered for use of water erosion control and wind erosion control.
- Soil binder is necessary when implementing EC-6 Straw mulch for sandy soil conditions.
- Soil binder shall not be applied when there is any forecasted rain for the next 24-hours to prevent the discharge of pollutants from the soil binder product.
- Soil binder shall be applied according to the manufacturer’s specifications.
- The Contractor and QSP shall consult with CASQA EC-5 and Appendix B of the CASQA Handbook to select an appropriate soil binder for the specific use situation of the Project and submit the proposed product to the QSD prior to use. The QSD shall respond to the Contractor within three working days (not including the day of submittal) for approval of the proposed soil binder product.
- Soil Binders is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preperation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

EC-6 Straw Mulch

- The Contractor shall consider the application of straw mulch to provide sediment control and temporary (or permanent) soil stabilization or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 3. Straw mulch may be used in the following locations:
    - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
- Straw mulch shall be considered to be installed to flat to mild slopes of disturbed soil areas not expected to receive vehicle traffic.
- The Contractor shall consider the use of straw mulch in conjunction for areas of seeding or hydroseeding to promote the growth of vegetation by improving soil moisture after seeding.
- The contractor shall only use a weed-free agricultural straw product.
- When applying straw mulch on sandy soil, the contractor shall pair straw mulch application with a soil binder. The Contractor and QSP shall consult with CASQA EC-5 and Appendix B of the CASQA Handbook to select an appropriate soil binder for the specific use situation of the Project and submit the proposed product to the QSD prior to use. The QSD shall respond to the Contractor within three working days (not including the day of submittal) for approval of the proposed soil binder product.
- If straw mulch is applied alone with no tackifier/binder, the Contractor shall at a minimum track walk over applied straw to into the soil, or use a crimper or punch roller to fully work straw into the soil. The Contractor shall plan for reapplication of straw as needed and consider the cost-benefits of working applied straw mulch into soil.
- Straw Mulch is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, EC-15 Soil Preperation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

EC-7 Geotextiles and Mats

Geotextiles and mats come in a variety of materials and thicknesses for different use cases. The contractor shall different types of geotextiles for the following circumstances:

Polypropylene fabric

- 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.
- Traditional black polypropylene fabric shall be used for:
    - Lining of disturbed concentrated flow channels.
        - Soil areas shall be prepared by clearing of trash, plant material, and rocks for a smooth surface. Fabric shall be dug into the soil at top of slope and installed with full contact to the soil to prevent stormwater from flowing under an installed mat.
        - Consider the addition of check dams per SE-4 to concentrated flow channels.
    - A reusable stockpile cover (or achieved by use of plastic tarps).
    - Underlining of trackout control rocks per TC-1.

- Underlining of landscaping mulch materials (woodchips, gravel, decomposed granite, rip rap, etc.) temporarily installed for soil stabilization as a tool for removal or re-use of landscaped materials for the final landscaping design.
- Immediate stabilization of disturbed slopes steeper than 3:1 (H:V) prior to rain events.
    - Disturbed slopes shall be prepared as a smooth surface by removing trash, plant material, and rocks.
    - Blanket shall be installed with overlap and staple spacing and type according to CASQA EC-7.

EC- 8 Wood Mulching

- The Contractor shall consider the use of wood mulching as an erosion control BMP to provide effective soil cover of disturbed areas that are not planned for disturbance for the next 14 days. If Wood Mulching is not selected, the Contractor shall implement an equivalent erosion control BMP for these areas throughout the Project.
- The Contractor shall consider the procuring wood chips that are a part of the landscaping design early for use as a recyclable temporary erosion control BMP throughout the Project. Disturbed soil areas needing immediate stabilization can be covered with polypropylene geotextile mats to facilitate collection of woodchips from temporary areas for re-use for the final landscaping design.
- Wood Mulching shall be used for final stabilization areas, as specified in the Project landscaping plan.
- Wood mulching shall not be used for slopes steeper than 5:1 (H:V).
- Wood mulching is one possible erosion control BMP. Other erosion control BMP options to consider include: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-14 Compost Blankets, EC-15 Soil Preperation and Roughening, and/or EC-16 Non-vegetative Stabilization. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per CGP Appendix D Section II.D.f..

EC-9 Earth Dike and Drainage Swales

Earth dikes and drainage swales are erosion controls that consists of 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 and to divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

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.
- To prevent run-on to material and waste storage areas.
- Below steep grades where runoff begins to concentrate.
- Along roadways and facility improvements subject to flood drainage.
- At the top of slopes to divert run on from adjacent or undisturbed slopes.
- At bottom and mid slope locations to intercept sheet flow and convey concentrated flows.
- Divert sediment laden runoff into sediment basins or traps.

When earthen dikes and/or drainage swales are used at the Project site, the Contractor shall:

- Newly graded slopes should be protected from erosion by runoff.

- Carefully size and locate earth dikes, drainage swales.
- Excessively steep, unlined dikes and swales are subject to erosion and gully formation.
- Use a lined ditch for high flow velocities.
- 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.

Earthen Dikes

The Contractor shall Review civil drawings for specifications and construct earth dikes according to the specifications in the approved plan. Generally 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%. Plastic sheeting may be used to line the dike however it has a short useful life and may need to be replaced more frequently. 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 or plastic sheeting 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 or approved civil drawings). Unless approved civil drawings or local drainage design criteria state otherwise, drainage swales should be designed as follows:

- Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).
- 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 riprap 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.
- 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.

EC-10 Velocity Dissipation Devices

The Contractor shall reduce the discharge of pollutants from the site by construction and maintenance of velocity dissipation devices in disturbed concentrated stormwater conveyance channels and/or channels expected to convey turbid stormwater from disturbed areas. The purpose of velocity dissipations to prevent scour of the soil caused by concentrated, height velocity flows. This project will use rip rap, gravel bags, etc. to construct the velocity dissipation devices along concentrated stormwater flow paths with expected turbid runoff.

EC-16 Non-Vegetated Stabilization

- The Contractor shall consider the application of non-vegetative stabilization to provide sediment control and temporary (or permanent) soil stabilization or use an equivalently effective erosion control BMP as needed throughout the Project, and as shown in Appendix A: Site Maps, Figure 3. Non-vegetative stabilization may be used in the following locations:
    - On disturbed soils within the construction project limits that are not planned for disturbance for the next 14 days (CGP Appendix D Section II.D.f.).
    - As specified in the Project plans.
- The purpose of non-vegetative stabilization methods is to provide exposed soils temporary or permanent stabilization from wind and water erosion.
- This project will use gravel, decomposed granite, rip-rap, etc. applied at 3”-4” in depth to areas identified in the Project landscaping plans and shown in Appendix A: Site Maps, Figures 3
- Non-vegetative Stabilization is possible erosion control BMP, with other options including: EC-3 Hydro Mulch, EC-4 Hydroseeding (temporary or permanent), EC-5 Soil Binders, EC-6 Straw Mulch, EC-7 Geotextile mats, EC-8 Wood Mulching, EC-14 Compost Blankets, and/or EC-15 Soil Preperation and Roughening. The contractor shall consult with the Project QSP, QSD, and/or CASQA Construction BMP Handbook to determine the most effective erosion control BMPs for each new completed disturbed soil area that requires temporary or permanent stabilization per Section IV.O.2.d of the CGP.

WE-1 Wind Erosion Control

- The Contractor shall prevent dust nuisance generated from construction activities on the site by applying water and/or soil binder on exposed soil surfaces.
    - When selecting soil binder for wind erosion control, the contractor will refer to the BMP narrative for EC-5 Soil Binder above and the CASQA BMP Fact Sheet in Appendix G.
- The contractor will prevent the discharge of sediment by wind erosion in accordance with the San Joaquin Valley Air Pollution Control District (SJVAPCD) Regulation VIII for fugitive dust control.

- Wind erosion control will be implemented in accordance to water conservation practices (see NS-1 found in Appendix G) as directed by the QSP.

3.2.2 Sediment Controls

Sediment controls are temporary or permanent structural measures that are intended to complement the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water.

The following sediment control BMP selection table indicates the BMPs that will be implemented to control sediment on the construction site. Fact Sheets for temporary sediment control BMPs are provided in Appendix G.

These temporary sediment control BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Table 3-3 Temporary Sediment Control BMPs

CASQA Fact Sheet	BMP Name	Considered for the Project (1)	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
SE-1	Silt Fence	✓(2) (3)	✓		
SE-2	Sediment Basin	✓		✓	Using sediment basin for Project excessively expensive. Cheaper sediment controls will be effective.
SE-3	Sediment Trap	✓	✓		
SE-4	Check Dams	✓		✓	No pervious flow channels to use BMP.
SE-5	Fiber Rolls	✓(2)(3)	✓		
SE-6	Gravel Bag Berm	✓(3)	✓		
SE-7	Street Sweeping	✓	✓		
SE-8	Sandbag Barrier	✓	✓		
SE-9	Straw Bale Barrier	✓		✓	Excessive costs. Other linear sediment controls will be just as effective.
SE-10	Storm Drain Inlet Protection	✓ RL2&3	✓		
SE-11	ATS	✓		✓	Excessively expensive and challenging to implement.
SE-12	Manufactured Linear Sediment Controls	✓	✓		
SE-13	Compost Sock and Berm	✓(3)	✓		
SE-14	Biofilter Bags	✓(3)		✓	Not as durable or effective as Gravel Bags.
NA	Passive Treatment System	✓		✓	Excessively expensive and challenging to implement.
TC-1	Stabilized Construction Entrance and Exit	✓	✓		
TC-2	Stabilized Construction Roadway	✓	✓		
TC-3	Entrance Outlet Tire Wash	✓		✓	Excessively expensive and challenging to implement.

(1) The 2022 CGPs Fact Sheet Section I.R.1.d through I.R.1.i describes various BMPs that should be considered for use on the construction site.
(2) The QSD shall ensure implementation of one of the minimum measures listed or a combination thereof to achieve and maintain the Risk Level requirements.
(3) All run-on and runoff from the construction site shall be managed. Risk Level 2 and 3 shall provide linear sediment control along toe of slope, face of slope, and at the grade breaks of exposed slope.

EC-1 Silt Fence

- The QSP and Contractor shall consider the use of silt fence as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected, the Contractor shall:
    - Install the silt fence in accordance with guidance shown in the CASQA Handbook Appendix G, and this BMP narrative section.
- If silt fence is not selected as a perimeter sediment control, the Contractor shall select and implement one of the following alternate BMPs: EC-5 Fiber Rolls, EC-6 Gravel Bag Berm, EC-12 Manufactured Linear Sediment Controls, and/or EC-13 Compost Socks.
- The Contractor shall maintain silt fence by repairing sagging, leaning, and holes. The Contractor shall maintain silt fence by removing accumulated sediment after rain events.

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-I in conformance with the requirements in ASTM designation D4491.
- 2" X 2" 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.

Implementation

- Trench and key in the bottom of the silt fence at a minimum of 12 in folded towards the direction of anticipated flow. Firmly compact backfilled 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.
- 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.
- Do not install silt fence as a perimeter control along slopes.
- Do not install silt fence at locations of anticipated concentrated flow.
- Always install silt fence along a level contour. Not doing so will divert and concentrate stormwater and create erosion.
- Turn the ends of the filter fence uphill to prevent stormwater from flowing around the fence

EC-3 Sediment Trap

- The QSP and Contractor shall consider the use of sediment trap(s) for the Project at low site locations near stormwater discharge locations (site perimeters or drain inlets) to provide effective sediment control. If selected, the Contractor shall:

- Install an appropriately sized sediment trap to temporarily contain stormwater from the anticipated run-on area,
- Not use sediment traps for run-on areas larger than five acres.
- Be used in conjunction with polypropylene fabrics per EC-7 and rip-rap per EC-16 to stabilize the designed outfall structure from scouring caused by concentrated discharge flow.

- The Contractor shall install sediment trap(s) as a form of drain inlet protection for drain inlets in disturbed drainage areas greater than one acre, where feasible based on site layout. Sediment traps are the most effective sediment control to remove sediment from high flows while preventing regional flooding.
- If the Contractor chooses not to implement sediment trap(s), the Contractor shall install and maintain effective sediment controls including: EC-1 Silt Fence, EC-5 Fiber Rolls, EC-6 Gravel Bag Berm, EC-12 Manufactured Linear Sediment Controls, and/or EC-13 Compost Socks.

EC-5 Fiber Rolls

- The QSP and Contractor shall consider the use of fiber rolls as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected:
  - The Contractor shall install fiber rolls shown in Appendix A: Site Map, Figure 2 and 3 to site perimeters prior to commencing grading.
  - Fiber rolls are not appropriate as the only BMP at a site and shall be used in conjunction with other erosion and sediment control measures to reduce pollutant discharges.
  - Fiber rolls shall be installed with "j-hooks" upgrade to prevent stormwater from flowing around the fiber roll.
  - Fiber rolls shall be maintained by the contractor to ensure effective sediment control. The exact location of fiber rolls will be determined in the field by the QSP.
  - Fiber rolls must be secured (staked) to the ground in a trench that is ¼ to 1/3 of the thickness of the roll, with a width the same diameter as the as the roll.
  - Fiber rolls used on this project will be eight to twelve inches in diameter unless the QSP specifies otherwise.
  - The Contractor shall repair or replace fiber rolls that are split, torn, unraveling or slumping.
- If fiber rolls are not selected as a perimeter sediment control, the Contractor shall select and implement one of the following alternate BMPs: EC-1 Silt Fence, EC-6 Gravel Bag Berm, EC-12 Manufactured Linear Sediment Controls, and/or EC-13 Compost Socks.
- The Contractor shall not use fiber rolls as drain inlet protection.

EC-6 Gravel Bag Berm

- Gravel bag berms are typically more expensive and labor intensive than alternate linear sediment controls like fiber rolls and compost socks. Gravel bag berms (as well as compost socks) provide a more porous linear control that filters sediment and other pollutants out of stormwater where fiber rolls do not.
- The QSP and Contractor shall consider the use of gravel bag berms as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected:
  - The Contractor shall gravel bag berms shown in Appendix A: Site Map, Figures 2 and 3 to site perimeters prior to commencing grading.
  - Gravel bag berms are not appropriate as the only BMP at a site and shall be used in conjunction with other erosion and sediment control measures to reduce pollutant discharges.
  - Gravel bag berms shall be installed with "j-hooks" upgrade to prevent stormwater from flowing around the fiber roll.
  - Gravel bag berms shall be maintained by the contractor to ensure effective sediment control. The exact location of fiber rolls will be determined in the field by the QSP.

- Fiber rolls must be secured (staked) to the ground in a trench that is ¼ to 1/3 of the thickness of the roll, with a width the same diameter as the as the roll.
- The Contractor shall size each gravel bag berm (height, width, shape) in accordance with EC-6 in the CASQA BMP Handbook found in Appendix G.
- The Contractor shall repair or replace gravel bags that are split, torn, or unraveling and remove any spilled gravel.

EC-7 Street Sweeping and Vacuuming

- The Contractor shall reduce the discharge of pollutants from the Project site by:
    - Sweeping and /or vacuuming the streets and roadways adjacent to the Project site. The Project site and off-site exits shall be inspected daily for track out.
    - Sweeping sediment observed on internal site pavement that drains to drain inlets or off-site areas prior to rain events.
    - Sweeping and/or vacuum the streets and roadways adjacent to the Project site in accordance with SJVAPCD's Regulation VIII on fugitive dust control.
- The Contractor shall limit speed of vehicles to control dust.

EC-8 Sandbag Barrier

- The Contractor shall use sandbag barriers as a BMP to:
    - Divert stormwater away from disturbed soil areas,
    - Divert stormwater away from steeper disturbed slopes,
    - Divert stormwater in a way that reduces drainage areas and resulting downgrade stormwater flow concentration,
    - As an optional material for use of constructing a sediment trap.
- The Contractor shall not install a linear sandbag barrier on a slope except along the slope contour.
- The Contractor shall replace damaged sandbags and remove any lost material.
- The Contractor shall use a pyramid approach when stacking sand bags, and follow the berm sizing (height, width, shape) listed in Appendix G: CASQA BMP Handbook.

EC-10 Storm Drain Inlet Protection

- Storm drain inlet protection will be used at all operational internal inlets to the storm drain system as shown on Appendix A: Site Map, Figures 2 and 3, and in accordance with the BMP Manual. Additional locations may be required based on actual field conditions/observations and such locations will be determined by the QSP.
- Inlets will be protected from stormwater discharge with the use of gravel bag berms, gravel bag j-weirs in gutters, sediment traps, silt fence, and/or pre-manufactured storm drain inlet inserts for drain inlet protections.
    - Silt fence shall be the primary choice of drain inlet protection **where/when feasible**. Silt fence as a drain inlet protection shall be installed according to EC-10 in the CASQA BMP Handbook, found in Appendix G. Conditions that will require the use of silt fence for the Project include:
        - When storm drain inlets are located in a pervious surrounding that provides an area that will allow stormwater to pool without resulting in flooding that will cause a public hazard or property damage.
    - Gravel bag berms and pre-manufactured storm drain inlet inserts shall be the secondary choice of drain inlet protections.

        - Gravel bag berms shall be sized to be up to 24" tall in a pyramid shape, but shorter if too high of a gravel bag berm would cause undesirable diversion of stormwater.
    - Gravel bag j-weirs shall be placed in **all** gutters expected to convey turbid stormwater from disturbed site areas. The Contractor shall install two to three sets of gravel bag j-weirs along gutters where the j-weir spans the width of the concrete gutter and the length is at least three times as long as the width. The QSP shall determine the exact location and arrangement of j-weirs.
    - Sediment traps shall be installed adjacent to drain inlets anticipated to receive stormwater from an area greater than approximately 1 acre, when feasible based on site layout.
- All storm drain inlet protections shall be inspected after rain events and maintained by removing accumulated sediment, re-arranging of materials, replacement of materials, etc.. Sediment traps shall be maintained after rain events to remove accumulated sediment to ensure deposited sediment is not resuspended into stormwater.
- Filter fabric shall not be used as a drain inlet protection.

EC-12 Manufactured Linear Sediment Controls

- The QSP and Contractor shall consider the use of manufactured linear sediment controls (MLSCs) as a substitute to EC-1 Silt Fence, EC-5 Fiber Rolls, EC-8 Gravel Bag Barrier, and EC-9 Sandbag Barrier. MCLSs come in a variety of products and should be considered for the following reasons:
    - Providing perimeter controls on pavement.
    - As a more re-usable perimeter control than fiber rolls and silt fence.
- The Contractor shall install any MLCSs according to the manufacturer's specification.

EC-13 Compost Sock and Berm

- The QSP and Contractor shall consider the use of compost socks and/or berms as a perimeter sediment control to comply with Section II.E.1.a of the CGP. If selected:
    - The Contractor shall install compost socks and/or berms as shown in Appendix A: Site Map, Figures 2 and 3 to site perimeters prior to commencing grading.
    - Compost socks and/or berms are not appropriate as the only BMP at a site and shall be used in conjunction with other erosion and sediment control measures to reduce pollutant discharges.
    - Compost socks and/or berms shall be installed with "j-hooks" upgrade to prevent stormwater from flowing around the compost socks and/or berms.
    - Compost socks and/or berms shall be maintained by the contractor to ensure effective sediment control. The exact location of compost socks and/or berms will be determined in the field by the QSP.
    - Compost socks shall not be punctured with stakes. Compost socks typically do not need to be secured with stakes or placed in trenches due to their weight.
    - The Contractor shall repair or replace compost socks and/or berms that are split, torn, unraveling or slumping.
- If compost socks and/or berms are not selected as a perimeter sediment control, the Contractor shall select and implement one of the following alternate BMPs: EC-1 Silt Fence, EC-5 Fiber Rolls, EC-6 Gravel Bag Berm, and/or EC-12 Manufactured Linear Sediment Controls.
- The QSP and Contractor shall consider the use of compost socks and/or berms for areas of slopes with expected high sheet flow amounts due to their filtering properties.
- The QSP and Contractor shall consider the use of compost socks and/or berms for slopes that are planned for vegetation establishment for final stabilization due to their ability to provide nutrients to soil.

- The Contractor shall not use compost socks as drain inlet protection due to their risk of discharging nutrients.
- The Contactor shall source compost and other materials in accordance with the guidance in Appendix G: CASQA BMP Factsheet.

TC-1 Stabilized Construction Entrance and Exit

- The Contractor shall ensure that construction activity traffic to and from the project is limited to entrances and exits that employ effective controls to prevent off-site tracking of sediment. A stabilized construction entrance is a pad of rip-rap underlain with polypropylene fabric. Stabilized Construction Entrance/Exits shall be implemented where existing pavement meets exposed disturbed soil areas of the project, as shown in Exhibit A: Site Maps, Figures 2 and 3, or in an equivalent location approved by the QSP, landowner, and any relevant City, County, or other right-of-way owners.
- The Contractor shall limit speed of vehicles to control dust. Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment. Remove aggregate, separate and dispose of sediment when construction entrance becomes clogged with sediment.

TC- 2 Stabilized Construction Roadway

The Contractor shall utilize the new 100+ ft of pavement within the Project site as a stabilized construction exit for removing sediment from construction vehicles from the site, as shown in Appendix A: Site Maps, Figures 2 and 3. The Contractor shall monitor this exit throughout the day and sweep the pavement of sediment immediately if sediment has accumulated on the pavement and is contributing to airborne dust.

3.3 NON-STORMWATER CONTROLS AND WASTE AND MATERIALS MANAGEMENT

3.3.1 Non-Stormwater Controls

Non-stormwater discharges into storm drainage systems or waterways which are not authorized under the 2022 CGP are prohibited. Non-stormwater discharges for which a separate NPDES permit is required by the local Regional Water Board are prohibited unless coverage under the separate NPDES permit has been obtained for the discharge. The selection of non-stormwater BMPs is based on the list of construction activities with a potential for non-stormwater discharges identified in Section 2.7 of this SWPPP.

The following non-stormwater control BMP selection table indicates the BMPs that will be implemented to control sediment on the construction site. Fact Sheets for temporary non-stormwater control BMPs are provided in Appendix G.

Non-stormwater BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Table 3-4 Temporary Non-Stormwater BMPs

CASQA Fact Sheet	BMP Name	Considered for the Project [(1)]	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
NS-1	Water Conservation Practices	✓	✓		
NS-2	Dewatering Operation	✓	✓		
NS-3	Paving and Grinding Operation	✓	✓		
NS-4	Temporary Stream Crossing	✓		✓	No stream crossings.
NS-5	Clear Water Diversion	✓		✓	No water diversions.
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 Operation	✓		✓	No pile driving.
NS-12	Concrete Curing	✓	✓		
NS-13	Concrete Finishing	✓	✓		
NS-14	Material and Equipment Use Over Water	✓		✓	No equipment over water.
NS-15	Demolition Removal Adjacent to Water	✓		✓	No demolition adjacent to water.
NS-16	Temporary Batch Plants	✓		✓	No temporary batch plant.

[(1)] The 2022 CGP Fact Sheet Section I.R.1.d through I.R.1.i describes various BMPs that should be considered for use on the construction site.

NS-1 Water Conservation Practices

Water conservation practices are a non-stormwater discharge management measure that consists of 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.

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.

Generally, the Contractor shall:

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Use nozzles on hoses that shut off when not in use.
- Washing of vehicles and equipment on the construction site is prohibited unless an emergency.
- 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.
- Install sediment and erosion control measures to non-stormwater use areas as needed if there is the potential to cause erosion or scour.
- Repair water equipment as needed to prevent unintended discharges, including but not limited to:
    - Water trucks
    - Water reservoirs (water buffalos)
    - Irrigation systems
    - Hydrant/water source connections

NS-2 Dewatering Operation

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. Non-stormwater includes, but is not limited to, groundwater, water from cofferdams, water diversions, and waters used during construction activities that must be removed from a work area.

These practices are implemented for discharges of non-stormwater from construction sites. 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. Stormwater mixed with non-stormwater should be managed as non-stormwater.

- Dewatering non stormwater cannot be discharged without prior notice to and approval from the 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 QSP 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.
- The QSP and Contractor shall review the CASQA BMP Factsheet in Appendix G to determine the appropriate equipment needed to conduct off-site dewatering operations in a manor that prevents the violation of water quality standards. One or more of the following equipment shall considered for use:
    - Weir tanks, dewatering tanks, gravity bag filter, sand media particulate filter, and pressurized bag filter.

NS-3 Paving and Grinding Operation

The Contractor shall prevent or reduce the discharge of pollutants from paving operations, using measures to prevent run-on and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

These procedures shall be implemented where paving, surfacing, resurfacing, or saw cutting, may pollute stormwater runoff or discharge to the storm drain system or watercourses.

- **Avoid paving during the wet season when feasible.**
- **Reschedule paving and grinding activities if rain is in the forecast.**
- Store materials away from drainage courses to prevent stormwater run-on (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.
- Stockpile material removed from roadways away from drain inlets, drainage ditches, and watercourses. 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.

- The Contractor shall shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to prevent any discharge of slurry.
- When paving involves AC, the Contractor shall follow the following steps prevent the discharge of grinding residue, un-compacted 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. This shall be accomplished by the use of effective sediment control BMPs.

    - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt must be recycled or disposed.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations shall be picked up by means of a vacuum attachment to the grinding machine, shall not be allowed to flow across the pavement, and shall 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

- 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 shall 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 shall not be applied if rainfall is predicted to occur during the application or manufacturer's specified 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.

NS- 6 Illicit Connection/Discharge

This is a non-stormwater management control that includes procedures and practices designed for construction contractors to recognize illicit connections or illegally dumped or discharged materials on a construction site and report incidents.

This 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.

- The QSP and Contractor shall review the SWPPP. Pre-existing areas of contamination should be identified and documented in the SWPPP.
- The QSP shall inspect the site before beginning the job for evidence of illicit connections, illegal dumping or discharges. Document any pre-existing conditions.
- 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.
- **Cleanup and Removal -** The responsibility for cleanup and removal of illicit or illegal dumping or discharges will vary by location. Contact the Project proponent and local stormwater management agency for further information.

NS-7 Potable Water/Irrigation

This is a non-stormwater management control for potable water/irrigation that 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.

Implement this BMP whenever potable water or irrigation water discharges occur to or from a construction site.

- 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.
- 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.

NS-8 Vehicle and Equipment Cleaning

- The Contractor shall not clean vehicles or equipment with water and/or soaps on-site. The Contractor shall wash all equipment off-site (with the exception of concrete truck washout).
- The Contractor shall use dry cleaning methods (rags) for cleaning equipment of grease and residues. Used rags shall be stored in watertight containers for re-use or disposed of as hazardous waste.
- If equipment must be washed with water on-site, the Contractor shall follow the procedures outlined in Appendix G: CASQA BMP Handbook.

NS-9 Vehicle and Equipment Fueling

Vehicle and 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 and implementing spill controls.

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

- Onsite vehicle and equipment fueling shall only be used where it is impractical to send vehicles and equipment offsite for fueling.
- 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 shall be available in fueling areas and on fueling trucks, and shall be disposed of properly after use.
- Drip pans or absorbent pads shall 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.
- When fueling must take place onsite, designate an area away from drainage courses to be used.

- Dedicated fueling areas shall be protected from stormwater run-on and run-off, 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 run-on, run-off, 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 the SJVAPCD.
- Federal, state, and local requirements should be observed for any stationary above ground storage tanks

NS-10 Vehicle and Equipment Maintenance

This is a non-stormwater management measure used to 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. These procedures are suitable on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Onsite vehicle and equipment maintenance should only be used where it is impractical to send vehicles and equipment offsite for maintenance and repair.

- 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 be done onsite, use designated areas, located away from drainage courses.
- Dedicated maintenance areas should be protected from storm water run-on and run-off 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.
- Look for leaks of fluids or oil from vehicles and equipment, at start up and repair immediately or place out of service with drip pans of buckets to contain the leaked material. Properly dispose of leaked material
- 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.

- 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.
- 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.

NS-12 Concrete Curing

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 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.

- For chemical concrete 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.
- For water concrete curing:
    - 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.
    - Utilize wet blankets or a similar method that maintains moisture while minimizing the use and possible discharge of water.

NS-13 Concrete Finishing

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 non stormwater management measures can minimize the impact that concrete finishing methods may have on stormwater and non-stormwater discharges.

These procedures apply to all construction locations where concrete finishing operations are performed.

- Divert blasting water to a collection/containment area.
- 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.
- Direct water from blasting operations away from inlets and watercourses to collection areas for infiltration or other means of removal (dewatering).
- Protect inlets during sandblasting operations.
- 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.

3.3.2 Materials Management and Waste Management

Materials management control practices consist of implementing procedural and structural BMPs for handling, storing, and using construction materials to prevent the release of those materials into stormwater discharges. The amount and type of construction materials to be utilized at the Site will depend upon the type of construction and the length of the construction period. The materials may be used continuously, such as fuel for vehicles and equipment, or the materials may be used for a discrete period, such as soil binders for temporary stabilization.

Waste management consist of implementing procedural and structural BMPs for handling, storing, and ensuring proper disposal of wastes to prevent the release of those wastes into stormwater discharges.

Materials and waste management pollution control BMPs will be implemented to minimize stormwater contact with construction materials, wastes, and service areas; and to prevent materials and wastes from being discharged off-site. The primary mechanisms for stormwater contact that shall be addressed include:

- Direct contact with precipitation
- Contact with stormwater run-on and runoff
- Wind dispersion of loose materials
- Direct discharge to the storm drain system through spills or dumping
- Extended contact with some materials and wastes, such as asphalt cold mix and treated wood products, which can leach pollutants into stormwater.

A list of construction activities is provided in Section 2.6. The following Materials and Waste Management BMP selection table, Table 3-5, indicates the BMPs that shall be implemented to handle materials and control construction site wastes associated with these construction activities. Fact Sheets for Materials and Waste Management BMPs are provided in Appendix G.

Material management BMPs will be implemented in conformance with the following guidelines and in accordance with the BMP Fact Sheets provided in Appendix G. If there is a conflict between documents, the Site Map will prevail over narrative in the body of the SWPPP or guidance in the BMP Fact Sheets. Site specific details in the Site Map prevail over standard details included in the Site Map. The narrative in the body of the SWPPP prevails over guidance in the BMP Fact Sheets.

Table 3-5 Temporary Materials Management BMPs

CASQA Fact Sheet	BMP Name	Considered for Project [1]	BMP used		If not used, state reason and alternate BMP, if applicable
			YES	NO	
WM-01	Material Delivery and Storage	✓	✓		
WM-02	Material Use	✓	✓		
WM-03	Stockpile Management	✓	✓		
WM-04	Spill Prevention and Control	✓	✓		
WM-05	Solid Waste Management	✓	✓		
WM-06	Hazardous Waste Management	✓	✓		
WM-07	Contaminated Soil Management			✓	There is no identified contaminated soil at the Project site.
WM-08	Concrete Waste Management	✓	✓		
WM-09	Sanitary-Septic Waste Management	✓	✓		
WM-10	Liquid Waste Management	✓	✓		

(1) The 2022 CGP Fact Sheet Section I.R.1.d through I.R.1.i describes various BMPs that should be considered for use on the construction site.

WM-1 Material Delivery and Storage

This waste management and pollution control measure is used to prevent, reduce, or eliminate the discharge of pollutants by minimizing the storage of hazardous materials on site, storing materials in a designated area, installing secondary containment, and conducting regular inspections.

Material delivery and storage control measures apply to 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; and other materials that may be detrimental if released to the environment.

Delivery & Storage

- Generally, construction materials should be stored off the ground, under cover, and, in temporary containment areas in certain cases.
- Material Safety Data Sheets (MSDS) shall be available for all materials stored on-site in the on-site job trailer.
- Designate areas on site for material delivery and storage areas.
- Material delivery and storage areas shall be located near the construction entrances, away from drainage areas, watercourses, and heavy traffic areas if possible.
- Place containment areas in an area which will be paved if possible.
- Install a stabilized entrance at the entrance to the storage area if vehicles or equipment will enter from a paved surface to an unpaved storage area.
- Stockpiles shall be protected in accordance with WM-3, Stockpile Management.
- Materials shall 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 shall be replaced as soon as possible.
- Materials should be stored indoors within existing structures or sheds when available. If this is not feasible, materials shall be covered by a fully secured impervious tarp.
- If stored outside, cover and store liquids, chemicals, boxed materials, drums, and materials with the potential to migrate during a storm on pallets, away from water courses and in secondary containment such as earthen dikes, horse troughs, or even a children's wading pool or "bus boy trays" for non-reactive materials such as detergents, oil, grease, and paints.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be placed in temporary secondary containment facilities for storage.

Containment Facility

- A temporary containment facility shall 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 shall be impervious to the materials stored 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 shall be collected and placed into drums. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids shall be sent to an approved disposal site.

- Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.
- Throughout the rainy season, each temporary containment facility shall be covered during nonworking days, prior to, and during rain events.

Hazardous or Regulated Materials

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Chemicals should be kept in their original labeled containers.
- 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.
- 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 in Appendix G: CASQA BMP Handbook. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.
- 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.

Spills

- 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.

WM-2 Material Use

This waste management and materials pollution control is implemented to prevent or reduce the discharge of pollutants to the storm drain system or watercourses from material use by using alternative products if available, and minimizing hazardous material uses onsite.

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,
- 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,
- Other materials that may be detrimental if released to the environment.

The following steps should be taken to minimize risk of stormwater pollution from material use:

- Reduce and minimize use of hazardous materials onsite when practical.
- 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 commissioner's 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.
- Keep Material Safety Data Sheets (MSDS) for all materials on site.
- 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 in a containment area. Never clean paintbrushes or rinse pain 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 other lined liquid waste container.
- 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, nontreated lumber, and other materials.
- Use materials only where and when needed to complete the construction activity. Use safer alternative materials as much as possible.
- Keep an ample supply of spill clean-up material near use areas.
- Avoid exposing applied materials to rainfall and runoff unless sufficient time has been allowed for them to dry.

WM-3 Stockpile Management

Stockpile management procedures and practices is a waste management and materials pollution control 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.

Implement in all stockpiles of soil and other loose materials.

- Locate stockpiles a minimum of 50 ft away from concentrated flows of stormwater, drainage courses, and inlets.
- Protect all stockpiles from stormwater run on using a temporary perimeter sediment barrier such as berms, dikes, fiber rolls, silt fences, sandbag, or gravel bags.
- Implement wind erosion control practices as appropriate on all stockpiled material. For specific information, see WE-1, Wind Erosion Control.

- All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.
- Manage stockpiles of contaminated soil in accordance with WM-7, Contaminated Soil Management.
- Place bagged materials on pallets and under cover.
- Ensure that stockpile coverings are installed securely to protect from wind and rain.
- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.
- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.
- Stockpiles of concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, and aggregate subbase shall be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of polluting materials

- Asphalt cold mix, fly ash, stucco, and hydrated lime stockpiles should be placed on and always covered with plastic sheeting or comparable material and surrounded by a berm.
- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.
- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.
- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff.

WM-4 Spill Prevention and Control

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 WM-5 Liquid Waste Management and WM-10 solid Waste Management.

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

Implementation

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, and 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 run-on 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 clean 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 WM-5 Waste Management and WM-7 contaminated soils in this section for specific information.
- Report all spills to the Project QSP immediately. A spill may trigger stormwater sampling for non-visible pollutants.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled at the discovery of the spill.
- Contain the spread of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Notify the project foreman immediately.
- Recover spilled materials.
- Clean the contaminated area and properly dispose of contaminated materials.

- 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.

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.

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 City or County officials. All emergency phone numbers will be posted at the construction site.
    - Contact the site superintendent. For spills of federal reportable quantities, (examples are listed below) in conformance with the requirements in 40 CFR parts 110,119, and 302, the site superintendent will notify the National Response Center at (800) 424-8802. The superintendent will notify the Regional Water Quality Control Board and any other applicable agencies.
- The services of a spill 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.
- Notification should first be made by telephone and followed up with a written report.
- Other agencies which may need to be consulted include, but are not limited to, 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.
- 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).

Sampling

- If there is evidence that the spilled material was discharged offsite, follow the appropriate sampling protocol (stormwater, non-stormwater or non-visible discharges) located in the CSMP.

Vehicle and Equipment Maintenance

- If maintenance must be performed onsite, use a designated area and secondary containment, located away from drainage courses, to prevent the run on 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 be performed onsite, designate areas located away from drainage courses to prevent the run on 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.

Typical Reportable Quantities for Construction Sites

Material	**Released to**	**Quantity**
Engine Oil, Fuel Hydraulic & Brake Fluid	Land	25 Gallons
Engine Oil, Fuel Hydraulic & Brake Fluid	Water	Visible Sheen
Gasoline	Land or Water	32 Gallons
Anti-Freeze	Land or Water	5000 lbs (539 Gallons)
Engine Degreaser	Land or Water	100 lbs (10 Gallons)

WM-5 Solid Waste Management

Solid waste management procedures and practices are a waste management and pollution control 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.

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.

- 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.
- Provide an adequate number of containers for the amount of trash that will be generated from the site 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.
- Trash receptacles with lids shall be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Solid waste storage areas should be located away from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Stormwater run-on shall be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Collect site trash daily, especially during rainy and windy conditions and cover receptacles at the end of each business day or while not in use.

- Collected litter and debris should not be stored next to inlets, drainage systems, or watercourses.
- Waste containers, dumpsters, & trash receptacles must be covered at the end of the work day and in the event of rain or significant wind.
- Arrange for regular waste collection before containers overflow.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines shall be a priority.
- 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.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Clean up immediately if a waste container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal facilities.
- Littering on the project site is prohibited.

WM-6 Hazardous Waste Management

This hazardous waste management measure is a waster management and pollution control measure that applies to all construction projects to prevent or reduce the discharge of pollutants to stormwater from hazardous waste through proper material use, waste disposal, and training of associates and subcontractors.

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 and 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)

Implementation

- 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 shall be stored in temporary containment facilities that comply with the following requirements:
    - 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.
- 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.
* 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 the entire 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.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

WM-8 Concrete Waste Management

The use of concrete waste managing measures including, concrete washouts, are wase management and pollution controls that prevent or reduce the discharge of pollutants to stormwater from concrete waste products conducting washout offsite or onsite in a designated area.

Suitable Applications

Concrete waste management procedures and practices shall be implemented on the Project where:

- Concrete is used as a construction material or where concrete dust and debris results from demolition activities.
- Slurries containing Portland cement concrete or asphalt concrete are generated, such as from saw cutting, coring, grinding, grinding, and hydro-concrete demolition.
- Concrete trucks and other concrete coated equipment area washed on site.
- Mortar-mixing stations and equipment.

Implementation

- Concrete washout containers shall consist of watertight plastic tubs over a beamed liner for secondary containment that accommodates access by concrete trucks.
- Arrange for pumping or accumulated slurry/water capacity is 75%.
- Place downstream as far as possible from storm drains, open ditches, and waterbodies.
- Place in a location that allows convenient access for concrete trucks, preferably near the area where concrete is being poured.
- Place far from construction traffic to reduce the likelihood of damage.
- The size and number of concrete washout facilities shall be appropriate for the anticipated amount of concrete waste.
- To prevent leaks, use prefabricated concrete washout containers that are watertight.
- Store dry and wet materials under cover and away from drainage areas.
- Avoid mixing of excess amounts of fresh concrete.
- Perform washout of concrete trucks offsite or in designated washout areas.
- Do not wash out concrete trucks into the soils, into storm drains, open ditches, streets, or water bodies.
- Do not dump excess concrete on non-designated concrete waste areas.

Concrete Slurry Wastes

- Residue from grinding operations should be picked up by means of vacuum attachment.
- Saw cutting residue shall not be allowed to flow across pavement and should not be left on the surface of pavement. See NS-3 Paving and Grinding Operations.
- Slurry residue should be vacuumed and disposed in a temporary put. Dispose of dry slurry residue in accordance with solid waste management WM-5.

WM-9 Sanitary-Septic Waste Management

Proper sanitary and septic waste management are waste management and material pollution controls that prevent the discharge of pollutants to stormwater from sanitary and septic waste by providing convenient, well-maintained facilities, an arranging for regular service and disposal.

Sanitary septic waste management practices are suitable for use at all construction sites that use temporary or portable sanitary and septic waste systems.

Implementation

- Shall be located away from drainage facilities, watercourses, and from traffic circulation.
- Provide a sufficient quantity of facilities to accommodate the workforce.
- Ensure containment of sanitation facilities to prevent discharge of pollutants to the stormwater drainage system or the receiving water.
- When subjected to high winds or risk of high winds, temporary sanitary facilities shall be secured to prevent overturning.
- Sanitary facilities should be located in a convenient location.
- Sanitary or septic wastes shall be treated or disposed of in accordance with state and local requirements.
- Sanitary facilities shall be maintained in good working order by a licensed service.
- Regular waste collection by a licensed hauler should be arranged before facilities overflow.

- Do not discharge or bury sanitary waste within the project site.
- Sanitary and septic systems that discharge directly into sanitary sewer systems, where permissible, shall comply with the local health agency, city, county, and sewer district requirements.
- Sanitary and septic facilities should be maintained in good working order by a licensed service.

WM-10 Liquid Waste Management

Liquid waste management is a waste management and materials pollution control that 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

Liquid waste management is applicable to construction projects that generate any of the following nonhazardous 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

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 dredge 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.

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.

3.4 TMDL-RELATED BMPS

There are no required TMDL-related BMPs for the Project since the Project does not discharge to a water body with TMDLs.

3.5 POST CONSTRUCTION STORMWATER MANAGEMENT MEASURES

Post construction BMPs are permanent measures installed during construction, designed to reduce or eliminate pollutant discharges from the site after construction is completed.

This site is subject to the post-construction requirements of an existing NPDES Phase I or Phase II MS4. ☒ Yes ☐ No

The post construction runoff reduction requirements have been satisfied through the City of Madera MS4 program, this project is exempt from 2022 CGP Provision IV.N.3. The MS4's post construction requirements and the post-construction plans and calculations [approved by] the MS4 were uploaded as part of the PRDs as required by 2022 CGP Provision IV.N.2. The approved Long-Term Maintenance Plan will be uploaded with the NOT.

Section 4 BMP Inspection and Maintenance

4.1 BMP INSPECTION AND MAINTENANCE

The 2022 CGP requires routine weekly inspections of BMPs, along with inspections before, during, and after qualifying precipitation events. A BMP inspection checklist must be filled out for inspections and maintained on-site with the SWPPP. The inspection checklist must include the necessary information covered in Section 7.6. A blank BMP Inspection Form can be found in Appendix H. Completed forms will be kept in Appendix N.

Maintenance, repair, or design and implementation of new BMPs alternatives will be begin withing 72 hours of the identification of failures or other shortcomings. Corrections will be completed as soon as possible, prior to the next forecasted precipitation event (2022 CGP Appendix D Section II.J).

The QSP will verify that all BMP maintenance and repairs were appropriately implemented during the next visual inspection following completion.

The QSP may delegate BMP maintenance and repair verification to an appropriately trained QSP Delegate.

Specific details for maintenance, inspection, and repair of Construction Site BMPs can be found in the BMP Factsheets in Appendix G.

Section 5 Training

Appendix J identifies the QSPs and QSP Delegates for the project. To promote stormwater management awareness specific for this project, periodic training of job-site personnel will be included as part of routine project meetings (e.g., daily/weekly tailgate safety meetings), or task specific training as needed. Refresher training will be provided as necessary.

The QSP will be responsible for providing this information at the meetings, and subsequently completing the Training Reporting Form shown in Appendix I, which identify the site-specific stormwater topics covered as well as the names of site personnel who attended the meeting.

The QSP may delegate specific tasks to trained QSP Delegates who have received the following training based on the guidelines developed by the Construction General Permit Training Team.

1. **Foundational training** for all QSP Delegate(s) regarding stormwater compliance roles and responsibilities, forecast information, and documentation and reporting procedures; and
2. **Site-specific training** regarding visual inspections, sampling procedures, and/or SWPPP and BMP implementation activities relevant to the responsibilities assigned to the QSP Delegate(s).

The delegate cannot perform the QSD and QSP inspections required in Section V.C.4 or Section V.D.2, respectively.

Documentation of training activities will be retained in Appendix I.

Section 6 Responsible Parties and Operators

6.1 RESPONSIBLE PARTIES

DAR(s) who are responsible for SWPPP implementation and have authority to sign permit-related documents are listed below. The DAR(s) assigned to this project are:

Name	Title	Phone Number
Rosalind Cox	LRP, Director of Facilities Planning and Construction	(559) 675-4548

QSD(s) identified for the project are identified in Appendix J. The QSD will have primary responsibility for assessing how construction activities will affect sediment transport, erosion, and other discharges of pollutants in stormwater runoff throughout the project. The QSD is required to revise the SWPPP to address potential problems identified by visual inspections, sampling data, comments from a QSP, or their own site observations. The QSD is required to perform the following on-site visual inspections:

- Within 30 days of construction activities commencing on site;
- Within 30 days when a new QSD is assigned to the project;
- Twice annually, once August through October and once January through March;
- Within 14 calendar days after a numeric action level exceedance; and
- Within the time period requested in writing from Regional Water Board staff.

QSPs and QSP Delegates identified for the project are identified in Appendix J. The QSP will have primary responsibility and significant authority for the implementation, maintenance, and inspection/monitoring of SWPPP requirements. The QSP will be available at all times throughout the duration of the project.

Duties of the QSP include but are not limited to:

- Implementing all elements of the 2022 CGP and SWPPP, including, but not limited to:
    - Performing the following on-site visual inspections:
        - One inspection per calendar month; other weekly inspections in the month can be delegated to a trained QSP Delegate under the specific direction of the QSP.
        - Within 72 hours prior to a forecasted qualifying precipitation event, to inspect any areas of concern and to verify the status of any deficient BMPs, or other identified issues at the site. If extended forecast precipitation data (greater than 72 hours) is available from the *National Weather Service*, then the Pre-Precipitation Event inspection may be done up to 120 hours in advance.
        - Within 14 days after a NAL exceedance, the QSP shall visually inspect the drainage area for exceedance and document any areas of concern.
        - Prior to the submittal for the NOT or COI (for acreage changes) for all or part of the site.

  - Ensuring that all BMPs are implemented, inspected, and properly maintained.
  - Ensure that the SMARTS generated WDID Number Notification form is posted on-site, in a location viewable by the public or readily available upon request, and the dates are correct and match the dates listed in SMARTS.
- Implementing non-stormwater management, and materials and waste management activities such as: monitoring discharges; general Site clean-up; vehicle and equipment cleaning, fueling and maintenance; spill control; ensuring that no materials other than stormwater are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems, etc.;
- Ensuring elimination of unauthorized discharges.
- The QSPs shall be assigned authority by the LRP to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate with the Contractor(s) to assure the necessary corrections/repairs are made immediately and that the project complies with the SWPPP, the 2022 CGP, and approved plans at all times.
- Notifying the LRP or Duly Authorized Representative immediately of off-site discharges or other non-compliance events.
- Providing foundation and site-specific training to QSP Delegates and overseeing QSP Delegate work. Tasks that may be delegated to appropriately trained QSP-delegates include:
  - Performing non-stormwater and stormwater visual observations and inspections;
  - Performing stormwater sampling and analysis, as required; and
  - Performing routine inspections and observations.

Table 6-1. QSP and QSP Delegate Authorized Inspections

	Weekly BMP and NSW	Pre-QPE	Daily-QPE Visual Inspections	Post-QPE Visual Inspections	Post NAL Exceedances	Monthly BMP and NSW	NOT
QSP	X	X	X	X	X	X	X
QSP Delegate	X		X	X			

6.2 CONTRACTOR LIST

Contractor Name:	TBD, Contractor information will be added via COI once known.
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Section 7 Construction Site Monitoring Program

7.1 Purpose

This Construction Site Monitoring Program was developed to address the following objectives:

1. To demonstrate that the site is in compliance with the Discharge Prohibitions.
2. To determine whether non-visible pollutants discharged from the construction site and are causing or contributing to exceedances of water quality objectives;
3. To determine whether immediate corrective actions, additional BMP implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges;
4. To determine whether BMPs included in the SWPPP are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

7.2 Applicability of Permit Requirements

This project has been determined to be a Risk Level 1 project. The 2022 CGP identifies the following types of monitoring as being applicable for a Risk Level 1 project.

Risk Level 1

- Visual inspections of BMPs;
- Visual monitoring of the site related to qualifying precipitation events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff for non-visible pollutants identified during the pollutant source assessments when applicable; and
- Sampling and analysis of construction site runoff as required by the Regional Water Board when applicable.

7.3. Weather and Precipitation Event Tracking

Visual monitoring and inspections requirements of the 2022 CGP are triggered by a Qualifying Precipitation Event. The 2022 CGP defines a Qualifying Precipitation Event as any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a Quantitative Precipitation Forecast (QPF) of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast.

7.3.1 Weather Tracking

The QSP should daily consult the National Oceanographic and Atmospheric Administration (NOAA) for the Forecast Weather Table Interface. These forecasts can be obtained at http://forecast.weather.gov. Weather reports should be printed and maintained with the SWPPP in Appendix M. Record the date and time the forecast was printed.

7.3.2 Rain Gauges

The QSP shall install a rain gauge on the project site. Locate the gauge in an open area away from obstructions such as trees or overhangs. Mount the gauge on a post at a height of 3 to 5 feet with the gauge extending several inches beyond the post. Make sure that the top of the gauge is level. Make sure the post is not in an area where rainwater can indirectly splash from sheds, equipment, trailers, etc.

The rain gauge(s) shall be read daily during normal site scheduled hours by the Contractor. The rain gauge should be read at approximately the same time every day and the date and time of each reading recorded. An example rain gauge log sheet is provided in Appendix O. Retain rain gauge readings in Appendix N. Follow the rain gauge instructions to obtain accurate measurements.

Once the rain gauge reading has been recorded, accumulated rain shall be emptied, and the gauge reset.

For comparison with the site rain gauge, the nearest appropriate governmental rain gauge(s) is located at the staging area shown in Appendix A: Site Maps, Figures 2-4.

7.4 Monitoring Locations

Monitoring locations are shown on the Site Maps in Appendix A. Monitoring locations are described in the Sections 7.6 and 7.7.

Whenever changes in the construction site might affect the appropriateness of sampling locations, the sampling locations shall be revised accordingly. All such revisions shall be implemented as soon as feasible and the SWPPP amended. Temporary changes that result in a one-time additional sampling location do not require a SWPPP amendment.

7.5 Safety and Monitoring Exemptions

Safety practices for sample collection will be in accordance with the Contractor's Project health and safety plan. A summary of the safety requirements that apply to sampling personnel is provided below.

- Wear all required PPE at all times.
- Be careful of slips, trips, and falls during wet site conditions.

This project is not required to collect samples or conduct visual observations (inspections) under the following conditions (see Section III.B of the 2022 CGP):

- During dangerous weather conditions such as electrical storms, flooding, and high winds above 40 miles per hour;
- Outside of scheduled site operating hours; or

When the site is not accessible to personnel. Scheduled site business hours are: 7 am to 5 pm, M-F

If monitoring (visual monitoring or sample collection) of the site is unsafe because of the dangerous conditions noted above, then the QSP shall document the conditions for why an exception to performing the monitoring was necessary. The exemption documentation will be filed in Appendix N and must be included in the Annual Report.

7.6 Visual Monitoring

Visual monitoring includes observations and inspections. Inspections of BMPs are required to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended. Visual observations of the site are required to observe storm water drainage areas to identify any spills, leaks, or uncontrolled pollutant sources.

Table 7-1 identifies the required frequency of visual observations and inspections. Inspections and observations will be conducted at the locations identified in Section 7.6.3.

Table 7-1 Summary of Visual Monitoring and Inspections

Type of Inspection	Frequency
Routine Inspections[1]	
Site Entrances/Exits	Daily
Hazardous Material/Waste storage areas	Daily
BMP Inspections	Weekly[2]
Qualifying Precipitation Event Triggered Inspections	
Site Inspections Prior to a Qualifying Precipitation Event	Within 72 hours of a qualifying precipitation event or up to 120 hours prior if supported with forecast [2]
BMP Inspections During an Extended Qualifying Precipitation Event	Once every 24-hour period of a qualifying precipitation event[3]
Site Inspections Following a Qualifying Precipitation Event	Within 96 hours of a qualifying precipitation event[2]

[1] Inspections are required during scheduled site operating hours.

[2]. Most BMPs must be inspected weekly; those identified below must be inspected more frequently.

[3] Inspections are required during scheduled site operating hours on days that the forecast predicts at least 0.25 inches of precipitation once the qualifying precipitation event commences.

7.6.1 Routine Observations and Inspections

Routine site inspections and visual monitoring are necessary to confirm that the project is in compliance with the requirements of the 2022 CGP.

7.6.1.1 Routine BMP Inspections

Inspections of BMPs are conducted to identify and record:

- BMPs that are properly installed;
- BMPs that need maintenance to operate effectively;
- BMPs that have failed; or
- BMPs that could fail to operate as intended.

7.6.1.2 Non-Stormwater Discharge Observations

Each drainage area will be inspected for the presence of or indications of prior unauthorized and authorized non-stormwater discharges. Inspections will record:

- Presence or evidence of any non-stormwater discharge (authorized or unauthorized);
- Identification and elimination of unauthorized non-stormwater discharges
- Pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.); and
- Source of discharge.

7.6.2 Qualifying Precipitation Event Triggered Observations and Inspections

Visual observations of the site and inspections of BMPs are required prior to a qualifying precipitation event; following a qualifying precipitation event, and every 24-hour period during a qualifying precipitation event. Pre-Qualifying Precipitation Event inspections will be conducted after consulting NOAA and determining that a precipitation event with a 50 percent or greater PoP and a QPF of 0.5 inches or more precipitation within a 24-hour period has been predicted by the National Weather Service Forecast Office.

7.6.2.1 Visual Observations Prior to a Forecasted Qualifying Precipitation Event

Within 72 hours prior to a qualifying precipitation event or up to 120 hours prior if extended forecast precipitation data is available, a stormwater visual monitoring site inspection will include observations of the following locations:

- All stormwater drainage areas to identify leaks, spills, or uncontrolled pollutant sources and when necessary, implement appropriate corrective actions.
- All BMPs to identify whether they have been properly implemented per the SWPPP and implement appropriate corrective actions, as necessary.
- All stormwater storage and containment areas to detect leaks and check for available capacity to prevent overflow.

The QSP must conduct the inspection prior to the qualifying precipitation event. Consistent with the requirements for a qualifying precipitation event, pre-rain BMP inspections and visual monitoring will be triggered by a NOAA forecast that indicates a 50 percent or greater probability of 0.5 inches of precipitation or more in a 24-hour period in the project area.

7.6.2.2 BMP Inspections During a Qualifying Precipitation Event

During an extended qualifying precipitation event BMP inspection will be conducted at least once every 24 hours. Qualifying precipitation events are extended for each subsequent 24-hour period forecast to have at least 0.25 inches of precipitation. The BMP inspections are to identify and record:

- If BMPs were adequately designed, implemented and effective.
- BMPs that require repair or replacement due to damage.
- Additional BMPs that need to be implemented and revise the SWPPP accordingly.

If the construction site is not accessible during the rain event, the visual inspections shall be performed at all relevant outfalls, discharge points, downstream locations. The inspections should record any projected maintenance activities.

7.6.2.3 Visual Observations Following a Qualifying Precipitation Event

Within 96 hours following the end of a qualifying precipitation event a stormwater visual monitoring site inspection is required to observe:

- If BMPs were adequately designed, implemented and effective.
- BMPs that require repair or replacement due to damage.
- Additional BMPs that need to be implemented and revise the SWPPP accordingly.

7.6.3 Visual Monitoring Procedures

Visual monitoring shall be conducted by the QSP or QSP Delegates.

The name(s) and contact number(s) of the QSPs or QSP Delegates assigned to conduct visual observations are listed below and their training qualifications are provided in Appendix J.

Assigned QSP:	TBD. To be updated via COI	Phone #:
Assigned QSP Delegate:		Phone #:
Assigned QSP Delegate:		Phone #:

Stormwater observations shall be documented on the *Visual Inspection Field Log Sheet* (see Appendix O). BMP inspections shall be documented on the site-specific BMP inspection checklist and include photographs of areas of concern along with the QSP's description of the problem.

The QSP shall within 24 hours of the inspection submit copies of the completed inspection report to the Contractor.

The QSP shall be responsible for keeping a digital record of visual monitoring inspections and shall provide their records to the QSD or Landowner upon request.

The completed reports will be kept in Appendix N. Results of visual monitoring must be summarized and reported in the Annual Report.

7.6.4 Visual Monitoring Follow-Up and Reporting

Maintenance, repairs, and correction of deficiencies, including design changes to BMPs, identified by the observations or inspections, including required repairs or maintenance of BMPs, shall be initiated within 72 hours of identification and completed as soon as possible, prior to the next forecasted precipitation event.

When design changes to BMPs are required, the SWPPP shall be amended to reflect the changes.

Deficiencies identified in site inspection reports and correction of deficiencies will be tracked on the *Inspection Field Log Sheet* or *BMP Inspection Report* shall be kept in Appendix N. QSP Delegates shall report issues identified during inspections that require corrective action to the QSP within 24 hours of the observation.

The QSP shall within 24 hours of the inspection submit copies of the completed *Inspection Field Log Sheet* or *BMP Inspection Report* with the corrective actions to the Contractor.

The QSP shall be responsible for keeping a digital record of visual monitoring inspections and shall provide their records to the QSD or Landowner upon request.

Results of visual monitoring must be summarized and reported in the Annual Report.

7.6.5 Visual Monitoring Locations

The inspections and observations identified in Sections 7.6.1 and 7.6.2 will be conducted at the locations identified in this section.

BMP locations are shown on the Site Maps in Appendix A.

Due to grading activities and the installation of new surface or underground stormwater conveyance systems, the drainage areas of the Project site will change throughout construction. The SWPPP identifies two main conditions for pre-grading/pre-stormwater conveyance system construction and post-grading/stormwater conveyance system construction for the purposes of identifying the main discharge locations of the Project for monitoring. These two main drainage conditions are presented in Site Maps in Appendix A.

The QSP and trained Delegates shall use the drainage conditions presented in Site Maps in Appendix A as a guide for understanding site drainage and then field verify the accurate drainage areas and discharge locations/sampling locations during the event of a release of a non-visible pollutant based on their observations of the current drainage conditions at the site.

For the pre-grading site condition, there are five drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) are shown on the Site Maps in Appendix A and Table 7-2 identifies each drainage area by location.

For the active earthwork site condition, there are six drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) are shown on the Site Maps in Appendix A and Table 7-2 identifies each drainage area by location.

For the post-grading/post-stormwater system construction site condition, there are thirteen drainage area(s) on the project site and the contractor's yard, staging areas, and storage areas. Drainage area(s) are shown on the Site Maps in Appendix A and Table 7-2 identifies each drainage area by location.

Table 7-2 Site Drainage Areas

Pre-Grading Condition	
Location No.	**Location**
DA 1	North grass field area
DA 2	East sidewalk and road of Santa Cruz Street
DA 3	West existing concrete area 1
DA 4	West existing concrete area 2
DA 5	West existing concrete area 3
DA 6	North half of south parking lot
DA 7	South half of south parking lot
Earthwork Condition	
DA 1	North half of staging area
DA 2	South half of staging area and north concrete paving area
DA 3	Building construction grading area
DA 4	Parking lot expansion area
DA 5	North half of existing parking lot
DA 6	South half of existing parking lot
Post-Grading/Post-Stormwater System Construction Condition	
DA 1	Northwest staging area

DA 2	West part of staging area, concrete and building construction area
DA 3	East part of staging area, concrete and building construction area
DA 4	Part of staging area and bus drop-off area
DA 5	West perimeter of building and concrete construction
DA 6	Small drainage area south of west building 1
DA 7	Small drainage area south of west building 2
DA 8	Small drainage area south of west building 3
DA 9	North French drain area between buildings
DA 10	French drain area between two eastern buildings
DA 11	Area east of northeast building
DA 12	South French drain area between buildings
DA 13	Concrete area northwest of expanded parking lot
DA 14	New parking lot entrance lane
DA 15	North half of new parking lot and existing parking lot
DA 16	South half of existing parking lot

There are four stormwater storage or containment area(s) are on the project site from which stormwater will be dewatered. Stormwater storage or containment area(s) are shown on the Site Maps in Appendix A and Table 7-3 identifies each stormwater storage or containment area by location.

Table 7-3 Stormwater Storage and Containment Areas (Dewatering Locations)

Location No.	Location
CA 1	North stagging area
CA 2	Center-north area, during grading
CA 3	Center-south area, during grading
CA 4	South new parking lot area, during demolition/grading

For the pre-grading/pre-stormwater system construction site condition, there are four discharge location(s) on the project site. Site stormwater discharge location(s) are shown on the Site Maps in Appendix A and Table 7-4 identifies each stormwater discharge location.

For the Earthwork and post-earthwork condition, there are six stormwater storage or containment area(s) are on the project site from which stormwater may be dewatered. Stormwater storage or containment area(s) are shown on the Site Maps in Appendix A and Table 7-3 identifies each stormwater storage or containment area by location.

For the post-grading/post-stormwater system construction site condition, there are thirteen discharge location(s) on the project site. Site stormwater discharge location(s) are shown on the Site Maps in Appendix A and Table 7-4 identifies each stormwater discharge location.

Table 7-4 Site Stormwater Discharge Locations

Pre-Grading Construction Condition	
Location No.	**Location**
SL 1	None, stromwater percolates into large grass field
SL 2	Gutter south of sidewalk of Santa Cruz Street
SL 3	Drain inlet in west existing concrete area 1
SL 4	Drain inlet in west existing concrete area 2
SL 5	Drain inlet in west existing concrete area 3
SL 6	Gutter south of sidewalk of Santa Cruz Street
SL 7	Gutter south of sidewalk of Santa Cruz Street
Earthwork Condition	
SL 1	Gutter in Santa Cruz St east of north half of staging area
SL 2	Gutter in Santa Cruz St east of south half of staging area and north concrete paving area
SL 3	Gutter in Santa Cruz St east of building construction grading area
SL 4	Gutter in Santa Cruz St east of parking lot expansion area
SL 5	Gutter in Santa Cruz St east of north half of existing parking lot
SL 6	Gutter in Santa Cruz St east of south half of existing parking lot
Post-Grading/Post-Stormwater System Construction Condition	
SL 1	Existing drain inlet southwest of northwest staging area
SL 2	Drain inlet in northwest concrete area
SL 3	Drain inlet in northeast concrete area
SL 4	Gutter in south end of drop-off area
SL 5	Existing drain inlet west of west perimeter of building and concrete construction
SL 6	Drain inlet in small drainage area south of west building 1
SL 7	Drain inlet in small drainage area south of west building 2
SL 8	Drain inlet in small drainage area south of west building 3
SL 9	North french drain between buildings
SL 10	French drain between two eastern buildings
SL 11	Drain inlet in area east of northeast building

SL 12	South French drain between buildings
SL 13	Drain inlet in concrete area northwest of expanded parking lot
SL 14	Valley gutter end of new parking lot entrance lane
SL 15	Gutter end of north half of new parking lot and existing parking lot
SL 16	Gutter end of south half of existing parking lot

7.7 Sampling and Analysis Plan for Non-Visible Pollutants in Stormwater Runoff Discharges

This Sampling and Analysis Plan for Non-Visible Pollutants describes the sampling and analysis strategy and schedule for monitoring non-visible pollutants in stormwater runoff discharges from the project site.

Sampling for non-visible pollutants, including those associated with TMDLs, will be conducted when (1) a breach, leakage, malfunction, or spill is observed; and (2) the leak or spill has not been cleaned up prior to the rain event; and (3) there is the potential for discharge of non-visible pollutants to surface waters or drainage system.

The QSP and trained Delegates are responsible for completing the following non-visible pollutant monitoring requirements:

- The QSP and trained Delegates shall collect one or more samples during any breach, malfunction, leakage, or spill observed during a visual inspection which could result in the discharge of pollutants to surface waters that would be visually detectable in storm water.
- The QSP and trained Delegates is not required to sample if one of the conditions described above (e.g., breach or spill) occurs and the site is cleaned of material and pollutants and/or BMPs are implemented prior to the next storm event.
- The QSP and trained Delegates shall ensure that water samples are large enough to characterize the site conditions.
- The QSP and trained Delegates shall collect samples at all discharge locations that can be safely accessed.
- The QSP and trained Delegates shall collect samples during the first two hours of discharge from rain events that occur during business hours which generate runoff.
- The QSP and trained Delegates shall analyze samples for the non-visible pollutant parameters, if applicable (see the list of parameters identified in Table 7-5 – Potential Non-Visible Pollutants and Water Quality Indicator Constituents Based on the Pollutant Source Assessment);
- The QSP and trained Delegates shall collect a sample of storm water that has not come in contact with the disturbed soil or materials stored or used onsite (uncontaminated sample) for comparison with the discharge sample;
- The QSP and trained Delegates shall compare the uncontaminated sample to the samples of discharge using field analysis or through laboratory analysis;
- For laboratory analyses, all sampling sample preservation, and other analyses must be conducted according to test procedures pursuant to 40 C.F.R. Part 136. SCE shall ensure that field samples are collected and analyzed according to manufacturer specifications of

the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specifications; and

- The QSP and trained Delegates shall keep all field/or analytical data with the SWPPP document.

Table 7-5 summarizes the potential non-visible pollutants identified in the pollutant source assessment Sections 2.6 and 2.7 and the water quality constituent or indicator for that pollutant. Drainage areas for the pre-grading/pre-stormwater system construction and post-grading/post-stormwater system construction site conditions where the source is present are identified in Table 7-6 and shown in the Site Maps in Appendix A.

Table 7-5 Potential Non-Visible Pollutants and Water Quality Indicator Constituents Based on the Pollutant Source Assessment

Pollutant	Water Quality Indicator or Constituent	Source/Reason from Pollutant Source Assessment	TMDL Pollutant	Pre-Grading Site Drainage Area	Earth-work Site Drainage Area	Post-Grading Site Drainage Area
PCBs (from demolished structures from 1950-1980)	PCBs	Building Demolition	No	None	None	None
Lead Paint	Pb	Building Demolition	No	None	None	None
Gypsum / Lime amendments	pH	Grading / Earthwork	No	None	1-4	None
Contaminated soil	Constituents specific to known contaminants, check with Laboratory	Grading / Earthwork	No	None	None	None
Sealant (Methyl methacrylate)	SVOC	Concrete Masonry Work	No	None	None	All
Curing compounds	VOCs, SVOCs, pH	Concrete Masonry Work	No	None	None	1-12, 14
Ash, slag, sand	pH, Al, Ca, Va, Zn	Concrete Masonry Work	No	None	None	All
Treated Wood	Cu, CR, As, Zn	Carpentry Work	No	None	None	1-12, 14
Particle Board	Formaldehyde	Carpentry Work	No	None	None	1-12, 14
Untreated Wood	BOD	Carpentry Work	No	None	None	All
Drywall	Cu, Al, CA, VA, Zn	Building Construction	No	None	None	1-12, 14
Solder, flux, pipe fitting	Cu, Pb, Sn, Sn	Plumbing	No	None	None	1-12, 14
Roofing Compound	Cu, Pb, VOC	Roofing	No	None	None	1-12, 14
Insulation	Al, Zn	Insulation	No	None	None	1-12, 14
Resins, Thinners, Paint Strippers, Lacquers, varnishes, enamels,	COD, SVOCs, VOCs, Metals, Phenols	Painting	No	None	None	All

Table 7-5 Potential Non-Visible Pollutants and Water Quality Indicator Constituents Based on the Pollutant Source Assessment

Pollutant	Water Quality Indicator or Constituent	Source/Reason from Pollutant Source Assessment	TMDL Pollutant	Pre-Grading Site Drainage Area	Earth-work Site Drainage Area	Post-Grading Site Drainage Area
Sealants, Adhesives						
Chlorinated water	Residual Chlorine, Chloramines	Utility Line Testing and Flushing	No	None	All	All
Pesticides/ Herbicides	Product dependent, see label and check with Laboratory	Vegetation Management	No	None	None	1-8, 11, 14-16
Vegetation Stockpiles	BOD	Vegetation Management	No	None	None	1-4
Fertilizers	TKN, NO_3, BOD, COD, DOC, Sulfate, NH_3, Phosphate Potassium	Landscaping	No	None	None	1-8, 11, 14-16
Aluminum Sulfate	AL, TDS, Sulfate	Landscaping/soil amendments	No	None	None	1-8, 11, 14-16
Liquid Waste	Constituents specific to materials, check with Laboratory	Liquid Waste	No	All	All	All
Sewer line breaks and Portable Toilets	BOD, Total/Fecal coliform	Sanitary Waste	No	1	2	All
Polymer/Co-polymers	TKN, NO_3, BOD, COD, DOC, Sulfate, Ni	Soil Preparation / Amendments / Dust Control	No	None	1-4	1-8, 11, 14-16
Lignin sulfate	TDS, Alkalinity	Soil Amendments/ Dust Control	No	None	1-4	1-8, 11, 14-16
Psyllium	COD, TOC	Soil Amendments/ Dust Control	No	None	1-4	1-8, 11, 14-16
Guar/Plant Gums	COD, TOC, Ni	Soil Amendments/ Dust Control	No	None	1-4	1-8, 11, 14-16
Batteries	Sulfuric Acid, Pb, pH	Vehicle and Equipment Use	No	All	All	All
Freon	Freon	Heating, Ventilation, Air Conditions	No	All	All	All

7.7.1 Sampling Schedule

Samples for the potential non-visible pollutant(s) and a sufficiently large unaffected background sample shall be collected during the first eight hours of discharge from rain events that result in a sufficient discharge for sample collection. Samples shall be collected during the site's scheduled hours and shall be collected regardless of the time of year and phase of the construction.

Collection of discharge samples for non-visible pollutant monitoring will be triggered only when any of the following conditions are observed during site inspections conducted prior to or during a rain event.

- Materials or wastes containing potential non-visible pollutants are not stored under watertight conditions. Watertight conditions are defined as (1) storage in a watertight container, (2) storage under a watertight roof or within a building, or (3) protected by temporary cover and containment that prevents stormwater contact and runoff from the storage area.
- Materials or wastes containing potential non-visible pollutants are stored under watertight conditions, but (1) a breach, malfunction, leakage, or spill is observed, (2) the leak or spill is not cleaned up prior to the rain event, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- A construction activity, including but not limited to those in Section 2.6, with the potential to contribute non-visible pollutants (1) was occurring during or within 24 hours prior to the rain event, (2) BMPs were observed to be breached, malfunctioning, or improperly implemented, and (3) there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Soil amendments that have the potential to change the chemical properties, engineering properties, or erosion resistance of the soil have been applied, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.
- Stormwater runoff from an area contaminated by historical usage of the site has been observed to combine with stormwater runoff from the site, and there is the potential for discharge of non-visible pollutants to surface waters or a storm drain system.

7.7.2 Sampling Locations

Sampling locations are based on proximity to planned non-visible pollutant storage, occurrence or use, accessibility for sampling, and personnel safety. Planned non-visible pollutant sampling locations are shown on the Site Maps in Appendix A and include the locations identified in Table 7-6.

Pre-grading site condition:

One sampling location(s) on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Zero sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Zero sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Zero sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants The QSP will identify onsite any sampling locations such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

One sampling location have been identified for the collection of samples of run-on to the project site. There is mot a possibility of there being run-on to the project

Earthwork construction site condition:

Two sampling location(s) on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

Four sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Zero sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Zero sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. The QSP will identify onsite any sampling locations such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

One sampling locations have been identified for the collection of samples of run-on to the project site. Run-on from these locations have no potential to combine with discharges from the site being sampled for non-visible pollutants. These samples are intended to identify potential sources of non-visible pollutants that originate off the project site.

Post-grading/Post-stormwater system construction site condition:

16 sampling location on the project site and the contractor's yard have been identified for the collection of samples of runoff from planned material and waste storage areas and areas where non-visible pollutant producing construction activities are planned.

12 sampling locations have been identified for the collection of samples of runoff from drainage areas where soil amendments will be applied that have the potential to affect water quality.

Zero sampling locations have been identified for the collection of samples of runoff from drainage areas contaminated by historical usage of the site.

Zero sampling location has been identified for the collection of an uncontaminated sample of runoff as a background sample for comparison with the samples being analyzed for non-visible pollutants. The QSP will identify onsite any sampling locations such that the sample will not have come in contact with the operations, activities, or areas identified in Section 7.7.1 or with disturbed soils areas.

One sampling locations have been identified for the collection of samples of run-on to the project site. Run-on from these locations do not have the potential to combine with discharges from the site being sampled for non-visible pollutants. These samples are intended to identify potential sources of non-visible pollutants that originate off the project site.

Table 7-6 Non-Visible Pollutant Sample Locations

Pre-Grading Construction Condition			
Sample Location Identifier	**Sample Location Description**	**Sample Location Latitude and Longitude** (Decimal Degrees)	**Runoff or Run-on**
SL 01	None, stromwater percolates into large grass field	N/A	N/A
CS 02	Gutter of Santa Cruz St north of site	36.95221222217376, -120.06287095340947	Run-on
SL 02	Gutter south of sidewalk of Santa Cruz Street	36.95130767967781, -120.06287095340947	
SL 03	Drain inlet in west existing concrete area 1	36.95165220055485, -120.06363842792007	Runoff
SL 04	Drain inlet in west existing concrete area 2	36.951490337093155, -120.06363683306911	Runoff
SL 05	Drain inlet in west existing concrete area 3	36.951253276595542, -120.06367510949393	Runoff
SL 06	Gutter south of sidewalk of Santa Cruz Street	36.951165333460564, -120.0628713045873	Runoff
SL 07	Gutter south of sidewalk of Santa Cruz Street	36.95102641155493, -120.06286811488538	Runoff
Earthwork Construction Condition			
Sample Location Identifier	**Sample Location Description**	**Sample Location Latitude and Longitude** (Decimal Degrees)	**Runoff or Run-on**
SL 01	Gutter in Santa Cruz St east of north half of staging area	36.951950366506, -120.06287239905109	Runoff
CS 01	Gutter of Santa Cruz St north of site	36.95221222217376, -120.06287095340947	Run-on
SL 02	Gutter in Santa Cruz St east of south half of staging area and north concrete paving area	36.951699828593796, -120.06287465451096	Runoff
SL 03	Gutter in Santa Cruz St east of building construction grading area	36.951445684977564, -120.06288142089056	Runoff

SL 04	Gutter in Santa Cruz St east of parking lot expansion area	36.95126544076415, -120.06287239905109	Runoff
SL 05	Gutter in Santa Cruz St east of north half of existing parking lot	36.95114287444929, -120.06287916543005	Runoff
SL 06	Gutter in Santa Cruz St east of south half of existing parking lot	36.95102932019312, -120.0628746545103	Runoff
Post-Grading/Post-Stormwater System Construction Condition			
Sample Location Identifier	**Sample Location Description**	**Sample Location Latitude and Longitude** (Decimal Degrees)	**Runoff or Run-on**
SL 01	Existing drain inlet southwest of northwest staging area	36.95165700846061, -120.06364248607962	Runoff
SL 02	Drain inlet in northwest concrete area	36.95177704260355, -120.0634761891261	Runoff
SL 03	Drain inlet in northeast concrete area	36.95179847725203, -120.06321869706903	Runoff
SL 04	Gutter in south end of drop-off area	36.95143837435742, -120.06288610315003	Runoff
CS 04	Gutter of Santa Cruz St north of site	36.95221222217376, -120.06287095340947	Run-on
SL 05	Existing drain inlet west of west perimeter of building and concrete construction	36.95147910036547, -120.06365053269451	Runoff
SL 06	Drain inlet in small drainage area south of west building 1	36.951470526470956, -120.06348423575052	Runoff
SL 07	Drain inlet in small drainage area south of west building 2	36.95148338731253, -120.0634600958702	Runoff
SL 08	Drain inlet in small drainage area south of west building 3	36.951476956892016, -120.06342790936304	Runoff
SL 09	North french drain between buildings	36.95162056948743, -120.06329648112558	Runoff
SL 10	French drain between two eastern buildings	36.95154983495935, -120.06319187497739	Runoff

SL 11	Drain inlet in area east of northeast building	36.95165486499258, -120.06311945533633	Runoff
SL 12	South French drain between buildings	36.951476956892016, -120.06338499402018	Runoff
SL 13	Drain inlet in concrete area northwest of expanded parking lot	36.9513955048519, -120.06356201980944	Runoff
SL 14	Valley gutter end of new parking lot entrance lane	36.95132262663625, -120.06289414977569	Runoff
SL 15	Gutter end of north half of new parking lot and existing parking lot	36.9511468612426, -120.06286732768639	Runoff
SL 16	Gutter end of south half of existing parking lot	36.95102253913392, -120.06287805652212	Runoff

If a stormwater visual monitoring site inspection conducted prior to or during a storm event identifies the presence of a material storage, waste storage, operations area with spills, or the potential for the discharge of non-visible pollutants to surface waters or a storm drain system that is at a location not listed above and has not been identified on the Site Maps, sampling locations will be selected by the QSP using the same rationale as that used to identify planned locations. Non-visible pollutant sampling locations shall be documented by the QSP on the pre-rain event inspection form prior to a forecasted qualifying precipitation event and the *Effluent Sampling Field Log Sheet*, which are provided in Appendix O.

7.7.3 Monitoring Preparation

Non-visible pollutant samples will be collected by:

QSP	☒ Yes	☐ No
QSP Delegate	☒ Yes	☐ No

An adequate stock of monitoring supplies and equipment for monitoring non-visible pollutants will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with rain or direct sunlight. The QSP or QSP Delegates responsible for sampling will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, clean powder-free nitrile gloves, sample collection equipment, coolers, appropriate number and volume of sample bottles, identification labels, re-sealable storage bags, paper towels, personal rain gear, ice, and *Effluent Sampling Field Log Sheets* and Chain of Custody (CoC) forms, which are provided in Appendix O.

7.7.3.1 Analytical Constituents

Table 7-7 lists the specific sources and types of potential non-visible pollutants based on the project pollutant source assessment and the water quality indicator constituent(s) for that pollutant. Table 7-7 provides the specific analytical methods and reporting limits for the potential non-visible pollutants. Analytical methods were selected in compliance with U.S. EPA sufficiently sensitive method requirements in 40 Code of Federal Regulations Part 136, as evidenced by the method detection limit and minimum level.

7.7.4 Sample Collection

Samples of discharge shall be collected at the designated non-visible pollutant sampling locations identified in Table 7-6 and shown on the Site Maps in Appendix A or in the locations determined by observed breaches, malfunctions, leakages, spills, operational areas, soil amendment application areas, and historical site usage areas that triggered the sampling event.

Only the QSP, or QSP Delegates trained on sample collection identified in Section 7.7.1.3 shall collect samples. Grab samples will be collected and preserved in accordance with the methods identified in Table 7-7. Samples will be collected by following the steps outlined below:

1. Place a laboratory provided sampling container directly into a stream of water down-gradient and within close proximity to the potential non-visible pollutant discharge location;
2. Transfer the collected sample into the sample bottles (supplied by the lab for the appropriate parameters being monitored) filling the bottles completely (or as instructed by the laboratory);
3. The up-gradient (uncontaminated) background samples will be collected first, prior to collecting the down-gradient sample, in order to minimize cross-contamination; and
4. Sampling personnel will collect the water up-gradient of where they are standing.

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

- Wear a clean pair of powder-free nitrile 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 than 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 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 rainwater to drip from rain gear or other surfaces into sample bottles;
- Not eat, smoke, or drink during sample collection nor sneeze or cough in the direction of an open sample bottle.
- Minimize the exposure of the samples to direct sunlight, as sunlight may cause biochemical transformation of the sample;
- Decontaminate sampling equipment prior to sample collection using a tri-sodium phosphate (TSP) solution water wash and triple rinse with distilled or de-ionized water; and
- Dispose of decontamination water/soaps appropriately (i.e., do not discharge to the storm drain system or receiving water).

Note, that depending upon the specific analytical test, some containers may contain preservatives. These containers should **never** be dipped into the stream but filled indirectly from the collection container.

7.7.4.1 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. As discussed in Section 7.7.7, adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

Table 7-7 Sample Collection, Preservation and Analysis for Monitoring Non-Visible Pollutants

Constituent	Analytical Method	Minimum Sample Volume	Sample Containers	Sample Preservation	Reporting Limit	Maximum Holding Time
SVOCs	EPA 625	1 x 1 L	Glass-amber	Store at 4°C	10 ug/L	7 days
VOCs	EPA 601/602	3 X 40 mL	VOA - Glass	Store at 4°C, HCL to pH<2	1 ug/L	14 days
BOD	EPA 405.1	1 x 500 mL	Polypropylene	Store at 4°C	1 mg/L	48 hours
COD	EPA 410.4	1 X 250mL	Glass - Amber	Store at 4°C, H2SO4 to pH<2	5 mg/L	28 days
DO	SM 4500-OG	1 x 250 mL	Glass-Amber	Store at 4°C	Check Lab	8 hours
NO3	EPA 353.2	1 x 250 mL	Glass-Amber	Store at 4°C, H2SO4	0.05 mg/L	28 days
NH3	EPA 350.1	1 x 250 mL	Glass-Amber	Store at 4°C, H2SO4	0.01 mg/L	
TKN	EPA 351.1	1 x 250 mL	Glass-Amber	Store at 4°C, H2SO4 to pH<2	0.1 mg/L	28 days
Coliform, Fecal	FDA BAM CH 4	1 x 100 mL	Glass/Polypropylene	Store at or below 10°C	0.1 mg/L	8 hours
Coliform, Total	SM 9221B	1 x 100 mL	Glass/Polypropylene	Store at or below 10°C	0.1 mg/L	8 hours
Metals (Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Se, Na, Th, Va, Zn)	EPA 200.8/1631	1 x 250 mL	Polypropylene	Store at 4°C, HNO3 to pH<2	0.1 mg/L	6 months
Chromium VI	EPA 7196	1 x 500 mL	Polypropylene	Store at 4°C	1 g/L	24 hours
Ortho Phenyl Phenol	HPLC FLUORESCENC E	1 x 1L	Tenax GC Tube	Store at 4°C	1 mg/L	8 hours
pH	SM 4500B	1 x 100 mL	Polypropylene	None	Unit less	15 minutes
Formaldehyde	EPA 1667A	1 x 20 mL	Glass-Amber	Store at 4°C	50 ug/L	5 days
PCBs	EPA 608	1 x 1 L	Glass-Amber	Store at 4°C, H2SO4 to pH 5-9	0.25 ug/L	40 days

7.7.5 Sample Analysis

Samples shall be analyzed using the analytical methods identified in the Table 7-7.

Samples will be analyzed by:

Laboratory Name:	BSK Associates – Fresno
Street Address:	1414 Stanislaus St,
City, State Zip:	Fresno, CA 93706
Telephone Number:	(559) 497-2888
Point of Contact:	Lisa Cardenas
ELAP Certification Number:	04227CA

Samples will be delivered to the laboratory by:

Driven by QSP/QSP Delegate/Contractor	☒	Yes	☐	No
Picked up by Laboratory Courier	☐	Yes	☒	No
Shipped	☐	Yes	☒	No

7.7.6 Sample Handling

All samples for laboratory analysis must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Place samples to be shipped inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The 2022 CGP requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless required sooner by the analytical laboratory to meet all hold times).

7.7.7 Sample Documentation Procedures

All original data documented on sample container identification labels, *Effluent Sampling Field Log Sheet* (Appendix O), and CoCs shall be recorded using waterproof ink. These shall be considered accountable documents. If an error is made on an accountable document, the individual shall make corrections by lining through the error and entering the correct information. The erroneous information shall not be obliterated. All corrections shall be initialed and dated.

Duplicate samples shall be identified consistent with the numbering system for other samples to prevent the laboratory from identifying duplicate samples. Duplicate samples shall be identified in the Effluent Sampling Field Log Sheet.

Sample documentation procedures include the following:

<u>Sample Bottle Identification Labels:</u> Sampling personnel shall attach an identification label to each sample bottle. Sample identification shall uniquely identify each sample location. (These location identifiers should be listed in the tables in the SWPPP.)

Field Log Sheets: Sampling personnel shall complete the *Effluent Sampling Field Log Sheet* and *Receiving Water Sampling Field Log Sheet* (Appendix O) for each sampling event, as appropriate.

Chain of Custody: Sampling personnel shall complete the CoC for each sampling event for which samples are collected for laboratory analysis. The sampler will sign the CoC (Appendix O) when the sample(s) is turned over to the testing laboratory or courier.

7.7.8 QA/QC Samples

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods. The following types of QA/QC will be conducted for this project:

☒ Field Duplicates at a frequency of 5 percent or 1 duplicate minimum per sampling event (Required for all sampling plans with field measurements or laboratory analysis)

☐ Equipment Blanks
(Only needed if the equipment used to collect samples could add the pollutants to sample)

☒ Field Blanks
(Only required if sampling method calls for field blanks)

☒ Travel Blanks
(Required for sampling plans that include VOC laboratory analysis)

7.7.8.1 Field Duplicates

Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples shall be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected shall be randomly selected from the discharge locations. Duplicate samples shall be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time as possible to the original sample. Duplicate samples shall not influence any evaluations or conclusion.

7.7.8.2 Equipment Blanks

Equipment blanks provide verification that equipment has not introduced a pollutant into the sample. Equipment blanks are typically collected when:

- New equipment is used;
- Equipment that has been cleaned after use at a contaminated site;
- Equipment that is not dedicated for surface water sampling is used; or
- Whenever a new lot of filters is used when sampling metals.

7.7.8.3 Field Blanks

Field blanks assess potential sample contamination levels that occur during field sampling activities. De-ionized water field blanks are taken to the field, transferred to the appropriate container, and treated the same as the corresponding sample type during the course of a sampling event.

7.7.8.4 Travel Blanks

Travel blanks assess the potential for cross-contamination of volatile constituents between sample containers during shipment from the field to the laboratory. De-ionized water blanks are taken along for the trip and held unopened in the same cooler with the VOC samples.

7.7.9 Quality Assurance and Quality Control

An effective Quality Assurance and Quality Control (QA/QC) plan shall be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- CoCs;
- QA/QC Samples; and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

7.7.10 Chain of Custody

The sample CoC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample CoC procedures include the following:

- Proper labeling of samples;
- Use of CoC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide CoC forms to be filled out for sample containers. An example CoC is included in Appendix O.

7.7.11 Data Verification

After results are received from the analytical laboratory, the QSP or QSP Delegates shall verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Data verification shall include:

- Check the CoC and laboratory reports.
  Make sure all requested analyses were performed and all samples are accounted for in the reports.
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values and follow up with the laboratory.
  Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. The QSP or QSP Delegates should especially note data that is an order of magnitude or more different than similar locations or is inconsistent with previous data from the same location.
- Check laboratory QA/QC results.
  EPA establishes QA/QC checks and acceptable criteria for laboratory analyses. These data are typically reported along with the sample results. The QSP or QSP Delegates shall evaluate the reported QA/QC data to check for contamination (method, field, and

equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.

- Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate.
  Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met and confirms this in writing.

Field data including inspections and observations must be verified as soon as the field logs are received, typically at the end of the sampling event. Field data verification shall include:

- Check field logs to make sure all required measurements were completed and appropriately documented;
- Check reported values that appear out of the typical range or inconsistent;
  Follow-up immediately to identify potential reporting or equipment problems, if appropriate, recalibrate equipment after sampling;
- Verify equipment calibrations;
- Review observations noted on the field logs; and
- Review notations of any errors and actions taken to correct the equipment or recording errors.

7.7.12 Data Evaluation and Reporting

The QSP shall complete an evaluation of the water quality sample analytical results based on a comparison of the results to the unaffected sample.

Runoff/downgradient results shall be compared with the associated upgradient/unaffected results and any associated run-on results. Should the runoff/downgradient sample show an increased level of the tested analyte relative to the unaffected background sample, which cannot be explained by run-on results, the BMPs, site conditions, and surrounding influences shall be assessed to determine the probable cause for the increase.

As determined by the site and data evaluation, appropriate BMPs shall be repaired or modified to mitigate discharges of non-visible pollutant concentrations. Any revisions to the BMPs shall be recorded as an amendment to the SWPPP.

The QSP is responsible for reporting:

- Analytical results of non-visible pollutant monitoring shall be submitted to the QSD within 5 days of obtaining the analytical results.

The QSD is responsible for reporting:

- Analytical results of non-visible pollutant monitoring shall be submitted to SMARTS by the QSD within 10 days of obtaining the analytical results.

The 2022 CGP prohibits the storm water discharges that contain hazardous substances equal to or in excess of reportable quantities established in 40 C.F.R. §§ 117.3 and 302.4. The results of any non-stormwater discharge results that indicate the presence of a hazardous substance in excess of established reportable quantities shall be immediately reported to the Regional Water Board and other agencies as required by 40 C.F.R. §§ 117.3 and 302.4.

7.8 Sampling and Analysis Plan for Dewatering Discharges

Dewatering activities associated with this project *are not* subject to a separate NPDES permit and will be discharged under this WDID. Dewatering discharges authorized include mechanical pumping or syphoning of non-potable water from sources including, but not limited to: groundwater removal specifically related to the construction activities from excavations, trenches, foundations, vaults, **and/or** stormwater collected in impoundments (e.g., trenches, ponds, puddles, low points on the active site, or other similar accumulation points).

Dewatering Activities for the Project Site:

☐ No dewatering activities are planned for this project.

☐ Dewatering activities planned for this project will be conducted and monitored according to the requirements of the following NPDES Permit: [insert name and order number of the permit.]

☒ Dewatering activities may occur for this project and will be conducted and monitored according to the requirements of the 2022 CGP Attachment J.

This Sampling and Analysis Plan for dewatering discharges describes the sampling and analysis strategy and schedule for monitoring dewatering discharges in accordance with the requirements of the 2022 CGP.

Dewatering of non-stormwater or non-groundwater sources (other than de-chlorinated potable water) is prohibited. Dewatering of stormwater with presence of an oily sheen, odor, or discoloration is prohibited. Dewatering of stormwater that is suspected to have contacted non-visible pollutants due to a spill, breach, or malfunction shall also be sampled for non-visible pollutants according to Section 7.7 of this SWPPP.

7.8.1 Dewatering Reporting Requirements

At least 24 hours prior to the beginning of a dewatering discharge, the QSP or trained Delegates shall notify the applicable Regional Water Board stormwater and local MS4 staff via email of the anticipated dewatering discharge and copy the LRP and QSD.

The Project QSP will update the field SWPPP at least 24 hours prior to the beginning of a dewatering discharge. The Project QSD will upload a formal COI with the amended SWPPP, to SMARTS within 14 days. The SWPPP will be amendment to include all requirements established in Attachment J, Section D.4 of the 2022 CGP.

7.8.2 Dewatering Numeric Action Levels (NALs)

Dewatering activities covered by the CGP are subject to the pH and turbidity NALs in Table 7-8 below. A NAL exceedance occurs when a single sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-8. Dewatering sampling is to be performed within the first hour of commencement of discharge and daily each day that the discharge continues.

Table 7-8: Dewatering Numeric Action Levels (NALs)

Parameter	Unit	Numeric Action Levels
pH	pH units	Lower NAL < 6.5, Upper NAL > 8.5
Turbidity	NTU	>250 NTU

If a pH or Turbidity exceedance occurs, dewatering activities will **cease immediately** until either: (1) enough time and dry weather has allowed sediment in stored water to settle or pH to neutralize, as advised by the QSP (2) additional BMPs have been implemented to prevent the NAL exceedance.

If a pH or Turbidity exceedance occurs, within five (5) calendar days, the project QSP will investigate the cause of the exceedance and identify corrective actions and notify the QSD and LRP. Within ten (10) days, the QSD will enter field measurements demonstrating the exceedance into SMARTS. If necessary, the QSD will revise the SWPPP to incorporate immediate corrective actions to prevent further exceedances of the numeric action levels for pH and turbidity.

7.8.3 Dewatering Schedule

As of the initial draft if this SWPPP there are no planned dewatering activities for the Project. The need for dewatering from the Project site may arise based on impoundment of low points in the Project site and a desire by the Contractor to continue construction activities in impounded areas.

If dewatering activities that result in discharge off-site are planned to commence, dewatering activities and sample analysis shall comply with this Section 7.8.

7.8.4 Dewatering Locations and Discharge Locations, and Sampling Locations

If the Contractor desires to pump or siphon impounded stormwater at the Project site, the QSP and trained Delegates shall first consider if on-site pervious areas could be utilized for on-site stormwater storage and percolation (without resulting in discharging off-site) rather than discharging impounded stormwater off-site. This moving of stormwater throughout the site is not considered dewatering and therefore does not require the reporting or sampling requirements outlined in this Section 7.8.

Since the need for dewatering operations are dependent on minor changes to the construction schedule and future precipitation events, the dewatering locations, discharge locations, and sampling locations are unknown as of the initial authoring of this SWPPP. If the Contractor/QSP identifies planned dewatering activities, the field copy of Site Maps in Appendix A and Table 7-9 will be updated by the QSP or Trained Delegates with dewatering locations, discharge locations, and sampling locations prior to starting dewatering operations.

Dewatering discharge locations shall be selected to prevent dewatering discharge from contacting construction materials and equipment. Outlet locations are prohibited from using waters of the United States as part of the treatment area for all areas or points where dewatering is discharged. Velocity reduction BMPs/devices shall be implemented to prevent scour down-gradient from the outlet location. Sampling locations will represent the water quality of dewatering water as it leaves the Project site.

The QSP shall notify the QSD and the LRP of these operations and locations prior to starting dewatering operations (as well as the regional Water Board as discussed in Section 7.8.1).

The QSD will submit a COI to SMARTS with these new operations and locations. This will include selecting dewatering outlet locations to prevent the dewatering discharge from coming in contacting with construction materials or equipment.

7.8.5 Dewatering Sampling Schedule

Sampling of dewatering discharges will be conducted within the first hour of the commencement of discharge and daily each day that the discharge continues. Dewatering operations shall not commence without the knowledge of the QSP and shall not commence without the presence of the QSP of QSP trained delegates who are prepared to conduct dewatering discharge sampling for turbidity and pH.

7.8.6. Sample Locations

Sampling locations are based on the planned dewatering locations. Planned dewatering sampling locations are listed in Table 7-16 and shown on the Site Maps in Appendix A.

The number of dewatering sampling location(s) on the project site and the contractor's yard are unknown as of the date of drafting this SWPPP. If the Contractor decides to conduct dewatering operations at the site, the QSP shall identify the dewatering discharge locations and the QSP or QSP delegates shall conduct sampling dewatering discharge for turbidity and pH.

Table 7-8 Turbidity and pH Dewatering Sample Locations

Sample Location Identifier	Sample Location Description	Sample Location Latitude and Longitude (Decimal Degrees)
Unknown, TBD	Unknown, TBD	Unknown, TBD

In the event that dewatering is required at a location not listed in Table 7-15, and has not been identified on the Site Maps, sampling locations will be selected by the QSP using the same rationale as that used to identify planned locations. Dewatering sampling locations shall be documented by the QSP or QSP delegates on the *Effluent Sampling Field Log Sheet*, which are provided in Appendix O.

7.8.7 Monitoring Preparation

Dewatering samples will be collected by:

QSP	TBD	☒ Yes	☐ No
QSD Delegate	TBD	☒ Yes	☐ No

An adequate stock of monitoring supplies and equipment for monitoring turbidity and will be available on the project site prior to a sampling event. Monitoring supplies and equipment will be stored in a cool temperature environment that will not come into contact with rain or direct sunlight. The QSP or QSP Delegates will be available to collect samples in accordance with the sampling schedule. Supplies maintained at the project site will include, but are not limited to, field meters, extra batteries, clean powder-free nitrile gloves, sample collection equipment, appropriate sample containers, paper towels, personal rain gear, and *Effluent Sampling Field Log Sheets* and CoC forms provided in Appendix O.

The QSP or QSP Delegates will obtain and maintain the field-testing instruments, as identified in Section 7.7.2.6, for analyzing samples in the field.

7.8.8 Dewatering Sample Collection

Dewatering samples shall be collected at the designated sampling locations determined by the QSP or identified in Table 7-15 and shown on the Site Maps in Appendix A.

Grab samples for turbidity and pH will be collected by following the steps outlined below:

1. Place the pH meter or secondary sample container directly into the stream of flow;
2. Sampling personnel will collect the water up-gradient of where they are standing.

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

- Pre-rinse the meter probe or secondary sample container with deionized water or within the flow of runoff;
- Not sample near a running vehicle where exhaust fumes may impact the sample;
- Not touch the exposed end of the meter's probe;
- Not touching inside secondary sampling containers;
- Avoid allowing rainwater to drip from rain gear or other surfaces into secondary sampling containers; and
- Not eat, smoke, or drink during sample collection nor sneeze or cough in the direction of the meter probe or secondary sampling container.

For pH and turbidity samples collected for field analysis, the collection shall be in accordance with SWAMP QAPrP[1] protocols and analysis, and equipment calibration shall be in accordance with field instrument manufacturer's specifications. Table 6-3 below lists the type of instruments used in the field for these parameters.

Table 7-9: Field Analysis Instrumentation

Field Instrument	EPA Analytical Method	Parameter	MDL
pH Meter	150.1	pH	0.2
Turbidity Meter	180.1	Turbidity	1

- The instruments will be maintained in accordance with manufacturer's instructions.
- The instrument(s) will be calibrated before each sampling event.
- Maintenance and calibration records will be maintained with the SWPPP.

Immediately following collection, samples for field analysis shall be tested in accordance with the field instrument manufacturer's instructions and results recorded on the Effluent Sampling Field Log Sheet located in Appendix D.

7.8.9 Dewatering Sampling Field Analyses

Discharges from the site are subject to Numeric Action Level (NALs) for pH and turbidity as shown in Table 7-10 below.

[1] Sampling personnel shall be trained to collect, maintain, and ship samples in accordance with the Surface Water Ambient Monitoring program (SWAMP) 2017 Quality Assurance Program Plan (QAPrP)

Table 7-10: Numeric Action Levels

Parameter	Unit	Numeric Action Levels
pH	pH units	Lower NAL < 6.5 Upper NAL > 8.5
Turbidity	NTU	>250 NTU

Compliance with the NAL for pH and turbidity is based on a single sample evaluation. An NAL exceedance occurs when any sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-10.

Turbidity and pH measurements must be conducted immediately. Do not store turbidity or pH samples for later measurement.

The QSP or Delegates shall complete the *Effluent Sampling Field Log Sheets* found in Appendix O while conducting dewatering sample analysis.

7.8.10 Data Evaluation and Reporting

At least 24 hours prior to the beginning of a dewatering discharge, the QSP or QSP Delegate shall notify the Regional Water Board via email of the anticipated dewatering discharge. The QSP or QSP Delegate shall copy the LRP and QSD on these notification emails.

The QSP shall within five calendar days of the sample collection submit copies of the completed *Effluent Sampling Field Log Sheets* to the LRP and QSD.

Compliance with the NALs for pH and turbidity in dewatering discharges is based on a single sample evaluation. A NAL exceedance occurs when any sample exceeds the turbidity NAL or is outside of the pH range shown in Table 7-13.

If the dewatering sampling results show that an NAL was exceeded, the QSP or QSP Delegate shall instruct the Contractor to immediately cease dewatering discharges. If the discharge is necessary to protect human life and health or prevent severe property damage and cannot be ceased, the QSP or QSP Delegates shall notify the Regional Water Board and the Local Stormwater Agency within 24 hours.

Table 7-17 Dewatering Notification Contacts

Agency	Name	Email
Regional Water Board	Fresno Branch Office	R5f_stormwater@waterboards.ca.gov
City of Madera	Raquel Rios	rrios@madera.gov

If an NAL for pH or turbidity was exceeded during dewatering operations, the QSP or trained delegates shall inform the QSD and LRP within 5 days and send a copy of the completed *Effluent Sampling Field Log Sheets*.

Exceedances of NALs shall be electronically reported to the State Water Board by the LRP or DAR through SMARTS within 10 days of the NAL exceedance measurement.

7.8.11 Dewatering NAL Corrective Actions

Upon receiving notice that dewatering operations caused a NAL exceedance, the QSD shall investigate the cause of the exceedance and identify corrective actions for dewatering operations.

Following a NAL exceedance, the QSD shall revise the SWPPP to incorporate corrective actions to prevent further exceedances within 10 days of the NAL exceedance measurement.

7.9 Sampling and Analysis Plan for Other Pollutants Required by the Regional Water Board

The Regional Water Board has not specified monitoring for additional pollutants.

7.10 Training of Sampling Personnel

QSP Delegates assigned to conduct sampling shall be trained by the QSP to collect, maintain, and ship samples in accordance with the 2022 CGP Sample Collection and Handling Instructions and supplemental information as needed. Training records of QSP Delegates assigned to sample are provided in Appendix I.

The QSP and QSP Delegates have received the following stormwater sampling training:

Name	Training
TBD and updated via COI	

The QSP and QSP Delegates have the following stormwater sampling experience:

Name	Experience
TBD and updated via COI	

7.11 Records Retention

All records of stormwater monitoring information and copies of reports (including Annual Reports) must be retained for a period of at least three years from date of submittal or longer if required by the Regional Water Board.

Results of visual monitoring, field measurements, and laboratory analyses must be kept in the SWPPP along with CoCs, and other documentation related to the monitoring.

Records are to be kept onsite while construction is ongoing. Records to be retained include:

- The date, place, and time of inspections, sampling, visual observations, and/or measurements, including precipitation;
- The individual(s) who performed the inspections, sampling, visual observation, and/or field measurements;
- The date and approximate time of field measurements and laboratory analyses;
- The individual(s) who performed the laboratory analyses;
- A summary of all analytical results, the method detection limits and reporting limits, and the analytical techniques or methods used;
- Rain gauge readings from site inspections;
- QA/QC records and results;

- Calibration records;
- Visual observation and sample collection exception records;
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations, or inspections;
- Dewatering notifications to the Regional Water Board;
- Dewatering exception notifications to the Regional Water Board and local stormwater agency;

Section 8 References

California Department of Toxic Substances Control. (2024, April 16). *EnviroStor*. Retrieved from https://www.envirostor.dtsc.ca.gov/public/

CASQA. (2023). *Stormwater BMP Handbook: Construction*. Retrieved from www.casqa.org

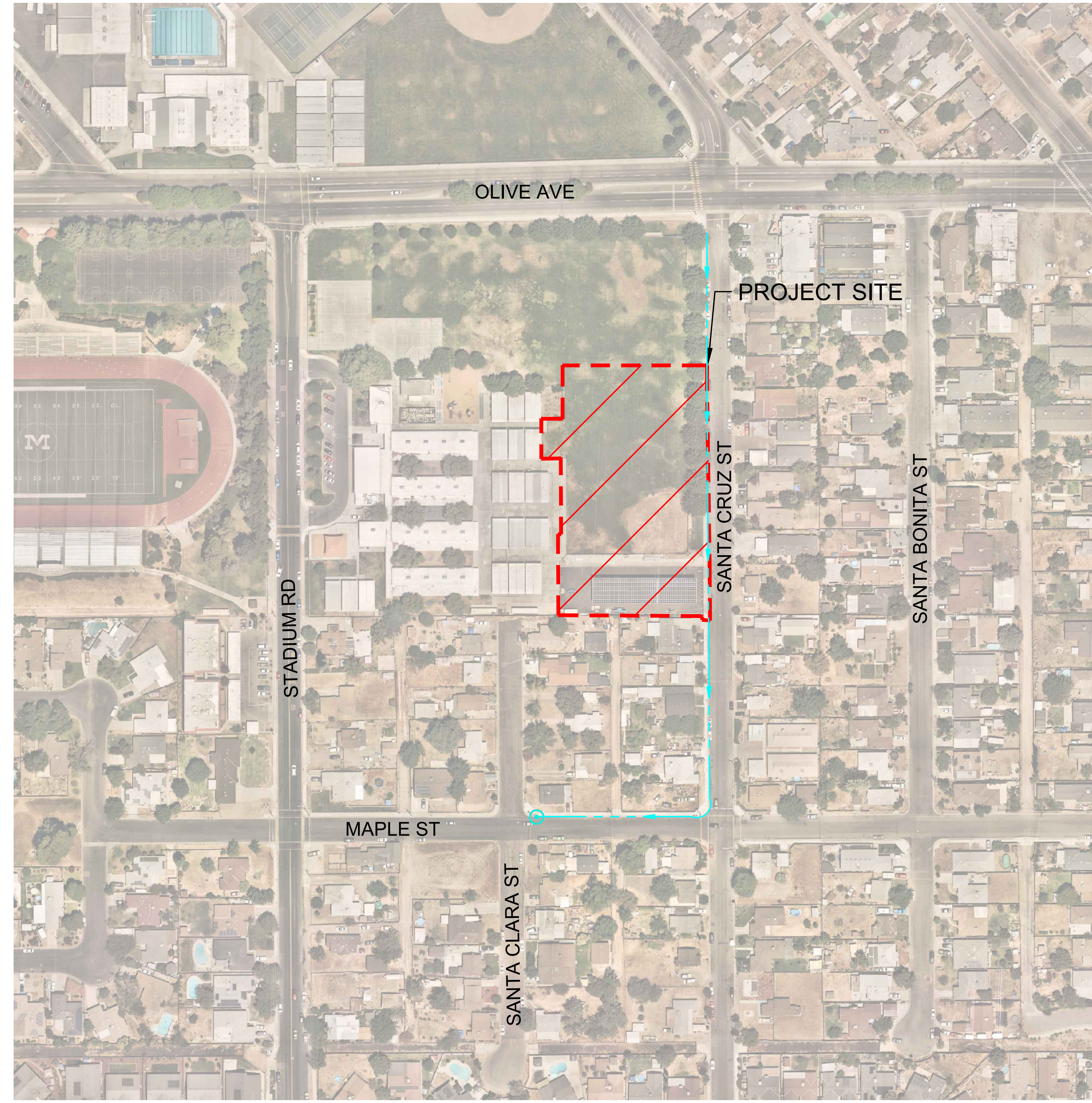
State Water Resources Control Board. (2022, May 11). *2020-2022 California Integrated Report*. Retrieved from https://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/2020_2022_integrated_report.html

SWRCB (State Water Resources Control Board. (2022). *Order 2022-0057-DWQ, NPDES Permit No. CAS000002: Stormwater Discharges Associated with Construction and Land Disturbing Activities*. Retrieved from https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction/general_permit_reissuance.html

U.S. Division of Agriculture. (2024, April 16). *Web Soils Survey*. Retrieved from https://websoilsurvey.nrcs.usda.gov/app/

Appendix A: Site Maps and Drawings

LOCATION MAP
NOT TO SCALE



PROJECT SITE
NOT TO SCALE

LOCATION AND VICINITY MAP LEGEND:

⊙ PROTECT EXISTING STORM WATER COLLECTION POINT/DRAIN INLET PER CASQA SE-10

SITE LOCATION: 109 STADIUM ROAD | MADERA, CA 93637 | 36.951810, -120.063980

FIGURE: 1A

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CONSULTING ENGINEERS

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MADERA UNIFIED SCHOOL DISTRICT

STORM WATER POLLUTION PREVENTION PLAN
MADISON ELEMENTARY SCHOOL MODERNIZATION
LOCATION AND VICINITY MAPS

DR. BY	MG
CH. BY	LB
DATE	06-20-2024
SCALE:	AS NOTED

SHEET NO. 1
OF 6 SHEETS

Drawing: C:\Users\mgennaro\AppData\Local\Temp\AcPublish_52880\2230299_Madison ES Modernization_SWPPP_figures_2024-03-20.dwg; Figure 1A Plot by: mgennaro Jun 20, 2024 - 1:54pm

CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT PROPOSED FRENCH DRAIN PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- PROPOSED STORM DRAIN PIPELINE
- PROPOSED GUTTER FLOW DIRECTION
- PROPOSED CHAIN LINK FENCE
- PROPOSED ASPHALT CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED BUILDING (ROOF IMPERVIOUS AREA)
- PROPOSED BUILDING OVERHANG (IMPERVIOUS AREAS)
- PROPOSED WALL (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED LANDSCAPING (PERVIOUS AREAS)
- AREAS OF NON-BUILT LAND DISTURBANCE FOR FINAL STABILIZATION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

EARTHWORK SYMBOL LEGEND:

- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- AREAS OF DEMOLITION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF NON-BUILT LAND DISTURBANCE. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF PROPOSED FILL. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF PROPOSED MINOR GRADING. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

	DRAINAGE AREA "X" BOUNDARY
##	DRAINAGE AREA NUMBER
CA##	STORMWATER CONTAINMENT AREA
CS##	STORMWATER RUN-ON CONTROL SAMPLE LOCATION
SL##	QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

1	CONCRETE WASHOUT LOCATION PER CASQA WM-08
2	LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
3	LOCATION OF RAIN GAUGE
4	MATERIAL STORAGE LOCATION PER CASQA WM-01
5	OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
6	RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
7	SOLID WASTE STORAGE LOCATION PER CASQA WM-05
8	STOCKPILE STORAGE LOCATION PER CASQW WM-03
WS	WATER SUPPLY LOCATION PER CASQA NS-1

PRE-EARTHWORK SYMBOL LEGEND:

- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- EXISTING ASPHALT (NON-ROOF IMPERVIOUS AREAS)
- EXISTING CONCRETE (NON-ROOFTOP IMPERVIOUS AREAS)
- EXISTING ROOFTOP IMPERVIOUS AREAS
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- PRE-CONSTRUCTION GEOTECHNICAL INVESTIGATION BORING LOCATION

NOTES TO CONTRACTOR:

1. REFER TO SECTION 3 OF THE PROJECT SWPPP FOR THE BMP IMPLEMENTATION SCHEDULE AND A COMPLETE NARRATIVE ON APPLICABLE BMPS FOR THE PROJECT. REFER TO THE CASQA CONSTRUCTION BMP HANDBOOK IN APPENDIX G TECHNICAL DETAILS ON ALL BMPS.
2. IN ADDITION TO THE BMPS DEPICTED HEREON, THE QSP AND CONTRACTOR SHALL STUDY SECTION 3 OF THE PROJECT SWPPP AND APPENDIX G TO SELECT, IMPLEMENT AND MAINTAIN EFFECTIVE BMPS FOR ALL CONSTRUCTION POLLUTANTS ORIGINATING FROM THE SITE THROUGHOUT THE LIFE OF THE PROJECT, IN ACCORDANCE WITH THE CGP.
3. THE CONTRACTOR AND QSP SHALL IDENTIFY DISTURBED AREAS THAT ARE NOT PLANNED FOR DISTURBANCE WITHIN THE NEXT 14 DAYS AND IMMEDIATELY TEMPORARILY (OR PERMANENTLY) STABILIZE THESE AREAS USING EFFECTIVE EROSION CONTROL BMPS AS DISCUSSED IN SECTION 3.2 OF THE SWPPP.
4. SUFFICIENT QUANTITIES OF TEMPORARY SEDIMENT CONTROL MATERIALS SHALL BE MAINTAINED ON-SITE THROUGHOUT THE DURATION OF THE PROJECT. ALLOWING FOR IMPLEMENTATION OF TEMPORARY SEDIMENT CONTROLS IN THE EVENT OF PREDICTED RAIN AND FOR RAPID RESPONSE DUE TO FAILURES OR EMERGENCY, IN CONFORMANCE WITH OTHER CGP REQUIREMENTS AS DESCRIBED IN THE PROJECT SWPPP.
5. STREET SURFACES SHALL BE SWEPT BY THE CONTRACTOR PER CASQA SE-7. VISIBLE SEDIMENT TRACKING SHALL BE SWEPT OR VACUUMED ON A DAILY BASIS.
6. DUST CONTROL PRACTICES SHALL CONFORM WITH THE LOCAL AIR DISTRICT AND CASQA WE-1.
7. IF CONSTRUCTION IS PHASED, BMPS MAY BE INSTALLED ONLY WITHIN ACTIVE AREAS OF CONSTRUCTION. ONCE EACH PHASE OF CONSTRUCTION IS COMPLETE AND PROJECT AREA IS STABILIZED, BMPS MAY BE REMOVED WITHIN THE STABILIZED AREA.
8. THE QSP SHALL CONTINUALLY UPDATE FIGURE 2-4 WITH THE ACTUAL LOCATIONS OF ALL BMPS, AND MAINTAIN A CURRENT COPY IN THE SITE SWPPP BINDER OR ACTIVE DIGITAL VERSION ACCESSIBLE ON-SITE. IF THE IMPLEMENTED BMPS ARE SIGNIFICANTLY DIFFERENT FROM THOSE INDICATED IN THE SWPPP, THE QSP SHALL CONTACT THE QSD TO REQUEST A SWPPP AMENDMENT BE PREPARED AND SUBMITTED TO THE WATER BOARD.
9. THE INDICATED STAGING AREAS ARE ASSUMED FOR SCHEMATIC PURPOSES ONLY, AND SHOULD BE COORDINATED WITH THE OWNER. DEPICTION OF STAGING AREAS SHALL NOT GUARANTEE USE OF THOSE AREAS WITHOUT PRIOR PERMISSION. THE QSP SHALL CONTINUALLY UPDATE THESE FIGURES WITH THE ACTUAL LOCATIONS OF ALL STAGING, AND MAINTAIN A CURRENT COPY IN THE SITE SWPPP BINDER. ALL STAGING AREAS SHALL BE FULLY STABILIZED BEFORE CLOSEOUT.
10. THE CONTRACTOR SHALL PLAN AND ACHIEVE FINAL STABILIZATION FOR ALL AREAS DISTURBED BY PROJECT ACTIVITIES WITHIN 90 DAYS OF COMPLETING CONSTRUCTION ACTIVITIES. FOR THE PURPOSES OF THIS PROJECT ACCEPTABLE FINAL STABILIZATION CONDITIONS INCLUDES 70% OR GREATER UNIFORM VEGETATIVE COVER OR NON-VEGETATIVE STABILIZATION PER CASQA EC-15.
11. REFER TO THE CONSTRUCTION DRAWINGS FOR MORE DETAIL.

SITE LOCATION: 109 STADIUM ROAD | MADERA, CA 93637 | 36.951810, -120.063980 — FIGURE: 1B

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MADERA UNIFIED SCHOOL DISTRICT

STORM WATER POLLUTION PREVENTION PLAN
MADISON ELEMENTARY SCHOOL MODERNIZATION
LEGENDS AND NOTES

DR. BY MG
CH. BY LB
DATE 06-20-2024
SCALE: AS NOTED

SHEET NO. 2 OF 6 SHEETS

PRE-EARTHWORK SYMBOL LEGEND:

- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- EXISTING ASPHALT (NON-ROOF IMPERVIOUS AREAS)
- EXISTING CONCRETE (NON-ROOFTOP IMPERVIOUS AREAS)
- EXISTING ROOFTOP IMPERVIOUS AREAS
- EXISTING PERVIOUS AREAS
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1
- PRE-CONSTRUCTION GEOTECHNICAL INVESTIGATION BORING LOCATION

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

	DRAINAGE AREA "X" BOUNDARY
##	DRAINAGE AREA NUMBER
CA##	STORMWATER CONTAINMENT AREA
CS##	STORMWATER RUN-ON CONTROL SAMPLE LOCATION
SL##	QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

1	CONCRETE WASHOUT LOCATION PER CASQA WM-08
2	LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
3	LOCATION OF RAIN GAUGE
4	MATERIAL STORAGE LOCATION PER CASQA WM-01
5	OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
6	RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
7	SOLID WASTE STORAGE LOCATION PER CASQA WM-05
8	STOCKPILE STORAGE LOCATION PER CASQW WM-03
WS	WATER SUPPLY LOCATION PER CASQA NS-1

N

0 10 30 60 90 120
SCALE IN FEET

SITE LOCATION: 109 STADIUM ROAD | MADERA, CA 93637 | 36.951810, -120.063980 | FIGURE: 2

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MADERA UNIFIED SCHOOL DISTRICT

STORM WATER POLLUTION PREVENTION PLAN
MADISON ELEMENTARY SCHOOL MODERNIZATION
PRE-EARTHWORK SITE MAP

DR. BY MG
CH. BY LB
DATE 06-20-2024
SCALE: AS NOTED

SHEET NO. 3
OF 6 SHEETS

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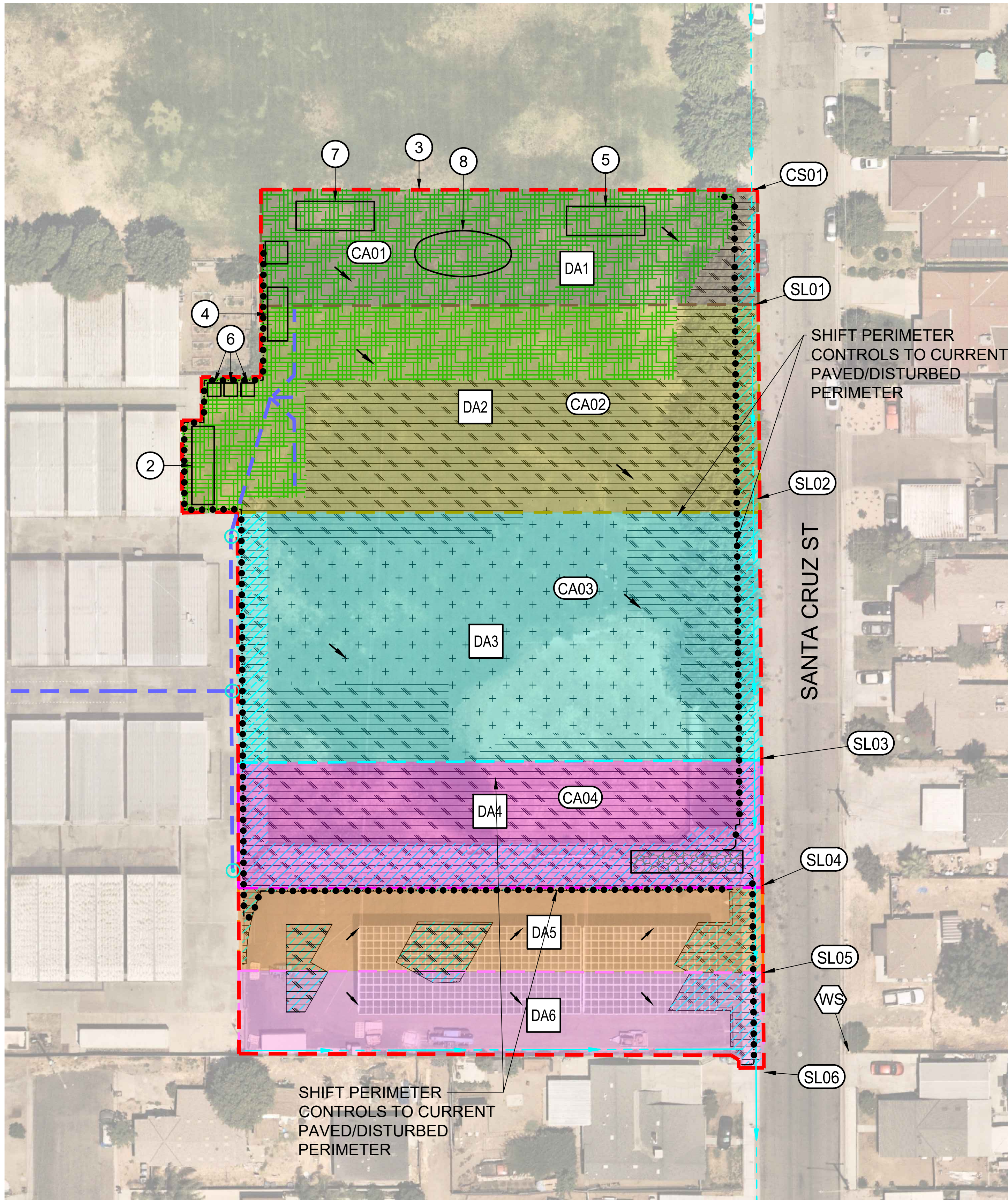

EARTHWORK SYMBOL LEGEND:

- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- AREAS OF DEMOLITION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF NON-BUILT LAND DISTURBANCE. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF PROPOSED FILL. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- AREAS OF PROPOSED MINOR GRADING. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY
- ## DRAINAGE AREA NUMBER
- CA## STORMWATER CONTAINMENT AREA
- CS## STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- SL## QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

1. CONCRETE WASHOUT LOCATION PER CASQA WM-08
2. LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
3. LOCATION OF RAIN GAUGE
4. MATERIAL STORAGE LOCATION PER CASQA WM-01
5. OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
6. RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
7. SOLID WASTE STORAGE LOCATION PER CASQA WM-05
8. STOCKPILE STORAGE LOCATION PER CASQW WM-03

WS WATER SUPPLY LOCATION PER CASQA NS-1

N

0 10 30 60 90 120
SCALE IN FEET

SITE LOCATION: 109 STADIUM ROAD | MADERA, CA 93637 | 36.951810, -120.063980 | FIGURE: 3

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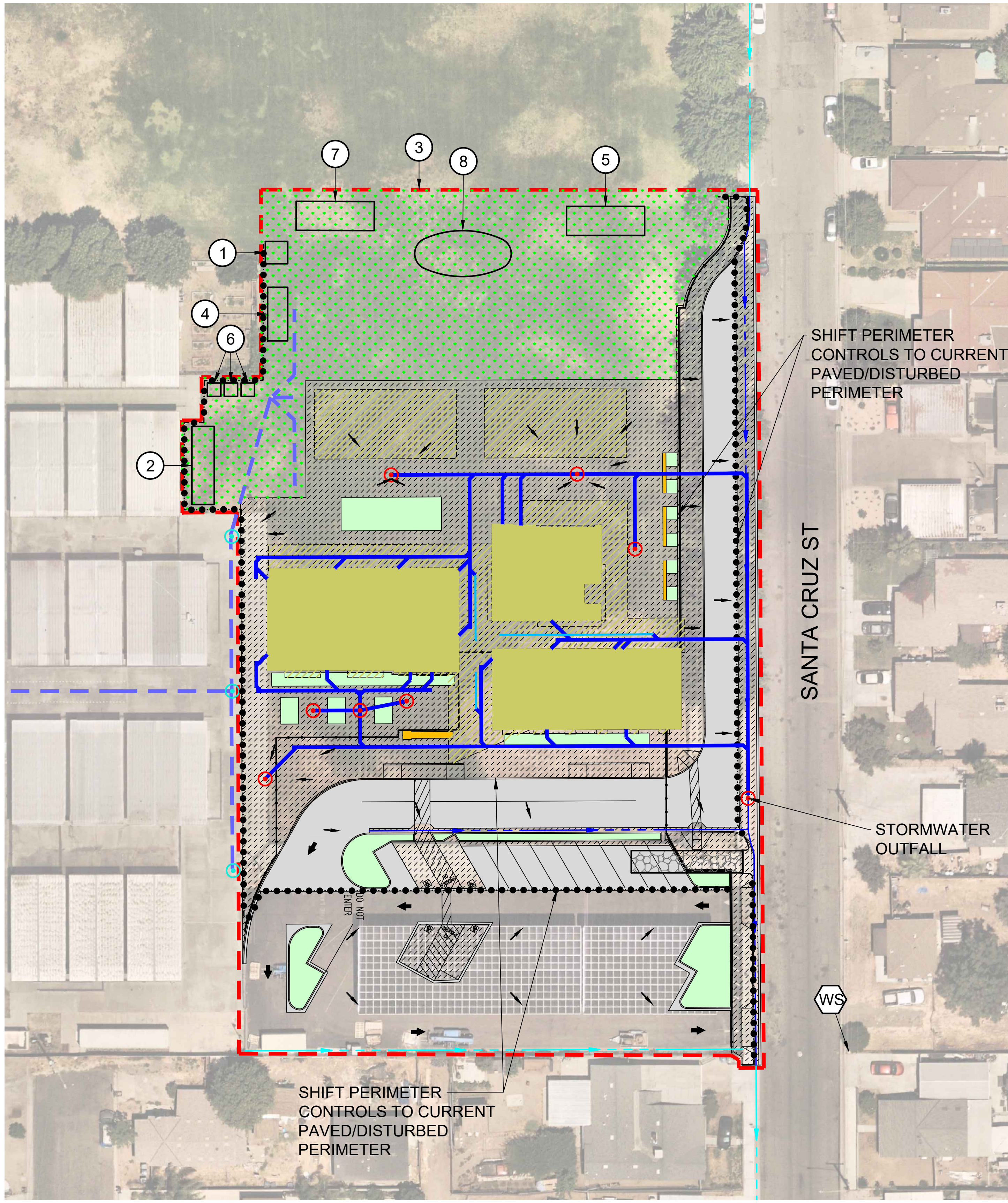
MADERA UNIFIED SCHOOL DISTRICT

STORM WATER POLLUTION PREVENTION PLAN
MADISON ELEMENTARY SCHOOL MODERNIZATION
EARTHWORK SITE MAP

DR. BY MG
CH. BY LB
DATE 06-20-2024
SCALE: AS NOTED

SHEET NO. 4
OF 6 SHEETS



CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT PROPOSED FRENCH DRAIN PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- PROPOSED STORM DRAIN PIPELINE
- PROPOSED GUTTER FLOW DIRECTION
- PROPOSED CHAIN LINK FENCE
- PROPOSED ASPHALT CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED BUILDING (ROOF IMPERVIOUS AREA)
- PROPOSED BUILDING OVERHANG (IMPERVIOUS AREAS)
- PROPOSED WALL (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED LANDSCAPING (PERVIOUS AREAS)
- AREAS OF NON-BUILT LAND DISTURBANCE FOR FINAL STABILIZATION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

STAGING AREA ITEMS:

1. CONCRETE WASHOUT LOCATION PER CASQA WM-08
2. LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
3. LOCATION OF RAIN GAUGE
4. MATERIAL STORAGE LOCATION PER CASQA WM-01
5. OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
6. RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
7. SOLID WASTE STORAGE LOCATION PER CASQA WM-05
8. STOCKPILE STORAGE LOCATION PER CASQW WM-03

WS WATER SUPPLY LOCATION PER CASQA NS-1

N

0 10 30 60 90 120
SCALE IN FEET

SITE LOCATION: 109 STADIUM ROAD | MADERA, CA 93637 | 36.951810, -120.063980			FIGURE: 4
Blair, Church & Flynn CONSULTING ENGINEERS	CONSULTANT Blair, Church & Flynn Consulting Engineers 451 Clovis Avenue, Suite 200 Clovis, California 93612 Tel (559) 326-1400 Fax (559) 326-1500	MADERA UNIFIED SCHOOL DISTRICT STORM WATER POLLUTION PREVENTION PLAN MADISON ELEMENTARY SCHOOL MODERNIZATION CONSTRUCTION SITE MAP	DR. BY MG CH. BY LB DATE 06-20-2024 SCALE: AS NOTED SHEET NO. 5 OF 6 SHEETS

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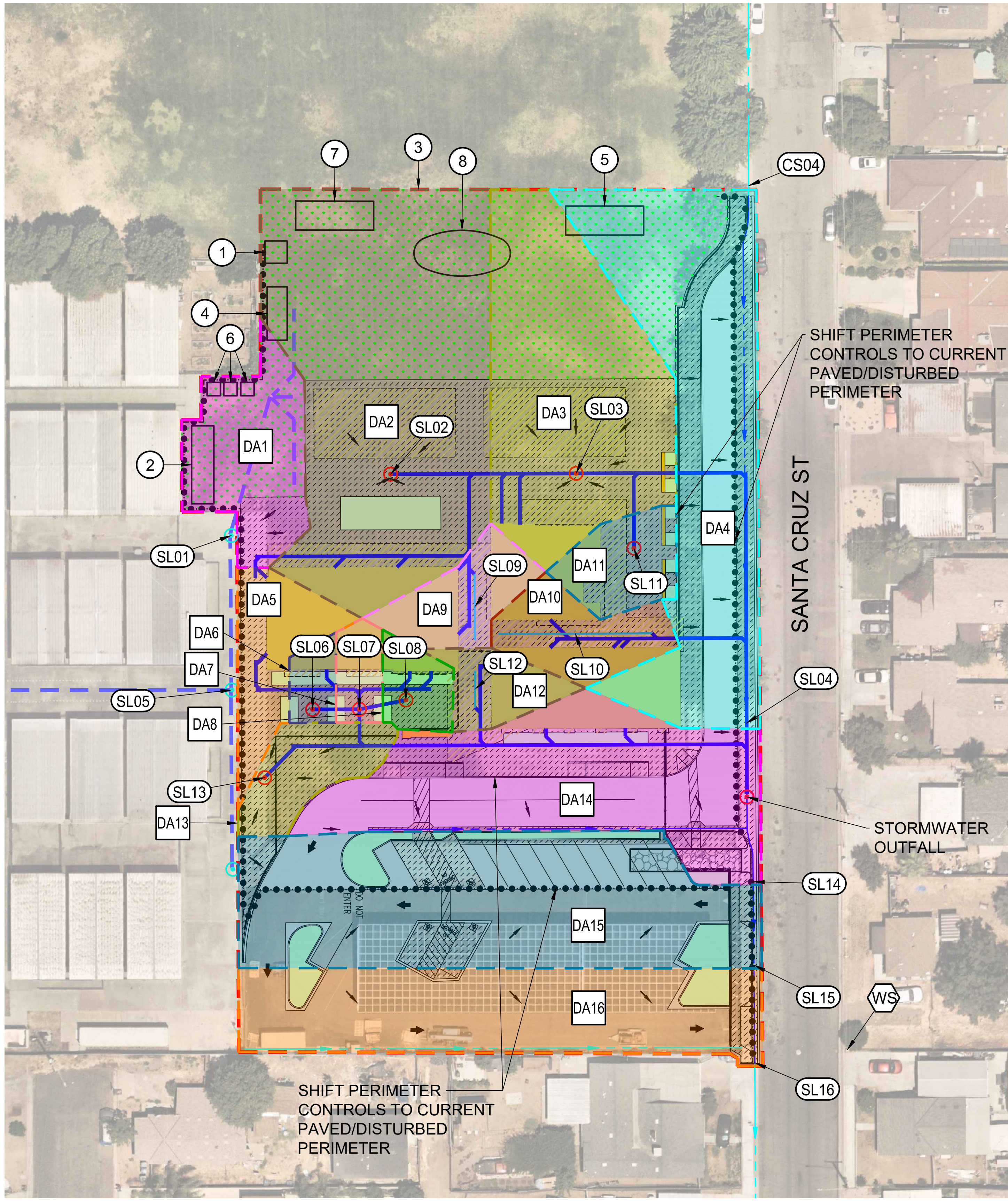

CONSTRUCTION SYMBOL LEGEND:

- PROTECT PROPOSED DRAIN INLET PER CASQA SE-10
- PROTECT PROPOSED FRENCH DRAIN PER CASQA SE-10
- PROTECT EXISTING DRAIN INLET PER CASQA SE-10
- SURFACE FLOW DIRECTION
- PROJECT BOUNDARY
- LOCATION OF LINEAR SEDIMENT CONTROL BMPS. REFER TO NOTE 1 AND 2. EXACT LOCATIONS OF THE SEDIMENT CONTROL BMP'S SHALL BE COORDINATED WITH THE QSP PRIOR TO INSTALLATION OR REMOVAL.
- EXISTING STORM DRAIN PIPELINE
- EXISTING GUTTER FLOW DIRECTION
- PROPOSED STORM DRAIN PIPELINE
- PROPOSED GUTTER FLOW DIRECTION
- PROPOSED CHAIN LINK FENCE
- PROPOSED ASPHALT CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED CONCRETE (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED BUILDING (ROOF IMPERVIOUS AREA)
- PROPOSED BUILDING OVERHANG (IMPERVIOUS AREAS)
- PROPOSED WALL (NON-ROOF IMPERVIOUS AREAS)
- PROPOSED LANDSCAPING (PERVIOUS AREAS)
- AREAS OF NON-BUILT LAND DISTURBANCE FOR FINAL STABILIZATION. DISTURBED SOIL AREAS NOT PLANNED FOR CONSTRUCTION ACTIVITIES OVER THE NEXT 14 DAYS SHALL BE STABILIZED BY USE OF EROSION CONTROL BMPS. SEE NOTE 3 ON FIGURE 1B.
- LOCATION OF STABILIZED CONSTRUCTION ENTRANCE/EXIT PER CASQA TC-1

DRAINAGE AREA/NON-VISIBLE SAMPLING SYMBOL LEGEND:

- DRAINAGE AREA "X" BOUNDARY
- ## DRAINAGE AREA NUMBER
- CS## STORMWATER RUN-ON CONTROL SAMPLE LOCATION
- SL## QSD IDENTIFIED DISCHARGE AND SAMPLING LOCATION. THE QSP SHALL FIELD VERIFY THE EXACT LOCATION OF DISCHARGE FOR A REPRESENTATIVE STORMWATER SAMPLE FOR NON-VISIBLE POLLUTANT SAMPLING.

STAGING AREA ITEMS:

1. CONCRETE WASHOUT LOCATION PER CASQA WM-08
2. LOCATION OF JOB TRAILER CONTAINING SPILL KIT AND ONSITE SWPPP
3. LOCATION OF RAIN GAUGE
4. MATERIAL STORAGE LOCATION PER CASQA WM-01
5. OVERNIGHT EQUIPMENT/VEHICLE STORAGE AND MAINTENANCE PER CASQA NS-8, NS-9 AND NS-10
6. RESTROOMS AND SANITARY FACILITIES PER CASQA WM-09
7. SOLID WASTE STORAGE LOCATION PER CASQA WM-05
8. STOCKPILE STORAGE LOCATION PER CASQW WM-03

WS WATER SUPPLY LOCATION PER CASQA NS-1

N

0 10 30 60 90 120
SCALE IN FEET

SITE LOCATION: 109 STADIUM ROAD | MADERA, CA 93637 | 36.951810, -120.063980 — FIGURE: 4.i

Blair, Church & Flynn CONSULTING ENGINEERS

CONSULTANT
Blair, Church & Flynn Consulting Engineers
451 Clovis Avenue, Suite 200
Clovis, California 93612
Tel (559) 326-1400
Fax (559) 326-1500

MADERA UNIFIED SCHOOL DISTRICT

STORM WATER POLLUTION PREVENTION PLAN
MADISON ELEMENTARY SCHOOL MODERNIZATION
DRAINAGE AREA AND SAMPLING SITE MAP - CONSTRUCTION

DR. BY	MG	SHEET NO.	6
CH. BY	LB	OF	6 SHEETS
DATE	06-20-2024		
SCALE:	AS NOTED		

Appendix B: Permit Registration Documents

Permit Registration Documents included in this Appendix:

Location in SWPPP	**Permit Registration Document** (in addition to a copy of the SWPPP)
Appendix A	Site Maps and Drawings
Appendix B	Notice of Intent
Appendix B	Risk Level Determination
N/A	Certification (LRP Certification is provided electronically with SMARTS PRD submittal)
Appendix Q	Post-Construction Requirements, if applicable
Appendix L	Post-Construction Water Balance Calculator, if applicable
Appendix B	Copy of Annual Fee Receipt
N/A	ATS Design Documents, if applicable
N/A	Passive Treatment Design Documents, if applicable

Stormwater Multiple Application and Report Tracking System

CalEPA California Environmental Protection Agency

You are logged in as Michael Gennaro. If this account does not belong to you, please log out.

Start a New Application | Active Applications | File Reports | Account Management | Recertify Existing Applications | Documents Ready for Certification

Home > Risk

Permit Type: Traditional:Construction - NOI **Application ID:** 571839 **Status:** Not Submitted

- Owner Information
- On-Site Contact Information
- Site Information
- Additional Site Information
- Risk
- TMDL
- Post Construction
- QSD Information
- Attachments
- Billing Information
- Certification
- Linked Users

Sediment Risk | Receiving Water Risk | Combined Risk

1. SEDIMENT RISK FACTOR CALCULATION

Instructions: Enter R, K, and LS factor values. System will calculate watershed erosion estimates and segment sediment risk factor.

A) R Factor Value: ***(What's this?)** 49.86 Erosivity Calculator Help

Populate K and LS using GIS layer data

B) K Factor Value: (weighted average, by area, for all site soils) ***(What's this?)** 0.32

C) LS Factor: (weighted average, by area, for all slopes) ***(What's this?)** 0.2

Watershed Erosion Estimate (=R*K*LS) in tons/acre 3.19104

Project Sediment Risk Factor: **(What's this?)** **Low**

Save & Continue

Fields marked with * are mandatory fields.

Stormwater Multiple Application and Report Tracking System

CalEPA California Environmental Protection Agency

You are logged in as Michael Gennaro. If this account does not belong to you, please log out.

Start a New Application | Active Applications | File Reports | Account Management | Recertify Existing Applications | Documents Ready for Certification

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Permit Type: Traditional:Construction - NOI **Application ID:** 571839 **Status:** Not Submitted

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- Risk
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- QSD Information
- Attachments
- Billing Information
- Certification
- Linked Users

Sediment Risk | Receiving Water Risk | Combined Risk

2. RECEIVING WATER RISK FACTOR CALCULATION

Statewide Map of High Receiving Water Risk Watersheds

A. Watershed Characteristics

A.1.(a) Does the disturbed area discharge directly or indirectly to a 303(d) listed waterbody impaired by sediment?

OR

A.1.(b) Is the disturbed area located within a sub-watershed draining to a 303(d) listed waterbody impaired by sediment?

OR

A.2. Is the disturbed area located within a planning watershed draining to a waterbody with designated beneficial uses of COLD, SPAWN AND MIGRATORY?

Receiving Water Risk (answer to above questions): No | Populate Receiving Water Risk

Project Receiving Water Risk Factor: Low

Save & Continue

Fields marked with * are mandatory fields.

Stormwater Multiple Application and Report Tracking System

CalEPA California Environmental Protection Agency

You are logged in as Michael Gennaro. If this account does not belong to you, please log out.

Start a New Application | Active Applications | File Reports | Account Management | Recertify Existing Applications | Documents Ready for Certification

Home > Risk

Permit Type: Traditional:Construction - NOI **Application ID:** 571839 **Status:** Not Submitted

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- Risk
- TMDL
- Post Construction
- QSD Information
- Attachments
- Billing Information
- Certification
- Linked Users

Sediment Risk | Receiving Water Risk | Combined Risk

3. COMBINED RISK LEVEL MATRIX

		Sediment Risk		
		Low	**Medium**	**High**
Receiving Water Risk	**Low**	Level1		Level2
	High		Level2	Level3

Project Sediment Risk: Low

Project Receiving Water Risk: Low

Project Combined Risk: **Level1**

Continue

Fields marked with * are mandatory fields.

Rainfall Erosivity Factor Calculator for Small Construction

Introduction

EPA's stormwater regulations allow NPDES permitting authorities to waive NPDES permitting requirements for stormwater discharges from small construction sites if:

- the construction site disturbs less than five acres, and
- the rainfall erosivity factor ("R" in the revised universal soil loss equation, or RUSLE) value is less than five during the period of construction activity.

If your small construction project is located in an area where EPA is the permitting authority and your R factor is less than five, you qualify for a low erosivity waiver (LEW) from NPDES stormwater permitting. If your small construction project does not qualify for a waiver, then NPDES stormwater permit coverage is required. Follow the steps below to calculate your R-Factor.

LEW certifications are submitted through the NPDES eReporting Tool or "CGP-NeT". Several states that are authorized to implement the NPDES permitting program also accept LEWs. Check with your state NPDES permitting authority for more information.

- Submit your LEW through EPA's eReporting Tool <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>

- List of states, Indian country, and territories where EPA is the permitting authority (pdf) <https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit-cover.pdf>
- Construction Rainfall Erosivity Waiver Fact Sheet <https://www.epa.gov/npdes/construction-rainfall-erosivity-waiver-fact-sheet>
- Small Construction Waivers and Instructions (pdf) <https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-c-waivers.pdf>

The R-factor calculation can also be integrated directly into custom applications using the R-Factor web service <https://epa.gov/api-docs/>.

Steps to Calculate an R Factor for your Small Construction Project

1 Select the estimated start and end dates of construction by clicking the calendar icons below and using the dropdown calendar. The period of construction activity begins at initial earth disturbance and ends with final stabilization.

Start Date: 08/01/2024

End Date: 07/31/2025

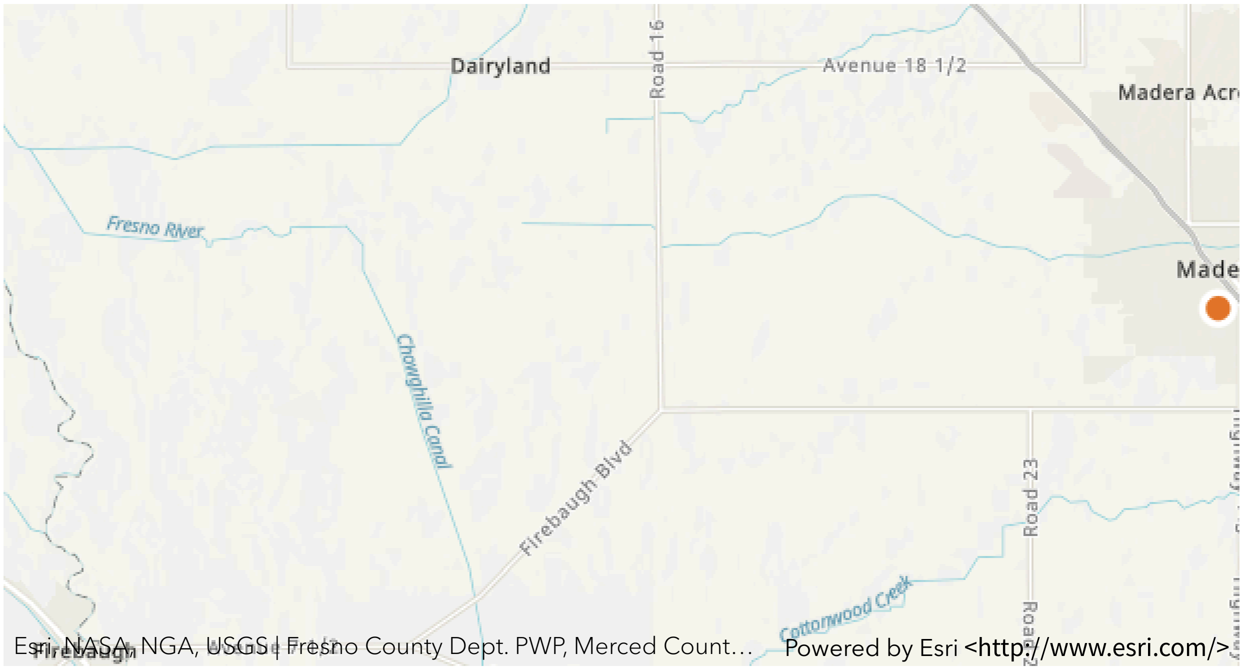
2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location: 36.951810, -120.063980

Search

+

—



3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 08/01/2024	**Latitude:** 36.9518
End Date: 07/31/2025	**Longitude:** -120.0640

Calculation Results

Rainfall erosivity factor (R Factor) = **24.93**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site's period of construction.

You do NOT qualify for a waiver from NPDES permitting requirements and must seek Construction General Permit (CGP) coverage. If you are located in an area where EPA is the permitting authority (pdf) <https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit-

Rainfall Erosivity Factor Calculator for Small Construction

Introduction

EPA's stormwater regulations allow NPDES permitting authorities to waive NPDES permitting requirements for stormwater discharges from small construction sites if:

- the construction site disturbs less than five acres, and
- the rainfall erosivity factor ("R" in the revised universal soil loss equation, or RUSLE) value is less than five during the period of construction activity.

If your small construction project is located in an area where EPA is the permitting authority and your R factor is less than five, you qualify for a low erosivity waiver (LEW) from NPDES stormwater permitting. If your small construction project does not qualify for a waiver, then NPDES stormwater permit coverage is required. Follow the steps below to calculate your R-Factor.

LEW certifications are submitted through the NPDES eReporting Tool or "CGP-NeT". Several states that are authorized to implement the NPDES permitting program also accept LEWs. Check with your state NPDES permitting authority for more information.

- Submit your LEW through EPA's eReporting Tool <https://www.epa.gov/npdes/submitting-notice-intent-noi-notice-termination-not-or-low-erosivity-waiver-lew-under>

- List of states, Indian country, and territories where EPA is the permitting authority (pdf) <https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit-cover.pdf>
- Construction Rainfall Erosivity Waiver Fact Sheet <https://www.epa.gov/npdes/construction-rainfall-erosivity-waiver-fact-sheet>
- Small Construction Waivers and Instructions (pdf) <https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-c-waivers.pdf>

The R-factor calculation can also be integrated directly into custom applications using the R-Factor web service <https://epa.gov/api-docs/>.

Steps to Calculate an R Factor for your Small Construction Project

1 Select the estimated start and end dates of construction by clicking the calendar icons below and using the dropdown calendar. The period of construction activity begins at initial earth disturbance and ends with final stabilization.

Start Date: 08/01/2025

End Date: 01/31/2026

2 Locate your small construction project by entering the address in the search box or by clicking on the map.

Location: 36.951810, -120.063980

Search

3 Click the "Calculate R Factor" button below.

Calculate R Factor

Facility Information

Start Date: 08/01/2025	**Latitude:** 36.9518
End Date: 01/31/2026	**Longitude:** -120.0640

Calculation Results

Rainfall erosivity factor (R Factor) = 14.21

A rainfall erosivity factor of 5.0 or greater has been calculated for your site's period of construction.

You do NOT qualify for a waiver from NPDES permitting requirements and must seek Construction General Permit (CGP) coverage. If you are located in an area where EPA is the permitting authority (pdf)
<https://www.epa.gov/system/files/documents/2022-01/2022-cgp-final-appendix-b-areas-of-permit-

Appendix C: SWPPP Amendment QSD Certifications

SWPPP Amendment No. ______

Project Name: Madison Elementary School Modernization

Project Number: **TBD**

Qualified SWPPP Developer's Certification of the Stormwater Pollution Prevention Plan Amendment

"This Stormwater Pollution Prevention Plan and its appendices were prepared under my direction to meet the requirements of the 2022 CGP (SWRCB Order No. 2022-0057-DWQ). I certify that I am a Qualified SWPPP Developer in good standing as of the date signed below."

QSD's Signature	Date
QSD Name	QSD Certificate Number
Title and Affiliation	Telephone
Address	Email

Appendix D: Submitted Changes of Information

Log of Updated PRDs

The 2022 CGP allows for the reduction or increase of the total acreage when a portion of the project is complete and/or conditions for termination of coverage have been met; when ownership of a portion of the project is purchased by a different entity; or when new acreage is added to the project.

A Change of Information (COI) shall be filed electronically within the timeframe shown in the table below. The SWPPP shall be modified appropriately, with revisions and amendments recorded in the SWPPP Amendment Log at the front of the SWPPP. COIs submitted electronically via SMARTS can be found in this Appendix.

Reason for Filing COI	Timeline for Filing COI
Reduction or increase in total disturbed area	Within 30 days of the reduction or increase
Updating site specific BMPs	Within 14 days of design change
Change construction start or end date	At least 14 days prior to the date to be changed
Post-construction plans updated or approved by the municipal stormwater permittee	Within 14 days of approval

---

This appendix includes all of the following updated PRDs (check all that apply):

☐ Change of Information;

☐ Revised Site Map;

☐ Revised Risk Assessment;

☐ New landowner's information (name, address, phone number, email address); and

☐ New signed certification statement.

Signature of [Authorized Representative of] Legally Responsible Person or Duly Authorized Representative	Date
Name of [Authorized Representative of] Legally Responsible Person or Duly Authorized Representative	Telephone Number

Appendix E: Construction Schedule

Appendix F: Construction Activities, Materials Used, and Associated Pollutants

Table F.a POLLUTANTS ASSOCIATED WITH CONSTRUCTION ACTIVITIES

General Work Activity/ Products with Potential Stormwater Pollutants	Specific Work Activity/Products with Potential Stormwater Pollutants	Pollutant Categories
Adhesives	• Adhesives, glues, resins, epoxy synthetics, PVC cement • Caulks, sealers, putty, sealing agents and • Coal tars (naphtha, pitch)	Oil and Grease, Synthetic Organics
Asphalt paving/curbs	• Hot and cold mix asphalt	Oil and Grease
Cleaners	• Polishes (metal, ceramic, tile) • Etching agents • Cleaners, ammonia, lye, caustic sodas, bleaching agents and chromate salts	Metals, Synthetic Organics
Concrete / Masonry	• Cement and brick dust • Colored chalks • Concrete curing compounds • Glazing compounds • Surfaces cleaners • Saw cut slurries • Tile cutting	Metals, Synthetic Organics
Drywall	• Saw-cutting drywall	Metals
Framing/Carpentry	• Sawdust, particle board dust, and treated woods • Saw cut slurries	Metals, Synthetic Organics
Heating, Ventilation, Air Conditioning	• Demolition or construction of air condition and heating systems	Metals, Synthetic Organics
Insulation	• Demolition or construction involving insulation, venting systems	Metals, Synthetic Organics
Liquid waste	• Wash waters • Irrigation line testing/flushing	Metals, Synthetic Organics
Painting	• Paint thinners, acetone, methyl ethyl ketone, stripper paints, lacquers, varnish, enamels, turpentine, gum spirit, solvents, dyes, stripping pigments and sanding	Metals, Synthetic Organics
Planting / Vegetation Management	• Vegetation control (pesticides/herbicides) • Planting • Plant maintenance • Vegetation removal	Nutrients, Metals, Synthetic Organics
Plumbing	• Solder (lead, tin), flux (zinc chloride), pipe fitting • Galvanized metal in nails, fences, and electric wiring	Metals, Synthetic Organics

Table F.a POLLUTANTS ASSOCIATED WITH CONSTRUCTION ACTIVITIES

General Work Activity/ Products with Potential Stormwater Pollutants	Specific Work Activity/Products with Potential Stormwater Pollutants	Pollutant Categories
Pools/fountains	• Chlorinated water	Synthetic Organics
Removal of existing structures	• Demolition of asphalt, concrete, masonry, framing, roofing, metal structures.	Metals, Oil and Grease, Synthetic Organics
Roofing	• Flashing • Saw cut slurries (tile cutting) • Shingle scrap and debris	Metals, Oil and Grease, Synthetic Organics
Sanitary waste	• Portable toilets • Disturbance of existing sewer lines.	Nutrients
Soil preparation/amendments	• Use of soil additives/amendments	Nutrients
Solid waste	• Litter, trash and debris • Vegetation	Gross Pollutants
Utility line testing and flushing	• Hydrostatic test water • Pipe flushing	Synthetic Organics
Vehicle and equipment use	• Equipment operation • Equipment maintenance • Equipment washing • Equipment fueling	Oil and Grease
Building Demolition	• Demolition debris built between 1950-1980 • Demolition debris from buildings with lead paint	Lead PCBs
1 Synthetic Organics are defined in Table 1.2 of the CASQA Stormwater BMP Handbook: Construction as adhesives, cleaners, sealants, solvents, etc. These are generally categorized as VOCs or SVOCs.		

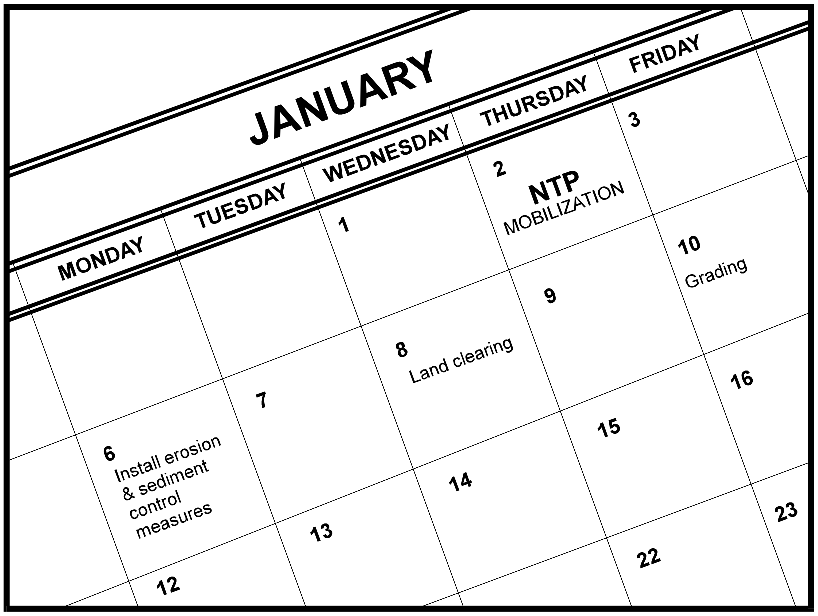
Table F.1 Pollutant Source Assessment Form

Phase	Activity	Associated Materials or Pollutants	Pollutant Category (1)
Demolition and Pre- Development Site Preparation Phase	Geotechnical investigations	Sediment	TSS
	Building, structure, and facility demolition (facilities from 1950-1980)	PCBs	Synthetic Organics
	Building and pipe Demolition (facilities from 1930-1977)	Asbestos	Hazardous pollutant
	Building/painted facility Demolition (facilities from pre-1978)	Lead paint	Metals
	Building Demolition	Sediment, trash	Sediment, gross pollutant
	Vehicle Equipment Operation and Storage	Fuel, Oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	Concrete cutting/grinding	sediment, concrete dust and slurry	Sediment, pH, metals
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
Grading and Land Development	Grading	Sediment	Sediment
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
Streets and Utilities Phase	Material Delivery	Varies based on materials	Varies based on materials
	Trenching and Soil Management	Sediment	Sediment
	Install pipelines, laterals, conduits	Joint and form lubricants, PVC shards/dust	Synthetic organics, gross Pollutants
	Adhesives	Adhesives, flues, resins, epoxy synthetic, PVC cement Caulks, sealers, putty, sealing agents.	Oil & grease, synthetic organics
	Asphalt Concrete Paving Operations	Sediment, bituminous chemicals	Sediment, oil & grease
	Concrete Paving and Operations	Curing Concrete, Concrete washout waste	Sediment, metals, pH
	Install emulsion sealer	Hydrocarbons	Oil & grease

	Paint pavement striping and markings	Paint	Synthetic organics, nutrients
	Vegetation clearing and storage	Stockpiled vegetation	Nutrients
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
	Utility line flushing	Chlorinated water	Synthetic organics
Vertical Construction Phase	Welding	Solder (lead, tin), flux (zinc chloride), pipe fitting	Metals, synthetic organics
	Framing/Carpentry	Sawdust, particle board dust, and treated woods	Metals, synthetic organics
	Drywall	Saw-cutting drywall	Metals
	Heating, ventilation, Air conditioning	Construction of HVAC systems	Metals, synthetic organics, oil and grease
	Insulation Installation	Insulation materials	Metals, synthetic organics
	Painting	Paint thinners, acetone, methyl ethyl ketone, stripper paints, lacquers, varnish, enamels, turpentine, gum spirit, solvents, dyes, stripping pigments and sanding	Metals, Synthetic Organics
	Pools/fountains	Chlorinated water	Synthetic organics
	Roofing	Flashing, saw cut slurries (tiles), Shingle scrap and debris, roof sealants	Metals, oil and grease, synthetic organics
	Plumbing	Solder (lead, tin), flux (zinc chloride),	Metals
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses
	Utility line flushing	Chlorinated water	Synthetic organics
Final Landscaping and Site Stabilization Phase	Planting / Vegetation Management	Vegetation control (pesticides/herbicides), planting, plant maintenance, vegetation removal	Nutrients, Metals, Synthetic Organics
	Soil preparation/amendments	Use of compost, chemical fertilizer, pH soil amendments	Nutrients, pH
	Vehicle Equipment Operation and Storage	Fuel, oil, Grease	Oil & grease
	Vehicle Equipment Operation and Storage	Freon, battery acid	Synthetic organics, metals
	General Operations	Trash, Sanitary waste	Gross pollutants, nutrients, bacteria, viruses

(1) Categories per CASQA BMP Handbook (i.e., Sediment, Nutrients, Bacteria and Viruses, Oil and Grease, Metals, Synthetic Organics, Pesticides, Gross Pollutants, and Vector Production).

Appendix G: CASQA Stormwater BMP Handbook: Construction Fact Sheets



Categories

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

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.

- Avoid soil disturbance during periods with high wind velocities.

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

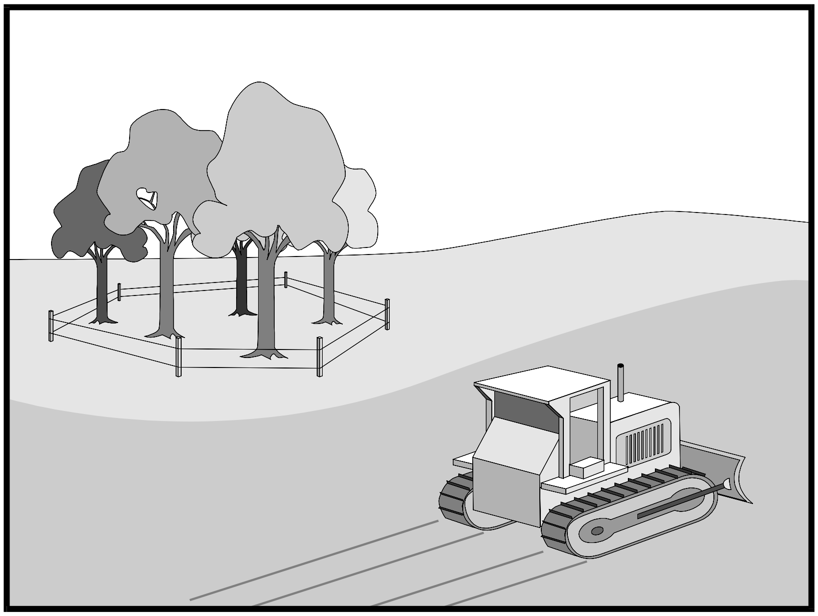
- Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.
- Amend the schedule when changes are warranted.
- Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

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



Categories

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

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.
- Protecting existing vegetation buffers and swales.

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.

- Consider pruning or mowing vegetation instead of removing it to allow for regrowth.

- If possible, retain vegetation buffer around the site and adjacent waterways.

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 trees in the late fall or early spring. Although to note, many native species do not require fertilization.

- 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.

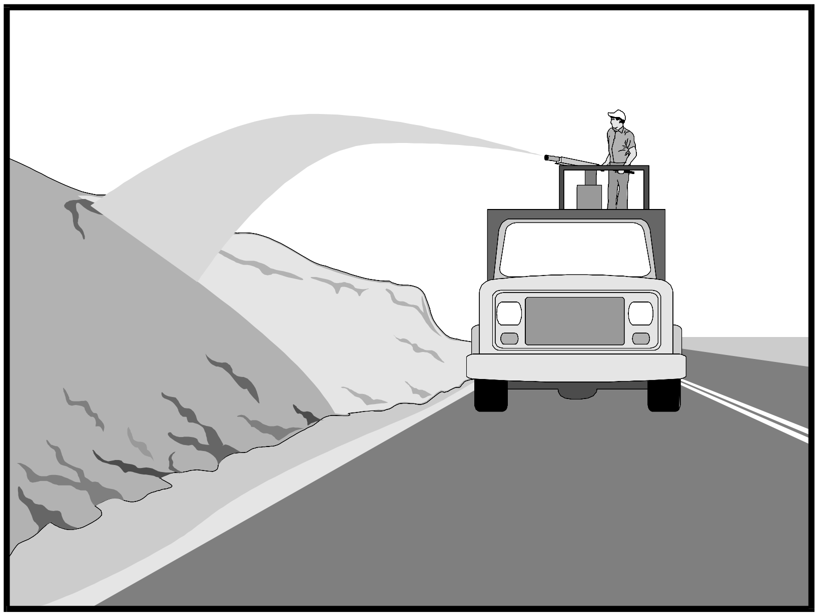
References

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.



Categories

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 Category**

☒ **Secondary Category**

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

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

Description and Purpose

Hydraulic Mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

Suitable Applications

Hydraulic mulch as a temporary, stand alone, erosion control BMP is suitable for disturbed areas that require temporary protection from wind and water erosion until permanent soil stabilization activities commence. Examples include:

- Rough-graded areas that will remain inactive for longer than permit-required thresholds (e.g., 14 days) or otherwise require stabilization to minimize erosion or prevent sediment discharges.
- Soil stockpiles.
- Slopes with exposed soil between existing vegetation such as trees or shrubs.
- Slopes planted with live, container-grown vegetation or plugs.
- Slopes burned by wildfire.
- To stabilize earthen berms
- Areas seeded by broadcasting or drilling

- Temporary stabilization during high wind conditions

Hydraulic mulch can also be applied to augment other erosion control BMPs such as:

- In conjunction with straw mulch (see EC-6 Straw Mulch) where the rate of hydraulic mulch is reduced to 100-500 lbs per acre and the slurry is applied over the straw as a tackifying agent to hold the straw in place.
- Supplemental application of soil amendments, such as fertilizer, lime, gypsum, soil bio-stimulants or compost.

Limitations

In general, hydraulic mulch is not limited by slope length, gradient or soil type. However, the following limitations typically apply:

- Most hydraulic mulch applications, particularly bonded fiber matrices (BFMs), require at least 24 hours to dry before rainfall occurs.
- Temporary applications (i.e., without a vegetative component) may require a second application in order to remain effective for an entire rainy season.
- Treatment areas must be accessible to hydraulic mulching equipment.
- Availability of water sources in remote areas for mixing and application.
- As a stand-alone temporary BMP, hydraulic mulches may need to be re-applied to maintain their erosion control effectiveness, typically after 6-12 months depending on the type of mulch used.
- Availability of hydraulic mulching equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Cellulose fiber mulches alone may not perform well on steep slopes or in course soils.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, compost, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown, and some may have water quality impacts due to their chemical makeup. Refer to specific chemical properties identified in the product Safety Data Sheet (may not include ecological information); products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to factsheet EC-05 for further guidance on selecting soil binders.
- A water supply is needed to refill hydro mulch equipment tank.
- Cannot be disturbed by walking or driving on the surface after application.
- Recommend using in conjunction with other BMPs (i.e., fiber rolls, etc.).

Implementation

- Where feasible, it is preferable to prepare soil surfaces prior to application by roughening embankments and fill areas with a crimping or punching type roller or by track walking.

- The majority of hydraulic mulch applications do not necessarily require surface/soil preparation (See EC-15 Soil Preparation) although in almost every case where re-vegetation is included as part of the practice, soil preparation can be beneficial. One of the advantages of hydraulic mulch over other erosion control methods is that it can be applied in areas where soil preparation is precluded by site conditions, such as steep slopes, rocky soils, or inaccessibility.

- Avoid mulch over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

- Hydraulic mulching is generally performed utilizing specialized machines that have a large water-holding/mixing tank and some form of mechanical agitation or other recirculation method to keep water, mulch and soil amendments in suspension. The mixed hydraulic slurry can be applied from a tower sprayer on top of the machine or by extending a hose to areas remote from the machine.

- Where possible apply hydraulic mulch from multiple directions to adequately cover the soil. Application from a single direction can result in shadowing, uneven coverage and failure of the BMP.

- Hydraulic mulch can also include a vegetative component, such as seed, rhizomes, or stolons (see EC-4 Hydraulic Seed).

- Typical hydraulic mulch application rates range from 2,000 pounds per acre for standard mulches (SMs) to 3,500 lbs. per acre for BFMs. However, the required amount of hydraulic mulch to provide adequate coverage of exposed topsoil may appear to exceed the standard rates when the roughness of the soil surface is changed due to soil preparation methods (see EC-15 Soil Preparation) or by slope gradient.

- Other factors such as existing soil moisture and soil texture can have a profound effect on the amount of hydraulic mulch required (i.e. application rate) applied to achieve an erosion-resistant covering.

- Avoid use of mulch without a tackifier component, especially on slopes.

- Mulches used in the hydraulic mulch slurry can include:

  - Cellulose fiber (paper- or corn-based)

  - Wood fibers

  - Cotton

  - Synthetics

  - Compost (see EC-14, Compost Blanket)

  - Straw

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Categories of Hydraulic Mulches

Standard Hydraulic Mulch (SM)

Standard hydraulic mulches are generally applied at a rate of 2,000 lbs. per acre and are manufactured containing around 5% tackifier (i.e. soil binder), usually a plant-derived guar or psyllium type. Most standard mulches are green in color derived from food-color based dyes.

Hydraulic Matrices (HM) and Stabilized Fiber Matrices (SFM)

Hydraulic matrices and stabilized fiber matrices are slurries which contain increased levels of tackifiers/soil binders; usually 10% or more by weight. HMs and SFMs have improved performance compared to a standard hydraulic mulch (SM) because of the additional percentage of tackifier and because of their higher application rates, typically 2,500 – 4,000 lbs. per acre. Hydraulic matrices can include a mixture of fibers, for example, a 50/50 blend of paper and wood fiber. In the case of an SFM, the tackifier/soil binder is specified as a polyacrylamide (PAM).

Bonded Fiber Matrix (BFM)

Bonded fiber matrices (BFMs) are hydraulically-applied systems of fibers, adhesives (typically guar- or polymer-based) and chemical cross-links. Upon drying, the slurry forms an erosion-resistant blanket that prevents soil erosion and promotes vegetation establishment. The cross-linked adhesive in the BFM should be biodegradable and should not dissolve or disperse upon re-wetting. BFMs are typically applied at rates from 3,000 to 4,000 lbs. per acre based on the manufacturer's recommendation. BFMs should not be applied immediately before, during or immediately after rainfall or if the soil is saturated. Depending on the product, BFMs typically require 12 to 24 hours to dry and become effective.

Hydraulic Compost Matrix (HCM)

Hydraulic compost matrix (HCM) is a field-derived practice whereby finely graded or sifted compost is introduced into the hydraulic mulch slurry. A guar-type tackifier can be added for steeper slope applications as well as any specified seed mixtures. An HCM can help to accelerate seed germination and growth. HCMs are particularly useful as an in-fill for three-dimensional re-vegetation geocomposites, such as turf reinforcement mats (TRM) (see EC-7 Geotextiles and Mats).

Costs

Average installed costs for hydraulic mulch categories are is provided in Table 1, below.

Table
HYDRAULIC MULCH BMPs
INSTALLED COSTS

BMP	Installed Cost/Acre
Standard Hydraulic Mulching (SM)	$2,100 - $4,700 per acre
Hydraulic Matrices (HM) and Stabilized Fiber Matrices	
Guar-based	$2,600 - $5,200 per acre
PAM-based	$3,200 - $7,200 per acre
Bonded Fiber Matrix (BFM)	$5,000 - $8,800 per acre
Hydraulic Compost Matrix (HCM)	$3,800 - $4,500 per acre

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

Inspection and Maintenance

- Maintain an unbroken, temporary mulched ground cover throughout the period of construction when the soils are not being reworked.

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

- Compare the number of bags or weight of applied mulch to the area treated to determine actual application rates and compliance with specifications.

References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

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.

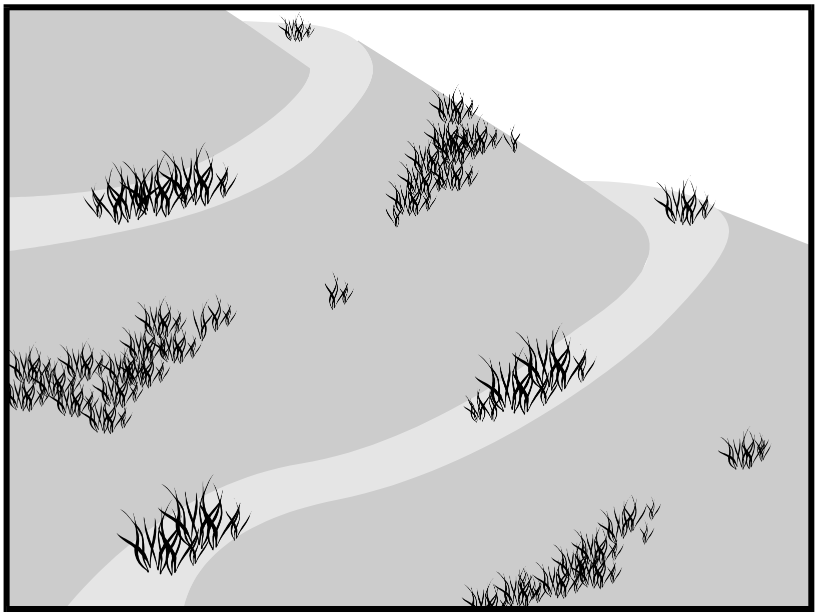
Soil Erosion by Water, Agriculture Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

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.



Categories

EC	Erosion Control	☑
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Legend:

☑ **Primary Category**

☒ **Secondary Category**

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

EC-14 Compost Blanket

EC-16 Non-Vegetative Stabilization

Description and Purpose

Hydroseeding typically consists of applying a mixture of a hydraulic mulch, seed, and water with the possible addition of tackifier, compost, mycorrhizae inoculant, fertilizer, and/or soil conditioner, to temporarily protect exposed soils from erosion by water and wind. Hydraulic seeding, or hydroseeding, is simply the method by which temporary or permanent seed is applied to the soil surface and temporary erosion control is established by means of the mulch component.

Suitable Applications

Hydroseeding is suitable for disturbed areas requiring temporary protection until permanent stabilization is established, for disturbed areas that will be re-disturbed following an extended period of inactivity, or to apply permanent stabilization measures. Hydroseeding without mulch or other cover (e.g., EC-7, Geotextiles and Mats) is not a stand-alone erosion control BMP and should be combined with additional measures until vegetation establishment.

Typical applications for hydroseeding include:

- Disturbed soil/graded areas where permanent stabilization or continued earthwork is not anticipated prior to seed germination.
- Cleared and graded areas exposed to seasonal rains or temporary irrigation.
- To vegetate swales and earthen berms.

- Areas not subject to heavy wear by construction equipment or high traffic.

Limitations

- Availability of hydroseeding equipment may be limited just prior to the rainy season and prior to storms due to high demand.
- Hydraulic seed should be applied with hydraulic mulch or a stand-alone hydroseed application should be followed by one of the following:
    - Straw mulch (see Straw Mulch EC-6)
    - Rolled erosion control products (see Geotextiles and Mats EC-7)
    - Application of Compost Blanket (see Compost Blanket EC-14)

  Hydraulic seed may be used alone only on small flat surfaces when there is sufficient time in the season to ensure adequate vegetation establishment and coverage to provide adequate erosion control.
- Hydraulic seed without mulch does not provide immediate erosion control.
- Temporary seeding may not be appropriate for steep slopes (i.e., slopes readily prone to rill erosion or without sufficient topsoil).
- 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 may not be appropriate for short term inactivity (i.e., less than 3-6 months).
- Vegetation may not establish when hydroseed is applied to very compact soils.
- Mulch may inhibit germination when applied at high rates.
- This BMP consists of a mixture of several constituents (e.g., fibers/mulches, tackifiers, and other chemical constituents), some of which may be proprietary and may come pre-mixed by the manufacturer. The water quality impacts of these constituents are relatively unknown, and some may have water quality impacts due to their chemical makeup. Additionally, these constituents may require non-visible pollutant monitoring. Refer to specific chemical properties identified in the product's Safety Data Sheet (SDS), although, note that not all SDS's provide ecological information; products should be evaluated for project-specific implementation by the QSD. Refer to fact sheet EC-05, Soil Binders, for further guidance on selecting soil binders.

Implementation

In order to select appropriate hydraulic seed mixtures, an evaluation of site conditions should be performed with respect to:

- Soil conditions
- Site topography and exposure (sun/wind)
- 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), Resource Conservation Districts and Agricultural Extension Service can provide information on appropriate seed mixes.

The following steps should be followed for implementation:

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying (See EC-15, Soil Preparation) the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.

- Avoid use of hydraulic seed in areas where the BMP would be incompatible with future earthwork activities.

- Hydraulic seed can be applied using a multiple step or one step process.

  - In a multiple step process, hydraulic seed is applied first, followed by mulch or a Rolled Erosion Control Product (RECP).

  - In the one step process, hydraulic seed is applied with hydraulic mulch in a hydraulic matrix. When the one step process is used to apply the mixture of fiber, seed, etc., the seed rate should be increased to compensate for all seeds not having direct contact with the soil.

- All hydraulically seeded areas should have mulch, or alternate erosion control cover to keep seeds in place and to moderate soil moisture and temperature until the seeds germinate and grow.

- All seeds should be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag should be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. The container should be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. All legume seed should be pellet inoculated. Inoculant sources should be species specific and should be applied at a rate of 2 lb of inoculant per 100 lb seed.

- Commercial fertilizer should conform to the requirements of the California Food and Agricultural Code, which can be found at: http://www.leginfo.ca.gov/.html/fac_table_of_contents.html. Fertilizer should be pelleted or granular form.

- Follow up applications should be made as needed to cover areas of poor coverage or germination/vegetation establishment and to maintain adequate soil protection.

- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Costs

Average cost for installation and maintenance may vary from as low as $2,400 per acre for flat slopes and stable soils, to $5,200 per acre for moderate to steep slopes and/or erosive soils. Cost of seed mixtures vary based on types of required vegetation.

BMP	Installed Cost per Acre
Hydraulic Seed	$2,400-$5,200

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.
- 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 should be inspected for complete coverage and adjusted as needed to maintain complete coverage.

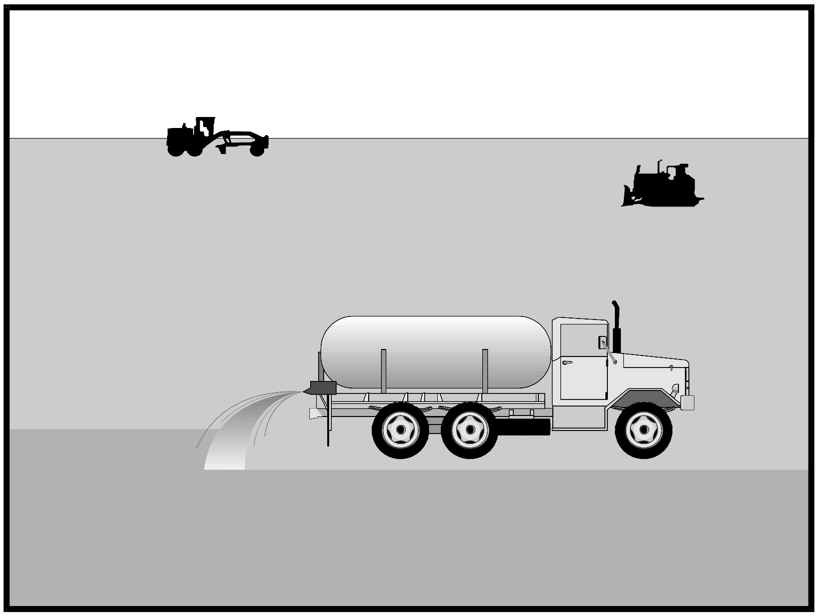
References

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Guidance Document: Soil Stabilization for Temporary Slopes, State of California Department of Transportation (Caltrans), November 1999.

Soil Binders



Categories

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Legend:

☑ **Primary Category**

☒ **Secondary Category**

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 binding consists of application and maintenance of a soil stabilizer to exposed soil surfaces. Soil binders are materials applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites.

Suitable Applications

Soil binders are typically applied to disturbed areas requiring temporary protection. Because soil binders, when used as a stand-alone practice, can often be incorporated into the soil, they are a good alternative to mulches in areas where grading activities will soon resume. Soil binders are commonly used in the following areas:

- Rough graded soils that will be inactive for a short period of time.
- Soil stockpiles.
- Temporary haul roads prior to placement of crushed rock.
- Compacted soil road base.
- Construction staging, materials storage, and layout areas.
- Slopes and areas requiring stabilization prior to rain.
- Disturbed areas subject to high winds.

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.
- Plant-material-based soil binders do not generally hold up to pedestrian or vehicular traffic across treated areas as well as polymeric emulsion blends or cementitious-based binders.
- Soil binders may not sufficiently penetrate compacted soils.
- Some soil binders are soil texture specific in terms of their effectiveness. For example, polyacrylamides (PAMs) work very well on silt and clayey soils but their performance decreases dramatically in sandy soils.
- 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 some chemical soil binders are relatively unknown, and some may have water quality impacts due to their chemical makeup. Additionally, these chemicals may require non-visible pollutant monitoring. Products should be evaluated for project-specific implementation by the SWPPP Preparer. Refer to the product Material Safety Data Sheet for chemical properties.

Implementation

General Considerations

- Soil binders should conform to local municipality specifications and requirements.
- Site 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 when cured. Obtain a Safety Data Sheet (SDS) from the manufacturer to ensure non-toxicity (note however, the SDS may not include ecological information).
- Stormwater runoff from PAM treated soils should pass through one of the following 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 should drain to a sediment basin.

- Areas less than 5 acres should drain to sediment control BMPs, such as a sediment trap, or a series of check dams. The total number of check dams used should be maximized to achieve the greatest amount of settlement of sediment prior to discharging from the site. Each check dam should be spaced evenly in the drainage channel through which stormwater flows are discharged off site.

- Performance of soil binders depends on temperature, humidity, and traffic across treated areas.
- Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation, etc.
- Some soil binders are designed for application to roads.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Selecting a Soil Binder

Properties of common soil binders used for erosion control are provided on Table 1 at the end of this Fact Sheet. 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 is related to the functional longevity of the binder, which 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, <6 months) 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, 6-12 months) 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 typically requires 12 to 24 hours drying time. 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 the 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.

<u>Copolymers of Sodium Acrylates and Acrylamides:</u> 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
2:1 to 1:1	10.0 – 20.0

Poly-Acrylamide (PAM) and Copolymer of Acrylamide**:** Linear copolymer polyacrylamide for use as a soil binder is packaged as a dry flowable solid, as a liquid. Refer to the manufacturer's recommendation for dilution and application rates as they vary based on liquid or dry form, site conditions and climate.

- Limitations specific to PAM are as follows:
  - Do not use PAM on a slope that flows into a water body without passing through a sediment trap or sediment basin.
  - The specific PAM copolymer formulation must be anionic. Cationic PAM should 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, should be used for soil applications.
  - PAM designated for erosion and sediment control should be "water soluble" or "linear" or "non-cross linked".
  - PAM should not be used as a stand-alone BMP to protect against water-based erosion. When combined with mulch, its effectiveness increases dramatically.

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 installed costs:

Soil Binder	Cost per Acre
Plant-Material-Based (Short Lived) Binders	$900-$1,200
Plant-Material-Based (Long Lived) Binders	$1,500-$1,900
Polymeric Emulsion Blend Binders	$900-$1,900
Cementitious-Based Binders	$1,000-$1,500

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech Inc.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.

- Reapply the selected soil binder as needed to maintain effectiveness.

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	Moderate to High	Low to High	Low to Moderate
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.

References

Erosion Control Pilot Study Report, State of California Department of Transportation (Caltrans), June 2000.

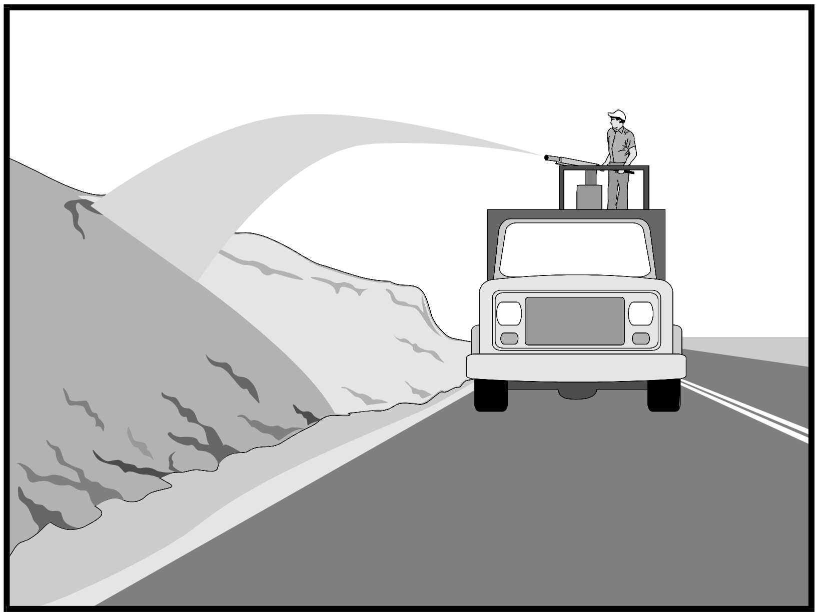
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

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), March 2003.

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.



Categories

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 Category**

☒ **Secondary Category**

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

EC-14 Compost Blanket

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper or anchoring it with a tackifier or 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 disturbed areas requiring temporary protection until permanent stabilization is established. Straw mulch can be specified for the following applications:

- As a stand-alone BMP on disturbed areas until soils can be prepared for permanent vegetation. The longevity of straw mulch is typically less than six months.
- Applied in combination with temporary seeding strategies
- Applied in combination with permanent seeding strategies to enhance plant establishment and final soil stabilization
- Applied around containerized plantings to control erosion until the plants become established to provide permanent stabilization

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 if weed-free agricultural straw is not specified.

- 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.

- Potential fugitive dust control issues associated with straw applications can occur. Application of a stabilizing emulsion or a water stream at the same time straw is being blown can reduce this problem.

- Use of plastic netting should be avoided in areas where wildlife may be entrapped and may be prohibited for projects in certain areas with sensitive wildlife species, especially reptiles and amphibians.

Implementation

- Straw should be derived from weed-free wheat, rice, or barley. Where required by the plans, specifications, permits, or environmental documents, native grass straw should be used.

- Use tackifier to anchor 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 can be used where other methods are impractical.

- Avoid placing straw onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.

- Straw mulch with tackifier should not be applied during or immediately before rainfall.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Application Procedures

- When using a tackifier to anchor the straw mulch, roughen embankment or fill areas by rolling with a crimping or punching-type roller or by track walking before placing the straw mulch. Track walking should only be used where rolling is impractical.

- Apply straw at a rate of between 3,000 and 4,000 lb./acre, either by machine or by hand distribution and provide 100% ground cover. A lighter application is used for flat surfaces and a heavier application is used for slopes.

- Evenly distribute straw mulch on the soil surface.

- Anchoring straw mulch to the soil surface by "punching" it into the soil mechanically (incorporating) can be used in lieu of a tackifier.

- Methods for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions, and longevity.
  - A tackifier acts to glue the straw fibers together and to the soil surface. The tackifier should 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.
  - On very 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."

Costs

Average annual cost for installation and maintenance is included in the table below. Application by hand is more time intensive and potentially more costly.

BMP	Unit Cost per Acre
Straw mulch, crimped or punched	$3,150-$6,900
Straw mulch with tackifier	$2,300-$6,200

Source: Cost information received from individual product suppliers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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. Straw mulch as a stand-alone BMP is temporary and is not suited for long-term erosion control.
- 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

Soil Stabilization BMP Research for Erosion and Sediment Controls: Cost Survey Technical Memorandum, State of California Department of Transportation (Caltrans), July 2007.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

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.

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Soil Erosion by Water, Agricultural Information Bulletin #513, U.S. Department of Agriculture, Soil Conservation Service.

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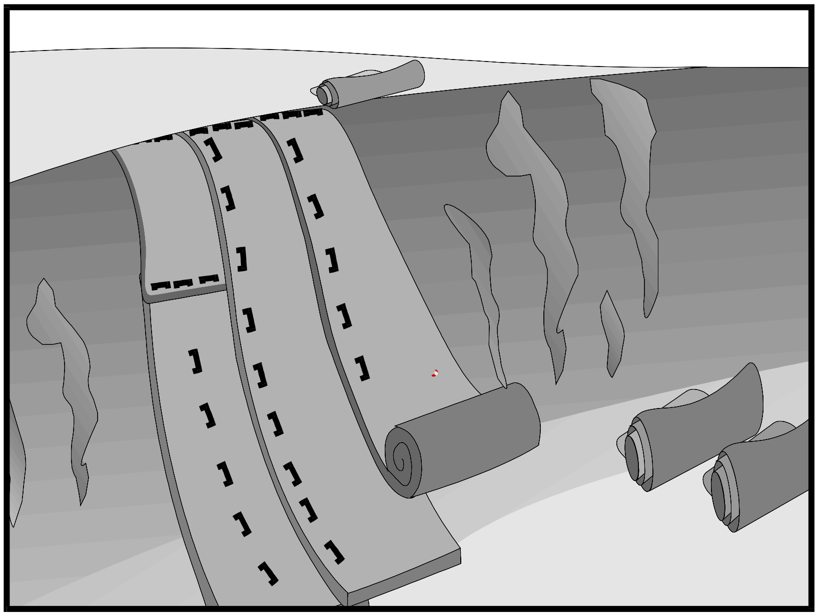

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Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-4 Hydroseeding

Description and Purpose

Rolled Erosion Control Products (RECPs), also known as erosion control matting or blankets, can be made of natural or synthetic materials or a combination of the two. RECPs 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, RECPs may be used to stabilize soils until vegetation is established or to reinforce non-woody surface vegetation.

Suitable Applications

RECPs are typically applied on slopes where erosion hazard is high, and vegetation will be slow to establish. Mattings are also used on stream banks, swales and other drainage channels where moving water at velocities between 3 ft/s and 6 ft/s are likely to cause scour and wash out new vegetation and in areas where the soil surface is disturbed and where existing vegetation has been removed. RECPs may also be used when seeding cannot occur (e.g., late season construction and/or the arrival of an early rain season). RECPs should be considered when the soils are fine grained and potentially erosive. RECPs should be considered in the following situations:

- Steep slopes, generally steeper than 3:1 (H:V).
- Long slopes.
- Slopes where the erosion potential is high.
- Slopes and disturbed soils where mulch must be anchored.

- Disturbed areas where temporary cover is needed, or plants are slow to establish or will not establish.

- Channels with flows exceeding 3.3 ft/s.

- Channels to be vegetated.

- Stockpiles.

- Slopes adjacent to water bodies.

Limitations

- RECP installed costs are generally higher than other erosion control BMPs, limiting their use to areas where other BMPs are ineffective (e.g., channels, steep slopes).

- RECPs may delay seed germination, due to reduction in soil temperature and/or sunlight.

- RECPs 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). If a staple or pin cannot be driven into the soil because the underlying soil is too hard or rocky, then an alternative BMP should be selected.

- If used for temporary erosion control, RECPs should be removed and disposed of prior to application of permanent soil stabilization measures.

- The use of plastic sheeting should be limited to covering stockpiles or very small graded areas for short periods of time (such as through one imminent storm event) until other measures, such as seeding and mulching, may be installed.

  - Plastic sheeting is easily vandalized, easily torn, photodegradable, and must be disposed of at a landfill.

  - Plastic sheeting results in 100% runoff, which may cause serious erosion problems in the areas receiving the increased flow.

- According to the State Water Board's *CGP Review, Issue #2*, only RECPs that either do not contain plastic netting or contain netting manufactured from 100% biodegradable non-plastic materials, such as jute, sisal, or coir fiber should be used due to plastic pollution and wildlife concerns. If a plastic-netted product is used for temporary stabilization, it must be promptly removed when no longer needed and removed or replaced with non-plastic netted RECPs for final stabilization.

- RECPs may have limitations based on soil type, slope gradient, or channel flow rate; consult the manufacturer for proper selection.

- Not suitable for areas that have foot traffic (tripping hazard) – e.g., pad areas around buildings under construction.

- RECPs that incorporate a plastic netting (e.g. straw blanket typically uses a plastic netting to hold the straw in place) may not be suitable near known wildlife habitat. Wildlife can become trapped in the plastic netting. As per State Water Board guidance, RECPs that contain plastic netting are discouraged for temporary controls and are not acceptable alternatives for permanent controls. RECPs that do not contain plastic netting or contain netting manufactured from 100% biodegradable non-plastic materials such as jute, sisal, or coir fiber should be used.

- RECPs may have limitations in extremely windy climates; they are susceptible to wind damage and displacement. However, when RECPs are properly trenched at the top and bottom and stapled in accordance with the manufacturer's recommendations, problems with wind can be minimized.

Implementation

Material Selection

- Natural RECPs have been found to be effective where re-vegetation will be provided by re-seeding. The choice of material should be based on the size of area, side slopes, surface conditions such as hardness, moisture, weed growth, and availability of materials.

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

- The following natural and synthetic RECPs are commonly used:

Geotextiles

- Material can be a woven or a non-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

- Generally plastic sheeting should only be used as stockpile covering or for very small graded areas for short periods of time (such as through one imminent storm event). If plastic sheeting must be used, choose a plastic that will withstand photo degradation.

- Plastic sheeting should have a minimum thickness of 6 mils and must be keyed in at the top of slope (when used as a temporary slope protection) 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 (when used as a temporary slope protection).

- 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 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. See typical installation details at the end of this fact sheet.

  - **Jute** is a natural fiber that is made into a yarn that is loosely woven into a biodegradable mesh. The performance of jute as a stand-alone RECP is low. Most other RECPs outperform jute as a temporary erosion control product and therefore jute is not commonly used. It is designed to be used in conjunction with vegetation. 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/yd². 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/yd². 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. Only biodegradable RECPs can remain on a site applying for a Notice of Termination due to plastic pollution and wild life concerns (State Waterboard, 2016). RECPs containing plastic that are used on a site must be disposed of for final stabilization.

- **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 geometric 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 soil preparation is essential to ensure complete contact of the RECP with the soil. Soil Roughening is not recommended in areas where RECPs will be installed.
- 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/Planting

Seed the area before blanket installation for erosion control and re-vegetation. Seeding after mat installation is often specified for turf reinforcement application. When seeding prior to blanket installation, all areas disturbed during blanket installation must be re-seeded. Where soil filling is specified for turf reinforcement mats (TRMs), 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. 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 shall be installed as required by the manufacturer.

Laying and Securing Matting

- Before laying the matting, all check slots should be installed and the seedbed should be friable, 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 (or greater, per manufacturer's specifications).
- 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. Check manufacturer's specifications to determine if a higher density staple pattern is required.

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 mat (TRM))

Installation should be in accordance with the manufacturer's recommendations. Typical installation guidelines are as follows:

- After seeding, spread and lightly rake ½-3/4 inches of fine topsoil into the TRM apertures to completely fill TRM thickness. Use backside of rake or other flat implement.
- Alternatively, if allowed by product specifications, spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment.
- 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

Installed costs can be relatively high compared to other BMPs. Approximate costs for installed materials are shown below:

Rolled Erosion Control Products		**Installed Cost per Acre**
Biodegradable	Jute Mesh	$7,700-$9,000
	Curled Wood Fiber	$10,200-$13,400
	Straw	$10,200-$13,400
	Wood Fiber	$10,200-$13,400
	Coconut Fiber	$16,600-$18,000
	Coconut Fiber Mesh	$38,400-$42,200
	Straw Coconut Fiber	$12,800-$15,400
Non-Biodegradable	Plastic Netting	$2,600-$2,800
	Plastic Mesh	$3,800-$4,500
	Synthetic Fiber with Netting	$43,500-$51,200
	Bonded Synthetic Fibers	$57,600-$70,400
	Combination with Biodegradable	$38,400-$46,100

Source: Cost information received from individual product manufacturers solicited by Geosyntec Consultants (2004). Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

Inspection and Maintenance

- RECPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

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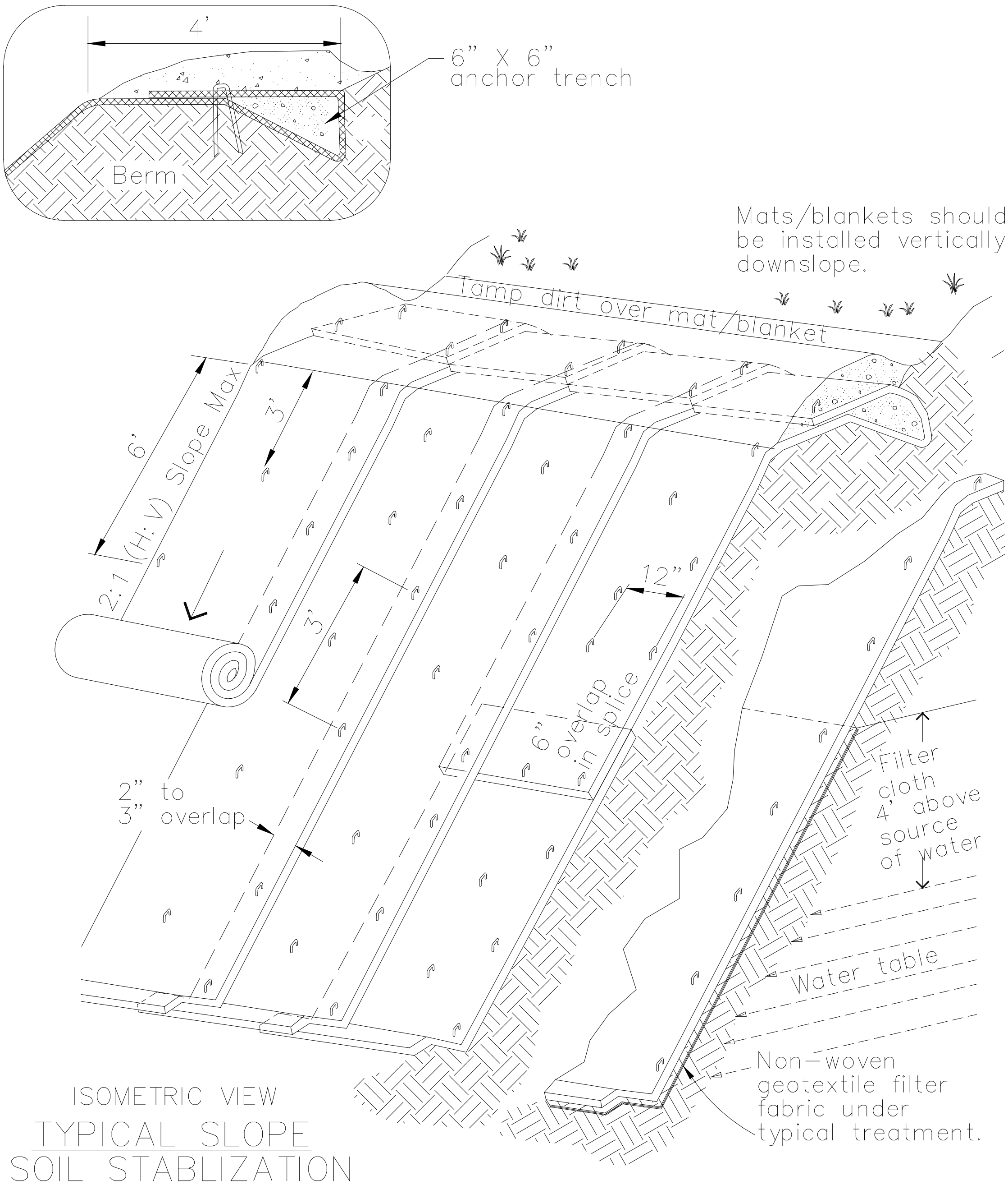


ISOMETRIC VIEW

TYPICAL SLOPE
SOIL STABLIZATION
NTS

WET SLOPE LINING
NTS

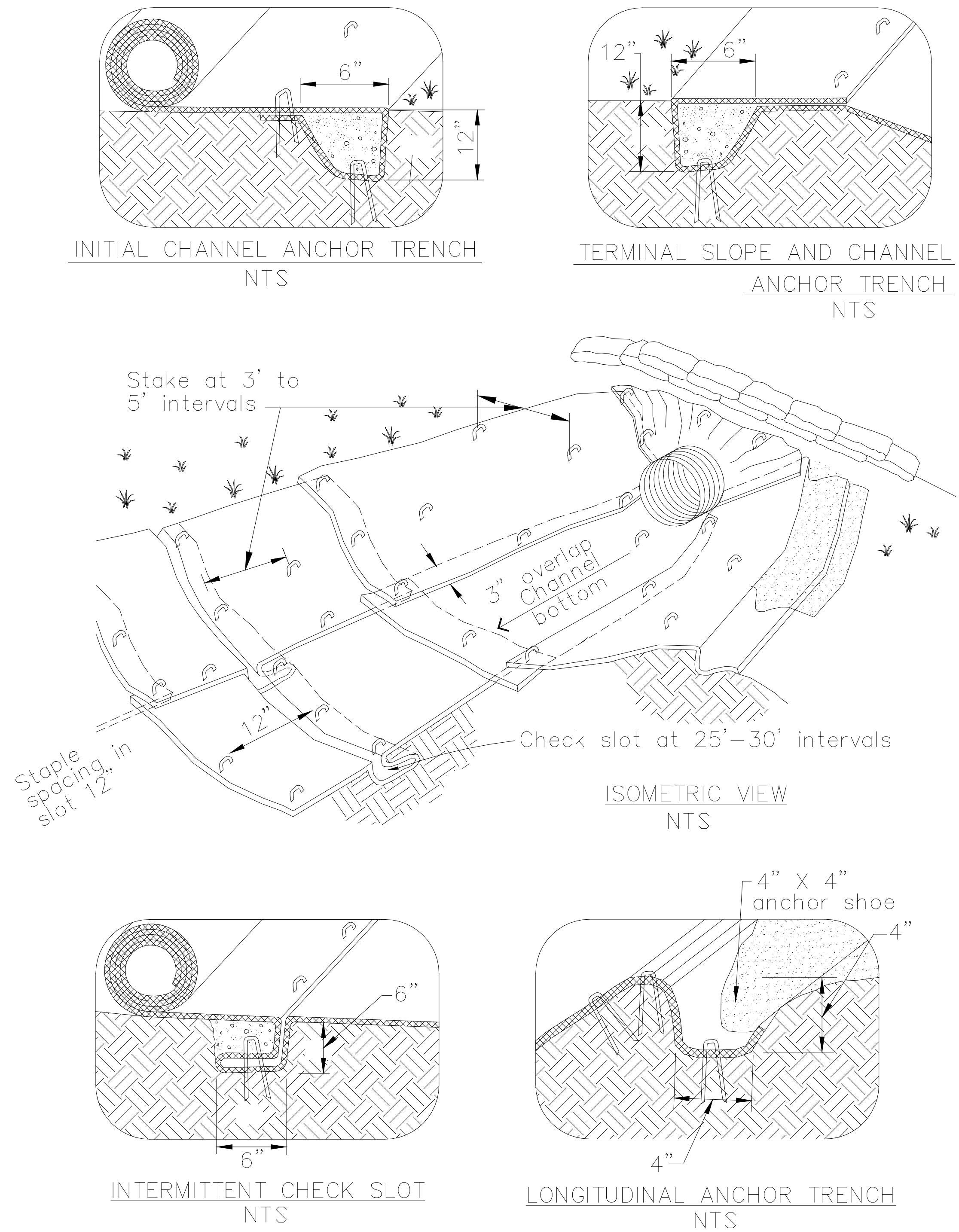
NOTES:

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



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

Categories

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

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 consists of applying a mixture of shredded wood mulch or bark 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. Wood mulch may also be used for final stabilization; generally, used in a landscape setting or areas that will have pedestrian traffic.

Limitations

- Best suited to flat areas or gentle slopes or 5:1 (H:V) or flatter. Not suitable for use on slopes steeper than 3:1 (H:V). For slopes steeper than 3:1, consider the use of Compost Blankets (EC-14).
- Wood mulch may introduce unwanted species if it contains seed, although it may also be used to prevent weed growth if it is seed-free.
- Not suitable for areas exposed to concentrated flows.
- If used for temporary stabilization, wood mulch 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. Chipped brush from on-site vegetation clearing activities may be used (this may require stockpiling and reapplying after earthwork is complete). 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

Assuming a 2-in. layer of wholesale landscaping-grade wood mulch, the average one-time cost for installation may range from $15,000 – $23,000 per acre[1]. Costs can increase if the source is not close to the project site.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.

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[1] Costs based on estimates provided by the California Department of Transportation's *Soil Stabilization BMP Research for Erosion and Sediment Controls Cost Survey Technical Memorandum*, CTSW-TM-07-172.35.1, July 2007 (available at: http://www.dot.ca.gov/hq/LandArch/16_la_design/guidance/estimating/Soil_Stabilization_Pricing.pdf) and adjusted for inflation from 1997 to 2016.

- 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.

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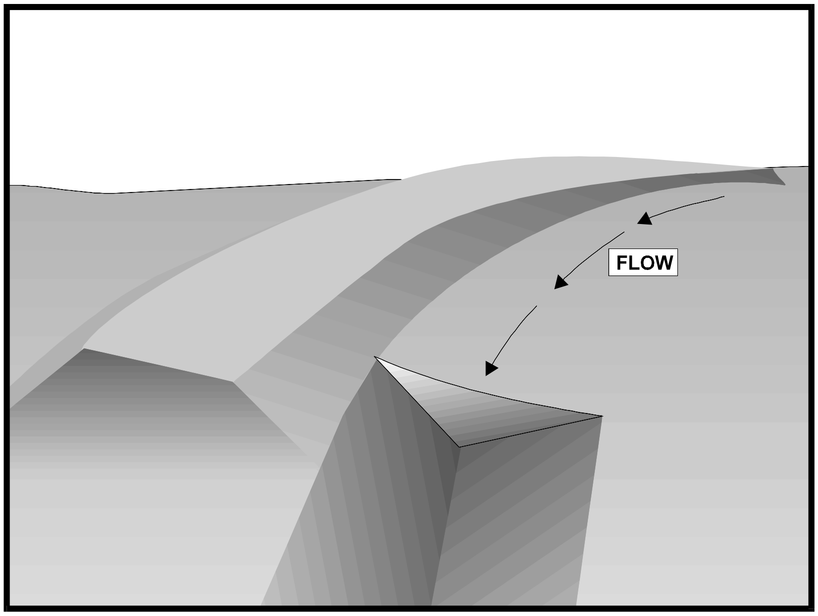
Earth Dikes and Drainage Swales EC-9



Categories

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

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
  - To intercept and divert run-on
  - Below steep grades where runoff begins to concentrate

CASQA
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- 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.
- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in drainage swales.

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.

- May be covered with hydro mulch, hydroseed, wood mulch, compost blanket, or RECP for stabilization.

- 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 %, but not more than 15 %.

- 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 % and use rip-rap or sod for swales with a slope between 5 and 15 %. 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 $19 to $70 per ft. for both earthwork and stabilization and depends on availability of material, site location, and access (Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.).
- Small dikes: $3 - $8/linear ft.; Large dikes: $3/yd^3 (Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.).
- 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

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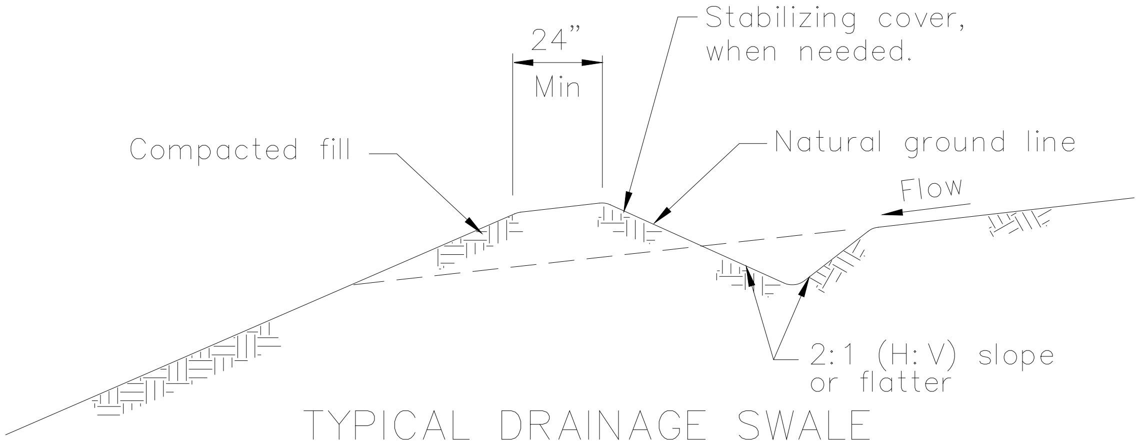
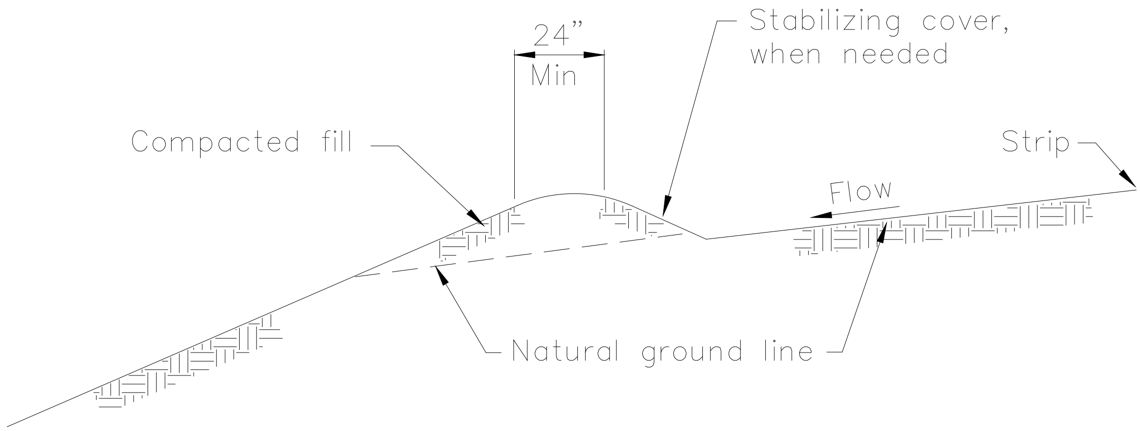


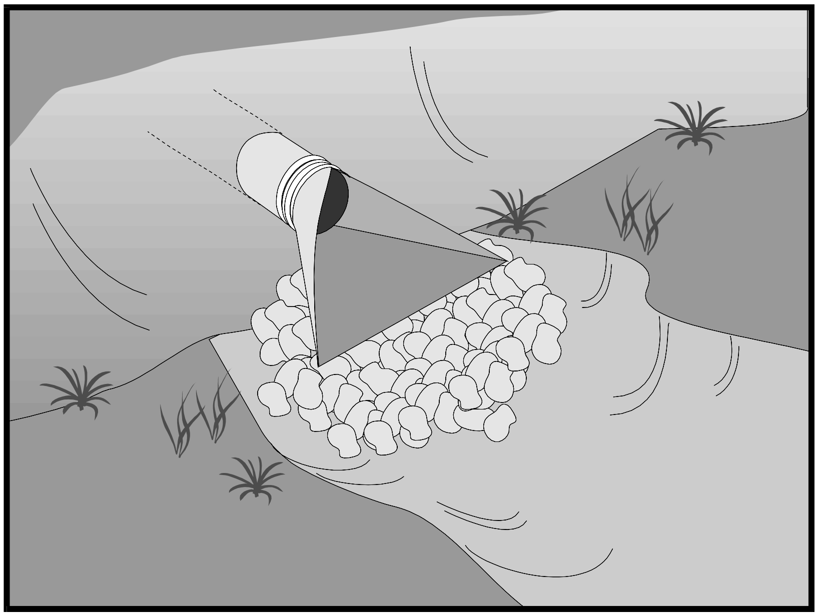
TYPICAL DRAINAGE SWALE
NOT TO SCALE

NOTES:

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



TYPICAL EARTH DIKE
NOT TO SCALE



Categories

EC	Erosion Control	☑
SE	Sediment Control	
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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.

- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in velocity dissipation devices.

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 $250 per device.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.

- 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.

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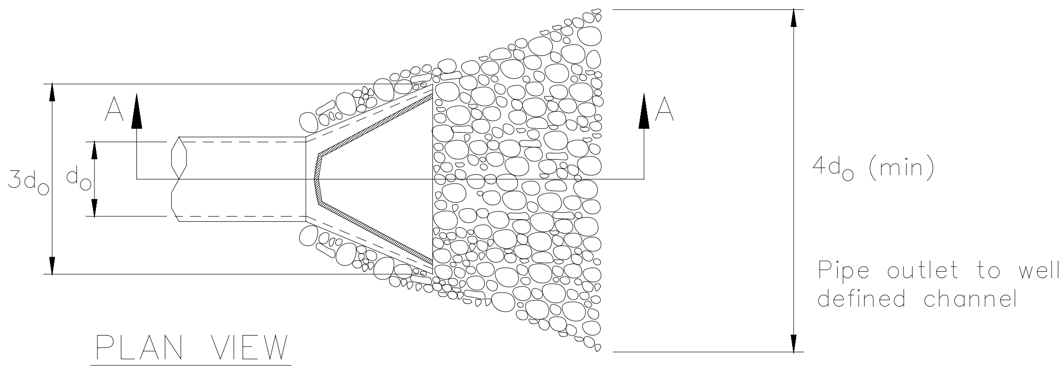
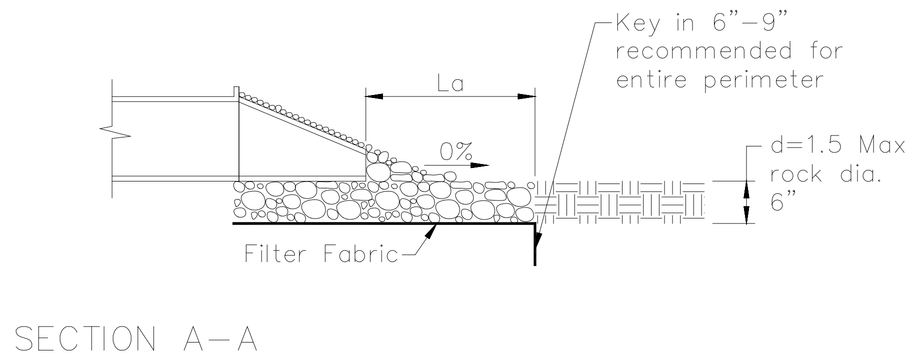
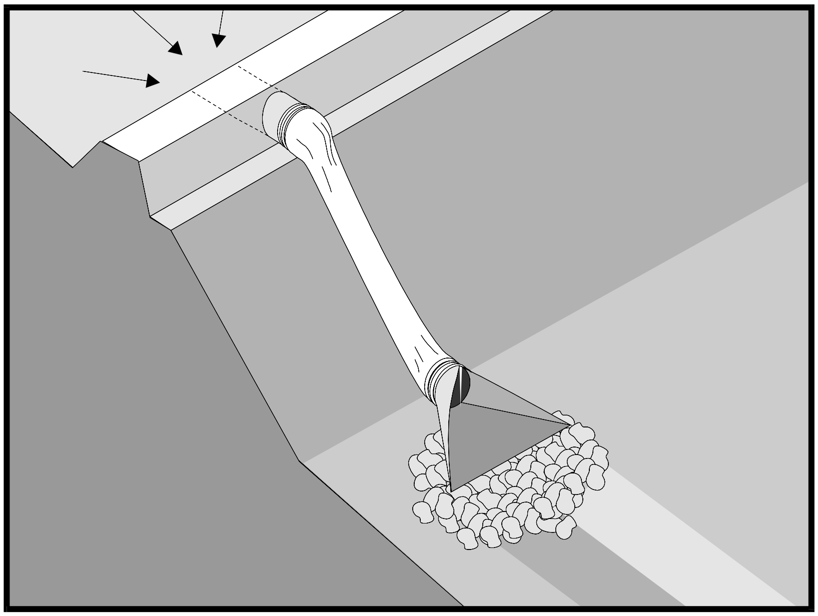




Pipe Diameter inches	Discharge ft^3/s	Apron Length, La ft	Rip Rap D_{50} Diameter Min inches
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

For larger or higher flows consult a Registered Civil Engineer
Source: USDA - SCS



Categories

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

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.

- Sediment accumulation, scour depressions, and/or persistent non-stormwater discharges can result in areas of standing water suitable for mosquito production in energy dissipaters associated with slope drain outlets.

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”	$25 per LF
15”	$28.00
18”	$33.00
24”	$41.00
30”	$64.00
PVC Pipes, Per Foot	
Size	Supplied and Installed Cost (No Trenching Included)
12”	$31.00
14”	$63.00
16”	$65.00
18”	$69.00
20”	$84.00
24”	$119.00
30”	$166.00

Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subjected to non-stormwater discharges daily while non-stormwater discharges occur. Minimize areas of standing water by removing sediment blockages and filling scour depressions.

- 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.

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National Management Measures to Control Nonpoint Source Pollution from Urban Areas, United States Environmental Protection Agency, 2002.

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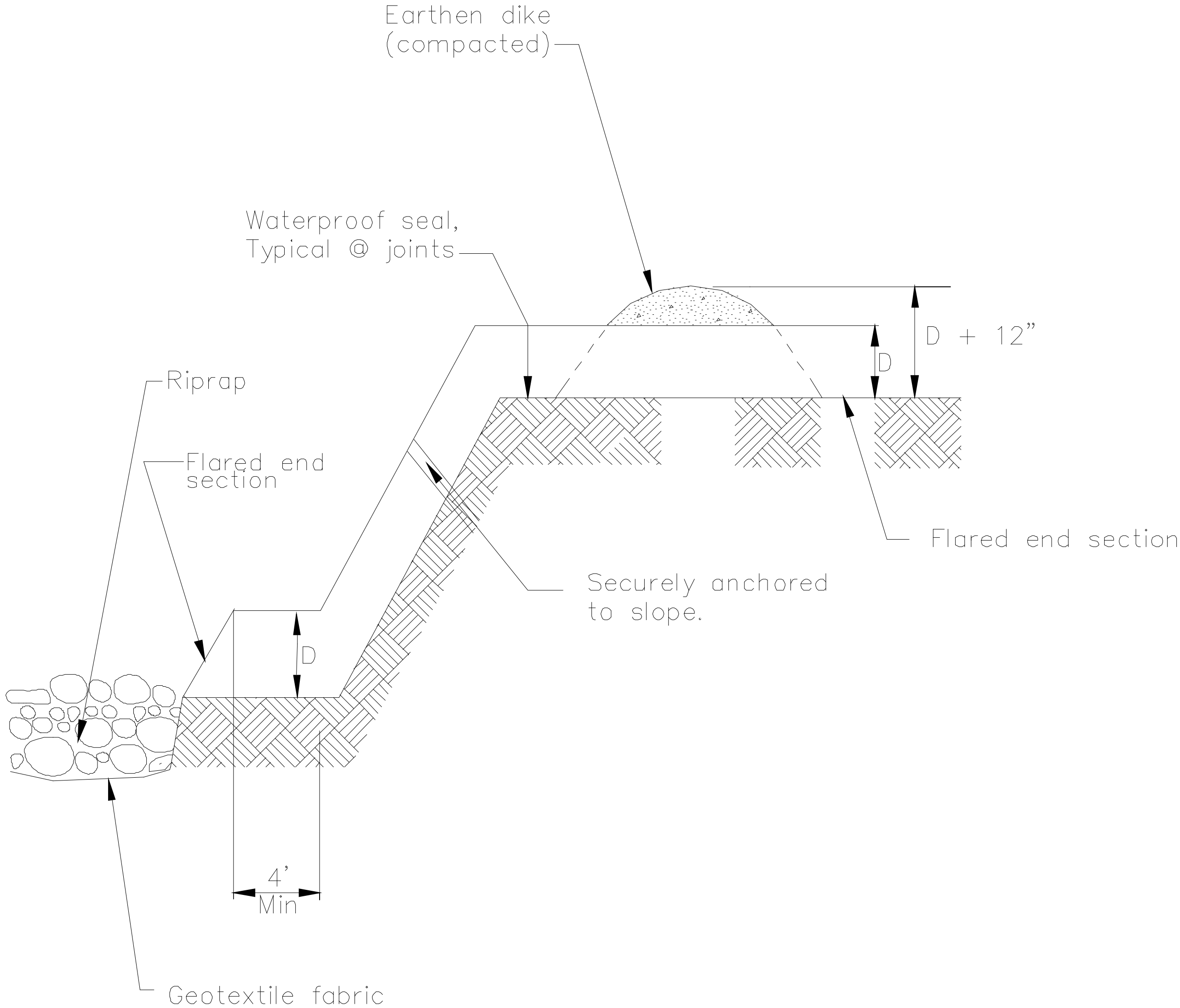

TYPICAL SLOPE DRAIN
NOT TO SCALE

Categories

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

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 barrier 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events until final stabilization is achieved.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).

References

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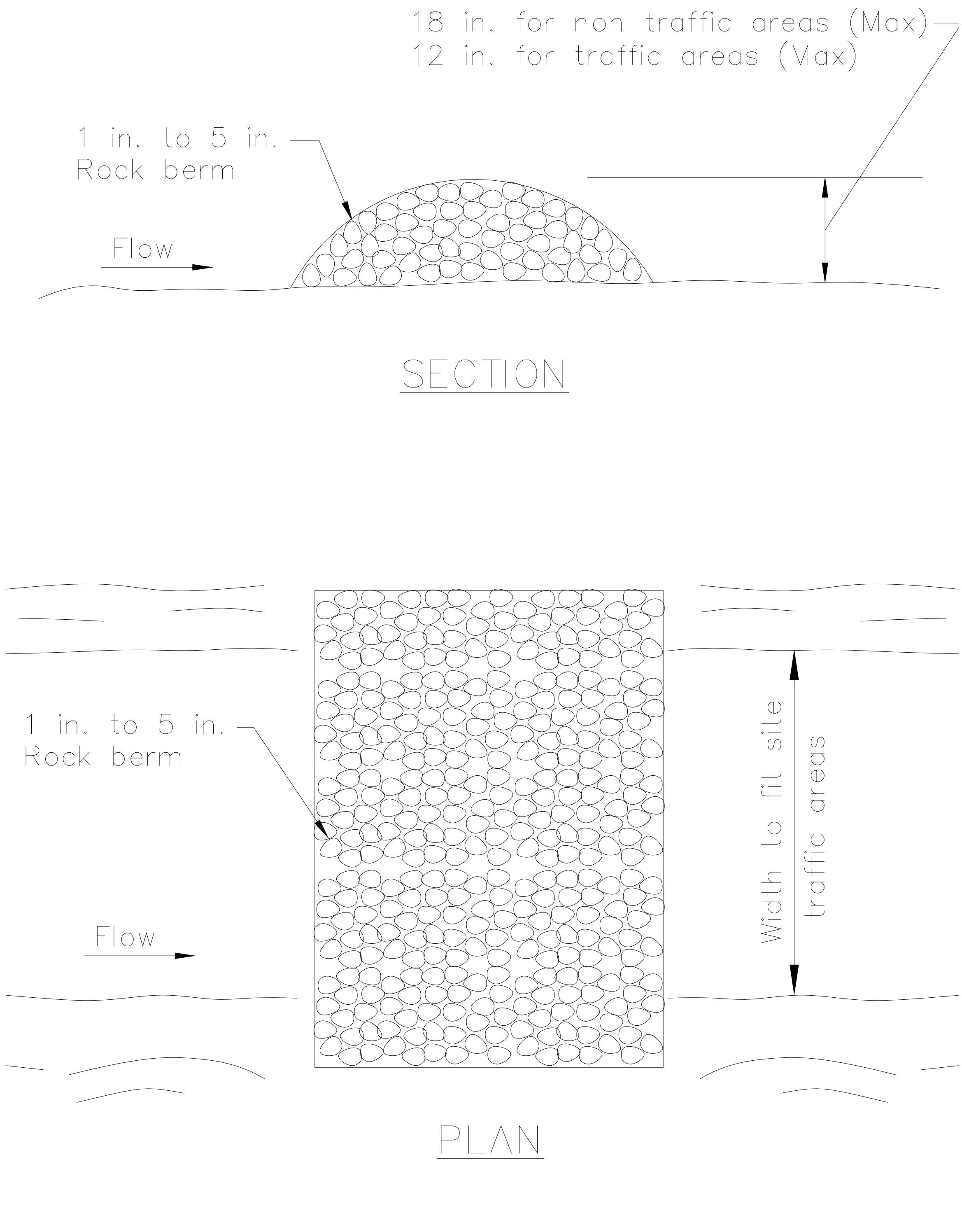

TYPICAL ROCK FILTER
NOT TO SCALE

Compost Blanket

Categories

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 Category**

☒ **Secondary Category**

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

A compost blanket is applied to slopes and earth disturbed areas to prevent erosion, and in some cases, increase infiltration and/or establish vegetation. The compost blanket can be applied by hand, conveyor system, compost spreader, or pneumatic delivery (blower) system. The blanket thickness is determined from the slope steepness and anticipated precipitation. A compost blanket protects the soil surface from raindrop erosion, particularly rills and gullies that may form under other methods of erosion control.

A compost blanket, if properly installed, can be very successful at vegetation establishment, weed suppression and erosion control. The compost blanket comes into direct contact with the underlying soil, reducing rill formation. Furthermore, compost provides organic matter and nutrients important for vegetation growth. The compost blanket provides soil structure that allows water to infiltrate the soil surface and retain moisture, which also promotes seed germination and vegetation growth, in addition to reducing runoff.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Green waste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly, compost selection is an important design consideration in the application of this type of erosion control.

Suitable Applications

A compost blanket is appropriate for slopes and earth disturbed areas requiring protection until permanent stabilization is established. A compost blanket can also used in combination with temporary and/or permanent seeding strategies to enhance plant establishment. Examples include:

- Rough-graded areas that will remain inactive for longer than 14 days
- Soil stockpiles
- Slopes with exposed soil between existing vegetation such as trees or shrubs
- Slopes planted with live, container-grown vegetation
- Disturbed areas where plants are slow to develop

A compost blanket is typically used on slopes of 2:1 (H:V) or gentler. However, a compost blanket can be effective when applied to slopes as steep as 1:1 (H:V) with appropriate design considerations including slope length, blanket thickness, adding components such as a tackifier, or using compost blankets in conjunction with other techniques, such as compost socks and berms or fiber rolls.

Compost can be pre-seeded prior to application to the soil (recommended by the EPA for construction site stormwater runoff control) or seeded after the blanket has been installed. The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons (USEPA, 1998).

Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Carefully consider the qualifications and experience of any compost producer/supplier.
- A compost blanket applied by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost-effective method of application.
- When blowers are used, the treatment areas should be within 300 ft of a road or surface capable of supporting trucks.
- Wind may limit application of compost and result in application to undesired locations.
- Compost blankets should not be applied in areas of concentrated flows.
- Steeper slopes may require additional blanket thickness and other stability measures such as using tackifiers or slope interruption devices (compost socks and berms, or fiber rolls). The same applies for sites with high precipitation totals or during the rainy season.

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in Table 1 below, taken from Caltrans Standard Special Provision 10-1 (SSP 10-1), Erosion Control (Compost Blanket).

- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.

- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.

- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.

- Compost should be high-quality mature compost. Immature compost can potentially leach nutrients.

- Compost should not be derived from mixed municipal solid waste and should be free of visible contaminants.

- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

- Compost should not possess objectionable odors.

- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	*TMECC 04.11-A Elastomeric pH 1:5 Slurry Method pH Units	6.0–8.0
Soluble Salts	TMECC 04.10-A Electrical Conductivity 1:5 Slurry Method dS/m (mmhos/cm)	0-10.0
Moisture Content	TMECC 03.09-A Total Solids & Moisture at 70+/- 5 deg C % Wet Weight Basis	30-60
Organic Matter Content	TMECC 05.07-A Loss-On-Ignition Organic Matter Method (LOI) % Dry Weight Basis	30–65
Maturity	TMECC 05.05-A Germination and Vigor Seed Emergence Seedling Vigor % Relative to Positive Control	80 or Above 80 or Above
Stability	TMECC 05.08-B Carbon Dioxide Evolution Rate mg CO_2-C/g OM per day	8 or below
Particle Size	TMECC 02.02-B Sample Sieving for Aggregate Size Classification % Dry Weight Basis	100% Passing, 3 inches 90-100% Passing, 1 inch 65-100% Passing, 3/4 inch 0 - 75% Passing, 1/4 inch Maximum length 6 inches
Pathogen	TMECC 07.01-B Fecal Coliform Bacteria < 1000 MPN/gram dry wt.	Pass
Pathogen	TMECC 07.01-B Salmonella < 3 MPN/4 grams dry wt.	Pass
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Plastic, Glass and Metal % > 4mm fraction	Combined Total: < 1.0
Physical Contaminants	TMECC 02.02-C Man Made Inert Removal and Classification: Sharps (Sewing needles, straight pins and hypodermic needles) % > 4mm fraction	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Installation

- Prior to compost application, prepare the slope by removing loose rocks, roots, stumps, and other debris greater than 2" in diameter. Prepare the slope area surface by scarifying or track walking/roughening if necessary.

- Select method to apply the compost blanket. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.

- A compost blanket thickness of 1" to 4" should be applied to slopes of 2:1 (H:V) or gentler, based on site-specific conditions. Increase blanket thickness with increased slope steepness and/or during installation during the rainy season (for example, 2" to 3" should be used for a

3:1 slope, while 1” to 2” can be used for a 4:1 slope). Erosion control using a compost blanket is not recommended for slopes greater than 1:1 (H:V).

- For steeper slopes, tackifiers should be utilized and/or other stabilization techniques employed. For example, compost socks or berms can be installed at intervals over the compost blanket (in a similar manner as Fiber Rolls, SE-5).

- Compost socks or berms (or equivalent linear sediment control BMP) should be placed at the top and/or bottom of the slope for additional erosion control performance.

- For optimum vegetation establishment, a blanket thickness of 1” to 2” is recommended. If vegetation establishment is not the primary function of the compost blanket, a thicker blanket may be recommended based on slope or rainfall conditions.

- Evenly distribute compost on the soil surface to the desired blanket thickness (1/2” to 4” as calculated prior based on-site conditions and objectives). Even distribution is an important factor in preventing future rill and gully erosion.

- The compost blanket should extend 3 to 6 feet over the top of the shoulder of the slope. A compost sock or compost berm can be used at the top of the slope as an auxiliary technique to prevent runoff from flowing underneath the compost blanket.

- Use additional anchoring and erosion control BMPs in conjunction of the compost blanket as needed.

Costs

The cost associated with a compost blanket is similar to that of a straw mat and generally less expensive than a geotextile blanket (USEPA, 2009). Caltrans has provided a recent estimate for $5,600 to $9,000 per acre for application of an unseeded 1-inch compost blanket (Caltrans Compost Specifications, 2009. Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.). Vendor costs indicate that proprietary blends of compost that are seeded and contain a nutrient rich “tackifier” can cost approximately $0.45 per square foot, or approximately $19,200 per acre for a 2-inch blanket (Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.). Application by hand is more time intensive and likely more costly.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Areas where erosion is evident, another layer of compost should be reapplied as soon as possible. It may be necessary to install an additional type of stormwater BMP at the top of slope or as a slope interrupter to control flow, such as a fiber roll (SE-5) or compost sock (SE-11).

- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

- Limit or prohibit foot traffic to minimize damage to BMP or impede vegetation establishment.

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An Analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

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Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-3 Hydraulic Mulch

EC-5 Soil Binders

EC-7 Geotextiles and Mats

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Description and Purpose

Soil Preparation/Roughening involves assessment and preparation of surface soils for BMP installation. This can include soil testing (for seed base, soil characteristics, or nutrients), as well as roughening surface soils by mechanical methods (including sheepsfoot rolling, track walking, scarifying, stair stepping, and imprinting) to prepare soil for additional BMPs, or to break up sheet flow. Soil Preparation can also involve tilling topsoil to prepare a seed bed and/or incorporation of soil amendments, to enhance vegetative establishment.

Suitable Applications

Soil preparation: Soil preparation is essential to proper vegetative establishment. In particular, soil preparation (i.e. tilling, raking, and amendment) is suitable for use in combination with any soil stabilization method, including Rolled Erosion Control Products (RECPs) or sod. Soil preparation should not be confused with roughening.

Roughening: Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces. Soil preparation is most effective when used in combination with erosion controls. Soil Roughening is suitable for use as a complementary process for controlling erosion on a site. Roughening is not intended to be used as a stand-alone BMP, and should be used with perimeter controls, additional erosion control measures, grade breaks, and vegetative establishment for maximum effectiveness. Roughening is intended to only affect surface soils and should not compromise slope stability or overall compaction. Suitable applications for soil roughening include:

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- Along any disturbed slopes, including temporary stockpiles, sediment basins, or compacted soil diversion berms and swales.

- Roughening should be used in combination with hydraulically applied stabilization methods, compost blanket, or straw mulch; but should not be used in combination with RECPs or sod because roughening is intended to leave terraces on the slope.

Limitations

- Preparation and roughening must take place prior to installing other erosion controls (such as hydraulically applied stabilizers) or sediment controls (such as fiber rolls) on the faces of slopes.

- In such cases where slope preparation is minimal, erosion control/revegetation BMPs that do not require extensive soil preparation - such as hydraulic mulching and seeding applications - should be employed.

- Consideration should be given to the type of erosion control BMP that follows surface preparation, as some BMPs are not designed to be installed over various types of tillage/roughening, i.e., RECPs should not be used with soil roughening due to a "bridging" effect, which suspends the blanket above the seed bed.

- Surface roughness has an effect on the amount of mulch material that needs to be applied, which shows up as a general increase in mulch material due to an increase in surface area (Topographic Index -see EC-3 Hydraulic Mulch).

Implementation

- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

General

A roughened surface can significantly reduce erosion. Based on tests done at the San Diego State Erosion Research Laboratory, various roughening techniques on slopes can result in a 12 - 76% reduction in the erosion rate versus smooth slopes.

Materials

Minimal materials are required unless amendments and/or seed are added to the soil. The majority of soil roughening/preparation can be done with equipment that is on hand at a normal construction site, such as bull dozers and compaction equipment.

Installation Guidelines

Soil Preparation

- Where appropriate or feasible, soil should be prepared to receive the seed by disking or otherwise scarifying the surface to eliminate crust, improve air and water infiltration and create a more favorable environment for germination and growth.

- Based upon soil testing conducted, apply additional soil amendments (e.g., fertilizers, additional seed) to the soil to help with germination. Follow EC-4, Hydroseeding, when selecting and applying seed and fertilizers.

Cut Slope Roughening:

- Stair-step grade or groove the cut slopes that are steeper than 3:1.
- Use stair-step grading on any erodible material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.
- Make the vertical cut distance less than the horizontal distance, and slightly slope the horizontal position of the "step" in toward the vertical wall.
- Do not make individual vertical cuts more than 2 ft. (0.6 m) high in soft materials or more than 3 ft. (0.9 m) high in rocky materials.
- Groove the slope using machinery to create a series of ridges and depressions that run across the slope, on the contour.

Fill Slope Roughening:

- Place on fill slopes with a gradient steeper than 3:1 in lifts not to exceed 8 in. (0.2 m), and make sure each lift is properly compacted.
- Ensure that the face of the slope consists of loose, uncompacted fill 4-6 in. (0.1-0.2 m) deep.
- Use grooving or tracking to roughen the face of the slopes, if necessary.
- Do not blade or scrape the final slope face.

Roughening for Slopes to be Mowed:

- Slopes that require mowing activities should not be steeper than 3:1.
- Roughen these areas to shallow grooves by track walking, scarifying, sheepsfoot rolling, or imprinting.
- Make grooves close together (less than 10 in.), and not less than 1 in. deep, and perpendicular to the direction of runoff (i.e., parallel to the slope contours).
- Excessive roughness is undesirable where mowing is planned.

Roughening with Tracked Machinery:

- Limit roughening with tracked machinery to soils with a sandy textural component to avoid undue compaction of the soil surface.
- Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. Do not back-blade during the final grading operation.
- Seed and mulch roughened areas as soon as possible to obtain optimum seed germination and growth.

Costs

Costs are based on the additional labor of tracking or preparation of the slope plus the cost of any required soil amendment materials.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check the seeded slopes for signs of erosion such as rills and gullies. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.
- Inspect BMPs weekly during normal operations, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

References

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Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Non-Vegetative Stabilization EC-16

Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Non-vegetative stabilization methods are used for temporary or permanent stabilization of areas prone to erosion and should be used only where vegetative options are not feasible; examples include:

- Areas of vehicular or pedestrian traffic such as roads or paths;
- Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
- Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
- Areas where vegetation will not grow adequately within the construction time frame.

There are several non-vegetative stabilization methods and selection should be based on site-specific conditions.

Decomposed Granite (DG) is a permanent erosion protection method that consists of a layer of stabilized decomposed granite placed over an erodible surface.

Degradable Mulches of various types (see EC-3, EC-6, EC-8) can be used for temporary non-vegetative stabilization; examples include straw mulch, compost, wood chips or hydraulic mulch.

Geotextiles and Mats can be used for temporary non-vegetative stabilization (see EC-7). These BMPs are typically manufactured from degradable or synthetic materials and are designed and specified based on their functional longevity, i.e., how long they will persist and provide erosion protection. All geotextiles and mats should be replaced when they exceed their functional longevity or when permanent stabilization methods are instituted.

Gravel Mulch is a non-degradable erosion control product that is composed of washed and screened coarse to very coarse gravel, 16 mm to 64 mm (0.6" - 2.5"), similar to an AASHTO No. 3 coarse aggregate.

Rock Slope Protection consists of utilizing large rock or rip-rap (4"- 24") to stabilize slopes with a high erosion potential and those subject to scour along waterways.

Soil Binders can be used for temporary non-vegetative stabilization (see EC-5). The key to their use is functional longevity. In most cases, the soil binder will need to be routinely monitored and re-applied to maintain an erosion-resistant coverage.

Suitable Applications

Non-vegetated stabilization methods are suitable for use on disturbed soil areas and on material stockpiles that need to be temporarily or permanently protected from erosion by water and wind. Non-vegetated stabilization should only be utilized when vegetation cannot be established in the required timeframe, due to soil or climactic conditions, or where vegetation may be a potential fire hazard.

Decomposed Granite (DG) and Gravel Mulch are suitable for use in areas where vegetation establishment is difficult, on flat surfaces, trails and pathways, and when used in conjunction with a stabilizer or tackifier, on shallow slopes (i.e., 10:1 [H:V]). DG and gravel can also be used on shallow rocky slopes where vegetation cannot be established for permanent erosion control.

Degradable Mulches can be used to cover and protect soil surfaces from erosion both in temporary and permanent applications. In many cases, the use of mulches by themselves requires routine inspection and re-application. See EC-3 Hydraulic Mulch, EC-6 Straw Mulch, EC-8 Wood Mulch, or EC-14 Compost Blankets for more information.

Geotextiles and Mats can be used as a temporary stand-alone soil stabilization method. Depending on material selection, geotextiles and mats can be a short-term (3 mos – 1 year) or long-term (1-2 years) temporary stabilization method. For more information on geotextiles and mats see EC-7 Geotextiles and Mats.

Rock Slope Protection can be used when the slopes are subject to scour or have a high erosion potential, such as slopes adjacent to flowing waterways or slopes subject to overflow from detention facilities (spillways).

Soil Binders can be used for temporary stabilization of stockpiles and disturbed areas not subject to heavy traffic. See EC-5 Soil Binders for more information.

Limitations

General

- Refer to EC-3, EC-6, EC-8, and EC-14 for limitations on use of mulches. Refer to EC-7 for limitations on use of geotextiles and mats. Refer to EC-5 for limitations on use of Soil Binders.

Decomposed Granite

- Not available in some geographic regions.
- If not tackified, material may be susceptible to erosion even on slight slopes (e.g., 30:1 [H:V]).
- Installed costs may be more expensive than vegetative stabilization methods.

Gravel Mulch

- Availability is limited in some geographic regions.
- If not properly screened and washed, can contain fine material that can erode and/or create dust problems.
- If inadequately sized, material may be susceptible to erosion on sloped areas.
- Pore spaces fill with dirt and debris over time; may provide a growing medium for weeds.

Rock Slope Protection

- Installation is labor intensive.
- Installed costs can be significantly higher than vegetative stabilization methods.
- Rounded stones may not be used on slopes greater than 2:1 [H:V].

Implementation

General

Non-vegetated stabilization should be used in accordance with the following general guidance:

- Should be used in conjunction with other BMPs, including drainage, erosion controls and sediment controls.
- Refer to EC-3, EC-6, EC-8, and EC-14 for implementation details for mulches. Refer to EC-7 for implementation details for geotextiles and mats. Refer to EC-5 for implementation details for soil binders.
- Non-vegetated stabilization measures should be implemented as soon as the disturbance in the areas they are intended to protect has ceased.
- Additional guidance on the comparison and selection of temporary slope stabilization methods is provided in Appendix F of the Handbook.

Decomposed Granite Stabilization

- If used for a road or path should be installed on a prepared base.
- Should be mixed with a stabilizer if used for roads or pathways, or on slope applications.
- Though porous it is recommended to prevent standing water on or next to a decomposed granite road or pathway.

Gravel Mulch

- Should be sized based on slope, rainfall, and upgradient run-on conditions. Stone size should be increased as potential for erosion increases (steeper slopes, high intensity rainfall).
- If permanent, a weed control fabric should be placed prior to installation.
- Should be installed at a minimum 2" depth.
- Should completely cover all exposed surfaces.

Rock Slope Protection

- Rock slope protection installation should follow Caltrans Standard Specification 72-2: Rock Slope Protection. Refer to the specification for rock conformity requirements and installation methods.
- When using rock slope protection, rock size and installation method should be specified by an Engineer.
- A geotextile fabric should be placed prior to installation.

Costs

- Costs are highly variable depending not only on technique chosen, but also on materials chosen within specific techniques. In addition, availability of certain materials will vary by region/location, which will also affect the cost. Costs of mulches, geotextiles and mats, and soil binders are presented in their respective fact sheets. Costs for decomposed granite, gravel mulch stabilization and rock slope protection may be higher depending on location and availability of materials. Caltrans has provided an estimate for gravel mulch of \$13 - \$20/yd^2 in flat areas and \$14 - \$30/yd^2 on side slopes (adjusted for inflation, 2016 dollars).

Inspection and Maintenance

General

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- For permanent installation, require inspection periodically and after major storm events to look for signs of erosion or damage to the stabilization.
- All damage should be repaired immediately.
- Refer to EC-3, EC-6, EC-8, and EC-14 for inspection and maintenance requirements for mulches. Refer to EC-7 for inspection and maintenance requirements for geotextiles and mats. Refer to EC-5 for inspection and maintenance requirements for soil binders.

Decomposed Granite and Gravel Mulch Stabilization

- Rake out and add decomposed granite or gravel as needed to areas subject to rill erosion. Inspect upgradient drainage controls and repair/modify as necessary.

- Should remain stable under loose surface material. Any significant problem areas should be repaired to restore uniformity to the installation.

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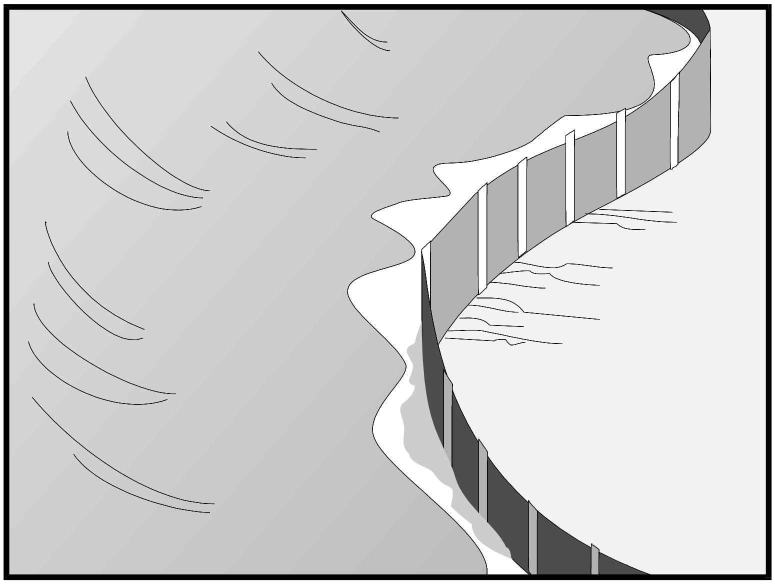

Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment (coarse sediment)	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm SE-12 Manufactured Linear Sediment Controls

SE-13 Compost Socks and Berms

SE-14 Biofilter Bags

Description and Purpose

A silt fence is made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support. The silt fence detains water, promoting sedimentation of coarse sediment behind the fence. Silt fence does not retain soil fine particles like clays or silts.

Suitable Applications

Silt fences are suitable for perimeter control, placed below areas where sheet flows discharge from the site. They could also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion and around inlets within disturbed areas (Storm Drain Inlet Protection, SE-10). Silt fences should not be used in locations where the flow is concentrated. Silt fences should always be used in combination with erosion controls. Suitable applications include:

- At perimeter of a project (although they should not be installed up and down slopes).
- Below the toe or down slope of exposed and erodible slopes.
- Along streams and channels.
- Around temporary spoil areas and stockpiles.
- Around inlets.
- 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 a flooding hazard.
- Do not use silt fence to divert water flows or place across any contour line.
- Improperly installed fences are subject to failure from undercutting, overtopping, or collapsing.
- Must be trenched and keyed in.
- According to the State Water Board's *CGP Review, Issue #2* (2014), silt fences reinforced with metal or plastic mesh should be avoided due to plastic pollution and wildlife concerns.
- Not intended for use as a substitute for Fiber Rolls (SE-5), when fiber rolls are being used as a slope interruption device.
- Do not use on slopes subject to creeping, slumping, or landslides.

Implementation

General

A silt fence is a temporary sediment barrier consisting of woven geotextile stretched across and attached to supporting posts, trenched-in, and, depending upon the strength of fabric used, supported with plastic or wire mesh fence. Silt fences trap coarse sediment by intercepting and detaining sediment-laden runoff from disturbed areas in order to promote sedimentation behind the fence.

The following layout and installation guidance can improve performance and should be followed:

- Silt fence should be used in combination with erosion controls up-slope in order to provide the most effective sediment control.
- Silt fence alone is not effective at reducing turbidity. (Barrett and Malina, 2004)
- Designers should consider diverting sediment laden water to a temporary sediment basin or trap. (EPA, 2012)
- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 ft. at any point along the silt fence.
- 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 $ft.^2$ of ponding area should be provided for every acre draining to the fence.
- Efficiency of silt fences is primarily dependent on the detention time of the runoff behind the control. (Barrett and Malina, 2004)

- The drainage area above any fence should not exceed a quarter of an acre. (Rule of Thumb-100-feet of silt fence per 10,000 $ft.^2$ of disturbed area.) (EPA, 2012)
- The maximum length of slope draining to any point along the silt fence should be 100 ft. per ft of silt 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 draining to the silt fence is permanently stabilized, after which, the silt fence fabric and posts should be removed and properly disposed.
- J-hooks, which have ends turning up the slope to break up long runs of fence and provide multiple storage areas that work like mini-retention areas, may be used to increase the effectiveness of silt fence.
- Be aware of local regulations regarding the type and installation requirements of silt fence, which may differ from those presented in this fact sheet.

Design and Layout

In areas where high winds are anticipated the fence should be supported by a plastic or wire mesh. The geotextile fabric of the silt fence should contain ultraviolet inhibitors and stabilizers to provide longevity equivalent to the project life or replacement schedule.

- Layout in accordance with the attached figures.
- For slopes that contain a high number of rocks or large dirt clods that tend to dislodge, it may be necessary to protect silt fence from rocks (e.g., rockfall netting) ensure the integrity of the silt fence installation.

Standard vs. Heavy Duty Silt Fence

Standard Silt Fence

- Generally applicable in cases where the area draining to fence produces moderate sediment loads.

Heavy Duty Silt Fence

- Heavy duty silt fence usually has 1 or more of the following characteristics, not possessed by standard silt fence.
  - Fabric is reinforced with wire backing or additional support.
  - Posts are spaced closer than pre-manufactured, standard silt fence products.
- Use is generally limited to areas affected by high winds.
- Area draining to fence produces moderate sediment loads.

Materials

Standard Silt Fence

- Silt fence material should be woven geotextile with a minimum width of 36 in. The fabric should conform to the requirements in ASTM designation D6461.

- Wooden 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.

Heavy-Duty Silt Fence

- Some silt fence has a wire backing to provide additional support, and there are products that may use prefabricated plastic holders for the silt fence and use metal posts instead of wood stakes.

Installation Guidelines – Traditional Method

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 of the proposed silt fence (trenches should not be excavated wider or deeper than necessary for proper silt fence installation).

- 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 geotextile 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 geotextile and closer post spacing are used, the mesh support fence may be eliminated.

- Woven geotextile should be purchased in a long roll, then cut to the length of the barrier. When joints are necessary, geotextile 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 native material and compacted.

- 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.

- Cross barriers should be a minimum of 1/3 and a maximum of ½ the height of the linear barrier.

- See typical installation details at the end of this fact sheet.

Installation Guidelines - Static Slicing Method

- Static Slicing is defined as insertion of a narrow blade pulled behind a tractor, similar to a plow blade, at least 10 in. into the soil while at the same time pulling silt geotextile fabric into the ground through the opening created by the blade to the depth of the blade. Once the geotextile is installed, the soil is compacted using tractor tires.
- This method will not work with pre-fabricated, wire backed silt fence.
- Benefits:
  - Ease of installation (most often done with a 2-person crew).
  - Minimal soil disturbance.
  - Better level of compaction along fence, less susceptible to undercutting
  - Uniform installation.
- Limitations:
  - Does not work in shallow or rocky soils.
  - Complete removal of geotextile material after use is difficult.
  - Be cautious when digging near potential underground utilities.

Costs

- It should be noted that costs vary greatly across regions due to available supplies and labor costs.
- Average annual cost for installation using the traditional silt fence installation method (assumes 6 month useful life) is $7 per linear foot based on vendor research. Range of cost is $3.50 - $9.10 per linear foot.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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, and replaced with new silt fence barriers.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches 1/3 of the barrier height.

- Silt fences should be left in place until the upgradient area is permanently stabilized. Until then, the silt fence should be inspected and maintained regularly.
- Remove silt fence when upgradient areas are stabilized. Fill and compact post holes and anchor trench, remove sediment accumulation, grade fence alignment to blend with adjacent ground, and stabilize disturbed area.

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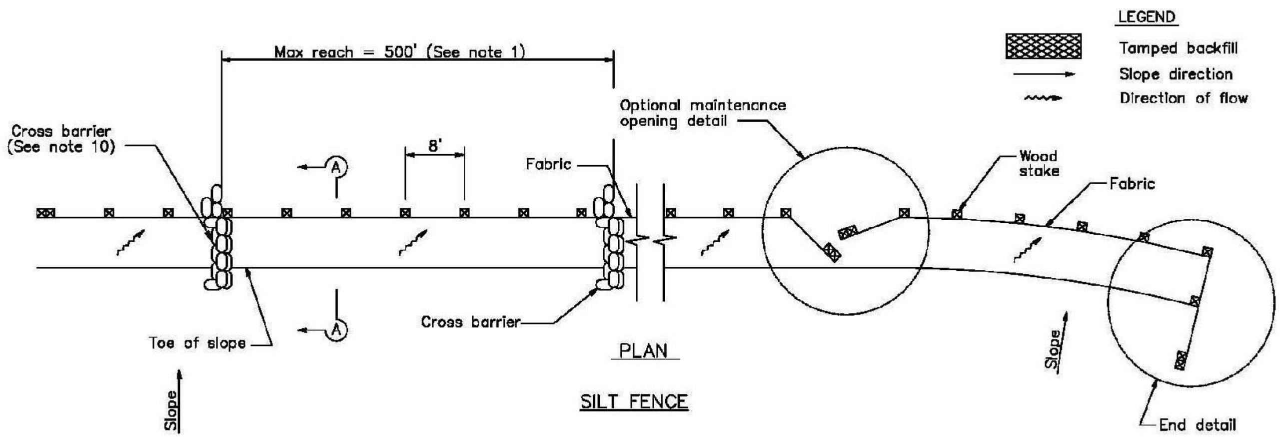
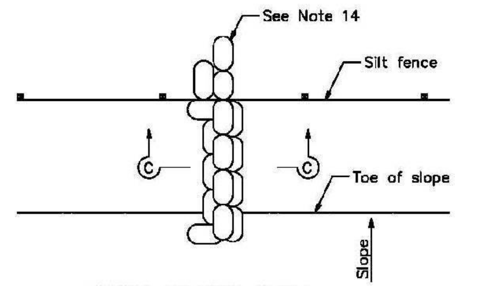
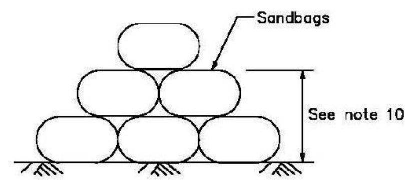


NOTES

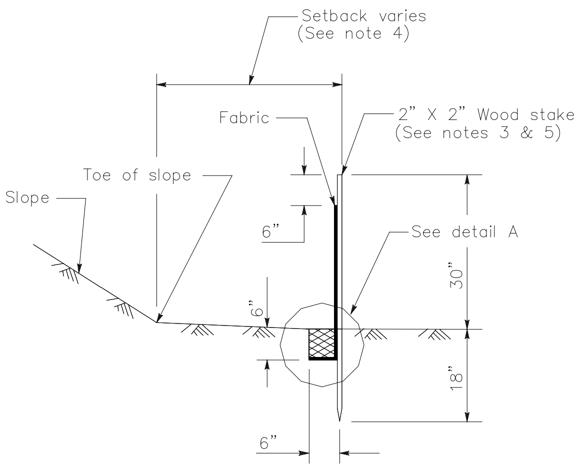
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/3 the height of the linear barrier, in no case shall the reach length exceed 500'.
2. The last 8'–0" of fence shall be turned up slope.
3. Stake dimensions are nominal.
4. Dimension may vary to 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.
14. Add 3–4 bags to cross barrier on downgradient side of silt fence as needed to prevent bypass or undermining and as allowable based on site limits of disturbance.



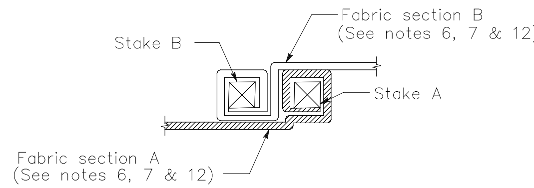
CROSS BARRIER DETAIL



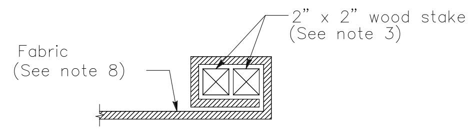
SECTION C–C



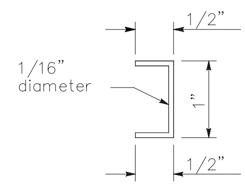
SECTION A–A



JOINING SECTION DETAIL (TOP VIEW)

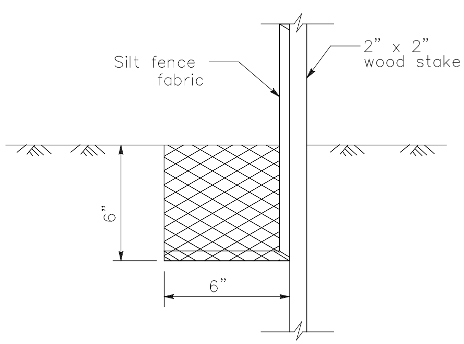


END STAKE DETAIL (TOP VIEW)

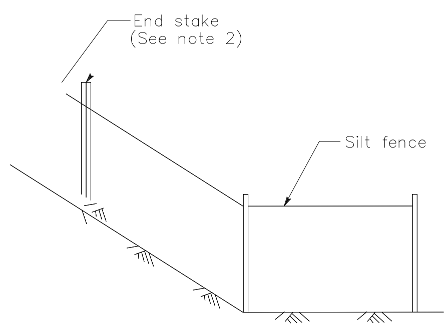


STAPLE DETAIL

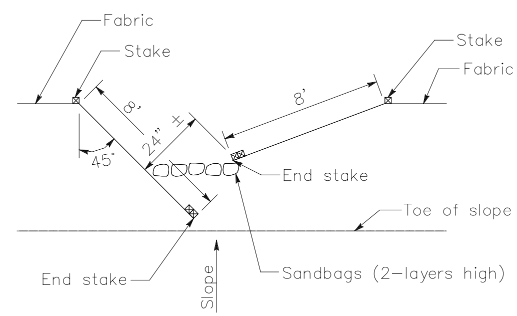
(SEE NOTE 9)



DETAIL A

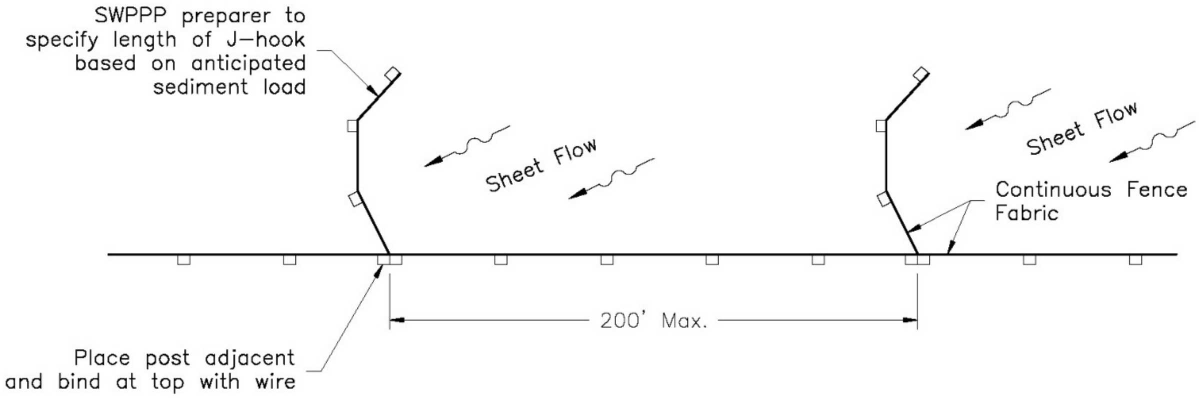


END DETAIL



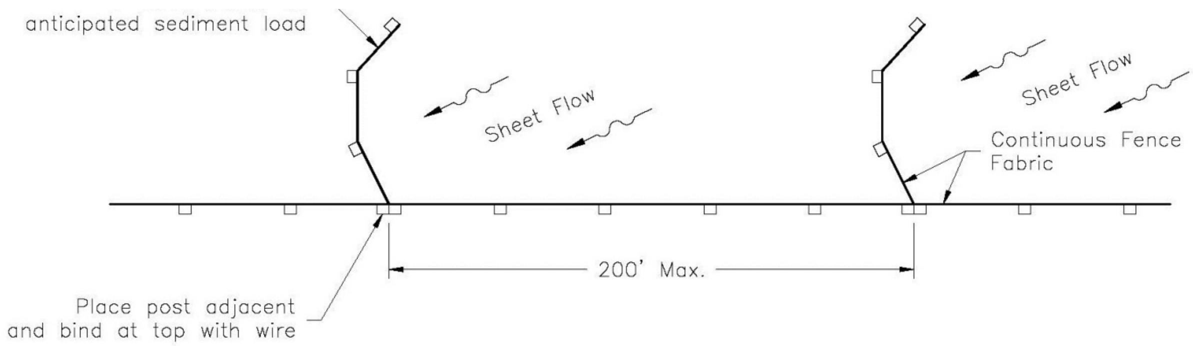
OPTIONAL MAINTENANCE OPENING DETAIL

(SEE NOTE 11)



Plan

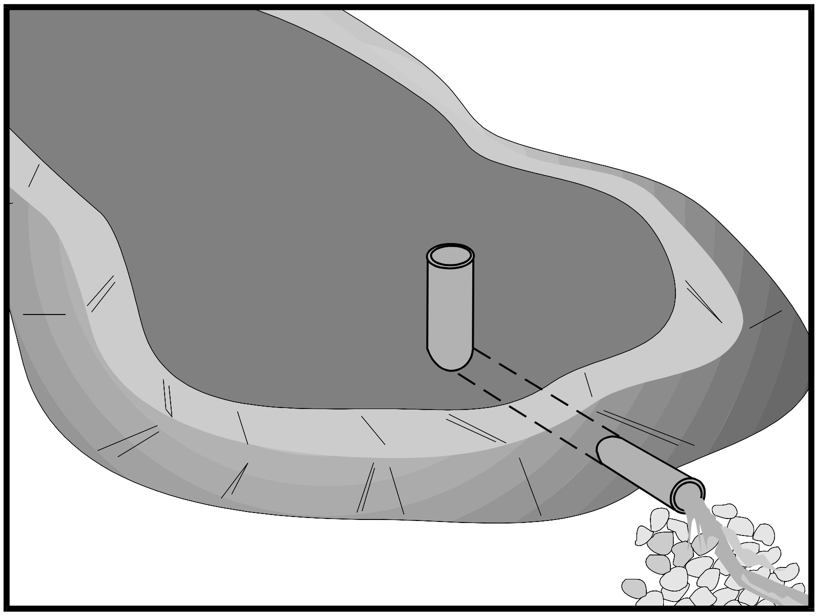
J-HOOK



Plan

J-HOOK

Sediment Basin SE-2



Categories

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 Category**

☒ **Secondary Category**

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 released.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin
- Erosion control practices to minimize disturbed areas on-site and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional (a.k.a. "physical") enhancements such as alternative outlet configurations or flow deflection baffles increase detention time and other techniques such as outlet skimmers preferentially drain flows with lower sediment concentrations. These "physical" enhancement techniques are described in this fact sheet. To further enhance sediment removal particularly at sites with fine soils or turbidity sensitive receiving waters, some projects may need to consider implementing Active Treatment Systems (ATS) whereby coagulants and flocculants are used to enhance settling and removal of suspended sediments. Guidance on implementing ATS is provided in SE-11.

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 and evaluated on a site by site basis
- 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.

- As a general guideline, sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. However, the tributary area should be evaluated on a site by site basis.
- 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 fact sheet are only effective in removing sediment down to about the silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical (or other appropriate method) treatment is used in addition to the sediment basin.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from California Department of Water Resources Division of Safety of Dams (http://www.water.ca.gov/damsafety/).

- Water that stands in sediment basins longer than 96 hours may become a source of mosquitoes (and midges), particularly along perimeter edges, in shallow zones, in scour or below-grade pools, around inlet pipes, along low-flow channels, and among protected habitats created by emergent or floating vegetation (e.g. cattails, water hyacinth), algal mats, riprap, etc.

- 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 expected to be used during active construction 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 convey runoff to the basin inlet.

Many development projects in California are 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 if properly designed and maintained can trap a significant amount of the sediment that flows into them. However, traditional basins do not remove all inflowing sediment. 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. Locations best suited for a sediment basin are generally in lower elevation areas of the site (or basin tributary area) where site drainage would not require significant diversion or other means to direct water to the basin but outside jurisdictional waterways. However, as necessary, drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). . 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 the basin in a jurisdictional 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.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft must obtain approval from the Division of Dam Safety. Local dam safety requirements may be more stringent.
- 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

When designing a sediment basin, designers should evaluate the site constraints that could affect the efficiency of the BMP. Some of these constraints include: the relationship between basin capacity, anticipated sediment load, and freeboard, available footprint for the basin, maintenance frequency and access, and hydraulic capacity and efficiency of the temporary outlet infrastructure. Sediment basins should be designed to maximize sediment removal and to consider sediment load retained by the basin as it affects basin performance.

Three Basin Design Options (Part A) are presented below along with a Typical Sediment/Detention Basin Design Methodology (Part B). Regardless of the design option that is selected, designers also need to evaluate the sediment basin capacity with respect to sediment accumulation (See "*Step 3. Evaluate the Capacity of the Sediment Basin") and* should incorporate approaches identified in "*Step 4. Other Design Considerations*" to enhance basin performance.

A) Basin Design Options:

Option 1:

Design sediment basin(s) using the standard equation:

$$A_s = \frac{1.2Q}{V_s} \qquad \text{(Eq. 1)}$$

Where:

A_s = Minimum surface area for trapping soil particles of a certain size

V_s = Settling velocity of the design particle size chosen (V_s = 0.00028 ft/s for a design particle size of 0.01 mm at 68°F)

1.2 = Factor of safety recommended by USEPA to account for the reduction in basin efficiency caused due to turbulence and other non ideal conditions.

$Q = CIA$ (Eq.2)

Where

Q = Peak basin influent flow rate measured in cubic feet per second (ft^3/s)

C = Runoff coefficient (unitless)

I = Peak rainfall intensity for the 10-year, 6-hour rain event (in/hr)

A = Area draining into the sediment basin in acres

The design particle size should 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 should be 100 percent of the calculated settling velocity.

This sizing basin method is dependent on the outlet structure design or the total basin length with an appropriate outlet. If the designer chooses to utilize the outlet structure to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a minimum of twice the basin width; the depth should 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). If the designer chooses to utilize the basin length (with appropriate basin outlet) to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a specifically designed to capture 100% of the design particle size; the depth should 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).

Basin design guidance provided herein assumes standard water properties (e.g., estimated average water temperature, kinematic viscosity, etc.) as a basis of the design. Designers can use an alternative design (Option 3) with site specific water properties as long as the design is as protective as Option 1.

The design guidance uses the peak influent flow rate to size sediment basins. Designers can use an alternative design (Option 3) with site specific average flow rates as long as the design is as protective as Option 1.

The basin should be located on the site where it can be maintained on a year-round basis and should be maintained on a schedule to retain the 2 ft of capacity.

Option 2:

Design 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 1.

Option 3:

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 1.

B) Typical Sediment/Detention Basin Design Methodology:

Design of a sediment basin requires the designer to have an understanding of the site constraints, knowledge of the local soil (e.g., particle size distribution of potentially contributing soils), drainage area of the basin, and local hydrology. Designers should not assume that a sediment basin for location A is applicable to location B. Therefore, designers can use this factsheet as guidance but will need to apply professional judgment and knowledge of the site to design an effective and efficient sediment basin. The following provides a general overview of typical design methodologies:

Step 1. Hydrologic Design

- Evaluate the site constraints and assess the drainage area for the sediment basin. Designers should consider on- and off-site flows as well as changes in the drainage area associated with site construction/disturbance. To minimize additional construction during the course of the project, the designer should consider identifying the maximum drainage area when calculating the basin dimensions.

- If a local hydrology manual is not available, it is recommended to follow standard rational method procedures to estimate the flow rate. The references section of this factsheet provides a reference to standard hydrology textbooks that can provide standard methodologies. If local rainfall depths are not available, values can be obtained from standard precipitation frequency maps from NOAA (downloaded from http://www.wrcc.dri.edu/pcpnfreq.html).

Step 2. Hydraulic Design

- Calculate the surface area required for the sediment basin using Equation 1. In which the flow rate is estimated for a 10-yr 6-hr event using rational method procedure listed in local hydrology manual and Vs is estimated using Stokes Law presented in Equation 3.

$$V_s = 2.81d^2 \qquad \text{(Eq.3)}$$

Where

V_s = Settling velocity in feet per second at 68˚F

d = diameter of sediment particle in millimeters (smallest soil grain size determined by wet sieve analysis or fine silt (0.01 mm [or 0.0004 in.])

- In general, the basin outlet design requires an iterative trial and error approach that considered the maximum water surface elevation, the elevation versus volume (stage-storage) relationship, the elevation verses basin outflow (a.k.a.-discharge) relationship, and the estimated inflow hydrograph. To adequately design the basins to settle sediment, the outlet configuration and associated outflow rates can be estimated by numerous methodologies. The following provides some guidance for design the basin outlet:

  - An outlet should have more than one orifice.

  - An outlet design typically utilizes multiple horizontal rows of orifices (approximately 3 or more) with at least 2 orifices per row (see Figures 1 and 2 at the end of this fact sheet).

- Orifices can vary in shape.
- Select the appropriate orifice diameter and number of perforations per row with the objective of minimizing the number of rows while maximizing the detention time.
- The diameter of each orifice is typically a maximum of 3-4 inches and a minimum of 0.25-0.5 inches.
- If a rectangular orifice is used, it is recommended to have minimum height of 0.5 inches and a maximum height of 6 inches.
- Rows are typically spaced at three times the diameter center to center vertically with a minimum distance of approximately 4 inches on center and a maximum distance of 1 foot on center.
- To estimate the outflow rate, each row is calculated separately based on the flow through a single orifice then multiplied by the number of orifices in the row. This step is repeated for each of the rows. Once all of the orifices are estimated, the total outflow rate versus elevation (stage-discharge curve) is developed to evaluate the detention time within the basin.
- Flow through a single orifice can be estimated using an Equation 4:

$$Q = BC'\,A(2gH)^{0.5} \qquad \text{(Eq.4)}$$

  Where
  Q = Outflow rate in ft^3/s
  C′ = Orifice coefficient (unitless)
  A = Area of the orifice (ft^2)
  g = acceleration due to gravity (ft^3/s)
  H = Head above the orifice (ft)
  B = Anticipated Blockage or clogging factor (unitless), It is dependent on anticipated sediment and debris load, trash rack configuration etc, so the value is dependent on design engineer’s professional judgment and/or local requirements (B is never greater than 1 and a value of 0.5 is generally used)

  - Care must be taken in the selection of orifice coefficient ("C′"); 0.60 is most often recommended and used. However, based on actual tests, Young and Graziano (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
- If different sizes of orifices are used along the riser then they have to be sized such that not more than 50 percent of the design storm event drains in one-third of the drawdown time (to provide adequate settling time for events smaller than the design storm event)

and the entire volume drains within 96 hours or as regulated by the local vector control agency. If a basin fails to drain within 96 hours, the basin must be pumped dry.

- Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.
- Floating Outlet Skimmer: The floating skimmer (see Figure 3 at the end of this fact sheet is an alternative outlet configuration (patented) that drains water from upper portion of the water column. This configuration has been used for temporary and permanent basins and can improve basin performance by eliminating bottom orifices which have the potential of discharging solids. Some design considerations for this alternative outlet device includes the addition of a sand filter or perforated under drain at the low point in the basin and near the floating skimmer. These secondary drains allow the basin to fully drain. More detailed guidelines for sizing the skimmer can be downloaded from http://www.fairclothskimmer.com/.
- Hold and Release Valve: An ideal sediment/detention basin would hold all flows to the design storm level for sufficient time to settle solids, and then slowly release the storm water. Implementing a reliable valve system for releasing detention basins is critical to eliminate the potential for flooding in such a system. Some variations of hold and release valves include manual valves, bladder devices or electrically operated valves. When a precipitation event is forecast, the valve would be close for the duration of the storm and appropriate settling time. When the settling duration is met (approximately 24 or 48 hours), the valve would be opened and allow the stormwater to be released at a rate that does not resuspend settled solids and in a non-erosive manner. If this type of system is used the valve should be designed to empty the entire basin within 96 hours or as stipulated by local vector control regulations.

Step 3. Evaluate the Capacity of the Sediment Basin

- Typically, sediment basins do not perform as designed when they are not properly maintained or the sediment yield to the basin is larger than expected. As part of a good sediment basin design, designers should consider maintenance cycles, estimated soil loss and/or sediment yield, and basin sediment storage volume. The two equations below can be used to quantify the amount of soil entering the basin.
- The Revised Universal Soil Loss Equation (RUSLE, Eq.5) can be used to estimate annual soil loss and the Modified Universal Soil Equation (MUSLE, Eq.6) can be used to estimate sediment yield from a single storm event.

$$A = R \times K \times LS \times C \times P \qquad \text{(Eq.5)}$$

$$Y = 95\left(Q \times q_p\right)^{0.56} \times K \times LS \times C \times P \qquad \text{(Eq.6)}$$

Where:

A = annual soil loss, tons/acre-year

R = rainfall erosion index, in 100 ft. Tons/acre.in/hr.

K = soil erodibility factor, tons/acre per unit of R

LS = slope length and steepness factor (unitless)

C = vegetative cover factor (unitless)

P = erosion control practice factor (unitless)

Y = single storm sediment yield in tons

Q = runoff volume in acre-feet

q_p = peak flow in cfs

- Detailed descriptions and methodologies for estimating the soil loss can be obtained from standard hydrology text books (See References section).

- Determination of the appropriate equation should consider construction duration and local environmental factors (soils, hydrology, etc.). For example, if a basin is planned for a project duration of 1 year and the designer specifies one maintenance cycle, RUSLE could be used to estimate the soil loss and thereby the designer could indicate that the sediment storage volume would be half of the soil loss value estimated. As an example, for use of MUSLE, a project may have a short construction duration thereby requiring fewer maintenance cycles and a reduced sediment storage volume. MUSLE would be used to estimate the anticipated soil loss based on a specific storm event to evaluate the sediment storage volume and appropriate maintenance frequency.

- The soil loss estimates are an essential step in the design, and it is essential that the designer provide construction contractors with enough information to understand maintenance frequency and/or depths within the basin that would trigger maintenance. Providing maintenance methods, frequency and specification should be included in design bid documents such as the SWPPP Site Map.

- Once the designer has quantified the amount of soil entering the basin, the depth required for sediment storage can be determined by dividing the estimated sediment loss by the surface area of the basin.

Step 4. Other Design Considerations

- Consider designing the volume of the settling zone for the total storm volume associated with the 2-year event or other appropriate design storms specified by the local agency. This volume can be used as a guide for sizing the basin without iterative routing calculations. The depth of the settling zone can be estimated by dividing the estimated 2-yr storm volume by the surface area of the basin.

- 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 basin depth must be no less than 3 ft (not including freeboard).

- 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 96 hours (also referred to as "drawdown time"). The 24-hour limit is specified to provide adequate settling time; the 96-hour limit is specified to mitigate vector control concerns.

- Confirmation of the basin performance can be evaluated by routing the design storm (10-yr 6-hr, or as directed by local regulations) through the basin based on the basin volume (stage-storage curve) and the outlet design (stage-discharge curve based on the orifice configuration or equivalent outlet design).

- 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 (or equivalent protection) on fill slopes.

  - 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, vegetation or appropriate erosion control should be used to protect the basin inlet, outlet, and slopes against erosion.

- The total depth of the sediment basin should include the depth required for sediment storage, depth required for settling zone and freeboard of at least 1 foot or as regulated by local flood control agency for a flood event specified by the local agency.

- The basin alignment should be designed such that the length of the basin is more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet. If the site topography does not allow for this configuration baffles should be installed so that the ratio is satisfied. If a basin has more than one inflow point, any inflow point that conveys more than 30 percent of the total peak inflow rate has to meet the required length to width ratio.

- An alternative basin sizing method proposed by Fifield (2004) can be consulted to estimate an alternative length to width ratio and basin configuration. These methods can be considered as part of Option 3 which allows for alternative designs that are protective or more protective of water quality.

- Baffles (see Figure 4 at the end of this fact sheet) can be considered at project sites where the existing topography or site constraints limit the length to width ratio. Baffles should be constructed of earthen berms or other structural material within the basin to divert flow in the basin, thus increasing the effective flow length from the basin inlet to the outlet riser. Baffles also reduce the change of short circuiting and allows for settling throughout the basin.

- Baffles are typically constructed from the invert of the basin to the crest of the emergency spillway (i.e., design event flows are meant to flow around the baffles and flows greater than the design event would flow over the baffles to the emergency spillway).

- Use of other materials for construction of basin baffles (such as silt fence) may not be appropriate based on the material specifications and will require frequent maintenance (maintain after every storm event). Maintenance may not be feasible when required due to flooded conditions resulting from frequent (i.e., back to back) storm events. Use of alternative baffle materials should not deviate from the intended purpose of the material, as described by the manufacturer.

- Sediment basins are best used in conjunction with erosion controls.

- 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.

- 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.

- 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.

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

The cost of a sediment basin is highly variable and is dependent of the site configuration. To decrease basin construction costs, designers should consider using existing site features such as berms or depressed area to site the sediment basin. Designers should also consider potential savings associated with designing the basin to minimize the number of maintenance cycles and siting the basin in a location where a permanent BMP (e.g., extended detention basin) is required for the project site.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level and as required by local requirements. It is recommended that at a minimum, basins be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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 basin 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 should be managed properly. The sediment should be appropriately evaluated and used or disposed of accordingly. Options include: incorporating sediment into earthwork on the site (only if there is no risk that sediment is contaminated); or off-site export/disposal at an appropriate location (e.g., sediment characterization and disposal to an appropriate landfill).

- Remove standing water from basin within 96 hours after accumulation.

- If the basin does not drain adequately (e.g., due to storms that are more frequent or larger than the design storm or other unforeseen site conditions), dewatering should be conducted in accordance with appropriate dewatering BMPs (see NS-2) and in accordance with local permits as applicable.

- 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.

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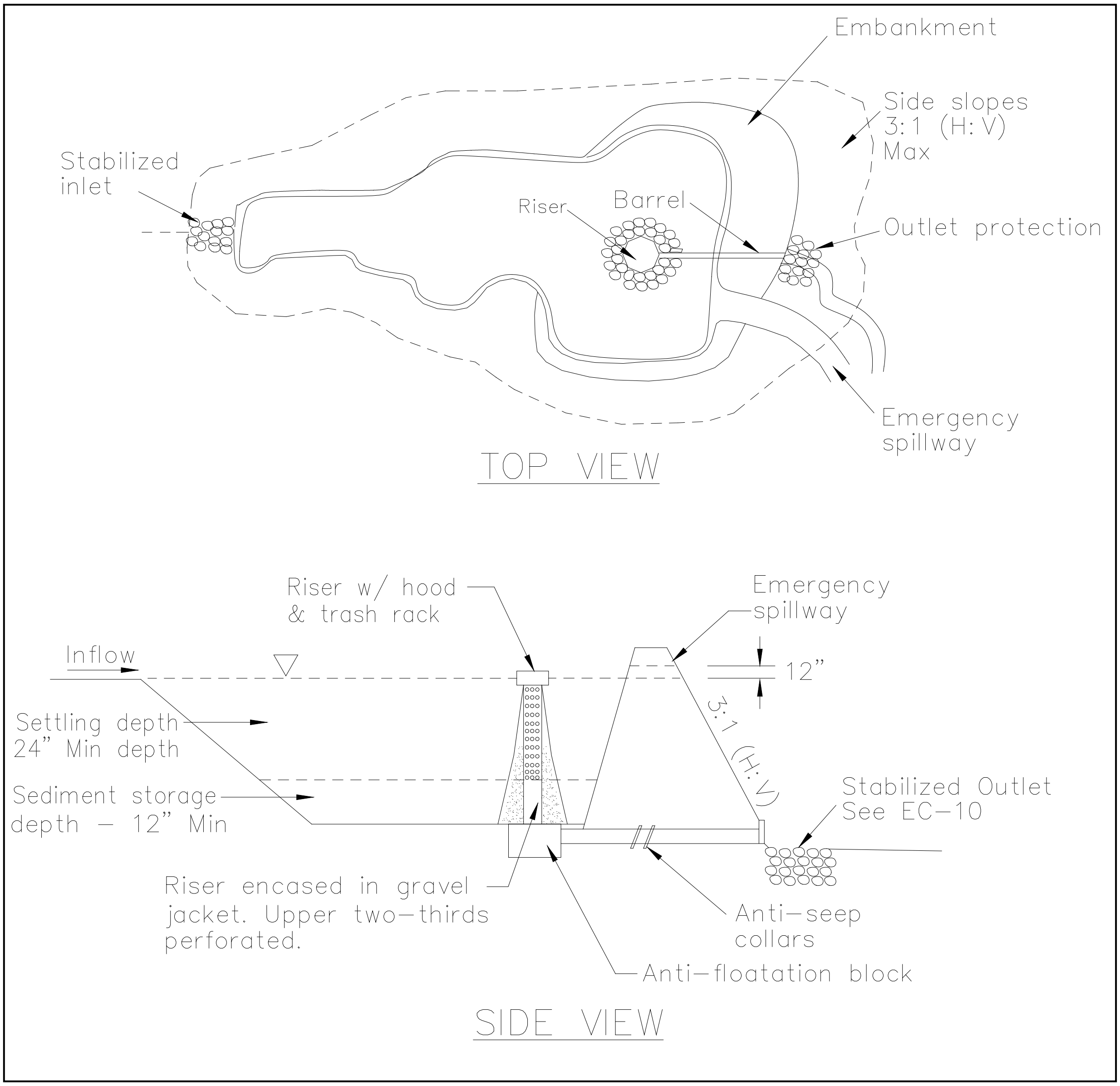


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
MULTIPLE ORIFICE DESIGN
NOT TO SCALE

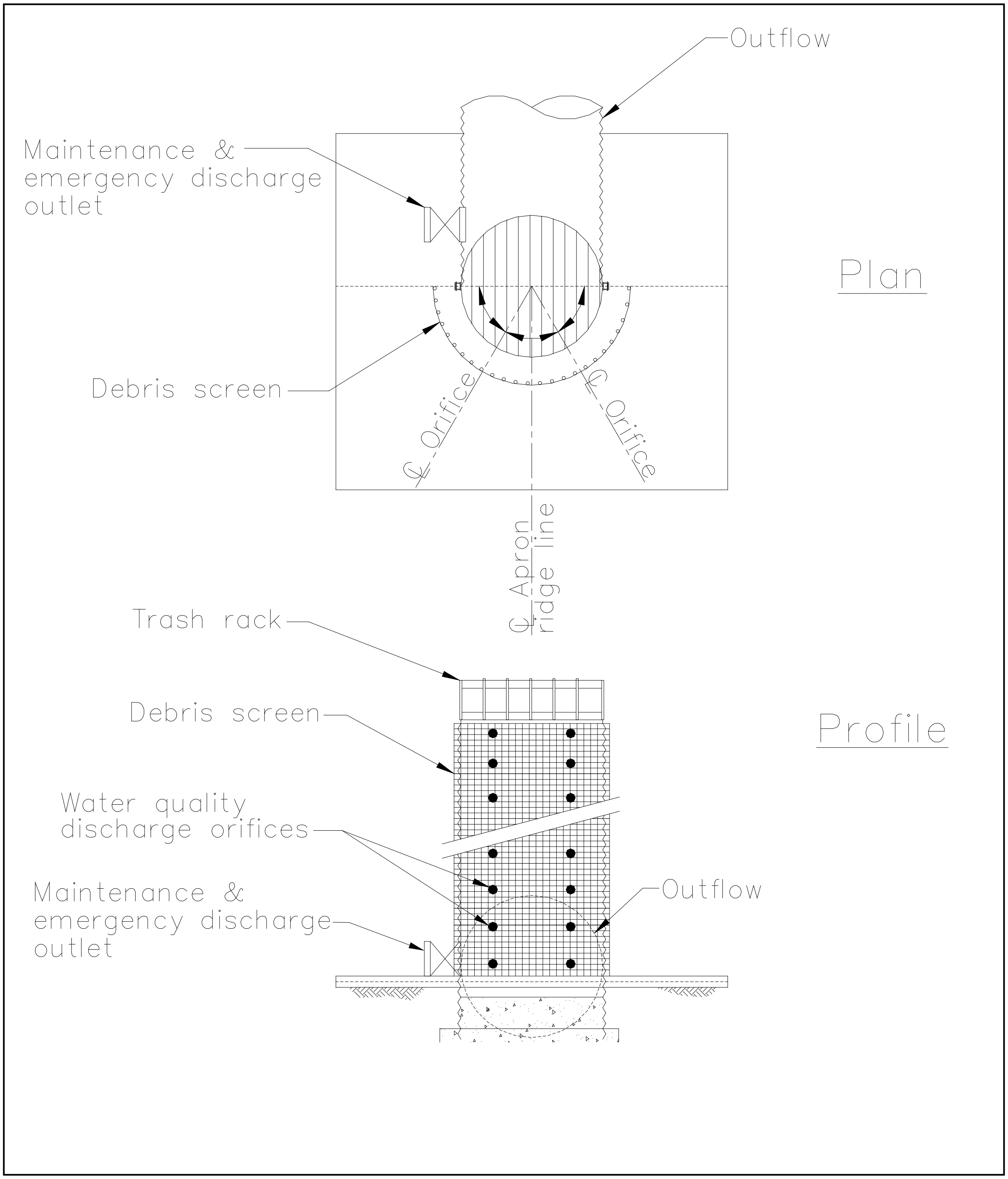
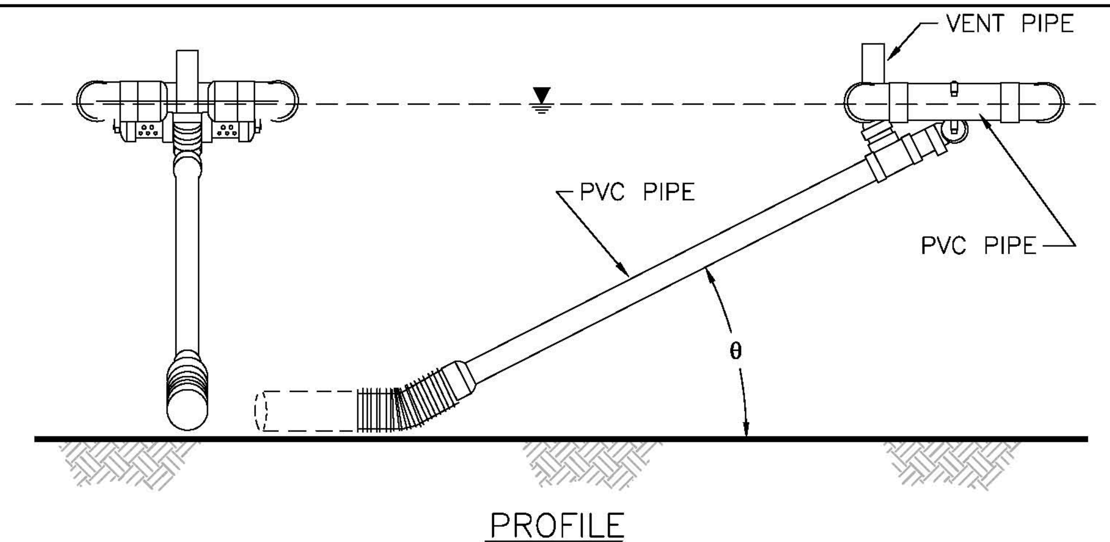


FIGURE 2: MULTIPLE ORIFICE OUTLET RISER

NOT TO SCALE



NOTES:

1. THE MOST IMPORTANT DESIGN PARAMETER IS THE CONTROL OF ORIFICE SIZE, WHICH CAN CONTROL DESIRED DEWATERING TIME. THE LONGER THE DEWATERING TIME, THE BETTER THE QUALITY OF WATER DISCHARGED FROM THE SEDIMENT BASIN.
2. DESIGN BY W. FAIRCLOTH (PATENT #5,820,751).
3. FIGURE IS MEANT TO CONVEY CONCEPT ONLY. SIZES/MATERIALS SPECIFIED DURING DETAILED DESIGN.

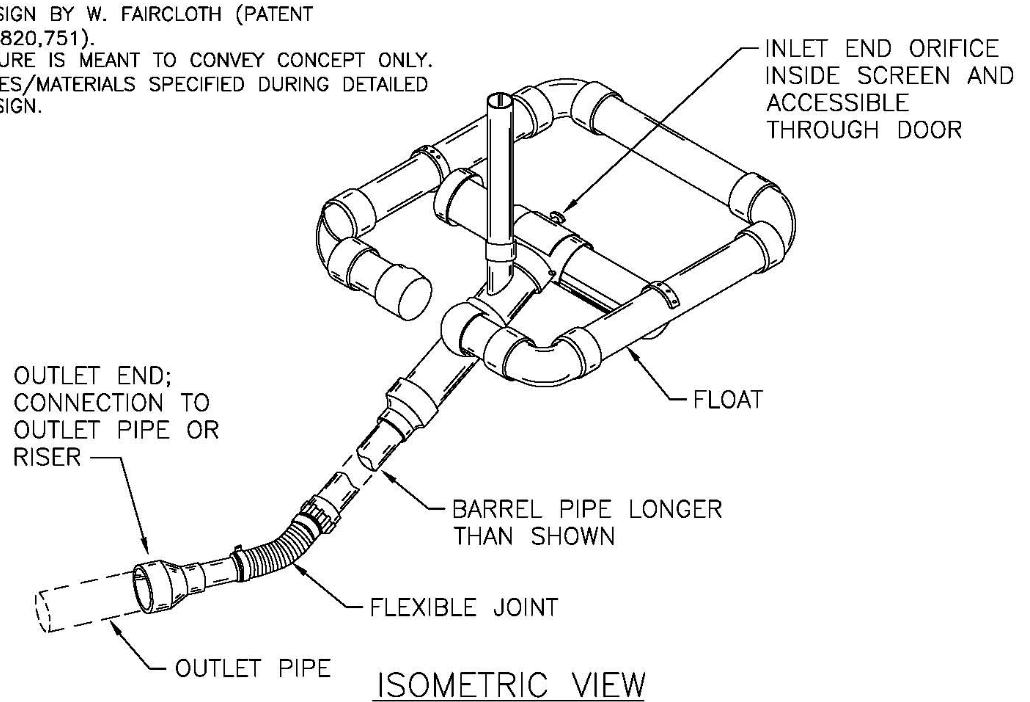


FIGURE 3: TYPICAL SKIMMER
NOT TO SCALE

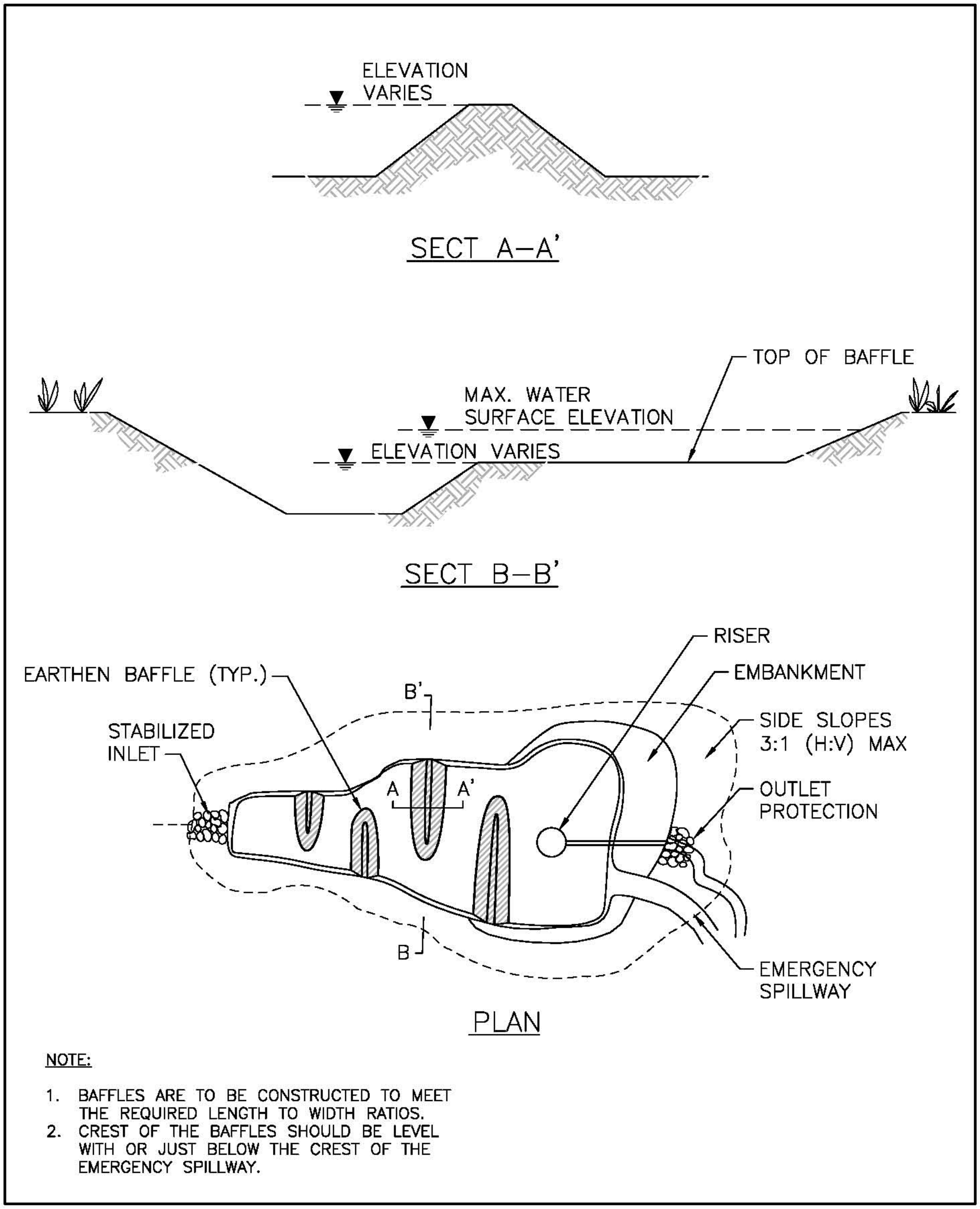
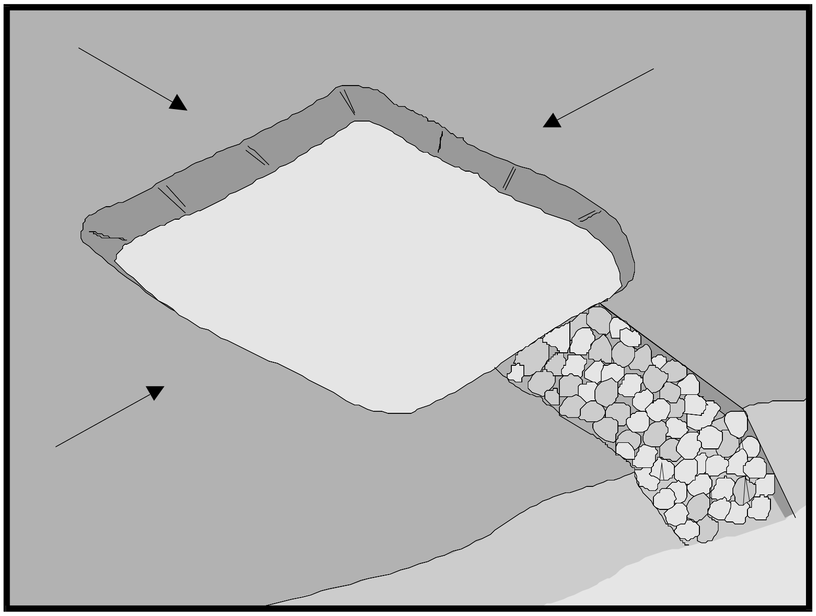


FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN
WITH BAFFLES

NOT TO SCALE



Categories

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

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 by gravity flow. Sediment traps are formed by excavating or constructing an earthen embankment across a waterway or low drainage area.

Trap design guidance provided in this fact sheet is not intended to guarantee compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment traps should be used in conjunction with a comprehensive system of BMPs.

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, 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 criterion 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 is \$15 ft^2 and plus additional costs for the design and maintenance.

Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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 96 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 per NS-2 shall be implemented at all times during dewatering activities.

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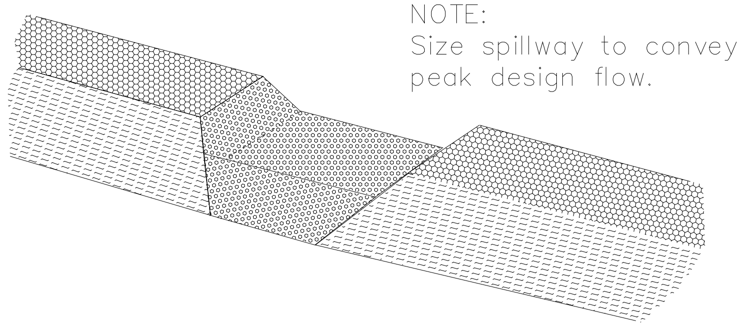
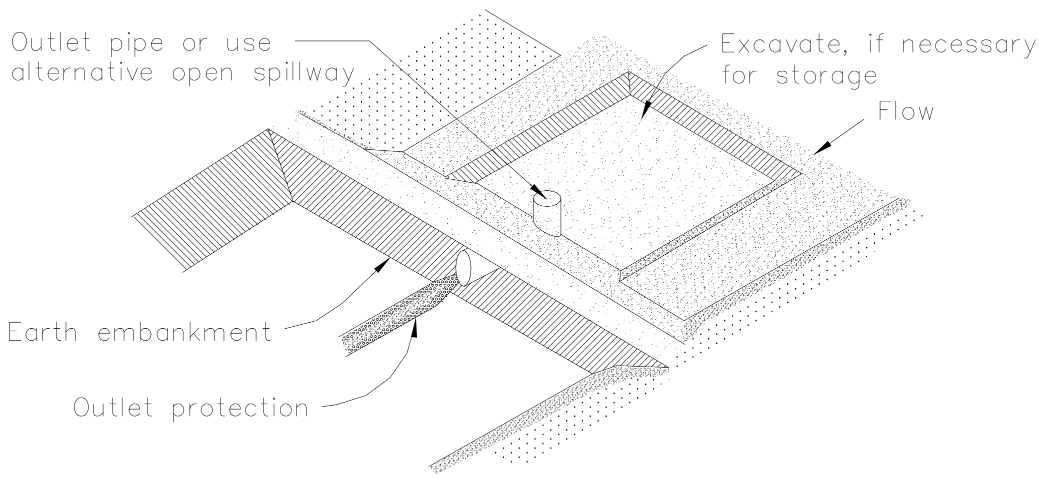
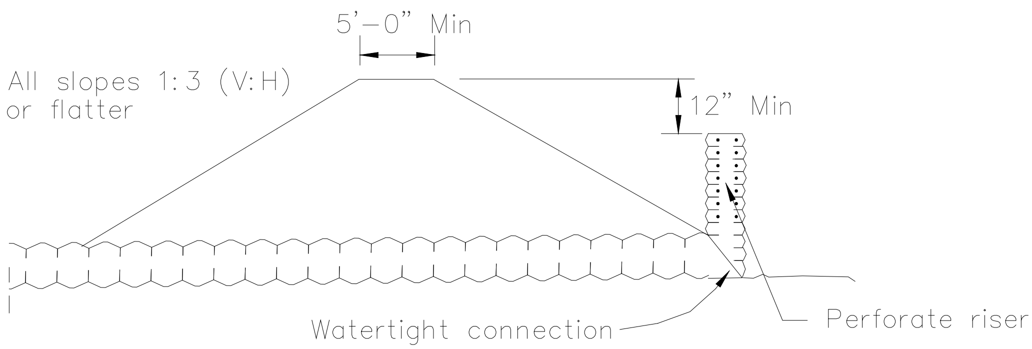


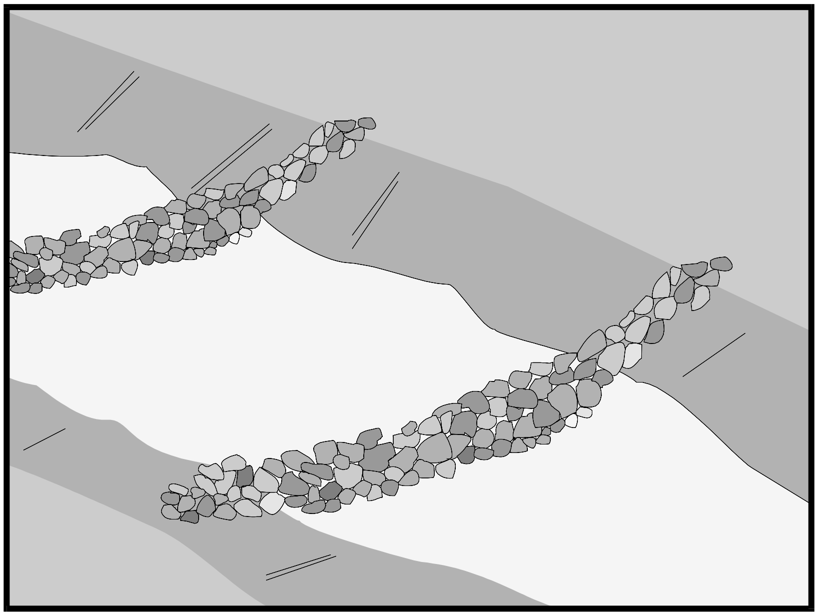
TYPICAL OPEN SPILLWAY





EMBANKMENT SECTION THRU RISER

TYPICAL SEDIMENT TRAP
NOT TO SCALE



Categories

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 Category**

☒ **Secondary Category**

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-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing scour and channel erosion by reducing flow velocity and increasing residence time within the channel, allowing sediment to settle.

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.
- To act as a grade control structure.

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 potential or sediment-laden flow 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.
- Do not construct check dams with straw bales or silt fence.
- Water suitable for mosquito production may stand behind check dams, particularly if subjected to daily non-stormwater discharges.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Using check dams to reduce channel slope reduces the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Thus, check dams are dual-purpose and serve an important role as erosion controls as well as sediment controls. Note that use of 1-2 isolated 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 should 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, either:

- Don't use check dams. Consider alternative BMPs, or.
- 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 (see "Spacing Between Check Dams" detail at the end of this fact sheet). The center section of the dam should be lower than the edge sections (at least 6 inches), acting as a spillway, so that the check dam will direct flows to the center of the ditch or swale (see "Typical Rock Check Dam" detail at the end of this fact sheet). Bypass or side-cutting can occur if a sufficient spillway is not provided in the center of the dam.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products can also be used as check dams (e.g. HDPE check dams, temporary silt dikes (SE-12)), 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. 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 should completely span the ditch or swale to prevent washout. The rock used should be large enough to stay in place given the expected design flow through the channel. It is recommended that abutments be extended 18 in. into the channel bank. Rock can be graded such that smaller diameter rock (e.g. 2-4 in) is located on the upstream side of larger rock (holding the smaller rock in place); increasing residence time.

Log check dams are usually constructed of 4 to 6 in. diameter logs, installed vertically. 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.

See fiber rolls, SE-5, for installation of fiber roll check dams.

Gravel bag and sand bag 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 (see "Gravel Bag Check Dam" detail at the end of this fact sheet).

Manufactured products, such as temporary silt dikes (SE-12), should be installed in accordance with the manufacturer's instructions. Installation typically requires anchoring or trenching of products, as well as regular maintenance to remove accumulated sediment and debris.

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.
- For multiple check dam installation, 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 should 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.

Materials

- Rock used for check dams should typically be 8-12 in rock and be sufficiently sized to stay in place given expected design flows in the channel. Smaller diameter rock (e.g. 2 to 4 in) can be placed on the upstream side of larger rock to increase residence time.

- 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.

- Temporary silt dikes used for check dams should conform to SE-12, Temporary Silt Dikes.

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 (pyramid approach). Gravel bags and sandbags should not be stacked any higher than 3 ft.

- Upper rows or gravel and sand bags shall overlap joints in lower rows.

- Fiber rolls should be trenched in, backfilled, and firmly staked in place.

- Install along a level contour.

- HDPE check dams, temporary silt dikes, and other manufactured products should be used and installed per manufacturer specifications.

Costs

Cost consists of labor costs if materials are readily available (such as gravel on-site). If material must be imported, costs will increase. For other material and installation costs, see SE-5, SE-6, SE-8, SE-12, and SE-14.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Replace missing rock, bags, rolls, etc. Replace bags or rolls that have degraded or have become damaged.

- If the check dam is used as a sediment capture device, sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- 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.
- Inspect areas behind check dams for pools of standing water, especially if subjected to daily non-stormwater discharges.
- Remove accumulated sediment prior to permanent seeding or soil stabilization.
- Remove check dam and accumulated sediment when check dams are no longer needed.

References

Draft – Sedimentation and Erosion Control, and Inventory of Current Practices, USEPA, April 1990.

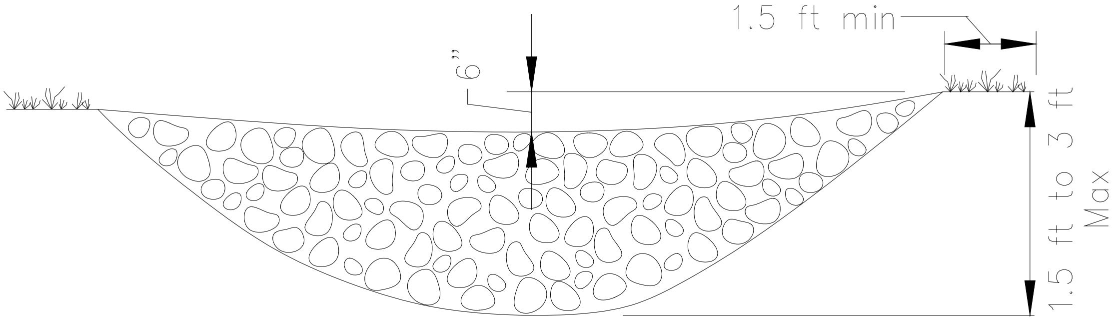
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

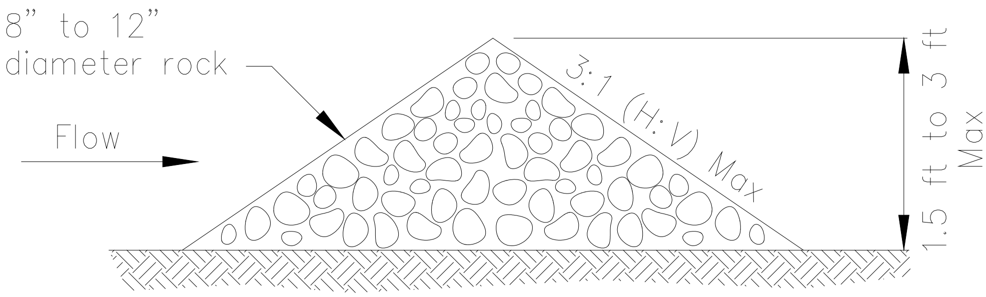
Stormwater Management of the Puget Sound Basin, Technical Manual, Publication #91-75, Washington State Department of Ecology, February 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Metzger, M.E. 2004. Managing mosquitoes in stormwater treatment devices. University of California Division of Agriculture and Natural Resources, Publication 8125. On-line: http://anrcatalog.ucdavis.edu/pdf/8125.pdf

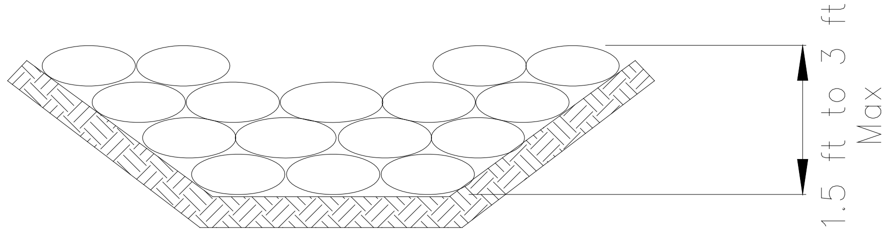


ELEVATION

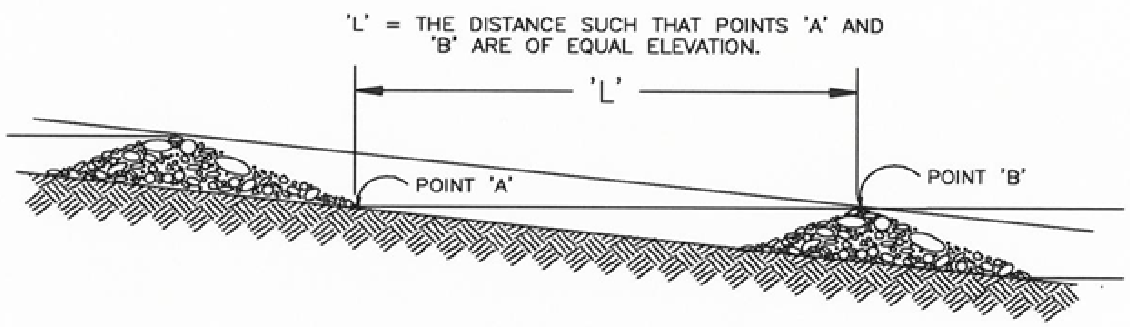


TYPICAL ROCK CHECK DAM SECTION

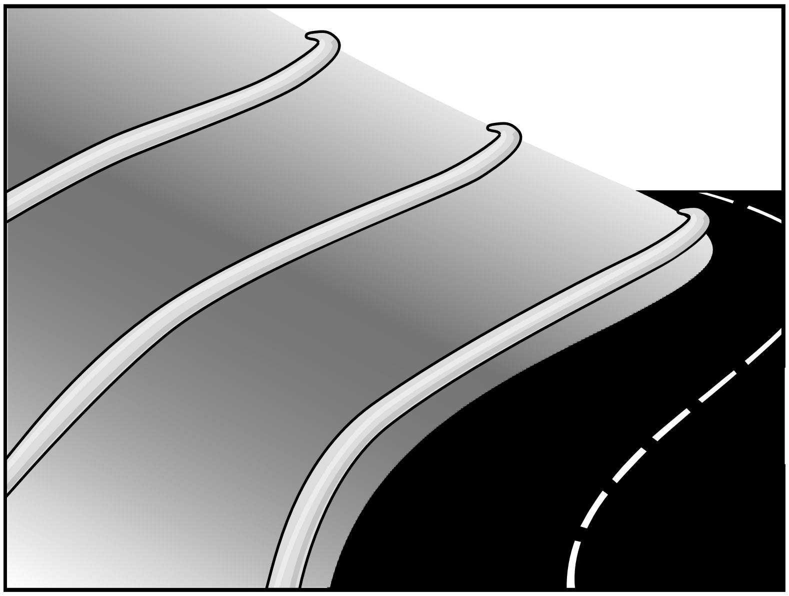
ROCK CHECK DAM
NOT TO SCALE



GRAVEL BAG CHECK DAM ELEVATION
NOT TO SCALE



SPACING BETWEEN CHECK DAMS



Categories

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 Category**

☒ **Secondary Category**

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-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

Description and Purpose

A fiber roll (also known as wattles or logs) consists of straw, coir, curled wood fiber, or other biodegradable materials bound into a tight tubular roll wrapped by plastic netting, which can be photodegradable, or natural fiber, such as jute, cotton, or sisal. Additionally, gravel core fiber rolls are available, which contain an imbedded ballast material such as gravel or sand for additional weight when staking the rolls are not feasible (such as use as inlet protection). When fiber rolls are placed at the toe and on the face of slopes along the contours, they intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide removal of sediment from the runoff (through sedimentation). By interrupting the length of a slope, fiber rolls can also reduce sheet and rill erosion until vegetation is established.

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 with minimal grade.
- Down-slope of exposed soil areas.

- At operational storm drains as a form of inlet protection.

- Around temporary stockpiles.

Limitations

- Fiber rolls should be used in conjunction with erosion control, such as hydroseed, RECPs, etc.

- Only biodegradable fiber rolls containing no plastic can remain on a site applying for a Notice of Termination due to plastic pollution and wildlife concerns (State Water Board, 2016). Fiber rolls containing plastic that are used on a site must be disposed of for final stabilization.

- Fiber rolls are not effective unless trenched in and staked. If not properly staked and trenched in, fiber rolls will not work as intended and could be transported by high flows.

- Not intended for use in high flow situations (i.e., for concentrated flows).

- Difficult to move once saturated.

- Fiber rolls have a limited sediment capture zone.

- Fiber rolls should not be used on slopes subject to creep, slumping, or landslide.

- Rolls typically function for 12-24 months, depending upon local conditions and roll material.

Implementation

Fiber Roll Materials

- Fiber rolls should be prefabricated.

- Fiber rolls may come manufactured containing polyacrylamide (PAM), a flocculating agent within the roll. Fiber rolls impregnated with PAM provide additional sediment removal capabilities and should be used in areas with fine, clayey or silty soils to provide additional sediment removal capabilities. Monitoring may be required for these installations.

- Fiber rolls are made from weed-free rice straw, flax, curled wood fiber, or coir bound into a tight tubular roll by netting or natural fiber (see *Limitations* above regarding plastic netting).

- Typical fiber rolls vary in diameter from 6 in. to 20 in. Larger diameter rolls are available as well. The larger the roll, the higher the sediment retention capacity.

- Typical fiber rolls lengths are 4, 10, 20 and 25 ft., although other lengths are likely available.

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).

- Prepare the slope before beginning installation.

- Dig small trenches across the slope on the contour. The trench depth should be ¼ to 1/3 of the thickness of the roll, and the width should equal the roll diameter, in order to provide area to backfill the trench.

- It is critical that rolls are installed perpendicular to water movement, and parallel to the slope contour.

- Start building trenches and installing rolls from the bottom of the slope and work up.

- It is recommended that pilot holes be driven through the fiber roll. Use a straight bar to drive holes through the roll and into the soil for the wooden stakes.

- Turn the ends of the fiber roll up slope to prevent runoff from going around the roll.

- Stake fiber rolls into the trench.

  - 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.

- See typical fiber roll installation details at the end of this fact sheet.

Removal

- Fiber rolls can be left in place or removed depending on the type of fiber roll and application (temporary vs. permanent installation). Fiber rolls encased with plastic netting or containing any plastic material will need to be removed from the site for final stabilization. Fiber rolls used in a permanent application are to be encased with a non-plastic material and are left in place. Removal of a fiber roll used in a permanent application can result in greater disturbance; therefore, during the BMP planning phase, the areas where fiber rolls will be used on final slopes, only fiber rolls wrapped in non-plastic material should be selected.

- Temporary installations should only be removed when up gradient areas are stabilized per General Permit requirements, and/or pollutant sources no longer present a hazard. But they should also be removed before vegetation becomes too mature so that the removal process does not disturb more soil and vegetation than is necessary.

Costs

Material costs for straw fiber rolls range from $26 - $38 per 25-ft. roll[1] and curled wood fiber rolls range from $30 - $40 per roll[2].

Material costs for PAM impregnated fiber rolls range between $9.00-$12.00 per linear foot, based upon vendor research[1] .

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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 should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-third the designated sediment storage depth.

- If fiber rolls are used for erosion control, such as in a 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.

- Repair any rills or gullies promptly.

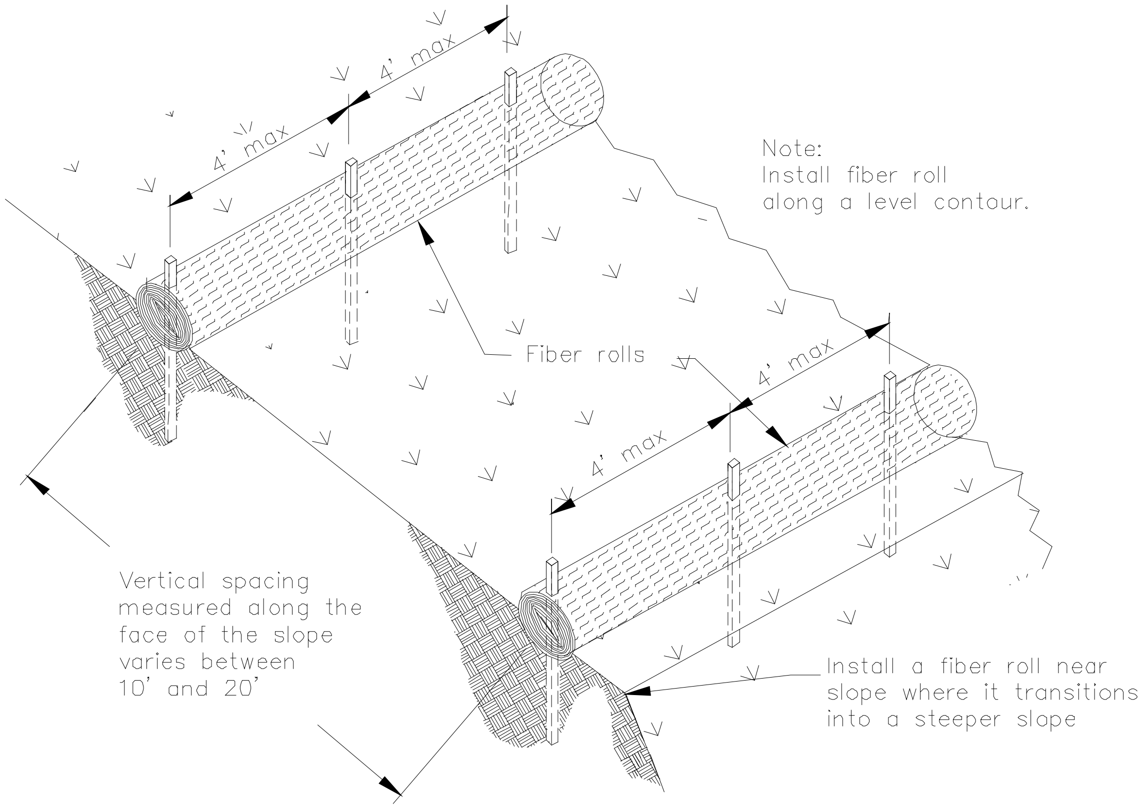
References

General Construction – Frequently Asked Questions, Storm Water Program website, State Water Resources Control Board, 2009 updated in 2016. Available online at: http://www.waterboards.ca.gov/water_issues/programs/stormwater/gen_const_faq.shtml.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

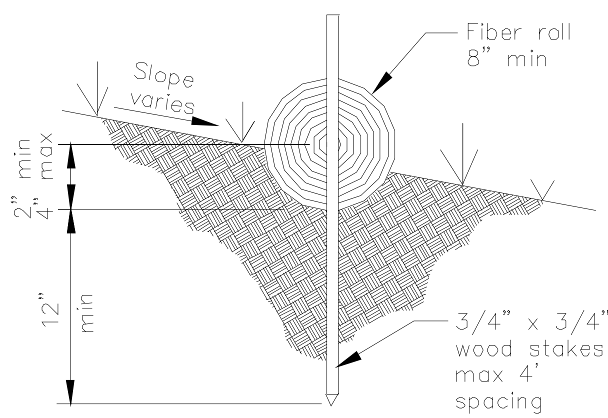
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

[1] Adjusted for inflation (2016 dollars) by Tetra Tech, Inc.
[2] Costs estimated based on vendor query by Tetra Tech, Inc. 2016.



TYPICAL FIBER ROLL INSTALLATION

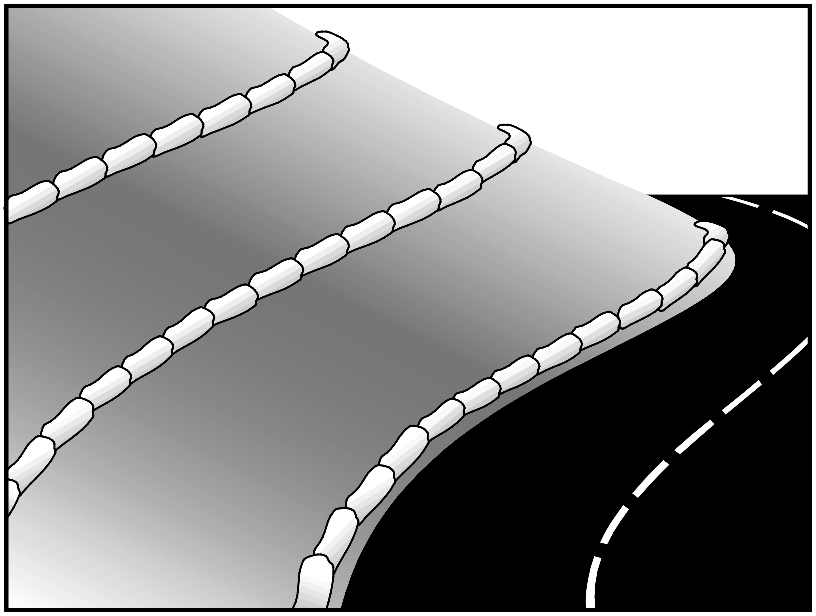
N.T.S.



ENTRENCHMENT DETAIL

N.T.S.

Gravel Bag Berm SE-6



Categories

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 Category**

☒ **Secondary Category**

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-12 Temporary Silt Dike

SE-14 Biofilter Bags

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 flow, 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 a 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 chevrons (small check dams) across mildly sloped construction roads. For use check dam use in channels, see SE-4, Check Dams.

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 berm, possibly causing flooding if sufficient space does not exist.

- Degraded gravel bags may rupture when removed, spilling contents.

- Installation can be labor intensive.

- Durability of gravel bags is somewhat limited, and bags may need to be replaced when installation is required for longer than 6 months.

- Easily damaged by construction equipment.

- 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 allows 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. Generally, gravel bag berms should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate gravel bag berms on level contours.

- When used for slope interruption, the following slope/sheet flow length combinations apply:

  - Slope inclination of 4:1 (H:V) or flatter: Gravel bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.

  - Slope inclination between 4:1 and 2:1 (H:V): Gravel bags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

Slope inclination 2:1 (H:V) or greater: Gravel bags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row near 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, gravel bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the gravel bag barrier may be constructed on the toe of the slope. 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 (H:V) 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 (H:V) or flatter.
- Butt ends of bags tightly.
- On multiple row, or multiple layer construction, overlap 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. Crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.

Costs

Material costs for gravel bags are average and are dependent upon material availability. $3.20-$3.80 per filled gravel bag is standard based upon vendor research (Adjusted for inflation, 2016 dollars, by Tetra Tech, Inc.).

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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 should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Remove gravel bag berms when no longer needed and recycle gravel fill whenever possible and properly dispose of bag material. Remove sediment accumulation and clean, re-grade, and stabilize the area.

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), March 2003.

Stormwater Pollution Plan Handbook, First Edition, State of California, Department of Transportation Division of New Technology, Materials and Research, October 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Street Sweeping and Vacuuming SE-7

Categories		
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

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).

- Sweeping may be less effective for fine particle soils (i.e., clay).

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.

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

- 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 $ 650/day to $2,500/day[1], 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.

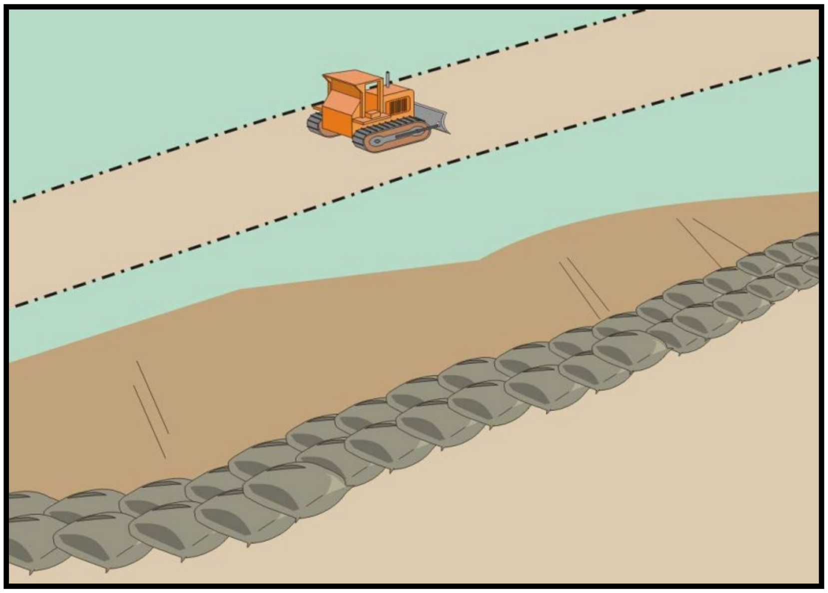
Inspection and Maintenance

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.

[1] Based on contractor query conducted by Tetra Tech, Inc. November 2016.



Categories

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Legend:

☑ **Primary Category**

☒ **Secondary Category**

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-12 Manufactured Linear Sediment Controls

SE-14 Biofilter Bags

Description and Purpose

A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept or to divert sheet flows. Sandbag barriers placed on a level contour pond sheet flow runoff, allowing sediment to settle out.

Suitable Applications

Sandbag barriers may be a suitable control measure for the applications described below. It is important to consider that sand bags are less porous than gravel bags and ponding or flooding can occur behind the barrier. Also, sand is easily transported by runoff if bags are damaged or ruptured. The SWPPP Preparer should select the location of a sandbag barrier with respect to the potential for flooding, damage, and the ability to maintain the BMP.

- 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

- It is necessary to limit the drainage area upstream of the barrier to 5 acres.
- Sandbags are not intended to be used as filtration devices.
- Easily damaged by construction equipment.
- Degraded sandbags may rupture when removed, spilling sand.
- Installation can be labor intensive.
- Durability of sandbags is somewhat limited, and bags will need to be replaced when there are signs of damage or wear.
- 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 allows sediment to settle. Sand-filled bags have limited porosity, which is further limited as the fine sand tends to quickly plug with sediment, limiting or completely blocking 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-14, Biofilter Bags. 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 gravel bag berms, but less porous. Generally, sandbag barriers should be used in conjunction with temporary soil stabilization controls up slope to provide effective erosion and sediment control.

Design and Layout

- Locate sandbag barriers on a level contour.
- When used for slope interruption, the following slope/sheet flow length combinations apply:
  - Slope inclination of 4:1 (H:V) or flatter: Sandbags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.
  - Slope inclination between 4:1 and 2:1 (H:V): Sandbags should be placed at a maximum interval of 15 ft. (a closer spacing is more effective), with the first row near the slope toe.

  - Slope inclination 2:1 (H:V) or greater: Sandbags should be placed at a maximum interval of 10 ft. (a closer spacing is more effective), with the first row 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, sand bag barriers should be set back from the slope toe to facilitate cleaning. Where specific site conditions do not allow for a set-back, the sand bag barrier may be constructed on the toe of the slope. 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.

- Butt ends of bags tightly.

- Overlap 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 (H:V) 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 (H:V) or flatter.

- See typical sandbag barrier installation details at the end of this fact sheet.

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 is not an acceptable substitute, as sand can more easily mobilize out of burlap.

- ***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 3 (Caltrans Standard Specification, Section 25) or similar permeable material free from clay and deleterious material, such as recycled concrete or asphalt.

Costs

Empty sandbags cost \$0.25 - \$0.75. Average cost of fill material is \$8 per yd^3. Additional labor is required to fill the bags. Pre-filled sandbags are more expensive at \$1.50 - \$2.00 per bag. These costs are based upon vendor research.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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 behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

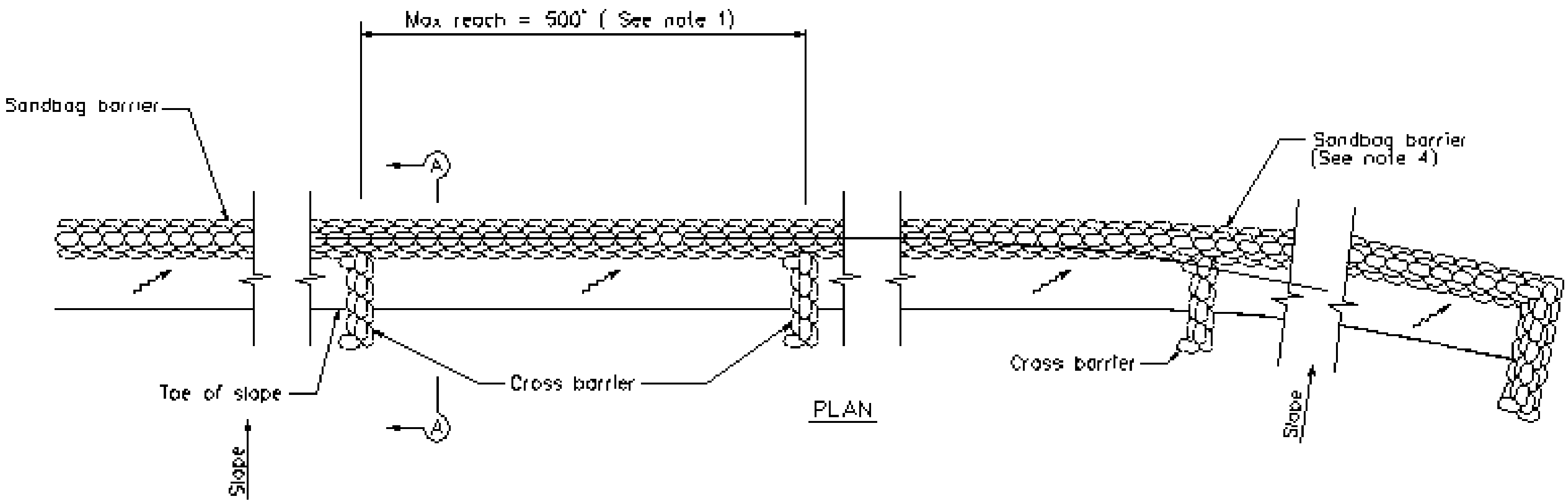
- Remove sandbags when no longer needed and recycle sand fill whenever possible and properly dispose of bag material. Remove sediment accumulation, and clean, re-grade, and stabilize the area.

References

Standard Specifications for Construction of Local Streets and Roads, California Department of Transportation (Caltrans), July 2002.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

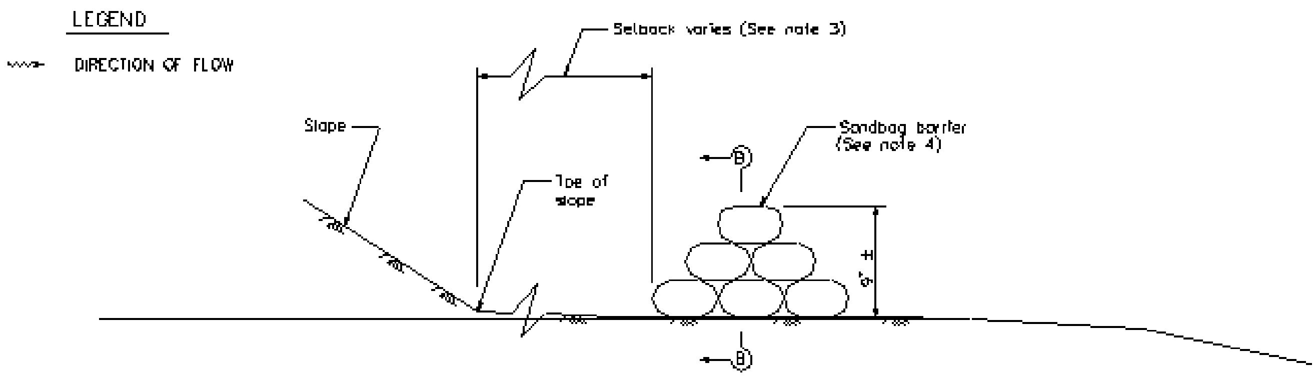
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



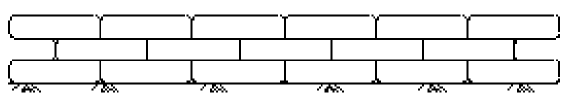
SANDBAG BARRIER

NOTES

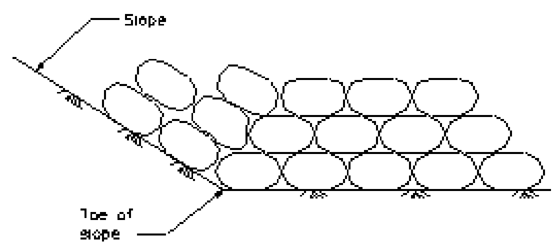
1. Construct the length of each reach so that the change in base elevation along the reach does not exceed 1/2 the height of the linear barrier. In no case shall the reach length exceed 500'.
2. Place sandbags tightly
3. Dimension may vary to fit field condition.
4. Sandbag barrier shall be a minimum 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.



SECTION A-A



SECTION B-B



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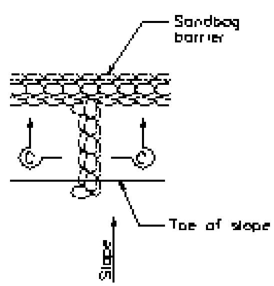
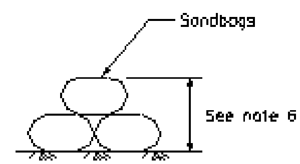
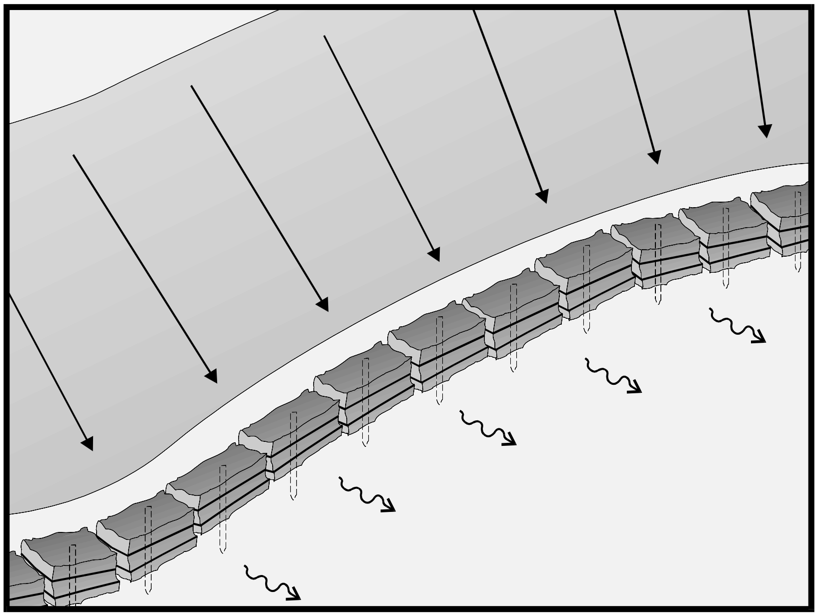


CROSS BARRIER DETAIL



SECTION C-C



Categories

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

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-12 Temporary Silt Dike

SE-14 Biofilter Bags

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 in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

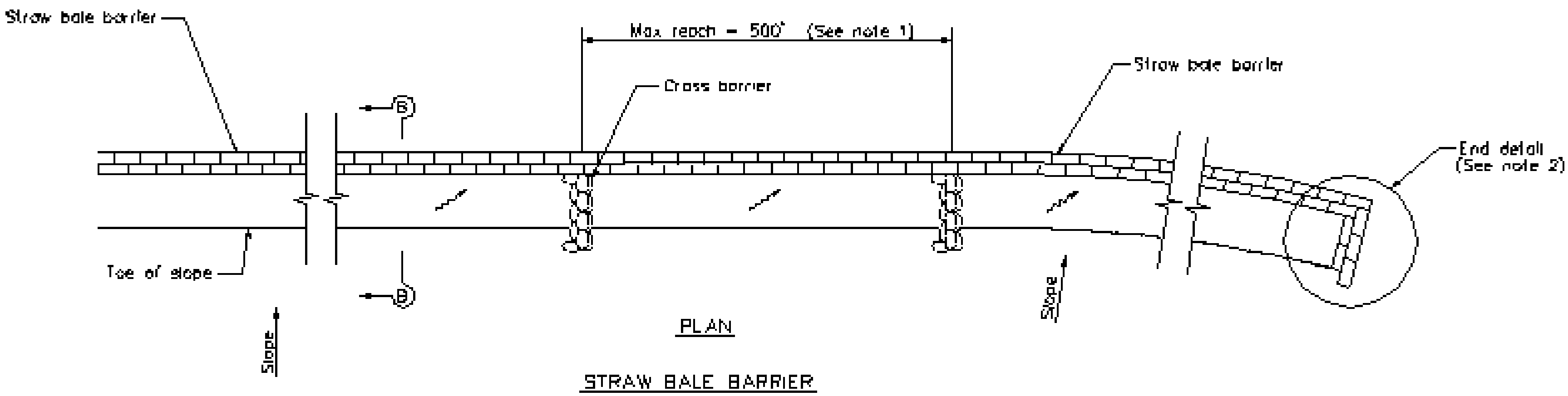
- Repair washouts or other damages as needed.

- 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.

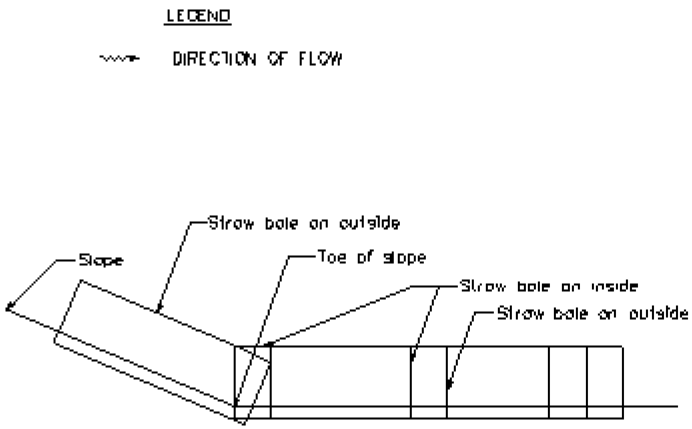


NOTES

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.

LEGEND

DIRECTION OF FLOW



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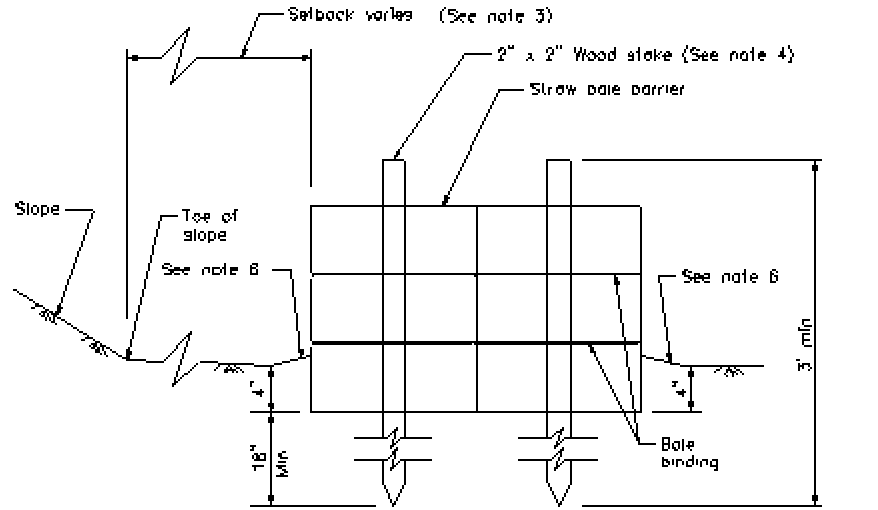
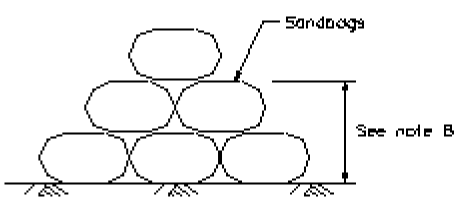
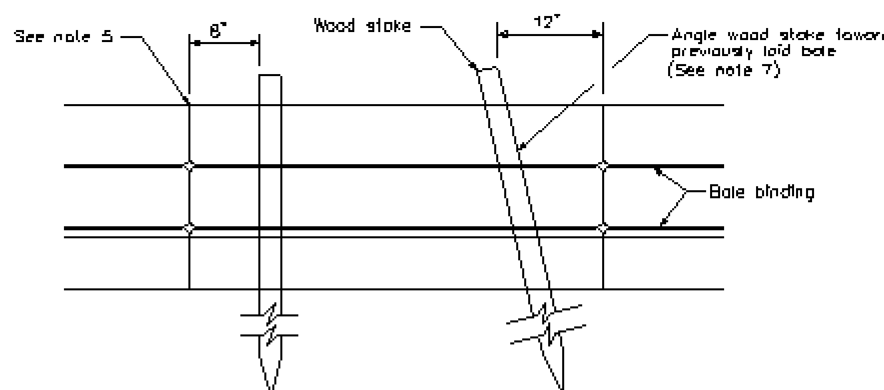


SECTION B-B

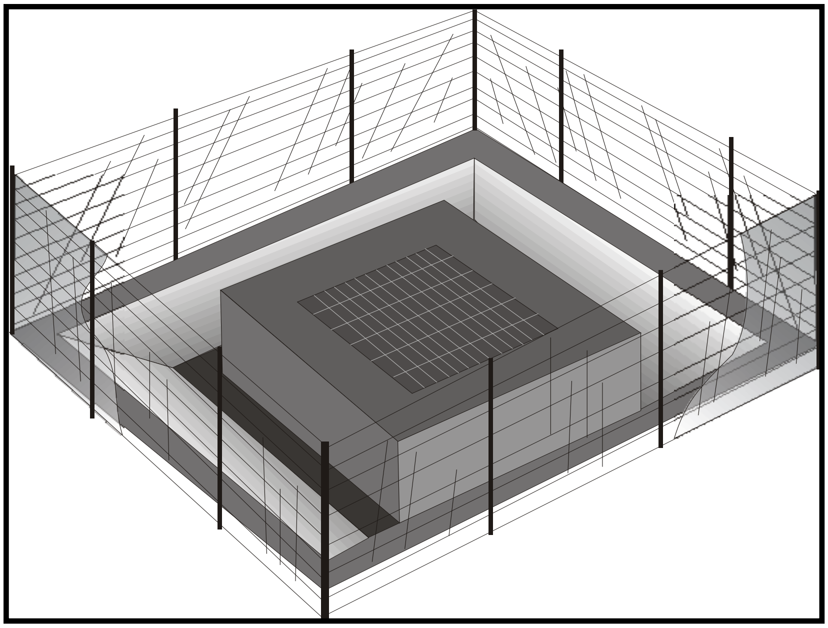


SANDBAG CROSS BARRIER



PROFILE

Storm Drain Inlet Protection SE-10



Categories

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 Category**

☒ **Secondary Category**

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-14 Biofilter Bags

SE-13 Compost Socks and Berms

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, 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. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

- Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.
- Sediment removal may be inadequate to prevent sediment discharges 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.
- Limit drainage area to 1 acre maximum. 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

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 and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

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.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - 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.
- Seven types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.

- Silt 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.

- Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.

- Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.

- Compost Socks: Allow filtered run-off to pass through the compost while retaining sediment and potentially other pollutants (SE-13). Appropriate for flows under 1.0 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 - Silt Fence -*** Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.

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 should 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 -*** 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. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag -*** 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. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.

  2. Leave room upstream of barrier for water to pond and sediment to settle.

  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.

  4. 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 -*** Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  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 woven geotextile 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.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable, and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.

    2. Biofilter bags should be placed around inlets to intercept runoff flows.

    3. All bag joints should overlap by 6 in.

    4. Leave room upstream for water to pond and for sediment to settle out.

    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

- ***DI Protection Type 7 – Compost Socks*** – A compost sock can be assembled on site by filling a mesh sock (e.g., with a pneumatic blower). Compost socks do not require special trenching compared to other sediment control methods (e.g., silt fence). Compost socks should conform to specification detailed in SE-13, Compost Socks and Berms.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one-year useful life) is $200 per inlet.

- Temporary geotextile inserts are proprietary, and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.

- See SE-13 for Compost Sock cost information.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Silt 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. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.

- Gravel Filters. If the gravel becomes clogged with sediment, it should 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 should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.

- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.

- Remove storm drain inlet protection once the drainage area is stabilized.

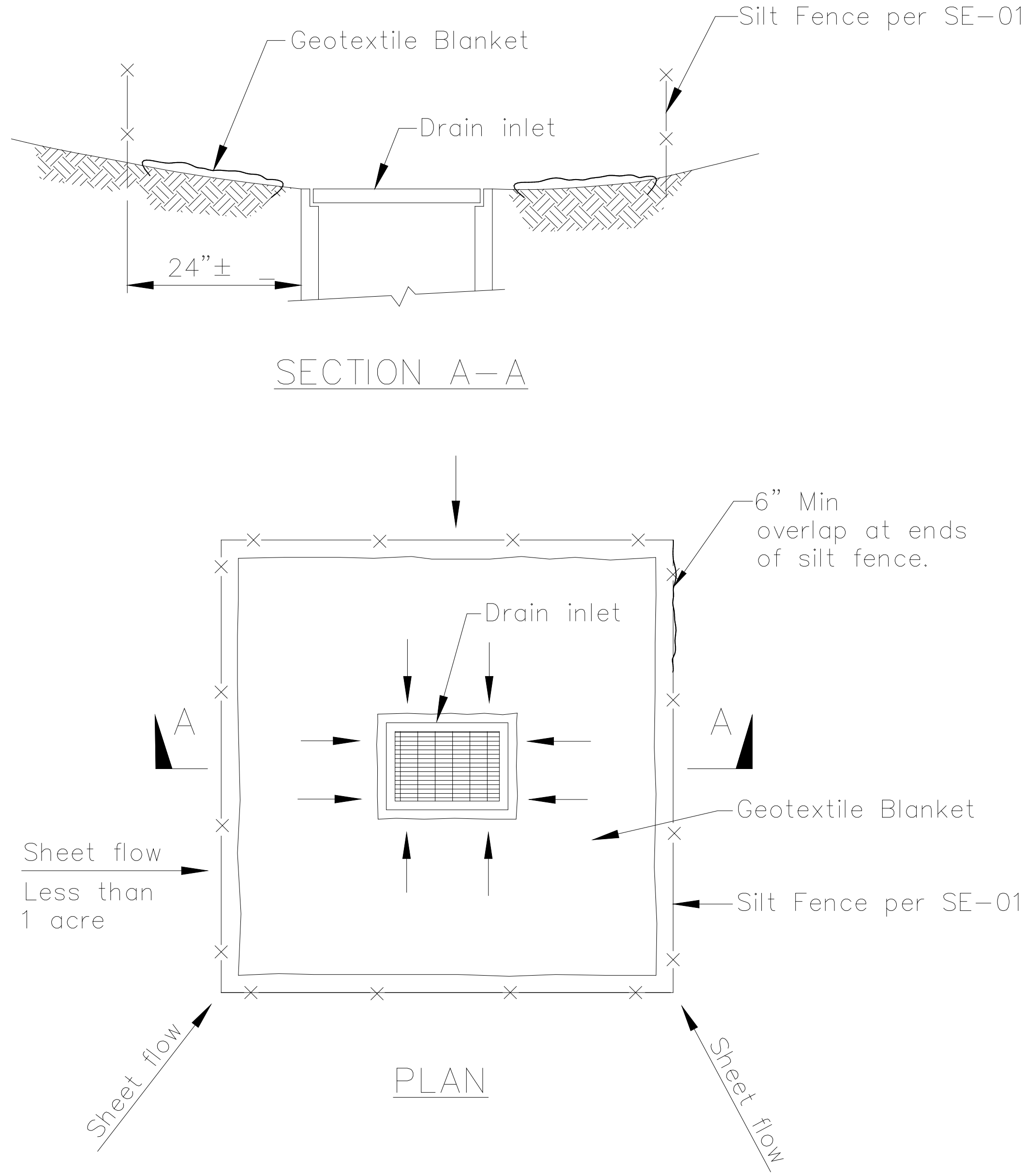
  - Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

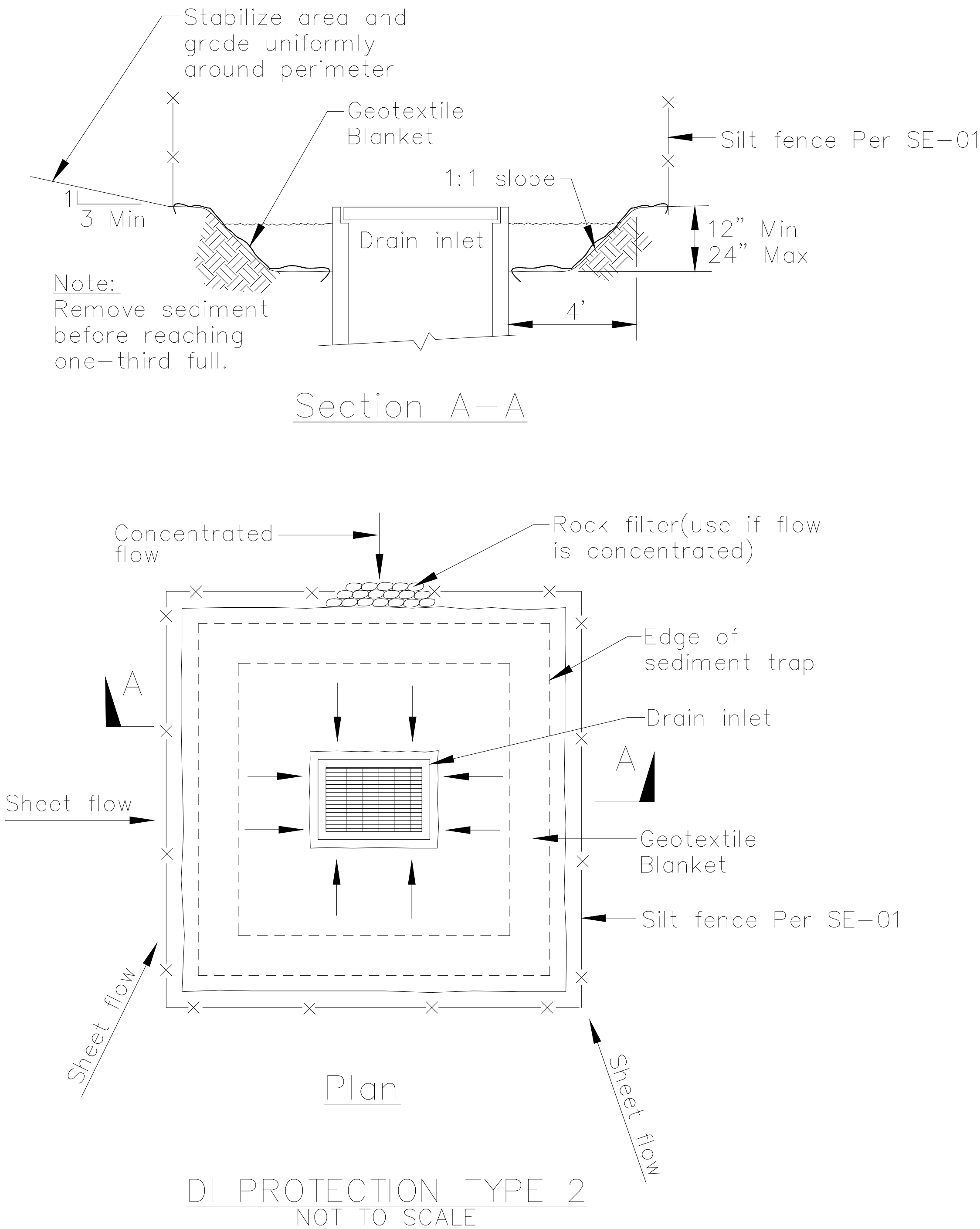
Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



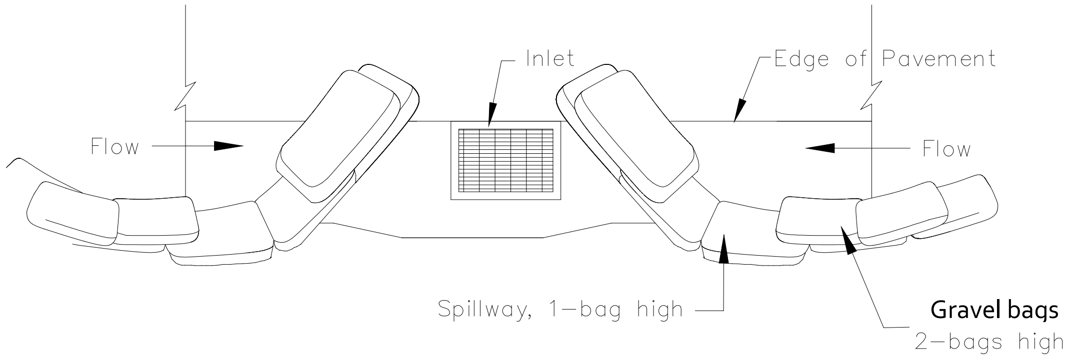
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

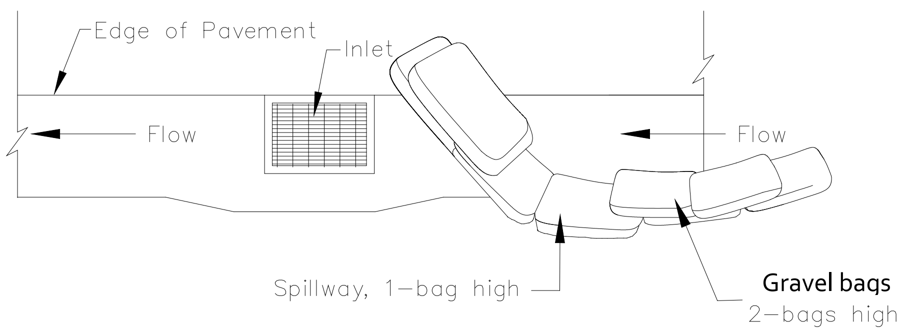
1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



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



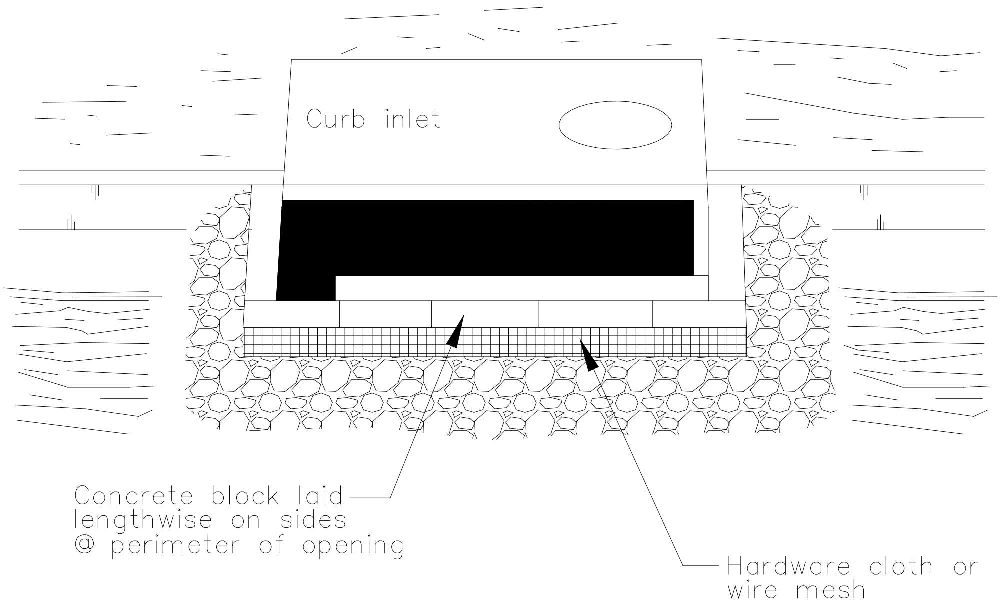
TYPICAL PROTECTION FOR INLET ON GRADE

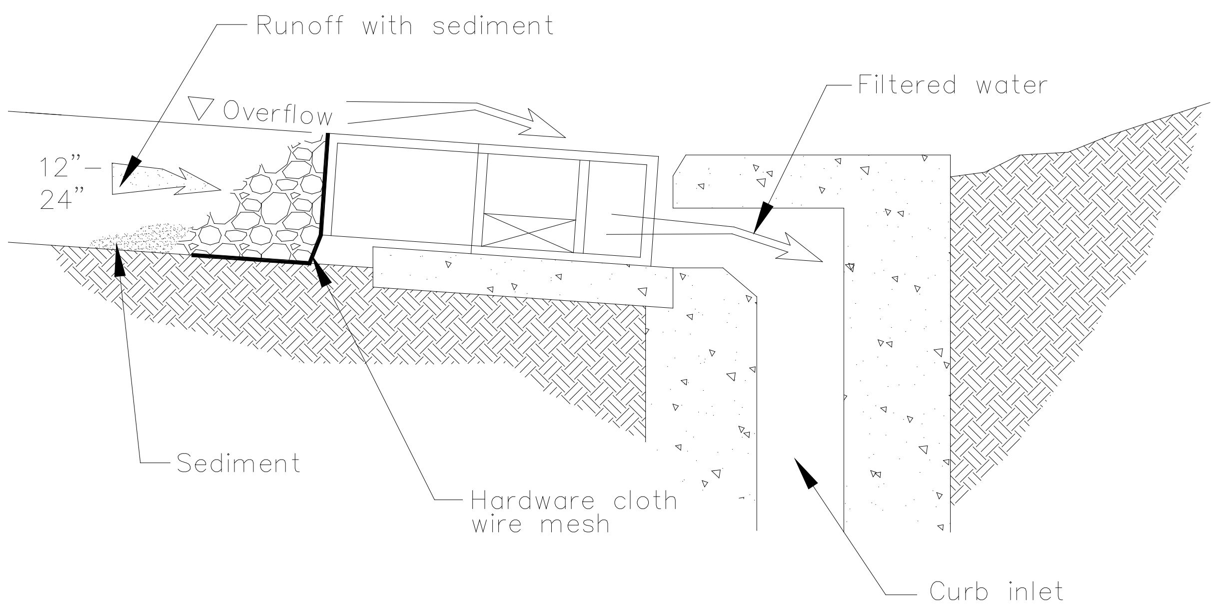
NOTES:

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.
6. Protection can be effective even if it is not immediately adjacent to the inlet provided that the inlet is protected from potential sources of pollution.

DI PROTECTION TYPE 3

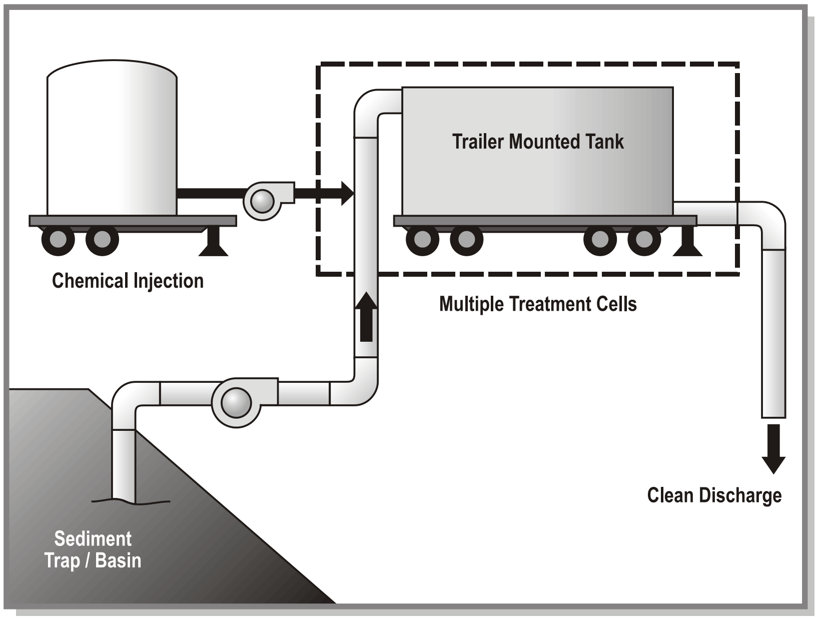
NOT TO SCALE





DI PROTECTION – TYPE 4

NOT TO SCALE



Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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Description and Purpose

Active Treatment Systems (ATS) reduce turbidity of construction site runoff by introducing chemicals to stormwater through direct dosing or an electrical current to enhance flocculation, coagulation, and settling of the suspended sediment. Coagulants and flocculants are used to enhance settling and removal of suspended sediments and generally include inorganic salts and polymers (USACE, 2001). The increased flocculation aids in sedimentation and ability to remove fine suspended sediments, thus reducing stormwater runoff turbidity and improving water quality.

Suitable Applications

ATS can reliably provide exceptional reductions of turbidity and associated pollutants and should be considered where turbid discharges to sediment and turbidity sensitive waters cannot be avoided using traditional BMPs. Additionally, it may be appropriate to use an ATS when site constraints inhibit the ability to construct a correctly sized sediment basin, when clay and/or highly erosive soils are present, or when the site has very steep or long slope lengths.

Limitations

Dischargers choosing to utilize chemical treatment in an ATS must follow all guidelines of the Construction General Permit Attachment F – Active Treatment System Requirements. General limitations are as follows:

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- Numeric Effluent Limit (NEL) for all discharges (10 NTU daily flow-weighted average)
- Limited availability of chemical residual testing procedures that meet permit requirements for flow-through treatment
- Specific field and classroom ATS training required to operate equipment
- Batch treatment requires extensive toxicity testing of effluent
- Batch treatment requires large footprint to accommodate treatment cells
- Requires additional filtration to remove residual floc and treatment chemicals prior to discharge
- Petroleum based polymers should not be used
- Requires site-specific design and equipment
- Limited discharge rates depending on receiving water body
- Labor intensive operation and maintenance
- ATS costs are higher on a unit basis for smaller sites that would be expected to have a lower volume of treated runoff
- ATS costs are seasonably variable due to increases or decreases in rainfall volumes

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). ATS may be used to reduce the turbidity of stormwater runoff. With an ATS, very high turbidities can be reduced to levels comparable to what is found in streams during dry weather.

Criteria for ATS 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.

- An ATS Plan, which includes an Operation and Maintenance component, a Monitoring, Sampling and Reporting component, a Health and Safety component, and a Spill Prevention component must be prepared and submitted to the Regional Water Quality Control Board (RWQCB).

- Treatment chemicals should be approved by EPA for potable water use or otherwise be demonstrated to be protective of human health and the environment. Chemical residual or whole effluent toxicity testing is required.
- Prior to field use of chemical treatment, jar tests are to be conducted to demonstrate that turbidity reduction necessary to meet the NELs and receiving water criteria can 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. A minimum of six site-specific jar tests must be conducted per chemical.
- The proposed maximum dosage should be at least a factor of five lower than the no observed effects concentration (NOEC).
- Effluent discharge from an ATS to a receiving water is conditional upon the favorable results of full-scale whole effluent bioassay/toxicity testing for batch treatment systems and upon chemical residuals testing for flow-through systems.
- Contact the RWQCB for a list of treatment chemicals that may be pre-approved for use.

Active Treatment System Design Considerations

The design and operation of an ATS should take into consideration the factors that determine optimum, cost-effective performance. While site characteristics will influence system design, it is important to recognize the following overriding considerations:

- 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.
- The mixing system for batch treatment must be sized to provide adequate mixing for the design storage volume. Lack of adequate mixing during the flocculation phase results in flocs that are too small and/or insufficiently dense. Too much mixing can rapidly destroy floc as it is formed.
- 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 filtration system such as sand, bag, or cartridge filter that would catch any unintended floc discharge.
- ATS is also regulated for pH of the discharge. A pH-adjusting chemical should be added into the treated water to control pH if the selected coagulant requires alteration of the pH of the discharge outside of the acceptable range.

Active Treatment System Design

ATS can be designed as batch treatment systems using either ponds or portable trailer-mounted tanks, or as flow-through systems using any number of proprietary designed systems.

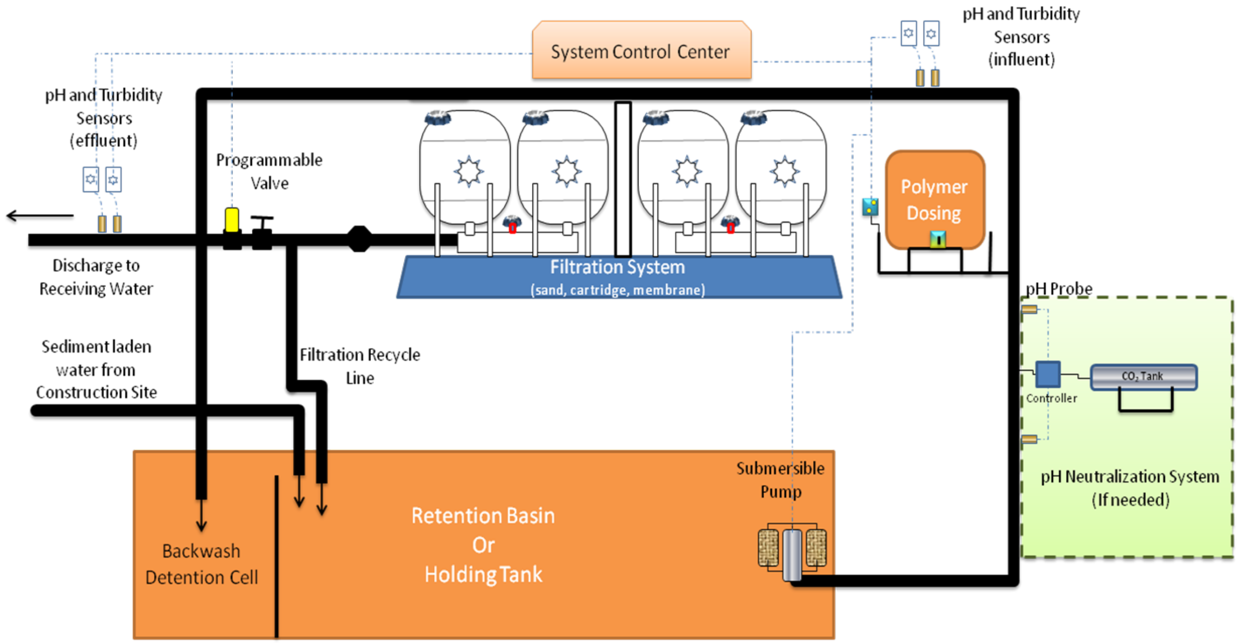

Figure has been adapted from Port of Seattle response to Washington Dept. of Ecology Action Order 2948

Batch Treatment

Batch Treatment systems consist of the stormwater collection system (either temporary diversion or the permanent site drainage system); a sediment basin, trap or holding tanks; pumps; a chemical feed system; treatment cells; and, interconnecting piping.

Batch treatment systems 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 a secured, covered location:

- 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 (if not already within the instrumentation panel of the chemical injector)

Flow-through Treatment

At a minimum, a flow-through ATS system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), an untreated stormwater storage pond or holding tank, and a chemically enhanced filtration system.

Stormwater is collected at interception point(s) on the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area.

The stormwater is stored until treatment occurs. It is important that the holding pond be large enough to provide adequate storage.

Stormwater is then pumped from the untreated stormwater storage pond to the chemically enhanced filtration system where polymer is added. Adjustments to pH may be necessary before chemical addition. The filtration system continually monitors the stormwater for turbidity and pH. If the discharge water is out of the acceptable turbidity or pH range, the water is recycled to the untreated stormwater pond (or holding tank) where it can be retreated. Flow through systems must ensure that:

- Cumulative flow volume shall be recorded daily. The data recording system shall have the capacity to record a minimum of seven days of continuous data.
- Instrumentation systems are interfaced with system control to provide auto shutoff or recirculation in the event that effluent measurements exceed turbidity or pH.
- Upon system upset, power failure, or other catastrophic event, the ATS will default to a recirculation mode or safe shut down.
- The instrumentation system provides a method for controlling coagulant dose, to prevent potential overdosing.

Sizing Criteria

An ATS shall be designed and approved by a Certified Professional in Erosion and Sediment Control (CPESC), a Certified Professional in Storm Water Quality (CPSWQ); a California registered civil engineer; or any other California registered engineer.

ATS must be designed to capture and treat (within 72 hours) runoff from the 10-year 24-hour storm event. The runoff volume of the watershed area to be treated from this size storm event is required to be calculated using the Rational Method with a runoff coefficient of 1.

If sediment basins are used to capture flow-through or batch treatment, see SE-2, Sediment Basin, for design criteria. Bypass should be provided around the ATS to accommodate extreme storm events. Primary settling should be encouraged in the sediment basin/storage pond. A forebay with access for maintenance may be beneficial.

The permissible discharge rate governed by potential downstream effect should be used to calculate the recommended size of the treatment cells. Local requirements related to Phase I or Phase II NPDES permit thresholds should be considered in developing maximum discharge rates the ATS Plan.

Costs

Costs for ATS may be significant due to equipment rental requirements and cost of chemicals. ATS cost is lower on a treated unit-basis for large construction sites with large volumes of runoff.

Inspection and Maintenance

ATS must be operated and maintained by individuals with experience in their use and trained in accordance with training requirements below. ATS should be monitored continuously while in use. A designated responsible person shall be on site daily at all times during treatment operations. Daily on-site visual monitoring of the system for proper performance shall be conducted and recorded in the project data log. The name, phone number, and training documentation of the person responsible for system operation and monitoring shall be included in the project data log.

The following monitoring requirements and results should be recorded in the data log:

Operational and Compliance Monitoring

- Effluent flow rate and volume shall be continuously monitored and recorded at 15- minute or less intervals.
- Influent and effluent pH must be continuously monitored and recorded at 15-minute or less intervals.
- Influent and effluent turbidity (expressed in NTU) must be continuously monitored and recorded at 15-minute or less intervals.
- The type and amount of chemical used for pH adjustment, if any, shall be monitored and recorded.
- Dose rate of chemical used in the ATS system (expressed in mg/L) shall be monitored and reported 15-minutes after startup and every 8 hours of operation.
- Laboratory duplicates – monthly laboratory duplicates for residual coagulant analysis must be performed and records shall be maintained onsite.
- Effluent shall be monitored and recorded for residual chemical/additive levels.
- If a residual chemical/additive test does not exist and the ATS is operating in a batch treatment mode of operation refer to the toxicity monitoring requirements below.

Toxicity Monitoring

Batch Treatment

Toxicity testing for systems operated in batch treatment mode should be made in accordance with the following:

- Acute toxicity testing on effluent samples representing effluent from each batch prior to discharge shall be undertaken. All bioassays shall be sent to a laboratory certified by the Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP). The required field of testing number for Whole Effluent Toxicity (WET) testing is E113.
- Acute toxicity tests shall be conducted with the following species and protocols. The methods to be used in the acute toxicity testing shall be those outlined for a 96-hour acute test in "Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, USEPA-841-R-02-012" for Fathead minnow, *Pimephales promelas*. Rainbow trout, *Oncorhynchus mykiss,* may be used as a substitute for fathead minnow.

All toxicity tests shall meet quality assurance criteria and test acceptability criteria in the most recent versions of the EPA test method for WET testing.

<u>Flow-through Treatment</u>

Toxicity testing for systems operated in flow-through treatment mode should be made in accordance with the following:

- A residual chemical test method shall be used that has a method detection limit (MDL) of 10% or less than the maximum allowable threshold concentration (MATC) for the specific coagulant in use and for the most sensitive species of the chemical used. The MATC is equal to the geometric mean of the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) Acute and Chronic toxicity results for most sensitive species determined for the specific coagulant.
- The residual chemical test method shall produce a result within one hour of sampling.
- A California State certified laboratory shall validate the selected residual chemical test. Specifically, the lab will review the test protocol, test parameters, and the detection limit of the coagulant. The discharger shall electronically submit this documentation as part of the ATS Plan.

Numeric Effluent Limit (NEL) Compliance:

All chemically treated stormwater must be sampled and tested for compliance with pH and turbidity limits. These limits have been established by the Construction General Permit. Sampling and testing for other pollutants may also be necessary at some sites. Turbidity limits have been set as 10 NTU as a daily flow-weighted average or 20 NTU from a single sample. pH must be within the range of 6.0 to 9.0 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 prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training:

Operators shall have training specific to using an ATS and liquid coagulants for stormwater discharges in California. The training shall be in the form of a formal class with a certificate and requirements for testing and certificate renewal. Training shall include a minimum of eight hours classroom and 32 hours field training.

Standard BMPs:

Erosion and sediment control BMPs should be implemented throughout the site to prevent erosion and discharge of sediment to the ATS. Some types of chemical coagulation and flocculation are only achievable in water below a certain turbidity; therefore, minimizing the amount of sediment reaching the system will increase the likelihood of meeting effluent limits and will potentially lower costs of chemical dosing.

Sediment Removal and Disposal

- Sediment shall be removed from the storage or treatment cells as necessary to ensure that the cells maintain their required water storage (i.e., volume) capability.
- Handling and disposal of all solids generated during ATS operations shall be done in accordance with all local, state, and federal laws and regulations.
- If sediment is determined to be non-toxic, it may be incorporated into the site away from drainages.

References

Engineering and Design – Precipitation/Coagulation/Flocculation. United States Army Corps of Engineers, EM 1110-1-4012, 2001.

Evaluation of Active Treatment Systems (ATS) for Construction Site Runoff. California Building and Industry Association (prepared by Geosyntec Consultants), 2008.

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.

Manufactured Linear Sediment Controls (MLSC) SE-12




Description and Purpose

Manufactured linear sediment controls (MLSC) are pre-manufactured devices that are typically specified and installed for drainage and sediment control on the perimeter of disturbed sites or stockpiles and as check dams within channels. Typically, MLSCs can be reused.

This fact sheet is intended to provide guidance on BMP selection and implementation of proprietary or vendor-supplied products, for sediment control. Products should be evaluated for project-specific implementation and used if determined to be appropriate by the SWPPP Preparer.

Suitable Applications

MLSCs are generally used in areas as a substitute for fiber rolls and silt fences in sediment control applications to slow down runoff water, divert drainage or contain fines and sediment. MLSCs are a linear control and application suitability varies based on the specific product type. They may be suitable:

- On paved surfaces for perimeter protection.
- As check structures in channels.
- Along the perimeter of disturbed sites in lieu of silt fence.

Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

- At operational storm drains as a form of inlet protection.
- Around temporary stockpiles or material/equipment storage areas.
- At the interface between graveled driveways and pavement.
- Along the toe of exposed and erodible slopes.

Limitations

- Limitations vary by product. Product manufacturer's printed product use instructions should be reviewed by the SWPPP Preparer to determine the project-specific applicability of MLSCs.

Implementation

General

When appropriately placed, MLSCs intercept and slow sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. The device is porous, which allows the ponded runoff to flow slowly through the device, releasing the runoff as sheet flows. Generally, MLSCs should be used in conjunction with temporary soil stabilization controls up-slope to provide an effective combination of erosion and sediment control.

Design and Layout

- MLSCs used on soil should be trenched or attached to the ground per manufacturer specifications in a manner that precludes runoff or ponded water from flowing around or under the device.
- MLSCs designed for use on asphalt or concrete may be attached using a variety of methods, including nailing the device to the pavement, or using a high strength adhesive.
- Follow manufacturer written specifications when installing MLSCs.
- Allow sufficient space up-slope from the silt dike to allow ponding, and to provide room for sediment storage.
- For installation near the toe of the slope, MLSCs should be set back 3 feet from the slope toe to facilitate cleaning. Where site conditions do not allow set back, the sediment control may be constructed on the toe of the slope. To prevent flows behind the barrier, sand or gravel bags can be placed perpendicular and between the sediment control and slope to serve as a barrier to parallel flow.
- Drainage area should not exceed 5 acres.

Materials

- Several manufactured products are available. The following search terms or combination of terms can be used with an internet search engine to find manufactured linear sediment controls:

- "silt barrier"
- "reusable silt fence"
- "silt fence alternative" or
- "perimeter sediment control"

Costs
Manufacturers should be contacted directly for current pricing.

Inspection and Maintenance
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Reshape or replace sections of damaged MLSCs as needed.
- Repair washouts or other damage as needed.
- Sediment that accumulates behind the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove MLSCs 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 properly.

References
City of Elko Construction Site Best Management Practices Handbook, December 2005.

Construction Site Best Management Practices Handbook, June 2008 Update, Truckee Meadows Regional Stormwater Quality Management Program, June 2008.

Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices, Texas Commission on Environmental Quality, Revised July 2005, Addendum Sheet, January26, 2011.

Stormwater Management Manual for Western Washington Volume II, Construction Stormwater Pollution Prevention, Washington State Department of Ecology, February 2005.

Compost Socks and Berms SE-13

Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☒
Bacteria	☒
Oil and Grease	☒
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

Compost socks and berms act as three-dimensional biodegradable filtering structures to intercept runoff where sheet flow occurs and are generally placed at the site perimeter or at intervals on sloped areas. Compost socks are generally a mesh sock containing compost and a compost berm is a dike of compost, trapezoidal in cross section. When employed to intercept sheet flow, both BMPs are placed perpendicular to the flow of runoff, allowing filtered runoff to pass through the compost and retaining sediment (and potentially other pollutants). A compost sock can be assembled on site by filling a mesh sock (e.g. with a pneumatic blower). The compost berm should be constructed using a backhoe or equivalent and/or a pneumatic delivery (blower) system and should be properly compacted. Compost socks and berms act as filters, reduce runoff velocities, and in some cases, aid in establishing vegetation.

Compost is organic, biodegradable, and renewable. Compost provides soil structure that allows water to infiltrate the compost medium which helps prevent rill erosion and the retained moisture promotes seed germination and vegetation growth, in addition to providing organic matter and nutrients important for fostering vegetation. Compost improves soil quality and productivity, as well as erosion and sediment control.

The compost of the compost sock or berm can be selected that targets site specific objectives in capturing sediment and other pollutants, supporting vegetation, or additional erosion control.

Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste. Many types of compost are products of municipal recycle or "Green waste" programs. Compost is organic and biodegradable and can be left onsite. There are many types of compost with a variety of properties with specific functions, and accordingly compost selection is an important design consideration in the application of this type of erosion and sediment control.

Suitable Applications

- Along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow (compost berms should only be used at the top of slopes or on slopes 4:1 (H:V) or flatter, all other slope applications should use compost socks)
- Along the perimeter of a project
- As check dams in unlined ditches (compost socks only)
- Down-slope of exposed soil areas
- At operational storm drains as a form of inlet protection (compost socks only)
- Around temporary stockpiles

Compost socks and berms do not require special trenching or BMP removal compared to other sediment control methods (e.g. silt fence or fiber rolls). Compost socks and berms can remain in place after earth disturbing activities are completed or the compost components can be spread over the site providing nutrients for plant growth and augmenting soil structure. BMPs that remain in place are particularly advantageous below embankments, especially adjacent streams, by limiting re-entry and the disturbance to sensitive areas.

Compost can be pre-seeded prior to application (recommended by the EPA for construction site stormwater runoff control and required for compost socks) or seeded after installation (for compost berms only). The compost medium can also remove pollutants in stormwater including heavy metals; oil and grease; and hydrocarbons.

Limitations

- Compost can potentially leach nutrients (dissolved phosphorus and nitrogen) into runoff and potentially impact water quality. Compost should not be used directly upstream from nutrient impaired waterbodies (Adams et. al, 2008).
- Compost may also contain other undesirable constituents that are detrimental to water quality. Compost should be obtained from a supplier certified by the California Integrated Waste Management Board or compost should otherwise meet the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7. Carefully consider the qualifications and experience of any compost producer/supplier.

- Application by hand is more time intensive and potentially costly. Using a pneumatic blower truck is the recommended cost-effective method of assembly.

- Compost socks and berms should not be employed at the base of slopes greater than 2:1 (H:V). They can be employed with other erosion control methods for steeper slopes.

- Difficult to move once saturated.

- Compost berms should not be applied in areas of concentrated flows.

- Compost socks and berms are easy to fix; however, they are susceptible to damage by frequent traffic. Compost socks can be used around heavy machinery, but regular disturbance decreases sock performance.

Implementation

Compost Materials

- California Compost Regulations (Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7, Section 17868.3) define and require a quality of compost for application. Compost should comply with all physical and chemical requirements. Specific requirements are provided in **Table 1**, taken from Caltrans *Standard Specifications* (2015).

- The Caltrans SSP, Section 21-2.02Q, *Compost Socks*, states that the sock used to retain the compost must be composed of natural, biodegradable products, such as cotton, jute, sisal, burlap or coir.

- The compost producer should be fully permitted as specified under the California Integrated Waste Management Board, Local Enforcement Agencies and any other State and Local Agencies that regulate Solid Waste Facilities. If exempt from State permitting requirements, the composting facility should certify that it follows guidelines and procedures for production of compost meeting the environmental health standards of Title 14, California Code of Regulations, Division 7, Chapter 3.1, Article 7.

- The compost producer should be a participant in United States Composting Council's Seal of Testing Assurance program.

- Compost medium parameter specifications for compost socks and berms have been developed to assist in compost selection, such as those provided by the American Association of State Highway Transportation Officials (AASHTO).

- Particle size is important parameter for selecting compost. Well consolidated, coarser grades of compost (e.g., small and large pieces) perform better for filtration objectives, while finer grades better support vegetation. Particle size of the compost should be selected based on site conditions, such as expected precipitation, and filtration goals and / or long-term plant nutrients.

- Compost moisture should be considered for composition quality and application purposes. A range of 30-50% is typical. Compost that is too dry is hard to apply and compost that is too wet is more difficult (and more expensive) to transport. For arid or semi-arid areas, or for application during the dry season, use compost with greater moisture content than areas with wetter climates. For wetter or more humid climates or for application during the wet season, drier composts can be used as the compost will absorb moisture from the ambient air.

- If vegetation establishment is a desired function of the compost, a compost sample should be inspected by a qualified individual. Vegetation has different nutrient and moisture needs.

- Organic content of the compost is also important and should range from 30 to 65% depending on site conditions.

- Compost should not be derived from mixed municipal solid waste and should be reasonably free of visible contaminates.

- Compost should not contain paint, petroleum products, pesticides or any other chemical residues harmful to animal life or plant growth. Metal concentrations in compost should not exceed the maximum metal concentrations listed under Title 14, California Code of Regulations, Division 7, Chapter 3.1, Section 17868.2.

- Compost should not possess objectionable odors.

- Compost should be weed free.

Table 1. Physical/Chemical Requirements of Compost
Reference - Caltrans SSP-10 Erosion Control Blanket (Compost)

Property	Test Method	Requirement
pH	TMECC 04.11-A	6.0–8.5
Soluble Salts	TMECC 04.10-A	0-10.0
Moisture Content	TMECC 03.09-A	30-60
Organic Matter Content	TMECC 05.07-A	30–100
Maturity	TMECC 05.05-A	80 or Above 80 or Above
Stability	TMECC 05.08-B	8 or below
Particle size for fine compost: dry weight Pass 5/8-inch sieve (min, %) Pass 3/8-inch sieve (min, %)	TMECC 02.02-B	95 70
Particle size for medium compost: dry weight Pass 2-inch sieve (min, %) Pass 1-inch sieve (max, %)	TMECC 02.02-B	95 30
Particle size for coarse compost: dry weight Pass 2-1/2-inch sieve (min, %) Pass 3/8-inch sieve (max, %)	TMECC 02.02-B	99 40
Pathogen Fecal Coliform Bacteria MPN/1-gram dry wt.	TMECC 07.01-B	< 1,000
Pathogen Salmonella MPN/4 grams dry wt.	TMECC 07.01-B	< 3
Physical Contaminants (% dry weight) Plastics, glass, and metal	TMECC 02.02-C	Combined Total: < 1.0
Physical Contaminants (% dry weight) Sharps	TMECC 02.02-C	None Detected

*TMECC refers to "Test Methods for the Examination of Composting and Compost," published by the United States Department of Agriculture and the United States Compost Council (USCC).

Installation

- Prior to application, prepare locations for socks and berms by removing brush and thick vegetation. The compost of the sock and/or berm should be allowed to come in full contact with the ground surface.

- Select method to apply the compost sock or berm. A pneumatic blower is most cost effective and most adaptive in applying compost to steep, rough terrain, and hard to reach locations.

- The compost of the berm should be distributed evenly to the surface, compacted, and shaped trapezoidal in cross section. Berm design is generally consisting of a base two times the height. AASHTO specification MP 9-03 provides compost berm dimensions based on anticipated site precipitation (AASHTO, 2003 and USEPA, 2009). State agencies, such as Oregon Department of Environmental Quality (ODEQ) have developed berm dimension based on slope steepness and length (ODEQ, 2004).

- Compost socks can be assembled on site by filling mesh socks with the selected compost. Mesh socks can be tied at one end, filled, and then tied at the other end. The ends of socks can be interlocked until the desired length is achieved. The sock diameter is a function of slope steepness and length. Again, ASSHTO provides specifications for various parameters. Compost socks range from 8” to 18” but are typically 12” to 18” in diameter.

- Compost socks are typically placed in contours perpendicular to sheet flow. They can also be placed in V formation on a slope. Compost socks need to be anchored, typically stakes, through the center of the sock. To prevent water flowing around them, the ends of compost socks should be placed upslope.

- Locate compost socks and berms on level contours spaced as follows:

  - Slope inclination of 4:1 (H:V) or flatter: Socks and/or berms should be placed at a maximum interval of 20 ft.

  - Slope inclination between 4:1 and 2:1 (H:V): Socks should be placed at a maximum interval of 15 ft. (a closer spacing is more effective).

  - Slope inclination 2:1 (H:V) or greater: Socks should be placed at a maximum interval of 10 ft. (a closer spacing is more effective).

- Place perimeter socks and berms using a j-hook installation. Use of vegetation will also provide additional anchoring.

- Compost socks and berms can be placed around the perimeter of an affected area, like a silt fence, if the area is flat or on a contour. Do not place these socks and berms where ponded water could become an issue.

- If used at the toe of slopes, the compost sock or berm should at a minimum of 5 to 10 feet away.

- Use additional anchoring and erosion control BMPs in conjunction of the compost socks and berms as needed.

- Consider using compost berms or socks as necessary at the top and/or bottom of the slope for additional erosion control performance.

- Compost socks and berms can also be effective over rocky and frozen ground if installed properly.

- It is recommended that the drainage areas of these compost BMPs do not exceed 0.25 acre per 100 feet placement interval and runoff does not exceed 1 cubic foot per second.

Costs

Recently obtained vendor costs indicated $4.50 per linear foot for compost berm application and $2.50 per linear foot for 8" socks and $3.20 per linear foot for 12"socks (Adjusted for inflation ,2016 dollars, by Tetra Tech, Inc.). Costs do not include final compost sock or berm functions at the end of construction activities, including spreading or removal, if required. ODEQ estimates that compost berms cost 30 percent less than silt fences to install.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Once damage is identified, mend or reapply the sock or berm as needed. Washed out areas should be replaced. If the sock or berm height is breached during a storm, an additional sock can be stacked to increase the sock height and similarly the berm dimensions can be increased, as applicable. An additional sock or berm may be installed upslope, as needed. It may be necessary to apply an additional type of stormwater BMP, such as a compost blanket.

- Sediment contained by the sock or berm should be removed prior reaching 1/3 of the exposed height of the BMP. The sediment can be stabilized with the compost sock or berm with vegetation at the end of construction activities.

- Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

- Limit traffic to minimize damage to BMPs or impede vegetation establishment.

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An analysis of Composting as an Environmental Remediation Technology, U.S. Environmental Protection Agency (USEPA), Solid Waste and Emergency Response (5305W), EPA530-R-8-008, 1998.

Characteristics of Compost: Moisture Holding and Water Quality Improvement, Center for Research in Water Resources, Kirchoff, C., Malina, J., and Barrett, M., 2003.

Compost Utilization for Erosion Control, The University of Georgia College of Agricultural and Environmental Sciences, pubs.caes.uga.edu/caespubs/pubcd/B1200.htm, Faucette, B. and Risse, M., 2001.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Standard Specifications, State of California, California State Transportation Agency, Department of Transportation (Caltrans), 2015. Available online at: http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2015_StdSpecs/2015_StdSpecs.pdf.

Evaluation of Environmental Benefits and Impacts of Compost and Industry Standard Erosion and Sediment Controls Measures Used in Construction Activities, Dissertation, Institute of Ecology, University of Georgia, Faucette, B., 2004.

National Pollutant Discharge Elimination System (NPDES), Compost Blankets, U.S. Environmental Protection Agency (USEPA). http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118, 2009.

Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Designation MP-9, Compost for Erosion/Sediment Control (Filter Berms), Provisional, American Association of State Highway Transportation Officials (AASHTO), 2003.

Stormwater Best Management Practices (BMPs) Field Trials of Erosion Control Compost in Reclamation of Rock Quarry Operations, Nonpoint Source Protection Program CWA §319(h), Texas Commission on Environmental Quality, Adams, T., McFarland, A., Hauck, L., Barrett, M., and Eck, B., 2008.

Biofilter Bags SE-14

Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-4 Check Dams

SE-5 Fiber Roll

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-10 Storm Drain Inlet Protection

Description and Purpose

Biofilter bags, or bio-bags, are a multi-purpose sediment control BMP consisting of a plastic mesh bag filled with 100% recycled wood product waste. Biofilter bags come in a variety of sizes (30" x 18" and 30" x 9" being common) and generally have between 1-2 cubic yards of recycled wood waste (or wood chips). Biofilter bags work by detaining flow and allowing a slow rate of discharge through the wood media. This action removes suspended sediment through gravity settling of the detained water and filtration within the bag.

Suitable Applications

Biofilter bags are a short-term BMP that can be rapidly deployed, maintained, and replaced. Biofilter bags can be an effective short-term solution to place in developed rills to prevent further erosion until permanent measures can be established. Suitable short-term applications include:

- As a linear sediment control measure:
  - Below the toe of slopes and erodible slopes
  - Below other small cleared areas
  - Along the perimeter of a site (with low-expected flow)
  - 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

- Inlet Protection (See SE-10)

- Supplement to silt fences or other sediment control devices

Limitations

- Short life-span (maximum usefulness of 2-3 months and should be replaced more frequently if needed); regular maintenance and replacement required to ensure effectiveness. Bags will rapidly fill with sediment and reduce permeability.

- Easily damaged by construction vehicles.

- If not properly staked, will fail on slope applications.

- If improperly installed can allow undercutting or side-cutting flow.

- Not effective where water velocities or volumes are high.

- Potentially buoyant and easily displaced if not properly installed.

Implementation

General

Biofilter bags are a relatively low cost temporary BMP that are easily deployed and have a simple installation that can be performed by hand. Without proper installation, however, biofilter bags can fail due to their light weight, potential displacement, and multiple joint locations. One of the benefits of utilizing biofilter bags is that the media (wood-product) can be recycled or used onsite when no longer needed (where acceptable).

Design and Layout – Linear control

- Locate biofilter bags on level contours.

  - Slopes between 20:1 and 4:1 (H:V): Biofilter bags should be placed at a maximum interval of 20 ft, with the first row near the slope toe.

  - Slopes between 4:1 and 2:1 (H:V): Biofilter bags should be placed at a maximum interval of 15 ft, with the first row near the slope toe.

  - Slopes 2:1 (H:V) or steeper: Biofilter bags should be placed at a maximum interval of 10 ft., with the first row placed the slope toe.

- Turn the ends of the biofilter bag barriers up slope to prevent runoff from going around the berm.
- Allow sufficient space up slope from the biofilter bag berm to allow ponding, and to provide room for sediment storage.
- Stake biofilter bags into a 1 to 2 in. deep trench with a width equal to the bag.
  - Drive one stake at each end of the bag.
  - Use wood stakes with a nominal classification of 0.75 by 0.75 in. and minimum length of 24 in.
- Biofilter bags should be overlapped (6 in.), not abutted.

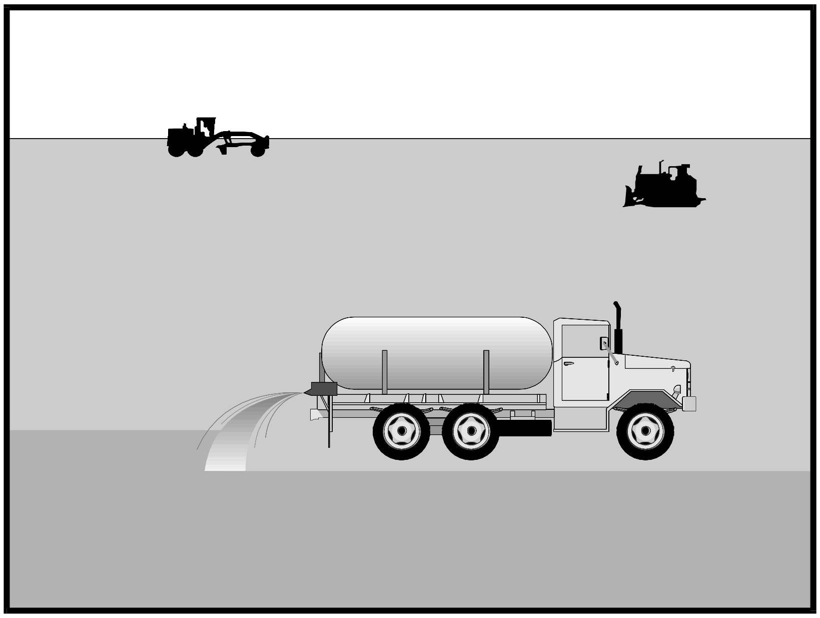
Costs
Pre-filled biofilter bags cost approximately $3.20-$4.50 per bag, dependent upon size (Adjusted for inflation, 2016 dollars, by Tetra Tech, Inc.).

Inspection and Maintenance
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Biofilter bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.
- Reshape or replace biofilter bags as needed.
- Repair washouts or other damage as needed.
- Sediment that is retained by the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Remove biofilter bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Biofilter media may be used on-site, if allowed.

References
Catalog of Stormwater Best Management Practices for Idaho Cities and Counties. Volume 2, Section 7, BMP 34 – Biofilter Bags, Idaho Department of Environmental Quality, 2005.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.



Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

EC-5 Soil Binders

Description and Purpose

Wind erosion or dust control consists of applying water or other chemical dust suppressants 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.

California's Mediterranean climate, with a short "wet" season and a typically long, hot "dry" season, allows the soils to thoroughly dry out. During the dry season, 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. Site conditions and climate can make dust control more of an erosion problem than water-based erosion. Additionally, many local agencies, including Air Quality Management Districts, require dust control and/or dust control permits in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. Wind erosion control is required to be implemented at all construction sites greater than 1 acre by the General Permit.

Suitable Applications

Most BMPs that provide protection against water-based erosion will also protect against wind-based erosion and dust control requirements required by other agencies will generally meet wind erosion control requirements for water quality protection. Wind erosion control BMPs are suitable during the following construction activities:

- Construction vehicle traffic on unpaved roads
- Drilling and blasting activities
- 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 (generally less than a few hours) and should be applied daily (or more often) to be effective.
- Over watering may cause erosion and track-out.
- 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.
- Chemical dust suppression agents may have potential environmental impacts. Selected chemical dust control agents should be environmentally benign.
- Effectiveness of controls depends on soil, temperature, humidity, wind velocity and traffic.
- Chemical dust suppression agents should not be used within 100 feet of wetlands or water bodies.
- Chemically treated subgrades 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.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.
- If the soil surface has minimal natural moisture, the affected area may need to be pre-wetted so that chemical dust control agents can uniformly penetrate the soil surface.

Implementation

Dust Control Practices

Dust control BMPs generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. The following table presents dust control practices that can be applied to varying site conditions that could potentially 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 include minimizing surface areas to be disturbed, limiting onsite vehicle traffic to 15 mph or less, and controlling the number and activity of vehicles on a site at any given time.

Chemical dust suppressants include: mulch and fiber based dust palliatives (e.g. paper mulch with gypsum binder), salts and brines (e.g. calcium chloride, magnesium chloride), non-petroleum based organics (e.g. vegetable oil, lignosulfonate), petroleum based organics (e.g. asphalt emulsion, dust oils, petroleum resins), synthetic polymers (e.g. polyvinyl acetate, vinyl, acrylic), clay additives (e.g. bentonite, montmorillonite) and electrochemical products (e.g. enzymes, ionic products).

Site Condition	Dust Control Practices							
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt	Temporary Gravel Construction Entrances/Equipment Wash Down	Synthetic 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 Stockpiles		X	X	X			X	X
Demolition			X			X	X	
Clearing/ Excavation			X	X				X
Truck Traffic on Unpaved Roads			X	X	X	X	X	
Tracking					X	X		

Additional preventive measures include:

- Schedule construction activities to minimize exposed area (see EC-1, Scheduling).
- Quickly treat exposed soils using water, mulching, chemical dust suppressants, or 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.
- Restrict construction traffic to stabilized roadways within the project site, as practicable.
- 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 (RWQCB) 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."

- 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 rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and wheel wash areas.
- Stabilize inactive areas of construction sites using temporary vegetation or chemical stabilization methods.

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 and should meet all applicable regulatory requirements.

Costs

Installation costs for water and chemical dust suppression vary based on the method used and the length of effectiveness. Annual costs may be high since some of 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.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Check areas protected to ensure coverage.
- Most water-based dust control measures require frequent application, often daily or even multiple times per day. Obtain vendor or independent information on longevity of chemical dust suppressants.

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, updated annually.

Construction Manual, Chapter 4, Section 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative", California Department of Transportation (Caltrans), July 2001.

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.

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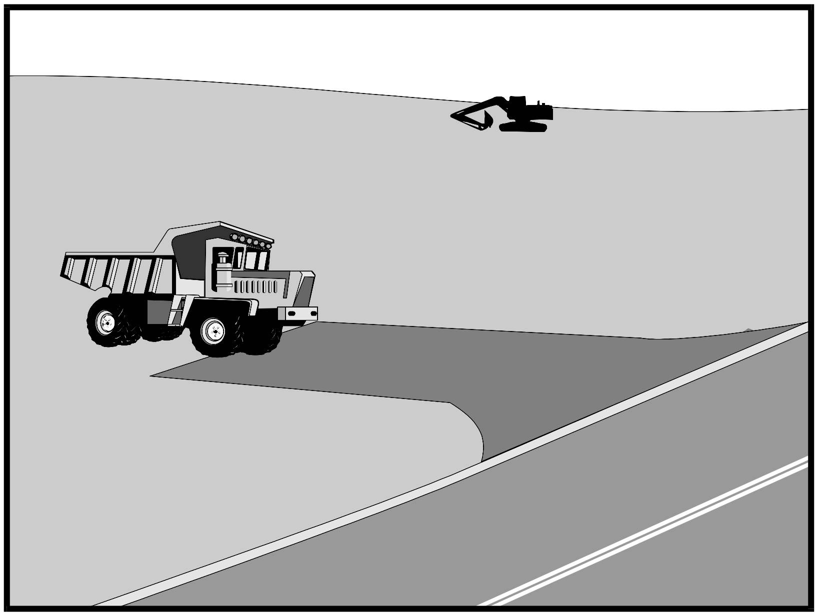
Stabilized Construction Entrance/Exit TC-1



Categories

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.

CALIFORNIA STORMWATER QUALITY ASSOCIATION®

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 or maximum site will allow, and 10 ft minimum width or to accommodate traffic.
- 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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 $1,500 to $6,100 each, averaging $3,100 per entrance. Costs will increase with addition of washing rack and sediment trap. With wash rack, costs range from $1,500 - $7,700 each, averaging $4,600 per entrance (All costs adjusted for inflation, 2016 dollars, by Tetra Tech Inc.

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.

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Guidance Specifying Management Measures for Nonpoint Pollution in Coastal Waters, EPA 840-B-9-002, USEPA, Office of Water, Washington, DC, 1993.

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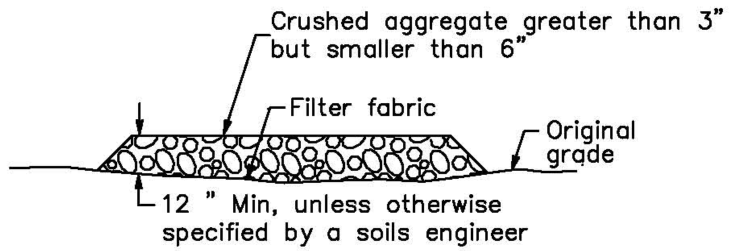
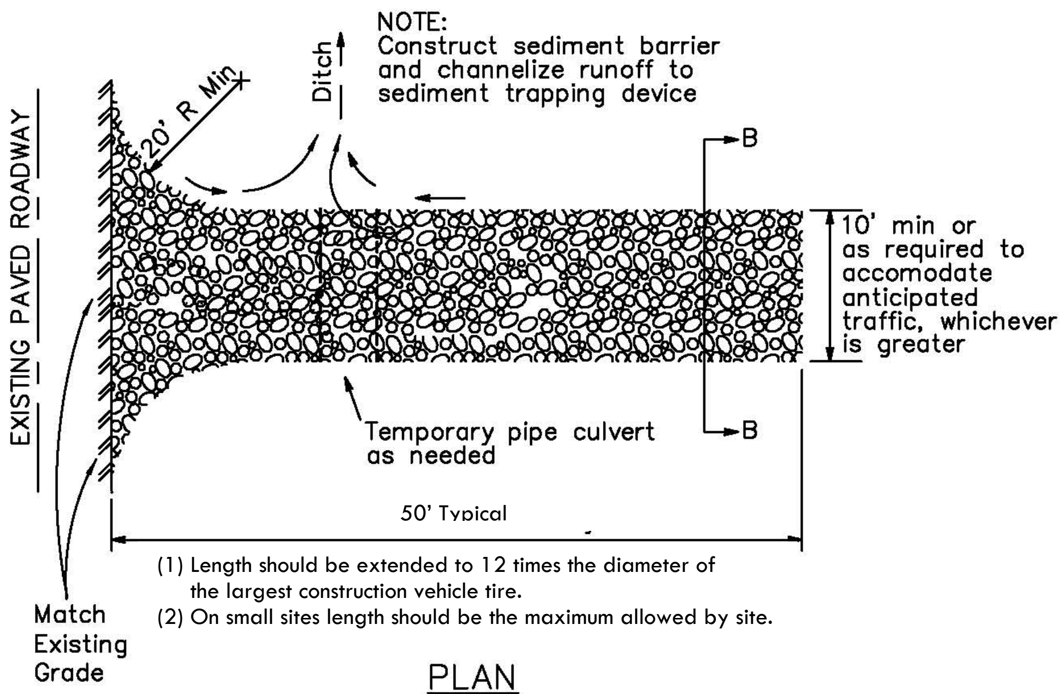
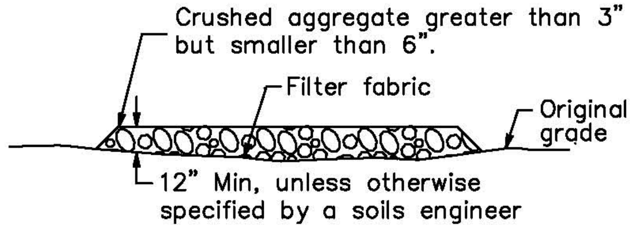


SECTION B–B
NTS



(1) Length should be extended to 12 times the diameter of the largest construction vehicle tire.
(2) On small sites length should be the maximum allowed by site.

PLAN
NTS



SECTION B–B
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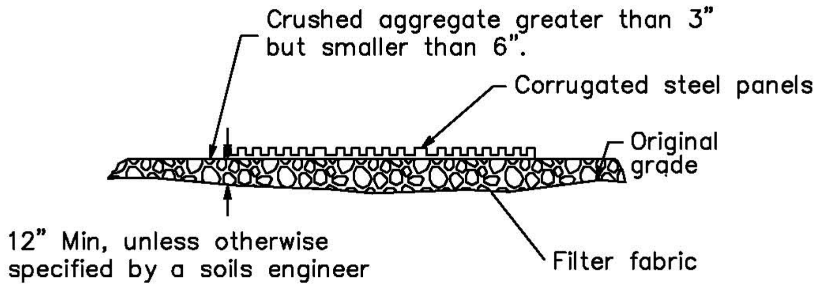
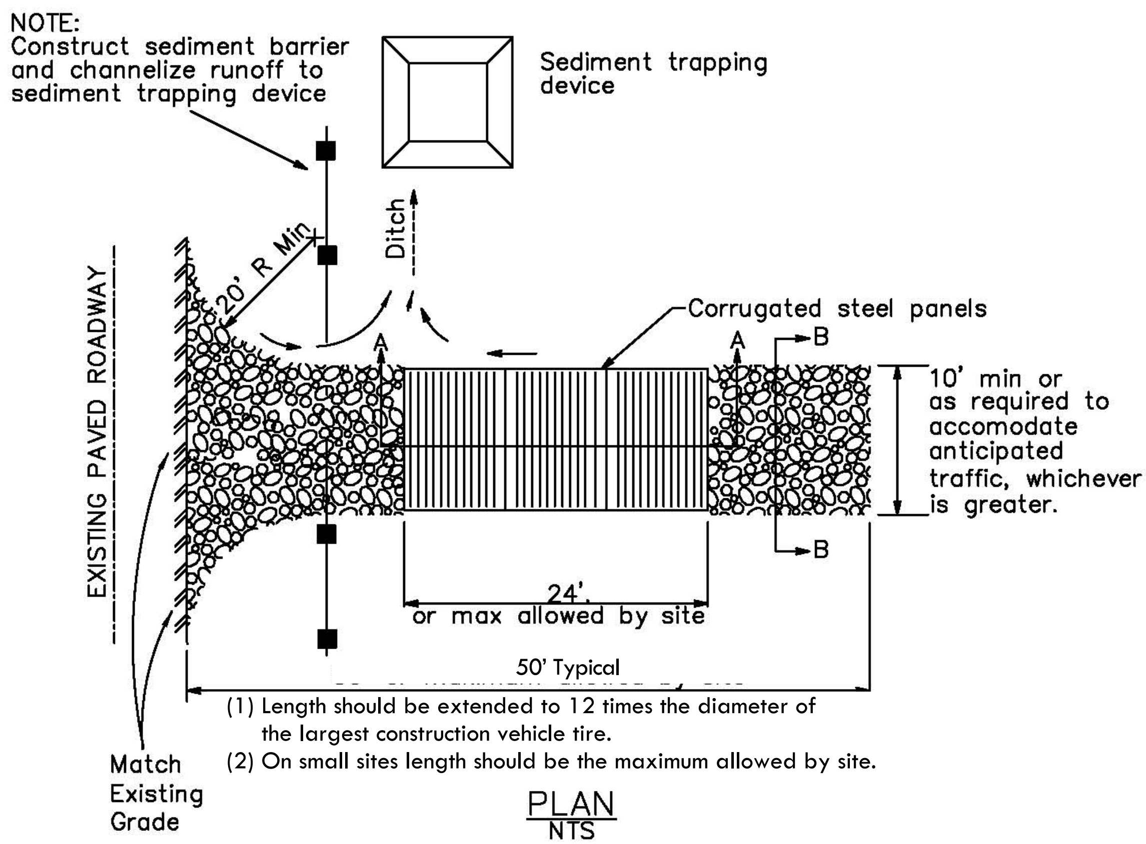
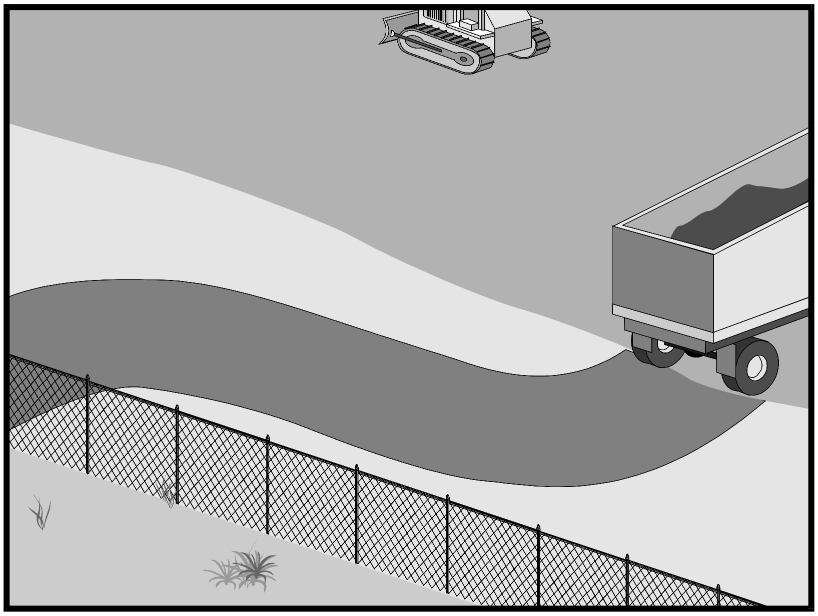


SECTION A–A
NOT TO SCALE



PLAN
NTS

Stabilized Construction Roadway TC-2



Categories

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, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.

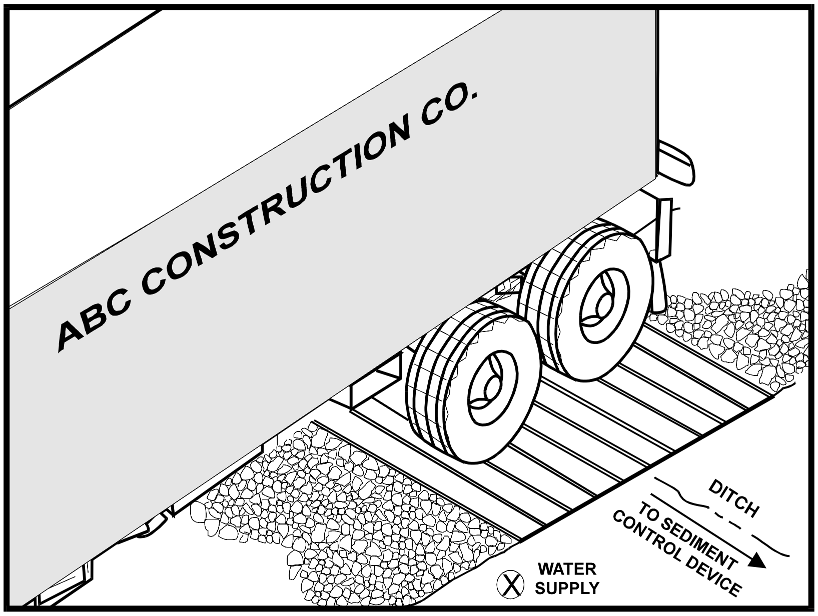
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

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



Categories

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.

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- 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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

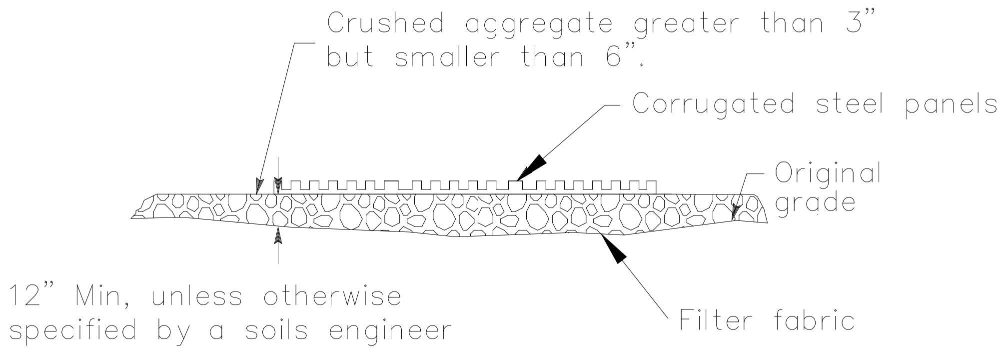
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance, Working Group, Working Paper; USEPA, April 1992.

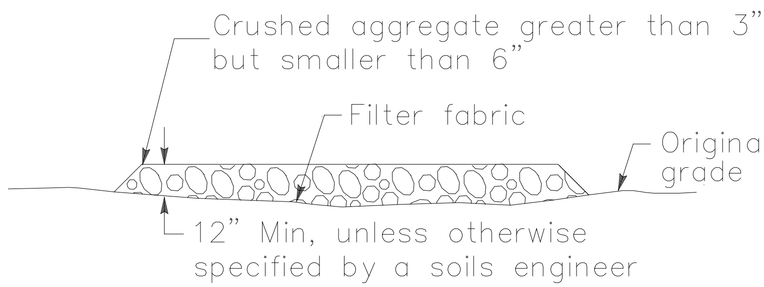
Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, May 1995.

Stormwater Quality Handbooks Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

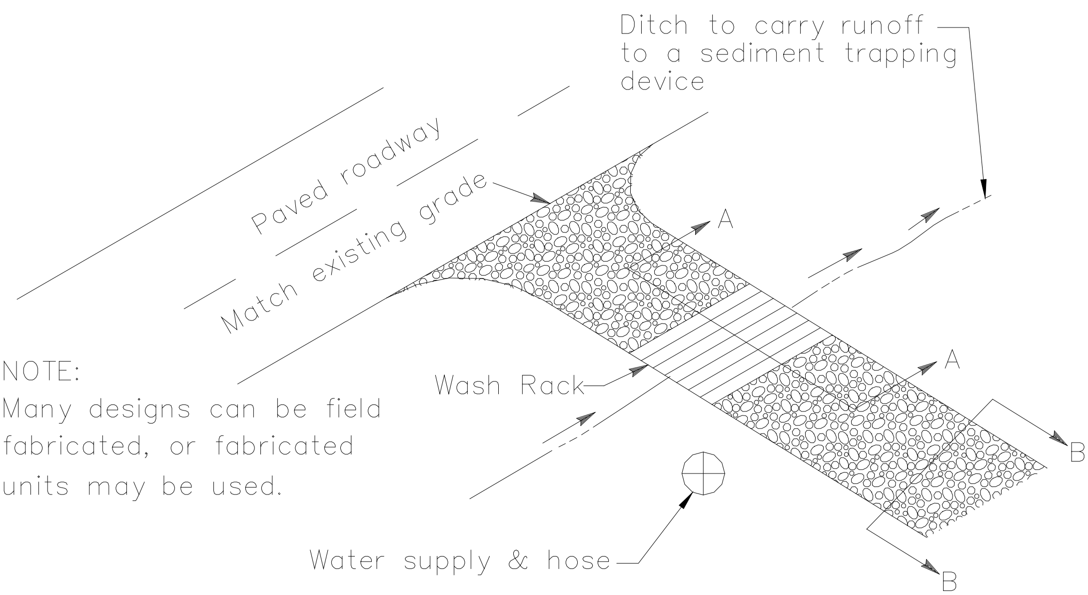
Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



SECTION A–A
NOT TO SCALE



SECTION B–B
NTS



NOTE:
Many designs can be field fabricated, or fabricated units may be used.

TYPICAL TIRE WASH
NOT TO SCALE

Section 4
Non-Stormwater Management and Material Management BMPs

4.1 Non-Stormwater Management BMPs

The discharge of materials other than stormwater and authorized non-stormwater discharges is prohibited by NPDES regulations as well as other local codes and ordinances. It is recognized that certain authorized 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, and pipe flushing and testing.

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 of this handbook 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. The key to implementing these BMPs is to maintain a clean site and keep water, runoff, and run-on away from potential pollutants, including bare soil. In general, conduct construction activities so that: potential pollutants are not discharged directly to drainage systems; generation of potential pollutants is limited; and pollutants that are generated are contained and cleaned up immediately and are therefore not available for later discharge. These BMPs are fundamental to water quality protection and all sites must implement non-stormwater BMPs appropriate for the construction activities being performed.

Table 4-1 Non-Stormwater Management BMPs

BMP#	BMP Name
NS-1	Water Conservation Practices[2]
NS-2	Dewatering Operations[1, 3]
NS-3	Paving and Grinding Operations[1, 3]
NS-4	Temporary Stream Crossing[1, 2]
NS-5	Clear Water Diversion[2]
NS-6	Illicit Connection/Discharge[1, 2]
NS-7	Potable Water/Irrigation[1, 2]
NS-8	Vehicle and Equipment Cleaning[1, 2]
NS-9	Vehicle and Equipment Fueling[1, 2]
NS-10	Vehicle and Equipment Maintenance[1, 2]
NS-11	Pile Driving Operations[1, 2]
NS-12	Concrete Curing[1, 3]
NS-13	Concrete Finishing[1, 3]
NS-14	Material Over Water[1, 2]
NS-15	Demolition Adjacent to Water[1, 2]
NS-16	Temporary Batch Plants[1, 3]

1) BMP fact sheet updated in 2009
2) BMP fact sheet updated in 2011
3) BMP fact sheet updated in 2012

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 may be subject to additional sampling and analysis requirements for non-visible pollutants contained in the General Permit. (See Section 2.5.4.2. of this handbook)

4.2 Waste Management and 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, and are under the control of the contractor, and are additional "good housekeeping practices," which involve keeping a clean, orderly construction site. These BMPs are fundamental to water quality protection and all sites must implement waste management and/or materials pollution control non-stormwater BMPs appropriate for the construction activities being performed.

Table 4-2 Waste Management and Materials Pollution Control BMPs

BMP#	BMP Name
WM-1	Material Delivery and Storage[1]
WM-2	Material Use[1]
WM-3	Stockpile Management[1, 2, 3]
WM-4	Spill Prevention and Control[1, 2]
WM-5	Solid Waste Management[1, 2]
WM-6	Hazardous Waste Management[1, 2]
WM-7	Contaminated Soil Management[1, 2]
WM-8	Concrete Waste Management[1, 3]
WM-9	Sanitary/ Septic Waste Management[1]
WM-10	Liquid Waste Management[1]
1) BMP fact sheet updated in 2009 2) BMP fact sheet updated in 2011 3) BMP fact sheet updated in 2012	

Waste management consists of implementing procedural and structural BMPs for handling, storing, and disposing of wastes generated by a construction project to prevent the release of waste materials into 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 of, storing, and the using 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/or by taking adequate precautions when handling materials. These controls must be implemented for all applicable activities, material usage, and site conditions. The discharge of construction materials or wastes from a site is prohibited.

Table 4-2 of this handbook 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 presents detailed information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 4-1 of this handbook. Completed fact sheets for each of the above activities are provided in Section 4.4 of this handbook.

The fact sheets also contain side bar presentations with information on BMP categories, targeted constituents, removal effectiveness, and potential alternatives.

Example NS-xx Fact Sheet

Description and Purpose

Suitable Applications

Limitations

Implementation

Costs

Inspection and Maintenance

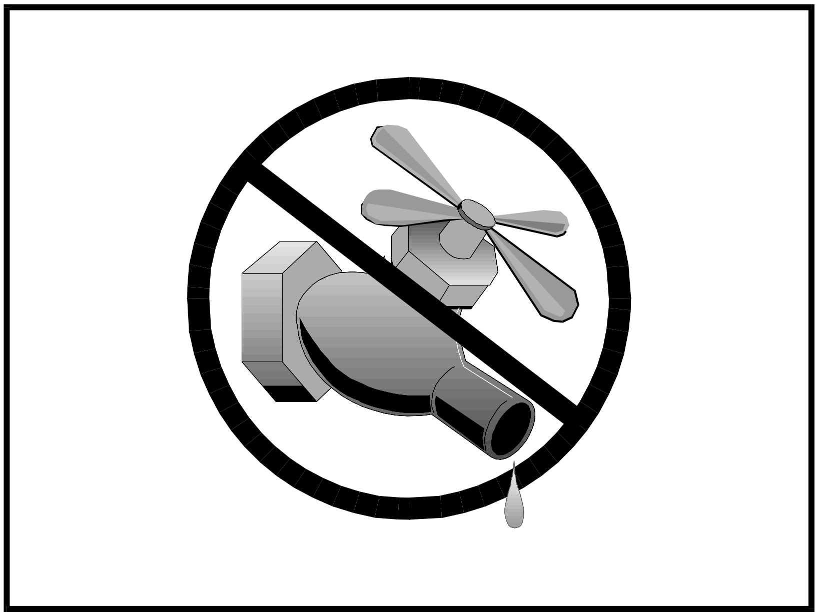
References

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 inclusions in SWPPPs. Copies of the fact sheets can be individually downloaded from the CASQA Online BMP Handbook at http://www.casqa.org.

BMP fact sheets are guidance and intended to provide a range of information about the BMPs. The BMP fact sheets should not be interpreted as General Permit requirements. CASQA recognizes that there may be alternative public domain and/or proprietary practices performing similar function. Alternative products should be evaluated for project-specific implementation and used if determined to be appropriate by the QSD. Fact sheets do not address site-specific implementation application needs and modifications. The QSD should provide site specific implementation requirements in the SWPPP.



Categories

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

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

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.

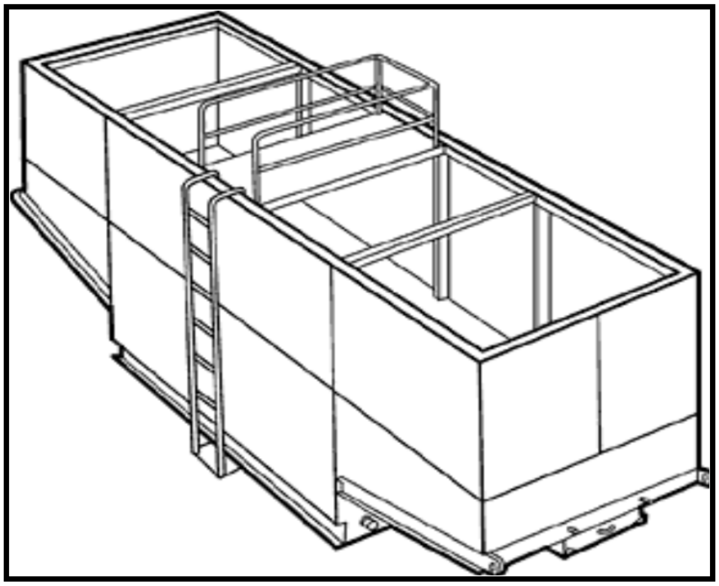
- Direct construction water runoff to areas where it can soak into the ground or be collected and used.
- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized 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 in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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



Categories

EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
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Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

SE-5: Fiber Roll

SE-6: Gravel Bag Berm

Description and Purpose

Dewatering operations are practices that manage the discharge of pollutants when non-stormwater and accumulated precipitation (stormwater) must be removed from a work location to proceed with construction work or to provide vector control.

The General Permit incorporates Numeric Action Levels (NAL) for turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Discharges from dewatering operations can contain high levels of fine sediment that, if not properly treated, could lead to exceedances of the General Permit requirements or Basin Plan standards.

The dewatering operations described in this fact sheet are not Active Treatment Systems (ATS) and do not include the use of chemical coagulations, chemical flocculation or electrocoagulation.

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 to facilitate construction.

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.

Stormwater mixed with non-stormwater should be managed as non-stormwater.

Limitations

- Dewatering operations will require and should comply with applicable local and project-specific permits and regulations. In some areas, all dewatering activities, regardless of the discharge volume, require a dewatering permit.
- Site conditions will dictate design and use of dewatering operations.
- The controls discussed in this fact sheet primarily address sediment. Other secondary pollutant removal benefits are discussed where applicable.
- The controls detailed in this fact sheet only allow for minimal settling time for sediment particles. Use only when site conditions restrict the use of the other control methods.
- Avoid dewatering discharges where possible by using the water for dust control.

Implementation

- A Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP).
- Regional Water Quality Control Board (RWQCB) Regions may require notification and approval prior to any discharge of water from construction sites.
- The destination of discharge from dewatering activities will typically determine the type of permit required for the discharge. For example, when discharging to a water of the U.S., a dewatering permit may be required through the site's governing RWQCB. When discharging to a sanitary sewer or Municipal Separate Storm Sewer System (MS4), a permit may need to be obtained from the owner of the sanitary sewer or MS4 in addition to obtaining an RWQCB dewatering permit. Additional permits or permissions from other agencies may be required for dewatering cofferdams or diversions.
- Dewatering discharges should not cause erosion at the discharge point. Appropriate BMPs should be implemented to maintain compliance with all applicable permits.
- Maintain dewatering records in accordance with all local and project-specific permits and regulations.

Sediment Treatment

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 sediment particle size and permit or receiving water limitations on sediment or turbidity are key considerations for selecting sediment treatment option(s); in some cases, the use of multiple devices may be appropriate. Use of other enhanced treatment methods (i.e., introduction of chemicals or electric current to enhance flocculation and removal of sediment) must comply with: 1) for storm drain or surface water discharges, the requirements for Active Treatment Systems (see SE-11); or 2) for sanitary sewer discharges, the requirements of applicable sanitary sewer discharge permits.

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) and have a designed outlet structure.

Appropriate Applications:

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

Implementation:

- Excavation and construction of related facilities is required.
- Temporary sediment basins should 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 outlet, as well as other features.
- Removal of sediment is required when the storage volume is reduced by one-third.

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) and do not have a designed outlet (but do have a spillway or overflow).

Appropriate Applications:

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

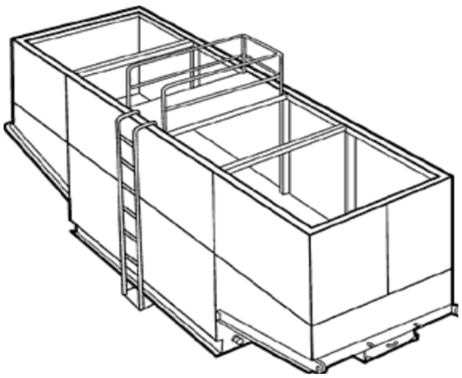
Implementation:

- 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.

- Treatment capacity (i.e., volume and number of tanks) should provide at a minimum the required volume for discrete particle settling for treatment design flows.

Maintenance:

- Periodic cleaning is required based on visual inspection or reduced flow.

- Oil and grease disposal should be conducted by a 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.

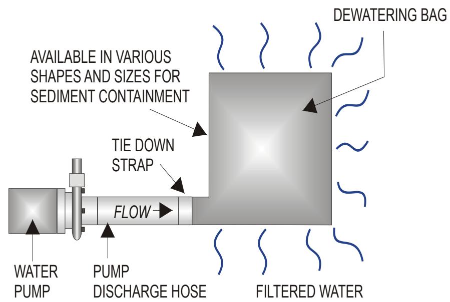
Implementation:

- 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 should be conducted 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 gravel, sand, silt, and fines.

Appropriate Applications:

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

Implementation:

- Water is pumped into one side of the bag and seeps through the top, bottom, and sides of the bag.

- Place filter bag on pavement or a gravel bed or paved surface. Avoid placing a dewatering bag on unprotected bare soil. If placing the bag on bare soil is unavoidable, a secondary barrier should be used, such as a rock filter bed placed beneath and beyond the edges of the bag to, prevent erosion and capture sediments that escape the bag.

- Perimeter control around the downstream end of the bag should be implemented. Secondary sediment controls are important especially in the initial stages of discharge, which tend to allow fines to pass through the bag.

Maintenance:

- Inspection of the flow conditions, bag condition, bag capacity, and the secondary barrier (as applicable) is required.

- Replace the bag when it no longer filters sediment or passes water at a reasonable rate.

- Caution should be taken when removing and disposing of the bag, to prevent the release of captured sediment

- Properly dispose of the bag offsite. If sediment is removed from the bag prior to disposal (bags can potentially be reused depending upon their condition), dispose of sediment in accordance with the general maintenance procedures described at the end of this BMP Fact Sheet.

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 control costs vary considerably depending on the dewatering and sediment treatment 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 $460 per month for a 1,000-gallon tank to $3,400 per month for a 10,000-gallon tank (adjusted for inflation, 2016 dollars, by Tetra Tech Inc.). Mobilization and demobilization costs vary considerably.

Inspection and Maintenance

- Inspect and verify that dewatering BMPs are in place and functioning prior to the commencement of activities requiring dewatering.

- Inspect dewatering BMPs daily while dewatering activities are being conducted.

- Inspect all equipment before use. Monitor dewatering operations to ensure they do not cause offsite discharge or erosion.
- Sample dewatering discharges as required by the General Permit.
- 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 should 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.

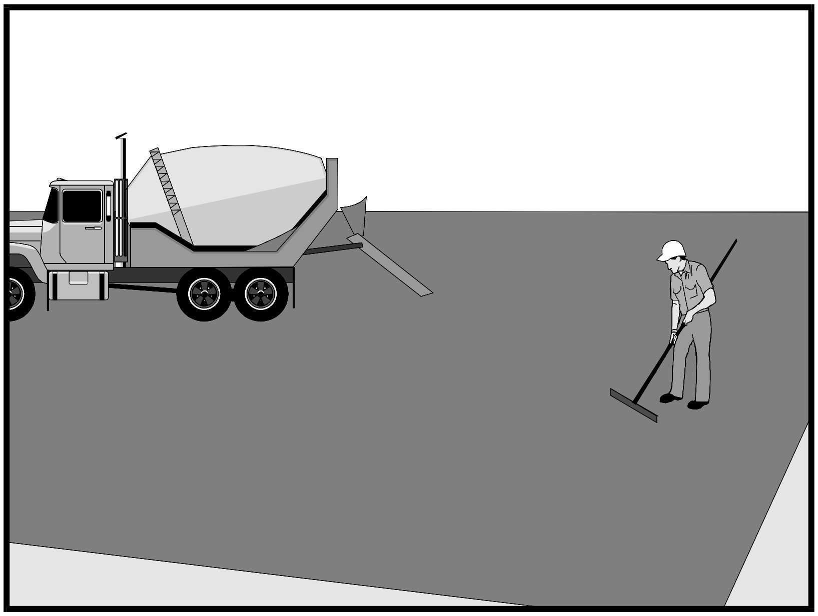
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003; Updated March 2004.

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).

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Paving and Grinding Operations NS-3



Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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.

The General Permit incorporates Numeric Action Levels (NAL) for pH and turbidity (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials associated with paving and grinding operations, including mortar, concrete, and cement and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

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

- Paving opportunities may be limited during wet weather.

  Discharges of freshly paved surfaces may raise pH to environmentally harmful levels and trigger permit violations.

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Implementation

General

- Avoid paving during the wet season when feasible.
- Reschedule paving and grinding activities if rain is forecasted.
- 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.
- 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 (Portland cement concrete) and AC (asphalt concrete) 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 should not be allowed to enter any storm drains or watercourses. Install inlet protection and perimeter controls until area is stabilized (i.e. cutting, grinding or other removal activities are complete and loose material has been properly removed and disposed of)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; SE-5, Fiber Rolls, or SE-13 Compost Socks and Berms
  - Collect and remove all broken asphalt and recycle when practical. Old or spilled asphalt should be recycled or disposed of properly.
- Do not allow saw-cut slurry to enter storm drains or watercourses. Residue from grinding operations should be picked up by a vacuum attachment to the grinding machine, or by sweeping, 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.
- Pavement removal activities should not be conducted in the rain.
- Collect removed pavement material by mechanical or manual methods. This material may be recycled for use as shoulder backing or base material.

- If removed pavement 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 should 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 waste materials by dry methods, such as sweeping or shoveling, 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 authorized by the local wastewater authority.

Sealing Operations

- During chip seal application and sweeping operations, petroleum or petroleum covered aggregate should not be allowed to enter any storm drain or water courses. Apply temporary perimeter controls until structure is stabilized (i.e. all sealing operations are complete and cured and loose materials have been properly removed and disposed).
- Inlet protection (SE-10, Storm Drain Inlet Protection) should be used 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 and dispose of in accordance with the applicable regulations. 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.
- 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.
- 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 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 paving and grinding operations.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Sample stormwater runoff required by the General Permit.
- Keep ample supplies of drip pans or absorbent materials onsite.
- Inspect and maintain machinery regularly to minimize leaks and drips.

References

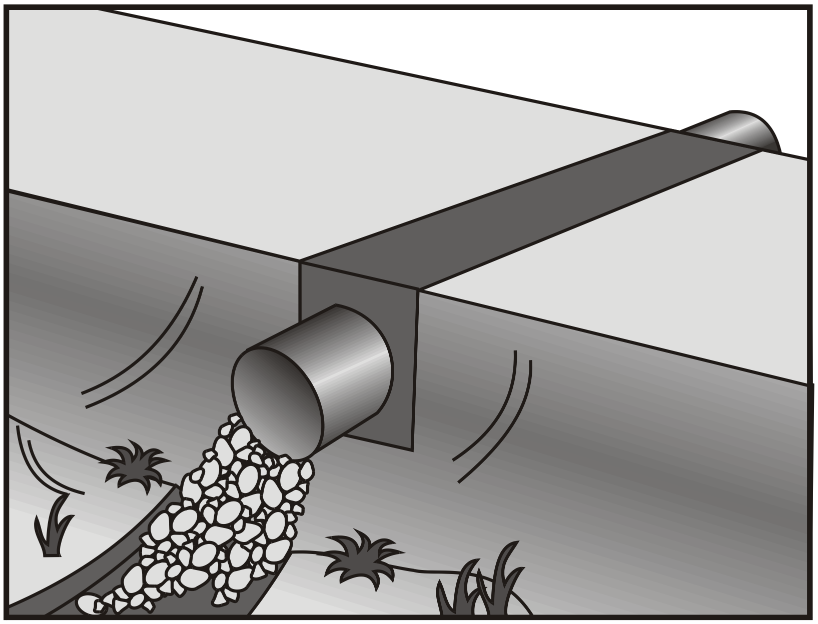
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

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), March 2003.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Temporary Stream Crossing NS-4



Categories

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

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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 \$58-\$122/ft^2 (costs adjusted for inflation, 2016 dollars, by Tetra Tech Inc.).

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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

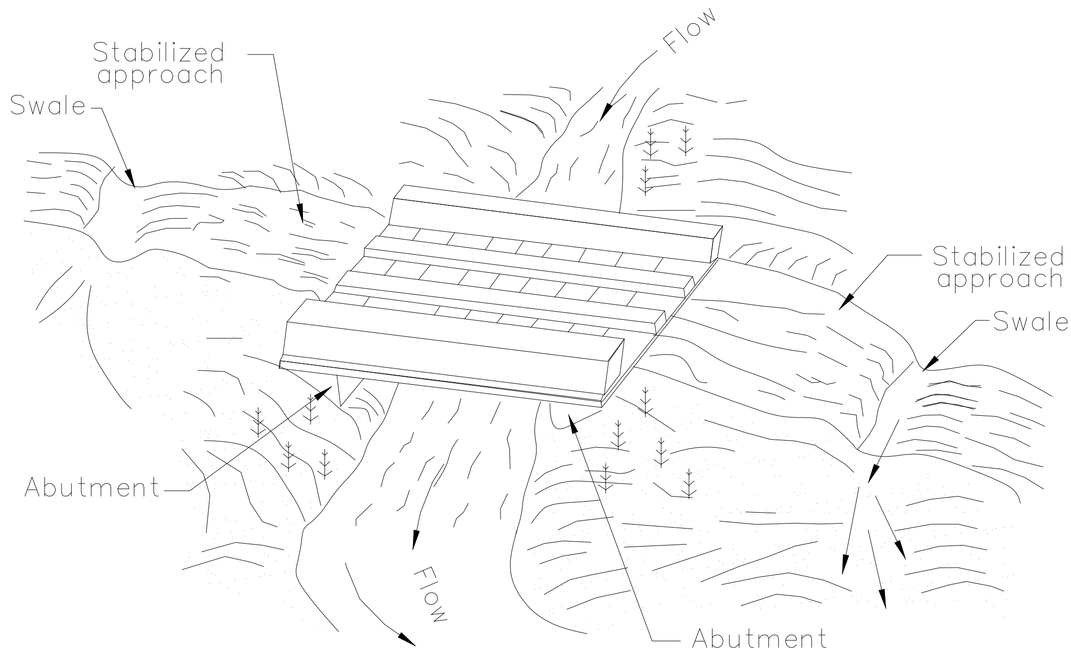
- Replace lost or displaced aggregate from inlets and outlets of culverts and cellular confinement systems.

- Remove temporary crossing promptly when it is no longer needed.

References

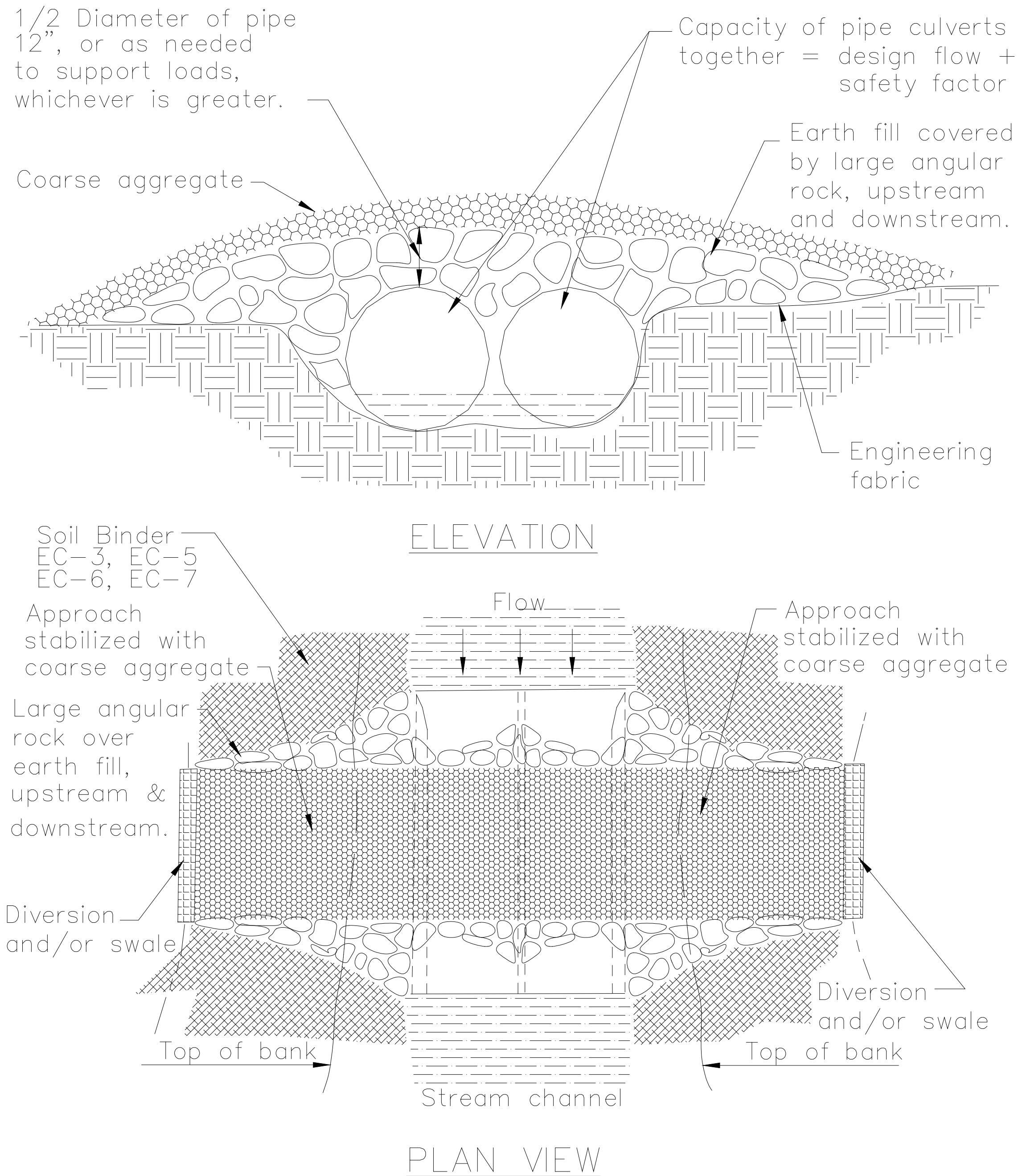
California Bank and Shore Rock Slope Protection Design – Practitioners Guide and Field Evaluations of Riprap Methods, Caltrans Study No. F90TL03, October 2000.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.



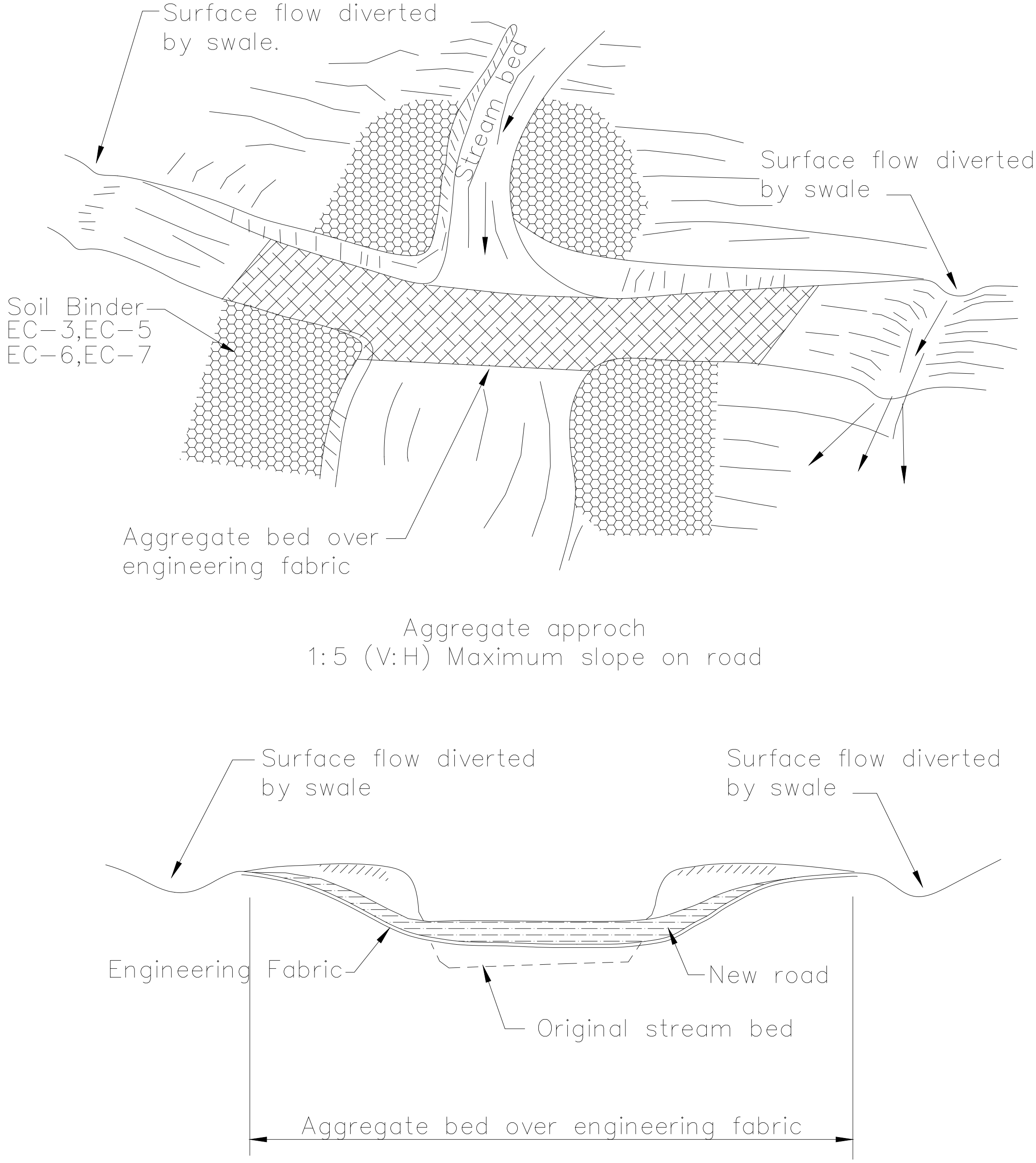
NOTE:
Surface flow of road diverted by swale and/or dike.

TYPICAL BRIDGE CROSSING
NOT TO SCALE

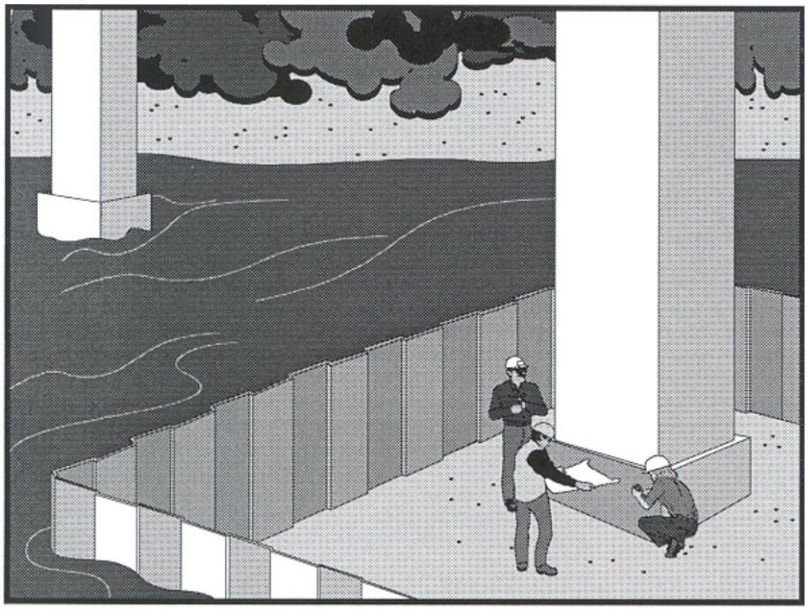


TYPICAL CULVERT CROSSING

NOT TO SCALE



TYPICAL FORD CROSSING
NOT TO SCALE



Categories

EC	Erosion Control	
SE	Sediment Control	
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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

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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 EC-12, 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

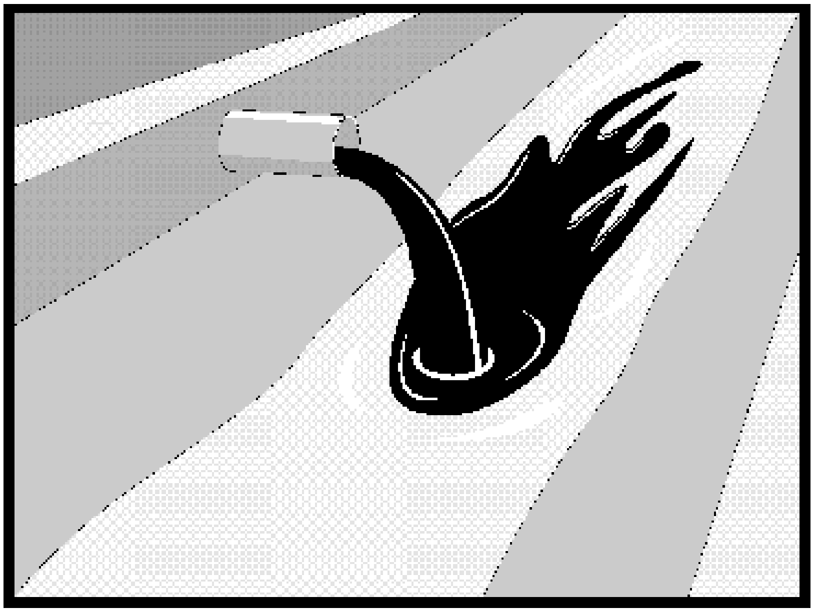
- Refer to BMP-specific inspection and maintenance requirements.

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



Categories

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

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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.

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- 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

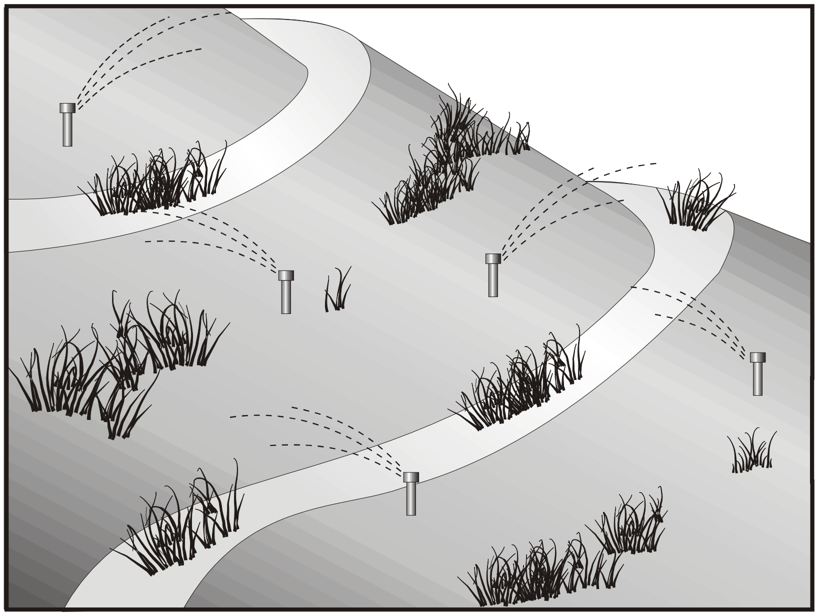
References

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



Categories

EC	Erosion Control	
SE	Sediment Control	
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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

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.

- 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.

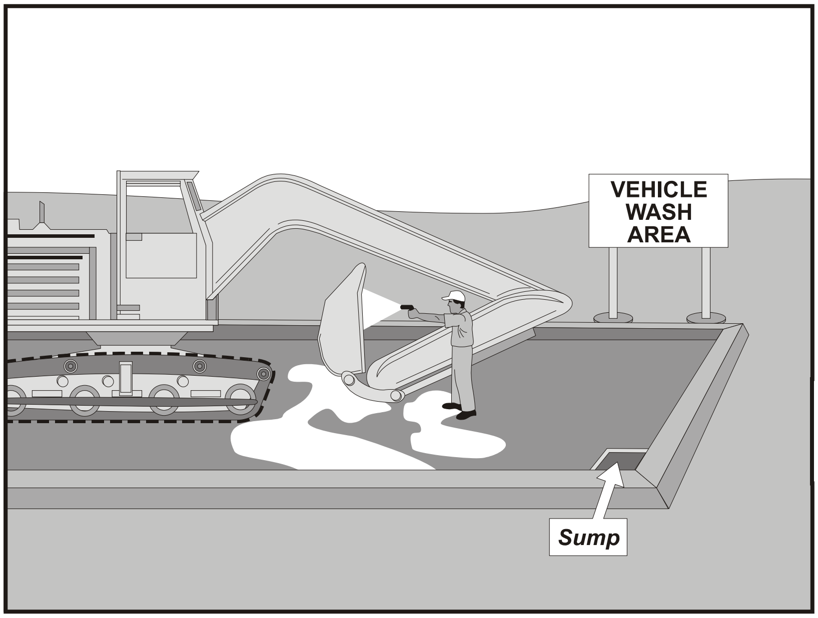
References

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



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☑ **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 TC-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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

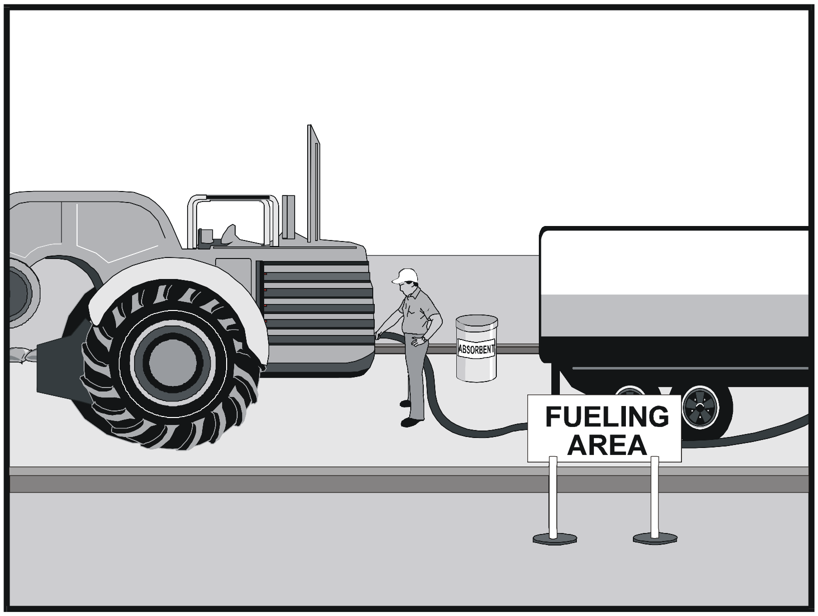
- Prohibit employees and subcontractors from washing personal vehicles and equipment on the construction site.

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



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☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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 TC-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.

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- 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

- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

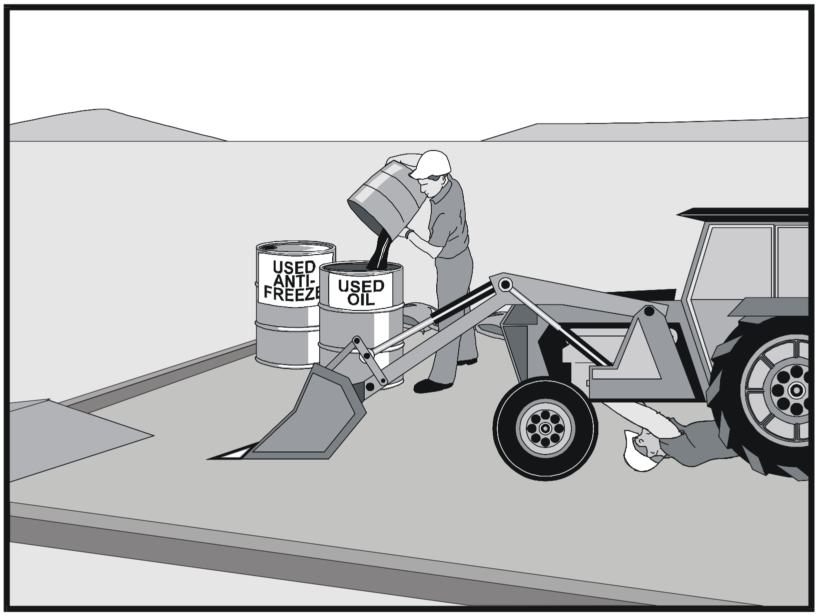
References

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.



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Legend:

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☒ **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 TC-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.

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.

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.

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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

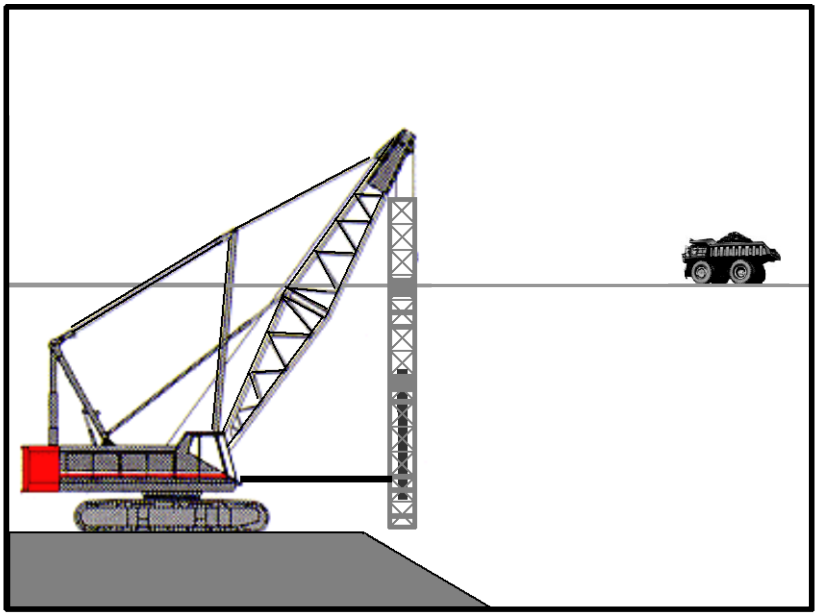
References

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



Categories

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

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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.

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- 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

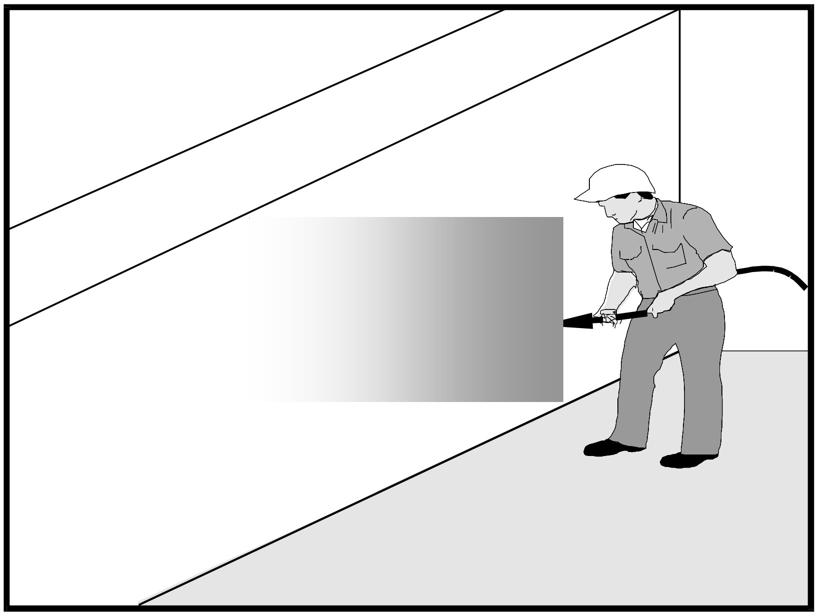
- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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



Categories

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 Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

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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.

Concrete and its associated curing materials have basic chemical properties that can raise the pH of water to levels outside of the permitted range. Discharges of stormwater and non-stormwater exposed to concrete during curing may have a high pH and may contain chemicals, metals, and fines. The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Proper procedures and care should be taken when managing concrete curing materials to prevent them from coming into contact with stormwater flows, which could result in a high pH discharge.

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

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

Implementation

Chemical Curing

- Avoid over spray of curing compounds.
- Minimize the drift 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 evaporation or other means of removal in accordance with all applicable permits. See WM-8 Concrete Waste Management.
- Collect cure water at the top of slopes and transport to a concrete waste management area in a non-erosive 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.

Education

- Educate employees, subcontractors, and suppliers on proper concrete curing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete curing procedures.

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.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts uncured and partially cured concrete as required by the General Permit.

- 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

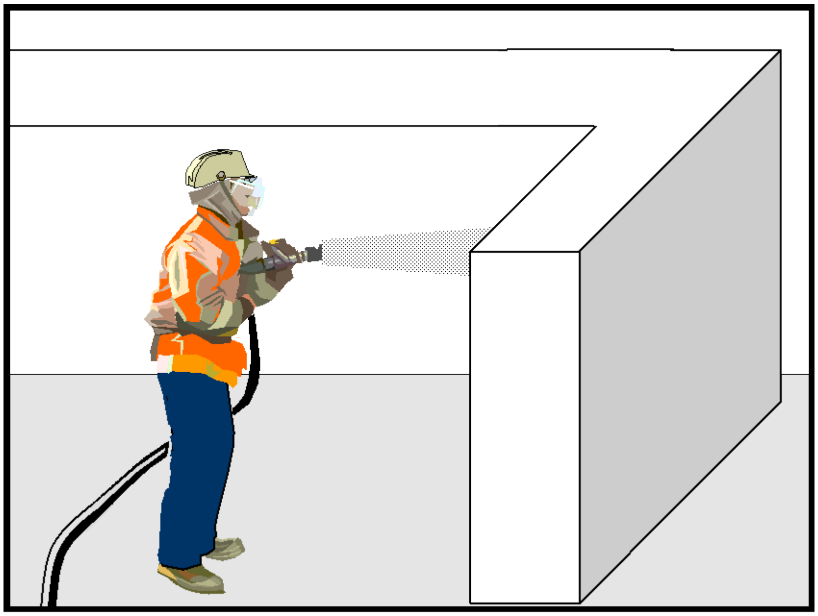
Blue Print for a Clean Bay-Construction-Related Industries: Best Management Practices for Stormwater Pollution Prevention; Santa Clara Valley Non-Point Source Pollution Control Program, 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.

Concrete Finishing NS-13



Categories

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 Category**

☒ **Secondary Category**

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.

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Concrete and its associated curing materials have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows, which could lead to exceedances of the General Permit requirements.

Suitable Applications

These procedures apply to all construction locations where concrete finishing operations are performed.

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Limitations

- Runoff contact with concrete waste can raise pH levels in the water to environmentally harmful levels and trigger permit violations.

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 Dewatering 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 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.

Education

- Educate employees, subcontractors, and suppliers on proper concrete finishing techniques to prevent contact with discharge as described herein.
- Arrange for the QSP or the appropriately trained contractor's superintendent or representative to oversee and enforce concrete finishing procedures.

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.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts concrete dust and debris as required by the General Permit.

- 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.
- Inspect containment structures for damage prior to use and prior to onset of forecasted rain.

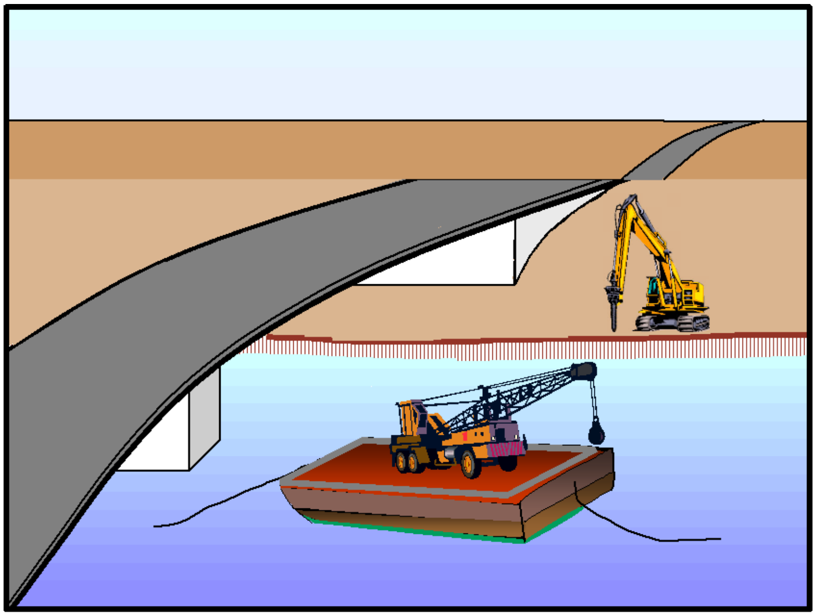
References

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), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Material Over Water



Categories

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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

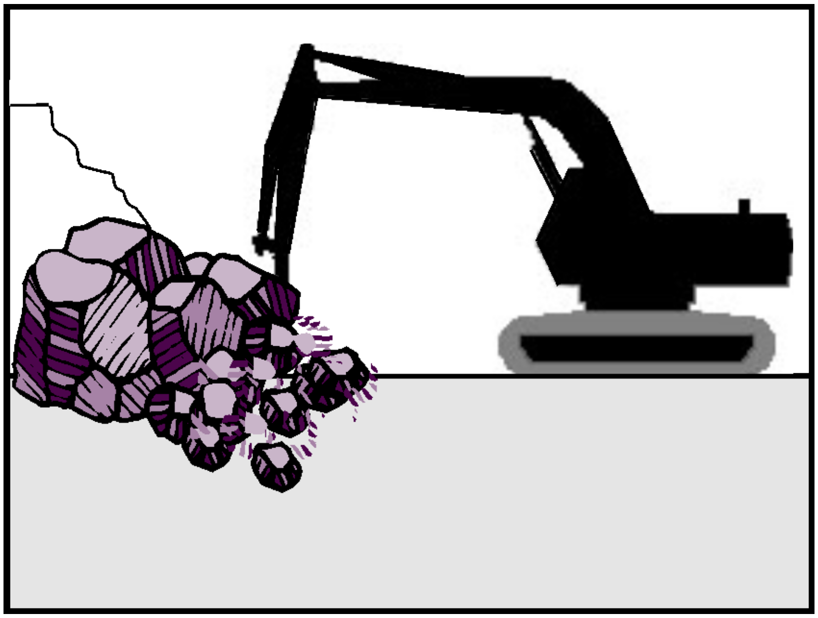
- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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



Categories

EC	Erosion Control	
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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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

Categories

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Legend:

☑ **Primary Category**

☒ **Secondary Category**

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.

The General Permit draft incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements). Many types of batch plant materials, including mortar, concrete, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows which may cause an exceedance of the General Permit requirements.

Suitable Applications

These procedures typically apply to construction sites where temporary batch plant facilities are used; however, some of the practices described are applicable to construction sites with general concrete use.

Limitations

The General Permit for discharges of stormwater associated with industrial activities (General Industrial Permit) 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. Contact the local regulatory agencies to determine if a permit is required.

Implementation

Planning

- Temporary batch plants may be subject to the General Industrial Permit. To obtain a copy of this permit and the application forms, visit http://www.waterboards.ca.gov or contact the State Water Resources 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 Construction Site Monitoring Plan (CSMP) should be included in the project Stormwater Pollution Prevention Plan (SWPPP). BMPs should be implemented, inspected, and maintained in accordance with these plans.

- 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 downwind 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 curbs or dikes should be placed at ingress and egress points (SE-12, Temporary Silt Dike).

- 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.
- Washing of concrete mixing and transport equipment (including concrete truck washout) should occur in a designated area in accordance with WM-8, Concrete Waste Management.
- Washing equipment, tools, or vehicles to remove PCC should be conducted in accordance with NS-7, Potable Water/Irrigation, NS-8, Vehicle and Equipment Cleaning, and WM-8, Concrete Waste Management.
- 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 particulate matter in accordance with the California Air Resources Control Board and local Air Pollution Control District Regulations.
- 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 should 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 (TC-2, Stabilized Construction Roadway), watered, treated with dust-suppressant chemicals (WE-1, Wind Erosion Control), 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 TC-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 sprayed 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 or store in a completely enclosed storage area on non-working days and prior to rain.

- Minimize stockpiles of demolished PCC by recycling them in a timely manner.

- Provide secondary containment for liquid materials (WM-1, Material Delivery and Storage, WM-10, Liquid Waste Management). 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 contain and clean up spilled cement and fly ash and contain.

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.

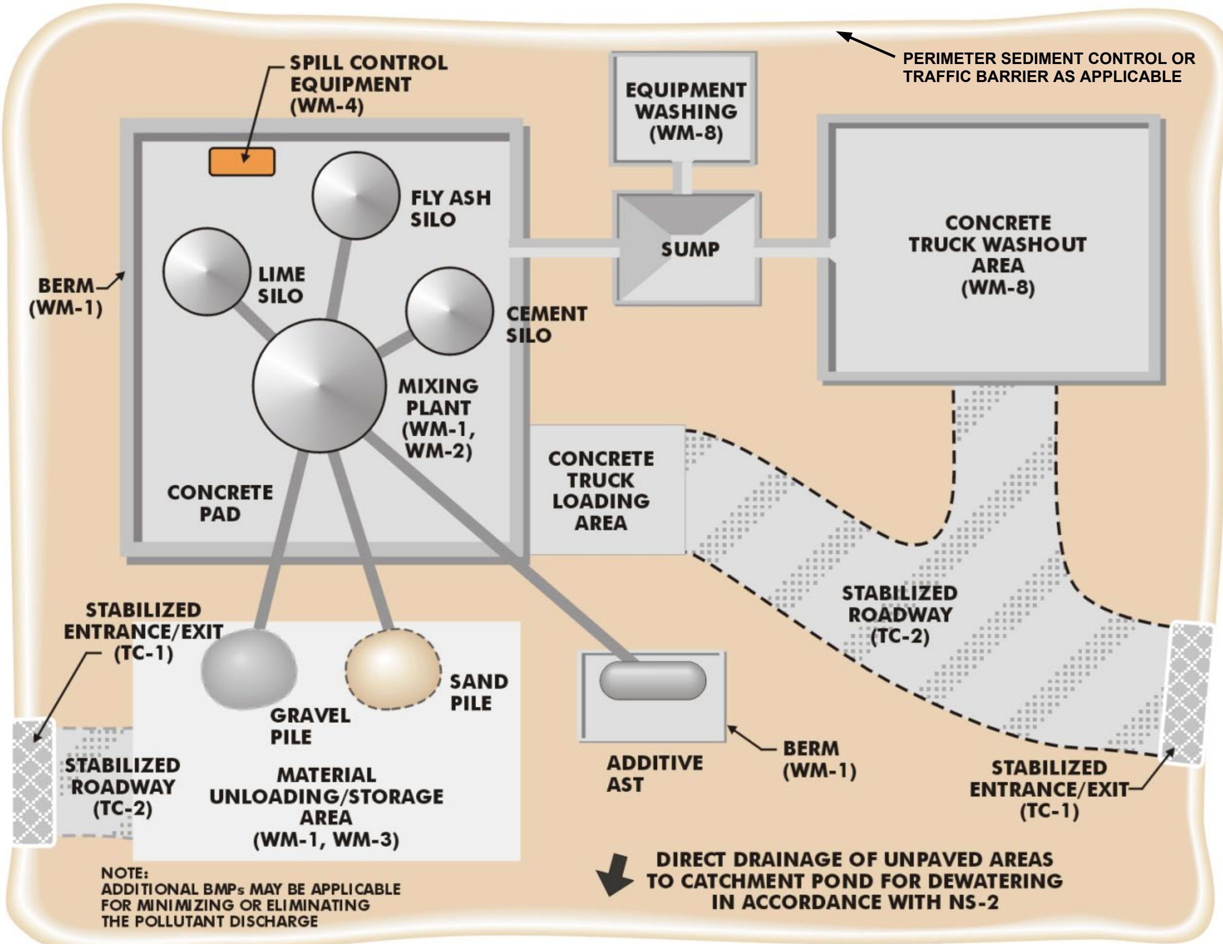
Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.
- Sample non-stormwater discharges and stormwater runoff that contacts cementitious materials or fly ash as required by the General Permit.
- Inspect and repair equipment (for damaged hoses, fittings, and gaskets).
- Inspect and maintain a Stabilized Construction Entrance/Exit (TC-1) as needed.
- Inspect and maintain stabilized haul roads as needed (TC-2, Stabilized Construction Roadway).
- Inspect and maintain materials and waste storage areas as needed.

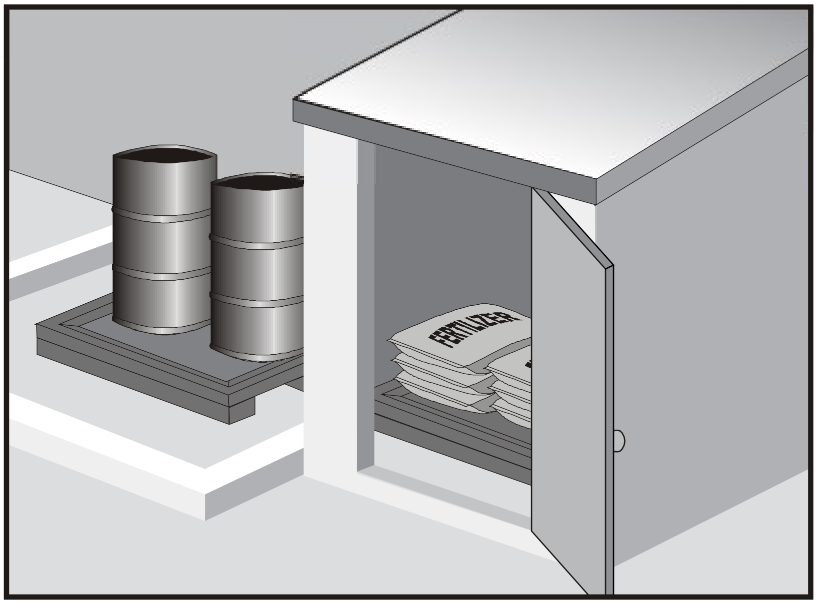
References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.



Typical Temporary Batch



Categories

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 Category**

☒ **Secondary Category**

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 watertight containers and/or a completely enclosed 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:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area that 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.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- 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 and dispose of 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.
- Materials should be covered 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 completely enclosed storage 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 wastes.

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.

- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

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

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Keep storage areas clean and well organized, including a current list of all materials onsite.

- Inspect labels on containers for legibility and accuracy.

- 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), March 2003.

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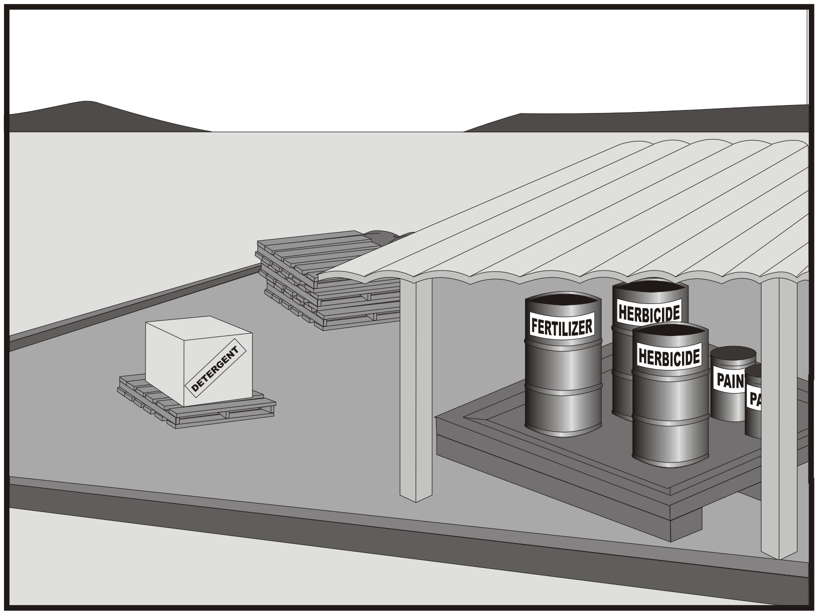


Categories

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 Category**

☒ **Secondary Category**

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
- 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
- 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.
- The preferred method of termiticide application is soil injection near the existing or proposed structure foundation/slab; however, if not feasible, soil drench application of termiticides should follow EPA label guidelines and the following recommendations (most of which are applicable to most pesticide applications):
  - Do not treat soil that is water-saturated or frozen.
  - Application shall not commence within 24-hours of a predicted precipitation event with a 40% or greater probability. Weather tracking must be performed on a daily basis prior to termiticide application and during the period of termiticide application.
  - Do not allow treatment chemicals to runoff from the target area. Apply proper quantity to prevent excess runoff. Provide containment for and divert stormwater from application areas using berms or diversion ditches during application.
  - Dry season: Do not apply within 10 feet of storm drains. Do not apply within 25 feet of aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds).
  - Wet season: Do not apply within 50 feet of storm drains or aquatic habitats (such as, but not limited to, lakes; reservoirs; rivers; permanent streams; marshes or ponds; estuaries; and commercial fish farm ponds) unless a vegetative buffer is present (if so, refer to dry season requirements).
  - Do not make on-grade applications when sustained wind speeds are above 10 mph (at application site) at nozzle end height.
  - Cover treatment site prior to a rain event in order to prevent run-off of the pesticide into non-target areas. The treated area should be limited to a size that can be backfilled and/or covered by the end of the work shift. Backfilling or covering of the treated area shall be done by the end of the same work shift in which the application is made.
  - The applicator must either cover the soil him/herself or provide written notification of the above requirement to the contractor on site and to the person commissioning the

application (if different than the contractor). If notice is provided to the contractor or the person commissioning the application, then they are responsible under the Federal Insecticide Fungicide, and Rodenticide Act (FIFRA) to ensure that: 1) if the concrete slab cannot be poured over the treated soil within 24 hours of application, the treated soil is covered with a waterproof covering (such as polyethylene sheeting), and 2) the treated soil is covered if precipitation is predicted to occur before the concrete slab is scheduled to be poured.

- 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 hydraulic application. 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 before predicted rainfall.

- 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 contain for proper disposal off site. 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.

- Document the location, time, chemicals applied, and applicator's name and qualifications.

- 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.

- Discontinue use of erodible landscape material within 2 days prior to a forecasted rain event and materials should be covered and/or bermed.

- Provide containment for material use areas such as masons' areas or paint mixing/preparation areas to prevent materials/pollutants from entering stormwater.

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.
- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Ensure employees and subcontractors throughout the job are using appropriate practices.

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.

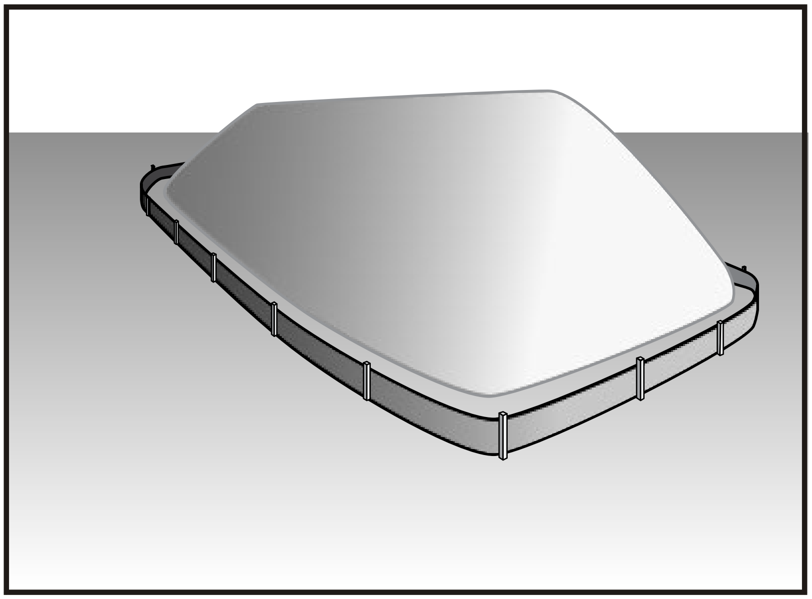
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Comments on Risk Assessments Risk Reduction Options for Cypermethrin: Docket No. OPP–2005–0293; California Stormwater Quality Association (CASQA) letter to USEPA, 2006.Environmental Hazard and General Labeling for Pyrethroid Non-Agricultural Outdoor Products, EPA-HQ-OPP-2008-0331-0021; USEPA, 2008.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Stockpile Management WM-3



Treat Categories

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 Category**

☒ **Secondary Category**

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, soil amendments, sand, 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 loose materials.

Limitations

- Plastic sheeting as a stockpile protection is temporary and hard to manage in windy conditions. Where plastic is used, consider use of plastic tarps with nylon reinforcement which may be more durable than standard sheeting.
- Plastic sheeting can increase runoff volume due to lack of infiltration and potentially cause perimeter control failure.
- Plastic sheeting breaks down faster in sunlight.
- The use of Plastic materials and photodegradable plastics should be avoided.

Implementation

Protection of stockpiles is a year-round requirement. To properly manage stockpiles:

- On larger sites, a minimum of 50 ft separation from concentrated flows of stormwater, drainage courses, and inlets is recommended.

- After 14 days of inactivity, a stockpile is non-active and requires further protection described below. All stockpiles are required to be protected as non-active stockpiles immediately if they are not scheduled to be used within 14 days.

- Protect all stockpiles from stormwater run-on using temporary perimeter sediment barriers such as compost berms (SE-13), temporary silt dikes (SE-12), fiber rolls (SE-5), silt fences (SE-1), sandbags (SE-8), gravel bags (SE-6), or biofilter bags (SE-14). Refer to the individual fact sheet for each of these controls for installation information.

- 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.

- Ensure that stockpile coverings are installed securely to protect from wind and rain.

- Some plastic covers withstand weather and sunlight better than others. Select cover materials or methods based on anticipated duration of use.

Protection of Non-Active Stockpiles

A stockpile is considered non-active if it either is not used for 14 days or if it is scheduled not to be used for 14 days or more. Stockpiles need to be protected immediately if they are not scheduled to be used within 14 days. Non-active stockpiles of the identified materials should be protected as follows:

Soil stockpiles

- Soil stockpiles should be covered or protected with soil stabilization measures and a temporary perimeter sediment barrier at all times.

- Temporary vegetation should be considered for topsoil piles that will be stockpiled for extended periods.

Stockpiles of Portland cement concrete rubble, asphalt concrete, asphalt concrete rubble, aggregate base, or aggregate sub base

- Stockpiles should be covered and protected with a temporary perimeter sediment barrier at all times.

Stockpiles of "cold mix"

- Cold mix stockpiles should be placed on and covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Stockpiles of fly ash, stucco, hydrated lime

- Stockpiles of materials that may raise the pH of runoff (i.e., basic materials) should be covered with plastic and surrounded by a berm.

Stockpiles/Storage of treated wood

- Treated wood should be covered with plastic sheeting or comparable material at all times and surrounded by a berm.

Protection of Active Stockpiles

A stockpile is active when it is being used or is scheduled to be used within 14 days of the previous use. Active stockpiles of the identified materials should be protected as follows:

- All stockpiles should be covered and protected with a temporary linear sediment barrier prior to the onset of precipitation.

- Stockpiles of "cold mix" and treated wood, and basic materials should be placed on and covered with plastic sheeting or comparable material and surrounded by a berm prior to the onset of precipitation.

- The downstream perimeter of an active stockpile should be protected with a linear sediment barrier or berm and runoff should be diverted around or away from the stockpile on the upstream perimeter.

Costs

For cost information associated with stockpile protection refer to the individual erosion or sediment control BMP fact sheet considered for implementation (For example, refer to SE-1 Silt Fence for installation of silt fence around the perimeter of a stockpile.)

Inspection and Maintenance

- Stockpiles must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- It may be necessary to inspect stockpiles covered with plastic sheeting more frequently during certain conditions (for example, high winds or extreme heat).

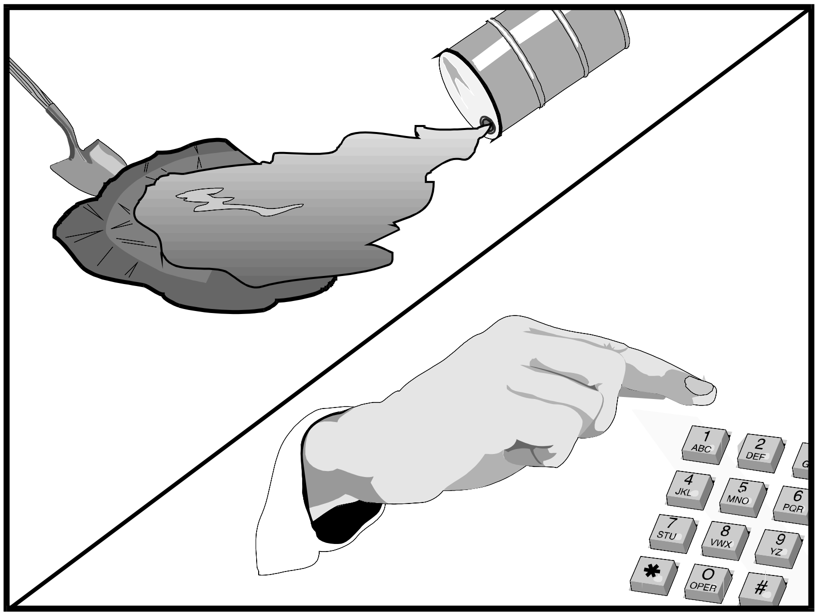
- Repair and/or replace perimeter controls and covers as needed to keep them functioning properly.

- Sediment shall be removed when it reaches one-third of the barrier height.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Spill Prevention and Control WM-4



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

Categories

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

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CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

- 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 spill's 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

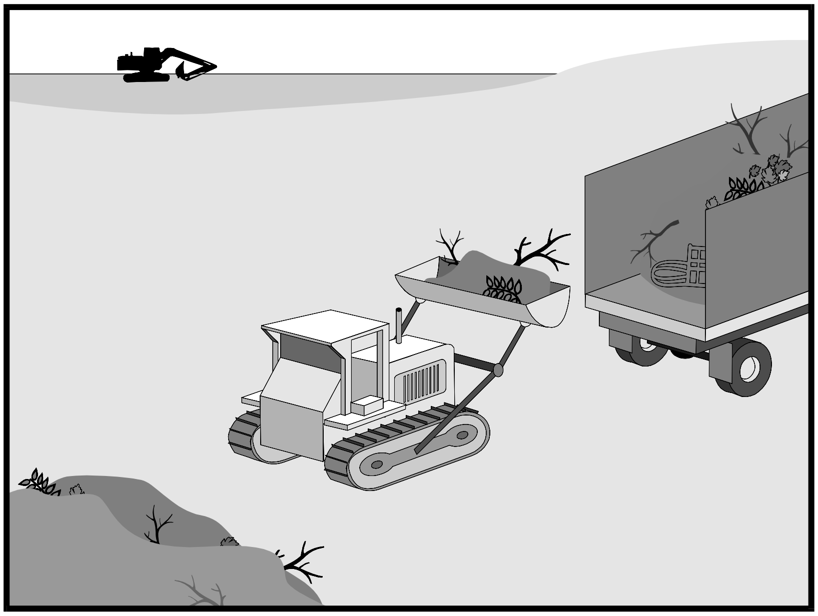
References

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



Categories

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

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- 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.
- Cover waste containers at the end of each work day and when it is raining.
- 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur

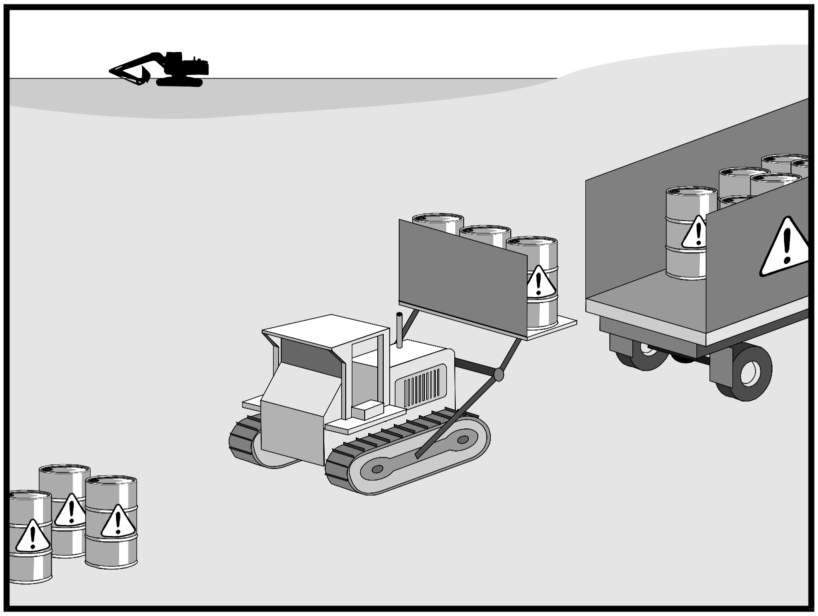
- Inspect construction waste area regularly.

- 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.



Categories

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TC	Tracking Control	
WE	Wind Erosion Control	
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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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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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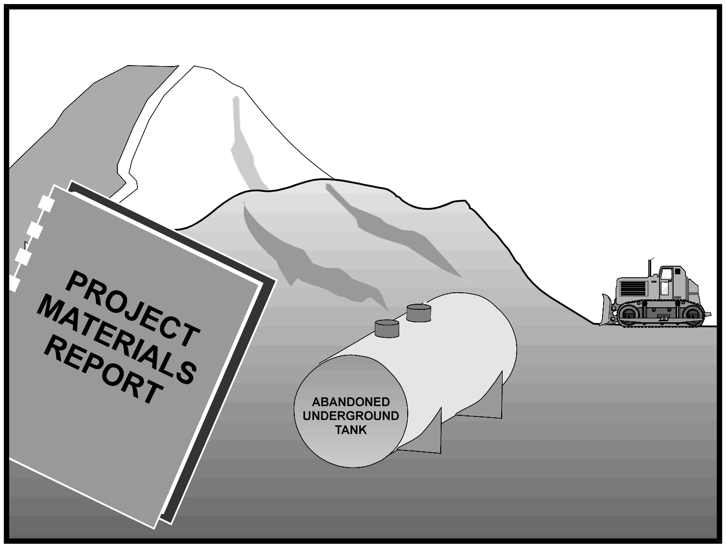
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Contaminated Soil Management WM-7



Categories

EC	Erosion Control	
SE	Sediment Control	
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Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

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 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 BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- 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.

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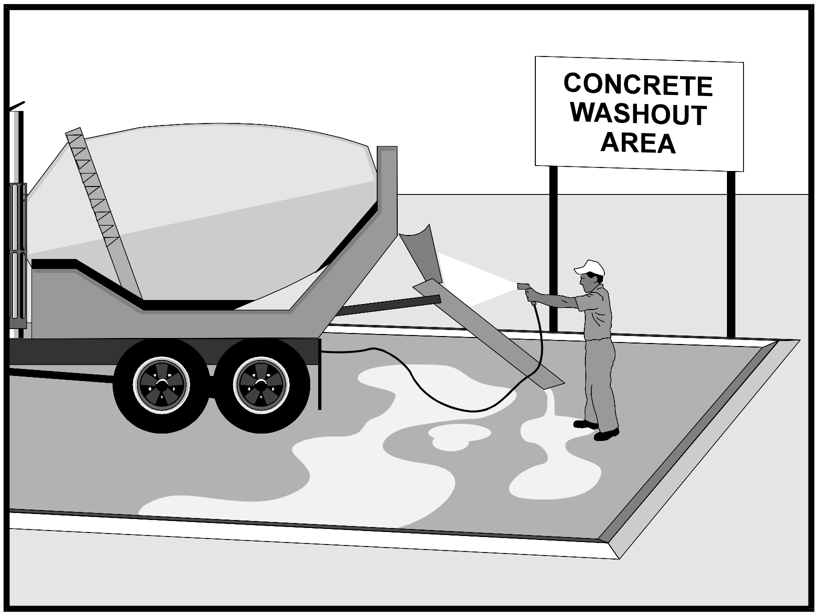

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WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☒
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

If User/Subscriber modifies this fact sheet in any way, the CASQA name/logo and footer below must be removed from each page and not appear on the modified version.

Description and Purpose

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

The General Permit incorporates Numeric Action Levels (NAL) for pH (see Section 2 of this handbook to determine your project's risk level and if you are subject to these requirements).

Many types of construction materials, including mortar, concrete, stucco, cement and block and their associated wastes have basic chemical properties that can raise pH levels outside of the permitted range. Additional care should be taken when managing these materials to prevent them from coming into contact with stormwater flows and raising pH to levels outside the accepted range.

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 from demolition activities.
- Slurries containing Portland cement concrete (PCC) are generated, such as from saw cutting, coring, grinding, grooving, and hydro-concrete demolition.
- Concrete trucks and other concrete-coated equipment are washed onsite.

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- Mortar-mixing stations exist.
- Stucco mixing and spraying.
- See also NS-8, Vehicle and Equipment Cleaning.

Limitations

- Offsite washout of concrete wastes may not always be possible.
- Multiple washouts may be needed to assure adequate capacity and to allow for evaporation.

Implementation

The following steps will help reduce stormwater pollution from concrete wastes:

- Incorporate requirements for concrete waste management into material supplier and subcontractor agreements.
- Store dry and wet materials under cover, away from drainage areas. Refer to WM-1, Material Delivery and Storage for more information.
- Avoid mixing excess amounts of concrete.
- Perform washout of concrete trucks in designated areas only, where washout will not reach stormwater.
- Do not wash out concrete trucks into storm drains, open ditches, streets, streams or onto the ground. Trucks should always be washed out into designated facilities.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- For onsite washout:
  - On larger sites, it is recommended to locate washout areas 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.
  - Washout wastes into the temporary washout where the concrete can set, be broken up, and then disposed properly.
  - Washouts shall be implemented in a manner that prevents leaching to underlying soils. Washout containers must be water tight and washouts on or in the ground must be lined with a suitable impervious liner, typically a plastic type material.
- 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.
- See typical concrete washout installation details at the end of this fact sheet.

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.

- 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.

Concrete Demolition Wastes

- Stockpile concrete demolition waste in accordance with BMP WM-3, Stockpile Management.

- Dispose of or recycle hardened concrete waste in accordance with applicable federal, state or local regulations.

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 (as described in Onsite Temporary Concrete Washout Facility, Concrete Transit Truck Washout Procedures, below).

- 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 concrete 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 or by sweeping. 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.

- Concrete slurry residue should be disposed in a temporary washout facility (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.

- Temporary washout facilities should be lined to prevent discharge to the underlying ground or surrounding area.

- 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 or recycled 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 or recycle 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; however, smaller sites or jobs may only need a smaller washout facility. With any washout, always maintain a sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.

  - Materials used to construct the washout area should conform to the provisions detailed in their respective BMPs (e.g., SE-8 Sandbag 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.

  - Alternatively, portable removable containers can be used as above grade concrete washouts. Also called a “roll-off”; this concrete washout facility should be properly sealed to prevent leakage and should be removed from the site and replaced when the container reaches 75% capacity.

- 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.

- The base of a washout facility should be free of rock or debris that may damage a plastic liner.

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 properly disposed or recycled in accordance with federal, state or local regulations. Materials used to construct temporary concrete washout facilities should be removed from the site of the work and properly disposed or recycled in accordance with federal, state or local regulations.

- 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. Roll-off concrete washout facilities can be more costly than other measures due to removal and replacement; however, provide a cleaner alternative to traditional washouts. The type of washout facility, size, and availability of materials will determine the cost of the washout.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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 properly disposed or recycled in accordance with federal, state or local regulations.

- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.

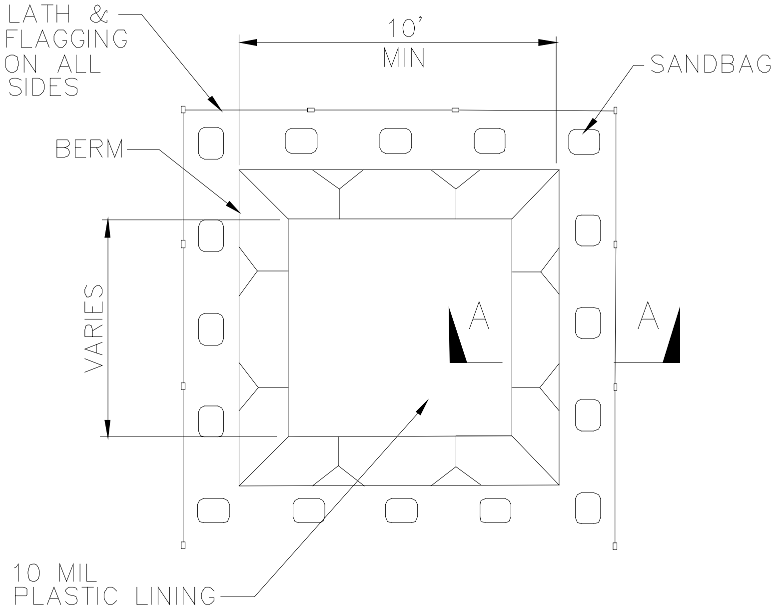
- Inspect washout facilities for damage (e.g. torn liner, evidence of leaks, signage, etc.). Repair all identified damage.

References

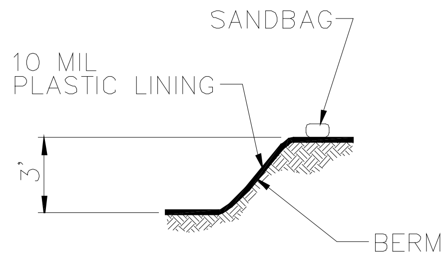
Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000, Updated March 2003.

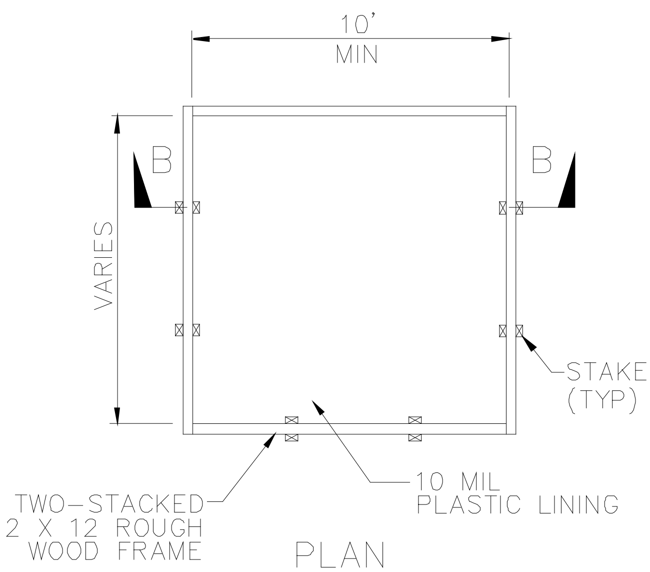
Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



PLAN
NOT TO SCALE
TYPE "BELOW GRADE"



SECTION A–A
NOT TO SCALE



PLAN
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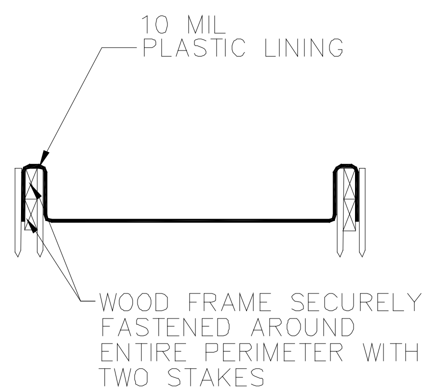
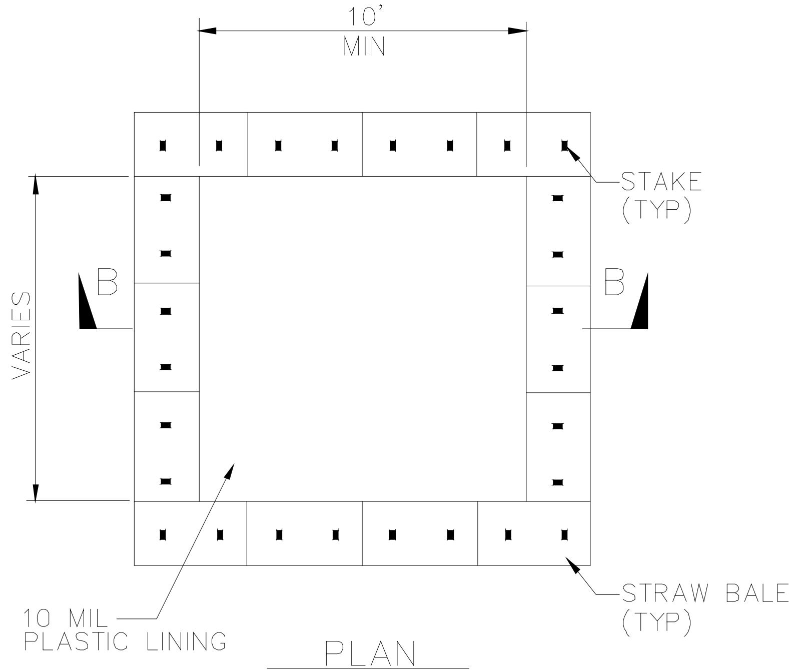
TYPE "ABOVE GRADE"



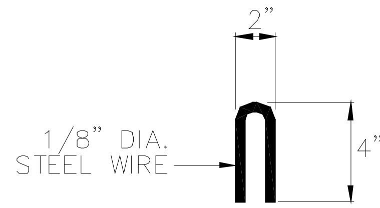
SECTION B–B
NOT TO SCALE

NOTES

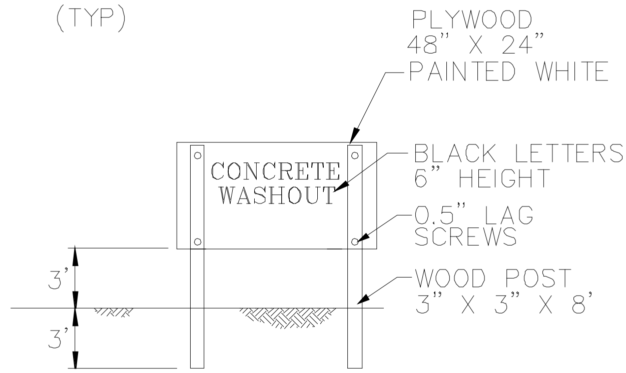
1. ACTUAL LAYOUT DETERMINED IN FIELD.
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.



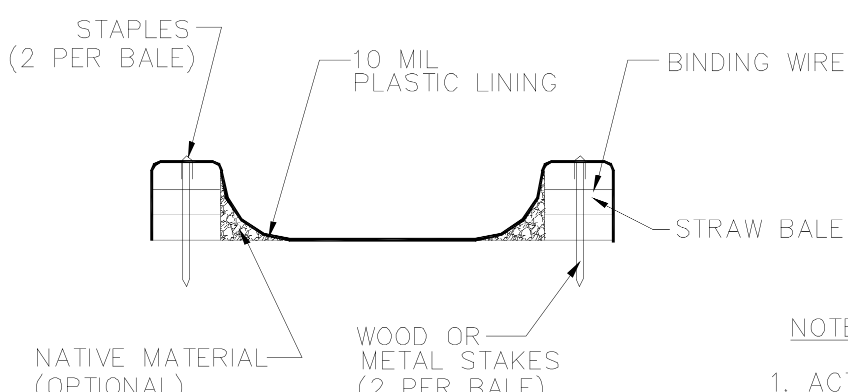
PLAN
NOT TO SCALE
TYPE "ABOVE GRADE"
WITH STRAW BALES



STAPLE DETAIL



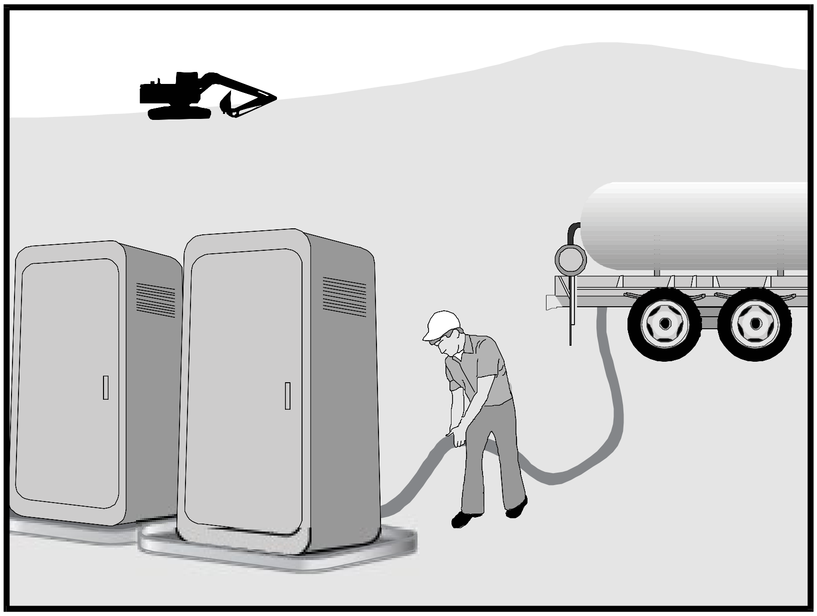
CONCRETE WASHOUT
SIGN DETAIL
(OR EQUIVALENT)



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.



Categories

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 Category**

☒ **Secondary Category**

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. If site conditions allow, place portable facilities a minimum of 50 feet from drainage conveyances and traffic areas. When subjected to high winds or risk of high winds, temporary sanitary facilities should be secured to prevent overturning.

- Temporary sanitary facilities must be equipped with containment to prevent discharge of pollutants to the stormwater drainage system of the receiving water.
- Consider safety as well as environmental implications before placing temporary sanitary facilities.
- 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.
- 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.
- If a spill does occur from a temporary sanitary facility, follow federal, state and local regulations for containment and clean-up.

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 the use of sanitary facilities (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

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- 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.

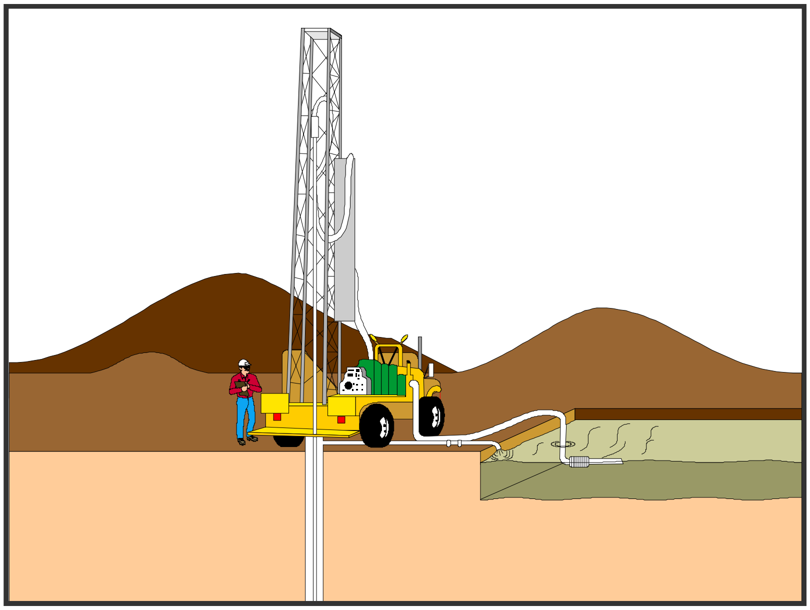
- If spills or leaks from sanitary or septic facilities occur that are not contained and discharge from the site, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

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



Categories

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

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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.

Section 5
Glossary and List of Acronyms

5.1 Glossary

303(d) Listed: Water bodies listed as impaired as per Section 303(d) of the 1972 CWA.

Active Areas of Construction: All areas subject to land surface disturbance activities related to the project including, but not limited to, project staging areas, immediate access areas and storage areas. All previously active areas of construction are considered active areas (unless temporarily defined as inactive areas) until final stabilization is complete.

Active Treatment System (ATS): A treatment technology that employs chemical coagulation, chemical flocculation, or electrocoagulation to reduce turbidity caused by fine suspended sediment, and/or to control pH levels. An active treatment system relies on enclosed computerized systems with pumps, filters, and real-time controls.

Acute Toxicity: Acute toxicity in water is caused by chemical stimuli that rapidly induce a negative effect on aquatic life; in aquatic toxicity tests, acute toxicity is demonstrated by an effect observed within 96 hours or less.

Acute Toxicity Test: Laboratory test in which an organism of interest (e.g., fathead minnow or rainbow trout) is placed in a water sample. By tracking the organism's survival, the lab can determine whether the sample water is toxic.

Aquatic: The water environment. Plants and animals that live in the water are referred to as being aquatic.

Bacteria: See pathogens.

Beneficial Uses: As defined in the California Water Code, beneficial uses of the waters of the State that may be protected against quality degradation include, but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. See also COLD, MIGR, and SPWN.

Best Management Practices (BMPs): Includes schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent, eliminate, or reduce the pollution of waters of the receiving waters. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Biofilter Bags: Plastic mesh bag filled with 100% recycled wood product waste. They come in a variety of sizes and are used to detain flow and allowing a slow rate of discharge through the wood media.

Cartridge Filter: 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.

Catch Basin (Also known as Inlet): Box-like underground concrete structure with openings in curbs and gutters designed to collect runoff from streets and pavement.

Check Dam: A small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or other proprietary products, placed across a constructed swale or drainage ditch. Check dams are used to reduce the effective slope of the channel and flow velocity, which allows sediment to settle out of suspension.

Clay A particle size class consisting of sediment particles less than 0.002 mm in diameter.

Clean Water Act (CWA): (33 U.S.C. 1251 et seq.) requirements of the NPDES program are defined under Sections 307, 402, 318 and 405 of the CWA.

COLD: Abbreviation for the Cold Freshwater Habitat Beneficial Use, which designates uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Compost: Compost is typically derived from combinations of feedstocks, biosolids, leaf and yard trimmings, manure, wood, or mixed solid waste; it is organic and biodegradable and can be left on-site.

Compost Berm: A dike of compost with a trapezoidal cross-section used to intercept sheet flow when placed perpendicular to runoff flow.

Compost Blanket: A layer of compost applied at the appropriate thickness onto slopes and earth disturbed areas to prevent erosion, and in some cases, increase infiltration and/or establish vegetation. Provides organic matter and nutrients important for plant growth.

Compost Sock: Mesh sock containing compost used as a three-dimensional biodegradable filtering structure to intercept runoff where sheet flow occurs.

Concrete Curing: 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.

Concrete Finishing: General term for methods used for bridge deck rehabilitation, paint removal, curing compound removal, and final surface finish appearances. Applications include sand blasting, shot blasting, grinding, or high-pressure water blasting.

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

Denuded: Land stripped of vegetation or land that has had its vegetation worn down due to the impacts from the elements or humans.

Detention: The temporary storage of stormwater to improve quality or reduce the volumetric flow rate of discharge or both.

Dewatering: The process of removing excess water in an excavation or impoundment by pumping or other mechanical means.

Dewatering Bag: See gravity bag filter.

Dewatering Operations: Practices that manage the discharge of pollutants when non-stormwater and/or stormwater must be removed from a work location to proceed with construction work or to provide vector control.

Dewatering Tank: 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.

Discharge: A release or flow of stormwater or other substance from a conveyance system or storage container. Broader – includes release to storm drains, etc.

Discharge Location: A common outlet from a construction site drainage area where stormwater, authorized non-stormwater, or dewatering discharge leaves the site or project boundary, or enters any on-site waters of the United States (e.g., a creek running through a site).

Disking: A mechanical method of roughening the upper layer of soil to reduce competing vegetation, improve water infiltration, and prepare for planting.

Effluent Limitations: Any numeric or narrative restriction imposed on quantities, discharge rates, and concentrations of pollutants which are discharged from point sources into waters of the United States, the waters of the contiguous zone, or the ocean.

Erosion: The process, by which soil particles are detached and transported by the actions of wind, water, or gravity.

Erosion Control BMPs: Are vegetation, such as grasses and wildflowers, and other materials, such as straw, fiber, stabilizing emulsion, protective blankets, rolled erosion control product, etc., placed to stabilize areas of disturbed soils, reduce loss of soil due to the action of water or wind, and prevent water pollution.

Fiber Rolls: A tight tubular roll made of straw, coir, or other biodegradable materials wrapped in netting which can be photodegradable or natural. Used along the contour or at the toe of a slope to intercept runoff, reduce flow velocity, and release the runoff as sheet flow, and provide some removal of sediment from the runoff.

Fines: Refers to soil particles (sediment) that fall within the clay or silt size fractions.

Forecasted Precipitation Event: Forecasted precipitation event is any weather pattern that is forecasted to have a 50 percent or greater chance of producing 0.5 inches of precipitation in a 24-hour period in the project area. The discharger shall obtain precipitation forecast information from the National Weather Service Forecast Office (e.g., by entering the zip code of the project's location at https://forecast.weather.gov). Precipitation events end when there are two sequential 24-hour periods with less than 0.25 inches of precipitation forecast for each period.

(Construction) General Permit: A National Pollutant Discharge Elimination System (NPDES) permit issued by the State Water Resources Control Board for the discharge of stormwater associated with construction activity from soil disturbance of one acre or more.

Grading: The cutting or filling of the land surface to a desired slope or elevation.

Gravel Bag Berm: Series of gravel-filled bags placed on a level contour to intercept sheet flow.

Gravity Bag Filter: 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 gravel, sand, silt, and fines.

Gross Pollutants: Typically refers to visible pollutants such as trash, debris, and floatables, which may create an aesthetic "eye sore" in waterways, but may also include heavy metals, pesticides, and bacteria in stormwater. Gross pollutants also include plant debris (such as leaves and lawn-clippings), animal excrement, street litter, and other organic matter.

Gully Erosion: Erosion that occurs where the volume of runoff is concentrated, flowing water cuts deep into the soil bringing together separate rills into larger channels called gullies. Gully erosion acts like rill erosion on a larger scale.

Hazardous Waste: A waste or combination of wastes that, because of its quantity, concentration, or physical, chemical or infectious characteristics, may either cause or significantly contribute to an increase in mortality or an increase in serious irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed. Possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity) or appears on special U.S. EPA or State lists. Regulated under the federal Resource Conservation and Recovery Act and the California Health and Safety Code.

Hydraulic Mulch: Hydraulic mulch consists of various types of fibrous materials mixed with water and sprayed onto the soil surface in slurry form to provide a layer of temporary protection from wind and water erosion.

Hydroseeding: Typically consists of applying a mixture of a hydraulic mulch, seed, fertilizer, and stabilizing emulsion with a hydraulic mulcher, to temporarily protect exposed soils from erosion by water and wind.

Illicit Discharges: Any discharge to an MS4 or receiving water that is not in compliance with applicable laws and regulations, e.g., is not discharged pursuant to an NPDES permit or applicable exemption or waiver.

Impervious Surface: Ground cover that prevents the infiltration of water into the soil, such as pavement and buildings.

Inactive Areas of Construction: Areas of construction activity that have been disturbed but which are not currently being worked and are not scheduled to be re-disturbed for at least 14 days.

Inactive Project: A project where all construction activities (including passive treatment technology, active treatment systems, and/or active equipment), are fully stabilized and will be suspended for 30 days or more.

Industrial General Permit: The NPDES General Permit (No. CAS000001) issued by the State Water Resources Control Board for discharge of stormwater associated with industrial activity. Available online at http://www.waterboards.ca.gov/water_issues/programs/stormwater/industrial.shtml.

Inlet: An entrance into a ditch, storm drain, or other waterway.

Integrated Pest Management (IPM): An ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism.

Leaching: Infiltration or percolation below the soil surface, which is perceived as a loss. Typically refers to fertilizers or salts being pushed below the plant rooting zone by rain or irrigation water.

Legally Responsible Person (LRP): The Legally Responsible Person is a representative of a permittee and signatory that is legally designated to sign, certify, and electronically submit any documents required by the General Permit, the State or Regional Water Board, or U.S. EPA.

Linear Underground/Overhead Project (LUP): Linear Underground/Overhead Projects (LUPs) include, but are not limited to, any conveyance, pipe, or pipeline for the transportation of any gaseous, liquid (including water and wastewater for domestic municipal services), liquescent, or slurry substance; any cable line or wire for the transmission of electrical energy; any cable line or wire for communications (e.g., telephone, telegraph, radio, or television messages); and associated ancillary facilities.

MIGR: Abbreviation for the Migration of Aquatic Organisms Beneficial Use, which designates uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Municipal Separate Storm Sewer System (MS4): A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains): (i) designed or used for collecting or conveying stormwater; (ii) which is not a combined sewer; and (iii) which is not part of a Publicly Owned Treatment Works (POTW) as defined at Title 40 of the Code of Federal Regulations (CFR) 122.2. A "Small MS4" is defined as an MS4 that is not a permitted MS4under the Phase I regulations. This definition of a Small MS4 applies to MS4 operated within cities and counties as well as other public storm drain operators that have a system of storm sewers.

Non-Point Source Pollution: Pollution that originates from diffuse contamination that does not originate from a single discrete source and specifically does not come from a point source as defined by the CWA. Non-point source pollution can originate from aerial diffuse sources, agriculture, forests, and runoff that does not flow through an MS4, industrial, or construction operation subject to an NPDES permit.

Non-stormwater Discharge: Non-stormwater discharges are discharges that do not originate from precipitation events. They can include, but are not limited to, discharges of process water, air conditioner condensate, non-contact cooling water, vehicle wash water, sanitary wastes, concrete washout water, paint wash water, irrigation water, dust control over-wetting, or pipe testing water.

Notice of Intent (NOI): Part of the required Permit Registration Documents, which provides information on the owner, location, type of project, and certifies that the owner will comply with the conditions of the General Permit.

Notice of Termination (NOT): Formal notice to SWRCB submitted by owner/developer that a construction project is complete and the project has met the conditions to terminate the permit.

NPDES Permit: NPDES is an acronym for National Pollutant Discharge Elimination System. NPDES is the national program for administering and regulating Sections 307, 318, 402, and 405 of the CWA. In California, the State Water Resources Control Board (SWRCB) has issued a General Permit for stormwater discharges associated with construction activities (see Appendix A).

Numeric Action Level (NAL): A numeric action level (e.g., a pH range, turbidity value, or concentration) is a level that triggers a required evaluation of the effectiveness of best management practices implemented on the subject construction site, and the required implementation of additional corrective actions necessary to reduce the subject pollutant below the numeric action level. The numeric action level compliance location applies to each sample location and/or corresponding discharge location.

Numeric Effluent Limitation (NEL): A technology-based or water quality-based limit (e.g., pH range, turbidity value, or concentration) established for discharges covered under the General Permit. The numeric effluent limitation compliance location(s) applies to each sample and/or discharge location at the point of discharge from an active treatment system or construction site with TMDL requirements, as applicable.

Nutrients: Compounds necessary for plant and animal growth. In regards to water quality, the term usually refers to nitrogen and phosphorus compounds. These nutrients can result in excessive or accelerated growth of vegetation, such as algae, resulting in impaired use of water in lakes and other sources of water supply or recreational opportunities. For example, nutrients have led to a loss of water clarity in Lake Tahoe. In addition, excessive algae growth leads to oxygen depletion which can be fatal to fish and aquatic life. Also, un-ionized ammonia (one of the forms of nitrogen) can be toxic to fish.

Oil and Grease: Oil and grease includes a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. Sources of oil and grease include leakage, spills, cleaning and sloughing associated with vehicle and equipment engines and suspensions, leaking and breaks in hydraulic systems, restaurants and waste oil disposal.

Organics: Compounds that are carbon based. Often synthetic organic compounds (adhesives, cleaners, sealants, solvents, etc.) are widely applied and may be improperly stored and disposed.

Outfall: The end point where storm drains discharge water into a waterway.

Passive Treatment: Passive treatment is the application of natural or synthetic chemicals and products to reduce turbidity in discharges through coagulation and flocculation. Passive treatment does not rely on computerized, enclosed systems with pumps, filters, and real-time controls. Passive treatment may include pumps where they are necessary to move water around the construction site. Passive treatment products are available in a variety of forms and may be land-applied for soil stabilization (e.g., bonded fiber matrixes, hydromulches) or water-applied for sediment removal (e.g., liquid treatment chemicals, powders, slow-releasing solid blocks/socks). General Permit Attachment G applies to the use of water-applied passive treatment products that remove suspended solids such as sediment from stormwater without using an active treatment system.

Pathogens: Refers to bacteria and viruses that cause disease. For separate storm drain systems, sources of these contaminants include animal excrement and sanitary sewer leaks and overflow. High levels of indicator bacteria in stormwater have led to the closure of beaches, lakes, and rivers to contact recreation such as swimming.

Permit Registration Documents (PRDs): A formal notice to SWRCB submitted by the owner of a construction site that said owner seeks coverage under the General Permit for discharges associated with construction activities.

Pesticide: Any substance used to eliminate pests. Pesticides include herbicides, fungicides, rodenticides, and insecticides.

pH: A measure of the acidic or basic nature of a solution. The typical pH scale ranges from 0 to 14, with pure water being neutral and having a pH of 7. Values above 7 are considered basic and pH values less than 7 are acidic, relative to how far they deviate from neutral (pH=7).

(Construction) Phases: The General Permit recognizes five distinct phases of construction activities: (1) Demolition and Pre-development Site Preparation Phase, (2) Grading and Land Development Phase, (3) Streets and Utilities Phase, (4) Vertical Construction Phase, and (5) Final Landscaping and Site Stabilization Phase. Each phase has activities that can result in different water quality effects from different water quality pollutants and some General Permit requirements are tailored to the construction phase.

Photodegradable: A material that breaks down or degrades in sunlight.

Planning Watershed: Planning watershed was defined by the Calwater watershed classification system as a watershed ranging in size from approximately 3,000 to 10,000 acres. The Calwater watershed classification system has since been merged with the national Watershed Boundary Dataset (WBD). For the purposes of this permit, Calwater planning watersheds are assumed to be roughly equivalent to the WBD's Hydrologic Unit Code, 12 digit subwatersheds (HUC-12). See: http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/constpermits/guidance/receivingwaterrisk.pdf.

Point Source: Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

Pollutant: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource.

Pollution Prevention (P2): Practices and actions that reduce or eliminate the generation of pollutants.

Polyacrylamide (PAM): Substance available in a variety of forms used to aggregate soil particles allowing them to settle out of suspension.

Precipitation: Any form of rain or snow.

Pressurized Bag Filter: 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. Some units include a combination of bag filters and cartridge filters for enhanced contaminant removal.

Pretreatment: Treatment of waste stream before it is discharged to a collection system.

Qualified SWPPP Developer (QSD): Individual who is a qualified stormwater professional authorized by the discharger to develop and revise SWPPPs. Effective September 1, 2023, a QSD shall have one of the following credentials:

a. A California registered professional civil engineer; or
b. A California registered professional geologist or engineering geologist; or
c. A California registered landscape architect; or
d. A professional hydrologist registered through the American Institute of Hydrology; or
e. A Certified Professional in Erosion and Sediment Control (CPESC) registered through EnviroCert International, Inc.; or
f. A Certified Professional in Storm Water Quality (CPSWQ) registered through EnviroCert International, Inc.; or
g. Any prerequisite course approved by the State Water Board's Division of Water Quality Deputy Director in accordance with General Permit Section V.G.

Effective September 2, 2011, a QSD shall have attended an SWRCB-sponsored or approved QSD training course.

Qualified SWPPP Practitioner (QSP): Individual who is a qualified stormwater professional authorized by the discharger to conduct non-stormwater and stormwater visual observations, sampling, and implementation of all elements of the SWPPP. Effective September 1, 2023, a QSP shall have attended an SWRCB-sponsored or approved QSP training course and shall be either a QSD or have one of the following credentials:

a. A Certified Erosion, Sediment and Storm Water Inspector (CESSWI) registered through EnviroCert International, Inc.; or
b. A Certified Inspector of Sediment and Erosion Control (CISEC) registered through Certified Inspector of Sediment and Erosion Control, Inc.; or
c. A Construction Management degree from an accredited 4-year institution that includes coursework that covers the underlying principles of erosion and sediment control and practices of reducing pollution in stormwater; or
d. Any prerequisite course approved by the State Water Board's Division of Water Quality Deputy Director in accordance with General Permit Section V.H.

Qualified SWPPP Practitioner Delegate (QSP Delegate): An individual assigned responsibility by the QSP for the implementation of specific elements of the SWPPP who has completed the required foundational and site-specific training provided by the QSP.

Qualifying Precipitation Event (QPE): Qualifying precipitation event is any weather pattern that is forecast to have a 50 percent or greater Probability of Precipitation (PoP) and a

Quantitative Precipitation Forecast (QPF) of 0.5 inches or more within a 24-hour period. The event begins with the 24-hour period when 0.5 inches has been forecast and continues on subsequent 24-hour periods when 0.25 inches of precipitation or more is forecast.

***Quantitative Precipitation Forecast (QPF)*:** Quantitative Precipitation Forecast is the forecast that includes precipitation and snow accumulation measurements. This information can be obtained from the NOAA Forecast.

Receiving Water: A river, lake, stream, estuary, bay, or ocean into which runoff is discharged.

Receiving Water Monitoring Trigger: Thresholds for particular effluent water quality measurements that trigger receiving water monitoring for a subset of construction projects. The General Permit includes receiving water triggers for pH and turbidity.

Responsible Discharger: Responsible dischargers are dischargers who:

a. Discharge stormwater and authorized non-stormwater directly, or through a municipal separate sewer system (MS4) or other conveyance, to impaired water bodies or watersheds identified in a U.S. EPA-approved TMDL with a waste load allocation assigned to construction stormwater sources; and
b. Have identified, through the site-specific pollutant source assessment, that one or more pollutants specific to the TMDL are present on-site with the potential to enter construction stormwater discharges.

Retention: The storage of stormwater to prevent it from leaving the development site.

Revised Universal Soil Loss Equation (RUSLE): A formula for determining soil loss in tons per acre according to different site specific variables. The equation is written as follows:

$$A=(R)(K)(LS)(C)(P)$$

Where:
R = rainfall-runoff erosivity factor
K = soil erodibility factor
LS = length-slope factor
C = cover factor
P = management operations and support practices

Rill Erosion: Rills are channels small enough to be smoothed over by normal tillage. Rill erosion takes place when water concentrates in these small channels and carries sediment in the water flow.

Riparian: Refers to the habitat located adjacent to rivers or streams.

Rolled Erosion Control Products (RECPs): These products, also known as geotextiles and mats, can be made of natural or synthetic materials or a combination of the two. RECPs 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.

Roughening: Soil roughening is generally referred to as track walking (sometimes called imprinting) a slope, where treads from heavy equipment run parallel to the contours of the slope and act as mini terraces.

Runoff: Water originating from rainfall, melted snow, and other sources (e.g., sprinkler irrigation) that flows over the land surface to drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands.

Run-on: Discharges that originate offsite and flow onto the property of a separate project site.

Sand: A soil particle between 0.05 and 2.0 mm in diameter.

Sandbag Barrier: Series of sand-filled bags placed on a level contour to intercept or divert sheet flows of water.

Sand Media Particulate Filter: 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.

Scour: The erosive and digging action in a watercourse caused by flowing water.

Secondary Containment: A device or control measure in addition to the primary containment that is used to stop a discharge of pollutants or hazardous material from leaving a specified area.

Sedimentation: The process of depositing soil particles, clays, sands, or other sediments that were picked up by runoff.

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.

Sediment Basin: 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 Control: Sediment controls are treatment control practices that trap soil particles after erosion by rain, flowing water, or wind. They include those practices that intercept and slow or detain the flow of stormwater to allow sediment to settle and be trapped (e.g., silt fence, sediment basin, fiber rolls, etc.). 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 Transport Capacity: The capability of a channel to move sediment, this varies under different flow conditions.

Sediment Trap: 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.

Sheet Erosion: Sheet erosion is relatively uniform erosion from the entire soil surface.

Significant Materials: Includes, but not limited to, raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designed under Section 101(14) of CERLCA; any chemical the facility is required to report pursuant to Section 313 of Title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with stormwater discharges.

Significant Quantities: The volume, concentrations, or mass of a pollutant in stormwater discharge that can cause or threaten to cause pollution, contamination, or nuisance that adversely impact human health or the environment and cause or contribute to a violation of any applicable water quality standards for receiving water.

Silt: A soil particle size class consisting of particles between 0.05 and 0.002 mm in diameter. These particles are smaller than sand and larger than clay.

Silt Fence: A silt fence is used to detain sediment-laden water, promoting sedimentation behind the fence. Silt fences are made of a woven geotextile that has been entrenched, attached to supporting poles, and sometimes backed by a plastic or wire mesh for support.

Soil Binder: Material applied to the soil surface to temporarily prevent water and wind induced erosion of exposed soils on construction sites. Soil binders are typically applied to disturbed areas requiring short term temporary protection.

Soil Preparation: Steps taken to prepare soil for planting or the installation of a BMP. Soil preparation may include tilling, raking, or the addition of a soil amendment.

Source Control BMPs: Operational practices that reduce potential pollutants at the source.

Source Reduction (also source control): The technique of stopping and/or reducing pollutants at their point of generation so that they do not come into contact with stormwater.

SPWN: Abbreviation for the Spawning, Reproduction, and/or Early Development Beneficial Use, which designates uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

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

Storm Drains: Above- and below-ground structures for transporting stormwater to streams or outfalls for flood control purposes.

Stormwater: Stormwater is rain, snowmelt, or any other liquid or solid precipitation that may result in runoff, and drainage from a site. Stormwater is that portion of precipitation that flows across a surface to the storm drain system or receiving waters.

Stormwater Discharge Associated with Industrial Activity: Discharge from any conveyance which is used for collecting and conveying stormwater from an area that is directly related to manufacturing, processing, or raw materials storage activities at an industrial plant.

Stormwater Pollution Prevention Plan (SWPPP): A written plan that documents the series of phases and activities that, first, characterizes your site, and then prompts you to select and carry out actions which prevent the pollution of stormwater discharges.

Straw Mulch: Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or crimper, or anchoring it with a tackifier or stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Temporary Batch Plant: During the construction of large structures or in remote locations, a temporary batch plant may be necessary to manufacture Portland Cement Concrete (PCC) or 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.

Temporary Silt Dike: Pre-manufactured device that is installed for semi-permanent drainage and sediment control on the perimeter of disturbed sites or stockpiles of materials or as check dams within channels.

Total Maximum Daily Load (TMDL): A TMDL is the sum of the maximum amount of a pollutant that a waterbody can receive per day and still meet state water quality standards. It is the sum of the individual Waste Load Allocations (WLAs) for point sources, the load allocations for nonpoint and natural background sources, and the margin of safety.

Toxicity: Adverse responses of organisms to chemicals or physical agents ranging from mortality to physiological responses such as impaired reproduction or growth anomalies.

Tracking Control: Tracking control refers to methods of preventing or reducing the tracking of sediment off-site by vehicles leaving the construction area.

Traditional Construction Project: Most construction projects, including but not limited to commercial, residential, industrial, institutional, and highway construction project. Does not include those projects defined as LUPs.

Trash: All improperly discarded solid material from any production, manufacturing, or processing operation including, but not limited to, products, product packaging, or containers constructed of plastic, steel, aluminum, glass, paper, or other synthetic or natural materials.

Treatment Control BMPs: Treatment methods to remove pollutants from stormwater.

Turbidity: The optical condition and cloudiness of water caused by suspended or dissolved particles or colloids. Turbidity is quantified by the degree to which light traveling through a water column is scattered by the suspended organic and inorganic particles it contains. The turbidity test is reported in Nephelometric Turbidity Units (NTU) or Jackson Turbidity Units (JTU) with a calibrated turbidity meter.

Urban Runoff: Stormwater from city streets and adjacent domestic or commercial properties that carries pollutants of various kinds into the sewer systems and receiving waters.

Vector: Organism that spreads disease (e.g., mosquitos and rodents).

Vegetation: Living plant matter.

Virus: See pathogens.

Wadable Stream: Streams that can be sampled by field crews wearing chest waders (generally less than 0.5 m-1.0 meters deep)

Waste Management: Source control management practices that prevent pollution by limiting or reducing potential pollutants at their source, before they come into contact with stormwater. Practices under this category can be thought of as "good housekeeping" and include procedural and structural BMPs for handing, storing, and disposing of wastes generated by a construction project.

Weir Tank: 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.

Wetland: An area of land that has water-saturated soils for long periods of time and water loving vegetation. Wetlands are typically flooded for part of the year, forming a transitional area between aquatic and terrestrial environments.

Wind Erosion Control: Methods used to minimize wind erosion. Controls consist of applying water or other dust palliatives to prevent or alleviate dust nuisance.

5.2 List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Concrete
ADL	Aerially Deposited Lead
AIMP	Impervious Area
AINF	Infiltration Area
ANSI	American National Standards Institute
APCD	Air Pollution Control District
APHA	American Public Health Association
APWA	American Public Works Association
AQMD	Air Quality Management District
ARB	Air Resources Board
ARS	Agricultural Research Service
ASTM	American Society for Testing Materials
ATS	Active Treatment System
AWWA	American Water Works Association
BAT	Best Available Technology (economically available)
BCT	Best Conventional Technology (pollution control)
BFM	Bonded Fiber Matrix
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
CA	Contractor Activities
CAL-OSHA	California Division of Occupational Safety and Health Administration
CASQA	California Stormwater Quality Association
CCR	California Code of Regulations
CCS	Cellular Confinement System
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CESSWI	Certified Erosion, Sediment, and Storm Water Inspector
CFR	Code of Federal Regulations
CISEC	Certified Inspector of Erosion and Sediment Control
COC	Chain of Custody

COE	United States Army Corps of Engineers, also known as, USACE
CPESC	Certified Professional in Erosion and Sediment Control
CPI	Coalescing Plate Interceptor
CPSWQ	Certified Professional in Storm Water Quality
CSMP	Construction Site Monitoring Program
CWA	Clean Water Act (Federal Water Pollution Control Act of 1972 as amended in 1987)
DCIA	Directly Connected Impervious Area
DFG	(California) Department of Fish and Game
DG	Decomposed Granite
DHS	Department of Health Services
DTSC	California Department of Toxic Substances Control
EC	Erosion Control
EEC	Effect Effluent Concentration
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ELG	Effluent Limitation Guideline
ELAP	Environmental Laboratory Accreditation Program
EMC	Event Mean Concentration
EOS	Equivalent Opening Size
EPA	Environmental Protection Agency
ESA	Environmentally Sensitive Area
ESC	Erosion and Sediment Control
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GIS	Geographical Information System
Hazmat	Hazardous Material
HCM	Hydraulic Compost Matrix
HDPE	High-Density Polyethylene
HM	Hydraulic Matrix
HSG	Hydrologic Soil Groups
IPM	Integrated Pest Management

LOEC	Lowest Observed Effect Concentration
LOI	Loss-On-Ignition
LUP	Linear Underground/Overhead Project
LRP	Legally Responsible Person
MATC	Maximum Allowable Threshold Concentration
MBAS	Methylene Blue Activated Substances
MBFM	Mechanically-Bonded Fiber Matrix
MEP	Maximum Extent Practicable
MDL	Method Detection Limit
MLSC	Manufactured Linear Sediment Control
MS4	Municipal Separate Storm Sewer System
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MSRP	Monitoring, Sampling & Reporting Plan
NAL	Numeric Action Level
NEL	Numeric Effluent Limitation
NELAP	National Environmental Laboratory Accreditation Program
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOEC	No Observed Effect Concentration
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NS	Non-stormwater Management
NSF	National Science Foundation
NTU	Nephelometric Turbidity Unit
NURP	National Urban Runoff Program
O&G	Oil and Grease

O&M	Operations and Maintenance
OSDS	On-site Disposal System
OSHA	Occupational Safety and Health Administration
P2	Pollution Prevention
PAHs	Poly-Aromatic Hydrocarbons
PAM	Polyacrylamide
PCBs	Polychlorinated Biphenyls
PCC	Portland Cement Concrete
PH	Professional Hydrologist
PLS	Pure Live Seed
PPT	Pollution Prevention Team
PoP	Probability of Precipitation
POTW	Publicly Owned Treatment Works
PRD	Permit Registration Document
PSD	Particle Size Distribution
PTS	Passive Treatment System
QA	Quality Assurance
QC	Quality Control
QSD	Qualified SWPPP Developer
QSP	Qualified SWPPP Practitioner
QPE	Qualifying Precipitation Event
QPF	Quantitative Precipitation Forecast
RCRA	Resource Conservation and Recovery Act
RECP	Rolled Erosion Control Product
RUSLE	Revised Universal Soil Loss Equation
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SCP	Scientific Collecting Permit
SE	Sediment Control
SIC	Standard Industrial Classification
SFM	Stabilized Fiber Matrix

SM	Standard Mulch
SMARTS	Storm Water Multiple Application and Report Tracking System
SPCC	Spill Prevention Control and Countermeasure
SSC	Suspended Sediment Concentration
SUSMP	Standard Urban Stormwater Mitigation Plan
SVOC	Semi-Volatile Organic Compound
SWAMP	Surface Water Ambient Monitoring Program
SWMP	Stormwater Management Program
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TC	Tracking Control
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TMECC	Test Methods for the Examination of Composting and Compost
TOC	Total Organic Carbon
TRM	Turf Reinforcement Mat
TSP	Trisodium phosphate
TSS	Total Suspended Solids
UFC	Uniform Fire Code
USACE	United States Army Corps of Engineers, also known as, COE
USC	United States Code
USCC	United States Compost Council
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
UV	Ultraviolet
VOCs	Volatile Organic Compounds
WDID	Waste Discharge Identification (Number)
WDR	Water Discharge Requirement
WE	Wind Erosion Control
WEF	Water Environment Federation
WET	Whole Effluent Toxicity
WM	Waste Management

Appendix H: BMP Inspection Form

BMP INSPECTION REPORT

Date and Time of Inspection:			Date Report Written:		
Inspection Type: (Circle one)	Weekly *Complete Parts I,II,III and VII*	Pre-Qualifying Precipitation Event (QPE) *Complete Parts I,II,III,IV and VII*	During QPE *Complete Parts I, II, III, V, and VII*	Post-QPE *Complete Parts I,II,III,VI and VII*	*Inactive Project Complete Parts I,II,III and VII*

Part I. General Information			
Site Information			
Construction Site Name: Madison Elementary School Modernization			
Construction stage and completed activities:			Approximate area of site that is exposed:
Photos Taken: (Circle one)	Yes	No	Photo Reference IDs:

Weather	
Estimate storm beginning: (date and time)	Estimate storm duration: (hours)
Estimate time since last storm: (days or hours)	Rain gauge reading and location: (in)
Is a “Qualifying Precipitation Event” predicted or did one occur (i.e., any weather pattern with a 50% chance of 0.5” or more within a 24-hr period when 0.5” has been forecast and continues on subsequent 24-hour periods when 0.25” of precipitation or more is forecast)? (Y/N) If yes, summarize forecast:	
Exception Documentation (explanation required if inspection could not be conducted). Visual inspections are not required outside of business hours or during dangerous weather conditions such as electrical storms, flooding, and high winds above 40 miles per hour.	

Inspector Information	
Inspector Name:	Inspector Title:
Inspector Certification:	Date:

Part II. BMP Observations. Describe deficiencies in Part III.

Minimum BMPs for Risk Level _____ Sites	Adequately designed, implemented and effective (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Construction Materials			
Inventory of products (excluding materials designed to be outdoors)			
Stockpiled construction materials not actively in use are covered and bermed			
All chemicals are stored in watertight containers with appropriate secondary containment, or in a completely enclosed storage shed			
Construction materials are minimally exposed to precipitation			
BMPs preventing the off-site tracking of materials are implemented and properly effective			
Good Housekeeping for Waste Management			
Wash/rinse water and materials are prevented from being disposed into the storm drain system			
Portable toilets are contained to prevent discharges of waste			
Sanitation facilities are clean and with no apparent for leaks and spills			
Equipment is in place to cover waste disposal containers at the end of business day and during rain events			
Discharges from waste disposal containers are prevented from discharging to the storm drain system / receiving water			
Stockpiled waste material is securely protected from wind and rain if not actively in use			
Procedures are in place for addressing hazardous and non-hazardous spills			
Appropriate spill response personnel are assigned and trained			
Equipment and materials for cleanup of spills is available onsite			
Washout areas (e.g., concrete) are contained appropriately to prevent discharge or infiltration into the underlying soil			
Good Housekeeping for Vehicle Storage and Maintenance			
Measures are in place to prevent oil, grease, or fuel from leaking into the ground, storm drains, or surface waters			
All equipment or vehicles are fueled, maintained, and stored in a designated area with appropriate BMPs			
Vehicle and equipment leaks are cleaned immediately and disposed of properly			

Part II. BMP Observations Continued. **Describe deficiencies in Part III.**			
Minimum BMPs for Risk Level _____ Sites	Adequately designed,	Action Required (yes/no)	Action Implemented (Date)

	implemented and effective (yes, no, N/A)		
Good Housekeeping for Landscape Materials			
Stockpiled landscape materials such as mulches and topsoil are contained and covered when not actively in use			
Erodible landscape material has not been applied 2 days before a forecasted rain event or during an event			
Erodible landscape materials are applied at quantities and rates in accordance with manufacturer recommendations			
Bagged erodible landscape materials are stored on pallets and covered			
Good Housekeeping for Air Deposition of Site Materials			
Good housekeeping measures are implemented onsite to control the air deposition of site materials and from site operations			
Non-Stormwater Management			
Non-Stormwater discharges are properly controlled			
Vehicles are washed in a manner to prevent non-stormwater discharges to surface waters or drainage systems			
Streets are cleaned in a manner to prevent unauthorized non-stormwater discharges to surface waters or drainage systems.			
Erosion Controls			
Wind erosion controls are effectively implemented			
Effective soil cover is provided for disturbed areas inactive (i.e., not scheduled to be disturbed for 14 days) as well as finished slopes, open space, utility backfill, and completed lots			
The use of plastic materials is limited in cases when a more sustainable, environmentally friendly alternative exists.			
Sediment Controls			
Perimeter controls are established and effective at controlling erosion and sediment discharges from the site			
Entrances and exits are stabilized to control erosion and sediment discharges from the site			
Sediment basins are properly maintained			
Inspect immediate access roads prior to forecasted precipitation			
Linear sediment control along toe of slope, face of slope an at grade breaks (Risk Level 2 & 3 Only)			
Limit construction activity to and from site to entrances and exits that employ effective controls to prevent offsite tracking (Risk Level 2 & 3 Only)			
Ensure all storm, drain inlets and perimeter controls, runoff control BMPs and pollutants controls at entrances and exits are maintained and protected from activities the reduce their effectiveness (Risk Level 2 & 3 Only)			
Run-On and Run-Off Controls			

Run-on to the site is effectively managed and directed away from all disturbed areas.			
Other			
Are the project SWPPP and BMP plan up to date, available onsite and being properly implemented?			
Is the posting of the project's unique WDID number, waiver identification number, and site and project contact information publicly accessible?			

Part III. Descriptions of BMP Deficiencies		
Deficiency	**Repairs Implemented: Note - Repairs must begin within 72 hours of identification and, complete repairs as soon as possible.**	
	Start Date	**Action**
1.		
2.		
3.		
4.		

Part IV. Additional Pre-QPE Observations. Note the presence or absence of floating and suspended materials, sheen, discoloration, turbidity, odors, and source(s) of pollutants(s).	
	Yes, No, N/A
Do stormwater storage and containment areas have adequate freeboard? If no, complete Part III.	
Are drainage areas free of spills, leaks, or uncontrolled pollutant sources? If no, complete Part VII and describe below.	
Notes:	
Are stormwater storage and containment areas free of leaks? If no, complete Parts III and/or VII and describe below.	
Notes:	

Part V. Additional During-QPE Observations. If BMPs cannot be inspected during inclement weather, list the results of visual inspections at all relevant outfalls, discharge points, and downstream locations. Note odors or visible sheen on the surface of discharges. Complete Part VII (Corrective Actions) as needed.
Outfall, Discharge Point, or Other Downstream Location

Location	Description
Location	Description
Location	Description
Location	Description

Part VI. Additional Post-QPE Observations. **Visually observe (inspect) stormwater discharges at all discharge locations within 96 hours after each qualifying precipitation event, and observe (inspect) the discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying precipitation event producing precipitation of ½ inch or more at the time of discharge. Complete Part VII (Corrective Actions) as needed.**	
Discharge Location, Storage or Containment Area	**Visual Observation**

Part VII. Additional Corrective Actions Required. Identify additional corrective actions not included with BMP Deficiencies (Part III) above. Note if SWPPP change is required.	
Required Actions	**Implementation Date**

Appendix I: Training Forms

Contractor Personnel Training Log

Stormwater Management Training Log and Documentation

Project Name: Madison Elementary School Modernization

WDID#: **TBD**

Stormwater Management Topic: (check as appropriate)

☐ Good Housekeeping BMPs ☐ Erosion Control BMPs

☐ Sediment Control BMPs ☐ Tracking Control

☐ Non-Stormwater Management BMPs ☐ Waste Management & Pollution Control BMPs

☐ BMP Implementation Activities ☐ Advanced BMPs

☐ Identification of QSPs and QSP Delegates

Training Objective: ____

Date: ________________________ Instructor:____________________

Training Length (hours): _________

Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

QSP Delegate Training Log

Stormwater Management Training Log and Documentation

Project Name: Madison Elementary School Modernization

WDID#: **TBD**

QSP Delegate Name: ______________________________

Delegated Responsibilities:

☐ Stormwater Visual Inspections

☐ Sampling

☐ BMP Inspections

☐ BMP Maintenance and Repair

Foundational Training

Topic	Date Completed	QSP Trainer
☐ Roles and Responsibilities		
☐ Forecast Information		
☐ Documentation and Reporting Procedures		

Site-Specific Training

Topic	Date Completed	QSP Trainer
☐ Visual Inspections		
☐ Sample Collection Procedures		
☐ Sample Reporting Procedures		
☐ BMP Implementation		

As needed, attach proof of external training (e.g., course completion certificates, credentials for the QSP Delegate).

Appendix J: Responsible Parties

Identification of QSP and QSP Delegates

Project Name: Madison Elementary School Modernization

WDID#: **TBD**

The following are QSPs and QSP Delegates associated with this project.

Name of Personnel [(1)]	QSP Number, or state "Delegate"	Company	Date

(1) If additional QSPs or QSP Delegates are required on the job site add additional lines

Appendix K: Contractors and Subcontractors

<u>Prime Contractor/Construction Management Firm:</u>

Contractor Name:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

<u>Sub-Contractors:</u>

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	

Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Sub-Contractor Name:	
Scope of Work:	
Title:	
Contractor Company:	
Address	
Phone Number:	
Phone Number (24/7)	

Appendix L: Post-Construction Demonstration

Appendix M: Weather Reports

The discharger must obtain the precipitation forecast information from the National Weather Service Forecast Office (http://forecast.weather.gov). A printed copy with the date and time of printing should be retained in this Appendix.

Appendix N: Monitoring Records

Place completed BMP Inspection Forms, photographic documentation, Effluent Sampling, Receiving Water, and Dewatering Field Logs, Monitoring Exceptions, NAL Exceedance Reports, and Receiving Water Monitoring Trigger Exceptions in this appendix.

Appendix O: Storm Event/Dewatering Monitoring Forms

Rain Gauge Log Sheet				
Construction Site Name:				
WDID #:				
Date (mm/dd/yy)	Time (24-hr)	Initials	Rainfall Depth (Inches)	Notes:

Risk Level 1, 2, 3
Visual Inspection Field Log Sheet

Date and Time of Inspection:				Report Date:	
Inspection Type:	☐ Weekly	☐ Pre Qualifying Precipitation Event (QPE)	☐ During QPE	☐ Post QPE	☐ Dewatering Discharge

Site Information

Construction Site Name:	
Construction stage and completed activities:	Approximate area of exposed site:

Weather and Observations

Date Rain Predicted to Occur:		Predicted % chance of precipitation (PoP): Predicted quantity of precipitation (QPF):	
Estimate storm beginning: ______________ (date and time)	Estimate storm duration:_________ (hours)	Estimate time since last storm: ________ (days or hours)	Rain gauge reading:________ (inches)

Observations: If yes identify location			
Odors	Yes ☐	No ☐	
Floating material	Yes ☐	No ☐	
Suspended Material	Yes ☐	No ☐	
Sheen	Yes ☐	No ☐	
Discolorations	Yes ☐	No ☐	
Turbidity	Yes ☐	No ☐	

Site Inspections

Outfalls or BMPs Evaluated	**Deficiencies Noted**
(add additional sheets or attached detailed BMP Inspection Checklists)	

Photos Taken:	Yes ☐	No ☐	Photo Reference IDs:

Corrective Actions Identified (note if SWPPP change is needed)

Inspector Information

Inspector Name:	Inspector Title:
Signature:	Date:

<table>
<tr><th colspan="4">Risk Level 1, 2, 3
Effluent Sampling Field Log Sheets</th></tr>
<tr><td colspan="2">Construction Site Name:</td><td>Date:</td><td>Time Start:</td></tr>
<tr><td colspan="4">Sampler:</td></tr>
<tr><td>Sampling Event Type:</td><td>☐ Stormwater</td><td>☐ Dewatering Discharge</td><td>☐ Non-visible pollutant</td></tr>
<tr><th colspan="4">Field Meter Calibration</th></tr>
<tr><td colspan="2">pH Meter ID No./Desc.:
Calibration Date/Time:</td><td colspan="2">Turbidity Meter ID No./Desc.:
Calibration Date/Time:</td></tr>
<tr><th colspan="4">Field pH and Turbidity Measurements</th></tr>
<tr><td>Discharge Location Description</td><td>pH</td><td>Turbidity</td><td>Time</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><th colspan="4">Grab Samples Collected</th></tr>
<tr><td>Discharge Location Description</td><td colspan="2">Sample Type</td><td>Time</td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Additional Sampling Notes:</td></tr>
<tr><td colspan="4">Time End:</td></tr>
</table>

Risk Level 3 ***Receiving Water Sampling Field Log Sheets***			
Construction Site Name:		Date:	Time Start:
Sampler:			
Receiving Water Description and Observations			
Receiving Water Name/ID:			
Observations:			
Odors	Yes ☐ No ☐		
Floating material	Yes ☐ No ☐		
Suspended Material	Yes ☐ No ☐		
Sheen	Yes ☐ No ☐		
Discolorations	Yes ☐ No ☐		
Turbidity	Yes ☐ No ☐		
Field Meter Calibration			
pH Meter ID No./Desc.: Calibration Date/Time:		Turbidity Meter ID No./Desc.: Calibration Date/Time:	
Field pH and Turbidity Measurements			
Upstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
Downstream Location			
Type	Result	Time	Notes
pH			
Turbidity			
Additional Sampling Notes:			
Time End:			

NAL Exceedance Evaluation Summary Report	Page __ of __
Project Name	
Project WDID	
Project Location	
Date of Exceedance	
Type of Exceedance	**NAL ☐ pH ☐ Turbidity** **☐ Other (specify) ________________**
Measurement or Analytical Method	**☐ Field meter** **(Sensitivity: _________)** **☐ Lab method (specify) ___________** **(Minimum Level: _____)** **(MDL: ______________)**
Calculated Daily Average	**☐ pH _______ pH units** **☐ Turbidity ________ NTU**
Rain Gauge Measurement	**_______ inches**
Visual Observations on Day of Exceedance	

NAL Exceedance Evaluation Summary Report	Page __ of __
Description of BMPs in Place at Time of Event	
Initial Assessment of Cause	
Corrective Actions Taken (deployed after exceedance)	
Additional Corrective Actions Proposed	
Report Completed By	______________________________ **(Print Name, Title)**
Signature	______________________________

CHAIN-OF-CUSTODY **DATE:** **Lab ID:**

DESTINATION LAB:		REQUESTED ANALYSIS	Notes:
	ATTN:		
ADDRESS:			
Office Phone:			
Cell Phone:			
SAMPLED BY:			
Contact:			
Project Name			

Client Sample ID	**Sample Date**	**Sample Time**	**Sample Matrix**	**Container**							
				#	**Type**	**Pres.**					

SENDER COMMENTS:	**RELINQUISHED BY**		
	Signature:		
	Print:		
	Company:		
	Date:		TIME:
LABORATORY COMMENTS:	**RECEIVED BY**		
	Signature:		
	Print:		
	Company:		
	Date:	TIME:	

Appendix P: Field Meter Instructions

Appendix Q: Supplemental Information

Appendix R: Construction General Permit

Copies of the Construction Stormwater General Permit may be downloaded from the State Water Board website at:

http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml.

Submittal

Prepared For:
Rosalind Cox

Date: June 13, 2024

Job Name:
Madera USD - Madison ES

Payment Terms: Net 30 Days

Delivery Terms:
Freight Allowed and Prepaid - F.O.B. Factory

Trane U.S. Inc. is pleased to provide the following submittal for your review and approval.
*****Submittal based on plans dated 3/15/2024*****

Rami Mislih
Trane U.S. Inc.
3026 N Business Park Ave, Ste 104
Fresno, CA 93727
Cell: (559) 840-7972

The attached information describes the equipment we propose to furnish for this project and is submitted for your approval.

Submittal Acceptance and return is a critical step, so please ensure submittals are returned with approval to release to production within 14 days of submittal date.

Product performance and submittal data is valid for a period of 6 months from the date of submittal generation. If six months or more has elapsed between submittal generation and equipment release, the product performance and submittal data will need to be verified. It is the customer's responsibility to obtain such verification.

CUSTOMER ACCEPTANCE

____
Authorized Representative

____
Printed Name

Title ______________________________

Purchase Order ______________________________

Acceptance Date ______________________________

Tag Data - 3-10Ton R-410 Packaged Heat Pump (Qty: 12)

Qty	Description	Model Number
6	4 Ton R-410 Packaged Heat Pump – High Static Motor	WSC048H4REA**00E10000000001
6	4 Ton R-410 Packaged Heat Pump – Standard Motor	WSC048H4REA**00E10000000001

Product Data
All Units

DX Cooling
Standard Efficiency
Convertible
4 Ton
460/60/3
Microprocessor Controls 3 Ph
12 kW@240,480,600 Derate to Unit Voltage
Hinged Panels/2 Inch Pleated Filters MERV 13
Condenser Coil Guards
Stainless Steel Drain Pans
Downflow Low-Leak Economizer W/ Power Exhaust *(Field Installed)* (Actuator Only for 3rd Party Controls)
Onsite Technical Support is Included – Startup
5 Year Parts & Labor Warranty

Qty: 6 Tag(s): HP-1-1 ~ HP-1-6
High Static Motor Modification - VFD for Balancing included

Qty: 6 Tag(s): HP-2-1 ~ HP-2-6
Standard Drive Motor – Multi Speed motor with Speed Settings for Balancing

Exclusions:

- ***Controls/Electrical:*** ***Disconnects, Circuit Breakers, Convenience Outlets, BACnet Communications, Temperature/Pressure/CO2 Sensors, Thermostats, Smoke Detectors***
- ***Equipment Accessories/Features:*** ***Double Wall Cabinet, Outside Air Monitoring Stations, Flue Extensions/Caps, Stainless Steel Heat Exchanger, Modulating Gas, Digital Scrolls/Variable Speed Compressors, VFD's, Curb Features (Vibration Isolation, Seismic Calculation, Pitched Curbs, Filters, Insulation), Extra Parts (Filters, Belts, Sheaves, Motors), Special Coatings, Hot Gas Bypass, Hot Gas Reheat, Rapid Restart, Any Items Not Specifically Mentioned Above***
- ***Warranties:*** ***Extended Parts and Labor***
- ***Startup Services:*** ***Storage/Rigging, Owner Training, BAS/BACNET/CX Integration/Assistance, Field/Factory Testing***

NOTE: Company warrants the equipment manufactured by a period of 12 months from initial startup or 18 months from date of shipment, whichever is less.

*****Company warrants the Equipment manufactured by Company for a period of the lesser of 12 months from initial start-up or 18 months from date of shipment, whichever is less.***

****Equipment proposed will require engineer's approval & any modifications to the proposed scope may result in additional cost***

Trane Precedent Heat Pump Packaged Rooftop

Unit Overview - WSC048H4REA**00E1000000000100000000000000

Application	Unit Size	Supply Fan		External Dimensions (in.)			Operating Weight		EER	IEER/SEER	Elevation
		Airflow	External Static Pressure	Height	Width	Length	Minimum	Maximum			
DX cooling	4 Ton	1600 cfm	0.800 in H2O	3.41 ft	3.69 ft	5.82 ft	540.0 lb	818.0 lb	12.30	14.30	0.00 ft

Unit Features

Panels/Filters	Hinged pnl/2 in pltd filters MERV 13-3ph

Unit Electrical

Voltage/phase/hertz	460/60/3
MCA	30.00 A
MOP	30.00 A
MCA (230 w/ Elec Heat)	0.00 A
MOP (230 w/ Elec Heat)	0.00 A

Cooling Section

		Capacity	
Entering Dry Bulb	84.30 F	**Gross Total**	46.21 MBh
Entering Wet Bulb	65.29 F	**Gross Sensible**	46.21 MBh
Ambient Temp	105.00 F	**Net Total**	44.49 MBh
Leaving Coil Dry Bulb	55.29 F	**Net Sensible**	44.49 MBh
Leaving Coil Wet Bulb	54.88 F	**Fan Motor Heat**	0.67 MBh
Leaving Unit Dry Bulb	58.05 F	**Refrig Charge-circuit 1**	9.3 lb
Leaving Unit Wet Bulb	56.16 F		

Heating Section

Heat Pump Mode		Secondary Heat	
Output Heating Capacity	47.07 MBh	**Heat Type**	Electric
Output Heating Capacity with Fan	47.74 MBh	**Heating Stages**	2
Heating Delta T	27.24 F	**Heating Capacity**	12 kW@240,480,600 derate to unit voltage
Heating EAT	58.22 F	**Electric Heat Output**	40.98 MBh
Heating Ambient Temp	47.00 F	**Electric Heat Air Temp Rise**	23.59 F
Heating Ambient WB	42.60 F		
Heating Ambient Relative Humidity	70.00 %		

Fan Section

Indoor Fan Data		Outdoor Fan Data	
Type	FC Centrifugal	**Type**	Propeller
Drive Type	Direct	**Fan Quantity**	1
Evap Fan FLA	2.50 A	**Drive Type**	Direct
Indoor Fan Performance		**Outdoor Fan Performance**	
Airflow	1600 cfm	**Condenser Fan FLA**	0.70 A
Design ESP	0.800 in H2O		
Component SP	0.070 in H2O		
Total SP	0.920 in H2O		
Supply Motor Horsepower	1.000 hp		
Indoor Motor Operating Power	0.68 bhp		
Indoor RPM	1067 rpm		

Compressor Section

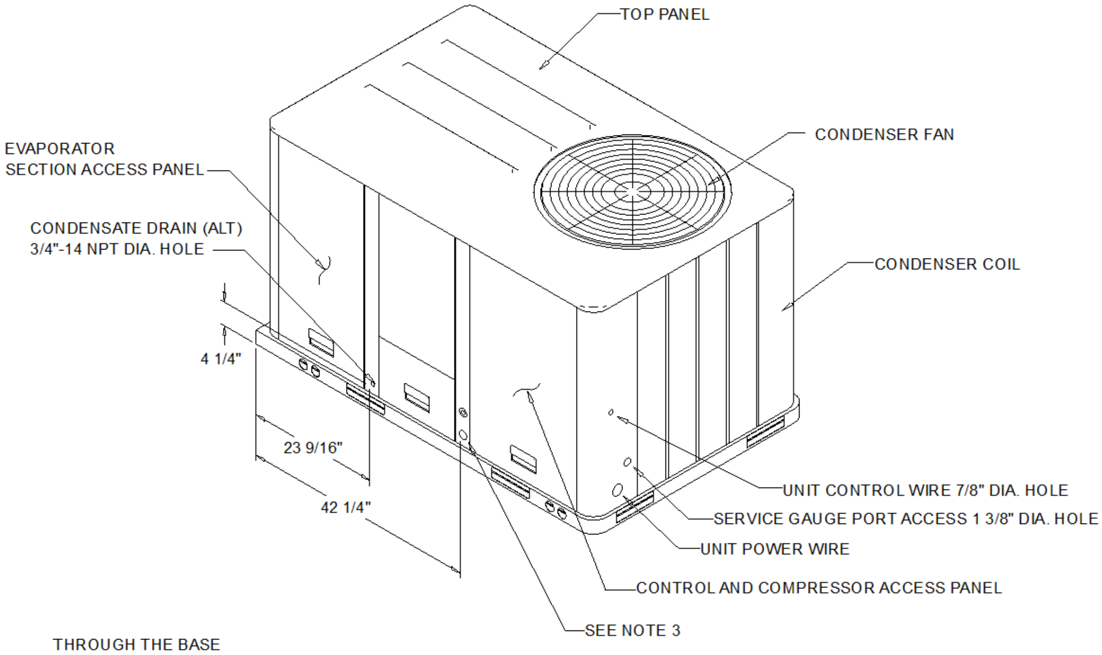
Power	3.97 kW
Circuit 1 RLA	6.30 A
Circuit 2 RLA	0.00 A

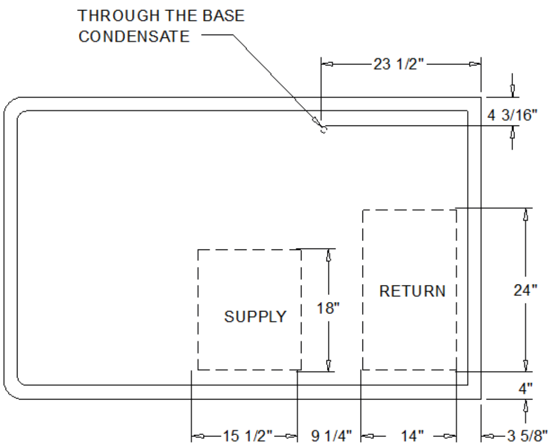
Acoustics

Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	84 dB	78 dB	70 dB	68 dB	63 dB	60 dB	61 dB	54 dB
Ducted Inlet	82 dB	74 dB	66 dB	60 dB	57 dB	50 dB	50 dB	43 dB
Outdoor Noise	85 dB	85 dB	81 dB	81 dB	77 dB	72 dB	69 dB	65 dB

Warranty

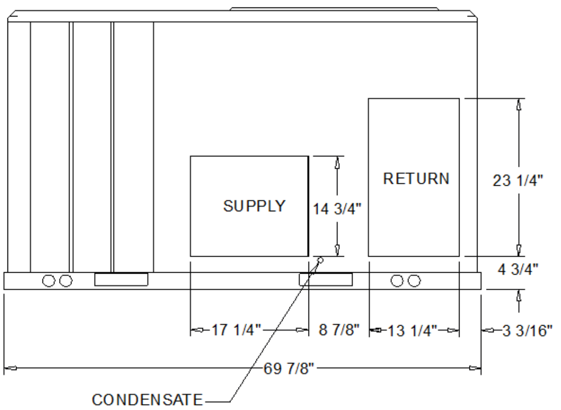
Delayed startup warranty	12/36 Delayed startup warranty
Labor warranty (first year)	1st Year Labor warranty
Labor - beyond first year	Labor - 2 - 5th year labor
Parts less compressor warranty	2nd-5th yr. parts less compr. warranty

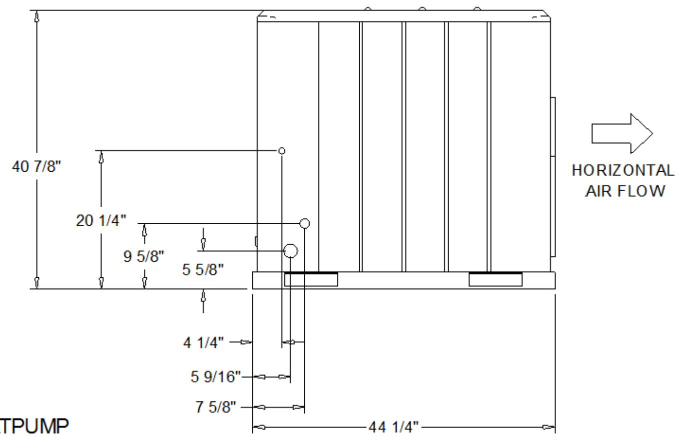




PLAN VIEW UNIT

DIMENSION DRAWING





PACKAGED HEATPUMP

DIMENSION DRAWING

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

Model:	WSC048H	Oversized Motor	
Unit Operating Voltage:	414-506	MCA:	N/A
Unit Primary Voltage:	460	MFS:	N/A
Unit Secondary Voltage:	--	MCB:	N/A
Unit Hertz:	60		
Unit Phase:	3		
SEER	12.3/14.3		
Standard Motor		Field Installed Oversized Motor	
Minimum Circuit Ampacity:	12.0	MCA:	N/A
Maximum Fuse Size:	15.0	MFS:	N/A
Maximum (HACR) Circuit Breaker:	15.0	MCB:	N/A

WITH HEATER

Heater kW Rating :	12.0
Stage:	2
MCA:	30.0
MFS	30.0
MCB	30.0

Oversized Motor		Field Installed Oversized Motor	
MCA:	N/A	MCA:	N/A
MFS:	N/A	MFS:	N/A
MCB:	N/A	MCB:	N/A

INDOOR MOTOR

Standard Motor		Outsized Motor		Field Installed Oversized Motor	
Number:	1	Number:	N/A	Number:	N/A
Horsepower:	1.0	Horsepower:	N/A	Horsepower:	N/A
Motor Speed (RPM):	-	Motor Speed (RPM):	N/A	Motor Speed (RPM):	N/A
Phase:	3	Phase:	N/A	Phase:	N/A
Full Load Amps:	2.5	Full Load Amps:	N/A	Full Load Amps:	N/A
Locked Rotor Amps:	-	Locked Rotor Amps:	N/A	Locked Rotor Amps:	N/A

COMPRESSOR — Circuit 1/2

Number:	1
Horsepower:	3.8
Phase:	3
Rated Load Amps:	6.3
Locked Rotor Amps:	-

OUTDOOR MOTOR

Number:	1
Horsepower:	0.40
Motor Speed (RPM):	1100
Phase:	3
Full Load Amps:	0.7
Locked Rotor Amps:	-

POWER EXHAUST ACCESSORY (3,7)

(Field Installed Power Exhaust)

Phase:	N/A
Horsepower:	N/A
Motor Speed (RPM):	N/A
Full Load Amps:	N/A
Locked Rotor Amps:	N/A

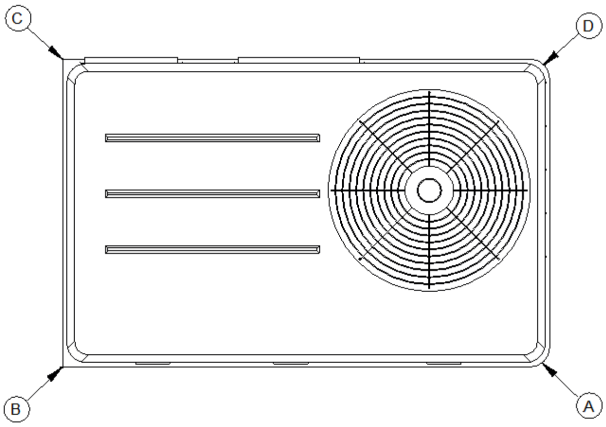
FILTERS

Type:	Throwaway
Furnished:	Yes
Number	2
Recommended	20"x35"x2"

REFRIGERANT (2)

Type	R410
Factory Charge	
Circuit #1	9.3 lb
Circuit #2	N/A

NOTES:
1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.
7. Installation of this power exhaust kit will affect unit level MCA and could affect MOP sizing having a direct impact on existing field wiring and unit protection devices. The change in MCA/MOP is the sole responsibility of the field installing party. Trane will not issue new nameplates as a result of this power exhaust accessory installation. FLA of the power exhaust kit option must be added to the MCA of the unit for building supply conductor sizing determination.



PACKAGED HEAT PUMP

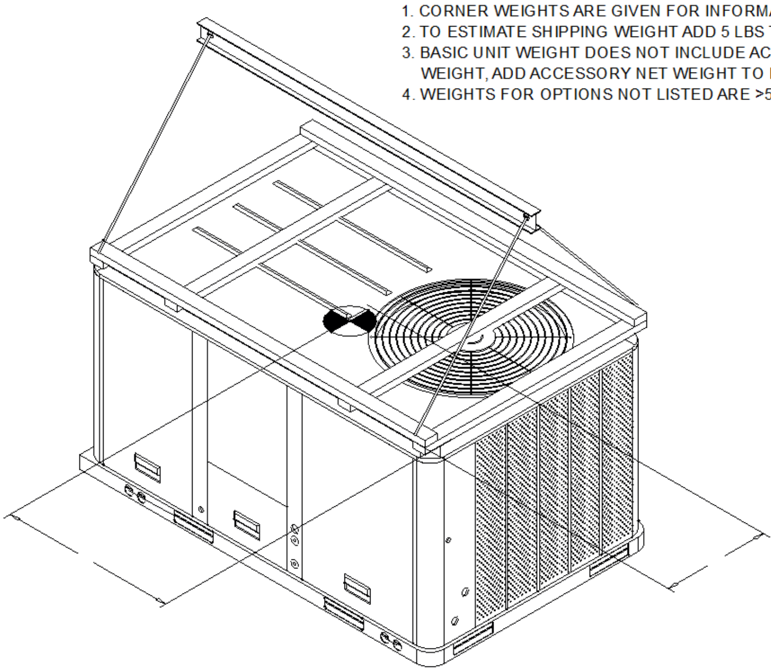
CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
HEATER	15.0 lb
THROUGHT THE BASE ELECTRICAL (FIOPS)	
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	10.0 lb
HAIL GUARD	12.0 lb
SMOKE DETECTOR, SUPPLY / RETURN	
ROOF CURB	

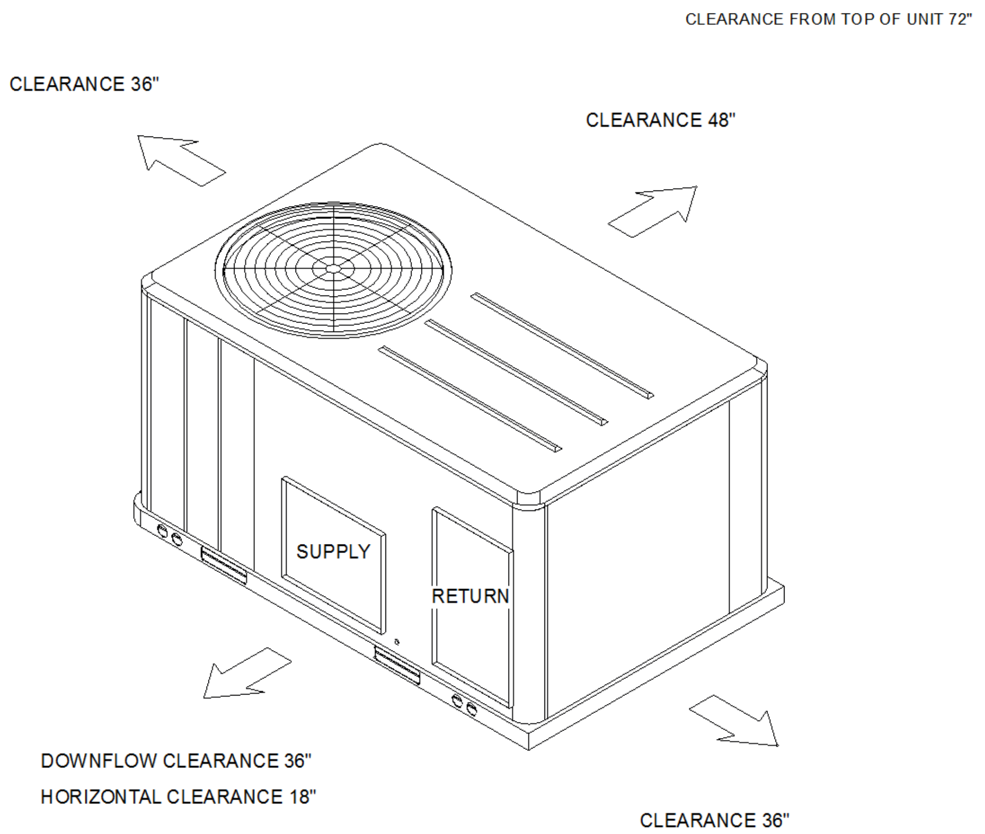
BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	A	165.0 lb	C	108.0 lb	(E) LENGHT	(F) WIDTH
645.0 lb	540.0 lb	B	131.0 lb	D	136.0 lb	31"	20"

NOTE:
1. CORNER WEIGHTS ARE GIVEN FOR INFORMATION ONLY.
2. TO ESTIMATE SHIPPING WEIGHT ADD 5 LBS TO NET WEIGHT.
3. BASIC UNIT WEIGHT DOES NOT INCLUDE ACCESSORY WEIGHT. TO OBTAIN TOTAL WEIGHT, ADD ACCESSORY NET WEIGHT TO BASIC UNIT WEIGHT.
4. WEIGHTS FOR OPTIONS NOT LISTED ARE >5 LBS.



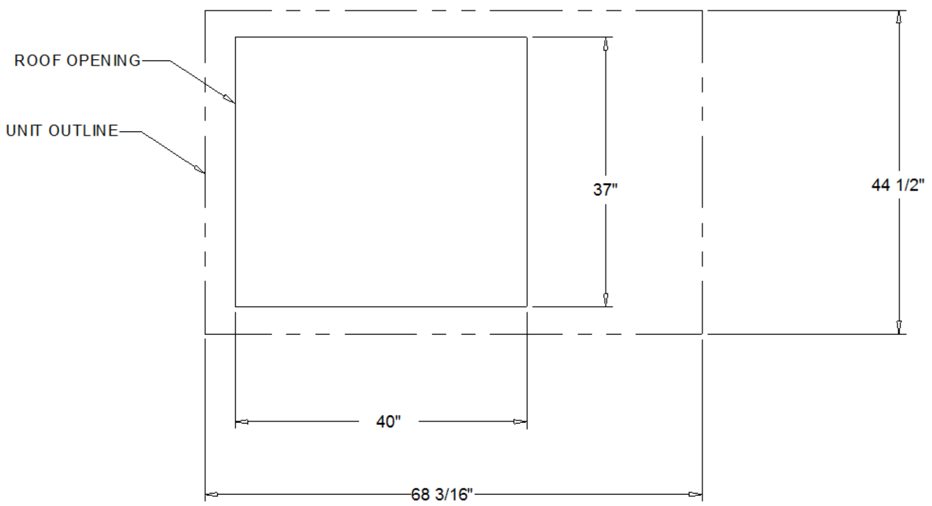
PACKAGED HEAT PUMP

RIGGING AND CENTER OF GRAVITY



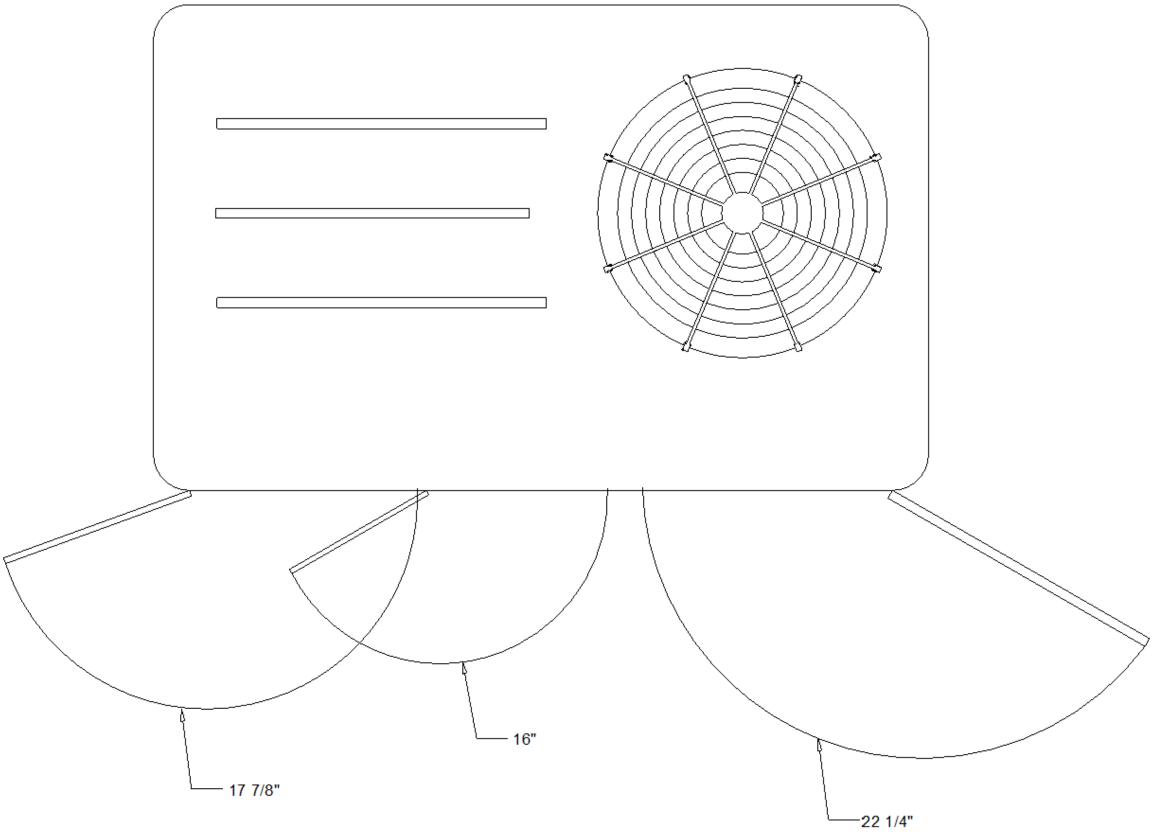
PACKAGED HEAT PUMP

CLEARANCE



PACKAGED HEAT PUMP

DOWNFLOW TYPICAL ROOF OPENING



SWING DIAMETER - HINGED DOOR(S) OPTION

General

The units shall be convertible airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for units with microprocessor controls. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance for Central Cooling Air Conditioners.

Case

Unit casing shall be constructed of zinc coated, heavy gauge, and galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. All insulation edges shall be either captured or sealed. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8" high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting, with forklift capabilities on three sides of the unit.

Unit Top

The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

Filters

Throwaway filters shall be standard on all units. Optional 2" MERV 8 and MERV 13 filters shall also be available.

Compressors

All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors.

Refrigerant Circuits

Service pressure ports, and refrigerant line filter driers are factory-installed as standard. An area shall be provided for replacement suction line driers.

Evaporator and Condenser Coils

Internally finned, 5/16"copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 650 psig and pressure tested to 450 psig. The condenser coil shall have a patent pending 1+1+1 hybrid coil designed with slight gaps for ease of cleaning. A removable, reversible, double-sloped condensate drain pan with through the base condensate drain is standard.

Tool-less Hail Guards

Tool-less, hail protection quality coil guards are available for condenser coil protection.

Outdoor Fans

The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

Indoor Fan

Standard efficiency 6 to 8.5 ton units come standard with belt drive motors with an adjustable idlerarm assembly for quick-adjustment to fan belts and motor sheaves. All high efficiency and 10 ton standard efficiency shall have variable speed direct drive motors. All motors shall be thermally protected. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

Stainless Steel Drain Pan
This option provides excellent corrosion and oxidation resistance. Drain pan shall be reversible and Constructed of 304 stainless steel.

Controls
Unit shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Unit shall provide an external location for mounting a fused disconnect device. A choice of microprocessor or electromechanical controls shall be available. Microprocessor controls provide for volt control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized Microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

Phase monitor
Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is equipped with an LED that provides an ON or FAULT indicator. There are no field adjustments. The module will automatically reset from a fault condition.

Electric Heaters
Electric heat modules shall be available for installation within basic unit. Electric heater elements shall be constructed of heavy-duty nickel chromium elements internally delta connected for 240 volt, wye connected for 480 and 600 volt. Staging shall be achieved through ReliaTel. Each heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from the factory, where required, and shall meet all NEC and CEC requirements when properly installed. Power assemblies shall provide single point connection. Electric heat modules shall be UL listed or CSA certified.

Sequence of Operation (if applied in a SINGLE-ZONE CONSTANT-VOLUME SYSTEM or a CHANGEOVER BYPASS SYSTEM)

B. SINGLE-ZONE CONSTANT-VOLUME SYSTEM

1. OCCUPIED HEAT/COOL:
The RTU shall operate the supply fan continuously and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing to maintain zone temperature at setpoint. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:
The RTU shall operate the supply fan and modulate (or cycle) compressors or modulate (or stage) heat to raise/lower zone temperature to its occupied setpoint. The OA damper shall remain closed, unless economizing.

D. CHANGEOVER BYPASS SYSTEM

1. OCCUPIED HEAT/COOL:
Each VAV terminal shall use pressure-independent control, with airflow measurement, to vary primary airflow to maintain zone temperature at its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing based on current zone cooling/heating demands. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:
Each VAV terminal unit shall vary primary airflow to raise/lower zone temperature to its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors or modulate (or stage) heat based on current zone cooling/heating demands. The OA damper shall remain closed, unless economizing.

3. COOLING/HEATING CHANGEOVER LOGIC:

The System Controller shall determine the overall system cooling/heating mode based on "voting" from each zone. When the majority of zones require cooling, the RTU shall operate in cooling mode and any zone that requires heating shall reduce primary airflow to minimum. When the majority of zones require heating, the RTU shall operate in heating mode and any zone that requires cooling shall reduce primary airflow to minimum.

Trane Precedent Heat Pump Packaged Rooftop

Unit Overview - WSC048H4REA**00E1000000000100000000000000

Application	Unit Size	Supply Fan		External Dimensions (in.)			Operating Weight		EER	IEER/SEER	Elevation
		Airflow	External Static Pressure	Height	Width	Length	Minimum	Maximum			
DX cooling	4 Ton	1600 cfm	0.800 in H2O	3.41 ft	3.69 ft	5.82 ft	540.0 lb	818.0 lb	12.30	14.30	0.00 ft

Unit Features

Panels/Filters	Hinged pnl/2 in pltd filters MERV 13-3ph

Unit Electrical

Voltage/phase/hertz	460/60/3
MCA	30.00 A
MOP	30.00 A
MCA (230 w/ Elec Heat)	0.00 A
MOP (230 w/ Elec Heat)	0.00 A

Cooling Section

		Capacity	
Entering Dry Bulb	78.75 F	Gross Total	44.92 MBh
Entering Wet Bulb	64.86 F	Gross Sensible	38.43 MBh
Ambient Temp	105.00 F	Net Total	43.18 MBh
Leaving Coil Dry Bulb	54.76 F	Net Sensible	36.69 MBh
Leaving Coil Wet Bulb	54.67 F	Fan Motor Heat	0.67 MBh
Leaving Unit Dry Bulb	57.54 F	Refrig Charge-circuit 1	9.3 lb
Leaving Unit Wet Bulb	55.96 F		

Heating Section

Heat Pump Mode		Secondary Heat	
Output Heating Capacity	47.07 MBh	Heat Type	Electric
Output Heating Capacity with Fan	47.75 MBh	Heating Stages	2
Heating Delta T	27.24 F	Heating Capacity	12 kW@240,480,600 derate to unit voltage
Heating EAT	60.50 F	Electric Heat Output	40.98 MBh
Heating Ambient Temp	47.00 F	Electric Heat Air Temp Rise	23.59 F
Heating Ambient WB	42.60 F		
Heating Ambient Relative Humidity	70.00 %		

Fan Section

Indoor Fan Data		Outdoor Fan Data	
Type	FC Centrifugal	Type	Propeller
Drive Type	Direct	Fan Quantity	1
Evap Fan FLA	2.50 A	Drive Type	Direct
Indoor Fan Performance		**Outdoor Fan Performance**	
Airflow	1600 cfm	Condenser Fan FLA	0.70 A
Design ESP	0.800 in H2O		
Component SP	0.070 in H2O		
Total SP	0.920 in H2O		
Supply Motor Horsepower	1.000 hp		
Indoor Motor Operating Power	0.68 bhp		
Indoor RPM	1067 rpm		

Compressor Section

Power	3.96 kW
Circuit 1 RLA	6.30 A
Circuit 2 RLA	0.00 A

Acoustics

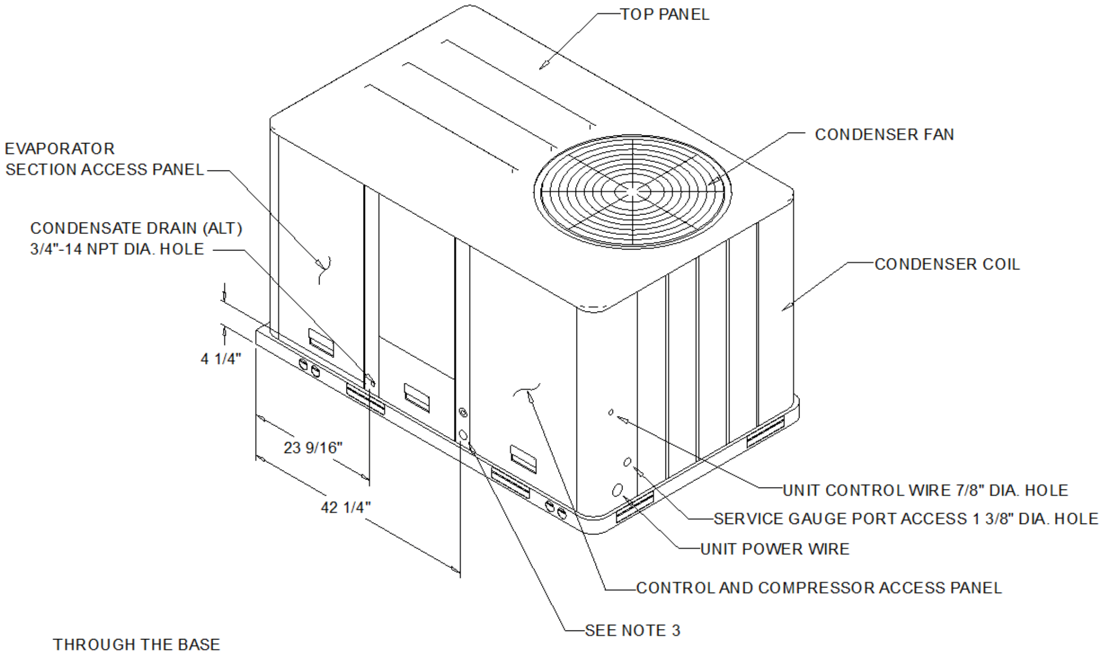
Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	84 dB	78 dB	70 dB	68 dB	63 dB	60 dB	61 dB	54 dB
Ducted Inlet	82 dB	74 dB	66 dB	60 dB	57 dB	50 dB	50 dB	43 dB
Outdoor Noise	85 dB	85 dB	81 dB	81 dB	77 dB	72 dB	69 dB	65 dB

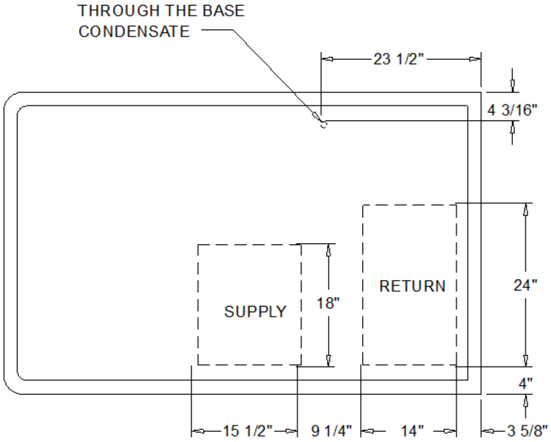
Warranty

Delayed startup warranty	12/36 Delayed startup warranty
Labor warranty (first year)	1st Year Labor warranty
Labor - beyond first year	Labor - 2 - 5th year labor
Parts less compressor warranty	2nd-5th yr. parts less compr. warranty

TRANE

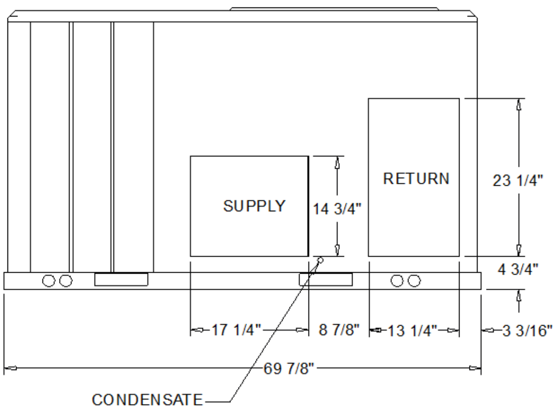
Job Name: Madera USD - Madison ES
Prepared For:
Unit Tag: HP 1-3
Quantity: 1

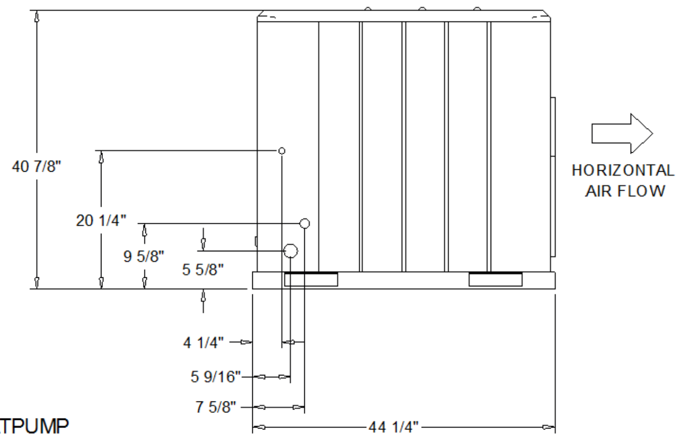




PLAN VIEW UNIT

DIMENSION DRAWING





PACKAGED HEATPUMP

DIMENSION DRAWING

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

Model:	WSC048H	Oversized Motor	
Unit Operating Voltage:	414-506	MCA:	N/A
Unit Primary Voltage:	460	MFS:	N/A
Unit Secondary Voltage:	--	MCB:	N/A
Unit Hertz:	60		
Unit Phase:	3		
SEER	12.3/14.3		
Standard Motor		Field Installed Oversized Motor	
Minimum Circuit Ampacity:	12.0	MCA:	N/A
Maximum Fuse Size:	15.0	MFS:	N/A
Maximum (HACR) Circuit Breaker:	15.0	MCB:	N/A

WITH HEATER

Heater kW Rating :	12.0
Stage:	2
MCA:	30.0
MFS	30.0
MCB	30.0

Oversized Motor		Field Installed Oversized Motor	
MCA:	N/A	MCA:	N/A
MFS:	N/A	MFS:	N/A
MCB:	N/A	MCB:	N/A

INDOOR MOTOR

Standard Motor		Outsized Motor		Field Installed Oversized Motor	
Number:	1	Number:	N/A	Number:	N/A
Horsepower:	1.0	Horsepower:	N/A	Horsepower:	N/A
Motor Speed (RPM):	-	Motor Speed (RPM):	N/A	Motor Speed (RPM):	N/A
Phase:	3	Phase:	N/A	Phase:	N/A
Full Load Amps:	2.5	Full Load Amps:	N/A	Full Load Amps:	N/A
Locked Rotor Amps:	-	Locked Rotor Amps:	N/A	Locked Rotor Amps:	N/A

COMPRESSOR

	Circuit 1/2
Number:	1
Horsepower:	3.8
Phase:	3
Rated Load Amps:	6.3
Locked Rotor Amps:	-

OUTDOOR MOTOR

Number:	1
Horsepower:	0.40
Motor Speed (RPM):	1100
Phase:	3
Full Load Amps:	0.7
Locked Rotor Amps:	-

POWER EXHAUST ACCESSORY (3,7)

(Field Installed Power Exhaust)

Phase:	N/A
Horsepower:	N/A
Motor Speed (RPM):	N/A
Full Load Amps:	N/A
Locked Rotor Amps:	N/A

FILTERS

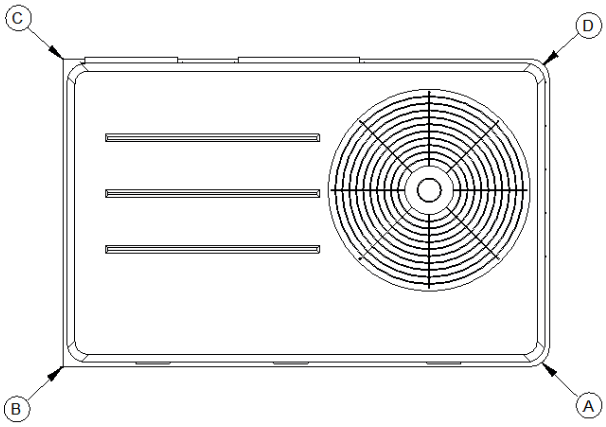
Type:	Throwaway
Furnished:	Yes
Number	2
Recommended	20"x35"x2"

REFRIGERANT (2)

Type	R410
Factory Charge	
Circuit #1	9.3 lb
Circuit #2	N/A

NOTES:
1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.
7. Installation of this power exhaust kit will affect unit level MCA and could affect MOP sizing having a direct impact on existing field wiring and unit protection devices. The change in MCA/MOP is the sole responsibility of the field installing party. Trane will not issue new nameplates as a result of this power exhaust accessory installation. FLA of the power exhaust kit option must be added to the MCA of the unit for building supply conductor sizing determination.

Job Name: Madera USD - Madison ES
Prepared For:
Unit Tag: HP 1-3
Quantity: 1



PACKAGED HEAT PUMP

CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
HEATER	15.0 lb
THROUGHT THE BASE ELECTRICAL (FIOPS)	
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	10.0 lb
HAIL GUARD	12.0 lb
SMOKE DETECTOR, SUPPLY / RETURN	
ROOF CURB	

BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	A	165.0 lb	C	108.0 lb	(E) LENGHT	(F) WIDTH
645.0 lb	540.0 lb	B	131.0 lb	D	136.0 lb	31"	20"

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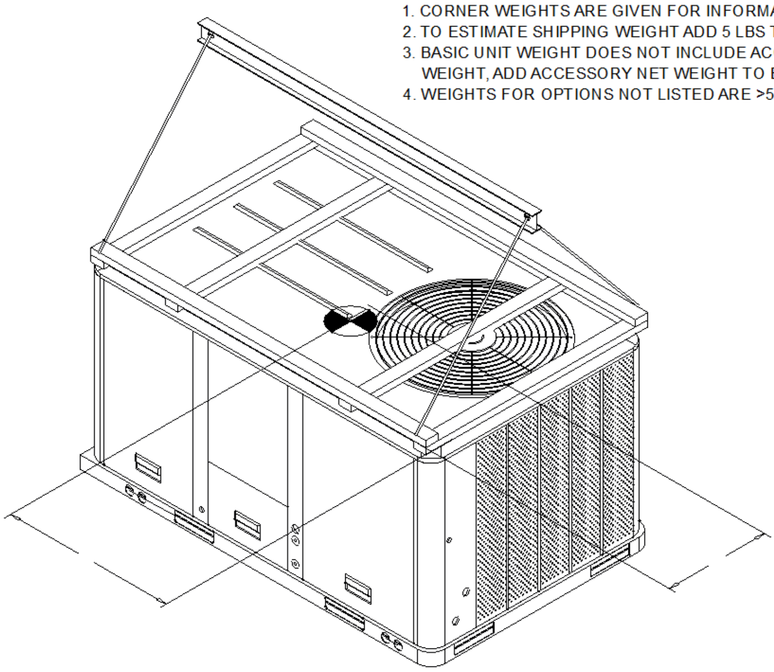
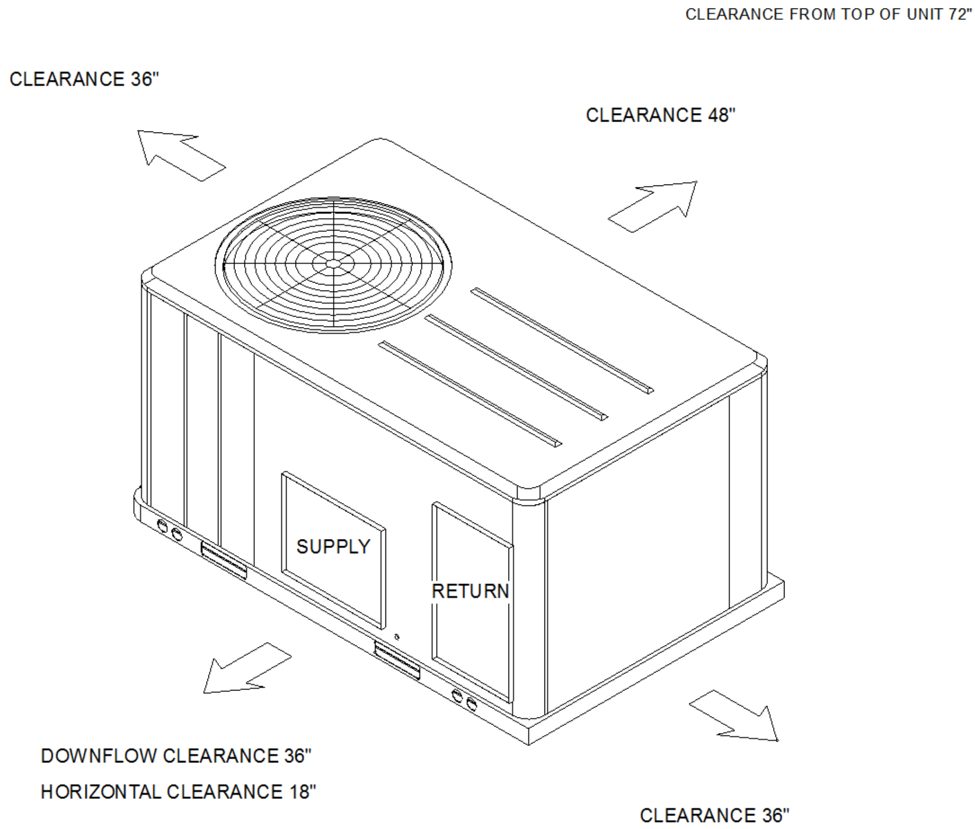


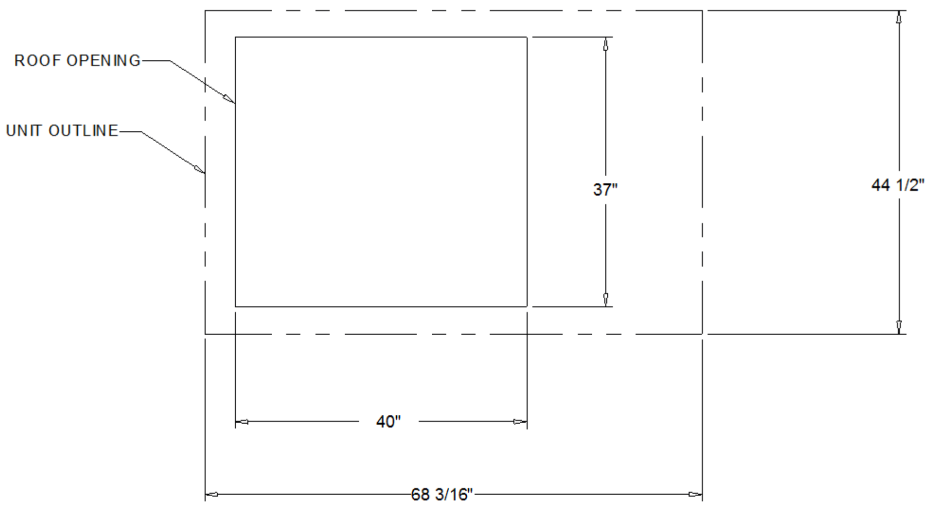
PACKAGED HEAT PUMP

RIGGING AND CENTER OF GRAVITY



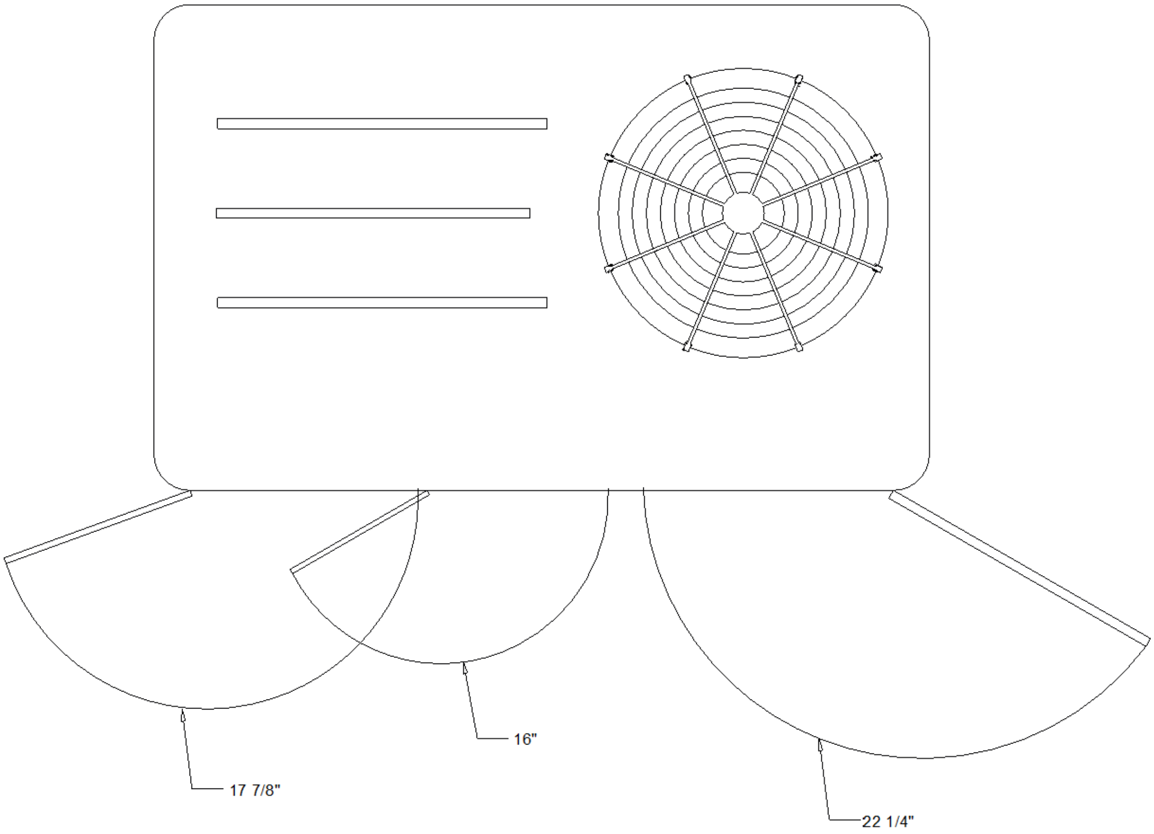
PACKAGED HEAT PUMP

CLEARANCE



PACKAGED HEAT PUMP

DOWNFLOW TYPICAL ROOF OPENING



SWING DIAMETER - HINGED DOOR(S) OPTION

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Sequence of Operation (if applied in a SINGLE-ZONE CONSTANT-VOLUME SYSTEM or a CHANGEOVER BYPASS SYSTEM)

B. SINGLE-ZONE CONSTANT-VOLUME SYSTEM

1. OCCUPIED HEAT/COOL:
The RTU shall operate the supply fan continuously and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing to maintain zone temperature at setpoint. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:
The RTU shall operate the supply fan and modulate (or cycle) compressors or modulate (or stage) heat to raise/lower zone temperature to its occupied setpoint. The OA damper shall remain closed, unless economizing.

D. CHANGEOVER BYPASS SYSTEM

1. OCCUPIED HEAT/COOL:
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2. MORNING WARM-UP/PRE-COOL:
Each VAV terminal unit shall vary primary airflow to raise/lower zone temperature to its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors or modulate (or stage) heat based on current zone cooling/heating demands. The OA damper shall remain closed, unless economizing.

3. COOLING/HEATING CHANGEOVER LOGIC:

The System Controller shall determine the overall system cooling/heating mode based on "voting" from each zone. When the majority of zones require cooling, the RTU shall operate in cooling mode and any zone that requires heating shall reduce primary airflow to minimum. When the majority of zones require heating, the RTU shall operate in heating mode and any zone that requires cooling shall reduce primary airflow to minimum.

Trane Precedent Heat Pump Packaged Rooftop

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		Airflow	External Static Pressure	Height	Width	Length	Minimum	Maximum			
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Unit Features

Panels/Filters	Hinged pnl/2 in pltd filters MERV 13-3ph

Unit Electrical

Voltage/phase/hertz	460/60/3
MCA	30.00 A
MOP	30.00 A
MCA (230 w/ Elec Heat)	0.00 A
MOP (230 w/ Elec Heat)	0.00 A

Cooling Section

		Capacity	
Entering Dry Bulb	79.45 F	**Gross Total**	45.11 MBh
Entering Wet Bulb	65.00 F	**Gross Sensible**	39.40 MBh
Ambient Temp	105.00 F	**Net Total**	43.37 MBh
Leaving Coil Dry Bulb	54.90 F	**Net Sensible**	37.66 MBh
Leaving Coil Wet Bulb	54.80 F	**Fan Motor Heat**	0.67 MBh
Leaving Unit Dry Bulb	57.67 F	**Refrig Charge-circuit 1**	9.3 lb
Leaving Unit Wet Bulb	56.09 F		

Heating Section

Heat Pump Mode		Secondary Heat	
Output Heating Capacity	47.07 MBh	**Heat Type**	Electric
Output Heating Capacity with Fan	47.75 MBh	**Heating Stages**	2
Heating Delta T	27.24 F	**Heating Capacity**	12 kW@240,480,600 derate to unit voltage
Heating EAT	59.74 F	**Electric Heat Output**	40.98 MBh
Heating Ambient Temp	47.00 F	**Electric Heat Air Temp Rise**	23.59 F
Heating Ambient WB	42.60 F		
Heating Ambient Relative Humidity	70.00 %		

Fan Section

Indoor Fan Data		Outdoor Fan Data	
Type	FC Centrifugal	**Type**	Propeller
Drive Type	Direct	**Fan Quantity**	1
Evap Fan FLA	2.50 A	**Drive Type**	Direct
Indoor Fan Performance		**Outdoor Fan Performance**	
Airflow	1600 cfm	**Condenser Fan FLA**	0.70 A
Design ESP	0.800 in H2O		
Component SP	0.070 in H2O		
Total SP	0.920 in H2O		
Supply Motor Horsepower	1.000 hp		
Indoor Motor Operating Power	0.68 bhp		
Indoor RPM	1067 rpm		

Compressor Section

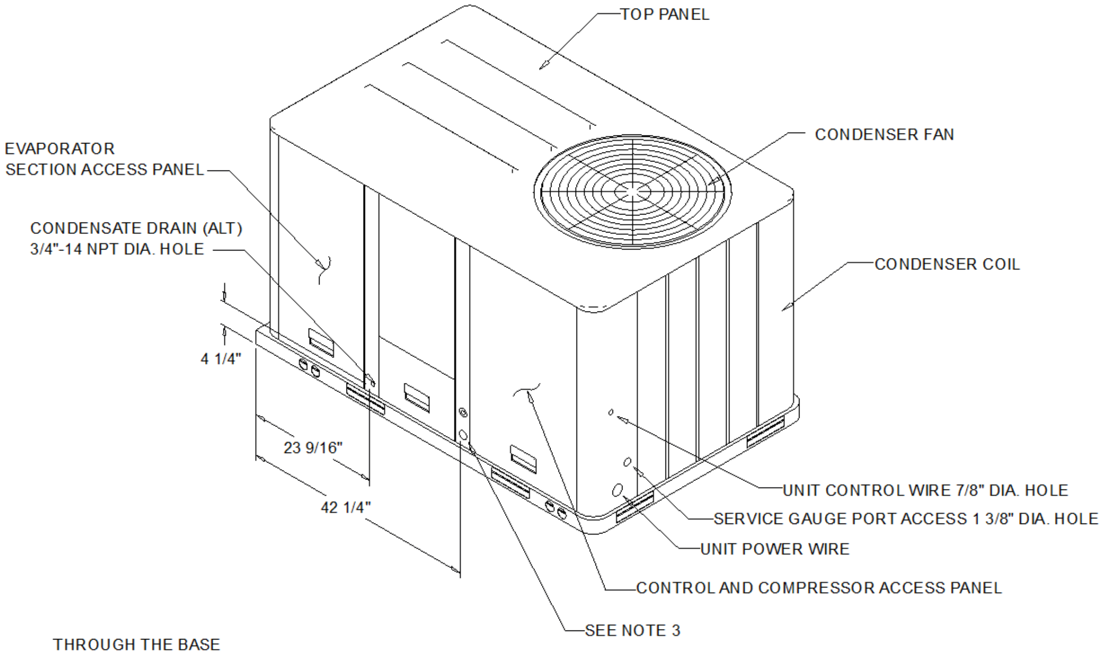
Power	3.96 kW
Circuit 1 RLA	6.30 A
Circuit 2 RLA	0.00 A

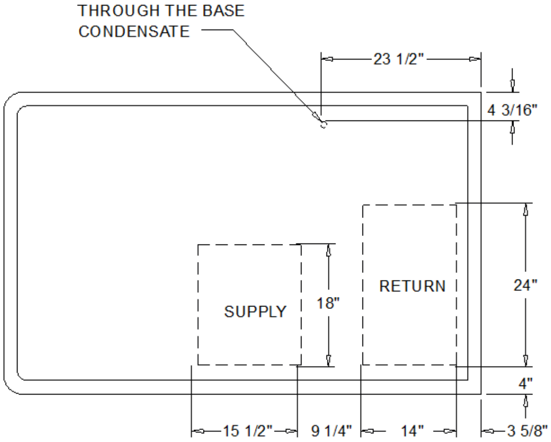
Acoustics

Sound Path	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Ducted Discharge	84 dB	78 dB	70 dB	68 dB	63 dB	60 dB	61 dB	54 dB
Ducted Inlet	82 dB	74 dB	66 dB	60 dB	57 dB	50 dB	50 dB	43 dB
Outdoor Noise	85 dB	85 dB	81 dB	81 dB	77 dB	72 dB	69 dB	65 dB

Warranty

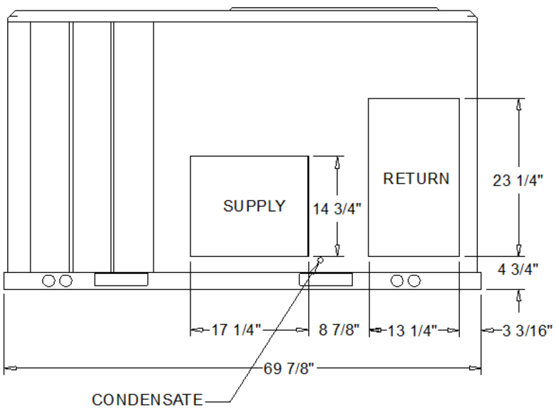
Delayed startup warranty	12/36 Delayed startup warranty
Labor warranty (first year)	1st Year Labor warranty
Labor - beyond first year	Labor - 2 - 5th year labor
Parts less compressor warranty	2nd-5th yr. parts less compr. warranty

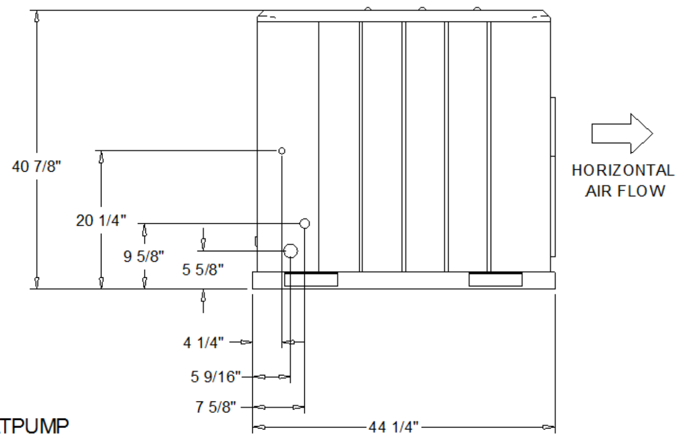




PLAN VIEW UNIT

DIMENSION DRAWING





PACKAGED HEATPUMP

DIMENSION DRAWING

ELECTRICAL / GENERAL DATA

GENERAL (2)(4)(6)

Model:	WSC048H	Oversized Motor	
Unit Operating Voltage:	414-506	MCA:	N/A
Unit Primary Voltage:	460	MFS:	N/A
Unit Secondary Voltage:	--	MCB:	N/A
Unit Hertz:	60		
Unit Phase:	3		
SEER	12.3/14.3		
Standard Motor		Field Installed Oversized Motor	
Minimum Circuit Ampacity:	12.0	MCA:	N/A
Maximum Fuse Size:	15.0	MFS:	N/A
Maximum (HACR) Circuit Breaker:	15.0	MCB:	N/A

WITH HEATER

Heater kW Rating :	12.0
Stage:	2
MCA:	30.0
MFS	30.0
MCB	30.0

Oversized Motor		Field Installed Oversized Motor	
MCA:	N/A	MCA:	N/A
MFS:	N/A	MFS:	N/A
MCB:	N/A	MCB:	N/A

INDOOR MOTOR

Standard Motor		Outsized Motor		Field Installed Oversized Motor	
Number:	1	Number:	N/A	Number:	N/A
Horsepower:	1.0	Horsepower:	N/A	Horsepower:	N/A
Motor Speed (RPM):	-	Motor Speed (RPM):	N/A	Motor Speed (RPM):	N/A
Phase:	3	Phase:	N/A	Phase:	N/A
Full Load Amps:	2.5	Full Load Amps:	N/A	Full Load Amps:	N/A
Locked Rotor Amps:	-	Locked Rotor Amps:	N/A	Locked Rotor Amps:	N/A

COMPRESSOR Circuit 1/2

Number:	1
Horsepower:	3.8
Phase:	3
Rated Load Amps:	6.3
Locked Rotor Amps:	-

OUTDOOR MOTOR

Number:	1
Horsepower:	0.40
Motor Speed (RPM):	1100
Phase:	3
Full Load Amps:	0.7
Locked Rotor Amps:	-

POWER EXHAUST ACCESSORY (3,7)

(Field Installed Power Exhaust)

Phase:	N/A
Horsepower:	N/A
Motor Speed (RPM):	N/A
Full Load Amps:	N/A
Locked Rotor Amps:	N/A

FILTERS

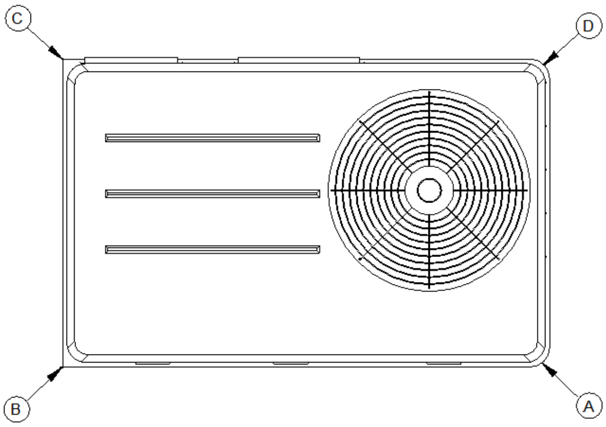
Type:	Throwaway
Furnished:	Yes
Number	2
Recommended	20"x35"x2"

REFRIGERANT (2)

Type	R410
Factory Charge	
Circuit #1	9.3 lb
Circuit #2	N/A

NOTES:

1. Maximum (HACR) Circuit Breaker sizing is for installations in the United States only.
2. Refrigerant charge is an approximate value. For a more precise value, see unit nameplate and service instructions.
3. Value does not include Power Exhaust Accessory.
4. Value includes oversized motor.
5. Value does not include Power Exhaust Accessory.
6. EER is rated at AHRI conditions and in accordance with DOE test procedures.
7. Installation of this power exhaust kit will affect unit level MCA and could affect MOP sizing having a direct impact on existing field wiring and unit protection devices. The change in MCA/MOP is the sole responsibility of the field installing party. Trane will not issue new nameplates as a result of this power exhaust accessory installation. FLA of the power exhaust kit option must be added to the MCA of the unit for building supply conductor sizing determination.



PACKAGED HEAT PUMP

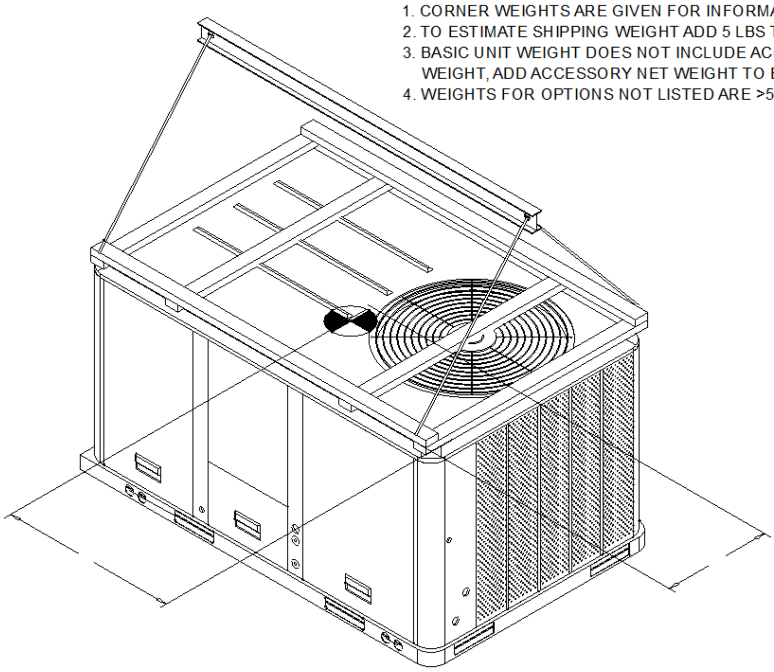
CORNER WEIGHT

INSTALLED ACCESSORIES NET WEIGHT DATA

ACCESSORY	WEIGHTS
ECONOMIZER	
MOTORIZED OUTSIDE AIR DAMPER	
MANUAL OUTSIDE AIR DAMPER	
BAROMETRIC RELIEF	
OVERSIZED MOTOR	
BELT DRIVE MOTOR	
POWER EXHAUST	
HEATER	15.0 lb
THROUGHT THE BASE ELECTRICAL (FIOPS)	
UNIT MOUNTED CIRCUIT BREAKER (FIOPS)	
UNIT MOUNTED DISCONNECT (FIOPS)	
POWERED CONVENIENCE OUTLET (FIOPS)	
HINGED DOORS (FIOPS)	10.0 lb
HAIL GUARD	12.0 lb
SMOKE DETECTOR, SUPPLY / RETURN	
ROOF CURB	

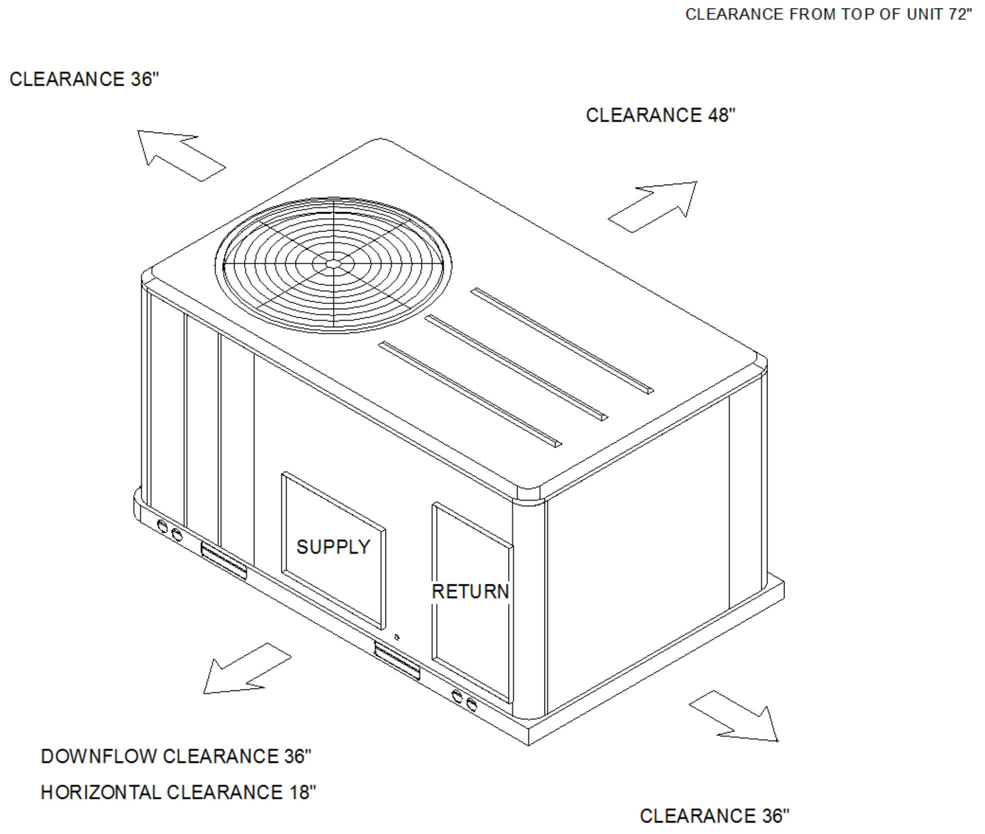
BASIC UNIT WEIGHTS		CORNER WEIGHTS				CENTER OF GRAVITIY	
SHIPPING	NET	A	165.0 lb	C	108.0 lb	(E) LENGHT	(F) WIDTH
645.0 lb	540.0 lb	B	131.0 lb	D	136.0 lb	31"	20"

NOTE:
1. CORNER WEIGHTS ARE GIVEN FOR INFORMATION ONLY.
2. TO ESTIMATE SHIPPING WEIGHT ADD 5 LBS TO NET WEIGHT.
3. BASIC UNIT WEIGHT DOES NOT INCLUDE ACCESSORY WEIGHT. TO OBTAIN TOTAL WEIGHT, ADD ACCESSORY NET WEIGHT TO BASIC UNIT WEIGHT.
4. WEIGHTS FOR OPTIONS NOT LISTED ARE >5 LBS.



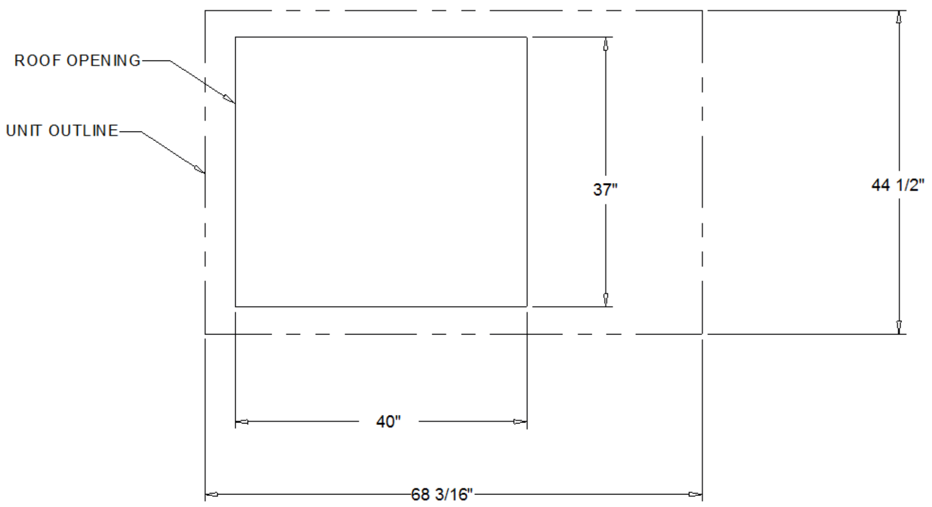
PACKAGED HEAT PUMP

RIGGING AND CENTER OF GRAVITY



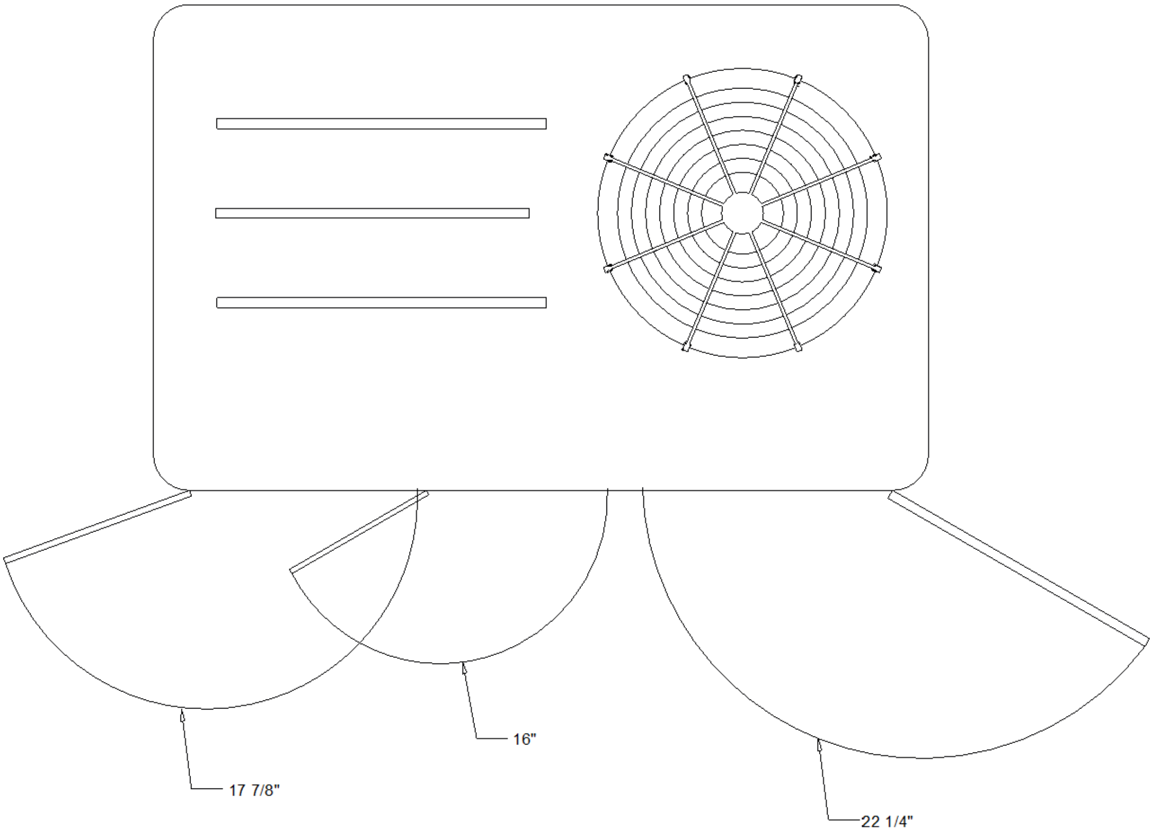
PACKAGED HEAT PUMP

CLEARANCE



PACKAGED HEAT PUMP

DOWNFLOW TYPICAL ROOF OPENING



SWING DIAMETER - HINGED DOOR(S) OPTION

General
The units shall be convertible airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for units with microprocessor controls. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be cULus listed and labeled, classified in accordance for Central Cooling Air Conditioners.

Case
Unit casing shall be constructed of zinc coated, heavy gauge, and galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. All exposed vertical panels and top covers in the indoor air section shall be insulated with a cleanable foil-faced, fire-retardant permanent, odorless glass fiber material. All insulation edges shall be either captured or sealed. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1 1/8" high downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting, with forklift capabilities on three sides of the unit.

Unit Top
The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top.

Filters
Throwaway filters shall be standard on all units. Optional 2" MERV 8 and MERV 13 filters shall also be available.

Compressors
All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Internal overloads shall be provided with the scroll compressors.

Refrigerant Circuits
Service pressure ports, and refrigerant line filter driers are factory-installed as standard. An area shall be provided for replacement suction line driers.

Evaporator and Condenser Coils
Internally finned, 5/16"copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. Coils shall be leak tested at the factory to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 650 psig and pressure tested to 450 psig. The condenser coil shall have a patent pending 1+1+1 hybrid coil designed with slight gaps for ease of cleaning. A removable, reversible, double-sloped condensate drain pan with through the base condensate drain is standard.

Tool-less Hail Guards
Tool-less, hail protection quality coil guards are available for condenser coil protection.

Outdoor Fans
The outdoor fan shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and shall have built-in thermal overload protection.

Indoor Fan
Standard efficiency 6 to 8.5 ton units come standard with belt drive motors with an adjustable idlerarm assembly for quick-adjustment to fan belts and motor sheaves. All high efficiency and 10 ton standard efficiency shall have variable speed direct drive motors. All motors shall be thermally protected. All indoor fan motors meet the U.S. Energy Policy Act of 1992 (EPACT).

Stainless Steel Drain Pan
This option provides excellent corrosion and oxidation resistance. Drain pan shall be reversible and Constructed of 304 stainless steel.

Controls
Unit shall be completely factory-wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Unit shall provide an external location for mounting a fused disconnect device. A choice of microprocessor or electromechanical controls shall be available. Microprocessor controls provide for volt control functions. The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures. The control algorithm maintains accurate temperature control, minimizes drift from set point, and provides better building comfort. A centralized Microprocessor shall provide anti-short cycle timing and time delay between compressors to provide a higher level of machine protection.

Phase monitor
Phase monitor shall provide 100% protection for motors and compressors against problems caused by phase loss, phase imbalance, and phase reversal. Phase monitor is equipped with an LED that provides an ON or FAULT indicator. There are no field adjustments. The module will automatically reset from a fault condition.

Electric Heaters
Electric heat modules shall be available for installation within basic unit. Electric heater elements shall be constructed of heavy-duty nickel chromium elements internally delta connected for 240 volt, wye connected for 480 and 600 volt. Staging shall be achieved through ReliaTel. Each heater package shall have automatically reset high limit control operating through heating element contactors. All heaters shall be individually fused from the factory, where required, and shall meet all NEC and CEC requirements when properly installed. Power assemblies shall provide single point connection. Electric heat modules shall be UL listed or CSA certified.

Sequence of Operation (if applied in a SINGLE-ZONE CONSTANT-VOLUME SYSTEM or a CHANGEOVER BYPASS SYSTEM)

B. SINGLE-ZONE CONSTANT-VOLUME SYSTEM

1. OCCUPIED HEAT/COOL:
The RTU shall operate the supply fan continuously and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing to maintain zone temperature at setpoint. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:
The RTU shall operate the supply fan and modulate (or cycle) compressors or modulate (or stage) heat to raise/lower zone temperature to its occupied setpoint. The OA damper shall remain closed, unless economizing.

D. CHANGEOVER BYPASS SYSTEM

1. OCCUPIED HEAT/COOL:
Each VAV terminal shall use pressure-independent control, with airflow measurement, to vary primary airflow to maintain zone temperature at its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors, modulate (or stage) heat, and/or enable airside economizing based on current zone cooling/heating demands. The OA damper shall open to bring in the required amount of ventilation.

2. MORNING WARM-UP/PRE-COOL:
Each VAV terminal unit shall vary primary airflow to raise/lower zone temperature to its occupied setpoint. The RTU shall modulate the bypass damper to maintain duct static pressure at setpoint and modulate (or cycle) compressors or modulate (or stage) heat based on current zone cooling/heating demands. The OA damper shall remain closed, unless economizing.

3. COOLING/HEATING CHANGEOVER LOGIC:

The System Controller shall determine the overall system cooling/heating mode based on "voting" from each zone. When the majority of zones require cooling, the RTU shall operate in cooling mode and any zone that requires heating shall reduce primary airflow to minimum. When the majority of zones require heating, the RTU shall operate in heating mode and any zone that requires cooling shall reduce primary airflow to minimum.

High Static Modification

Below is the Electrical Data Changes on the Modified Heat Pumps, HP-1-1 ~ HP-1-6.
The Weight Change is Negligible.
Sample Fan Selection Comefri THLZ Fan is Below.

Factory

			Electric Heat	Max Mode	Standard Size
MCA		30.00	0.00	30.00	30.00
MOP		32.54	0.00	32.54	35.00
RDE		27.81	0.00	27.81	30.00
DSS		28.36	0.00	28.36	30.00
Key Load		6.30	0.00		
Compressor 1	*Amps*	6.3			
Condenser Fan 1	*Amps*	0.7			
Supply Fan 1	*Amps*	2.5			
Misc. Loads	*Amps*	0.1			
Electric Reheat	*kW*	12			

Modified

			Electric Heat	Max Mode	Standard Size
MCA		29.60	0.00	29.60	29.60
MOP		32.14	0.00	32.14	30.00
RDE		27.41	0.00	27.41	30.00
DSS		27.90	0.00	27.90	30.00
Key Load		6.30	0.00		
Compressor 1	*Amps*	6.3			
Condenser Fan 1	*Amps*	0.7			
Supply Fan 1	*Amps*	2.1	1 hp Belt-Drive Motor		
Misc. Loads	*Amps*	0.1			
Electric Reheat	*kW*	12			

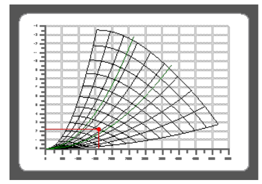
5/24/2024
Aeolus4 1.0.24046.0 Feb 2024

Customer	Dewinder Singh, Fresno Trane CSO		
Project	Madera USD Madison ES	**Description**	
Your Ref.	Nick Cavitt	**Our Ref.**	Trane Creative Solutions

Input data

Volume	1600 CFM	**Temperature**	68.0 °F	**Density**	0.075 lb/cu.ft
Static Pressure	2.21 In.W.G.	**Altitude**	0 ft	**Free Inlet - Free Outlet**	

	Catalogue data		
Selected Fan **THLZ 250 FF T**	n Max 1/min	Pw Max BHP	J lb ft²
	5800	6.71	0.47



Fan Information

c ft/min	p tot In.W.G.	p sta In.W.G.	p dyn In.W.G.	tip speed ft/min	RPM 1/min	eta Tot %	eta Sta %	P fan BHP	Min Mot. BHP	P mot BHP	Shaft diameter in
1434	2.34	2.21	0.13	7093	2752	75.66	71.51	0.78	0.93	1.00	0.79

fm[Hz]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Tot.**
Lw7 Total Sound Power Level at the fan inlet, with ducted outlet - Lwmi Inlet and Casing Sound Power Level (free inlet) do not includes the effect of duct end correction									
Level Lw7 dB/dB(A)	76 / 50	74 / 58	76 / 68	77 / 74	74 / 74	71 / 73	67 / 68	60 / 59	**83 / 81**
Lw6 Total Sound Power Level at the free outlet - Lwmo Outlet Sound Power Level (free outlet) do not includes the effect of duct end correction									
Level Lw6 dB/dB(A)	76 / 50	77 / 61	78 / 70	79 / 76	76 / 76	74 / 76	67 / 68	60 / 59	**85 / 81**

Electronic Cometer

Piezo ring Q [m³/s] = dFac (Δp[Pa])$^{0.5}$

dFac	Q [m³/s]	Δp[Pa]
0.033	0.76	524

Δp: pressure differential between the suction chamber of the AHU and the sensor/ring

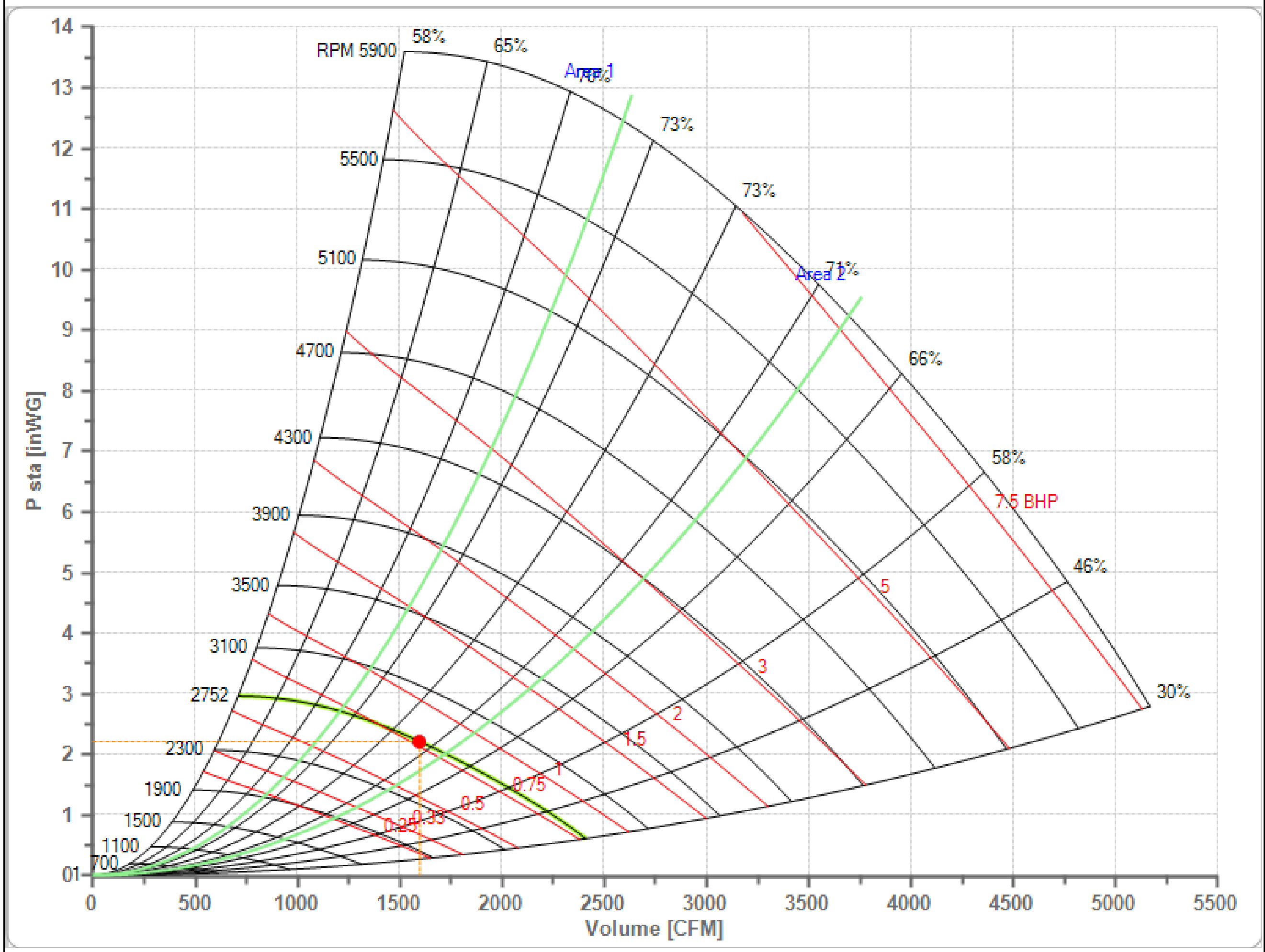
-

Chart

comefri
fans of energy saving

5/24/2024
Aeolus4 1.0.24046.0 Feb 2024

Selected Fan	THLZ 250 FF T	Fan working conditions	Free Inlet - Free Outlet
n Max	5800 1/min	Volume	1600 CFM
Pw Max	6.71 BHP	Total Pressure	2.34 In.W.G.
J	0.47 lb ft²	Static Pressure	2.21 In.W.G.
		P fan	0.78 BHP
Required working point	•	eta Tot	75.66 %
Effective working point	•	eta Sta	71.51 %
		RPM	2752 1/min
		Temperature	68.0 °F
		Altitude	0 ft

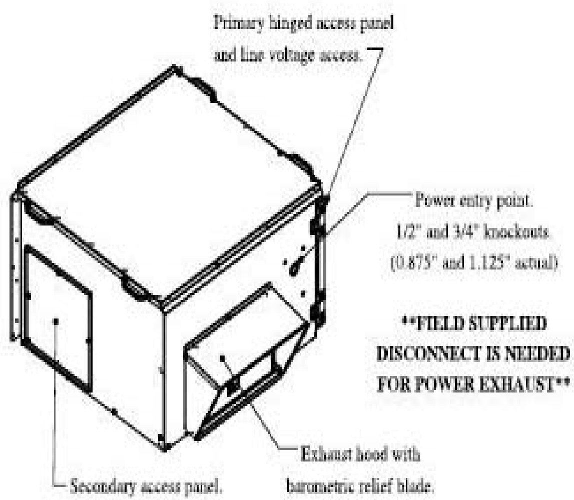


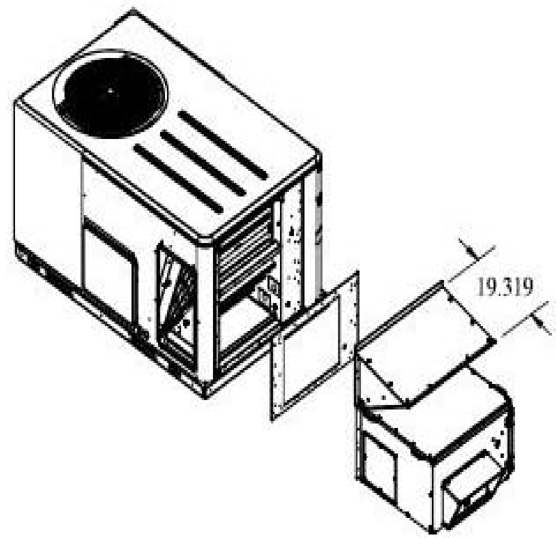
MicroMetl	Date: 6/6/2024	Weights: 207lbs/93.89kg	Units: HP-1-1 ~ HP-2-6 (Qty: 12)	Part Number: PECD-PRC0BCB-D00B-4LH
Submitted To: Alfredo.MarquezRivera@Trane.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with Actuator Only for 3rd Party Economizer Controls - No Controller, Belimo Actuator, No Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

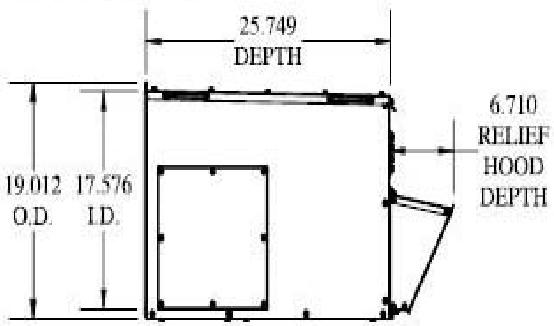
FEATURES:

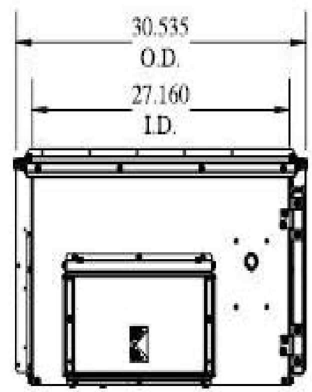
- Includes ECD-PRC0BCB series economizer.
- External gear driven dampers with roll formed blades.
- Designed for vertical applications only.
- Factory assembled rain hood, with aluminum water entrainment filters.
- Filter access door supplied with RTU.
- Hinged filter access door is ordered separately.
  - MMC P/# for Chassis B - ECD-PRC0BB-HDOOR
  - MMC P/# for Chassis F - ECD-PRC0BF-HDOOR
- Rain hood is sloped for water run off.
- All harnesses and plugs needed are supplied.
- Economizer is class 1A & AMCA certified.
- Relief blades are AMCA certified.
- Uses filter rack with unit.
- Field supplied and installed disconnect is required.
- Blower is forward curved, double inlet, with pre-lubricated ball bearings, have a dynamically balanced wheel, and are mounted on rubber isolators.
- Thermally protected motors.
- Adjustable motor pulleys
- See page 2 for PE performance and electrical data.
- Motorized relief available, add -M to end of part number
  - Ex: PECD-PRC0BCB-Dxxx-xxx-M





AMCA WORLDWIDE CERTIFIED RATINGS — AIR LEAKAGE — AIR PERFORMANCE — AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.





MicroMetl	Date: 6/6/2024	Weights: 207lbs/93.89kg	Units: HP-1-1 ~ HP-2-6 (Qty: 12)	Part Number: PECD-PRC0BCB-D00B-4LH
Submitted To: Alfredo.MarquezRivera@Trane.com	Job:	Notes:		

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with Actuator Only for 3rd Party Economizer Controls - No Controller, Belimo Actuator, No Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

Compliant Economizer:

1. **Title 24:** Economizers meet California Energy Commission Title 24-2013 / 2016 prescriptive section 140.4 (damper leakage etc.).
2. **ASHRAE 90.1:** Economizers meet ASHRAE 90.1-2013 / 2016 damper leakage requirement.
3. **IECC:** Economizers meet IECC 2012, IECC 2015, IECC 2018 for outside air, return air, and relief damper (when provided) leakage requirements.
4. **AMCA:** Outside air and return air (volume) dampers are AMCA Class 1A rated at 1" w.g. Refer to MicroMetl NS2 catalog sheet on web site for details. Relief air dampers (when provided) are also AMCA rated. Refer to GR1 series catalog sheet on web site for details.

MicroMetl Corporation certifies that the models GR1 and NS2 shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with requirements of the AMCA Certified Ratings Programs. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

MicroMetl	Date: 6/6/2024	Weights: 207lbs/93.89kg	Units: HP-1-1 ~ HP-2-6 (Qty: 12)	Part Number: PECD-PRC0BCB-D00B-4LH

Submitted To: Alfredo.MarquezRivera@Trane.com	Job:	Notes:

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- 1/2HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
1VH	208-230/240	1	Constant Volume	0.5	4.1-4.3	5.1-5.4	9.2-9.7	N/A
2VH	208-230/240	3	Constant Volume	0.5	2.3-2.2	2.9-2.8	5.2-5.0	N/A
1LH or 1TH	208-230/240	1	Modulating	0.5	5.7*	7.1	12.8	10 Amp
2LH or 2TH	208-230/240	3	Modulating	0.5	3.9*	4.9	8.8	10 Amp
4VH	460/480	3	Constant Volume	0.5	1.1	1.4	2.5	N/A
4LH or 4TH	460/480	3	Modulating	0.5	1.5*	1.9	3.4	10 Amp

- 1HP Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V1	208-230/240	3	Constant Volume	1.0	3.8-3.6	4.8-4.5	8.6-8.1	N/A
1L1	208-230/240	1	Modulating	1.0	10.0*	12.5	22.5	20 Amp
2L1 or 2T1	208-230/240	3	Modulating	1.0	6.4*	8.0	14.4	12 Amp
4V1	460/480	3	Constant Volume	1.0	1.9	2.4	4.3	N/A
4L1 or 4T1	460/480	3	Modulating	1.0	2.8*	3.5	6.3	10 Amp

*VFD Input Current

MicroMetl	Date: 6/6/2024	Weights: 207lbs/93.89kg	Units: HP-1-1 ~ HP-2-6 (Qty: 12)	Part Number: PECD-PRC0BCB-D00B-4LH

Submitted To: Alfredo.MarquezRivera@Trane.com	Job:	Notes:

Economizer & Power Exhaust Combination Package, Genesis Ultra Low Leak Vertical with Actuator Only for 3rd Party Economizer Controls - No Controller, Belimo Actuator, No Sensor, 460 Volt Three Phase, Modulating, Designed To Operate At 1850 CFM @ 1/2" - 1/2 HP. Power Exhaust Painted To Match RTU, All Necessary Panels And Hardware Included. Electrical junction box provided. High voltage cable to be field supplied and installed. Power Exhaust VFD is BacNet Compatible..

- Series Low Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
1VH	208-230	1	Constant Volume	0.5	4.1-4.3	5.1-5.4	9.2-9.7	N/A
2VH	208-230	3	Constant Volume	0.5	2.3-2.2	2.9-2.8	5.2-5.0	N/A
1LH or 1TH	230	1	Modulating	0.5	5.7*	7.1	12.8	10 Amp
2LH or 2TH	230	3	Modulating	0.5	3.9*	4.9	8.8	10 Amp
4VH	460	3	Constant Volume	0.5	1.1	1.4	2.5	N/A
4LH or 4LH	460	3	Modulating	0.5	1.5*	1.9	3.4	10 Amp

- Series High Static Power Exhaust Configurations and Electrical Data

Suffix	Voltage	Phase	Description	HP	FLA	MCA	MOCP	Internally Provided Fuses
2V1	208-230	3	Constant Volume	1.0	3.8-3.6	4.8-4.5	8.6-8.1	N/A
1L1	208-230	1	Modulating	1.0	10.0*	12.5	22.5	20 Amp
2L1 or 2T1	230	3	Modulating	1.0	6.4*	8.0	14.4	12 Amp
4V1	460	3	Constant Volume	1.0	1.9	2.4	4.3	N/A
4L1 or 4T1	460	3	Modulating	1.0	2.8*	3.5	6.3	10 Amp

*VFD Input Current

"1/2 HP" Sound Data - Assumes .3125 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
2200	0.1	712	dBA	76	74	71	69	68	65	61	58	62
2075	.25	760		78	76	74	71	70	68	64	61	64
2025	.3	781		78	76	75	72	71	69	64	61	65
1950	.4	821		81	78	76	73	71	69	65	62	66
1850	.5	864		83	80	77	74	72	69	66	63	67
1775	.6	908		84	82	79	76	74	72	68	65	68
1650	.75	974		86	83	82	78	76	76	70	67	71

"1 HP" Sound Data - Assumes .3125 Internal Exhaust Cabinet Static.

CFM	ESP	RPM	Freq. (Hz)	63	125	250	500	1000	2000	4000	8000	Blower Outlet dBA @ 5ft.
2900	0.1	840	dBA	82	79	76	73	71	68	65	62	66
2825	.25	875		83	80	78	74	73	70	67	64	67
2800	.3	886		83	81	78	75	73	71	67	64	68
2725	.4	909		84	81	79	76	74	73	68	65	69
2675	.5	935		85	82	80	77	75	74	69	66	70
2625	.6	967		86	83	82	78	76	75	70	67	71
2525	.75	1011		87	85	83	79	77	76	71	68	72

<table>
<tr><th>Colu</th><th>Question</th><th>Response</th><th>Submitted by</th></tr>
<tr><td>1</td><td>As per the Note on sheet M3.1 please provide a copy of the following documents, in order to provide a complete & competitive bid:
1.) Copy of approved equipment submittals
2.) Copy of approved Trane proposal
3.) Copy of the purchase order</td><td>Please see attached equipment submittal and equipment proposal.</td><td>Boone</td></tr>
<tr><td>2</td><td>Regarding the Madison ES two-story bid, please confirm if the building will be modular or site-built.</td><td>The new building will be site built not modular.</td><td>Silver Creek</td></tr>
<tr><td>3</td><td>Attached is Section 01 57 15 Integrated Pest Management. Is a Integrated Pest Management really required for this project? This is a new building and not a remodel of an existing building. I have searched the Central Vally and could not find anyone interested in bidding for this work nor anyone or firm that is IPM Star Certified. Is this requirement just for the new construction or the entire site during construction for the full 365 calendar days?</td><td>No integrated pest management will be required for this project.</td><td>Ardent</td></tr>
<tr><td>4</td><td>RFI: Please clarify the wall tile selection (manufacturer/size/style) as per below plans:

Enlarged Floor Plan A1.3 in rooms #113, 120 & 121

Enlarged Floor Plan A1.4 in rooms #210 & 211</td><td>Room 120 & 121 - Wall Tile - Daltile - 6"x18" - Color Wheel Linear - Matte Biscuit K775

Room 210 & 211 - Wall Tile - Daltile - 6"x18" - Color Wheel Linear - Matte Biscuit K775

Room #113 is removed from plan.</td><td>Better Enterprises</td></tr>
<tr><td>5</td><td>RFI-2: Please clarify the the below Tile selections (collection;style;size confirmation)

In reference to the Color Schedule, A2.3:

TL-2 Datile; 6"x12"; Color: K775 Matte Biscuit - Is this Colorwheel Linear or Classic?*
*Please note: the size 6"x12" is not available in either style - Please confirm size.

TL-3 Datile; 6"x12" Cove Base; Color: K775 Matte Biscuit - Is this Colorwheel Linear or Classic?*
*Please note: the size 6"x12" Cove is not available in either style - Please confirm size.</td><td>TL-1: Crossville - 12"x12" - Argent - Clean Slate (field/floor tile)

TL-2: Daltile - 6"x18" - Color Wheel Linear - Matte Biscuit K775 (wall tile)

TL-3: Daltile - 6"x6" - Collor Wheel Classic - Matte Biscuit K775 (cove base tile)

TL-4: Daltile - 4"x12" - Color Wheel Linear - Matte Biscuit K775 (wall tile)</td><td>Better Enterprises</td></tr>
</table>

6	Section: 102800-Toilet Accessories Issue: 1) The following items are shown & not specified. Please provide manufacturer & model #'s for pricing: Soap Dipsenser(TA-1) Paper Towel Dispenser(TA-4) Issue: 2) Model #T22 for the Royce Rolls Ringer(TA-3) is no longer a valid item number. Please provide a different model number.	Response 1) Soap dispensers and paper towel dispensers shall be owner furnished contractor installed (OFCI).	Ardent/ Seals Construction/ AMG/ Fortune Ratliff
7	There appears to be a conflict between sheets ES.1 and FA1.0 for the routing of low voltage site conduits to the new two-story building. Sheet ES.1 shows the fire alarm and signal pathways routed from the north whereas sheet FA1.0 shows the fire alarm pathway routed from the south and the signal pathway routed from the west. Please clarify which route is correct.	Answer forthcoming in future addendum	Industrial Electrical
8	On sheet A2.1, the Type D storefront door size is listed on the door schedule, however the overall dimensions of the frame with transom and side lites is not shown. Our storefront supplier is not able to provide a quote/take-off without this information. Please advise if this information is listed elsewhere as they are not able to locate it.	Answer forthcoming in future addendum	San Joaquin Glass
9	RFI 1: Detail 9/AX5.8 shows the 3" pipe welded to the HSS3x1 post. Please confirm cap plate requirement and weld the for HSS3x1 post.	Answer forthcoming in future addendum	The KYA Group
10	RFI 2: Detail 1/AX5.7 notes Stainless Steel rail mounts. Detail 11/AX5.7 notes Stainless Steel grab rails for Stair #1. Please confirm if detail 4/A1.6 is stair 1. Please confirm if any grab rails are Stainless Steel.	Answer forthcoming in future addendum	The KYA Group

11	RFI 3: Detail 16/AX5.8 shows the connections for the Woven wire. Per specs the mesh needs to have 18ga U edging. Please confirm requirement of U edging with the 2" bar. Also please confirm weld from ¾" bar to HSS3x1. Details show continuous weld. At least one side of this flat bar will need to be installed after all elements are galvanized. To minimize post galvanizing welds, please accept stitch welds for the flat bar to HSS3x1.	Answer forthcoming in future addendum	The KYA Group
12	RFI4: : Detail 16/AX5.8 shows the connections for the Woven wire. Please confirm the 2" flat bar is supposed to be ¾" thick. The bar scales to 3/8".	Flat bar is 3/8" thick.	The KYA Group
13	RFI 5: Specs for rails 05 50 00 1.4B Calls for the submittal to have a stamped engineer for shop drawings. It would appear these are fully designed. Please confirm requirement of engineer stamp on rail shop drawings.	Answer forthcoming in future addendum	The KYA Group
14	1) Please confirm builder's risk insurance need to provided for this project? 2) If builder's risk is required, do we need to include earthquake and flood coverage?	Answer forthcoming in future addendum	AMG
15	There is not a Division 28 Safety and Security specification in the documents but the plans show intrusion alarm devices on sheets T1.1 & T1.2 Technology 1st and 2nd Floor Plans. Question: Is an intrusion alarm detection system part of this project?	Answer forthcoming in future addendum	Access Systems/ AMG
16	Plans sheet T2.2 MDF/IDF Enlarged Floor Plans Enlarged plan keyed notes #11 Security Panels Question: Is an access control system part of this project? Question: What is the District's basis of design for the security system?	Answer forthcoming in future addendum	AMG
17	Since this is a DSA project are there any permits that the contractor will be required to pay for and pull?	Answer forthcoming in future addendum	
18	I see the requirement for the Storm Water Discharge permit, is there a Designed SWPPP Plan?	SWPPP included in Addedum	
19	Can you confirm if the DVBE requirement is only a Good Faith effort of 3%?	Answer forthcoming in future addendum	

20	I noticed the $5M/$10M General Liability Limits, are the subcontractors required to carry the same? Most Subcontractors do not carry that high of limits typically.	Answer forthcoming in future addendum	
21	Can you confirm if submitting the CARB compliance documents at bid time is required? We will not know who the low subcontractors are until bid submission and would have to ask for everyone's CRC's?	Answer forthcoming in future addendum	
22	Does the General Contractor need to sign document 00900 E.O. N-6-22 compliance with economic sanctions?	Answer forthcoming in future addendum	
23	The door schedule on plan page A2.1 is missing some information. 1. There are no door types 48, 58, 74, & 76 listed in the door type detail but they are listed in the door type column on the door schedule. Please provide details for these door types. 2. Door/frame materials and head, jamb, & threshold details are missing from openings 104D, 105D, 122B, 211I, 211M, & 211N. These openings are also missing hardware groups.	Answer forthcoming in future addendum	Seals Construction
24	The wall legend on plan pages A1.1 & A1.2 show most of the walls as fire rated. The door schedule on plan page A2.1 does not show any fire rated openings. Please confirm if any door openings need to be fire rated. If fire ratings are required the hardware groups will need to be revised as well.	In type VA construcution, the openings are **<u>not required</u>** to be fire rated as there are no occupancy seperations. The fire rating in the walls is to protect the primary strucutre of the building	Seals Construction
25	Openings 211I, 211M, & 211N are not listed on the floor plans on plan pages A1.1 & A1.2. Please advise as to where these openings are on the floor plans.	Answer forthcoming in future addendum	Seals Construction
26	The mechanical equipment schedule on sheet M3.1 shows (x4) Greenheck exhaust fans that are not shown anywhere else on the mechanical plan sheets. Please advise if these do not need to be provided.	Answer forthcoming in future addendum	Strategic Mechanical
27	First and second floor, floor finish legend Sealed Concrete SC U.O.N. Are the concrete walks, stair treads and landings to be Sealed Concrete or Pedestrian Traffic Coated? Please Clarify Specifications 07 18 13; Drawings A2.4 & A2.6	Answer forthcoming in future addendum	Ardent

28	For the MBarC Shade Structures: 1) No Gutters/RWL shown in plans. Are gutters required or not? 2) Please specify finishes for columns and beams (field painted, galv or both.) 3) Please specify finishes for framing and hardware. 3) Decking and trim are factory finished baked enamel in standard architectural colors. Color sheet attached.	Answer forthcoming in future addendum	Ardent
29	1) What material should we use for the countertops? 2) What material should we use for the cabinets?	Countertops (plastic laminate) - PL-2 - Formica - Citadel Warp Cabinets (plastic laminate) - PL-1 - Wilsonart - Fawn Cypress	Fortune Ratliff
30	1) Are the temporary relocatable classrooms owner furnished and set by owner and or owner direct contractor? Please Clarify 2) Are the foundation wood pads furnished and installed by the owner and or owner direct contractor? Please Clarify 3) Are the ramps landings and railing owner furnished and set by owner and or owner direct contractor? Please Clarify 4) Are the foundation skirts and the ramp/landing skirts, owner furnished and set by owner and or owner direct contractor? Please Clarify 5) What condition are the relocatable classrooms, will they require any patching, repairs or modifications, (Painting, Flooring, Walls, Wall Finishes, Ceilings, Doors, Door Hardware, Lighting, Data, HVAC Systems, ETC.)? Please Clarify	Answer forthcoming in future addendum	Ardent

31	1. In Sheet A2.3 (Finish Schedule), Carpet Tile CPT-2 (Walk off Carpet) is indicated. However, it is not shown anywhere in the Finish Plan. Could you please confirm whether we are using this product in the project or not? If yes please confirm the location of the same. 2. In Sheet A2.3, the floor tile TL1 manufacturer is listed as Crossville, while the specification document 093000 indicates Marazzi as the manufacturer. Could you please confirm which manufacturer should be used for TL1? 3. TL1 (12"x12") is available as12"x12" field tile and also in mosaic format (12"x12" sheet). Could you please confirm which one we should use from the above? 4. As per Sheets A1.3 and A1.4, Staff Restrooms 116, 119, 209, and Boys Restroom 121 are shown with wall tile finishes, while Girls Restrooms 120, 210, and Boys Restroom 211 are shown with fiber-reinforced panel (FRP) finishes; confirm if this means that only 4 out of the 7 restrooms will have wall tile finishes 5. As per sheet A2.3 Color Schedule, Tiles TL1 and TL2 are mentioned as Daltile, but no specific style is provided. Additionally, the 6"x12" size is not available for Daltile. Could you please confirm the correct size and style for TL1 and TL2? 6. Could you please confirm whether Schluter trims are acceptable in the tile outer edges, or tile trims are specifically required for this project? 7. Could you please confirm if there is any flooring work required under the cabinet?	1. Will not be using CPT-2 (walk off carpet). 2. TL-1 manufacturer is Crossville. 3. TL-1 is a 12"x12" field tile. 4. Girls Restrooms 120, 210, and Boys Restroom 211 will all have tile as well. 5. The following tiles will be used: TL-1 - 12"x12" - Clean Slate - Argent - Crossville TL-2 - 6"x18" - Matte Biscuit K775 - Color Wheel Linear - Daltile TL-3 - 6"x6" cove base - Matte Biscuit K775 - Color Wheel Classic - Daltile TL-4 - 4"x12" - Matte Biscuit K755 - Color Wheel Linear - Daltile 6. Schluter trims are acceptable. 7. The only required flooring work is under any sink cabinets.	Ardent / Michael Surface Solutions / Fortune-Ratliff General Contractors, Inc / Seals

32	1)Plan sheet X1.5 Decorative Metal Fence and Gate Legend #18 indicates security keypad card reader. Could not find any reference in electrical plans or signal plans to the locations. Are there to be keypads and card readers on gates? 2)Plan sheet E0.0 Lighting Fixtures Legend, electrical plans sheets E2.1 and E2.2 show exit emergency lights. Fixture schedule on plan sheet E6.1 does not list an exit emergency light. Will a specification be offered for this fixture? 3)Plan sheet E101: Will any of the receptacles in offices and conference room be required to be occupancy controlled? 4)Plan sheets E1 and E2 show power receptacles. Symbol list for power devices and symbols do not indicate the use of Tamper Resistant receptacles. Will there be an indication of receptacles that are to be of Tamper Resistance type? 6)Electrical specification 260500 / Part 2 / Products / A. / B. / C. indicates to provide allowances: Are we to have separate pricing for each of these allowances or is it to be lump sum? 6a) Question for (B.): (B.) Indicates to provide (25) additional 20A 1-pole 277V lighting circuits. 1)Panel H1 as drawn, does not have breaker space to accommodate this requirement. Are we to include an additional 480V 3-phase 4-wire distribution panel to archive this requirement?	Answer forthcoming in future addendum	AMG
33	The finish schedule and the interior elevations do not match. Some pages show FRP and some show tile. Please confirm if restrooms 116, 119, 120, 121, 209, 210, & 211 are to receive wall tile.	Answer forthcoming in future addendum	Fortune Ratliff
34	Interior elevations 15/A7.1, 19/A7.2, 19/A7.4, & 23/A7.4 depict a gypsum board finish adjacent to the glazing. Exterior elevations and floor plans show this space to be glazing. Please confirm the gypsum board finish depicted adjacent to the glazing on elevations 15/A7.1, 19/A7.2, 19/A7.4, & 23/A7.4 is to be glazing.	Answer forthcoming in future addendum	Fortune Ratliff
35	The door schedule shows a detail for Type A overhead doors, however, there do not appear to be any overhead doors on this project. Please advise.	Overhead doors are not included in this project, please remove from your scope	Fortune Ratliff

SECTION 01 57 23 – STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
  1. Provide all material, labor, and services necessary to: comply with the State of California Construction General Permit Order 2022-0057-DWQ (CGP); implement the Project Storm Water Pollution Prevention Plan (SWPPP); and install and maintain appropriate Best Management Practices (BMP) according to the SWPPP and California Stormwater Quality Association (CASQA) Construction BMP Handbook.
  2. Retain a certified Qualified SWPPP Practitioner (QSP) to implement all Construction Site Monitoring Program (CSMP) elements of the SWPPP, or delegate appropriate roles to the trained Contractor.
  3. Complete and maintain all inspections, sampling, weather monitoring, and recordkeeping required by the CGP, commensurate with a Risk Level 1 SWPPP.
  4. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants within 90-days of completing outdoor construction activities; and notifying Owner and QSD of acceptable termination conditions.
  5. All Contract requirements in Division 00 and 01 specifications.

B. This Section does not include:
  1. The Owner shall retain a Qualified SWPPP Developer (QSD) to prepare the SWPPP document.
  2. The Owner shall submit the Notice of Intent (NOI), SWPPP, Changes of Information (COI), and Annual Reports, Notice of Termination (NOT) to the SWRCB on SMARTS.
  3. The Owner shall complete all required QSD inspections.
  4. The Owner shall pay the NOI application fee and annual renewal fees.
  5. The Owner shall maintain the role of LRP and all responsibilities associated, except where those responsibilities are assigned to the Contractor within these specifications.
  6. The Owner shall complete online digital certification of online reporting on SMARTS
  7. After the Contractor has met all conditions for SWPPP termination, Owner shall complete the NOT and obtain approval from SWRCB. If the NOT is returned by SWRCB due to unacceptable site conditions, Contractor shall implement any redresses specified by the SWRCB.
  8. Owner shall ensure that the Project design has incorporated all post-construction requirements specified by the CGP, MS4 permittee, and local agency stormwater regulations.

C. Acronyms:
  1. BMP Best Management Practices
  2. CGP Construction General Permit
  3. CSMP Construction Site Monitoring Program
  4. CASQA California Stormwater Quality Association
  5. EPA Environmental Protection Agency
  6. ELAP Environmental Laboratory Accreditation Program
  7. NOI Notice of Intent
  8. NOT Notice of Termination
  9. COI Change of Information

10. MS4 Municipal Separate Storm Sewer System
11. NPDES National Pollution Discharge Elimination System
12. QSD Qualified SWPPP Developer
13. QSP Qualified SWPPP Practitioner
14. LRP Legally Responsible Person
15. PRD Permit Registration Documents
16. SMARTS Stormwater Multiple Application and Report Tracking System
17. SWPPP Storm Water Pollution Prevention Plan
18. SWRCB State Water Resources Control Board
19. RWQCB Regional Water Quality Control Board

1.2 REFERENCES

A. Construction General Permit:
1. 2022-0057-DWQ Construction General Permit
2. https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction/general_permit_reissuance.html

B. Project SWPPP Document
1. Available on SMARTS once approved by SWRCB
2. Available by request from the Owner.

C. CASQA Construction BMP Handbook:
1. https://www.casqa.org/resources/bmp-handbooks
2. Appendix G of the Project SWPPP.

1.3 RELATED SECTIONS

A. Section 31 11 00 – Site Clearing

B. Section 31 20 00 – Earthwork

C. Section 33 41 00 – Storm Drainage

D. Section 44 11 13 – Fugitive Dust Control

1.4 SUBMITTALS

A. All submittals shall be in accordance with the submittal requirements of these specifications.

B. The Contractor shall provide, to the Owner and QSD, the name, certification number, and contact information of their retained QSP within 30 days of starting construction.

C. The Contractor shall provide to the Owner and QSD, completed training records of QSP delegation to the Contractor within 30 days of starting construction.

D. The Contractor shall submit to the Owner and QSD the proposed product to be used at the site as soil binder or tackifier for the purposes of erosion control for approval.

E. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical results from the laboratory.

F. The Contractor, QSP, or QSP Delegates shall submit to the Owner and QSD the dewatering field sampling results in the form of the Effluent Sampling Field Log within five days of an NAL exceedance for pH or turbidity.

G. The Contractor shall provide, to Owner and QSD, documentation of implementing all SWPPP requirements, for each Annual Report, within 30 calendar days of the end of each reporting period (reporting period is July 1 through June 30 of each year), or upon requesting to terminate the Project SWPPP.

H. Upon request from the Owner or Owner's agents, Contractor shall provide all documentation that is required throughout construction including, but not limited to, CSMP records, sampling records, non-stormwater spill and discharge events, rain logs, QSP-signed inspection reports for delegated reports, and completed QSP delegation training records.

1.5 REQUIREMENTS

A. General:
   1. Contractor is responsible for understanding and carrying out all provisions of the SWPPP, CGP, and any requirements from local agencies (except as excluded above in 1.1.B., where Owner responsibilities are specified).
   2. The requirements of the CGP, SWPPP, MS4 permittee, and any other local regulations related to stormwater pollution prevention shall be reviewed by Contractor, prior to initiating any ground disturbance or other activities that could lead to stormwater pollution, for a full understanding of the intent, objectives, and implementation.
   3. Contractor responsibilities begin immediately upon execution of the contract containing these specifications and continue until the SWPPP has been terminated with SWRCB.
   4. Specific requirements include, but are not limited to:
      a. Daily weather monitoring and record keeping to identify upcoming storm events and required qualifying precipitation event-related inspections.
      b. Installation of an on-site rain gauge and daily rain gauge reading recording.
      c. Installation, implementation, and maintenance of BMPs, and prevention of prohibited activities and unauthorized non-stormwater discharges.
      d. Conducting and reporting to the QSD all non-visible pollutant release sampling and dewatering sampling.
      e. Ensure that all subcontractors and agents are trained to understand and implement their relevant responsibilities under the CGP, SWPPP, and these specifications.
      f. Pay any penalties, fines, and corrective action costs resulting from failure to comply with SWPPP, CGP, and local agency requirements, and hold the Owner/LRP harmless from any such failures.
      g. Ensure that all conditions are met for SWPPP termination including, but not limited to: fully stabilizing all disturbed areas of the site; removing temporary BMPs, construction materials, and equipment; cleaning the site of any storm water pollutants; and notifying Owner and QSD of acceptable termination conditions.
   5. The SWPPP is an aid to the Contractor in complying with the CGP. CGP requirements shall take precedence over anything contained in the SWPPP, Contractor shall notify the Owner and QSD of any conflicts between the SWPPP and CGP, and no such conflicts shall relieve the Contractor of any responsibilities for execution of these specifications.
   6. See the approved SWPPP for the determined Project risk level. The requirements associated with the project's risk level shall be found in the SWPPP.

B. Retaining a Qualified SWPPP Practitioner (QSP)
1. The Contractor shall retain a certified QSP who will have responsibility and oversight for the implementation of the CSMP elements of the SWPPP and CGP.
2. Contractor shall maintain documentation in the on-site SWPPP and digitally that proves a certified QSP conducted oversight of all SWPPP and CGP compliance activities including, but not limited to:
   a. CSMP inspections, training, weather forecast monitoring and recordkeeping, on-site rain gauge records, non-visible pollutant discharge sampling, and recordkeeping. The responsibilities of the Contractor's QSP are explained in Part 3, Section 3.1 of these SWPPP specifications.

C. Non-visible pollutant discharge sampling:
1. The Contractor's QSP shall train Contractor staff members on non-visible pollutant observation and sampling procedures of the CGP and Section 7 of the Project SWPPP. The QSP and QSP trained delegates shall conduct non-visible sampling when required by site observations and activities according to the CGP.
2. The Contractor shall be prepared with a pH field meter and calibration fluid and clean non-visible pollutant sample bottles and preservatives based on the current non-visible pollutants on-site, as identified in Section 7 of the Project SWPPP.
3. The Contractor shall be prepared to preserve stormwater samples on ice to 4° Celsius immediately after taking stormwater samples and until being driven, picked-up, or shipped to an ELAP certified laboratory.
4. The Contractor shall pay for all costs related to non-visible pollutant sampling and laboratory analysis.
5. A QSP-trained and delegated Contractor staff member or the QSP shall:
   a. Always be available on-site within one hour during site operation hours to conduct non-visible pollutant discharge sampling as required by the CGP.
   b. Complete the non-visible pollutant sampling procedures identified in Section 7 of the Project SWPPP and according to the CGP immediately after the discovery of exposure of non-visible pollutants to stormwater that have a potential to discharge off-site.
   c. Take non-visible pollutant samples of effluent from waste dumpsters left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
   d. Take non-visible pollutant samples of runnoff from demolished building materials left uncovered during rainfall during site operation hours that have a potential to discharge off-site.
6. The Contractor or QSP shall report analytical laboratory results from stormwater sampling to the Owner and QSD within 48 hours of receiving analytical results from the laboratory.

D. De-watering discharge sampling
1. Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP and Section 7 of the Project SWPPP.
2. The Contractor, QSP, or QSP trained delegates shall notify the Regional Water Quality Control Board via email 24-hours prior to the start of planned dewatering operations.
3. The Contractor, QSP, or QSP Delegates shall notify the QSD and LRP if dewatering sample results yielded an NAL exceedance for pH or turbidity within 5 calendar days of the exceedance, including the completed Effluent Sampling Field Log.
4. The Contractor shall immediately cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-

8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.

E. The Contractor shall be responsible for achieving Final Stabilization, as defined by the CGP, for all areas disturbed by Project construction activities in order to terminate the SWPPP within 90-days of completing construction activities, including areas without landscaping plans.
   1. The Contractor shall re-establish any existing vegetation disturbed by the Project with the same vegetation type as was disturbed.
   2. The Contractor shall achieve Final Stabilization for all graded areas with no landscaping plan and disturbed pre-existing non-landscaped vegetation disturbed by the Project with either non-vegetative stabilization as defined by the CASQA Construction BMP Handbook or by use of seeding/hydroseeding with a native erosion control seed mix.

F. The Contractor shall be fully aware of the requirements for the full execution of the SWPPP; the requirements of these specifications for implementing, maintaining, and enforcing the provisions of the SWPPP; and the impact that the SWPPP will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with the CGP is a violation of federal and state law. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Permit arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor's failure to comply with Permit requirements.

1.6 QUALITY ASSURANCE

A. Certified SWPPP Professionals:
   1. Qualified SWPPP Developer (QSD)
      a. The Owner shall retain a certified QSD.
      b. The QSD's name, certification number, and contact information shall be listed within the SWPPP document.
   2. Qualified SWPPP Practitioner (QSP)
      a. The Contractor shall retain a certified QSP.
      b. The QSP's name, certification number, and contact information shall be provided to the Project QSD and in the on-site SWPPP.

B. Regulatory Requirements:
   1. Contractor shall comply with the lawful requirements of any applicable municipality, county, drainage district, municipal storm water management program and other local agencies regarding discharges of storm water to separate storm drain system or other watercourses under their jurisdiction, including but not limited to the following:
      a. EPA Environmental Protection Agency.
      b. SWRCB State Water Resources Control Board.
      c. RWQCB Regional Water Quality Control Board.

2. All stormwater compliance shall be in accordance with local regulations:
   a. County of Madera.
   b. City of Madera.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Best Management Practices (BMPs):
   1. The Contractor is responsible for the providing and furnishing all BMPs, products, and practices necessary to comply with the SWPPP and CGP. All materials and BMPs shall follow the CASQA Construction BMP Handbook and installed as described within the fact sheets, unless otherwise instructed by a qualified professional.
   2. The Contractor must provide, implement, and carry out all BMPs required to comply with the CGP, regardless of the BMPs contained in the SWPPP, and shall notify Owner and QSD of any conflicts between the SWPPP and CGP.
   3. The Contractor shall comply with the erosion control BMP requirements of the CGP, stating that BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days (CGP Appendix D Section II.D.f).
   4. Prior to substantially altering BMPs recommended in the SWPPP, Contractor shall notify the Owner and QSD for review of the alternative BMPs and to obtain instructions for documenting the changes.
   5. Contractor shall consult with the QSP to ensure all BMPs are appropriate, feasible, effective, and correctly implemented.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Monitoring by the Contractor's QSP:
   1. Implement the CSMP and document all records in the SWPPP as required by the CGP, including, but not limited to: weekly, pre-storm, during-storm, post-storm, and quarterly inspections, daily weather monitoring, training of responsible contractor and subcontractor personell, and incidental non-visible pollutant discharge sampling.
      a. CSMP inspection reports:
         1) The QSP or QSP trained delegates shall include photographs showing all disturbed areas, BMPs, BMP deficiencies, material storage locations, stormwater containment areas, and active construction areas. All photographs shall include comments noting any BMP corrective actions and completed corrective actions.
         2) The QSP or QSP trained delegates shall document in their CSMP Inspection reports when all outdoor construction activities have ceased.
      b. QSP Training Records:
         1) The QSP or QSP trained delegates shall administer and document training of contractor and subcontractor staff responsible for BMP implementation, instillation, and maintenance and document it in the SWPPP.
         2) If QSP delegates any weekly/during storm inspections and/or non-visible pollutant discharge sampling requirements to Contractor personnel, QSP shall provide and document training to those personnel.
            a) If CSMP inspection shave been delegated, the QSP shall review and sign all documentation completed by the trained QSP delegate.
      c. Weather Monitoring:

1) The QSP or QSP trained delegates shall save records of daily weather monitoring of the nearest NOAA weather station.
2) The QSP or QSP trained delegates shall record the daily on-site rain gauge reading and retain the records for the duration of the Project.

d. Incidental Non-Visible Pollutant Discharge Sampling:
1) The QSP or QSP trained delegates shall perform any stormwater and non-stormwater sampling, as required by the CGP. If any samples are sent offsite for laboratory analysis, QSP will identify a designated ELAP-certified laboratory and coordinate sample procurement, transportation, analysis, and recordkeeping. If QSP delegates any of these duties to Contractor personnel, QSP shall provide training and document the training in the SWPPP. QSP shall upload sampling results to SMARTS.

e. De-watering Discharge Sampling
1) Prior to conducting dewatering operations via pump or siphon that could result in discharge off-site, the Contractor shall contact the QSP to ensure that dewatering discharge can be sampled for pH and turbidity in accordance with the Appendix J of the CGP. The Contractor shall cease dewatering operations if dewatering samples yield a result higher than 250 NTUs or is outside of the pH range for 6.5-8.5. The Contractor shall wait for sediment to settle/pH to neutralize or utilize BMPs to bring water for dewatering to be within the acceptable ranges of turbidity or pH when resuming dewatering operations.

f. The QSP shall consult with the Contractor to understand the construction schedule and identify site areas where erosion control BMPs must be initialized immediately to temporarily stabilize an area disturbed by construction where construction activities will not be resumed within 14 days in accordance with CGP Appendix D Section II.D.f.

2. New CSMP records outlined above in Part 3, Section 3.1.A shall be provided by the QSP to the QSD and Owner on a bi-monthly basis while the SWPPP NOI is active. New CSMP records shall be sent in the first week of odd numbered months.
3. The QSP shall identify required amendments to the SWPPP based on construction activity and notify the QSD and Owner.
4. The QSP shall identify when the site area has achieved “final stabilization” per the CGP definition, and inform the QSD and Owner.
5. The Contractor’s QSP shall advise the Contractor on achieving final stabilization of all areas disturbed by the Project within 90-days of outdoor construction activities ceasing. The Contractor shall be responsible for achieving final stabilization, as defined by the CGP, for all areas disturbed by Project activities, including areas without landscaping plans.
6. For the full monitoring requirements refer to the SWPPP and CGP.

B. Monitoring by Owner
1. The Owner has the right to monitor and oversee the Contractor’s implementation and maintenance of the BMPs and SWPPP.
2. Should the Owner determine that the Contractor’s efforts fail to meet the requirements of the CGP and the SWPPP, the Owner reserves the right to employ any and/or all of the following actions:
a. Notify the SWRCB of the perceived failure of the Contractor to comply with the CGP and SWPPP.
b. Withhold an amount of money from the Contractor’s Payment Request, equal to the Owner’s estimate of the value of the work required to implement and maintain the required BMPs, as well as provide the required inspection, training, and testing forms.
c. If the SWPPP is not terminated within 90-days of outdoor construction activities ceasing, withhold monies due the Contractor under this Contract, in

an amount sufficient to complete the work, pay any additional fees due the State, and close out the SWPPP in compliance with the General Permit.

C. Availability and access to the SWPPP:
   1. As required by the SWPPP and CGP, the Contractor shall keep a minimum of one copy of the SWPPP, addenda, all PRDS, all inspection reports and all SWPPP records in the following locations:
      a. Contractor’s Project Site Field Office.
      b. Contractor’s General Business Office.
   2. The SWPPP shall be made available for public inspection at any time during normal business hours.
   3. All SWPPP records shall be made available to the Owner and their agents when requested.

3.2 CLEANING AND REMOVAL

A. Removal of BMPs
   1. All temporary BMPs shall be completely removed from the Project Site prior to filing of the NOT.
   2. The removal of any and all BMPs shall be coordinated and approved by the Contractor’s QSP.
   3. All permanent BMPs shall remain on the Project Site, unless directed otherwise by Owner. The Owner will be responsible for ongoing inspection and maintenance after final acceptance.

B. Under written agreement and with the approval of the Owner, the Contractor may assign maintenance and removal responsibilities of the project BMPs to a subsequent Contractor for later work phases at the Project Site.

3.3 RECORD KEEPING

A. Paper and electronic records of all CSMP inspections, testing, training reports, all PRDs, inspection records, site photos, and all other SWPPP related records, shall be retained for a period of at least three years after the close of construction. These records shall be available at the project site until construction is completed.

3.4 PAYMENT

A. Full compensation for all costs involved in implementing, and monitoring the implementation of the SWPPP for this project, including inspections, testing, and training, performing corrective measures as required to better implement the SWPPP, providing all labor, materials, and resources to maintain the SWPPP and all required records of the SWPPP, and being full liable for all failures to fulfill the intent and requirements of the CGP set forth by the SWRCB, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION 01 57 23

SECTION 44 11 13 – FUGITIVE DUST CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Provide all material, labor, fees, and services necessary to comply with the San Joaquin Valley Air Pollution Control District (SJVAPCD) Regulation VIII for dust control requirements.
   2. Contractor will determine the total disturbed surface area and the estimated bulk material moving volumes anticipated for the Project to determine if a Construction Notification or Dust Control Plan is required. Contractor shall prepare and submit a Construction Notification or Dust Control Plan to the SJVAPCD based on these expected Project conditions/activities.
   3. Non-residential Projects that will include five acres or more of disturbed surface area and/or will be moving, depositing, or relocating more than 2,500 cubic yards of bulk material on at least three days of the project are required to submit a Dust Control Plan to the SJVAPCD and receive approval prior to commencing earth moving activities.
   4. Non-residential projects that will include less five acres of disturbed surface area must submit a Construction Notification at least 48 hours prior to commencement of any earthmoving activities. No approval or response from the SJVAPCD is required.
   5. Contractor shall be solely responsible for payment of any fees or fines related to violations of SJVAPCD Regulation VIII from Project activities/conditions.
   6. All Contract requirements in Division 00 and 01 specifications.

B. This Section does not include:
   1. None.

C. Acronyms:
   1. SJVAPCD San Joaquin Valley Air Pollution Control District

1.2 REFERENCES

A. SJVAPCD Compliance Assistance Web Page on Dust Control:
   1. https://ww2.valleyair.org/compliance/dust-control/

B. SJVAPCD Regulation VIII
   1. https://ww2.valleyair.org/rules-and-planning/current-district-rules-and-regulations/regulation-viii-fugitive-pm10-prohibitions/

1.3 RELATED SECTIONS

A. Section 31 11 00 – Site Clearing

B. Section 31 20 00 – Earthwork

C. Section 01 57 23 – Stormwater Pollution Prevention Plan

1.4 SUBMITTALS

A. If applicable, Contractor shall submit to the SJVAPCD the Project Dust Control Plan at least 30 days prior to commencing earth moving activities.

B. If applicable, Contractor shall submit to the SJVAPCD the Project Construction Notification at least 48 hours prior to commencing earth moving activities.

C. Contractor shall submit to Owner the Project Dust Control Plan approved by the SJVAPCD or documentation of submission of a Construction Notification to SJVAPCD prior to commencing earth moving activities.

1.5 REQUIREMENTS

A. Comply with all requirements of SJVAPCD Regulation VIII throughout the life of this contract.

B. The Contractor shall be fully aware of the requirements of SJVAPCD Regulation VIII, the requirements of these specifications for preparing, implementing, maintaining, and enforcing the provisions of SJVAPCD Regulation VIII, and the impact that Regulation VIII will have on the operation, prosecution and cost of the work. A submittal of a bid on this project will be considered as prima facie evidence that the Contractor fully comprehends these requirements and impacts and has fully allowed for their effect on this project, both in time and cost. Failure to comply with SJVAPCD Regulation VIII is a violation of local regulations. Contractor hereby agrees to indemnify, defend and hold harmless Owner, its officers, agents, and employees from and against any and all claims, demands, losses or liabilities of any kind or nature which Owner, its officers, agents, and employees may sustain or incur for noncompliance with the Regulation VIII arising out of or in connection with the Project, except for liability resulting from the negligence or willful misconduct of Owner, its officers, agents or employees. Owner may seek damages from Contractor for delay in completing the Project in accordance herewith, including damage caused by Contractor’s failure to comply with Regulation VIII requirements.

1.6 QUALITY ASSURANCE

A. None.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dust Management Practices (DMPs):
   1. The Contractor is responsible for the providing and furnishing all DMPs, products, and practices necessary to comply with Regulation VIII. All materials and DMPs shall follow the requirements outlined in Regulation VIII, Rule 8021.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Dust Control Training Class Certificate:
   1. At least one key individual representing the Contractor who prepares a Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.
   2. At least one key individual representing the Contractor who is tasked to implement the Dust Control Plan must complete a Dust Control Training Class conducted by the SJVAPCD.

3.2 CLEANING AND REMOVAL

A. All temporary DMPs shall be completely removed from the Project Site upon completion of construction.

3.3 RECORD KEEPING

A. If a Dust Control Plan applies to the Project, Contractor shall maintain records in accordance with the recordkeeping requirements of Regulation VIII, Rule 8011.

3.4 PAYMENT

A. Full compensation for all costs involved in preparing, submitting, implementing, and monitoring the implementation of Regulation VIII for this project, including training, performing corrective measures, providing all labor, materials, resources to maintain the site, and all required records for a Dust Control Plan (if applicable), and being full liable for all failures to fulfill the intent and requirements of the Regulation VIII set forth by the SJVAPCD, shall be included in the cost bid for the various items of work and no additional payment will be made therefor.

END OF SECTION 44 11 13

SECTION 07 42 13 METAL WALL PANELS

1.GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 01 Specification Sections apply to this section.

1.2. SUMMARY

A. This Section includes pre-formed flat seam wall panel system complete with anchor clips, fasteners, flashing, and trim.

B. Includes all labor, materials, and equipment to install a metal wall panel system over the properly prepared substrate.

C. Includes a metal wall panel system over self-adhering underlayment and with all accessories as needed for a complete warrantable roofing system.

D. Related Sections:
1. Section 06 10 00 : Rough Carpentry.
2. Section 07 22 00 : Roof and Deck Insulation.

E. Reference Standards:
1. American Iron and Steel Institute (AISI):
   a. Specification for the Design of Cold-Formed Steel Structural Members.
2. American Society for Testing and Materials (ASTM):
   a. ASTM A240 Specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
   b. ASTM A792 Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   c. ASTM A875 Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot-Dip Process.
   d. ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   e. ASTM B370 Specification for Copper and Sheet and Strip for Building Construction.
   f. ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   g. ASTM E330 Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.
   h. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Air Pressure Differences.
3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   a. Architectural Sheet Metal Manual.

1.3. SUBMITTALS

A. Shop Drawings: Show wall panels (and roofing system, if applicable) with flashings and accessories in elevations, sections, and details. Include metal thickness and finishes, panel lengths, joining details, anchorage details, flashings, and special fabrication provisions for termination and penetrations. Indicate relationships with adjacent and interfacing work.

Indicate fastener types and spacing and provide fastener pullout values. Shop drawings must be completed by the wall panel manufacturer's engineering department. Any and/or all changes recommended by the successful bidder must be approved by the manufacturer in writing prior to submittal.

B. Product Data: Include manufacturer's detailed material and system description, concealed anchor clips, sealant, and closure installation instructions, and finish specifications. Indicate fastener types and spacing and required fastener pullout values.

C. Samples:
   1. Provide full-size samples of the following materials and system components. Samples shall be of identical material type, thickness, panel width, and material grade/alloy as the system specified for this Project:
      a. Submit sample of panel section, at least four inches (4") long by full panel width, showing panel profile and a sample of color selected.
      b. Submit sample of foam closure strips to fit inside and outside specified panel profile.
      c. Submit sample of panel fasteners.

D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the manufacturer and the Owner.

E. Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the State of California. This report shall show that the submitted equal meets the design and performance criteria in this specification. Substitution requests submitted without licensed engineer approval will be rejected for nonconformance.

F. Design and Test Reports:
   1. Provide the following certified test reports from an independent testing laboratory:
      a. Independent laboratory testing report for system design load and seam integrity.
      b. A letter from an officer of the manufacturing company certifying that the materials furnished for this Project are the same as represented in tests and supporting data.
      c. Manufacturer's verifications that the panels are factory roll formed.
      d. ASTM E283 test results must clearly demonstrate compliance with the performance requirements specified in article 1.9 ASTM E331 Test Report.
      e. ASTM E330 test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.
      f. ASTM E331 test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.

G. Mill production reports certifying that the metal thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

H. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7, Method 2 for Components and Cladding. In no case shall the design loads be taken to be less than those detailed in Design and Performance Criteria article.

I. Qualification Data for Wall System Installer: Refer to Quality Assurance Article below.

J. Certification of Work Progress Inspection Frequency: Refer to Quality Assurance Article below.

K. Pre-Installation Conference Proceedings: Refer to Quality Assurance Article below.

L. Test Reports: Submit third party validation of environmental claims, prepared by UL Environment, for all metal wall panels containing recycled content and/or bio-based content.

M. Contract Closeout Submittals:
1. General: Comply with requirements of Section 01 77 00: Closeout Procedures.
2. Special Project warranty: Provide specified warranty for the Project, executed by the authorized agent of the manufacturer.
3. Wall panel maintenance instructions: Provide a manual of manufacturer's recommendations for maintenance of installed systems.
4. Insurance certification: Assist Owner in preparation and submittal of wall installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on wall panel system installation and associated work.
5. Demonstration and training schedule: Provide a schedule of proposed dates and times for instruction of Owner's personnel in the maintenance requirements for completed wall panel system installation work.

1.4. PERFORMANCE REQUIREMENTS

A. Thermal Expansion and Contraction:
1. Completed metal wall panel and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
2. The design temperature differential shall be not less than [200] degrees F.
3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.

B. Uniform wind load capacity:
1. Installed wall panel system shall withstand negative design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as specified.
2. Attach the results of the ASCE 7 minimum design load calculations, as submitted, to this specification. Detailed Drawings showing the specific wind pressure zones shall accompany the calculations:
   a. Design code: ASCE 7, Method 2 for Components and Cladding.
   b. Safety factor: 1.67 after any load reduction or material stress increase.
   c. Category III Building with an Importance Factor of 1.00.
   d. Wind speed: 115 mph.
   e. Ultimate pullout value: 434 pounds per each of the two (2) fasteners holding the panel anchor to the wall substrate or framing system.
   f. Exposure category: B.
   g. Wall height: Four feet (20').
   h. Minimum building width: 30 feet.
   i. Wall area design wind pressure:
      1. Zone 4: Field of wall 15.5 psf.
      2. Zone 5: Wall corners 19.1 psf.
3. Capacity shall be determined using uniform static air pressure method in accordance with ASTM E330. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.

C. ASTM E283 - Static pressure air infiltration (doors, windows, curtain walls):
1. Pressure leakage rate:
   a. 1.57 PSF 0.0033 cfm/sq. ft.
   b. 6.24 PSF 0.0056 cfm/sq. ft.
   c. 12.0 PSF 0.062 cfm/sq. ft.
   d. 15.0 PSF 0.064 cfm/sq. ft

e. 20.0 PSF 0.074 cfm/sq. ft.

D. ASTM E330 - Uniform static load test for structural performance for 1-1/2-inch panel profile:
1. Test results must provide an allowable pressure of no less than:
a. 42 lbs/sqft. For three-foot (3'-0") spans.
b. 52 lbs/sqft for one-foot (1'-0") span.

E. ASTM E331 - Static pressure water infiltration (doors, windows, curtain walls):
1. Pressure result:
a. 5 Gal./Hr. per S.F. and Static No Leakage.
b. Pressure of 20.0 Psf. For 15 minutes.

1.5. QUALITY ASSURANCE

A. Installer Qualifications:
1. Engage an installer who has completed the manufacturer's approved contractor course and is currently certified for the installation of the specified system:
a. If required, fabricator/installer shall submit work experience and evidence of adequate financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

B. Source Limitations:
1. Obtain all components of the wall panel system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the manufacturer:
a. Upon request of the Architect or Owner, submit manufacturer's written approval of secondary components in list form, signed by an authorized agent of the manufacturer.
b. Manufacturer shall have direct authority and control over all fabrication of steel components as well as the raw materials used in their fabrication.

C. Source Quality Control: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.

D. Engage the manufacturer's field representative to conduct required periodic inspections of work in progress as described herein and furnish written documentation of all such inspections.

E. Manufacturer shall provide the Owner with a written statement that they will provide a site inspection two (2) days per week that confirms that the Project is being constructed as specified, by an experienced, full-time employee of the company.

F. Alternate Manufacturers:
1. The following manufacturer criteria must be submitted. Alternate systems will not be considered for approval unless each of these items has been submitted for review at least ten (10) business days prior to bid opening:
a. Submit each item listed in article 1.3 (A through E) for evaluation of the proposed system.
b. Tests shall have been made for identical systems within the ranges of specified performance criteria.
c. Empirical calculations for wall performance shall only be acceptable for positive loads.
d. A list of a minimum of five (5) jobs where the proposed alternate material was used under similar conditions. The reference list shall include date of project, size of project, project address, and telephone number of architect/owner contact.

e. A financial statement demonstrating a minimum of a 3:1 ratio of assets to liabilities.
f. A written statement from the manufacturer stating that they will provide the building owner with a daily site inspection for a minimum of one (1) hour per day by an experienced, full-time employee of the company.
g. A written statement from the manufacturer stating that they will provide the engineer of record with a daily site inspection by an experienced full-time employee of the company.
h. A written statement from a corporate officer of the manufacturing company stating that he or she has reviewed the specifications and confirms that the proposed system meets or exceeds all performance requirements listed as well as meets the panel size, gauge, weight, clip design, sealant design, uplift pressures, and height of the vertical seam.
i. A copy of manufacturer’s warranty.
j. Proof that the manufacturer has been in business for a minimum number of years equal to the warranty period required for this Project.

G. Pre-Installation Conference:
1. Convene a pre-installation conference approximately two (2) weeks before scheduled commencement of system installation and associated work.
2. Require attendance of installer of each component of associated work that must precede or follow wall panel work (including mechanical or electrical work if any), Architect, Owner, system manufacturer’s representative, and other representatives directly concerned with performance of the work, including (where applicable) Owner’s insurers, testing agencies, and governing authorities.
3. Objectives of conference to include:
a. Review foreseeable methods and procedures related to work, including set up and mobilization areas for stored material and work area.
b. Tour representative areas of building and inspect and discuss condition of substrates, penetrations, and other preparatory work performed by others.
c. Review structural loading limitations of wall framing and inspect for unacceptable variations in planarity.
d. Review system requirements (Drawings, specifications, and other Contract Documents).
e. Review required submittals both completed and yet to be completed.
f. Review and finalize construction schedule related to work and verify availability of materials, installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
g. Review required inspection, testing, certifying, and material usage accounting procedures.
h. Review weather and forecasted weather conditions and procedures for unfavorable conditions, including possibility of temporary wall protection (if not mandatory requirement).
i. Record discussion of conference including decisions and agreements (or disagreements) reached. Furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
j. Review notification procedures for weather or non-working days.
k. The Owner’s representative will designate one of the conference participants to record the proceedings and promptly distribute them to the participants for record.
l. The intent of the conference is to resolve issues affecting the installation and performance of wall panel work. Do not proceed with work until such issues are resolved the satisfaction of the Owner and Engineer of Record. This shall not be construed as interference with the progress of work on the part of the Owner or Engineer of Record.

H. Manufacturer’s Inspections:

1. When the Project is in progress, the wall panel system manufacturer will inspect the work not less than two (2) days per week. In addition, the manufacturer will:
   a. Keep the Architect or Owner informed as to the progress and quality of the work as observed.
   b. Provide jobsite inspections a minimum of two (2) days per week.
   c. Report to the Architect in writing any failure or refusal of Contractor to correct unacceptable practices called to the Contractor's attention.
   d. Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.6. WARRANTY

A. Manufacturer shall execute a single warranty covering of the following criteria. Multiple-source warranties are not acceptable:
   1. Manufacturer's standard twenty (20) year finish warranty covering checking, crazing, peeling, chalking, fading, or adhesion.
   2. Installer's three (3) year warranty covering wall panel system installation.
   3. Warranties shall commence on date of Substantial Completion.
   4. Provide a single warranty by a single approved manufacturer for roof areas, wall areas, and transitions between the two systems, if applicable.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Responsibilities:
   1. All panels shall be shipped from the manufacturer with a strippable film or similar packaging material separating the individual panels to minimize flexing, stressing, scratching, or otherwise damaging the material during transit to the job.
   2. Fully cover steel with tarpaulins or similar protective cover during transit to prevent dirt and debris from coming in contact with the finished goods.

B. Installer's Responsibilities:
   1. Stack pre-finished materials to prevent twisting, bending, abrasion, and denting and elevate one end to facilitate moisture run-off.
   2. Unload wall panels using a boom or crane, supporting the panels in at least two (2) locations during lifting, and never lift more than three (3) panels at a time.
   3. Protect moisture-sensitive and water-based materials from the weather.
   4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from Project site.

2.PRODUCTS

2.1. PRODUCTS, GENERAL

A. Refer to Section 01 60 00: Product Requirements.

B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

C. Substitutions:
   1. Products proposed as equal to the products specified in this Section shall be submitted

in accordance with bidding requirements and Division 01 provisions:

a. Proposals shall be accompanied by a copy of the manufacturer's standard specification. That specification shall be signed and sealed by a professional engineer licensed in the State of California. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
b. Include a list of three (3) projects of similar type and extent, located within a 100-mile radius from the location of the Project. In addition, the three (3) projects must be at least five (5) years old and be available for inspection by the Architect, Owner, or Owner's representative.
c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2. ACCEPTABLE MANUFACTURERS

A. Basis of Design (District Standard): IMETCO Latitude wall panel system engineered and manufactured by

IMETCO 5001 Bailey Loop McClellan, CA 95652
Telephone: (559) 647-1196
Website: www.garlandco.com
Local Representative: Rich Jones.

B. Site Formed Panels: Bidder will not be allowed to supply panels formed at the jobsite on portable roll formers; metal panels must be factory pre-manufactured and engineered for this Project.

2.3. METAL WALL PANEL SYSTEM

A. General:
1. The products, quality, and performance criteria specified shall be regarded as the minimum standard of quality required for the Project.

B. Materials:
1. Panel material: 22-gauge, zinc-coated (galvanized) steel sheet, as per ASTM A653: G90 (Z275) coating designation; structural quality, grade 40 ksi (275 MPa).
2. Flashing and flat stock material: Fabricate in profiles indicated on Drawings of same material, thickness, and finish as wall panel system, unless indicated otherwise.
3. Profile 1 - LW-2
4. Profile 2 - LW-5

C. Finish on Surfaces:
1. Exposed surfaces for coated panels:
   a. Two (2) coat coil applied, baked-on full-strength (70 percent resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
   b. Color shall be Custom Color
2. Unexposed surfaces for coated panels shall be baked-on polyester coating with .20 - .30 dry film thickness (TDF).
3. Exposed and unexposed surfaces for uncoated panels shall be as shipped from the mill.

D. Characteristics:

1. Fabrication: Panels shall be factory roll-formed from the specified metal. Field rolled panels will not be allowed.
2. Configuration: Interlocking lap seam wall panels with ribs at 4" on center, incorporating concealed anchor clips. Through fastened or exposed fastener systems are not acceptable.
3. Panel seam legs shall be 1-1/2-inch nominal concealed depth behind the panel face. Seam shall allow for expansion and contraction of panels due to thermal changes.
4. Anchor clips: Clips shall be 22-gauge galvalume steel designed to allow thermal movement of the panel in each direction along the longitudinal dimension.
5. Panel width (seam spacing): 16-inch nominal.
6. Panel lengths: Full length without joints to the extent as is practical.
7. Profile of panel face shall have a single vee-groove reveal located three inches (3") in from each panel seam. These will absorb thermal stresses, reduce oil canning, and provide aesthetic appeal.

E. Accessories:
1. Fasteners:
   a. Concealed fasteners: Corrosion resistant steel screws, #10 x 1-inch long, pancake head, Phillips drive. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.
   b. Exposed fasteners: Series 410 stainless steel screws or 1/8-inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the wall panels.
2. Provide all miscellaneous accessories for complete installation.

2.4. ACCESSORY PRODUCTS

A. Sealant:
1. Acceptable product:
   a. Concealed application: Non-curing butyl sealant or equal.
   b. Exposed application: Garland SS sealant or equal.
2. Colors: As selected by architect from sealant manufacturer's standard selection.

B. Wall Substrate:
1. Install 15/32-inch (minimum) thickness exterior grade plywood sheathing along wall area.

C. Underlayment:
1. Underlayment shall be one (1) ply of 60 mil minimum self-adhesive membrane Intelliwrap SA by IMETCO. Seams shall be lapped in accordance with manufacturer's recommendations.

2.5. FABRICATION

A. Shop fabricate metal panels and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.

B. Form flashing components from full single width sheet in minimum ten-foot (10') sections. Provide shop fabricated, mitered corners, joined using closed end pop rivets and joint sealant.

C. Fabricate panels and related sheet metal work in accordance with approved shop drawings and applicable standards.

3.EXECUTION

3.1. PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage and protection requirements for wall panel system:
   1. Protection:
      a. Protect completed work from subsequent construction operations. Comply with manufacturer’s recommendations.
      b. Do not encumber the site with stored materials or equipment.
      c. Do not support wall-mounted equipment directly on the wall panel system.

B. Ascertain that work of other trades that penetrates the wall or is to be made watertight by the wall is in place an approved prior to installation.

3.2. PREPARATION

A. Inspection: Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves, or buckles in the substrate before proceeding with installation of the pre-formed metal panels.

B. Pre-installation conference: Prior to beginning metal wall panel work, convene a pre-installation conference as specified in Part 1 of this Section.

C. It is understood that the ongoing operations of the Owner area of a critical nature as to leak sensitivity. Do not work on more wall area than can be restored completely watertight in one (1) day.

3.3. INSTALLATION, GENERAL

A. Install wall system when the atmospheric dry bulb temperature is minimum 40 degrees Fahrenheit and rising.

B. Install all components of the wall system in exact accordance with the manufacturer’s standard published procedures as applicable to these Project conditions and substrates.

3.4. WALL PANEL INSTALLATION

A. Comply with all details and install wall panel materials and flashings in accordance with approved manufacturer’s shop drawings and manufacturer’s product data within specified erection tolerances.

B. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

C. Limit exposed fasteners to extent indicated on shop drawings.

D. Seal laps and joints in accordance with system manufacturer’s product data.

E. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

F. Form joints in linear sheet metal to allow for 1/4-inch minimum expansion at 20 feet on center maximum and eight feet (8') from corners.

G. At joints in linear sheet metal items, set sheet metal items in two (2) 1/4-inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

3.5. CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.6. CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during construction. Comply with requirements of authorities having jurisdiction.

3.7. FINAL INSPECTION

A. At completion of installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, system manufacturer's representative, and other representatives directly concerned with performance of system.

B. Inspect work and flashing of penetrations, walls, curbs, and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation that is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Notify the Owner upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the system manufacturer.

F. Immediately correct leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the work under the terms of the conditions of the Contract.

3.8. DEMONSTRATION AND TRAINING

A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:
1. Troubleshooting procedures.
2. Notification procedures for reporting leaks or other problems.
3. Maintenance.
4. The Owner's obligations for maintaining the warranty in effect and force.
5. The manufacturer's obligations for maintaining the warranty in effect and force.

END OF SECTION 07 42 13

SECTION 07 52 00 MODIFIED BITUMINOUS MEMBRANE ROOFING

1.GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes all labor, materials, and equipment to install a modified bitumen roof system over a properly prepared substrate.

B. Includes a new cold applied 2-ply asphalt roofing system with all accessories as needed for a complete warrantable roofing system.

C. Related Sections:
1. Section 01 33 00: Submittal Procedure.
2. Section 05 50 00: Metal Fabrications.
3. Section 06 10 00: Rough Carpentry.
4. Section 07 21 00: Thermal Insulation.
5. Section 07 62 00: Roof Related Sheet Metal.
6. Section 07 72 00: Roof Accessories.
7. Section 07 72 33: Roof Hatches.
8. Section 07 72 36: Smoke Vents.
9. Division 23: HVAC.
10. Division 26: Electrical.

B. Reference Standards:
1. ASTM Listings:
   a. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   b. ASTM D312 - Standard Specification for Asphalt used in Roofing.
   c. ASTM D451 - Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.
   d. ASTM D1970 - Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.
   e. ASTM D1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.
   f. ASTM D1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
   g. ASTM D1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.
   h. ASTM D2178 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
   i. ASTM D2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.
   j. ASTM D4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.
   k. ASTM D5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.
   l. ASTM D6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

m. ASTM D6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
n. ASTM D6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
o. ASTM E108 - Standard Test Methods for Fire Test of Roof Coverings

2. Factory Mutual Research (FM): Roof Assembly Classifications.
3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
4. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): Architectural Sheet Metal Manual.
5. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.
6. Warnock Hersey (WH): Fire Hazard Classifications.
7. ASCE 7, Minimum Design Loads for Buildings and Other Structures
8. UL - Fire Resistance Directory.
9. California Title 24 Energy Efficient Standards.

1.3. SUBMITTALS

A. Product Data:
1. Manufacturer's data sheets on each product to be used, including:
   a. Preparation instructions and recommendations.
   b. Storage and handling requirements and recommendations.
   c. Installation instructions.

B. Shop Drawings: Submit shop drawings including installation details of roofing, flashing, fastening, insulation and vapor barrier, including notation of roof slopes and fastening patterns of insulation and base modified bitumen membrane, prior to job start.

C. Design Pressure Calculations: Submit design pressure calculations for the roof area in accordance with ASCE 7 and local Building Code requirements. Include a roof system attachment analysis report, certifying the system's compliance with applicable wind load requirements before Work begins. Report shall be reviewed by a Professional Engineer registered in the State of the Project who has provided roof system attachment analysis for not less than 5 consecutive years.

E. Recycled or Bio-Based Materials: Provide third party certification through UL Environment of roof System membranes containing recycled or bio based materials

F. Verification Samples: For each modified bituminous membrane ply product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

G. Provide written certification from the roofing system manufacturer certifying the applicator is currently authorized to install the specified roof system and ability to provide the specified warranty.

H. Provide written certification from the roofing system manufacturer certifying both the low slope roofing system and steep slope roofing systems are have a composite warranty by the same manufacturer covering both roof systems.

I. Sample Warranty: Provide an unexecuted copy of the warranty specified for this project clearly stating the terms required of the owner, contractor, and manufacturer.

J. Manufacturer's Certificates: Provide to certify products meet or exceed specified requirements.

K. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.

L. Manufacturer's Fire Compliance Certificate: Certify that the roof system furnished is approved by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey (WH) or approved third party testing facility in accordance with ASTM E108, Class A for external fire and meets local or nationally recognized building codes.

M. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic inspection and maintenance of all completed roofing work. Provide product warranty executed by the manufacturer. Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.4. QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified with documented ISO 9001 certification and minimum of twelve years of documented experience and must not have been in Chapter 11 bankruptcy during the last five years.

C. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and a certified Pre-Approved Garland Contractor.

D. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.

E. Product Certification: Provide manufacturer's certification that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.

F. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

G. The Manufacturer's Field Representative to conduct required inspections of work in progress 2 days per week as described herein and shall furnish written documentation of all such inspections on a weekly basis.

H. Pre-Installation Meetings:
   1. Convene minimum two weeks prior to commencing Work of this section.
   2. Review installation procedures and coordination required with related Work.
   3. Inspect and make notes of job conditions prior to installation:
      a. Record minutes of the conference and provide copies to all parties present.
      b. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
      c. Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Owner and Architect.

1.5. WARRANTY

A. Upon completion of the work, provide the Manufacturer's written and signed NDL Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition:
   1. Warranty Period:
      a. 30 years from date of acceptance.
      b. Provide warranty from a single manufacturer for all standing seam metal roof areas, low slope modified bitumen roof areas, coping systems, etc. and transitions between the product types.

B. Installer is to guarantee all work against defects in materials and workmanship for a period indicated following final acceptance of the Work:
   1. Warranty Period:
      a. 3 years from date of acceptance.

C. Coordination:
   1. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.

B. Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.

C. Stored in accordance with the instructions of the manufacturer prior to their application or installation. Store roll goods on end on a clean flat surface except store KEE-Stone FB 60 rolls flat on a clean flat surface. No wet or damaged materials will be used in the application.

D. Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.

E. Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/Engineer.

F. Adhesive storage shall be between the range of above 50 degree F (10 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.

2.PRODUCTS

2.1. MANUFACTURERS

A. Acceptable Manufacturer (District Standard):
   1. The Garland Company, Inc.; 3800 E. 91st St., Cleveland, OH 44105. Local Representative: Richard Jones Phone: (559) 647-1196. rjones@garlandco.com Web Site: www.garlandco.com.

B. The Products specified are intended and the Standard of Quality for the products required for this project. If other products are proposed the bidder must disclose in the bid the manufacturer and the products that they intend to use on the Project. If no manufacturer and products are listed, the bid may be accepted only with the use of products specified:

1. Bidder will not be allowed to change materials after the bid opening date.
2. If alternate products are included in the bid, the products must be equal to or exceed the products specified including warranty terms and manufacturer inspections.
3. Supporting technical data, comparison between systems, sample warranties, and all items noted in section 1.5 submittals shall be submitted to the Architect/ Owner for approval a minimum of ten (10) days prior to the bid date for review.
4. In making a request for substitution, the Bidder/Roofing Contractor represents that it has:
   a. Investigate the proposed product or method, and determined that it is equal or superior in all respects to that specified.
   b. Provide the same guarantee for substitution as for the product and method specified.
   c. Coordinate installation of accepted substitution in work, making such changes as may be required for work to be completed in all respects.
   d. Waive all claims for additional cost related to substitution, which consequently become apparent.
   e. Cost data is complete and includes all related cost under his/her contract or other contracts, which may be affected by the substitution.
   f. Reimburse the Owner for all redesign cost by the Architect for accommodation of the substitution.
5. Architect/ Owner reserves the right to be the final authority on the acceptance or rejection of any or all bids, proposed alternate roofing systems or materials that has met ALL specified requirement criteria.
6. Failure to submit substitution package, or any portion thereof requested, will result in immediate disqualification and consideration for that particular contractors request for manufacturer substitution.
7. Requests for substitutions will not be considered.

2.2. COLD APPLIED 2-PLY ROOF SYSTEM

A. Materials:
1. Rosin Sheet:
   a. One ply of mechanically attached to the prepared substrate:
      1. Red Rosin Paper.
2. Insulation:
   a. Unless otherwise specified in related sections:
      1. Base Layer(s): mechanically fasten per ASCE 7 calculations performed by the roofing system manufacturer.
      2. Top Layer: One layer of six side primed ½” woodfiber insulation board is to be installed with insulation adhesive.
3. Base (Ply) Sheet:
   a. One ply bonded to the prepared substrate with Interply Adhesive:
      1. StressBase 80.
4. Modified Cap (Ply) Sheet:
   a. One ply bonded to the prepared substrate with Interply Adhesive:
      1. StressPly Plus FR Mineral.
5. Interply Adhesive:
   a. Weatherking Plus WC.
6. Flashing Base Ply:
   a. One ply bonded to the prepared substrate with Interply Adhesive:
      1. StressBase 80.
7. Flashing Cap (Ply) Sheet:
   a. One ply bonded to the prepared substrate with Interply Adhesive:

1. StressPly Plus FR Mineral.
8. Flashing Ply Adhesive:
   a. Flashing Bond Mastic.
9. Surfacing:
   a. Pyramic Plus Lo Acrylic Coating.

2.3. ACCESSORIES

A. Roof Insulation Base Layer(s): Provide roof insulation as specified.

B. Roof Insulation Top Layer:
   1. Provide one layer of ½" six side primed Blue Ridge Structodek High Density Fiberboard Roof Insulation. ASTM C208, Type II.

C. Vapor Retarder:
   1. Red Rosin Paper by WR Meadows:
      a. Install layer rosin sheet shingled uniformly to achieve one ply over the entire prepared substrate. Shingle in direction of slope of roof to shed water on each area of roof:
         1. Weight – 12 lb./roll.
         2. Size – 500 square feet p/roll.
         3. 36" wide by 167' long.

D. Nails and Fasteners:
   1. Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel, Fasteners shall be self-clinching type of penetrating type as recommended by the deck manufacturer. Fasten nails and fasteners flush-driven through flat metal discs not less than 1 inch (25 mm) diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than 1 inch (25 mm) diameter are used.

E. Walkway Pads:
   1. As recommended and furnished by the membrane manufacturer set in approved adhesive to control foot traffic on roof top surface and provide a durable system compliant non-slip walkway:
      a. WhiteWalk Roof Traffic Pads by WR Meadows ½" x 3' x 4'.
      b. Install walk way pads in a path from all roof access points to and around all HVAC and serviceable mechanical equipment, to and around roof hatches, and as designated by the owner and approved plan set.

F. Urethane Sealant Hybrid - Tuff-Stuff MS:
   1. One part, non-sag sealant as approved and furnished by the membrane manufacturer for moving joints:
      a. Tensile Strength, ASTM D412: 250 psi.
      b. Elongation, ASTM D412: 450%.
      c. Hardness, Shore A ASTM C920: 35.
      d. Adhesion-in-Peel, ASTM C92: 30 ply.

G. Sealant - Green-Lock Structural Adhesive:
   1. Single component, 100% solids structural adhesive as furnished and recommended by the membrane manufacturer.
      a. Elongation, ASTM D412: 300%.
      b. Hardness, Shore A, ASTM C920: 50.
      c. Shear Strength, ASTM D1002: 300 psi.

H. Butyl Tape: 100% solids, asbestos free and compressive tape designed to seal as recommended and furnished by the membrane manufacturer.

I. Glass Fiber Cant - Glass Cant: Continuous triangular cross Section made of inorganic fibrous glass used as a cant strip as recommended and furnished by the membrane manufacturer.

2.4. EDGE TREATMENT AND ROOF PENETRATION FLASHINGS

A. Pre-Manufactured Edge Metal Finishes:
  1. Exposed and unexposed surfaces for mill finish flashing, fascia, and coping cap, as shipped from the mill.
  2. Exposed surfaces for coated panels:
     a. Steel Finishes - fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.
     b. Weathering finish as referred by National Coil Coaters Association (NCCA). Provided with the following properties:
        1. Pencil Hardness: ASTM D3363, HB-H / NCCA II-2.
        2. Bend: ASTM D4145, O-T / NCCA II-19.
        3. Cross-Hatch Adhesion: ASTM D3359, no loss of adhesion.
        4. Gloss (60 deg. angle): ASTM D523, 25+/-5%.
        5. Reverse Bend: ASTM D2794, no cracking or loss of adhesion.
        6. Nominal Thickness - ASTM D1005:
           a. Primer: 0.2 mils.
           b. Topcoat, 0.7 mils min.
           c. Clear Coat (optional, only used with 22 ga. steel) 0.3 mils.
        7. Color: Provide as specified (subject to minimum quantities).

B. Flashing Boot - Rubbertite Flashing Boot: Neoprene pipe boot for sealing single or multiple pipe penetrations adhered in approved adhesives as recommended and furnished by the membrane manufacturer.

C. Vents and Breathers: Heavy gauge aluminum and fully insulated vent that allows moisture and air to escape but not enter the roof system as recommended and furnished by the membrane manufacturer.

D. Pitch pans, Rain Collar 24 gauge stainless or 20oz (567gram) copper. All joints should be welded/soldered watertight. See details for design.

E. Drain Flashings should be 4lb (1.8kg) sheet lead formed and rolled.

F. Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled. All plumbing stacks are to have the factory lead caps installed. Caulking and banding will not be acceptable on open top pipe penetrations. On field fabricated flashings where a lead cap can't be applied a lead umbrella flashing is to be installed. Caulking and banding will be required with the specified sealant on the umbrella counter flashing.

G. Liquid Flashing - Tuff-Flash:
  1. An asphaltic-polyurethane, low odor, liquid flashing material designed for specialized details unable to be waterproofed with typical modified membrane flashings:
     a. Tensile Strength, ASTM D412: 400 psi.
     b. Elongation, ASTM D412: 300%.
     c. Density @77 deg. F 8.5 lb/gal typical.

H. Fabricated Flashings:

1. Fabricated flashings and trim shall conform to the detail requirements of SMACNA.

I. Manufactured Roof Specialties:
   1. Shop fabricated copings, fascia, gravel stops, control joints, expansion joints, joint covers and related flashings and trim are specified elsewhere.
   2. Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

3.EXECUTION

3.1. PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

3.2. EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.

C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.

D. If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.3. PREPARATION

A. General:
   1. Clean surfaces thoroughly prior to installation.
   2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   3. Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
   4. Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
   5. Wherever necessary, all surfaces to receive roofing materials shall be power broom and vacuumed to remove debris and loose matter prior to starting work.
   6. Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
   7. Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lbs. (136 k) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. per nail.
   8. Prime decks where required, in accordance with requirements and recommendations of the primer and deck manufacturer.

B. Wood Deck:
   1. Dimensional wood deck shall be minimum 1 inch (25 mm) thick, knotholes and cracks larger than 1/4 inch shall be covered with sheet metal. All boards shall be appropriately

nailed and have adequate end bearing to the centers of beams/rafters. Lumber shall be kiln dried.
2. Plywood shall be a minimum 15/32 inch (11.9 mm) thick and conform to the standards and installation requirements of the American Plywood Association (APA).
3. If no roof insulation is specified, provide a suitable dry sheathing paper, followed by an approved base sheet nailed appropriately for the specified roof system, with 1 inch (25 mm) diameter caps and annular nails unless otherwise required by the applicable Code or Approval agency.
4. Insulation is to be mechanically attached in accordance with the insulation manufacturer's recommendations unless otherwise required by the applicable Code.
5. In all retrofit roof applications, it is required that deck be inspected for defects. Any defects are to be corrected per the deck manufacturer's recommendations and standards of the APA/Engineered Wood Association prior to new roof application.
6. Light metal wall ties or other structural metal exposed on top of the wood deck shall be covered with one ply of a heavy roofing sheet, such as HPR Glasbase Base Sheet, extending 2 inches to 6 inches (51 mm to 152 mm) beyond the metal in all directions. Nail in place before applying the base ply.

3.4. INSTALLATION - GENERAL

A. Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association's Roofing & Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.

B. General:
1. Avoid installation of modified bitumen membranes at temperatures lower than 40-45 degrees F. When work at such temperatures unavoidable use the following precautions:
   a. Take extra care during cold weather installation and when ambient temperatures are affected by wind or humidity, to ensure adequate bonding is achieved between the surfaces to be joined. Use extra care at material seam welds and where adhesion of the applied product to the appropriately prepared substrate as the substrate can be affected by such temperature constraints as well.
   b. Unrolling of cold materials, under low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. Rolls must be at least 40 degrees F at the time of application. If the membrane roll becomes stiff or difficult to install, it must be replaced with roll from a heated storage area.

C. Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water

D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank 1 inch cap nails, or screws and plates at a rate of 1 fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and 4 feet o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install 4 additional fasteners at the upper edge of the membrane when strapping the plies.

3.5. INSTALLATION COLD APPLIED ROOF SYSTEM

A. Base Ply:
1. Cut base ply sheets into 18 foot lengths and allow plies to relax before installing. Install base sheet in Interply Adhesive:

a. Applied at the rate required by the manufacturer. Shingle base sheets uniformly to achieve one ply throughout over the prepared substrate. Shingle in proper direction to shed water on each large area of roofing:
    1. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
    2. Solidly bond to the substrate and adjacent ply with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
    3. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Use care to eliminate air entrapment under the membrane.
    4. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
    5. Extend plies 2 inches beyond top edges of cants at wall and projection bases.
    6. Install base flashing ply to all perimeter and projection details.
    7. Allow the one ply of base sheet to cure at least 30 minutes before installing the modified membrane. However, the modified membrane must be installed the same day as the base plies.

B. Modified Cap Ply(s):
    1. Cut cap ply sheets into 18 foot lengths and allow plies to relax before installing. Install in interplay adhesive applied at the rate required by the manufacturer. Shingle sheets uniformly over the prepared substrate to achieve the number of plys specified. Shingle in proper direction to shed water on each large area of roofing:
        a. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
        b. Solidly bond to the base layers with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
        c. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Care should be taken to eliminate air entrapment under the membrane.
        d. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
        e. Allow cold adhesive to set for 5 to 10 minutes before installing the top layer of modified membrane.
        f. Extend membrane 2 inches beyond top edge of all cants in full moppings of the cold adhesive as shown on the Drawings.

C. Fibrous Cant Strips:
    1. Provide non-combustible perlite or glass fiber cant strips at all wall/curb detail treatments where angle changes are greater than 45 degrees. Cant may be set in approved cold adhesives, hot asphalt or mechanically attached with approved plates and fasteners.

D. Wood Blocking, Nailers and Cant Strips:
    1. Provide wood blocking, nailers and cant strips as specified in Rough Carpentry:
        a. Provide nailers at all roof perimeters and penetrations for fastening membrane flashings and sheet metal components.
        b. Wood nailers should match the height of any insulation, providing a smooth and even transition between flashing and insulation areas.
        c. Nailer lengths should be spaced with a minimum 1/8 inch gap for expansion and contraction between each length or change of direction.
        d. Nailers and flashings should be fastened in accordance with Factory Mutual "Loss Prevention Data Sheet 1- 49, Perimeter Flashing" and be designed to be capable of resisting a minimum force of 200 lbs/lineal foot in any direction.

E. Metal Work:
1. Provide metal flashings, counter flashings, parapet coping caps and thru-wall flashings as specified in Division 07. Install in accordance with the SMACNA "Architectural Sheet Metal Manual" or the NRCA Roofing Waterproofing manual.

F. Termination Bar:
1. Provide a metal termination bar or approved top edge securement at the terminus of all flashing sheets at walls and curbs. Fasten the bar a minimum of 8 inches (203 mm) o/c to achieve constant compression. Provide suitable, sealant at the top edge if required.

G. Flashing Base Ply:
1. Install flashing sheets by the same application method used for the base ply:
   a. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
   b. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
   c. Adhere to the underlying base ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
   d. Solidly adhere the entire flashing ply to the substrate. Secure the tops of all flashings that are not run up and over curb through termination bar fastened at 6 inches (152 mm) O.C. and sealed at top.
   e. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
   f. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work.
   g. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.

H. Flashing Cap Ply:
1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
3. Adhere to the underlying base flashing ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
4. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
5. Coordinate roof accessories, miscellaneous sheet metal accessory items with the roofing system work.
6. All stripping shall be installed prior to flashing cap sheet installation.
7. Heat and scrape granules when welding or adhering at cut areas and seams to granular surfaces at all flashings.
8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.
9. Seal all vertical laps of flashing cap with a three-course application of trowel-grade mastic and fiberglass mesh and apply white roofing granules.

I. Roof Walkways:

1. Provide walkways in areas indicated on the Drawings or at a minimum:
   a. Install walk way pads in a path from all roof access points to and around all HVAC and serviceable mechanical equipment, to and around roof hatches, and as designated by the owner.

3.6. INSTALLATION OF SURFACING

A. Prior to installation of surface coating, obtain approval from manufacturer as to work completed. On average, at least 30 days are required prior to final surfacing:
   1. Reflective Coating:
      a. Allow all cold applied mastics and coating to properly dry and cure before coating application.
      b. Paint all exposed roofing with manufacturer's base coat acrylic coating installed at a rate of one (1.5) gallons per square, back roll entire installation required.
      c. Paint all exposed roofing with manufacturer's Energy Star top coat acrylic coating installed at a rate of one (1.5) gallons per square, complete coverage for a clean neat appearance is required. Additional coats may be required to achieve complete coverage and proper mil thickness.

3.7. INSTALLATION EDGE TREATMENT AND ROOF PENETRATION FLASHING

A. Fabricated Flashings:
   1. Fabricated flashings and trim are provided as specified:
      a. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the Copper Development Association "Copper in Architecture - Handbook" as applicable.

B. Metal Edge:
   1. Inspect the nailers to assure proper attachment and configuration.
   2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.
   3. Install continuous cleat and fasten at 6 inches (152 mm) o.c.
   4. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailers every 3 inches (76 mm) o.c. staggered.
   5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.
   6. Strip in flange with base flashing ply covering entire flange in bitumen with 6 inches (152 mm) on to the field of roof. Assure ply laps do not coincide with metal laps.
   7. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Seal outside edge with rubberized cement.

C. Roof Edge With Gutter:
   1. Inspect the nailer to assure proper attachment and configuration. Increase slope at metal edge by additional degree of slope in first board.
   2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.
   3. Install gutter and strapping.
   4. Install continuous cleat and fasten at 6 inches (152 mm) o.c.
   5. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailer every 3 inches (76 mm) o.c. staggered.
   6. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.
   7. Strip in flange with base flashing ply covering entire flange in bitumen with 6 inches (152 mm) onto the field of the roof. Assure ply laps do not coincide with metal laps.
   8. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof.

D. Scupper Through Wall (Overflow):

1. Inspect the nailer to assure proper attachment and configuration.
2. Run one ply over nailer up the overflow, into the scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.
3. Install scupper box in a 1/4 inch (6 mm) bed of mastic. Assure all box seams are soldered and have a minimum 4 inch (101 mm) flange. Make sure all corners are closed and soldered. Prime scupper at a rate of 100 square feet per gallon and allow to dry.
4. Fasten flange of scupper box every 3 inches (76 mm) o.c. staggered.
5. Strip in flange scupper box with base flashing ply covering entire area with 6 inch (152 mm) overlap on to the field of the roof and wall flashing.
6. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all seams.

E. Coping Cap:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches (609 mm). Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Attach tapered board to top of wall.
4. Install base flashing ply covering entire wall and wrapped over top of wall and down face with 6 inches (152 mm) on to field of roof and set in cold asphalt. Nail membrane at 8 inches (203 mm) o.c.
5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all seams and install white roofing granules in fresh mastic.
6. Install continuous cleat and fasten at 6 inches (152 mm) o.c. to outside wall.
7. Install new metal coping cap hooked to continuous cleat.
8. Fasten inside cap 24 inches (609 mm) o.c. with approved fasteners and neoprene washers through slotted holes, which allow for expansion and contraction.

F. Surface Mounted Counterflashing:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches (609 mm). Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering wall set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and install white roofing granules in fresh mastic.
5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall. Alternatively use caulk to replace the butyl tape.
6. Secure counterflashing set on butyl tape above flashing at 8 inches (203 mm) o.c. and caulk top of counterflashing.

G. Equipment Support:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Attach top of membrane to top of curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and install white roofing granules in fresh roofing mastic.

5. Install pre-manufactured cover. Fasten sides at 24 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

H. Curb Detail/Air Handling Station:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and install white roofing granules into fresh mastic.
5. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

I. Skylight:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Attach top of membrane to top of wood nailer and apply a three-course application of mastic and mesh. Allow to cure and install white roofing granules in fresh mastic.
5. Install pre-manufactured lens and fasten flashing sides at 8 inches (203 mm) o.c. with fasteners and neoprene washers.

J. Exhaust Fan:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply installed over the base flashing ply, 9 inches (228 mm) on to field of the roof. Attach top of membrane to top of wood curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and install white roofing granules into fresh mastic.
5. Install metal exhaust fan over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendation.

K. Roof Drain:
1. Plug drain to prevent debris from entering plumbing.
2. Taper insulation to drain minimum of 24 inches (609 mm) from center of drain.
3. Install two base flashing plies (40 inch square minimum) in bitumen.
4. Set lead/copper flashing (30 inch square minimum) in 1/4 inch (6 mm) bed of mastic. Run lead/copper into drain a minimum of 2 inches (50 mm). Prime lead/copper at a rate of 100 square feet per gallon and allow to dry.
5. Run roof system plies over drain. Cut out plies inside drain bowl.
6. Install modified membrane (48 inch square minimum) in bitumen.
7. Install clamping ring and assure that all plies are under the clamping ring.
8. Remove drain plug and install strainer.

L. Plumbing Stack:

1. Minimum stack height is 12 inches (609 mm).
2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
3. Set lead/copper flashing in 1/4 inch (6 mm) bed of mastic.
4. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
5. Install base flashing ply in bitumen.
6. Install membrane in bitumen.
7. Caulk the intersection of the membrane with elastomeric sealant.
8. Turn sleeve a minimum of 1 inch (25 mm) down inside of stack, if stack is taller than the lead jack factory cap must be installed.

M. Heat Stack:
1. Minimum stack height is 12 inches (609 mm).
2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
3. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
4. Install base flashing ply in bitumen.
5. Install modified membrane in bitumen.
6. Caulk the intersection of the membrane with elastomeric sealant.
7. Install new collar over cape. Weld collar or install stainless steel draw brand.

3.8. CLEANING

A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.

B. Remove asphalt markings from finished surfaces.

C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.9. PROTECTION

A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.

B. Protect exposed surfaces of finished walls with tarps to prevent damage.

C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.

D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.

E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

3.10. FIELD QUALITY CONTROL

A. Inspection:
1. Provide manufacturer's field observations at start-up and two (2) days per week through project completion. Provide a final inspection upon completion of the Work:
   a. Warranty shall be issued upon manufacturer's acceptance of the installation.
   b. Field observations shall be performed by a representative employed full-time by

the manufacturer and whose primary job description is to assist, inspect and approve membrane installations for the manufacturer.

c. Provide observation reports from the representative indicating procedures followed, weather conditions and any discrepancies found during inspection.
d. Provide a final report from the representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

4.SCHEDULES

4.1. GENERAL

A. Base (Ply) Sheet:
1. StressBase 80 - 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet reinforced with a fiberglass scrim, performance requirements according to ASTM D5147:
   a. Tensile Strength, ASTM D5147:
      1. 2 in/min. @ 0 +/- 3.6 deg. F MD 100 lbf/in XD 100 lbf/in.
      2. 50mm/min. @ -17.78 +/- 2 deg. C MD 17.5 kN/m XD 17.5 kN/m.
   b. Tear Strength, ASTM D5147:
      1. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 110 lbf XD 100 lbf.
      2. 50mm/min. @ 23 +/- 2 deg. C MD 489 N XD 444 N.
   c. Elongation at Maximum Tensile, ASTM D5147:
      1. 2 in/min. @ 0 +/- 3.6 deg. F MD 4 % XD 4 %.
      2. 50mm/min@ -17.78 +/- 2 deg. C MD 4 % XD 4 %.
   d. Low Temperature Flexibility, ASTM D5147, Passes -40 deg. F (-40 deg. C).

B. Modified Cap (Ply) Sheet:
1. StressPly Plus FR Mineral - 155 mil SBS (Styrene-Butadiene-Styrene) mineral surfaced, rubber modified roofing membrane reinforced with a fiberglass and polyester composite scrim. ASTM D6162, Type III Grade G:
   a. Tensile Strength, ASTM D5147:
      1. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 310 lbf/in XD 310 lbf/in.
      2. 50 mm/min. @ 23 +/- 2 deg. C MD 54.25 kN/m XD 54.25 kN/m.
   b. Tear Strength, ASTM D5147:
      1. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 500 lbf XD 500 lbf.
      2. 50 mm/min. @ 23 +/- 2 deg. C MD 2224 N XD 2224 N.
   c. Elongation at Maximum Tensile, ASTM D5147:
      1. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 8% XD 8%.
      2. 50 mm/min. @ 23 +/- 2 deg. C MD 8% XD 8%.
   d. Low Temperature Flexibility, ASTM D5147, Passes -30 deg. F (-34 deg. C).

C. Interply Adhesive:
1. Weatherking Plus WC:
   a. Rubberized, polymer modified cold process asphalt roofing bitumen V.O.C. compliant ASTM D3019. Performance Requirements:
      1. Non-Volatile Content ASTM D4479 78%.
      2. Density ASTM D1475 9.0 lbs./gal.
      3. Viscosity Stormer ASTM D562 900-1100 grams.
      4. Flash Point ASTM D93 100 deg. F min. (37 deg. C).
      5. Slope: up to 2:12.
      6. V.O.C. ASTM D3960 Less than 250 g/l.
      7. Flash Point ASTM D93 105 deg. F.
      8. Slope maximum 1:12.

D. Flashing Base Ply:
   1. StressBase 80 - 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet reinforced with a fiberglass scrim, performance requirements according to ASTM D5147:
      a. Tensile Strength, ASTM D5147:
         1. 2 in/min. @ 0 +/- 3.6 deg. F MD 100 lbf/in XD 100 lbf/in.
         2. 50 mm/min. @ -17.78 +/- 2 deg. C MD 17.5 kN/m XD 17.5 kN/m.
      b. Tear Strength, ASTM D5147:
         1. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 110 lbf XD 100 lbf.
         2. 50 mm/min. @ 23 +/- 2 deg. C MD 489 N XD 444 N.
      c. Elongation at Maximum Tensile, ASTM D5147:
         1. 2 in/min. @ 0 +/- 3.6 deg. F MD 4 % XD 4 %.
         2. 50 mm/min. @ -17.78 +/- 2 deg. C MD 4 % XD 4 %.
      d. Low Temperature Flexibility, ASTM D5147.
         1. Passes -40 deg. F (-40 deg. C).

E. Flashing Ply Adhesive:
   1. Flashing Bond:
      a. Asphalt roofing mastic V.O.C. compliant, Type II trowel grade flashing adhesive:
         1. Non-Volatile Content ASTM D4479 70 min.
         2. Density ASTM D1475 8.3 lbs./gal. (1kg/l).
         3. Flash Point ASTM D93 103 deg. F (39 deg. C).

F. Surfacing:
   1. Flashing Cap (Ply) Sheet:
      a. StressPly Plus FR Mineral - 155 mil SBS (Styrene-Butadiene-Styrene) mineral surfaced, rubber modified roofing membrane reinforced with a fiberglass and polyester composite scrim. ASTM D6162, Type III Grade G:
         1. Tensile Strength, ASTM D5147:
            a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 310 lbf/in XD 310 lbf/in.
            b. 50 mm/min. @ 23 +/- 2 deg. C MD 54.25 kN/m XD 54.25 kN/m.
         2. Tear Strength, ASTM D5147:
            a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 500 lbf XD 500 lbf.
            b. 50 mm/min. @ 23 +/- 2 deg. C MD 2224 N XD 2224 N.
         3. Elongation at Maximum Tensile, ASTM D5147:
            a. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 8% XD 8%.
            b. 50 mm/min. @ 23 +/- 2 deg. C MD 8% XD 8%.
         4. Low Temperature Flexibility, ASTM D5147, Passes -30 deg. F (-34 deg. C).

G. Coating:
   1. White Elastomeric Roof Coating:
      a. Pyramic Plus Lo Acrylic Roof Coating - White, Non Toxic, Fire Retardant Roof Coating:
         1. Non Volatile 66%.
         2. Density 12lb. / gal.
         3. VOC <50 gal./l.
         4. Reflectance 0.84.
         5. Emittance 0.91.
         6. SRI 106.

END OF SECTION 07 52 00

SECTION 07 62 01   COPING SYSTEM

1.GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2. SUMMARY

A. Provide all labor, equipment, and materials to and install the specified pre-manufactured coping system as specified:
   1. Coping cap at parapets.

B. Related Sections:
   1. Section 06 10 00: Rough Carpentry.

C. Reference Standards:
   1. American Society for Testing and Materials (ASTM):
      a. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip Process.
      b. ASTM A792 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
      c. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      d. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
      e. ASTM D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
   2. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI).
   3. Warnock Hersey International, Inc., Middleton, WI (WH).
   4. Factory Mutual Research Corporation (FMRC).
   5. Underwriters Laboratories (UL).
   6. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
      a. Latest Edition Architectural Sheet Metal Manual.
   7. National Roofing Contractors Association (NRCA):
      a. Roofing and Waterproofing Manual.
   8. American Society of Civil Engineers (ASCE):
      a. ASCE 7 Minimum Design Loads for Buildings and Other Structures.

1.3. SUBMITTALS

A. Product Data:
   1. Provide manufacturer's specification data sheets for each product.
   2. Metal material characteristics and installation recommendations.
   3. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

B. Samples: Submit two (2) samples, illustrating typical metal edge, coping, gutters, fascia extenders for material and finish.

C. Shop Drawings:
   1. For manufactured and ANSI/SPRI approved shop fabricated gravel stops, fascia,

scuppers, and all other sheet metal fabrications.
2. Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.
3. Indicate type, gauge and finish of metal.

D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

E. Design Loads: Any material submitted as equal to the specified material must be accompanied by a report signed and sealed by a professional engineer licensed in the state in which the installation is to take place. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance.

F. Factory Mutual Research Corporation's (FMRC) wind uplift resistance classification: The roof perimeter flashing shall conform to the requirements as defined by the FMRC Loss Prevention Data Sheet 1-49.

G. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.

H. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.

I. Certification of work progress inspection. Refer to Quality Assurance Article below.

J. Certifications:
1. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.
2. Submit roof manufacturer's certification that metal furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

K. Closeout Submittals:
1. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.
2. Roofing Maintenance Instructions: Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.
3. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.4. PERFORMANCE REQUIREMENTS

A. Thermal Expansion and Contraction:
1. Completed metal edge flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

1.5. QUALITY ASSURANCE

A. Engage an experienced roofing contractor specializing in sheet metal flashing work with a minimum of five (5) years’ experience.

B. Maintain a full-time supervisor/foreman who is on the job-site at all times during installation. Foreman must have a minimum of five (5) years' experience with the installation of similar system to that specified.

C. Source Limitation: Obtain components from a single manufacturer. Secondary products which cannot be supplied by the specified manufacturer shall be approved in writing by the primary manufacturer prior to bidding.

D. Upon request fabricator/installer shall submit work experience and evidence of financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

1.6. WARRANTY

A. Owner shall receive one (1) warranty from manufacturer of roofing materials covering all of the following criteria. Multiple warranties are not acceptable:
   1. Pre-finished metal material shall require a written twenty (20)-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D2244 or chalking excess of 8 units per ASTM D659. If either occurs material shall be replaced per warranty, at no cost to the Owner.
   2. Changes: Changes or alterations in the edge metal system without prior written consent from the manufacturer shall render the system unacceptable for a warranty.
   3. Warranty shall commence on date of substantial completion or final payment, whichever is agreed by contract.
   4. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of three years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.
   5. Installing roofing contractor shall be responsible for the installation of the edge metal system in general accordance with the membrane manufacturer's recommendations.
   6. Installing contractor shall certify that the edge metal system has been installed per the manufacturer's printed details and specifications.
   7. One manufacturer shall provide a single warranty for all accessory metal for flashings, metal edges and copings, along with the warranty for metal roof areas, membrane roof areas, and any transitions between two different material types.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials which may cause discoloration or staining.

2.PRODUCTS

2.1. PRODUCTS, GENERAL

A. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

B. Substitutions:
1. Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions:
   a. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
   b. Include a list of three (3) projects of similar type and extent, located within a one-hundred-mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
   c. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
   d. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2. ACCEPTABLE MANUFACTURERS

A. The design is based upon roofing systems engineered and manufactured by:
1. The Garland Company (District Standard)
   3800 East 91st Street
   Cleveland, Ohio 44105
   Telephone: 559-647-1196
   Website: www.garlandco.com
   Local representative: Rich Jones

2.3. MATERIALS

A. General: Product designations for the materials used in this section shall be based on performance characteristics of the R-MER Edge System manufactured by the Garland Company, Cleveland, OH, and shall form the basis of the contract documents.

B. R-Mer Edge Coping:
1. Minimum gauge of steel or thickness of Aluminum to be specified in accordance with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc. recommendations. 22 gauge, Zinc-Coated (Galvanized) Steel Sheet, as per ASTM A653: G90 (Z275) coating designation; structural quality, grade 40 ksi (275 MPa).

C. R-Mer Edge Coping Chairs:
1. Zinc-coated steel, ASTM A653, coating designation G-90, in thickness of 0.0635 nom./ 16 gauge, 36" to 48" by coil length, chemically treated, commercial or lock-forming quality.

D. Finishes:
1. Exposed surfaces for coated panels:
   a. Steel Finishes: fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.
   b. Weathering finish as referred by National Coil Coaters Association (NCCA).

PROPERTY	TEST METHOD	FLUOROCARBON*

Pencil Hardness	ASTM D3363 NCCA II-2	HB-H
Bend	ASTM D-4145 NCCA II-19	O-T
Cross-Hatch Adhesion	ASTM D3359	no loss of adhesion
Gloss (60° angle)	ASTM D523	25+/-5%
Reverse Impact	ASTM D2794	no cracking or loss of adhesion
Nominal Thickness	ASTM D1005	
Primer Topcoat		0.2 mils 0.8 mils
TOTAL		1.0 mils

* Subject to minimum quantity requirements

c. Color shall from Standard or Designer colors
d. Exposed and unexposed surfaces for anodized aluminum flashing, fascia, and coping cap, shall be as shipped from mill.

2.4. RELATED MATERIALS AND ACCESSORIES

A. Metal Primer: Zinc chromate type.

B. Plastic Cement: ASTM D 4586.

C. Sealant: Tuff Stuff Urethane Caulking.

D. Underlayment: Aqua Block 60.

E. Slip Sheet: Rosin sized building paper.

F. Fasteners:
1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
2. Fastening shall conform to Factory Mutual requirements or as stated on section details, whichever is more stringent.

G. Gutter and Downspout Anchorage Devices: Material as specified for system.

3.EXECUTION

3.1. PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal edge system.

3.2. PROTECTION

A. Isolate metal products from dissimilar metals, masonry or concrete with bituminous paint, tape, or slip sheet. Use gasketed fasteners where required to prevent corrosive reactions.

3.3. GENERAL

A. Secure fascia to wood nailers at the bottom edge with a continuous cleat.

B. Fastening of metal to walls and wood blocking shall comply with building code standards.

C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.

D. Allow sufficient clearances for expansion and contraction of linear metal components. Secure metal using fasteners as required by the system. Exposed face fastening will be rejected.

3.4. INSPECTION

A. Verify that curbs are solidly set and nailing strips located.

B. Perform field measurements prior to fabrication.

C. Coordinate work with work of other trades.

D. Verify that substrate is dry, clean and free of foreign matter.

E. Commencement of installation shall be considered acceptance of existing conditions.

3.5. MANUFACTURED SHEET METAL SYSTEMS

A. Furnish and install manufactured fascia and coping cap systems in strict accordance with manufacturer's printed instructions.

B. Provide factory-fabricated accessories including, but not limited to, fascia extenders, miters, scuppers, joint covers, etc. Refer to Source limitation provision in Part 1.

3.6. SHOP-FABRICATED SHEET METAL

A. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

B. Hem exposed edges.

C. Angle bottom edges of exposed vertical surfaces to form drip.

D. Lap corners with adjoining pieces fastened and set in sealant.

E. Form joints for gravel stop fascia system, coping cap with a 3/8" opening between sections. Back the opening with an internal drainage plate formed to the profile of fascia piece.

F. Install sheet metal to comply with referenced ANSI/SPRI, SMACNA and NRCA standards.

3.7. FLASHING MEMBRANE INSTALLATION

A. Snap-On Coping Cap Detail:
   1. Install Miters first.
   2. Position base flashing of the Built-Up and/or Modified Roofing membrane over the wall edge covering nailers completely, fastening eight (8) inches on center. Install membrane and cap sheet with proper material and procedure according to manufacturer's recommendations.
   3. Install minimum sixteen (16) gauge, sixteen (16) inch long by specified width anchor chair at [Contact Garland Representative] feet on center.
   4. Install six (6) inch wide splice plate by centering over sixteen (16) inch long by specified width anchor chair. Apply two beads of sealant to either side of the splice plate's center. Approximately two (2) inches from the coping cap joint. Install Coping Cap by hooking outside hem of coping on outside face of anchor chair. Press downward on inside edge of coping until "snap" occurs and hem is engaged on the entire chair.

3.8. CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.9. CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated. Comply with requirements of authorities having jurisdiction

3.10. FINAL INSPECTION

A. At completion of installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Inspect work and flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Notify the [Owner] upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

F. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

3.11. DEMONSTRATION AND TRAINING

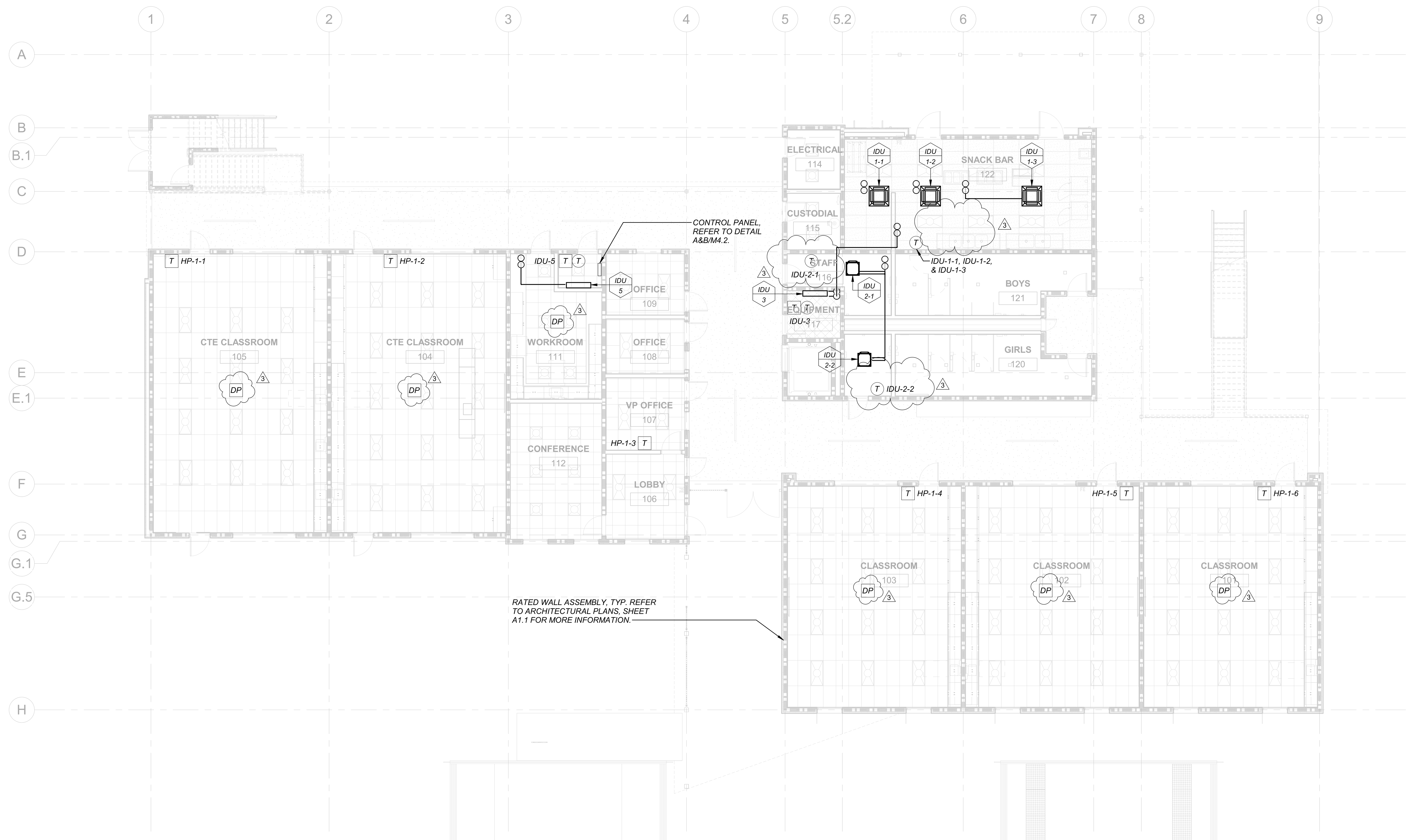
A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:
   1. Troubleshooting procedures.

2. Notification procedures for reporting leaks or other apparent roofing problems.
3. Maintenance.
4. The Owner's obligations for maintaining the warranty in effect and force.
5. The Manufacturer's obligations for maintaining the warranty in effect and force.

END OF SECTION 07 62 01

SHEET NOTES:

1. REFER TO APPROPRIATE REFRIGERANT DIAGRAM ON SHEET M4.3 FOR PIPE SIZES AND CONNECTION DETAILS.
2. REFER TO FIRE PROTECTION DETAILS ON SHEET M4.2 FOR INSULATED PIPE PENETRATING FIRE RATED WALLS.



FIRST FLOOR MECHANICAL PIPING PLAN

SCALE: 1/8" = 1'-0"

PBK

ARCHITECT PBK Architects, Inc.
FRESNO
7790 North Palm Avenue
Fresno, CA 93711
559-448-8400 P
559-448-8467 F
PBK.com

MADISON ELEMENTARY SCHOOL - 2 STORY CLASSROOM BUILDING

109 Stadium Rd, Madera, CA 93637

STATUS

PROFESSIONAL SEAL

LICENSED ARCHITECT MICHAEL R. SCHOEN No. C-30165 RENEWAL DATE FEB 28, 2026 STATE OF CALIFORNIA

PROJECT NUMBER 230278
DATE 03/15/2024
DSA APPLICATION NO. 02-122191
FILE NO. 20-30
PTN NO. 65243-157
DRAWN BY Author

REVISIONS

#	DESCRIPTION	DATE
3	Addendum 3	01/10/2025

STATUS

FIRST FLOOR MECHANICAL PIPING PLAN

M1.2

LAWRENCE ENGINEERING GROUP
4910 E. Clinton Way, Suite 101 Fresno, CA 93727
(559) 431-0101 FAX (559) 431-1362
23149

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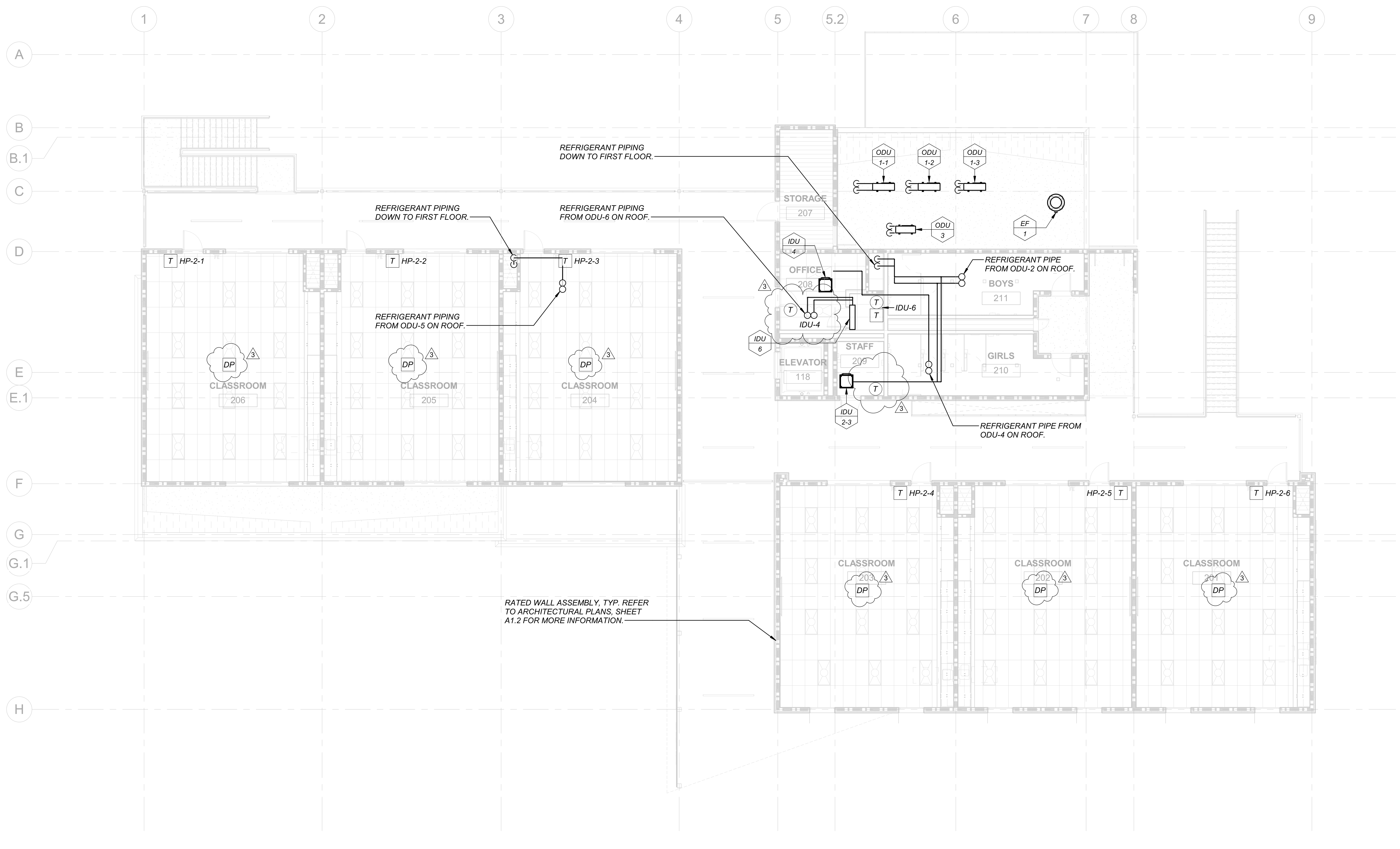
SHEET NOTES:

1. REFER TO APPROPRIATE REFRIGERANT DIAGRAM ON SHEET M4.3 FOR PIPE SIZES AND CONNECTION DETAILS.
2. REFER TO FIRE PROTECTION DETAILS ON SHEET M4.2 FOR INSULATED PIPE PENETRATING FIRE RATED WALLS.



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DRAWN BY Author

REVISIONS

#	DESCRIPTION	DATE
3	Addendum 3	01/10/2025

STATUS

SECOND FLOOR PIPING PLAN

M1.4

LAWRENCE ENGINEERING GROUP
4910 E. Clinton Way., Suite 101 Fresno, CA 93727
(559) 431-0101 FAX (559) 431-1362
23149

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PACKAGE HEAT PUMP SCHEDULE - FIRST FLOOR

	DESIGNATION	HP 1-1	HP 1-2	HP 1-3	HP 1-4	HP 1-5	HP 1-6
	VOLTS / PHASE	460 / 3	460 / 3	460 / 3	460 / 3	460 / 3	460 / 3
	FLA / MCA	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)
	M.O.C.P	30	30	30	30	30	30
	SEER / EER (AT ARI)	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3
BLOWER	CFM	1,600	1,600	1,600	1,600	1,600	1,600
	EXT. SP (IN WC)	1.75"	1.75"	1.75"	1.75"	1.75"	1.75"
	MIN OSA	500	500	400	425	425	425
	HP / BHP	1.0 / 0.78	1.0 / 0.78	1.0 / 0.78	1.0 / 0.78	1.0 / 0.78	1.0 / 0.78
	RPM	2,752	2,752	2,752	2,752	2,752	2,752
	DRIVE	BELT	BELT	BELT	BELT	BELT	BELT
COOLING	TOTAL (MBH)	44.49	44.49	43.18	43.37	43.37	43.37
	SENSIBLE (MBH)	44.49	44.49	36.69	37.66	37.66	37.66
	EADB / EAWB (°F)	84.3 / 65.3	84.3 / 65.3	78.7 / 64.8	79.45 / 65.0	79.45 / 65.0	79.45 / 65.0
	UNIT DISCHARGE TEMP. (°F)	58.1	58.1	57.5	57.7	57.7	57.7
	AMBIENT AIR (°F)	105	105	105	105	105	105
HEATING	CAPACITY @ 47 DEG. (MBH)	47.74	47.74	47.75	47.75	47.75	47.75
	COP	3.7	3.7	3.7	3.7	3.7	3.7
	AUXILARY ELEC. (KW)	12	12	12	12	12	12
	NO. OF STAGES	2	2	2	2	2	2
PWR. EXH.	FLA / MCA	2.8 / 3.5	2.8 / 3.5	2.8 / 3.5	2.8 / 3.5	2.8 / 3.5	2.8 / 3.5
	MOCP	6.3	6.3	6.3	6.3	6.3	6.3
	INTERNAL FUSE (A)	10	10	10	10	10	10
FILTER	QUANTITY / SIZE	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"
	MERV RATING	MERV 13	MERV 13	MERV 13	MERV 13	MERV 13	MERV 13
	TYPE	2" PLEATED	2" PLEATED	2" PLEATED	2" PLEATED	2" PLEATED	2" PLEATED
	P D (IN WC)	0.2	0.2	0.2	0.2	0.2	0.2
	MANUFACTURER	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE
	TYPE	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP
	MODEL NUMBER	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA
	LOCATION	ROOF	ROOF	ROOF	ROOF	ROOF	ROOF
	OPER. WT. (LBS)	1124	1124	1124	1124	1124	1124
	ACCESSORIES	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10

1. MECHANICAL CONTRACTOR TO COORDINATE WITH FACTORY FOR SLOPE SEISMIC CURB
2. MODULATING ECONOMIZER & POWER EXHAUST
3. EMS CONTRACTOR TO PROVIDE BACNET/IP METASYS INTEGRATION WITH FIELD INSTALLED CONTROLLER.
4. SUPPLEMENTAL ELECTRIC HEAT, INCLUDED IN MCA
5. VFD FOR BALANCING
6. FDD & ECONOMIZER ACTUATOR
7. ECM CONDENSER FANS & DIGITAL COMPRESSORS
8. SINGLE WALL CONSTRUCTION W/ S/S DRIP PANS
9. PROVIDE CO2 SENSOR
10. UNIT TO SHUTDOWN UPON SMOKE DETECTION, BY FIRE ALARM. COORDINATE WITH DIVISION 26.

NOTE:

THIS EQUIPMENT HAS BEEN FURNISHED BY THE OWNER. MECHANICAL CONTRACTOR TO VERIFY AND INSTALL OWNER-FURNISHED EQUIPMENT. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, FACTORY START-UP, DISCIPLINE COORDINATION, SUPPORT COORDINATION, TESTING AND BALANCING, ACCESSORIES, TITLE 24 TESTING, AND CONTROLS; ALL REQUIRED LABOR / MATERIAL, SERVICES FOR PROPER INSTALLATION, OPERATION, AND WARRANTY OF OWNER-FURNISHED EQUIPMENT. MECHANICAL CONTRACTOR TO PICK-UP EQUIPMENT AT OWNER STORAGE LOCATION AND DELIVER TO ON-SITE STORAGE AT THE START OF CONSTRUCTION. MECHANICAL CONTRACTOR TO PROVIDE, INSTALL, AND COORDINATE ROOF CURB FOR EACH OWNER- FURNISHED EQUIPMENT AND VERIFY ALL CURB DIMENSIONS.

PACKAGE HEAT PUMP SCHEDULE - SECOND FLOOR

	DESIGNATION	HP 2-1	HP 2-2	HP 2-3	HP 2-4	HP 2-5	HP 2-6
	VOLTS / PHASE	460 / 3	460 / 3	460 / 3	460 / 3	460 / 3	460 / 3
	FLA / MCA	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)	9.5 / 30 4.)
	M.O.C.P	30	30	30	30	30	30
	SEER / EER (AT ARI)	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3	14.3 / 12.3
BLOWER	CFM	1,600	1,600	1,600	1,600	1,600	1,600
	EXT. SP (IN WC)	0.8	0.8	0.8	0.8	0.8	0.8
	MIN OSA	425	425	425	425	425	425
	HP / BHP	1.0 / 0.68	1.0 / 0.68	1.0 / 0.68	1.0 / 0.68	1.0 / 0.68	1.0 / 0.68
	RPM	1,067	1,067	1,067	1,067	1,067	1,067
	DRIVE	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT
COOLING	SENSIBLE (MBH)	43.37	43.37	43.37	43.37	43.37	43.37
	TOTAL (MBH)	37.66	37.66	37.66	37.66	37.66	37.66
	EADB / EAWB (°F)	79.45 / 65.0	79.45 / 65.0	79.45 / 65.0	79.45 / 65.0	79.45 / 65.0	79.45 / 65.0
	UNIT DISCHARGE TEMP. (°F)	57.7	57.7	57.7	57.7	57.7	57.7
	AMBIENT AIR (°F)	105	105	105	105	105	105
HEATING	CAPACITY @ 47 DEG. (MBH)	47.75	47.75	47.75	47.75	47.75	47.75
	COP	3.7	3.7	3.7	3.7	3.7	3.7
	AUXILARY ELEC. (KW)	12	12	12	12	12	12
	NO. OF STAGES	2	2	2	2	2	2
PWR. EXH.	FLA / MCA	1.5 / 1.9	1.5 / 1.9	1.5 / 1.9	1.5 / 1.9	1.5 / 1.9	1.5 / 1.9
	MOCP	3.4	3.4	3.4	3.4	3.4	3.4
	INTERNAL FUSE (A)	10	10	10	10	10	10
FILTER	QUANTITY / SIZE	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"	2 / 20"x35"x2"
	MERV RATING	MERV 13	MERV 13	MERV 13	MERV 13	MERV 13	MERV 13
	TYPE	2" PLEATED	2" PLEATED	2" PLEATED	2" PLEATED	2" PLEATED	2" PLEATED
	P D (IN WC)	0.2	0.2	0.2	0.2	0.2	0.2
	MANUFACTURER	TRANE	TRANE	TRANE	TRANE	TRANE	TRANE
	TYPE	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP	HEAT PUMP
	MODEL NUMBER	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA	WSC-048H4REA
	LOCATION	ROOF	ROOF	ROOF	ROOF	ROOF	ROOF
	OPER. WT. (LBS)	940	940	940	940	940	940
	ACCESSORIES	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10

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2. MODULATING ECONOMIZER & POWER EXHAUST
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10. UNIT TO SHUTDOWN UPON SMOKE DETECTION, BY FIRE ALARM. COORDINATE WITH FIRE ALARM.

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INDOOR UNIT SCHEDULE

	DESIGNATION	IDU 1-1	IDU 1-2	IDU 1-3	IDU 2-1	IDU 2-2	IDU 2-3	IDU 3	IDU 4	IDU 5	IDU 6
BLOWER	SUPPLY AIR (CFM)	800	800	800	245	245	245	650	245	350	350
	EXT. SP (IN. WC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MIN. O.S.A. (CFM)	OSA BY ERV-1	OSA BY ERV-1	OSA BY ERV-1	OSA BY ERV-1	OSA BY ERV-1	OSA BY ERV-1	N/A	OSA BY ERV-1	N/A	N/A
	MCA/MOCP	2.0 / 15	2.0 / 15	2.0 / 15	- / 15	- / 15	- / 15	1.0 / 15	0.4 / 15	1.0 / 15	1.0 / 15
	FLA	0.95	0.95	0.95	0.23	0.23	0.23	0.36	0.32	0.33	0.33
	VOLTS/PHASE	208/1	208/1	208/1	208/1	208/1	208/1	208/1	208/1	208/1	208/1
	SEER / EER	21.8 / 12.9	21.8 / 12.9	21.8 / 12.9	23.0 / 15.0	23.0 / 15.0	23.0 / 15.0	21.4 / 12.2	19.8 / 12.2	18.5 / 9.9	18.5 / 9.9
COOLING	SENSIBLE (MBH)	36.0	36.0	36.0	12.0	12.0	12.0	24.0	15.0	18.0	18.0
	TOTAL (MBH)	36.0	36.0	36.0	12.0	12.0	12.0	24.0	15.0	18.0	18.0
	EADB/EAWB (°F)	80/67	80/67	80/67	80/67	80/67	80/67	80/67	80/67	80/67	80/67
	REFRIGERANT	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A	R-410A
HEATING	TOTAL (MBH)	42.0	42.0	42.0	13.5	13.5	13.5	28.0	19.1	22.0	22.0
	HSPF / COP	10.4 / 4.38	10.4 / 4.38	10.4 / 4.38	11.0 / 4.0	11.0 / 4.0	11.0 / 4.0	11.0 / 4.35	11.2 / 3.0	10.2 / 4.28	10.2 / 4.28
FILTER	QUANTITY/SIZE	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY
	TYPE	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY	FACTORY
	P D (IN. WC)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MANUFACTURER	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI	TRANE-MITSUBISHI
	TYPE	CEILING CASSETTE	CEILING CASSETTE	CEILING CASSETTE	CEILING CASSETTE	CEILING CASSETTE	CEILING CASSETTE	WALL MOUNT	CEILING CASSETTE	WALL MOUNT	WALL MOUNT
	MODEL NUMBER	TPLA0A0361EA70A	TPLA0A0361EA70A	TPLA0A0361EA70A	TPLFYP0122FM140A	TPLFYP0122FM140A	TPLFYP0122FM140A	TPKA0A0241KA70A	NTXCKS15A112AA	TPKA0A0181HA70A	TPKA0A0181HA70A
	CONDENSING UNIT	ODU 1-1	ODU 1-2	ODU 1-3	ODU-2	ODU-2	ODU-2	ODU-3	ODU-4	ODU-5	ODU-5
	LOCATION	SNAKCBAR	SNACKBAR	SNACKBAR	STAFF RR	STAFF RR	STAFF RR	EQUIPMENT	OFFICE	IDF	IDF
	OPER. WT (LBS)	56	56	56	31	31	31	46	31	29	29
	ACCESSORIES	1, 2, 4	1, 2, 3	1, 2, 3	2, 3	2, 3	2, 3	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3

1. IDU POWERED BY ODU
2. WIRED SIMPLE WALL CONTROLLER
3. FACTORY CONDENSATE PUMP (POWERED BY IDU) W/ OVERFLOW SAFETY SWITCH
4. DELUXE MA REMOTE CONTROLLER

NOTE: HIGH PROBABILITY SYSTEM PER CMC 1103.2 IN REGARDS TO REFRIGERANT.

ENERGY RECOVERY VENTILATOR SCHEDULE

DESIGNATION	ERV 1
SUPPLY AIR (CFM)	2,200
EXT. SP (IN WC)	2.0
BHP	1.72
HP	2.00
EXHAUST AIR (CFM)	2,200
EXT. SP (IN WC)	2.0
BHP	1.72
HP	2.00
SUMMER DESIGN (INDOOR)	75 / 62
SUMMER DESIGN (OUTDOOR)	105 / 74
SUPPLY CONDITIONS	79.4 / 64.5
WINTER DESIGN (INDOORS)	72 / 55.8
WINTER DESIGN (OUTDOORS)	31.5 / 26.5
SUPPLY CONDITIONS	65.5 / 51.6
MINIMUM CKT. AMPACITY	16.8
MOP (A)	20
VOLTS/PHASE	230/3
MANUFACTURER	GREENHECK
MODEL NUMBER	ERV-45-30L
OPER. WT (LBS)	1400
ACCESSORIES	1 2 3 4 5 6 7 8

1. MERV 13 S/A FILTERS
2. MERV 8 E/A FILTERS
3. DOUBLE WALL CONSTRUCTION
4. HINGED ACCESS DOOR
5. VFD'S FOR BOTH FANS
6. LOW LEAKAGE DAMPERS
7. EMS CONTRACTOR TO PROVIDE BACNET/IP METASYS INTEGRATION WITH FIELD INSTALLED CONTROLLER.
8. FACTORY SLOPED ROOF CURB

EXHAUST FAN SCHEDULE

DESIGNATION	EF 1
CFM	1488
EXT. S.P. (IN. WC)	0.50
HP / BHP	1/2 / 0.329
VOLTS / PHASE	115/1
MCA / MOP (AMPS)	- / 15
FLA (AMPS)	6.3
RPM	1476
TIP SPEED/ SONES	- / 15.1
DRIVE	DIRECT
MOUNTING	CURB
MANUFACTURER	CAPTIVEAIRE
TYPE	UPBLAST
MODEL NUMBER	DU50HFA
CONTROL	KITCHEN HOOD
LOCATION	ROOF
OPER. WT. (LBS)	101
ACCESSORIES	1, 2, 3, 4, 5, 6

1. B.D.D.
2. FACTORY SLOPED CURB
3. ECM WITH 0-10 VDC SPEED CONTROL
4. BIRDSCREEN
5. FACTORY DISCONNECT (FIELD MTD)
6. DIAL ON MOTOR FOR BALANCING

3

GRILLE SCHEDULE

MARK	DUTY	DESCRIPTION
A	CEILING SUPPLY	TITUS TDC (TYPE 3) LOUVER FACE SQUARE RECTANGULAR NECK DIFFUSER FOR STD. LAY-IN CEILING, AND NO. 26 OFF-WHITE FINISH. (18"X18" NECK ADAPTER SIZE SHOWN).
B	CEILING SUPPLY	TITUS TDC (TYPE 1) LOUVER FACE SQUARE RECTANGULAR NECK DIFFUSER FOR SURFACE MOUNTING, AND NO. 26 OFF-WHITE FINISH.
C	CEILING RETURN OR EXHAUST	TITUS PAR (TYPE 3) PERFORATED FACE SQUARE OR RECTANGULAR NECK REGISTER FOR STD. LAY-IN CEILING , FLAT BLACK INTERIOR, AND NO. 26 OFF-WHITE FINISH.
D	CEILING RETURN OR EXHAUST	TITUS CORE 50F (TYPE 1) ALUMINUM EGG CRATE REGISTER WITH 1/2" x 1/2" GRID, FOR SURFACE MOUNTING WITH NO. 26 OFF-WHITE FINISH.

GENERAL NOTES :

1. THE INTENT OF THE DRAWING AND SPECIFICATIONS IS TO CONSTRUCT THE BUILDING IN ACCORDANCE WITH THE 2022 EDITION OF TITLE 24, CALIFORNIA CODE OF REGULATIONS. CHANGES TO THE STRUCTURAL, ACCESSIBILITY OR FIRE AND LIFE-SAFETY PORTIONS OF THE APPROVED PLANS AND SPECIFICATIONS SHALL BE MADE BY AN ADDENDUM OR CONSTRUCTION CHANGE DOCUMENT AS REQUIRED IN SECTION 4-338, PART 1, TITLE 24, CCR, AND SHALL BE SUBMITTED TO AND APPROVED BY DSA PRIOR TO COMMENCEMENT OF THE WORK. DOCUMENTS SHALL BE PREPARED AND SUBMITTED TO DSA IN COMPLIANCE WITH DSA INTERPRETATION OF REGULATION IR A-6.

2. LAYOUT OF MATERIALS, EQUIPMENT AND SYSTEMS IS GENERALLY DIAGRAMMATIC UNLESS SPECIFICALLY DIMENSIONED. SOME WORK MAY BE SHOWN OFFSET FOR CLARITY. THE HVAC BUILDING PLANS HAVE BEEN PREPARED TO MATCH THE ARCHITECTURAL PLANS. IF DIFFERENCES OCCUR, THE ARCHITECTURAL PLANS ARE TO TAKE PRECEDENCE. THE ACTUAL LOCATIONS OF ALL MATERIALS, PIPING, DUCTWORK, FIXTURES, EQUIPMENT, SUPPORTS, ETC. SHALL BE CAREFULLY PLANNED, PRIOR TO INSTALLATION OF ANY WORK, TO AVOID ALL INTERFERENCE WITH EACH OTHER, OR WITH STRUCTURAL, ELECTRICAL, ARCHITECTURAL, OR OTHER ELEMENTS. ALL DUCT AND PIPE OFFSET ELBOWS FOR COORDINATION BETWEEN TRADES ARE NOT SHOWN. CONTRACTOR SHALL INCLUDE SUFFICIENT FUNDS FOR THE COORDINATION OFFSETS IN THE BID. VERIFY THE PROPER VOLTAGE AND PHASE OF ALL EQUIPMENT WITH THE ELECTRICAL PLANS. ALL CONFLICTS SHALL BE CALLED TO THE ATTENTION OF THE ARCHITECT AND THE ENGINEER PRIOR TO THE INSTALLATION OF ANY WORK OR THE ORDERING OF ANY EQUIPMENT.

3. WHEN INSTALLING DRILLED-IN ANCHORS AND/OR POWDER-DRIVEN PINS IN EXISTING NON-PRESTRESSED CONCRETE, USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING THE EXISTING REINFORCING BARS. WHEN INSTALLING THEM INTO EXISTING PRESTRESSED CONCRETE (PRE- OR POST-TENSIONED), LOCATE THE PRESTRESSED TENDONS BY USING A NON-DESTRUCTIVE METHOD PRIOR TO INSTALLATION. EXERCISE EXTREME CARE AND CAUTION TO AVOID CUTTING OR DAMAGING THE TENDONS DURING INSTALLATION. MAINTAIN A MINIMUM CLEARANCE OF ONE INCH BETWEEN THE REINFORCEMENT AND THE DRILLED-IN ANCHOR AND/OR PIN.

4. ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE THERE NO DETAIL IS INDICATED, THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED TO MEET THE FORCE AND DISPLACEMENT REQUIREMENTS PRESCRIBED IN THE 2022 CBC, SECTIONS 1617A.1.18 THROUGH 1617A.1.26 AND ASCE 7-16 CHAPTERS 13, 26 AND 30.

   1. ALL PERMANENT EQUIPMENT AND COMPONENTS.
   2. TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G. HARD WIRED) TO THE BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS OR WATER.
   3. MOVABLE EQUIPMENT WHICH IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS ARE REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

   THE ATTACHMENT OF THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT NEED NOT BE DETAILED ON THE PLANS. THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

   A. COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVE A CENTER MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.

   B. COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS, LESS THAN THAN 5 POUNDS PER FOOT, WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

   FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE STRUCTURAL ENGINEER OF RECORD AND THE DSA DISTRICT STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH ABOVE REQUIREMENTS.

3

5. PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE:

   PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-16 SECTION 13.3 AS DEFINED IN ASCE 7-16 SECTION 13.6.5, 13.6.6, 13.6.7, 13.6.8, AND 2022 CBC, SECTIONS 1617A.1.24, 1617A.1.25, 1617A.1.26.

   THE METHOD OF SHOWING BRACING AND ATTACHMENTS TO THE STRUCTURE FOR THE IDENTIFIED DISTRIBUTION SYSTEM ARE AS NOTED BELOW. WHEN BRACING AND ATTACHMENTS ARE BASED ON A PREAPPROVED INSTALLATION GUIDE (E.G., HCAi OPM FOR 2022 CBC OR LATER), COPIES OF THE BRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF AND DURING THE HANGING AND BRACING OF THE DISTRIBUTION SYSTEMS. THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS. MECHANICAL PIPING (MP), MECHANICAL DUCTS (MD), PLUMBING PIPING (PP):

   MP☒ MD☒ PP☐ IR 16-13 SECTION 2.1: PROJECT-SPECIFIC DESIGN

   MP☐ MD☐ PP☐ IR 16-13 SECTION 2.2: DESIGN BASED ON OSHPD OPM, PART OF PROJECT SUBMITTAL

6. PENETRATIONS THROUGH FIRE RATED WALLS, FLOOR/CEILING, AND ROOF/CEILING ASSEMBLIES SHALL BE SEALED USING AN APPROVED SYSTEM CAPABLE OF PREVENTING THE PASSAGE OF FLAMES AND HOT GASES WHEN SUBJECTED TO THE REQUIREMENTS OF THE TEST STANDARD SPECIFIC TO FIRE STOPS PER 2022 CBC SECTION 714. THIS INCLUDES EXISTING PIPE AND CONDUIT THROUGH NEW ASSEMBLIES. CUSTOM DESIGNED SYSTEMS WHICH COMBINE COMPONENTS FROM DIFFERENT APPROVED SYSTEMS BUT HAVE NOT BEEN TESTED AS A COMPLETE ASSEMBLY WILL NOT BE ACCEPTABLE. FOR FIRE STOPS FOR PIPE PENETRATIONS SEE SPECIFICATIONS.

7. DUCTWORK SIZES SHOWN ARE INSIDE CLEAR DIMENSIONS. WHERE ACOUSTIC LINING IS SHOWN, INCREASE EACH SHEET METAL DIMENSION TO ACCOMMODATE LINING & MAINTAIN CLEAR INSIDE DUCT DIMENSIONS SHOWN.

8. SA DUCTWORK SHALL BE 1" PRESSURE CLASS, AND] RA & EA DUCTWORK SHALL 1" PRESSURE CLASS UNLESS OTHERWISE NOTED.

REGISTERED PROFESSIONAL ENGINEER
RYAN W. CARLSON
Exp. 6-30-26
MECHANICAL
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MADISON ELEMENTARY SCHOOL - 2 STORY CLASSROOM BUILDING

109 Stadium Rd, Madera, CA 93637

STATUS

PROFESSIONAL SEAL

PROJECT NUMBER	230278
DATE	03/15/2024
DSA APPLICATION NO.	02-122191
FILE NO.	20-30
PTN NO.	65243-157
DRAWN BY	Author

REVISIONS

#	DESCRIPTION	DATE
3	ADDENDUM 3	1/10/25

PROJECT STATUS

MECHANICAL SCHEDULES

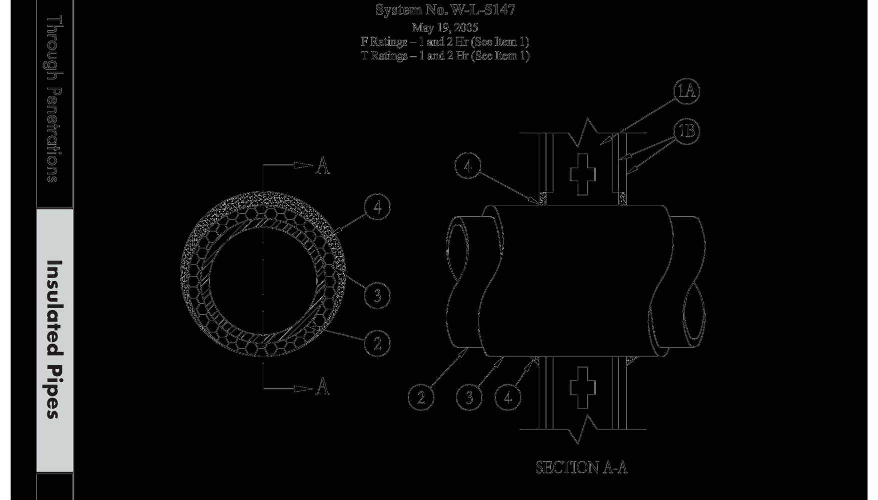
M3.1

System No. W-L-5147

May 16, 2003

F Ratings — 1 and 2 Hr (See Item 1)

T Ratings — 1 and 2 Hr (See Item 1)



SECTION A-A

Through Penetrations | Insulated Pipes | 5000 Series | Gypsum | WL

522 3M Fire Protection Products www.3m.com/firestop W-L-5147 • 1 of 1

System No. C-AJ-5001

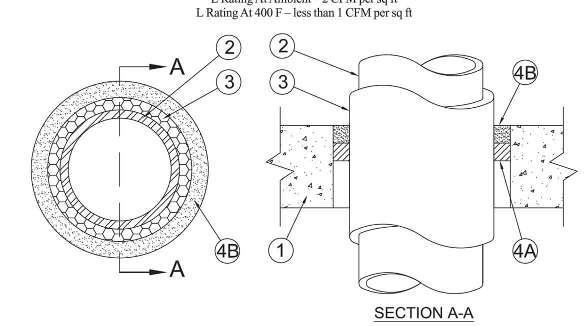
March 05, 2007

F Ratings – 1-1/2, 2 and 3 Hr (See Item 4)

T Ratings – 0, 1/2, 3/4 and 1 Hr (See Items 1A and 4)

L Rating At Ambient – 2 CFM per sq ft

L Rating At 400 F – less than 1 CFM per sq ft



SECTION A-A

Min Floor or Wall Thickn In. (mm)	Max Pipe Diam In. (mm)	Nom Pipe Covering Thkns In. (mm)	Annular Space In. (mm)	F Rating Hr	T Rating Hr
2-1/2 (64)	4 (102)	1 or 1-1/2 (25 or 38)	1/2 to 2-1/8 (13 to 60)	2	1
4-1/2 (114)	4 (102)	2 (51)	1/4 to 3-5/8 (6 to 92)	2	1-1/2
2-1/2 (64)	12 (305)	1 (25)	1/2 to 1-1/2 (13 to 38)	2	1/2
4-1/2 (114)	12 (305)	1 (25)	1/2 to 2-3/8 (13 to 60)	3	1
2-1/2 (64)	12 (305)	1/2 (13)	1/2 to 2-3/8 (13 to 60)	2	0

3M COMPANY – CP 25WB+ or FB-3000 WT

*Bearing the UL Classification Marking

This material was extracted and drawn by 3M Fire Protection Products from the 2007 edition of the UL Fire Resistance Directory.

Through Penetrations | Insulated Pipes | 5000 Series | Concrete | CAJ

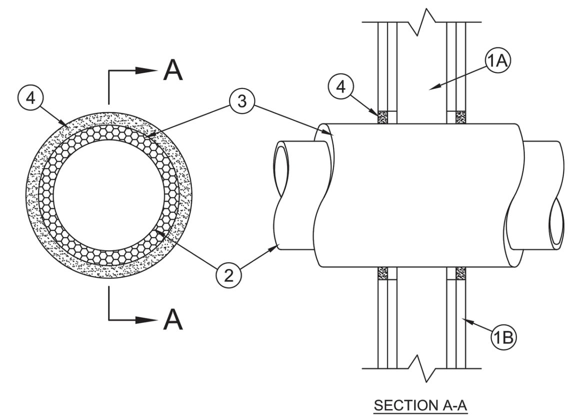
3M Fire Protection Products www.3m.com/firestop C-AJ-5001 • 1 of 1 465

System No. W-L-7177

October 04, 2007

F Ratings – 1 and 2 Hr (See Item 1)

T Ratings – 1 and 1-3/4 Hr (See Item 1)



SECTION A-A

3M COMPANY – FB-3000 WT

*Bearing the UL Classification Mark

Through Penetrations | Misc. Mechanical | 7000 Series | Gypsum | WL

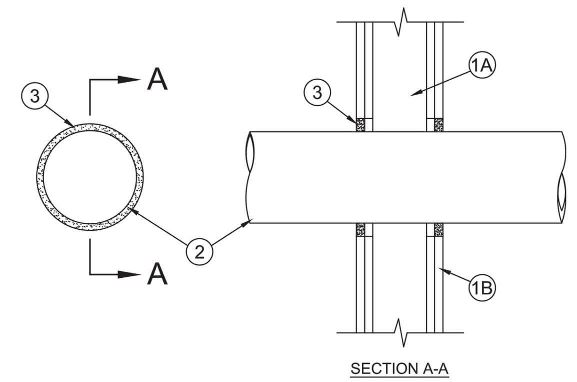
586 3M Fire Protection Products www.3m.com/firestop W-L-7177 • 1 of 1

System No. W-L-7045

July 26, 2007

F Ratings – 1 and 2 Hr (See Item 1)

T Rating – 0 Hr



SECTION A-A

3M COMPANY – CP 25WB+ or FB-3000 WT

*Bearing the UL Classification Mark

Through Penetrations | Misc. Mechanical | 7000 Series | Gypsum | WL

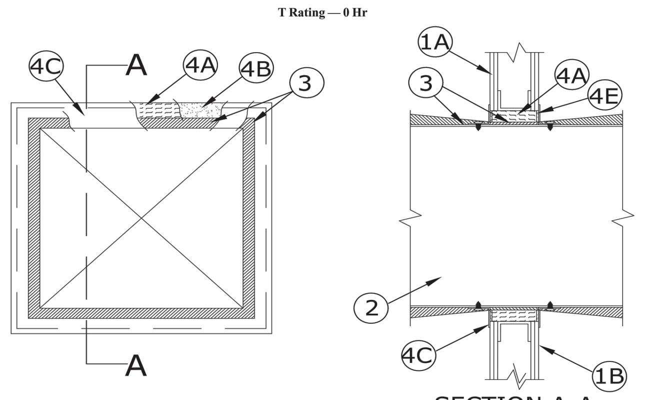
3M Fire Protection Products www.3m.com/firestop W-L-7045 • 1 of 1 573

System No. W-L-7195

April 16, 2014

F Rating — 1 and 2 Hr (See Item 1)

T Rating — 0 Hr



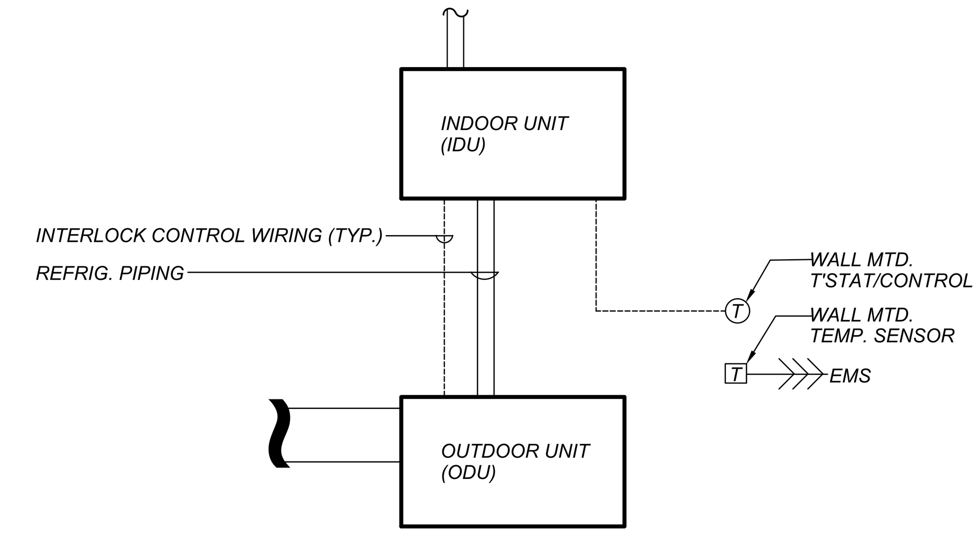
SECTION A-A

3M COMPANY 3M FIRE PROTECTION PRODUCTS — IC 15WB+, CP 25WB+, FB-3000 WT

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

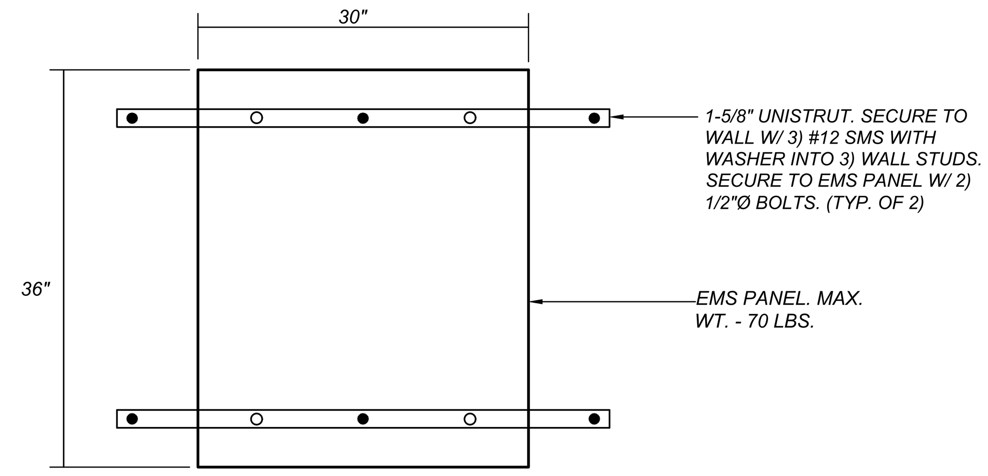
Through Penetrations | Misc. Mechanical | 7000 Series | Gypsum | WL

www.3m.com/firestop 1-800-328-1687 W-L-7195 • 1 of 1 3M Fire Protection Products Through Penetrations Application and Specifiers Guide



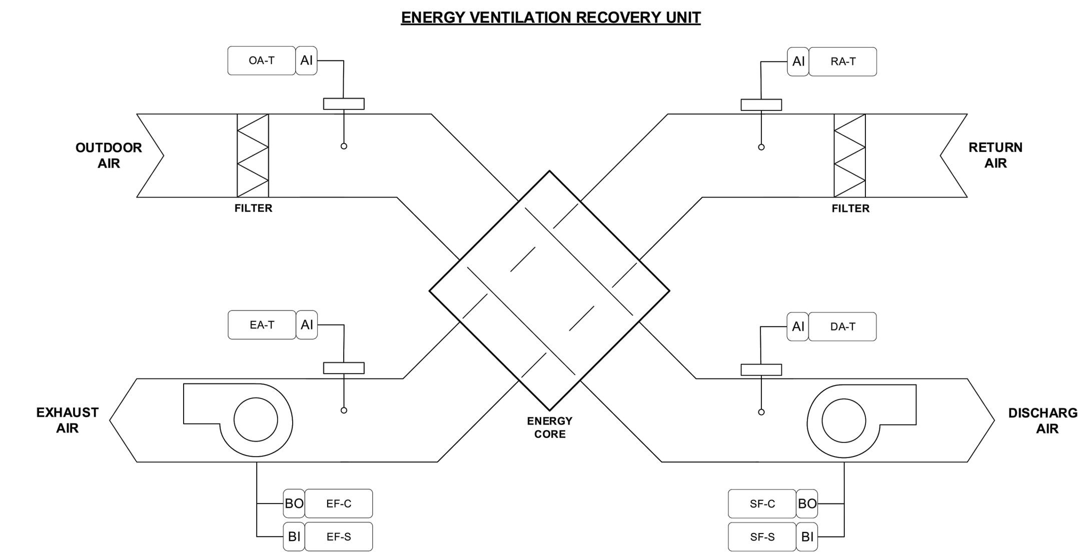
SPLIT SYSTEM DIAGRAM (ODU/IDU - 3,5,6)

SCALE: NONE — E / M4.2



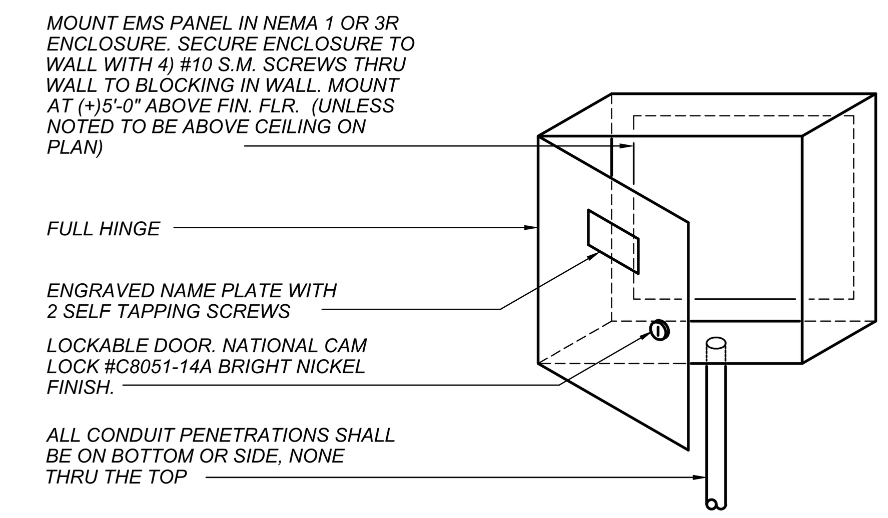
EMS PANEL MOUNTING DETAIL

SCALE: NONE — MC015 — A / M4.2



ENERGY RECOVERY VENTILATOR DIAGRAM

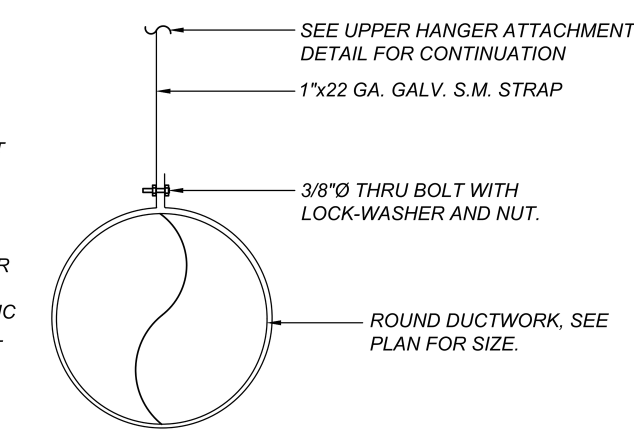
SCALE: NONE — F / M4.2



EMS PANEL ENCLOSURE DETAIL

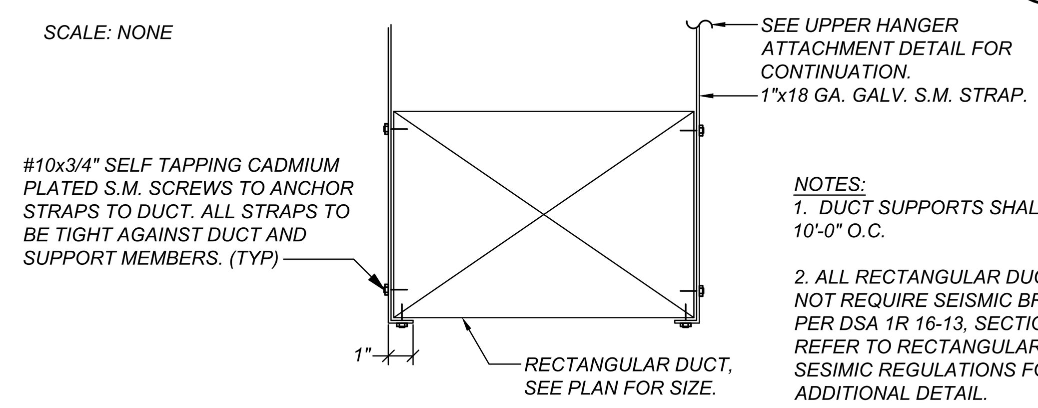
SCALE: NONE — MC014 — B / M4.2

NOTES:
1. DUCT SUPPORTS SHALL BE 10'-0" O.C..
2. ALL DUCTS ARE LESS THAN 36"Ø PER SMACNA - HVAC DUCT CONSTRUCTION STANDARDS, FIGURE 5-5.
3. ALL ROUND DUCT DO NOT REQUIRE SEISMIC BRACING PER DSA 1R 16-13, SECTION 3.3.2. REFER TO ROUND DUCT SEISMIC REGULATIONS FOR ADDITIONAL DETAIL.



ROUND DUCT HANGING DETAIL

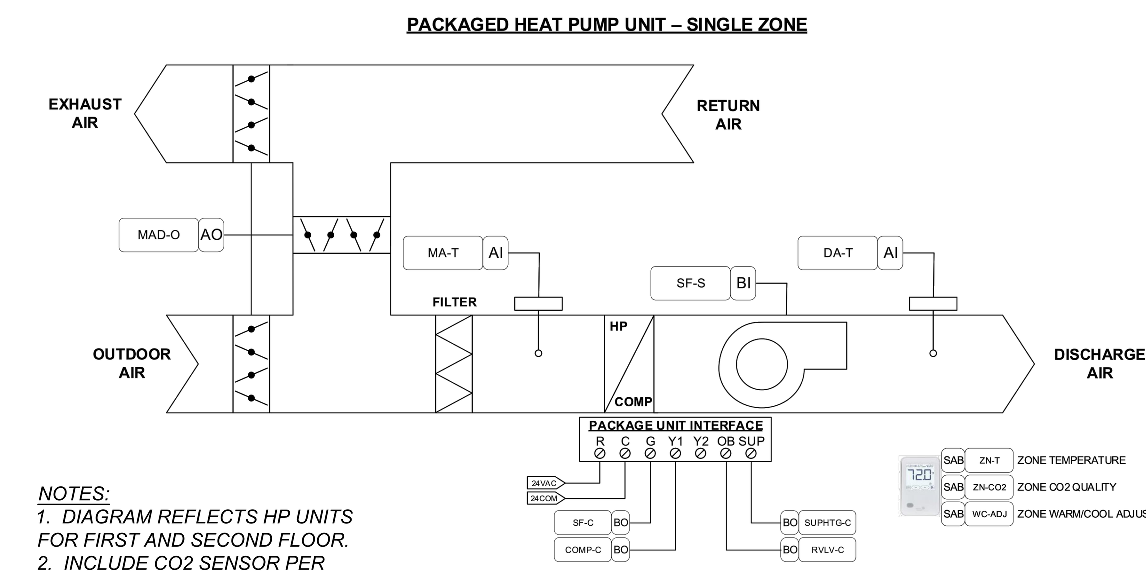
SCALE: NONE — G / M4.2



NOTES:
1. DUCT SUPPORTS SHALL BE 10'-0" O.C.
2. ALL RECTANGULAR DUCT DO NOT REQUIRE SEISMIC BRACING PER DSA 1R 16-13, SECTION 3.3.2. REFER TO RECTANGULAR DUCT SESIMIC REGULATIONS FOR ADDITIONAL DETAIL.

RECTANGULAR DUCT HANGING DETAIL

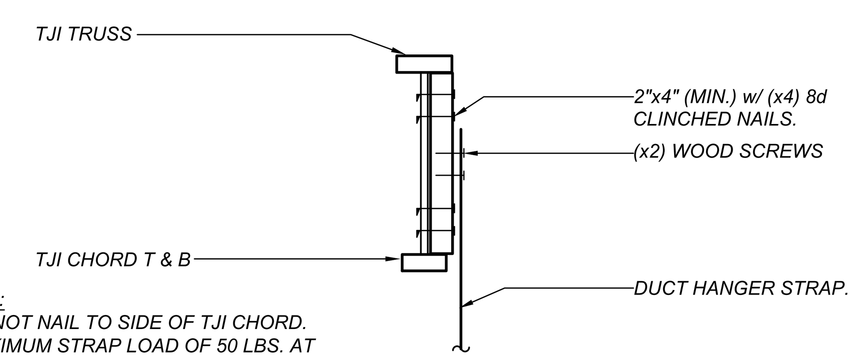
H / M4.2



NOTES:
1. DIAGRAM REFLECTS HP UNITS FOR FIRST AND SECOND FLOOR.
2. INCLUDE CO2 SENSOR PER UNIT SCHEDULE.

PACKAGE HP UNIT DIAGRAM

SCALE: NONE — MC090 — C / M4.2

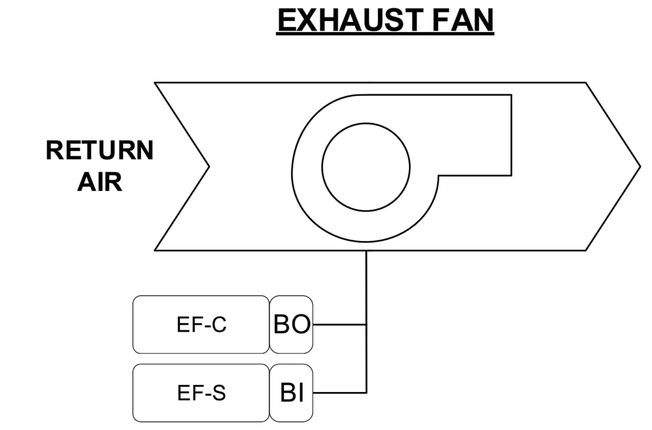


NOTES:
1. DO NOT NAIL TO SIDE OF TJI CHORD.
2. MAXIMUM STRAP LOAD OF 50 LBS. AT HANGER SPACING PER CURRENT SMACNA GUIDELINES.
3. REFER TO STRUCTURAL DETAIL 9/S4.9 FOR ADDITIONAL INFORMATION.

TJI DUCT HANGER STRAP DETAIL

SCALE: NONE — MD066 — K / M4.2

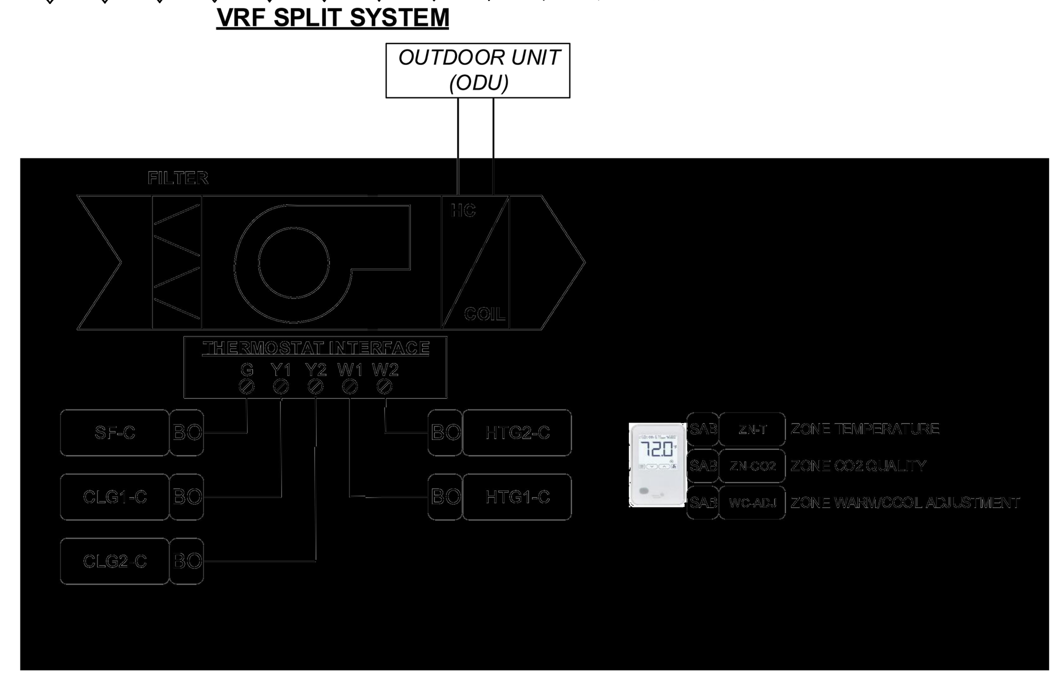
EXHAUST FAN



EXHAUST FAN DIAGRAM

SCALE: NONE — D / M4.2

VRF SPLIT SYSTEM



SPLIT SYSTEM DIAGRAM (ODU/IDU - 1,2,4)

SCALE: NONE — J / M4.2

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MADISON ELEMENTARY SCHOOL - 2 STORY CLASSROOM BUILDING

109 Stadium Rd. Madera, CA 93637

STATUS

PROFESSIONAL SEAL

LICENSED ARCHITECT — MICHAEL R. SCHOEN — No. C-35183 — RENEWAL DATE FEB 28, 2025 — STATE OF CALIFORNIA

PROJECT NUMBER	230278
DATE	03/15/2024
DSA APPLICATION NO.	02-122191
FILE NO.	20-30
PTN NO.	65243-157
DRAWN BY	Author

REVISIONS

#	DESCRIPTION	DATE
3	ADDENDUM 3	1/10/25

PROJECT STATUS

MECHANICAL DETAILS

M4.2

REGISTERED PROFESSIONAL ENGINEER — RYAN W. CARLSON — No. M36176 — Exp. 6-30-26 — MECHANICAL — STATE OF CALIFORNIA

LAWRENCE ENGINEERING GROUP
4110 E. Clinton Way, Suite 101 (559) 431-0101 — 23149 — Fresno, CA 93727 FAX (559) 431-1362