

---

EROSION AND SEDIMENT CONTROL

# FIELD MANUAL

THIRD EDITION  
JUNE 1999

C A L I F O R N I A  
R E G I O N A L W A T E R Q U A L I T Y C O N T R O L B O A R D  
S A N F R A N C I S C O B A Y R E G I O N

---

---

# C O N T E N T S

Getting the Most From this Manual	Pg v
Acknowledgements	Pg vii
Disclaimer	Pg ix
Introduction and Principles of Erosion and Sediment Control	Pg 1-6
Regulatory Background	Pg 7-12
Regional Water Quality Control Board Contact Information	Pg 13
Environmental Impacts and Planning for Erosion Control	Pg. 15-19
Erosion and Sediment Control Practices:	Pg. 21-91
Scheduling	Pg. 21-22
Preservation of Existing Vegetation	Pg. 23
Slope Grading	Pg. 25-29
Temporary Seeding and Mulching	Pg. 31
Permanent Seeding and Mulching	Pg. 33
Hydromulching - Hydroseeding	Pg. 35-40
Dust Control	Pg. 41-43
Erosion Control Blankets and Geotextiles	Pg. 45-46
Fiber Rolls	Pg. 47-48
Temporary Stream Crossing	Pg. 49-50
Stabilized Construction Entrance	Pg. 51-52
Entrance / Exit Tire Wash	Pg. 53
Outlet Protection - Energy Dissipation	Pg. 55-56
Check Dams	Pg. 57-58
Silt Fencing	Pg. 59-63
Temporary Straw Bale Dike	Pg. 65-67
Sand / Gravel Bag Barrier	Pg. 69-70
Brush or Rock Filter	Pg. 71
Storm Drain Inlet Protection	Pg. 73-75
Catch Basin Inlet Filters	Pg. 77
Sediment Basin	Pg. 79-83
Sediment Traps	Pg. 85-86
Dewatering:	Pg. 87-90
Toxic Pollutants in Soil or Groundwater	Pg. 89
Sediments in Groundwater	Pg. 90
Secondary Filtration	Pg. 91

---

General Site and Materials Management	
Water Conservation Practices	Pg. 93
Solid and Demolition Waste Management	Pg. 95–96
Hazardous Waste Management	Pg. 97–98
Spill Prevention and Control	Pg. 99–100
Vehicle and Equipment Service	Pg. 101
Material, Delivery, Handling and Storage	Pg. 103–104
Paints and Liquid Materials	Pg. 105–106
Handling and Disposal of Concrete and Cement	Pg. 107–108
Pavement Construction Management	Pg. 109–110
Contaminated Soil and Water Management	Pg. 111–112
Sanitary/Septic Waste Management	Pg. 113
Landscaping Management	Pg. 115
Corrective Measures—Maintenance	Pg. 117–122
Inspection and Monitoring	Pg. 123–129
References	Pg. 131–132

---

## GETTING THE MOST FROM THIS MANUAL

In order to protect water quality during construction, three categories of control practices must be implemented:

- 1) erosion control practices,
- 2) sediment control practices, and
- 3) general site and materials management.

While erosion and sediment control practices are required primarily during earth moving activities such as excavation and grading, site and material management controls (such as waste management and vehicle fueling controls) will be necessary throughout the life of a construction project, from demolition to painting to landscaping.

Throughout this Manual, many terms—such as *best management practices*, *measures*, *controls*—are used to describe efforts to protect water quality. Some of the controls recommended here involve site planning (such as careful construction scheduling and the preservation of existing vegetation) while others refer to the physical installation of structural control materials (such as erosion control mats or silt fencing). Planning considerations should not be overlooked in favor of structural controls however, because existing vegetation and the natural topography are the best means of regulating the volume and quality of runoff from land surfaces to adjacent streams. Minimum disturbance activities are both more efficient and more economical than structural controls such as revegetation, especially over the long term, and should be attempted wherever possible.

### *Erosion control is more art than science*

The control practices described in this Manual are tools and methods intended to be adapted and modified as dictated by site-specific conditions. It should not be assumed, however, that all of the controls represented here are necessary or even appropriate for all construction sites. Nor should it be assumed that the techniques represented are guarantees or quick-fixes for problems resulting from bad planning or sloppy Storm Water Pollution Prevention Plan (SWPPP) implementation. All control measures must be properly located, installed and maintained to be effective.

---

## A C K N O W L E D G E M E N T S

The First Edition Field Manual (November 1996) was prepared by Carol L. Forrest, P.E. and Amy C. Klabunde of Woodward-Clyde Consultants in cooperation with staff of the State of California Regional Water Quality Control Board San Francisco Bay Region and the San Francisco Estuary Project. Sponsorship was provided by Warmington Homes and the San Francisco Estuary Project.

Second Edition (July 1998) updates were provided by Hossain Kazemi and George Leyva, Regional Water Quality Control Board San Francisco Bay Region; Marcie Adams, San Francisco Estuary Project; Heather Nelson, Bay Area Storm Water Management Agencies Association (Materials Management); and Michael Mellon, Wood Recycling, Inc. (Hydroseeding/Mulching). Second Edition graphics produced by CSEC and the San Francisco Estuary Project. Third Edition (July 1999) updates and graphics prepared by staff of the San Francisco Estuary Project and the Regional Water Quality Control Board San Francisco Bay Region. All Manual updates and reprinting were made possible by supplemental environmental projects funded in lieu of civil penalty, by donations, and by the San Francisco Estuary Project.

The authors wish to acknowledge Caltrans for the use of material from Caltrans' Storm Water Quality Handbooks prepared by Woodward-Clyde, Camp Dresser & McKee, Aguilar Engineering, Psomas & Associates, and MK Centennial. The Project Team gratefully acknowledges the efforts of the Watershed Management Division of the Regional Board who guided development and review of the Manual, and the numerous reviewers in both the public and private sectors who have contributed to its content and usefulness.

We also wish to acknowledge past sponsorship by Kaufman and Broad Home Corporation; Seeno Construction; Warmington Homes; Home Builders Association of Northern California; and the San Francisco Estuary Project—all of whom have enabled production and printing of the Field Manual and associated *Construction Site Planning and Management for Water Quality Protection* workshops. Lastly, we would like to thank Loretta Barsamian, Executive Officer, San Francisco Bay Regional Water Quality Control Board (RWQCB) and RWQCB Board Members for supporting education on erosion and sediment control in the San Francisco Bay Area.

### **Project Team Members:**

Marcie Adams—San Francisco Estuary Project  
Jerry Amos—Woodward-Clyde Consultants  
Cynthia Brouwer—Woodward-Clyde Consultants  
Bruce Brennan—Woodward-Clyde Consultants  
Carol Forrest—Woodward-Clyde Consultants  
Alan Friedman—RWQCB-SFBR  
Hossain Kazemi—RWQCB-SFBR  
Amy Klabunde—Woodward-Clyde Consultants  
Larry Kolb—RWQCB-SFBR  
George Leyva—RWQCB-SFBR  
Heather Nelson—BASMAA  
Bruce Wolfe—RWQCB-SFBR  
David Yam—Caltrans

### **Regional Board:**

Loretta Barsamian, Executive Officer

---

## D I S C L A I M E R

The Field Manual should not be construed as policy of any regional water quality control board but used as a guidance document to minimize erosion and polluted runoff from construction sites. The controls described in this Manual are intended to serve as minimum control standards or “best management practices” for the construction industry and to allow for consistent regulation of construction activities by applying a uniform standard.

Although initially prepared for the San Francisco Bay Region, control techniques described in the Field Manual are broadly applicable to all of California.

The citing of products, companies, or trade names does not constitute an endorsement.

The Field Manual is a dynamic document that will be reviewed and updated periodically in accordance with new practices and technologies for erosion and sediment control and general site and materials management. Comments on the Field Manual may be directed to San Francisco Bay RWQCB staff Hossain Kazemi at (510)622-2369. Questions regarding Manual production and associated products may be directed to San Francisco Estuary Project staff Carol Thornton at (510)622-2419.

The Field Manual is distributed by: Friends of the San Francisco Estuary  
P.O. Box 791  
Oakland CA 94604-0791  
(510)622-2398

---

# I N T R O D U C T I O N

Soil erosion and sedimentation pose a serious threat to the quality of our waters. Erosion is the washing away of soil by rain. Sedimentation is the accumulation of soil and other matter washed into our waterways from the land.

When raindrops strike bare soil, large amounts of topsoil are dislodged and carried downstream in storm water runoff. When land is disturbed, therefore—by construction or road building, for example—its erodability greatly increases. As soil and other particles (construction-related materials and chemicals such as paints, solvents, vehicle fluids and concrete) are washed into streams, aquatic life dependent on clean water and gravel beds are severely stressed. The cumulative toll on the environment can be devastating (For Environmental Impacts, See pages 15 to 19).

Erosion and sedimentation can also cause flooding, and nuisance problems for downgradient property owners and on adjacent streets. Other problems resulting from sedimentation resulting from uncontrolled erosion include the clogging of streams, storm drains and culverts; artificial siltation of reservoirs and other water bodies; as well as pollution of waterways and drinking water supplies.

Uncontrolled erosion is costly, violates state and federal pollution laws, exposes developers, contractors, and landowners to legal liabilities, and provides ammunition to those who argue that the development process itself is out of control.

As the flat lands are built out and as more and more development takes place on steep hillsides, the threat from erosion is increasing. In recent years, citizen groups and environmental organizations have recognized that the environmental losses and economic costs of development-related erosion are generally borne by the taxpayer rather than the polluter. More frequent citizen suits and better enforcement of environmental regulations reflect decreasing tolerance for this discrepancy.

---

## OUR SHARED ROLES IN POLLUTION PREVENTION

The prevention of water pollution is a responsibility shared by everyone involved in the development/construction process. Before, during and after construction, various entities have decision making authority and as such, have a responsibility to do what they can to prevent pollution.

The controls described in this Manual are intended to address Phase 3: Pre-Construction and Phase 4: Construction (below) by providing the latest information on “best management practices” for developers, contractors, inspectors and others responsible for oversight of on-site pre-construction and construction activity. Reliance on Pre-Construction and Construction controls alone represents a major flaw in pollution prevention, however. Efforts in Phase 1: Policy, Phase 2: Planning and Phase 5: Post Construction are also necessary to achieve comprehensive water resource protection.

### Phase 1: Policy—Developing General Plans and regulations

**Key Players:** Elected officials, municipal planners and voting constituents  
**Responsibility:** To develop policies and adopt local ordinances which encourage and support pollution prevention.

### Phase 2: Planning—Creating new plans for development

**Key Players:** Decision-makers, planners, constituents, engineers and developers  
**Responsibility:** To design and support plans which will best prevent pollution and include permanent storm water practices and controls.

### Phase 3: Pre-Construction—Determining details of construction activities

**Key Players:** Engineers, inspectors, developers and contractors  
**Responsibility:** To work together to secure the necessary permits, to develop and review Storm Water Pollution Prevention Plans, and to select the practices that will best prevent pollution during construction.

### Phase 4: Construction—Grading, street/structure construction, landscape installation

**Key Players:** Inspectors, developers, contractors and sub-contractors  
**Responsibility:** To support and implement pollution prevention practices for all construction activities.

### Phase 5: Post-Construction—Completing construction and property transfer

**Key Players:** Inspectors and property owners  
**Responsibility:** To ensure that construction activity is completed as permitted, to implement permanent pollution prevention practices, and to maintain permanent structural controls.

---

## EROSION CONTROL VS. SEDIMENT CONTROL

In planning, implementing, and maintaining an erosion and sediment control system, it is important to understand the difference between erosion control and sediment control.

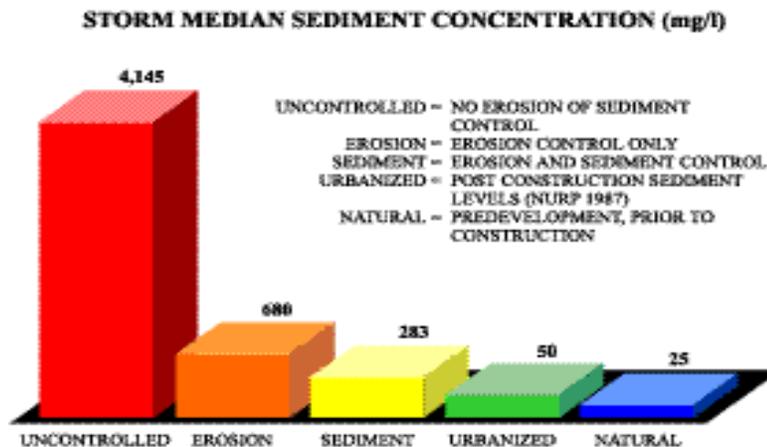
### EROSION CONTROL

Erosion control practices protect the soil surface and prevent soil particles from being detached by rainfall or wind. Erosion control treats soil as a resource with value and works to keep it in place.

### SEDIMENT CONTROL

Sediment control practices trap soil particles after they have been dislodged and moved by wind or water. Sediment controls are generally passive systems that rely on filtering or settling soil particles out of the water or wind that is transporting them. Sediment control treats soil as a waste product and works to remove it from storm water runoff.

Generally speaking, erosion controls are both more efficient and more cost-effective than sediment controls, and are preferred because they keep the soil in place and protect the resource. *Whenever possible, the primary protection on a site should be erosion controls, with sediment controls implemented as a secondary or “back-up” system.* The graph below compares sediment discharged from sites with various levels of controls in place.



---

## WHAT MAKES A CONTROL PLAN EFFECTIVE?

For an erosion and sediment control plan to be effective, it is essential that adequate best management practices (BMPs) be implemented before the rainy season begins. Once erosion has occurred, it is extremely difficult to remove the soil suspended in storm water runoff. By initially protecting soil from raindrop impact and *preventing* erosion, the burden on more costly and less effective sediment controls is greatly reduced.

Provisions for both temporary and permanent erosion and sediment controls must be implemented in accordance with the Storm Water Pollution Prevention Plan (SWPPP) designed for the site. Once implemented, controls should be monitored, maintained and immediately repaired to ensure their effectiveness. Control measures should be updated and the SWPPP amended as necessary and as dictated by changes in construction and the construction schedule.

## G R O U N D R U L E S

The following principles should be followed to the maximum extent practicable to control erosion and sedimentation from the disturbed areas of a construction site:

1. Fit grading to the surrounding terrain. Contour slopes in accordance with soil type and natural repose.
2. Retain existing vegetation to the extent feasible.
3. Time grading operations to minimize soil exposure in the rainy season.
4. Minimize the length and steepness of slopes.
5. Emphasize erosion controls by vegetating and mulching, or otherwise stabilizing disturbed areas.
6. Direct runoff away from disturbed areas.
7. Keep runoff velocities low, using energy dissipating control measures.
8. Prepare drainageways and outlets to handle concentrated runoff until permanent drainage structures are constructed.
9. Trap sediment on site using a combination of erosion and sediment control measures.
10. Inspect and maintain control measures before and after each rainstorm. A log of site inspections (including date, observations made and inspector) should be retained for at least three years.

---

## WHAT IS THE OPTIMUM GRADING PERIOD?

In California, the optimum grading period is the non-rainy season, *generally* between April 1st and October 1st. If grading is to continue into the rainy season, then the length of time that soils are exposed and the total area of exposed soil must be minimized. Because of high demand and material shortages during winter months, materials used for erosion and sediment control should be stockpiled on-site throughout the rainy season. Control materials should be available at all times so that problems and failures may be immediately addressed.



## TIMING IS CRITICAL

Properly timing the installation of erosion and sediment controls can determine whether or not a site will meet its NPDES Permit requirements. A specified work schedule coordinating timing of land disturbing activities with the installation of erosion and sediment control practices to reduce on site erosion and off site sedimentation should be an objective of project planning.

During the rainy months, any disturbed area that will remain exposed for more than 14 days should be provided with protective erosion control measures. Every attempt must be made to stabilize disturbed areas at least 48 hours before storm events. These measures may be temporary if they will be replaced by permanent measures at a later date, or they may be the permanent erosion controls.

It is not adequate to rely solely on sediment control measures to keep sediment-laden runoff from leaving a site during the wet season.

Diligent application of the following guidelines will prevent accelerated erosion:

- Minimize the length of time that soils are left exposed
- Reduce the total area of exposed soil during the rainy season
- Protect critical areas (drainage channels, creeks and natural watercourses)
- Monitor before and after each rain storm to assess the effectiveness of control measures

Clearing and grading activities are usually regulated at the local level through a variety of ordinances. Some municipal ordinances specify a maximum area that may be exposed at any given time on a site during the winter months. Check with the local jurisdiction for these requirements.

---

## REGULATORY BACKGROUND

In 1990, the U.S. Environmental Protection Agency published regulations requiring that storm water discharges resulting from construction activities disturbing land areas of five or more acres be covered by a “National Pollutant Discharge Elimination System” or NPDES Permit. In California, the State Water Resources Control Board (State Board) is responsible for issuing such permits and has adopted a statewide General Permit to address discharges of storm water runoff associated with applicable construction activities. The nine regional water quality control boards oversee implementation and enforcement of the General Permit statewide.

## WHAT DOES THE GENERAL PERMIT REQUIRE?

The General Permit requires all owners of land where applicable construction activity occurs to:

- ▶ Submit a Notice of Intent (NOI) to comply with the General Permit, a [site map](#) and the appropriate filing fee to the State Board. A package containing an NOI and the General Permit can be obtained from your local regional board. For contact information, see page 13.
- ▶ Eliminate or minimize non-storm water discharges from the construction site to storm drains and other waterbodies. Non-storm water discharges may result from a variety of sources, including dumping, leaking storage and maintenance areas and spillage of chemicals and waste materials.
- ▶ Develop, implement, and update a Storm Water Pollution Prevention Plan (SWPPP) for the site. The Regional Board, San Francisco Bay Region has prepared “Guidelines for Preparing a SWPPP,” which is available from the Board at (510)622-2419.
- ▶ Develop a site monitoring program and perform inspections of the measures implemented as part of the SWPPP. If the implemented measures do not adequately minimize storm water and non-storm water discharges, those measures must be modified.
- ▶ Annually certify, based on inspections, that the site is in compliance with the General Permit. The Regional Board, San Francisco Bay Region, requires annual submission of a report documenting the site’s compliance with the State General Permit.

The State Board is in the process of revising and reissuing the General Permit. While the above requirements are not expected to change, status on this reissuance and a copy of proposed permit language are available from any local regional board. For information on the revised/adopted Permit, contact your local Regional Water Quality Control Board. For contact information, see pg. 13.

---

## PROPOSED FRAMEWORK FOR THE SWPPP

- I. Title Page
- II. Certification Page
- III. Amendments
- IV. Table of Contents
- V. Introduction
- VI. Source Identification
  - A. Topography Map
  - B. Site Map
    - 1. Areas of Soil Disturbance
    - 2. Surface Water Locations
    - 3. Areas of Existing Vegetation
    - 4. Location of Control Practices Used During Construction
    - 5. Drainage Patterns and Slopes Anticipated After Major Grading Activities are Completed
    - 6. Areas Used to Store Soils and Wastes
      - a. Soil Storage
      - b. Waste Storage
      - c. Materials Storage
    - 7. Vehicle and Equipment Storage and Service Areas
    - 8. Existing and Planned Paved Areas and Buildings
    - 9. Location of Post-Construction Control Practices
- VII. Narrative Descriptions
  - A. Site Estimates and Description of On Site Soil
  - B. Pollutants Likely to be Present in Storm Water Discharges
  - C. Toxic Materials
  - D. Erosion and Sediment Control Practices
    - 1. General Practices
    - 2. Soil Stabilization
    - 3. Practices to Reduce Tracking Sediment Onto Public and Private Roads
    - 4. Wind Erosion:
      - a. Dust Control
      - b. Sweeping
    - 5. Practices to Minimize Contact with Storm Water
      - a. Construction Vehicles and Equipment
        - i) Maintenance
        - ii) Fueling
        - iii) Washing
      - b. Materials
    - 6. Construction Material Loading, Unloading, and Access Areas
    - 7. Waste Management and Disposal
      - a. Concrete Wash-Out
      - b. Concrete / Asphalt Debris
      - c. Miscellaneous Waste
    - 8. Preconstruction Control Practices
  - E. Non-Storm Water Management
  - F. Maintenance, Inspection, and Repair of Structural Controls
  - G. Spill Prevention and Control
    - 1. Minor Spills
    - 2. Major Spills
  - H. Post-Construction Storm Water Management
  - I. Personnel Training
  - J. List of Contractors / Subcontractors
  - K. Monitoring
    - 1. General Plan Summary
    - 2. Site Inspections
    - 3. Compliance Certification
    - 4. Noncompliance Reporting
    - 5. Records

---

## W H O I S R E S P O N S I B L E ?

The owner of the land where the construction takes place is responsible for filing the Notice of Intent (NOI) and fee, complying with the terms of the General Permit, and seeing that all contractors comply with the General Permit as well. A separate NOI must be filed for each separate construction site. If a new owner is involved and construction is to continue, a separate NOI must be filed by the new owner. Once construction is complete or site ownership has been transferred, a Notice of Termination must be filed to verify that General Permit coverage is no longer necessary.

## N O T I C E O F T E R M I N A T I O N

A construction project is considered complete only when the following conditions have been met:

- 1) all portions of the site have been transferred to a new owner
- 2) there is no potential for construction related storm water pollution
- 3) all elements of the SWPPP have been completed
- 4) construction materials and waste have been disposed of properly
- 5) the site is in compliance with all local storm water management requirements
- 6) a post construction storm water management plan is in place as described in the SWPPP for the site

Submission of a Notice of Termination containing falsified information is a violation of both the requirement to have a permit and the Clean Water Act. Such action makes the Notice of Termination applicant subject to enforcement action.

The regional board may not recognize a partial termination. If you wish to revise the “*total size of construction site*” information as stated on the original Notice of Intent, you should instead change the “*size of site*” data in Part B of your attached Compliance Status Report.

---

## HOW DOES A SITE RECEIVE PERMIT COVERAGE?

A package that contains the Notice of Intent (NOI) and the General Permit can be obtained from your local Regional Water Quality Control Board (See page 13).

The completed NOI, [site map](#) and appropriate fee should be submitted prior to construction to:

State Water Resources Control Board  
Division of Water Quality - Storm Water Permit Unit  
P.O. Box 19977 - Sacramento, CA 95812-1977

## WHAT ARE THE PENALTIES FOR NON-COMPLIANCE?

The regional boards are responsible for enforcing the General Permit. A construction site may be inspected for compliance, and if found lacking, an inspector may issue a permit violation (Notice to Comply) to compel action or may recommend issuance of a Notice of Violation, or Civil Liability to the Executive Officer of the Regional Water Quality Control Board.

Failure to obtain Permit coverage, failure to develop or implement an adequate SWPPP, failure to minimize non-storm water discharges or to limit storm water discharges, or failure to monitor and perform inspections are all violations of the federal [Clean Water Act](#) and [California Water Code](#).

Civil penalties of up to \$10,000 per day plus \$10 per gallon of sediment-laden runoff or wastewater discharged for each violation may be imposed administratively by the regional boards; fines of up to \$25,000 per day for each violation may be assessed if imposed by the Superior Court.



---

## 404 PERMIT AND 401 CERTIFICATION REQUIREMENTS

Sections 404 and 401 of the Federal Clean Water Act require permitting and certification for construction and/or other work conducted in “waters of the United States.” Such work includes levee work, dredging, filling, grading, or any other temporary or permanent modification of streams or other water bodies. By definition, “waters of the United States” includes the Bay-Delta, rivers, creeks, seasonal wetlands, grassy swales, seep wetlands, ponds and any other waterbodies.

### 404 PERMITTING—U.S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers (Corps) oversees issuance of four types of Section 404 permits: Individual, Regional, General and Nationwide. Each of these 404 permit types require prior Section 401 certification by the state in which the work is to take place. In California, the State Board has pre-issued 401 certification for certain types of activities authorized by Nationwide Permits. Contact your local regional board to determine if your activity may have been certified by the State Board, or check at [http://www.ceres.ca.gov/wetlands/permitting/401\\_nwp.html](http://www.ceres.ca.gov/wetlands/permitting/401_nwp.html). For more information regarding the Section 404 application/permitting process, contact the Corps district office.

### 401 CERTIFICATION—STATE WATER RESOURCES CONTROL BOARD

The State Board oversees Section 401 certifications to assure that any activity to be permitted by the Corps will not result in discharge or fill violating State and Federal water quality standards.

Each regional board maintains a Basin Plan for each hydrologic basin in California. Each Basin Plan includes lists of waterbodies in that basin, and water quality standards applicable to those waterbodies. An application for 401 certification may either be waived, certified, certified with conditions, or denied by the regional board or State Board.

According to the Basin Plan adopted for the San Francisco Bay Region, activities filling or impacting waterbodies are not permitted except in cases where no practical alternative to filling is available (with the exception of water dependent projects). Projects should be planned to avoid impacts to waterbodies, modified to minimize unavoidable impacts, and, once impacts have been minimized, mitigated to compensate for environmental damage done.

A regional board must act within sixty days of receipt of a complete application, satisfactory to the regional board, unless additional time is granted by the Corps District Engineer. A complete 401 certification application package should include:

- 1) a complete project description
- 2) the appropriate filing fee
- 3) a copy of the Section 404 permit application or pre-construction notification (if applicable)
- 4) final CEQA documentation (if available)
- 5) other: alternatives analysis, mitigation plan, monitoring plan

For more information regarding 401 certifications, contact the appropriate regional board.

---

## WHAT OTHER AGENCIES REGULATE CONSTRUCTION?

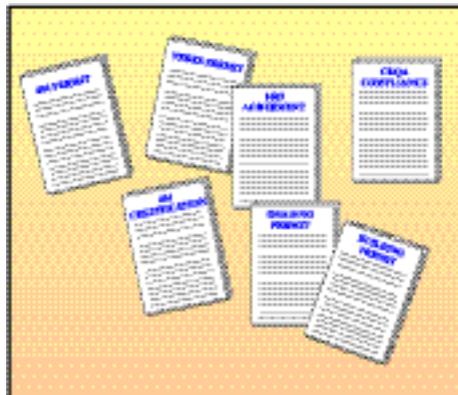
Local cities and counties require that construction sites conform to **local ordinances** governing building and grading permits and plans, including erosion and sediment control plans. These local ordinances may be more or less stringent than the General Permit and must be addressed in planning for site construction. It is anticipated that by complying with the General Permit, site owners will largely conform with local ordinances. Appropriate portions of local requirements should be incorporated into the SWPPP.

The California Department of Fish and Game requires that a **Streambed Alteration Agreement (1603)** be completed prior to the disturbance of any stream in California. Such an agreement specifies when work can be performed in the stream, what erosion control and other measures will be necessary to protect the stream, and measures that will be required after work completion.

**Before applying for a Fish and Game 1603 Agreement, you should first obtain 401 certification or Waste Discharge Requirements (WDRs) from your regional board to assure that water quality standards will not be violated.** For further information on 1603 agreements contact any Department of Fish and Game warden or office.

Projects impacting coastal or estuarine water bodies may also require permits from the California Coastal Commission or, in the San Francisco Bay Area, from the Bay Conservation and Development Commission.

Up-to-date information and application materials for 1603 Agreements, 404 Permits, 401 Certifications and Coastal Development Permits can be accessed and downloaded on the Internet at <http://www.ceres.ca.gov/wetlands/permitting>.



---

## REGIONAL WATER QUALITY CONTROL BOARDS

### Region 1

#### North Coast Region

5550 Skylane Boulevard, Suite A  
Santa Rosa, California 95403  
707-576-2220 ☎

### Region 2

#### San Francisco Bay Region

1515 Clay Street, Suite 1400  
Oakland, California 94612  
510-622-2300 ☎

### Region 3

#### Central Coast Region

81 Higuera Street, Suite 200  
San Luis Obispo, California 93401-5427  
805-549-3147 ☎

### Region 4

#### Los Angeles Region

101 Centre Plaza Drive  
Monterey Park, California 91754-2156  
213-266-7500 ☎

### Region 5 - S

#### Central Valley Region

3443 Routier Road, Suite A  
Sacramento, California 95827-3098  
916-255-3000 ☎

### Region 5 - F

#### Fresno Office

3614 East Ashlan Avenue  
Fresno, California 93726  
209-445-5116 ☎

### Region 5 - R

#### Redding Office

415 Knollcrest Drive  
Redding, California 96002  
530-224-4845 ☎

### Region 6 - SLT

#### Lahontan Region

2501 Lake Tahoe Blvd.  
South Lake Tahoe, California 96150  
530-542-5400 ☎

### Region 6 - V

#### Victorville Office

15428 Civic Drive, Suite 100  
Victorville, California 92392  
619-241-6583 ☎

### Region 7

#### Colorado River Basin Region

73-720 Fred Waring Drive, Suite 100  
Palm Desert, California 92260  
619-346-7491 ☎

### Region 8

#### Santa Ana Region

3737 Main St., Suite 500  
Riverside, California 92501-3339  
909-782-4130 ☎

### Region 9

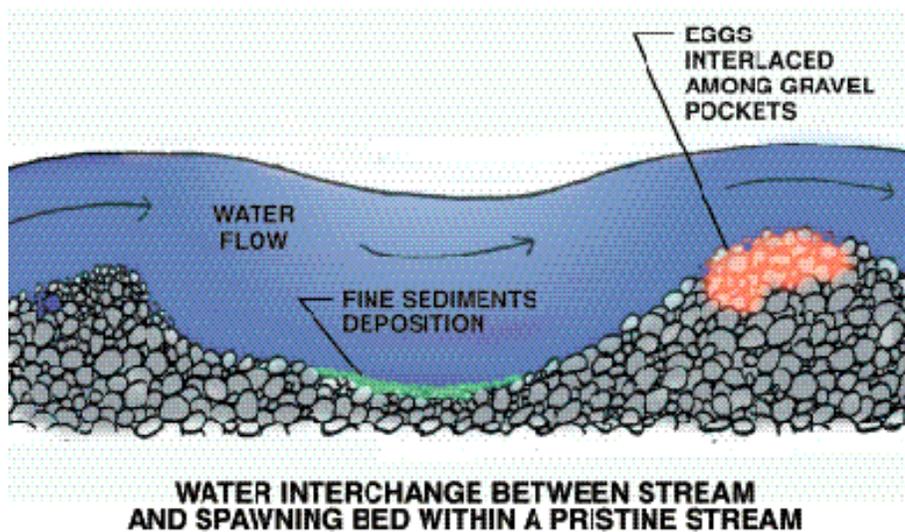
#### San Diego Region

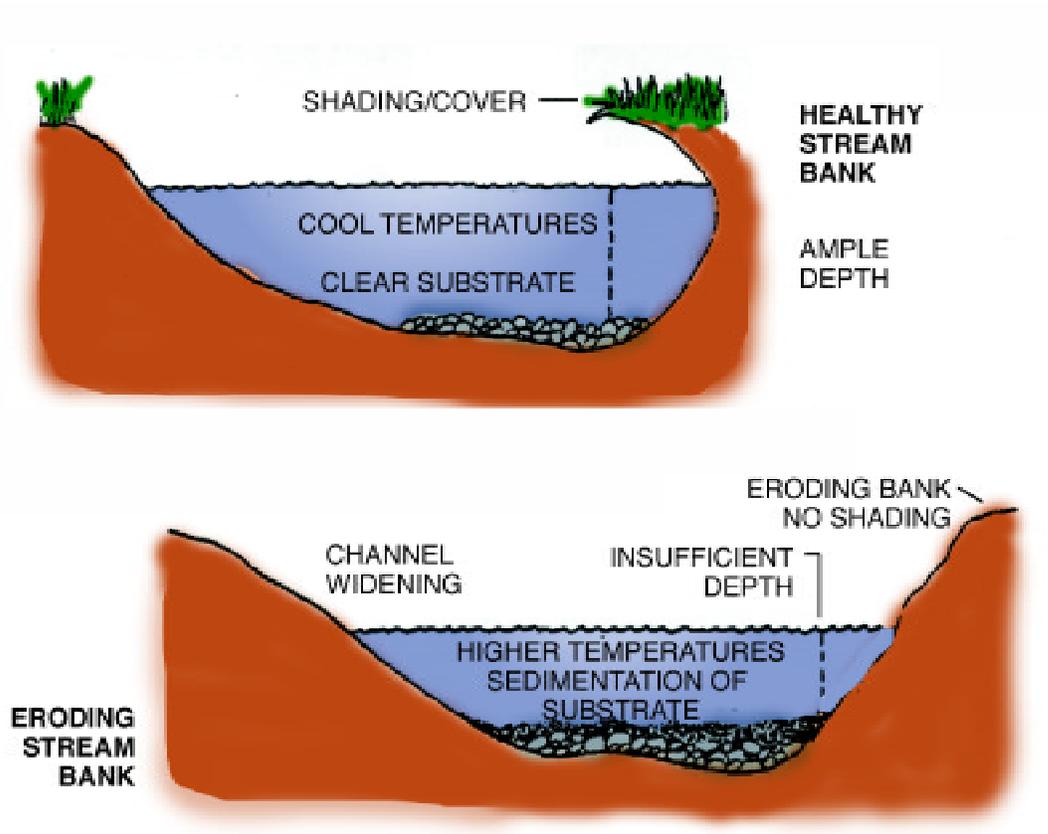
9771 Clairemont Mesa Blvd., Suite A  
San Diego, California 92124  
619-467-2952 ☎

---

## E N V I R O N M E N T A L I M P A C T S

- When raindrops strike bare soil, fine particles and organic matter are dislodged and transported in storm water flows. With the structure of the soil broken down, a hard crust often forms when the soil dries. This crust inhibits water infiltration and plant establishment, consequently increasing the volume of runoff and the potential for erosion in the future.
- Eroded soil contains nitrogen, phosphorous and other nutrients. When carried into water bodies in storm water runoff, these nutrients trigger algae growth with the effect of reducing water clarity, creating odors, depleting oxygen and leading to fish kills.
- Excessive deposition of sediments in streams “paves” stream bottoms, blankets the bottom fauna, and destroys fish habitat and spawning areas.
- Turbidity (cloudiness) from sediment reduces in-stream photosynthesis, leading to reduced food supply and habitat, and upsetting the food chain.





**BENEFITS OF A HEALTHY STREAM BANK  
VERSUS AN ERODING BANK**

---

## PLANNING FOR EROSION CONTROL

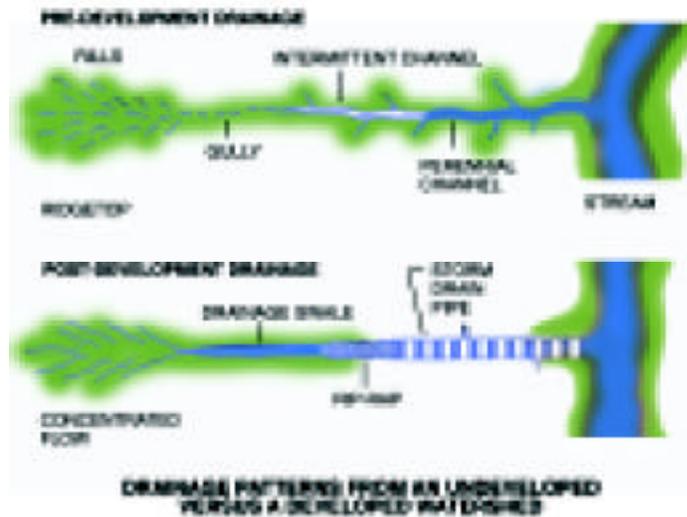
### IMPACTS OF CLEARING AND GRADING

When a site is prepared for construction, clearing and grading practices eliminate vegetation and smooth over the depressions and gullies that are part of a natural landscape.

In an altered landscape, streamflows are delivered to receiving waters at a volume, velocity and pollutant concentration (especially sediment) dramatically greater than would occur in the natural environment. Flows in a developed watershed encounter little or no surface flow infiltration or pollutant filtration. Instead they travel quickly and directly to storm drain collectors, and then discharge directly into streams with equally large volumes and velocities.

Clearing and grading practices upstream therefore increase the potential for erosion in downgradient property areas.

Minimum-disturbance activities (such as preservation of vegetation and grade) are preferable to structural control measures because they protect and preserve the natural drainage system. Natural drainage is the most effective means of filtering sediment and pollution and regulating the volume of runoff from land surfaces to adjacent streams. In addition, preservation and minimum-disturbance activities are more cost effective than re-vegetation practices or structural controls—especially over the long term.



Clearing and grading activities are usually regulated at the local level through a variety of ordinances including erosion and sediment control requirements, clearing and grading requirements, steep slope requirements, tree preservation requirements and natural resource protection ordinances.

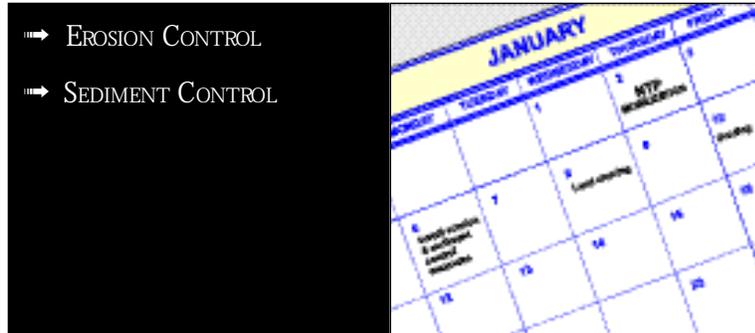
---

## BENEFITS OF MINIMUM DISTURBANCE ACTIVITIES



---

## S C H E D U L I N G



- Purpose:* The project schedule should sequence construction activities with the installation of erosion and sediment control measures. The purpose is to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking and to perform the construction activities and control practices in accordance with the planned schedule.
- Application:* All projects involving land-disturbing activities.
- Limitations:* None identified.
- Inspection and Maintenance:*
- Incorporate the use of a schedule or flow chart to layout the construction plan.
  - Work out the sequencing and timetable for the starting and completion of each item such as site clearing, grading, excavation, pouring foundations, installing utilities, etc.
  - Incorporate erosion and sediment control items in construction schedule.
  - Avoid or minimize land disturbing activities scheduled between October and April 1st. Extra precautions (BMP's) should be implemented to protect the site from erosion.
  - Schedule major grading operations in dry-weather months (April thru October).
  - Allow enough time before rainfall begins to stabilize soil with vegetation or physical means or to install temporary sediment trapping devices.

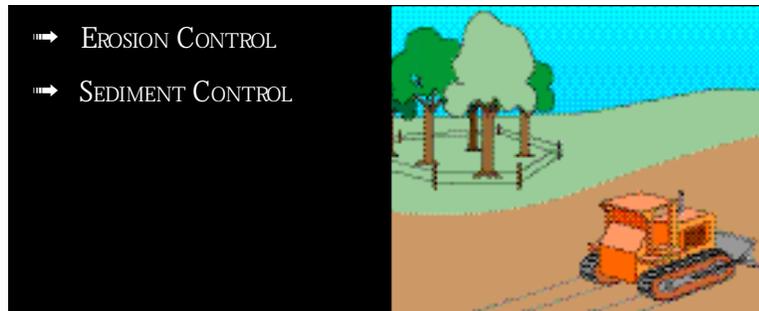
- 
- Erosion may be caused during dry seasons by unseasonal rainfall, wind, and vehicle tracking. Maintain site stabilization year-round, and keep wet-season sediment trapping devices in operational condition.
  - Whenever possible, schedule work to minimize the extent of site disturbance at any one time.
  - Incorporate staged revegetation of graded slopes and installation of geotextile blankets as work progresses.
  - Sequence trenching activities by closing open portions before new trenching begins.

*Inspection and  
maintenance:*

- ➡ Routinely verify that work is progressing in accordance with the *Maintenance* project schedule. If progress deviates, take corrective actions.
- ➡ When changes to the project schedule are unavoidable, amend the sequence schedule well in advance to anticipate potential problems and maintain control.

---

## PRESERVATION OF EXISTING VEGETATION



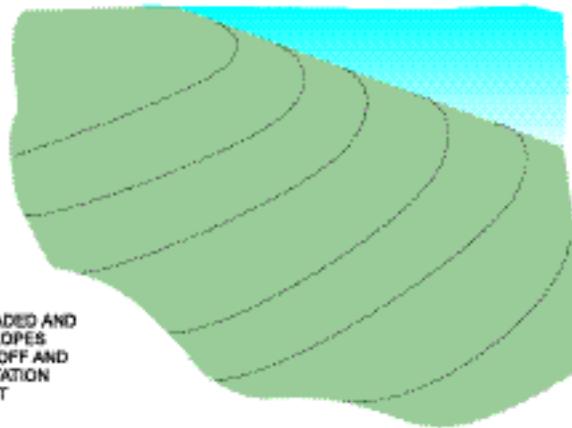
- Purpose:* Protection of plants and trees in any area subject to land-disturbing activities is beneficial and should be attempted wherever possible. Existing vegetation serves as an effective form of erosion and sediment control, and provides watershed protection, landscape beautification, dust control, pollution control, noise reduction, and shade cover.
- Application:*
- Appropriate to all types of construction sites
  - Floodplains
  - Wetlands
  - Streambanks
  - Steep slopes
  - Areas where construction will occur at a later date
  - Sensitive habitat areas where natural vegetation exists
- Limitations:*
- ✦ Protection of existing vegetation requires planning, and may constrict the area available for construction activities.
- Timing:* Efforts to preserve existing vegetation should be made before site disturbance begins.
- Installation Guidelines:*
- ➔ Areas not to be disturbed must be clearly marked with construction fencing at all times and communicated to contractors.
  - ➔ Any damage to the area must be repaired immediately in accordance with the landscaping plan.

---

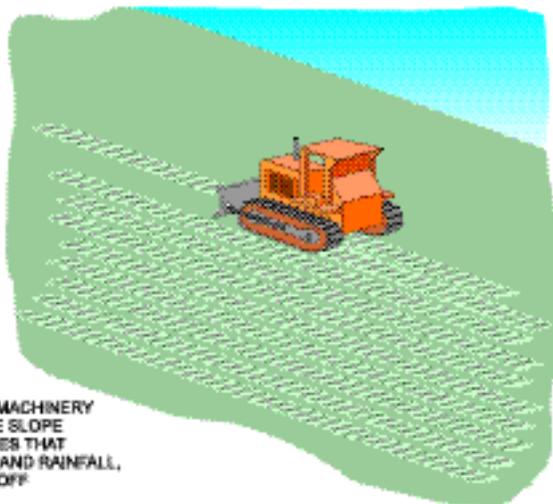
## S L O P E   G R A D I N G



- Purpose:* Roughening and terracing are techniques for creating unevenness on bare soil by creating furrows across slopes, creating stair-steps, or by tracking the soil surface. Surface roughening or terracing reduces erosion potential by decreasing runoff velocities, trapping sediment, and increasing infiltration of water into the soil.
- Application:*
- All construction slopes require surface roughening or terracing of some kind to facilitate the long-term stabilization of vegetation.
  - Where surface roughening will benefit seeding, planting, and mulching.
  - Graded areas with smooth and hard surfaces.
  - Where slope length needs to be shortened by terracing. Terracing is usually permanent, and should be designed based on site conditions and under the direction and approval of a registered civil engineer.
- Limitations:*
- ⚠ Roughening may increase grading costs and result in sloughing in certain soil types.
  - ⚠ Sole reliance on roughening for temporary erosion control is of limited effectiveness in intense rainfall events. Roughening should be used in conjunction with temporary erosion control measures, such as seeding and mulching.
  - ⚠ Stair-step grading may not be practical for sandy, steep, or shallow soils.
- Inspection and Maintenance:*
- ➡ Periodically check seeded, planted and mulched slopes for rills and gullies, particularly after significant storm events. Fill these areas slightly above the original grade, then reseed and mulch as soon as possible.



SMOOTHLY GRADED AND  
COMPACTED SLOPES  
INCREASE RUNOFF AND  
REDUCE VEGETATION  
ESTABLISHMENT

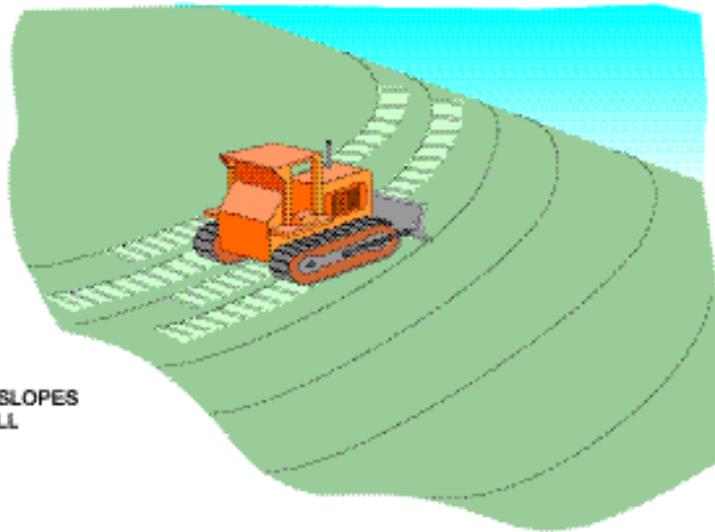


"TRACKING" WITH MACHINERY  
UP AND DOWN THE SLOPE  
PROVIDES GROOVES THAT  
WILL CATCH SEED AND RAINFALL,  
AND REDUCE RUNOFF

**TRACKING**



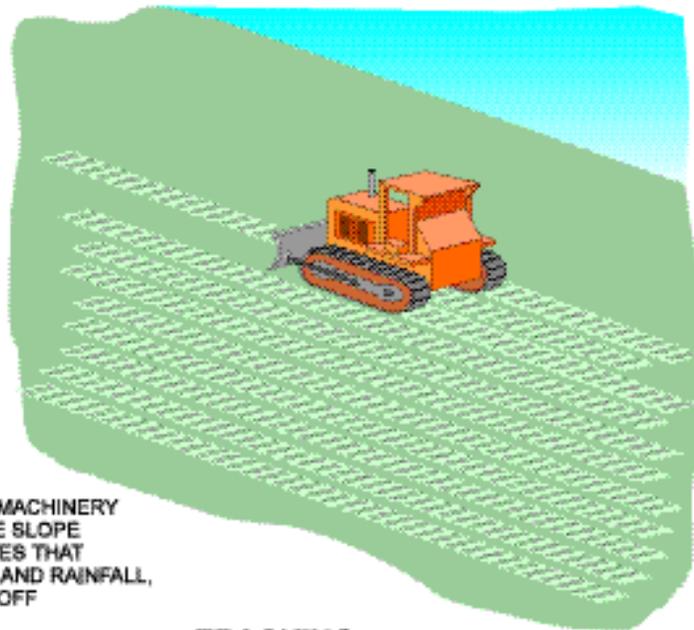
**DON'T**



**DO NOT TRACK SLOPES  
ACROSS THE HILL**

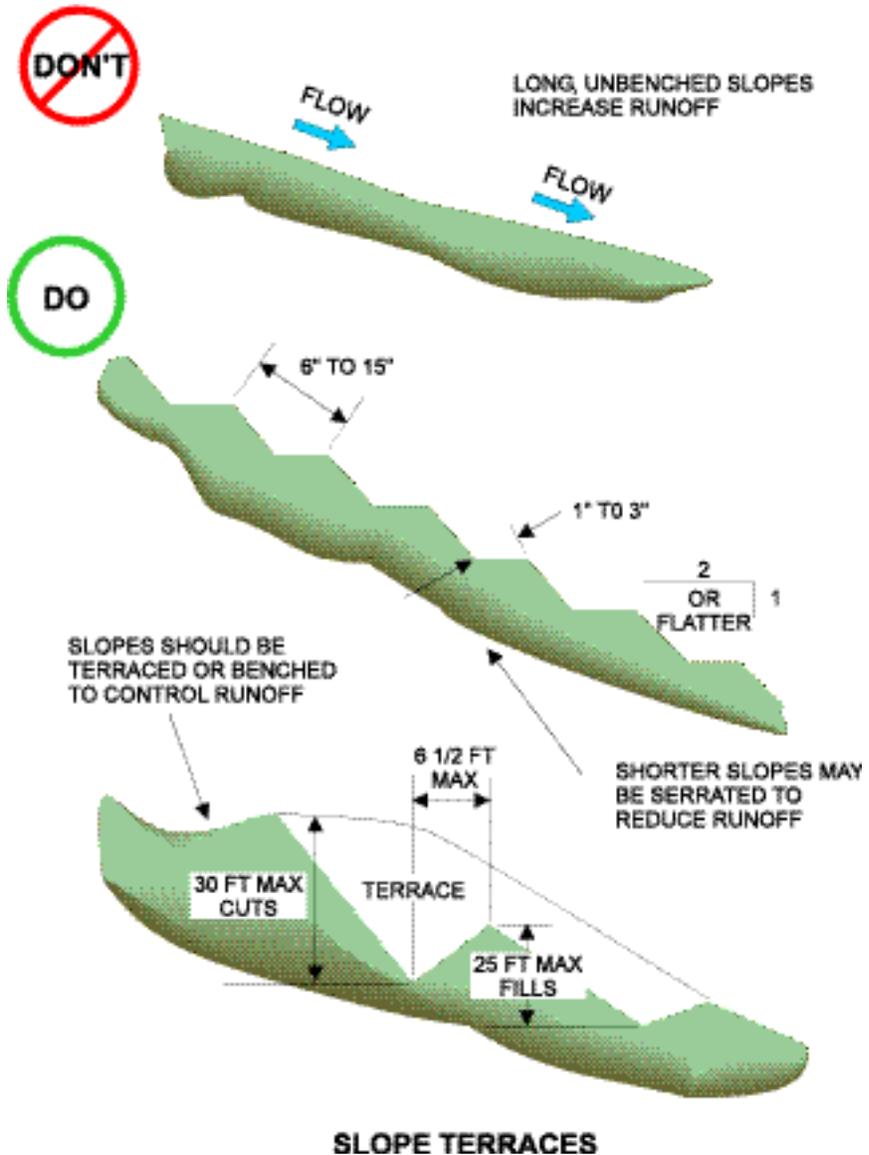


**DO**

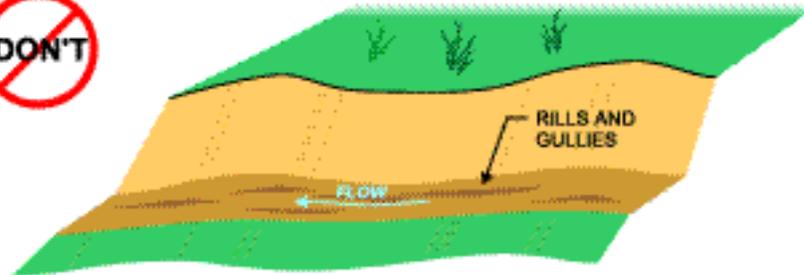


**"TRACKING" WITH MACHINERY  
UP AND DOWN THE SLOPE  
PROVIDES GROOVES THAT  
WILL CATCH SEED AND RAINFALL,  
AND REDUCE RUNOFF**

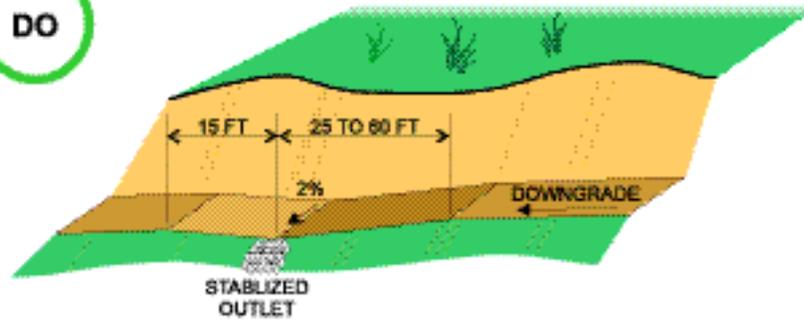
**TRACKING**



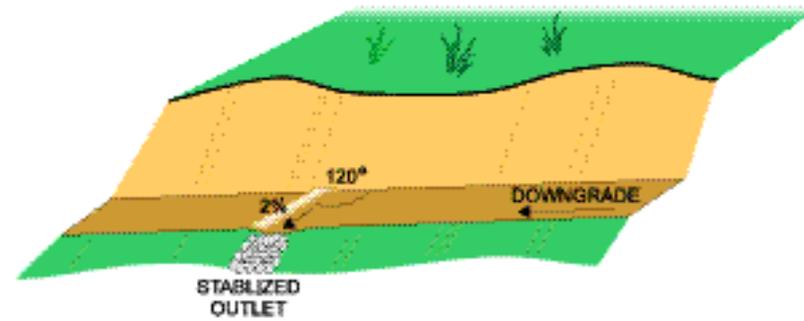
**DON'T**



**DO**



ROLLING DIPS AND WATERBARS  
CONVEY RUNOFF TO A STABLE OUTLET



**ROAD DRAINAGE**

---

## TEMPORARY SEEDING AND MULCHING



- Purpose:* The purpose of temporary vegetative protection is to reduce erosion by establishing quick growing plants to stabilize disturbed areas which will not have permanent landscaping installed for a period of time or which may be redisturbed at a later date. Generally inexpensive and easy to do.
- Application:*
- Construction projects where exposed soils require temporary erosion protection.
  - Disturbed areas requiring temporary protection until permanent landscaping is established.
  - Disturbed areas that must be redisturbed following an extended period of inactivity.
- Limitations:*
- ⚠ If the site is susceptible to erosion, additional control measures may be necessary during the establishment of vegetation. Frequent inspection is necessary.
  - ⚠ Grasses may require regular maintenance and uncut dry grass may present a fire hazard.
  - ⚠ Temporary seeding for stabilization of steep slopes may be difficult without additional erosion measures such as blankets, matrices, matting, or other effective technique.
- Inspection and Maintenance:*
- ➔ All seeded areas must be inspected for failures during the rainy season and repaired immediately by temporary mulching or other revegetation practices.

---

## PERMANENT SEEDING AND MULCHING



*Purpose:*

The purpose of permanent seeding and planting is to establish a permanent perennial vegetative cover on areas that have been disturbed by construction. The establishment of permanent vegetation is beneficial for long-term aesthetics, reduces erosion by slowing runoff velocities, enhances infiltration and transpiration, traps sediment and other particulates, protects soil from raindrop impact, and provides habitat for wildlife. Relatively inexpensive.

*Application:*

- Cut and fill areas
- Slopes
- Waterways
- Buffer strips
- Landscape corridors
- Stream banks

*Limitations:*

- ⚠ May require irrigation to establish vegetation during dry weather or drought.
- ⚠ If the site is susceptible to erosion, additional control measures may be necessary during the establishment of vegetation.

*Inspection and Maintenance:*

- ➡ If soil moisture is deficient, new vegetation should be supplied with supplemental water until firmly established.
- ➡ Cutting or mowing grasses will encourage the establishment and spread of the grass.
- ➡ All seeded areas should be inspected for failures and reseeded, fertilized, and mulched within the planting season, using half the original application rates.

---

## H Y D R O M U L C H I N G - H Y D R O S E E D I N G



*Purpose:*

To temporarily or permanently stabilize disturbed soils, to protect the soil surface from raindrop impact, to increase infiltration, to conserve moisture, to prevent soil compaction or crusting and to decrease runoff. Mulching also fosters growth of vegetation by protecting the seeds from predators, reducing evaporation and insulating the soil. The terms *hydroseeding* and *hydro-mulching* are often used interchangeably to describe a planting technique that employs a wet slurry of seed, mulch fiber, fertilizer and water and allowing for rapid plant growth on disturbed areas.

*Application:*

- ⇔ Mulch is mixed in the tank along with water, seed and fertilizer. When sprayed on the ground, it forms a continuous blanket that protects the seeds by holding them in place and by retaining soil moisture.
- ⇔ Coverage consistency is the most important thing. Each sprayed area should look about the same.
- ⇔ On steep slopes greater than 2.5:1, or where applied mulch is susceptible to movement by wind or water, the mulch should be hydraulically applied or the straw mulch should be appropriately anchored. Hydraulic fiber mulches and/or tackifying agents are used effectively to bind the straw together and prevent displacement by wind and rain.

*Applicable*

*Materials:*

- vegetable fibers (straw, hay)
- wood bark chips
- hydraulic mulches made from recycled paper
- hydraulic mulches made from wood fiber
- hydraulic matrices (Bonded Fiber Matrix)

---

*Description and  
Limitations.*

**Vegetable Fibers (Hay or Straw):** Primarily used as temporary or permanent measures for stabilizing disturbed areas. Potential for introduction of weed seed and unwanted plant material in sensitive areas. Most critical limitation is that where straw blowers are used to apply mulch, areas for treatment must be within 45 m (150 ft) of a road or surface capable of supporting large vehicular traffic. Of the two types of mulch (hay versus straw), straw is the preferred alternative.

**Wood/Bark Chips:** Primarily used in disturbed areas as a temporary ground cover around trees, shrubs and landscape plantings. Erosion control effectiveness unknown but considered poor. Chips are difficult if not impossible to anchor on steepened slopes and may be blown by high winds. Shredded products tend to hold together better than chips, and stay on slopes better and are less subject to wind erosion. Does not withstand concentrated flow and is prone to sheet erosion. May absorb nutrients necessary for plant establishment/growth.

**Hydraulic Mulches (made from recycled paper):** Rapid method for applying seed and fertilizer in almost any disturbed area. Good delivery mechanism for even dispersal of hydraulically-applied seeds. Short fiber length and lack of tack-ifier limits erosion control effectiveness and does little to moderate moisture and temperature in soils. Residual inks contained in mulch can be a potential problem in environmentally sensitive areas. Longevity significantly less than that of wood fiber mulches.

**Hydraulic Mulches (made from wood fiber):** Mulches derived from whole wood chips are the industry standard and provide a quick and uniform method and medium for planting large areas quickly and economically. With longer fiber length than paper mulch, wood fibers persist longer and offer better wet-dry characteristics than paper (cellulose) mulches. Provides limited erosion control protection, even with tackifier and moderate moisture and soil temperature when applied at higher rates.

**Hydraulic Matrices (Bonded Fiber Matrix):** This “mulch related” category includes hydraulic slurries composed of wood fiber, cellulose fiber or a combination, held together by the chemical bond, a mechanical bond, or a combination of the two. Rather than mix components from various manufacturers, all fibers and binding agents are contained in one bag to ensure uniformity and consistency throughout the project.

Well suited for sites with existing desirable vegetation and where worker safety and minimal disturbance of the site are desirable. Advantages are application using standard hydraulic seeding equipment forming a coverage and erosion control performance equivalent to rolled erosion control blankets, but more quickly. Chemically bonded products often require cure time (drying time) to be effective and limit application to dry soils where there is no threat of rainfall within 48 hours. However, mechanically bonded fiber matrices do not require *cure time* and are effective immediately on application.

---

*Installation  
Guidelines:*

⇒ **Vegetable Fibers (Hay or Straw)** : Loose hay and/or straw are the most common mulch materials used in conjunction with direct seeding of soil. Mulching is generally the second part of a multi-step process that should be implemented as follows:

- Apply seed and fertilizer to the bare soil (optional).
- Apply loose hay or straw over the top of the seed/fertilizer at a rate of 4,500 kg/ha (2 tons/ac) either by machine or by hand distribution. Straw is preferable to hay.
- Anchor the mulch in place by using a tackifier, netting, or crimp it into the soil mechanically.

Methods for holding the mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity. Crimping straw or hay into the soil is the best way to anchor it in place:

- On small areas, a spade or shovel can be used.
- On slopes with soils which are stable and can safely support construction equipment without contributing to compaction and instability problems, straw or hay can be “punched” into the ground using a knife-blade roller or a straight-bladed coulter, known commercially as a “crimper.”
- On small areas and/or steep slopes, straw or hay can also be held in place using plastic netting or jute. The netting should be held in place according to manufacturer’s specification.
- For steep slopes or large areas, straw/hay should be held in place using appropriate tackifiers until vegetation is established.

⇒ **Wood/Bark Chips:** Suitable for areas that will not be mowed closely or for ground cover in ornamental or landscape plantings.

- The mulch should be evenly distributed across the soil surface to a depth of 50 mm (2 in) to 75 mm (3 in).
- Should be distributed by hand (although pneumatic methods are currently being developed).
- Soils must be tested before application and a minimum of 6 kg of nitrogen per metric ton of mulch (12 lbs of nitrogen per ton of mulch) must be added to prevent nutrient deficiency in plants.

- 
- ⇔ **Hydraulic Mulches (made from recycled paper):** This mulch is made from recycled newspaper, magazine, or other waste paper sources.
    - The mulch should be mixed with seed, fertilizer, and tackifier as specified and applied at a rate recommended by the manufacturer in order to achieve uniform, effective coverage.
  - ⇔ **Hydraulic Mulches (made from wood fiber):** This mulch is manufactured from wood waste from lumber mills or from urban sources.
    - The mulch is mixed with seed and fertilizer as specified and applied at a rate recommended by the manufacturer in order to achieve uniform, effective coverage and provide adequate distribution of seed.
  - ⇔ **Hydraulic Matrices (Bonded Fiber Matrix):** This mulch category includes hydraulic slurries composed of wood fiber, paper fiber or a combination of the two held together by a binding system.

A hydraulic matrix is applied as aqueous slurry (with seed) using standard hydroseeding equipment to provide immediate dust control, temporary erosion control, and stabilization until permanent vegetation is reestablished.

Another category of hydraulic matrices is known as a **Bonded Fiber Matrix (BFM)**. Rather than mix components from various manufacturers to create a hydraulic matrix, all fiber and binders are contained in one bag. A typical construction specification and application for a BFM is as follows:

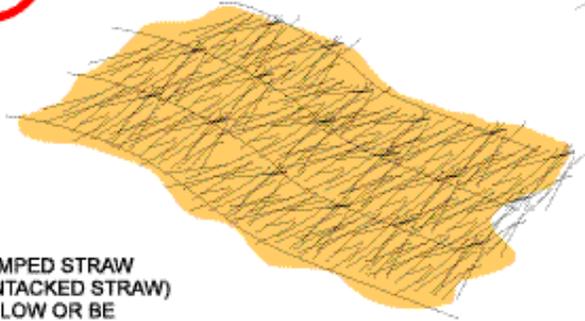
Bonded Fiber Matrix shall be a commercially manufactured product designed specifically for such use. The BMF shall be a mixture of long wood fibers and various bonding agents that, when hydraulically applied, produce a sprayed-in-place matrix that:

- Does not dissolve or disperse upon rewetting.
- Contains no germination or growth inhibiting factors.
- Forms no water insensitive crust.

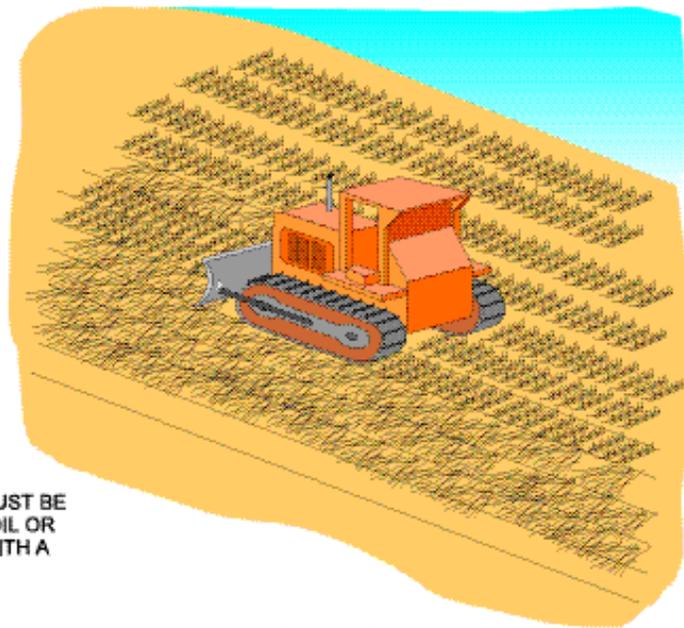
- 
- The BMF should be applied at rates from 3,400 kg/ha (3,000 lbs/acre) to 4,500 kg/ha (4,000 Lbs/Acre) and based on manufacturer's recommendation.
  - The BMF shall be a hydraulic matrix which when applied and upon drying, adheres to the soil to form a 100% cover which is biodegradable, promotes vegetation, and prevents soil erosion.
  - The BMF shall not be applied immediately before, during, or immediately after rainfall so that the matrix will have an opportunity to dry for 24 hours after installation.

*Limitations:*

- ⚠ Hydraulic mulch application rates beyond 2,500 pounds may interfere with germination and are not usually recommended for turf establishment.
- ⚠ Like any seedbed, the site should be kept moist, not wet, through the first few weeks or until the grass is established.
- ⚠ If mulch is utilized as part of a revegetation strategy, then a balance needs to be struck between the degradation of the mulch and the emergence of vegetation over time. In other words, where vegetation is the ultimate cover, maintenance and inspection should focus on the quality and diversity of vegetation establishment through the mulch.



UNCRIMPED STRAW  
(OR UNTACKED STRAW)  
WILL BLOW OR BE  
WASHED AWAY



STRAW MULCH MUST BE  
CRIMPED INTO SOIL OR  
HELD IN PLACE WITH A  
LIQUID TACKIFIER

**STRAW MULCH**

---

## D U S T   C O N T R O L



*Purpose:*

Stabilizing materials are applied to the disturbed soil surface to prevent the transport of soil from exposed surfaces on construction sites either by wind or storm water runoff.

Dust control measures may consist of either chemical, structural or mechanical measures. Examples are shown in Table 1.

*Application:*

- Dust control should be practiced on all construction sites with exposed soils as needed.
- Dust control is particularly important in windy or wind-prone areas.
- Sites with silt and clay soils are particularly prone to dust.
- Dust control is considered a temporary measure and as an intermediate treatment between site disturbance and construction, paving, or revegetation.

*Limitation:*

- ⚠ Dust control measures are temporary in nature and require reapplication.
- ⚠ Chemical stabilization materials may have harmful effects on water quality if used incorrectly.
- ⚠ Excessive sprinkling with water may result in non-storm water discharge from the site.

*Inspection and Maintenance:*

- Areas exposed to excessive wind, vehicle traffic, or rain should be inspected daily.
- Reapply soil stabilizers at appropriate intervals, and based on need.

Table 1

Method	Selection	Site Preparation	Recommended Application Rate
<b>Chemicals - Inorganic</b>			
Water	<ul style="list-style-type: none"> <li>- Most commonly used practice</li> <li>- Evaporates quickly</li> <li>- Lasts less than 1 day</li> </ul>	<p>For all liquid agents:</p> <ul style="list-style-type: none"> <li>- Blade a smooth surface.</li> <li>- Crown or slope surface to avoid ponding.</li> <li>- Compact soils if needed.</li> <li>- Uniformly pre-wet at 0.14-1.4 L/m<sup>2</sup> (0.03-0.3 gal/yd<sup>2</sup>).</li> <li>- Apply solution under pressure. Overlap solution 100-300 mm (6-12 in).</li> <li>- Allow treated area to cure 0-4 hours.</li> <li>- Compact area after curing.</li> <li>- Apply second treatment before first treatment becomes ineffective, using 50% application rate.</li> <li>- In low humidities, reactivate chemicals by rewetting at 0.5-0.9 L/m<sup>2</sup> (0.1-0.2 gal/yd<sup>2</sup>).</li> </ul>	0.6 L/m <sup>2</sup> (0.125 gal/yd <sup>2</sup> ) every 20 to 30 minutes.
Salts	<ul style="list-style-type: none"> <li>- Restricts evaporation</li> <li>- Lasts 6-12 months</li> <li>- Can be corrosive</li> <li>- Less effective in low humidity</li> <li>- Can build up in soils and leach by rain</li> </ul>		<ul style="list-style-type: none"> <li>- Apply 36% solution at 1.21 L/m<sup>2</sup> (0.27 gal/yd<sup>2</sup>) or as loose, dry granules per manufacturer.</li> </ul>
<ul style="list-style-type: none"> <li>- Magnesium Chloride (MgCl)</li> </ul>	<ul style="list-style-type: none"> <li>- Restrict evaporation</li> <li>- Works at higher temperatures and lower humidity than CaCl</li> <li>- May be more costly than CaCl</li> </ul>		<ul style="list-style-type: none"> <li>- Apply 26-32% solution at 2.3 L/m<sup>2</sup> (0.5 gal/yd<sup>2</sup>).</li> </ul>
<ul style="list-style-type: none"> <li>- Sodium Chloride (NaCl)</li> </ul>	<ul style="list-style-type: none"> <li>- Effective over smaller range of conditions</li> <li>- Less expensive</li> <li>- Can be corrosive</li> <li>- Less effective in low humidity</li> </ul>		<ul style="list-style-type: none"> <li>- Per manufacturer.</li> </ul>
Silicates	<ul style="list-style-type: none"> <li>- Generally expensive</li> <li>- Available in small quantities</li> <li>- Require second application</li> </ul>		
Surfactants	<ul style="list-style-type: none"> <li>- High evaporation rates</li> <li>- Effective for short time periods</li> <li>- Must apply frequently</li> </ul>		

**Table 1 (Continued)**

Method	Selection	Site Preparation	Recommended Application Rate
<b>Chemicals - Organic</b>			
- Copolymers	<ul style="list-style-type: none"> <li>- Form semipermeable transparent crust.</li> <li>- Resist ultraviolet radiation and moisture induced breakdown.</li> <li>- Last 1 to 2 years.</li> </ul>	Same as above.	750-940 L/ha (80-100 gal/ac).
- Petroleum Products	<ul style="list-style-type: none"> <li>- Bind soil particles</li> <li>- May hinder foliage growth</li> <li>- Environmental and aesthetic concerns</li> <li>- Higher cost</li> </ul>		Use 57-63% resins as base. Apply at 750-940 L/ha (80-100 gal/ac).
- Lignin Sulfonate	<ul style="list-style-type: none"> <li>- Paper industry waste product</li> <li>- Acts as dispersing agent</li> <li>- Best in dry climates</li> <li>- Can be slippery</li> </ul>		Loosen surface 25-50 mm (1-2 in). Need 4-8% fines.
- Vegetable Oils	<ul style="list-style-type: none"> <li>- Coat grains of soil, so limited binding ability</li> <li>- May become brittle</li> <li>- Limited availability</li> </ul>		Per manufacturer.
- Spray-on Adhesives	<ul style="list-style-type: none"> <li>- Available as organic or synthetic</li> <li>- Effective on dry, hard soils</li> <li>- Form a crust</li> <li>- Can last 3 to 4 years</li> </ul>		Per manufacturer.

---

## EROSION CONTROL BLANKETS AND GEOTEXTILES



*Purpose:*

Erosion control blankets or mats are biodegradable or synthetic blankets that are used for temporary or permanent stabilization of disturbed soils at construction sites. Erosion control blankets and mats protect disturbed soil from rain and surface runoff impact, increase infiltration, decrease soil compaction and crusting, protect seeds from impact and predators, and moderate soil temperature to enhance the growth of vegetation.

*Application:*

- Slopes and disturbed soils where mulch must be anchored and other methods such as crimping or tackifying are not feasible or adequate.
- Steep slopes, generally steeper than 3:1.
- Slopes where erosion hazard is high.
- Critical slopes adjacent to sensitive areas such as streams, wetlands, or other highly valued resources.
- Disturbed soils where plants are slow to develop protective cover.
- Channels with flows from 0.6 m/s (2 fps) to 1.2m/s (4 fps).
- Channels intended to be vegetated and where the design flow velocity exceeds the permissible velocity.

*Limitations:*

- ⚠ While blankets and mats are easy to install, are biodegradable, and effective in reducing erosion and enhancing vegetative growth, they are typically more expensive than other erosion control measures due to high material and labor costs.

- 
- ⚠ Rolled blankets are not suitable for rocky sites or areas where final vegetation will be mowed. Proper site preparation, including proper soil compaction, are necessary to ensure adequate contact of the blanket/matting with the soil.
  - ⚠ Plastic sheeting is easily vandalized, easily torn, not degradable, and should be disposed of at a landfill. Plastic results in 100% runoff, increasing the potential for serious erosion problems in downgradient areas receiving increased flows. Plastic use should be limited to covering stock piles, or very small graded areas as a temporary measure and for short periods of time.

*Installation:*

Follow manufacturer's recommendations for installation. In general these will be as follows:

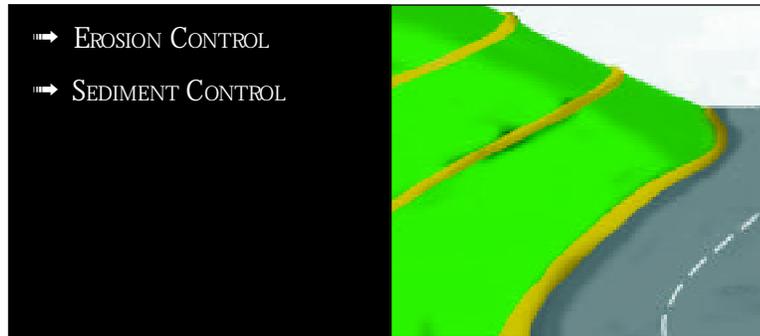
- ↔ Begin at the top of the slope and anchor the blanket in a 150 mm (6 in) deep by 150 mm (6 in) wide trench. Backfill trench and tamp earth firmly.
- ↔ Unroll blanket downslope in the direction of water flow, not horizontally.
- ↔ Overlap the edges of adjacent parallel rolls 50mm (2 in) to 75 mm (3 in) and staple every 1 m (3 ft).
- ↔ When blankets must be spliced, place blankets end over end (shingle style) with 150 mm (6 in) overlap. Staple through overlapped areas, approximately 300 mm (12 in) apart.
- ↔ Lay blankets loosely and maintain direct contact with the soil—do not stretch.
- ↔ Staple blankets sufficiently to ensure that materials will maintain direct contact with soil.

*Inspection and Maintenance:*

- ➡ Inspect all blankets and mats after installation and periodically throughout the course of construction.
- ➡ Inspect blankets and mats before and after significant rain events for erosion and undermining. Repair failures immediately.
- ➡ If washout or breakages occur, re-install or re-anchor materials only after repairing damage to the slope or channel (rills, gullies etc).

---

## F I B E R   R O L L S



*Purpose:*

Fiber rolls (sediment logs or wattles), composed of bio-degradable fibers stuffed in a photo-degradable open weave netting, are designed to reduce sediment runoff from disturbed soils into the storm drain system or watercourses. Fiber rolls are porous and allow water to filter through fibers and trap sediment, increase filtration rates, slow runoff and reduce sheet and rill erosion. Wattles also create a favorable environment for plant establishment.

*Application:*

- Along the face of exposed and erodible slopes to shorten slope length
- At grade breaks where slopes transition to a steeper slope
- In drainage swales to slow flows
- Along streambanks to assist stabilization and revegetation

*Inspection and Maintenance:*

Follow manufacturer's recommendations for installation. In general, these will be as follows:

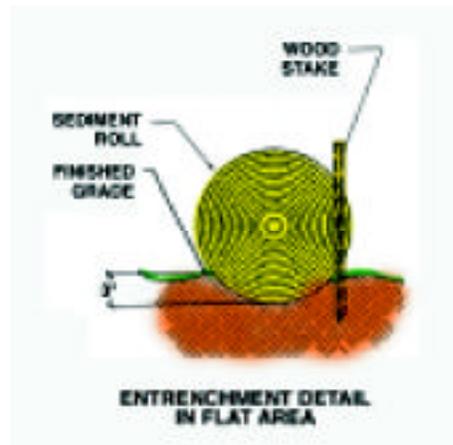
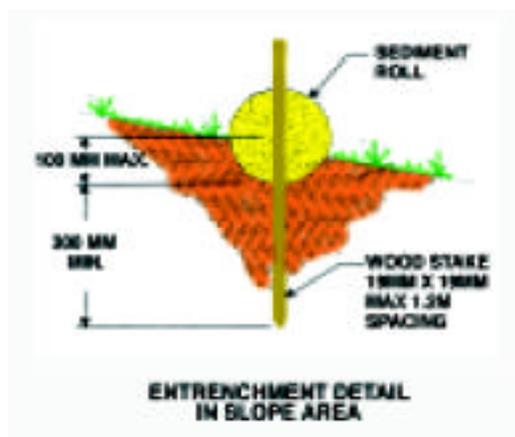
- ⇨ Fine grade the subgrade by hand dressing where necessary to remove local deviations and to remove larger stones or debris that will inhibit intimate contact of the fiber roll with the subgrade.
- ⇨ Prior to roll installation, contour a concave key trench 50 to 100 mm (2 to 4 inches) deep along the proposed installation route.
- ⇨ Soil excavated in trenching should be placed on the uphill or flow side of the roll to prevent water from undercutting the roll.
- ⇨ Place fiber rolls into the key trench and stake on both sides of the roll within 6 feet of each end and then every six inches with 1" x 2" x 23" stakes.
- ⇨ Stakes are typically driven in on alternating sides of the roll. When more than one fiber roll is placed in a row, the rolls should be abutted securely to one another to provide a tight joint, not overlapped.

*Limitations:*

- ⚠ Designed for low surface flows not to exceed 1 cfs for small areas.
- ⚠ Designed for short slopes or slopes flatter than 3:1.
- ⚠ Primary purpose is not sediment control, although do provide some sediment removal.

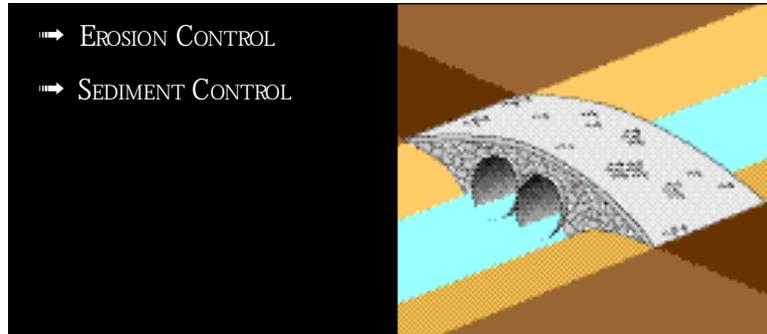
*Inspection and Maintenance:*

- ➡ Repair or replace split, torn, unraveling or slumping fiber rolls.
- ➡ Inspect fiber rolls when rain is forecast, following rain events and at least daily during prolonged rainfall. Perform required maintenance.
- ➡ In most cases, fiber rolls do not require removal and can be abandoned in place. If not excessively soiled, rolls may be removed, replaced and reused.



---

## TEMPORARY STREAM CROSSING



*Purpose:*

A temporary stream crossing is a bridge or culvert placed across a waterway to allow vehicles to cross during construction without entering the water. This structure protects sensitive areas and eliminates erosion caused by vehicles.

*Application  
Guidelines:*

- Construction sites where construction equipment or vehicles will frequently cross a waterway.
- When alternate access routes impose significant constraints such as length, narrowness, or poor soil strength.
- Where duration of construction activities is not anticipated to be longer than one year.

There are three types of temporary stream crossings:

1. Culverts—used on perennial and intermittent streams.
2. Fords—appropriate during the dry season in arid areas for dry washes and ephemeral streams.
3. Bridges—appropriate for streams with high flow velocities, steep gradients, and/or where temporary restrictions in the channel are not allowed.

---

*Limitations:*

- ✦ Will require Army Corps 404 Permit, State Board 401 Certification, and California Department of Fish and Game Streambed Alteration Agreement.
- ✦ Waterway will be disturbed during installation and removal of structure-adequate erosion protection before and during installation, and during removal required therefore.
- ✦ May require dewatering or temporary diversion of the stream.
- ✦ May become an obstruction in the waterway, constricting flood flows and causing flow backups and washouts.
- ✦ Disturbed areas must be stabilized during construction and after structure removal.

*Inspection and Maintenance:*

Inspection, at a minimum, should occur weekly during dry months and before and after each significant rain event, including:

- ➡ Checking for blockage in the channel, sediment buildup in culverts or behind fords, or trapped debris.
- ➡ Checking for erosion of abutments, channel scour, riprap displacement, or piping in the soil.
- ➡ Checking for structural weakening of the temporary crossing, such as cracks, and undermining of foundations and abutments.

Maintenance should include:

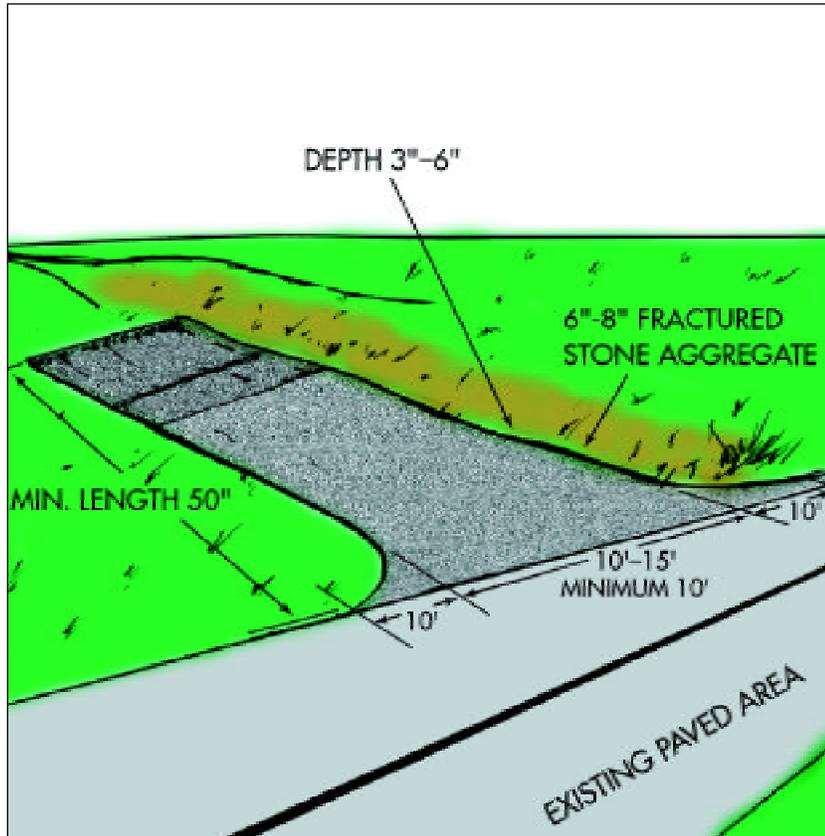
- ➡ Minimum disturbance.
- ➡ Periodic removal of silt behind fords, in culverts, and under bridges.
- ➡ Replacement of lost aggregate from inlets and outlets of culverts.
- ➡ Removal of temporary crossing promptly when it is no longer needed.

---

## STABILIZED CONSTRUCTION ENTRANCE



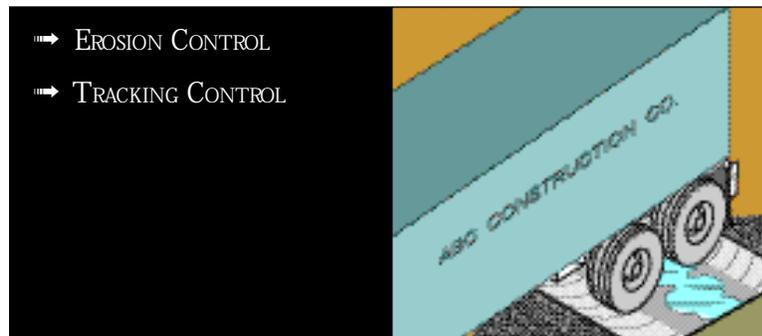
- Purpose:* Stabilizing the point of ingress/egress is an effective means of minimizing the tracking of mud and dirt onto public roads by construction vehicles.
- Application:*
- On sites where tracking onto public roads is a potential problem.
  - Site conditions will dictate design and need.
- Installation Guidelines:*
- ⇨ Properly grade entrance to prevent runoff from construction site.
  - ⇨ Route runoff from stabilized entrance through a sediment trapping device before water is discharged.
  - ⇨ Design stabilized entrance to support the heaviest vehicles which will use it.
  - ⇨ Select entrance stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions.
  - ⇨ If aggregate is selected, place a 200 mm (8 inch thick) course of aggregate over the geotextile fabric or a thickness of aggregate recommended by a soils engineer.
- Inspection and Maintenance:*
- ➡ Inspect routinely for damage and repair as needed.
  - ➡ Require that all employees, subcontractors, and suppliers utilize the stabilized construction entrance.
  - ➡ Service sediment trapping devices regularly.



length—minimum 50'  
width—minimum 10'  
(should be flared at the existing road to provide turning radius)  
depth—3" to 6"

---

## ENTRANCE / EXIT TIRE WASH



*Application:*

- On construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

*Limitations:*

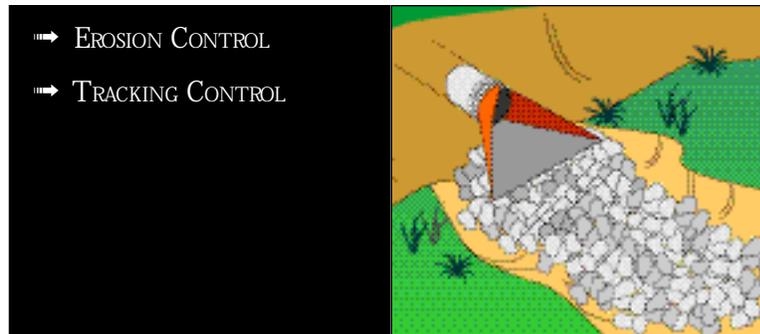
- ⚠ A wash area requires a supply of wash water as well as a turnout or double wide exit to avoid entering vehicles from having to drive through the wash area.

*Inspection and Maintenance:*

- ➡ Inspect regularly to ensure the wash area is functioning efficiently.
- ➡ Maintain exits in a working and effective condition to prevent tracking of sediment onto public roads.

---

## OUTLET PROTECTION - ENERGY DISSIPATION



*Purpose:* Physical devices placed at pipe outlets and in channels reduce the velocity and energy of concentrated storm water flows. Outlet protection helps to prevent scour and to minimize the potential for downstream erosion.

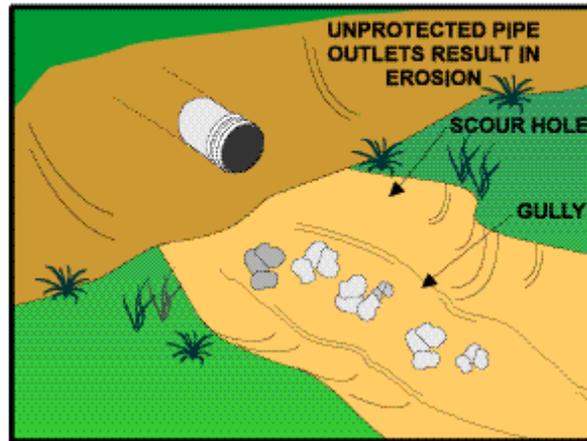
*Application:*

- Outlets of pipes, drains, culverts, conduits, or channels.
- Outlets located at the bottom of mild to steep slopes.
- Outlets of channels that carry continuous flows of water.
- Outlets subject to short, intense flows of water, such as from flash floods.
- Where lined conveyances discharge to unlined conveyances.

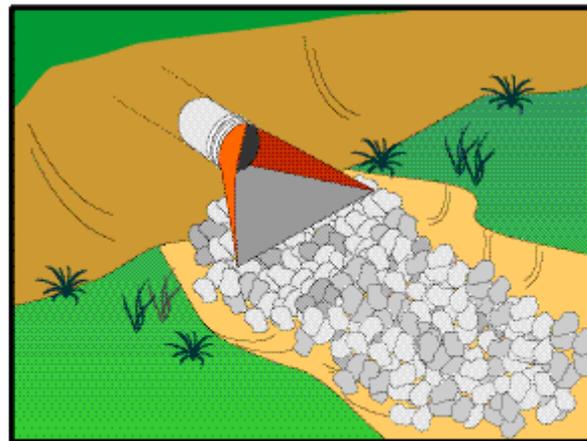
*Limitations:*

- ⚠ Require 401 Water Quality Certification (State Water Resources Control Board) and 1603 Streambed Alteration Agreement (California Department of Fish and Game). See pages 11 and 12 for more information.
- ⚠ May require frequent maintenance for rock outlets with high velocity flows.
- ⚠ Loose rocks or stones may wash away during high flows. Grouted riprap may breakup from hydrostatic pressure without adequate drainage.

**DON'T**



**DO**



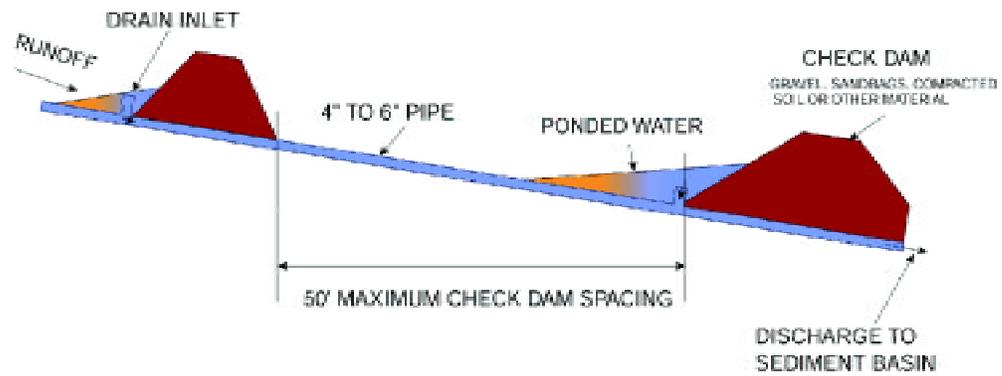
**ENERGY DISSIPATOR**

---

## C H E C K   D A M S



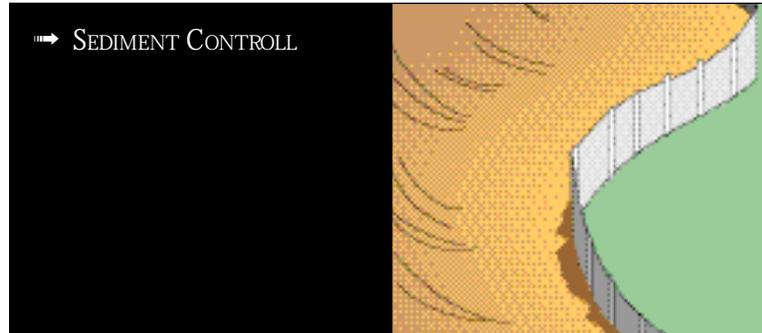
- Purpose:* A check dam is a small, temporary dam constructed of rocks, logs/timbers or gravel/sand bags and placed across a natural or man-made channel or drainage ditch. By dissipating flow velocity, check dams reduce natural drainage ditch erosion caused by storm water runoff. Check dams are often used as temporary control measures while a channel is being permanently lined with vegetation or other materials.
- Application:*
- In small open channels that drain 4 ha (10 ac) or less.
  - In steep channels where storm water runoff velocities exceed 1.5 m/s (5 fps) and must be reduced to protect against erosion.
  - During establishment of grass linings in drainage ditches/channels.
  - In temporary ditches or channels where the short length of service does not allow or warrant establishment or construction of erosion-resistant linings.
- Limitations:*
- ⚠ Not to be used in live streams.
  - ⚠ Not appropriate in channels draining areas over 4 ha (10 ac).
  - ⚠ Not to be placed in channels that are already grass lined unless erosion is expected.
  - ⚠ Require extensive maintenance following high velocity flows.
  - ⚠ Trapped sediment should be removed to prevent resuspension during subsequent storms.
  - ⚠ Not to be constructed of straw bales or silt fencing.
- Inspection and Maintenance:*
- ➡ Inspect check dams periodically before and after storm events to check for undermining.
  - ➡ Repair failures by replacing loosed materials (rocks, gravel bags, etc.).



### CHECK DAM

---

# S I L T F E N C I N G



*Purpose:*

A silt fence is a temporary barrier of permeable fabric designed to intercept and slow the flow of sediment laden sheet flow runoff. Silt fencing ponds runoff, allows sediment to settle, and releases filtered water slowly.

*Application:*

- Along the perimeter of the site.
- Along streams and channels (*NOT across streams and channels*).
- Below the toe of exposed and erodible slopes.
- Downslope of exposed soil areas.
- Around temporary soil stockpiles.

*Application Guidelines:*

- ➔ Must be constructed along a level contour or will result in the creation of rills and gullies and consequent failure.
- ➔ Limit tributary drainage area upstream of the silt fence to less than 0.3 ha/100m (0.25 ac/100 ft) of fence.
- ➔ Limit the length of slope draining to any point along the silt fence to 30m (100 ft) or less.
- ➔ Limit length of any single run of fence to 150m (500 ft).
- ➔ Turn the last 6 feet of fence up slope in “J” or “L” shapes to allow for ponding. Silt fencing must pond runoff to be effective.
- ➔ Fence segments should not be connected.
- ➔ Limit to locations suitable for temporary ponding or deposition of sediment.

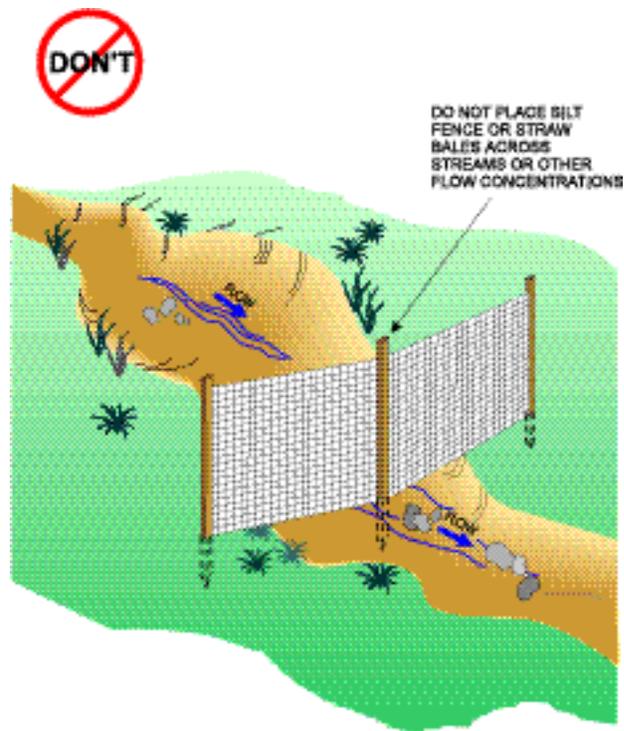
*Limitations:*

- ⚠ Do not use in streams, channels, or anywhere flow is concentrated.
- ⚠ Do not use silt fence to divert flow.
- ⚠ Do not use silt fence on slopes.

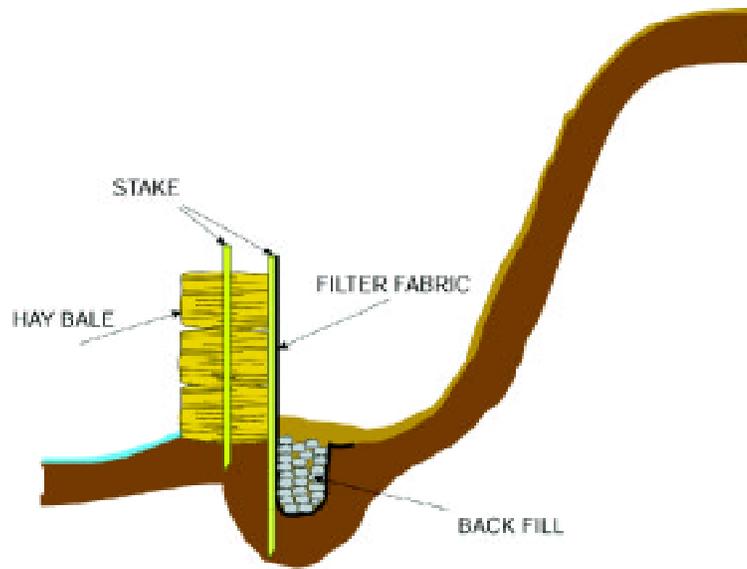
---

*Inspection and  
Maintenance:*

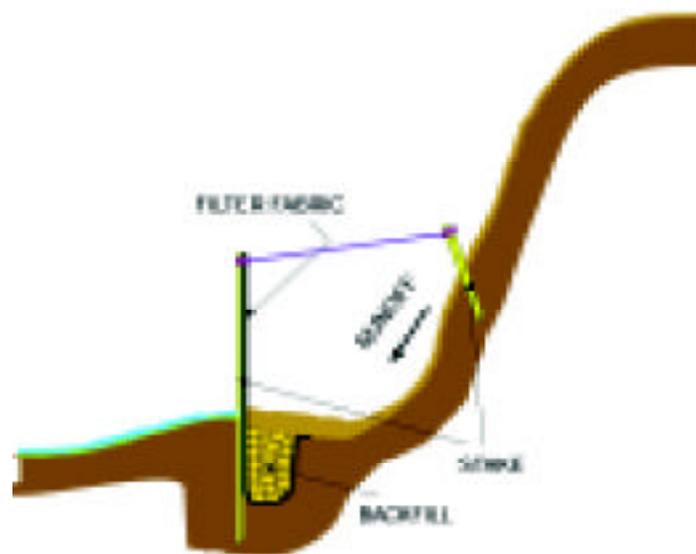
- ➔ Inspect when rain is forecast, and following rainfall events.
- ➔ Remove sediment when accumulations reach one-third fence height.
- ➔ Repair undercut silt fences, and repair or replace all split, torn, slumping, or weathered fabric.
- ➔ Remove silt fence when no longer needed.



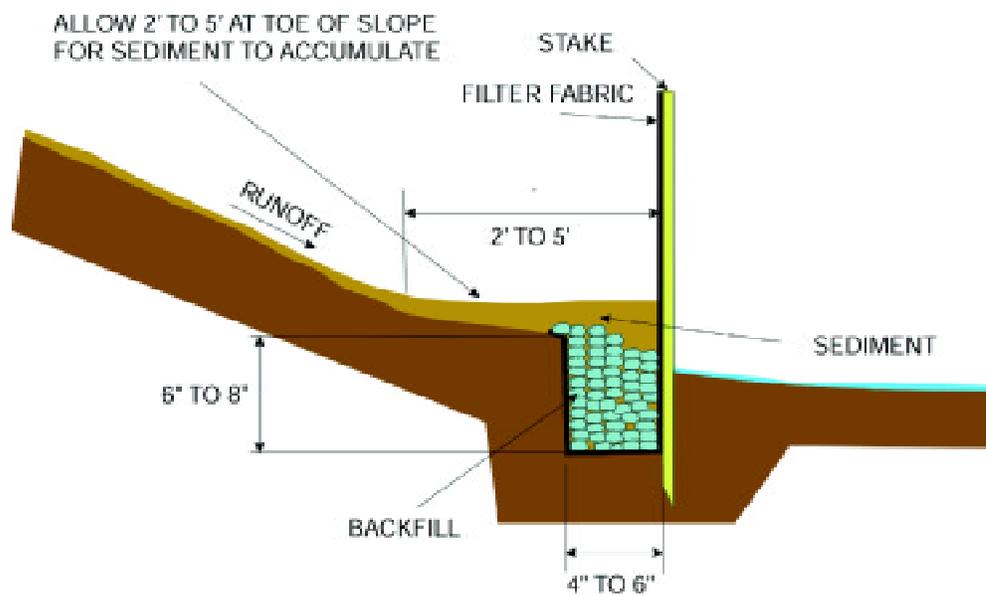
SILT FENCING PLACED ACROSS STREAMS OR OTHER FLOW CONCENTRATIONS IS INEFFECTIVE IN PONDING WATER AND LEADS TO UNDERCUTTING, GULLY FORMATION, AND FENCE FAILURE.



**STRENGTHENING**

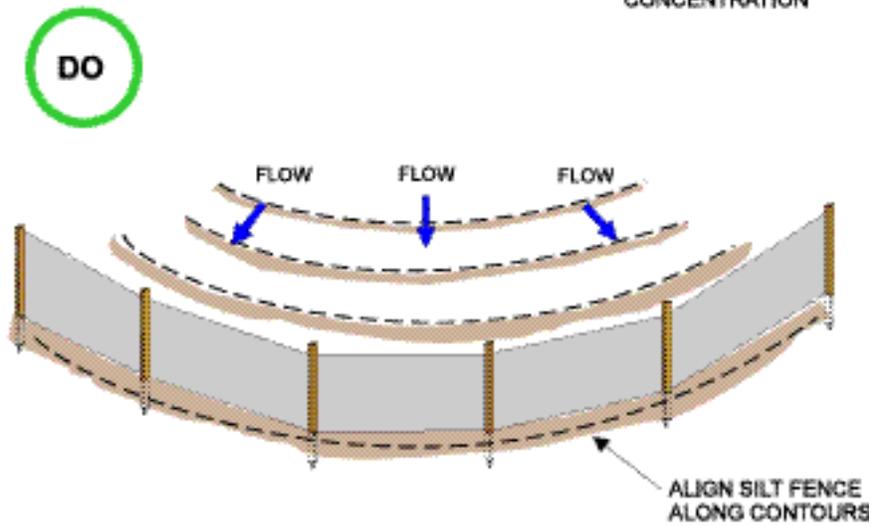
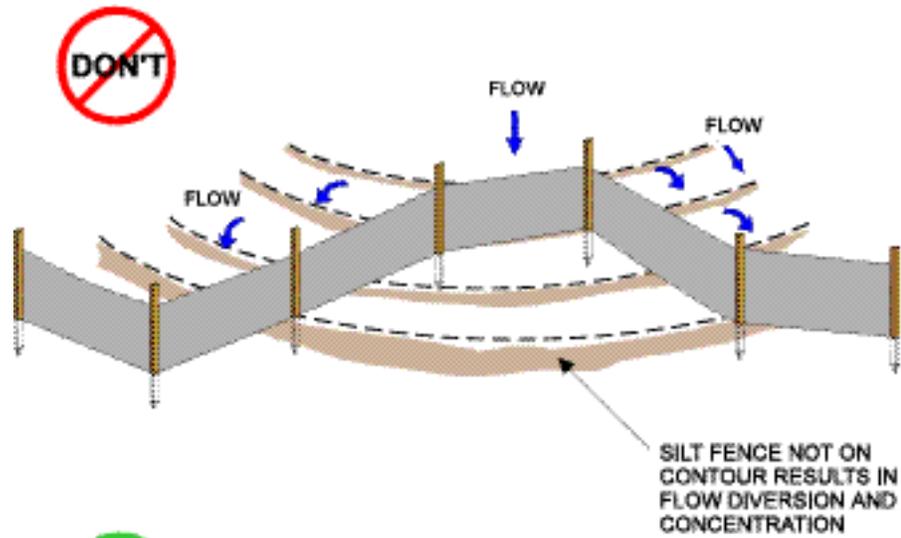


**ANCHORING**



### RECOMMENDED INSTALLATION OF SILT FENCE

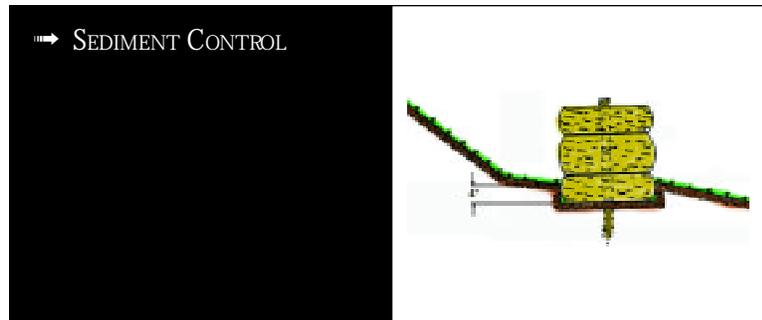
KEY IN FILTER FABRIC A MINIMUM OF 6" BELOW THE GROUND SURFACE AND 6" ACROSS, THEN BACKFILL WITH DIRT OR GRAVEL.



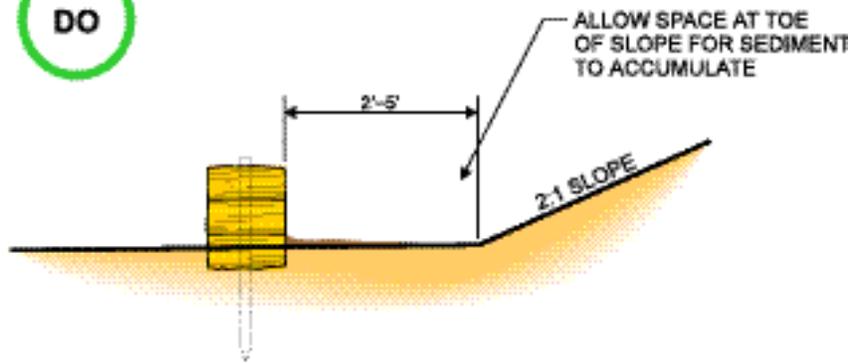
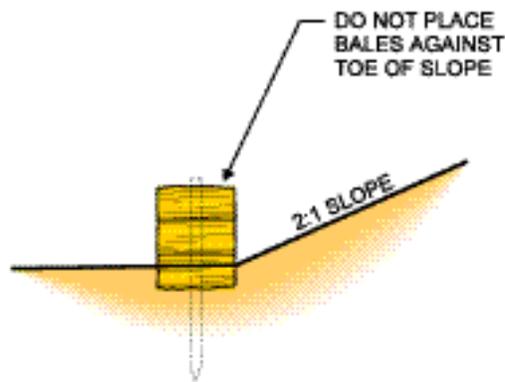
**SILT FENCE**

---

## TEMPORARY STRAW BALE DIKE



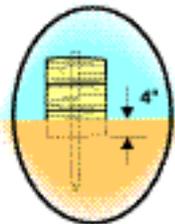
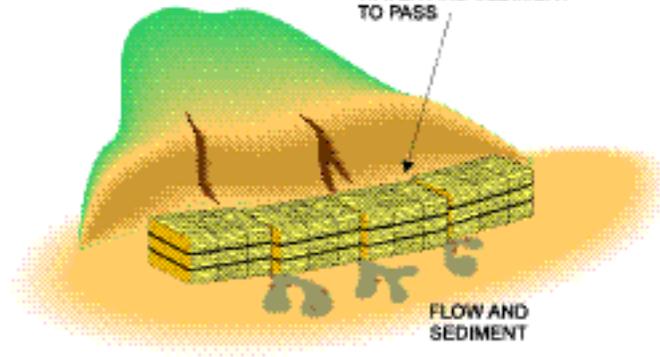
- Purpose:* Straw bales are temporary barriers which are entrenched, anchored, and installed end to end across or at the toe of a slope. Straw bale barriers are used to intercept and retain sediment in storm water runoff from unprotected areas by reducing the velocity of sheet flows and retaining sediment behind the barrier.
- Application:*
- Along the perimeter of the site.
  - Beneath flat areas which have been disturbed and are subject to sheet and rill erosion.
- Installation Guidelines:*
- ⇨ Slopes 50:1 (2%) or flatter are preferred. If the slope exceeds 10:1 (10%), the length of slope upstream of the barrier must be less than 15 m (50 ft).
  - ⇨ Limit the drainage area upstream of the straw bale barriers to 0.3 ha/100 m (0.25 ac/100 ft).
  - ⇨ Limit the slope length draining to the barrier to 30 m (100 ft).
- Limitations:*
- ⚠ Limit the use to construction activities that can be completed in less than three months.
  - ⚠ Do not use in paved areas or in areas subject to concentrated flow, channel flow, or in live streams.
- Inspection and Maintenance:*
- ➡ Inspect after each significant rainfall event, and daily during prolonged storm events.
  - ➡ Remove sediment when accumulations reach 1/3 barrier height.
  - ➡ Remove straw bale dikes when no longer necessary.



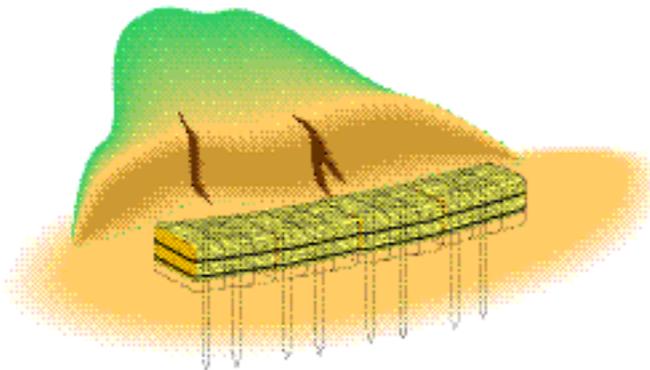
### STRAW BALE DIKE



UNEMBEDDED, UNSTAKED  
STRAW BALES ALLOW  
WATER AND SEDIMENT  
TO PASS



NOTE: EMBED  
STRAW BALE  
4" MIN. INTO  
SOIL



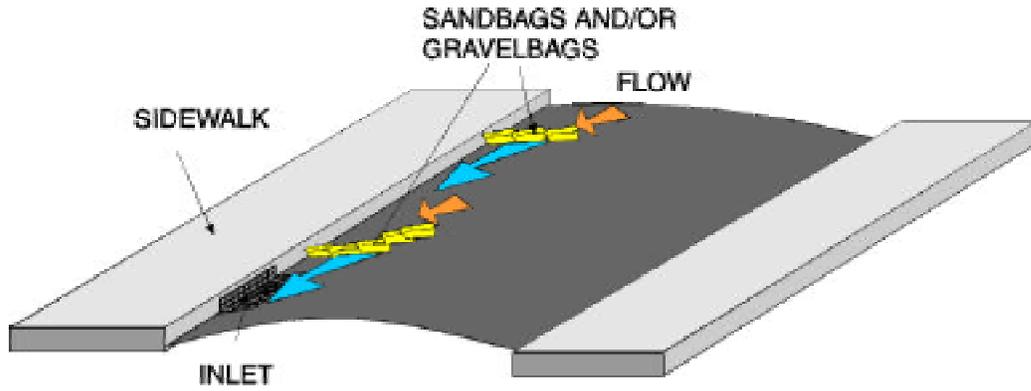
STRAW BALE DIKES WHICH ARE NOT PROPERLY ENTRENCHED ARE POWERLESS IN DISSIPATING FLOW ENERGY, INEFFECTIVE IN CAPTURING SEDIMENT AND MAY LEAD TO UNDERCUTTING AND GULLY FORMATION.

---

## SAND / GRAVEL BAG BARRIER



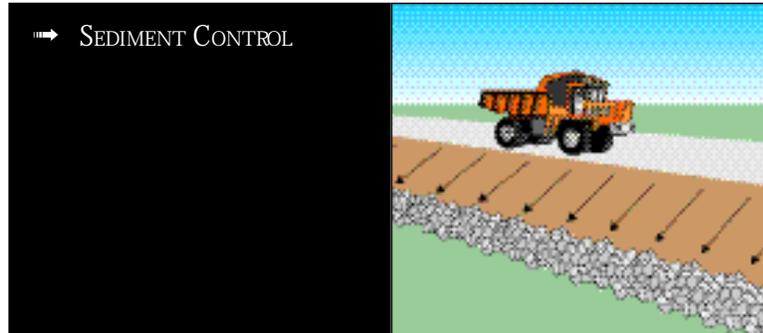
- Purpose:* A temporary berm of stacked sand or gravel bags, installed along a level contour to detain sediment-laden runoff from disturbed areas, retains the sediment, and releases the water as sheet flow. Sand bags can also be used as check dams in small ditches.
- Application:*
- Along the perimeter of the site.
  - Across channels to serve as a barrier for utility trenches or to provide a temporary channel crossing for construction equipment.
  - Parallel to roadways to keep sediment off paved areas.
  - To divert or direct flow or to create a temporary sediment basin.
  - When extended construction period limits the use of either silt fence or straw bale barriers.
  - When site conditions or construction sequencing require adjustments or relocation of the barrier to meet changing field conditions and needs during construction.
- Limitations:*
- ⚠ Limit the drainage area upstream of the barriers to 2 ha (5 ac).
  - ⚠ Installation can be labor intensive.
  - ⚠ Should not be used to detain concentrated flows.
  - ⚠ Gravel bags preferable to sand bags near storm drain inlets.
- Inspection and Maintenance:*
- ➡ Inspect before and after significant storm events
  - ➡ Remove accumulated sediment when one-third barrier height.
  - ➡ Repair washouts and other damage as needed.
  - ➡ Remove barrier when no longer needed.



SAND OR GRAVEL BAGS (PREFERRED) USED IN ROADWAYS SERVE TO DIVERT FLOW, SLOW FLOW VELOCITY, AND POND AND FILTER RUNOFF.

---

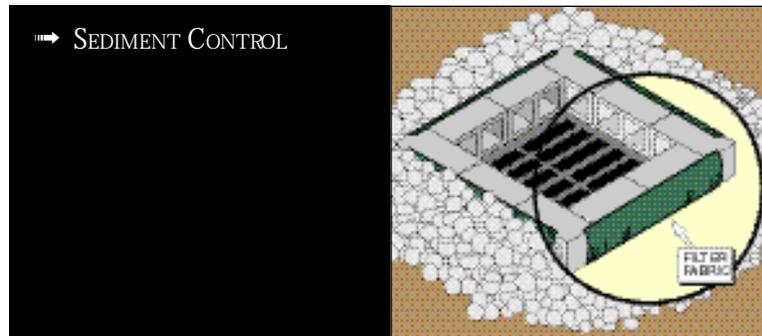
## B R U S H O R R O C K F I L T E R



- Purpose:* Effective temporary barriers are brush, wrapped in filter cloth and secured in place, or rock anchored in place to intercept and filter sediment-laden stormwater runoff from disturbed areas, retaining sediment and releasing water as sheet flow.
- Application:*
- Where contributing drain areas are less than or equal to 2 ha (5 ac).
  - Along the perimeter of disturbed areas.
  - Near the toe of slopes subject to sheet flow and rill erosion.
  - Along streams and channels.
  - Across mildly sloped construction roads (rock filter berms only).
- Limitations:*
- ⚠ Not appropriate for contributing drainage areas greater than 2 ha (5 ac).
  - ⚠ Require sufficient space for water to pond.
  - ⚠ Not effective for diverting runoff (filters allow runoff to seep through).
  - ⚠ Rock filter berms are difficult to remove.
- Inspection and Maintenance:*
- ➡ Inspect berms before and after each significant rainfall event, and weekly throughout the rainy season.
  - ➡ Reshape berms as needed and replace lost or dislodged rock, brush and/or filter fabric.
  - ➡ Inspect for sediment accumulation and remove sediment when depth reaches one-third the berm height or 300 mm (12 in), whichever occurs first.
  - ➡ Remove filter barriers upon completion of construction activities.

---

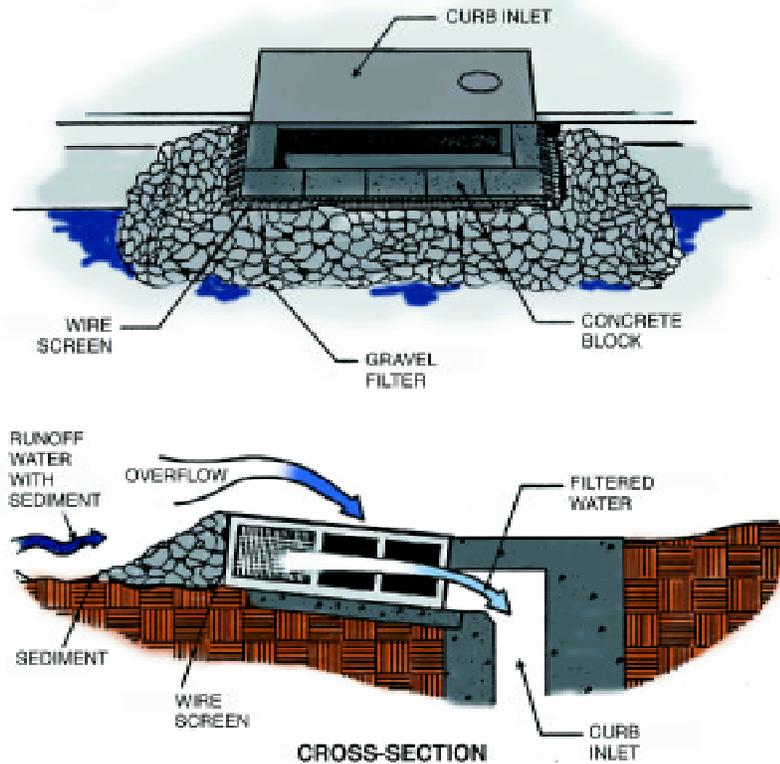
## STORM DRAIN INLET PROTECTION

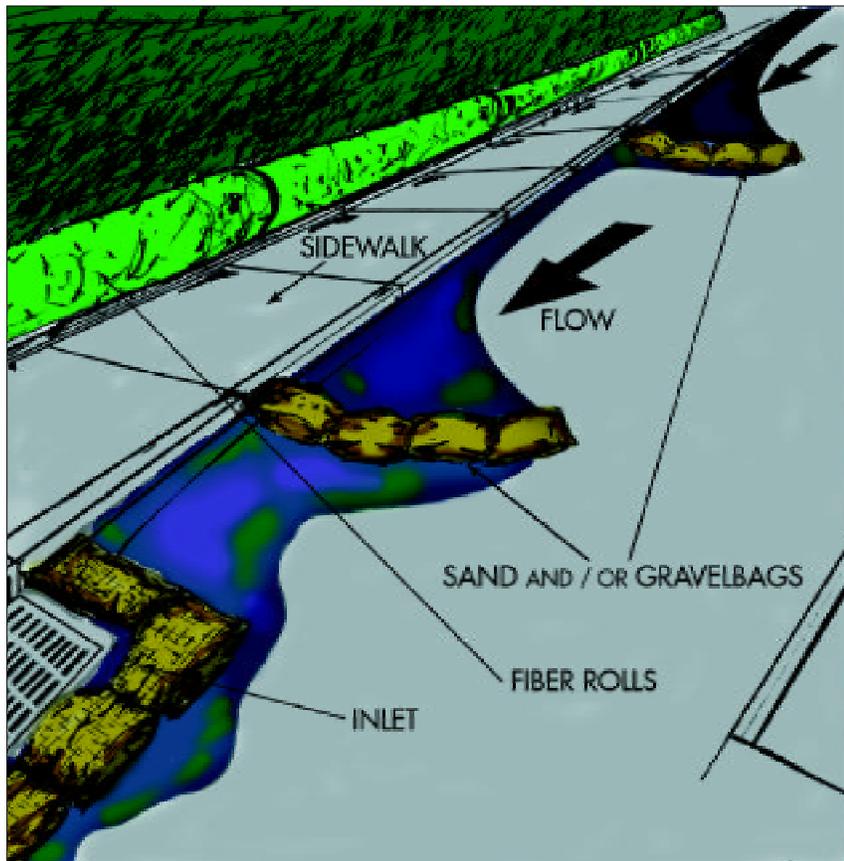


- Purpose:* Temporary devices constructed around storm drains improve the quality of water being discharged to inlets or catch basins by ponding sediment-laden runoff and increasing settling time. Appropriate for small drainage areas only.
- Application:*
- Where sediment laden surface runoff may enter an inlet.
  - Where drainage areas have not been permanently stabilized.
  - Where the drainage area is 0.4 ha (1 ac) or less.
  - Appropriate during wet seasons.
  - Appropriate in open areas subject to sheet flow and for flows not exceeding 0.014 m<sup>3</sup>/s (0.5 cfs).
  - Block and gravel bag barriers are applicable when sheet flows or concentrated flows exceed 0.014 m<sup>3</sup>/s (0.5 cfs), and it is necessary to allow for overtopping to prevent flooding.
  - Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected and overflow capability is needed.
- Limitations:*
- ⚠ Use only when ponding will not encroach into highway traffic or onto erodible surfaces and slopes.
  - ⚠ Sediment removal becomes more difficult in high flow conditions. If high flow conditions are expected, other on-site sediment trapping techniques should be used in conjunction with inlet protection.
  - ⚠ Frequent maintenance is required to minimize short-circuiting and to remove sediment deposits and buildup.

*Inspection and  
Maintenance:*

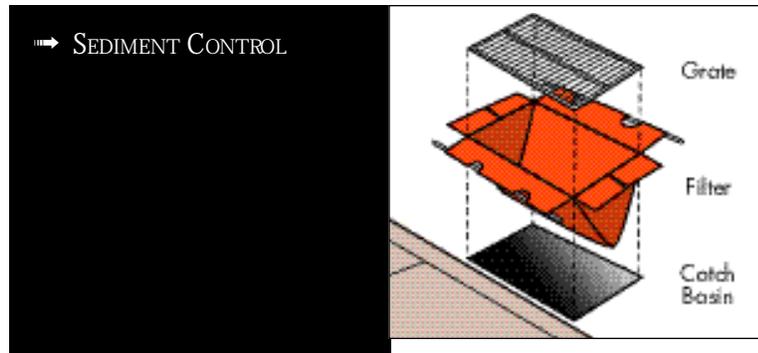
- ♣ For drainage areas larger than 0.4 ha (1 ac), runoff should be routed to a sediment trapping device designed for larger flows.
- ♣ Filter fabric should not be used to cover the inlet grate.
- ➔ Bring the disturbed area to the grade of the drop inlet and smooth and compact it. Appropriately stabilize all bare areas around the inlet.
- ➔ Properly dispose of accumulated sediment.
- ➔ Inspect all inlet protection devices before and after rainfall events, and weekly throughout the rainy season. During extended rainfall events, inspect inlet protection devices at least once every 24 hours.
- ➔ Remove all inlet protection devices within thirty days after the site is stabilized, or when inlet protection is no longer required.





---

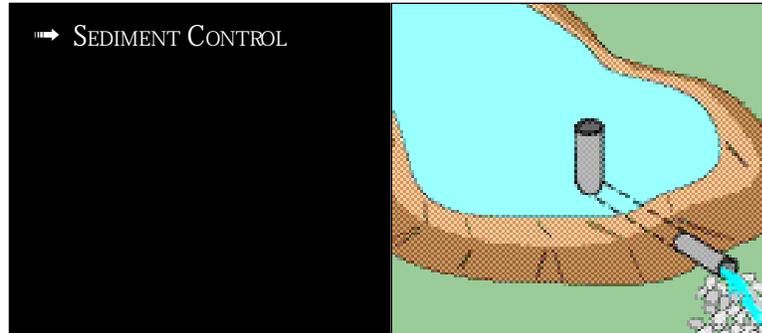
## CATCH BASIN INLET FILTERS



- Purpose: Temporary inlet filter lowered into catch basins and held in place by the grate. Designed to improve the quality of the water being discharged to inlets or catchbasins by filtering silt and sediment from runoff.
- Application:
- Construction sites with disturbed or unvegetated areas where sediment laden water can enter catchbasins or inlets
  - Where pollution of watercourses or drainage system clogging from sediment laden storm water is a concern.
- Limitations:
- ⚠ Should be used only as a secondary sediment control in conjunction with primary erosion control measures such as hydroseeding/hydro-mulching, or erosion control blankets
- Installation:
- ↔ Remove drain grate
  - ↔ Insert catch basin filter into basin leaving 3" flap exposed
  - ↔ replace grate to basin thereby pinching fabric between grate and catch basin and holding filter in place
- Inspection and Maintenance:
- ➡ Inspect catch basin filters weekly and after every rain event
  - ➡ Empty catch basin filters when filters appear to be half full
  - ➡ Dispose of trapped sediment in accordance with local requirements
  - ➡ Clean and reuse inlet filters or discard and replace as necessary.

---

## S E D I M E N T      B A S I N



- Purpose:* A sediment basin is a controlled storm water release structure, formed by excavation or by construction of an earthen embankment across a waterway or low drainage area. Sediment basins collect and temporarily detain storm water runoff to provide ample settling time before runoff is discharged.
- Application:*
- On all construction projects with disturbed areas during the wet season.
  - To prevent the sediment-laden storm water from entering streams, lakes, or drainage ways.
  - At outlets of disturbed areas.
  - Where practical, contributing drainage areas should be subdivided into smaller areas, and multiple sediment basins installed.
- Limitations:*
- ⚠ Alternative measures must be thoroughly investigated for erosion control before selecting a sediment basin.
  - ⚠ Require large surface areas to permit settling of sediment.
  - ⚠ For drainage areas greater than 40 ha (100 ac), use multiple basins.
  - ⚠ Must be designed by a registered professional civil engineer with review or approval by the overseeing agency.
  - ⚠ Require regular maintenance to remove silt deposits.
  - ⚠ Not to be located in live streams.

---

*Guidelines:*

→ Basin should be located:

- (1) where a low embankment can be constructed across a swale or excavation
- (2) where post-construction (permanent) detention basins will be constructed
- (3) where failure would not cause loss of life or property damage
- (4) in areas accessible for maintenance work, including sediment removal and sediment stockpiling in a protected area.

→ Use the following equations when sizing the sediment basin:

1)  $Q = C i A$

Where:

- $Q$  = Flow expected from the site, in cubic feet per second
- $C$  = Coefficient of runoff (typically between 0.4 to 0.7), depending on imperviousness of contributing area
- $i$  = Expected rainfall, in inches per hour
- $A$  = Contributing area, in acres

2)  $A_s = 1.2Q/V_s$

Where:

- $A_s$  = Surface area of settling basin with 2-foot of minimum depth
- $Q$  = Flow as calculated above
- $V_s$  = Settling velocity of particles, in feet per second

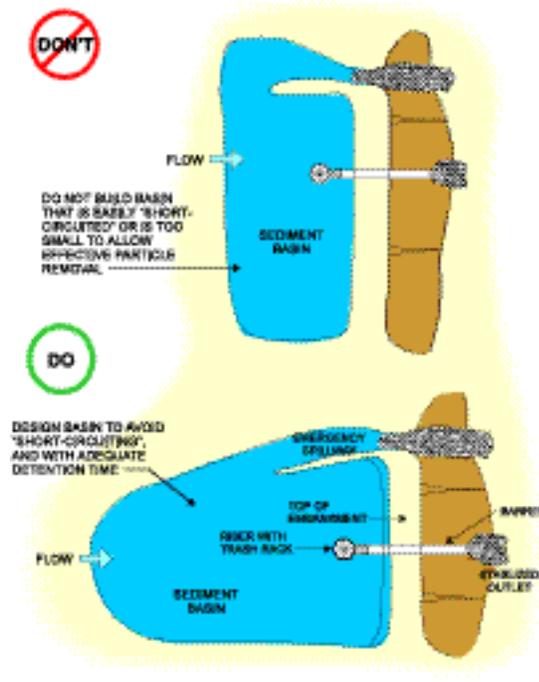
Particle Size (mm)	Particle Description	Settling Velocity $V_s$ (fps)
0.5	coarse sand	0.19
0.2	Medium sand	0.067
0.1	fine sand	0.023
0.05	coarse silt	0.0062
0.02	medium silt	0.00096
0.01	fine silt	0.00024
0.005	clay	0.00006

- 
- ➡ Construct sediment basin prior to wet season and construction activities.
  - ➡ Construct sediment basin prior to wet season and construction activities.
  - ➡ Areas under embankments, structural works, and sediment basin must be cleared and stripped of vegetation.
  - ➡ Basin length to width ratio should be greater than 3:1 (L:W).
  - ➡ Baffles should be provided to prevent short-circuiting of inlet flow.
  - ➡ Locate basin inlets to maximize travel distance to basin outlet.
  - ➡ Rock or vegetation should be used to protect the basin inlet and slopes against erosion.
  - ➡ A forebay, constructed upstream of the basin, may be provided to remove debris and larger particles.
  - ➡ Principal outlet should consist of a corrugated metal 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.
  - ➡ Place outlet structure on firm, smooth foundation with base securely anchored with concrete or other means to prevent floatation.
  - ➡ Attach riser pipe (watertight connection) to a horizontal pipe (barrel) which extends through the embankment to toe of fill. Provide anti-seep collars on the barrel.
  - ➡ Cleanout level should be clearly marked on the riser pipe.
  - ➡ Construct an emergency spillway to accommodate flows not carried by the principal spillway. Spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap.
  - ➡ Use outlet protection at the pipe outlet.
  - ➡ Safety fence should be installed to prevent unauthorized entry.
  - ➡ Excavation, transport, and disposal of contaminated material and hazardous materials must be in accordance with the rules and regulations of the following agencies:
    1. United States Department of Transportation (USDOT)
    2. United States Environmental Protection Agency (USEPA)
    3. California Environmental Protection Agency (CAL-EPA)
    4. Department of Toxic Substances Control (DTSC)
    5. California Division of Occupational Safety and Health Administration (CAL-OSHA)

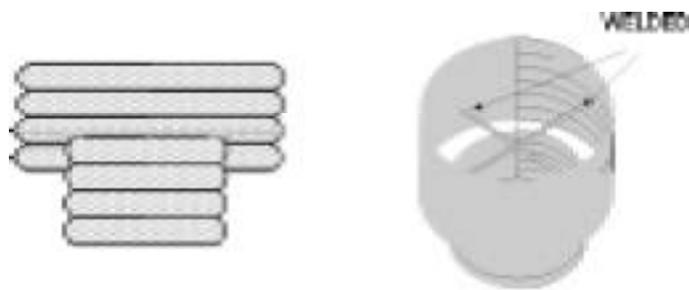
---

*Inspection and Monitoring*

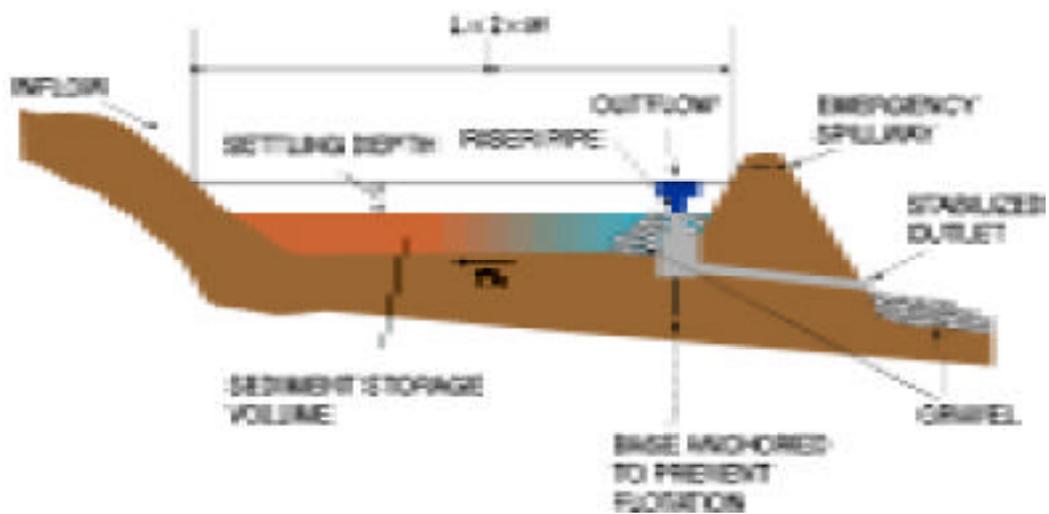
- ➔ Inspect sediment basins before and after rainfall events and weekly throughout the rainy season. During extended rainfall events, inspect sediment basins at least every 24 hours.
- ➔ Sample both inlet and outlet frequently during discharge for total suspended solids to monitor efficiency of erosion control measures and sediment basin, respectively.
- ➔ Examine basin banks for seepage and structural soundness.
- ➔ Check outlet structure and spillway for any damage or obstructions. Remove obstructions and repair damage as necessary.
- ➔ Check outlet area for erosion and stabilize if necessary.
- ➔ Remove sediment when storage zone is one-third full.
- ➔ Sediment removed from basin and stored on site must be protected against erosion (with plastic covering or silt barriers, for example).



SEDIMENT BASIN SHOULD BE DESIGNED WITH LENGTH IN MIND TO PREVENT SHORT-CIRCUITING.



PERFORATED RISER PIPE OPEN  
AT TOP



---

## SEDIMENT TRAPS



*Purpose:* A sediment trap is a small basin with a controlled release structure, formed by excavating or by constructing an earthen embankment, straw bale check dam, or gravel bag barrier across the drainage path. The trap is used only to retain larger size sediment and should only be used in conjunction with upstream erosion control measures and a downstream sediment basin.

*Application:*

- Construction projects with disturbed areas during the wet season.
- Where sediment-laden storm water may enter the storm drain system or watercourses.
- For small drainage areas (less than 2 ha) before entering a sediment basin.

The size of the sediment trap should be designed utilizing the equations provided in the previous sediment basin description.

*Limitations:*

- ⚠ Require large surface areas to permit settling of sediment.
- ⚠ Not appropriate for drainage areas greater than 2 ha (5 ac).
- ⚠ Traps only remove large and medium sized particles and require upstream erosion control.
- ⚠ Attractive but dangerous to children - require protective fencing.
- ⚠ Not to be located in live streams.

---

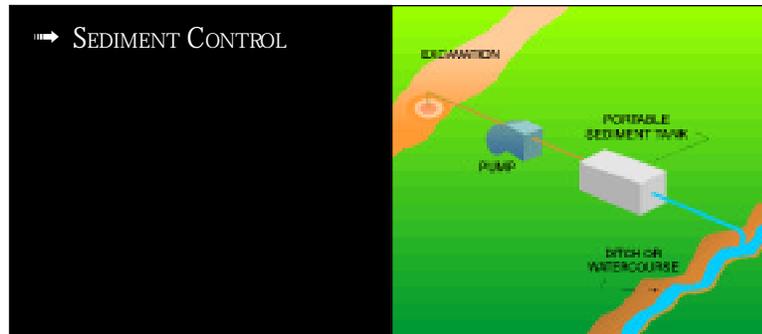
*Installation  
Guidelines:*

- ⇨ Construct sediment traps prior to wet season and construction activities.
- ⇨ Trap should be located:
  - (1) where a low embankment can be excavated or 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 length to width ratio should be greater than 3:1 (L:W) or baffles are required to prevent short circuiting of the inlet flow.
- ⇨ Trap inlets should be located to maximize the travel distance to the trap outlet.
- ⇨ Use rock or vegetation to protect the trap outlet against erosion.
- ⇨ To dewater the trap, the outlet should be constructed in one of the following two ways:
  - (1) Use corrugated metal or reinforced concrete riser pipe with dewatering holes encased in gravel to prevent floating debris from flowing out of the trap or obstructing the system.
  - (2) Construct a crushed stone outlet section of the embankment at the low point of the trap. The stone section serves as a nonerosive spillway outlet for flood flows, and the bottom section provides a means of dewatering the trap between rainfall events.

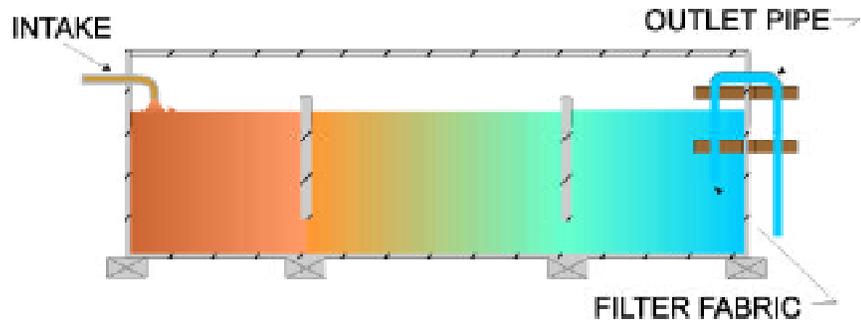
*Inspection and  
Maintenance:*

- ⇒ Inspect sediment traps before and after rainfall events and weekly during the rest of the rainy season. During extended rainfall events, inspect sediment traps at least every 24 hours.
- ⇒ Examine trap banks for seepage and structural soundness.
- ⇒ Check outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- ⇒ Check outlet area for erosion and stabilize, if required.
- ⇒ Remove accumulated sediment when the volume has reached one third the original trap volume.
- ⇒ Properly dispose of sediment and debris removed from the trap.

## D E W A T E R I N G

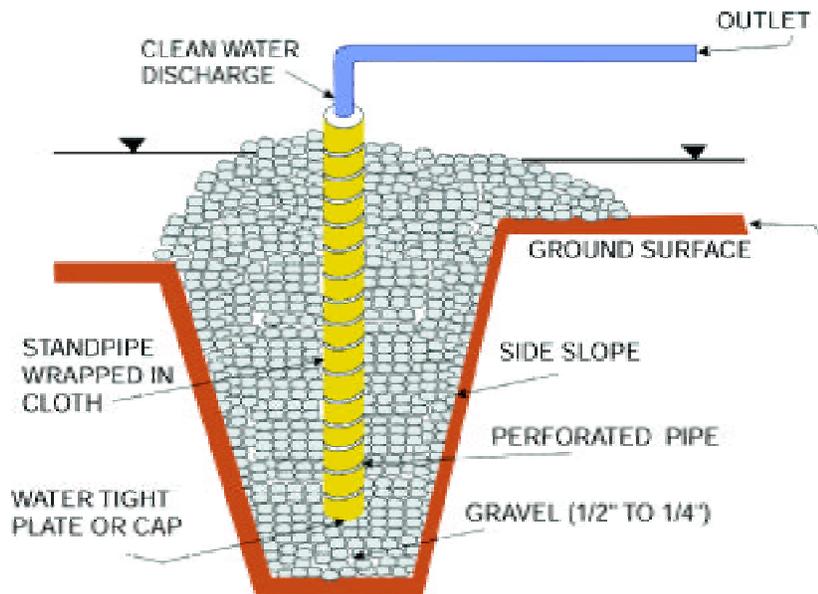


- Purpose:* A temporary method to filter sediment-laden water from excavated areas on construction sites prior to discharge to the stormdrain or surface waters.
- DISCHARGING SEDIMENT-LADEN WATER FROM A DEWATERING SITE INTO ANY WATER OF THE STATE WITHOUT FILTRATION IS PROHIBITED.
- Application:*
- Wherever sediment-laden water must be removed from the construction site using a dewatering pump.
  - Sediment traps, basins, or excavations on construction sites.
- Applicable Methods:*
- Filter box
  - Portable sediment tank—Figure 1
  - Sump pit and perforated standpipe wrapped in filter pack and surrounded by stones—Figure 2
- Limitations:*
- ⚠ A dewatering structure should be sized to allow water to flow through the filtering media without overflowing the structure.
  - ⚠ Dewatering practices should be considered as a last-resort control measure. Adequate erosion and sediment control measures are to be considered first.
  - ⚠ Construction site conditions will dictate design and use.
- Inspection and Maintenance:*
- ➡ The dewatering structure must be inspected frequently during operation and repaired or replaced once sediment build-up decreases the efficiency of the structure design.
  - ➡ When floating suction hoses are used, personnel should be assigned to monitor dewatering operations and effluent to ensure that sediment is not discharged into a stormdrain or into a water of the State (Goal 100 mg/1 Total Suspended Solid).



## PORTABLE SEDIMENT TANK

FIGURE 1: PORTABLE SEDIMENT TANK



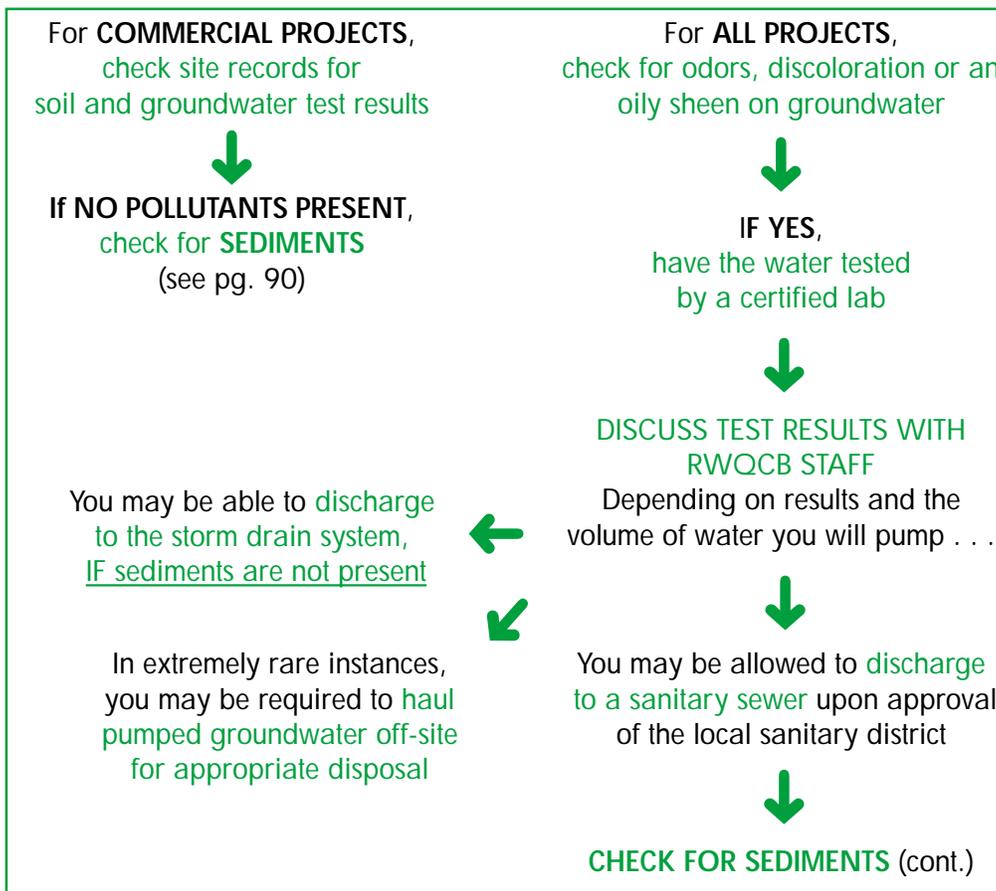
## DEWATERING PIT

FIGURE 2: SUMP PIT AND PERFORATED STANDPIPE WRAPPED IN FILTER FABRIC AND SURROUNDED BY STONES.

---

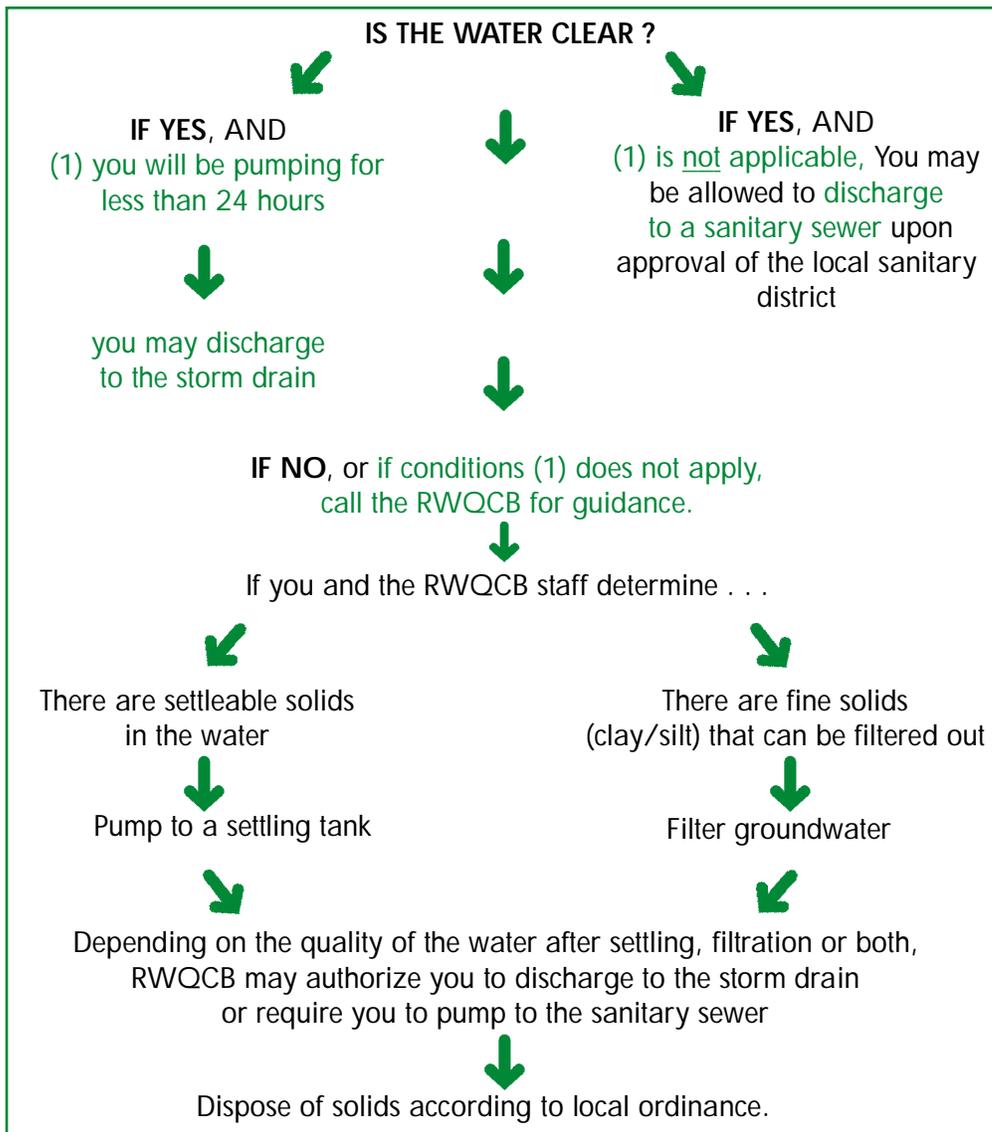
## TOXIC POLLUTANTS IN SOIL OR GROUNDWATER

If your site requires dewatering, you should be concerned about TOXIC POLLUTANTS IN SOIL AND/OR GROUNDWATER:



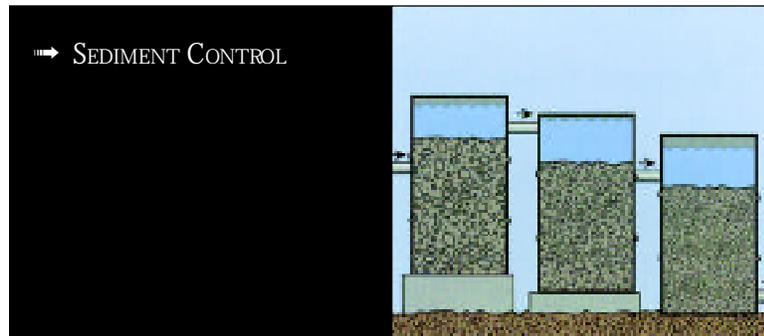
## SEDIMENTS IN GROUNDWATER

If your site requires dewatering, you should be concerned about SEDIMENTS that will clog storm drains or sewer lines, or smother aquatic life in local creeks or the Bay:



---

## SECONDARY FILTRATION



- Purpose:** Secondary filtration of sediments using high efficiency filter cartridges may be necessary to remove fine particles such as clays from stormwater runoff, sediment ponds, and excavated areas on construction sites.
- Application:**
- To remove fine sediments not settled in sediment basins.
  - Whenever fine sediment laden water is pumped from construction sites.
  - To protect against discharge of heavily sediment laden water from overflow to sediment basins or from automatic pumping
  - As a pre-treatment, to remove sediments from hydrocarbon contaminated ground and surface water.
- Limitations:**
- ⚠ Will not remove colloidal clays.
  - ⚠ Requires a pump to process water through system.
  - ⚠ Is not an efficient treatment of water with heavy sediment loads.
  - ⚠ Recommend a settling tank or sand filter as pretreatment when possible.
- Inspection and Maintenance:**
- ➡ Check operating pressures and flows periodically.
  - ➡ Ensure that the discharge is not causing erosion.
  - ➡ Change filter cartridges as pressures increase or as the quality of discharge water deteriorates.

---

## WATER CONSERVATION PRACTICES



- Purpose:* Appropriate uses and restrictions on the use of water on construction sites reduce the potential for erosion and the transport of pollutants off site.
- Application:* All construction sites where water is used.
- Limitations:* None identified.
- Installation Guidelines:*
- Reset irrigation controllers according to seasonal needs.
  - Keep water equipment in good working condition.
  - Repair water leaks promptly.
  - Discourage washing of equipment on the construction site.
  - Avoid using water to clean construction areas. Sweep paved areas where practical.
  - Direct construction water runoff to areas where it can soak into the ground.
  - Apply dust control water sparingly to avoid washing sediments into drainage system. Use recycled water when possible.
  - When washing vehicles and equipment:
    - (1) minimize water use and retain all runoff on-site
    - (2) do not use soaps or chemicals
    - (3) use a commercial washrack facility whenever possible
- Inspection and Maintenance:* ➔ Inspect water equipment at least twice weekly.

---

## SOLID AND DEMOLITION WASTE MANAGEMENT



**Purpose:** Proper management of demolition materials and solid waste created and stockpiled on site eliminates and minimizes the discharge of pollutants to the storm drain system and watercourses.

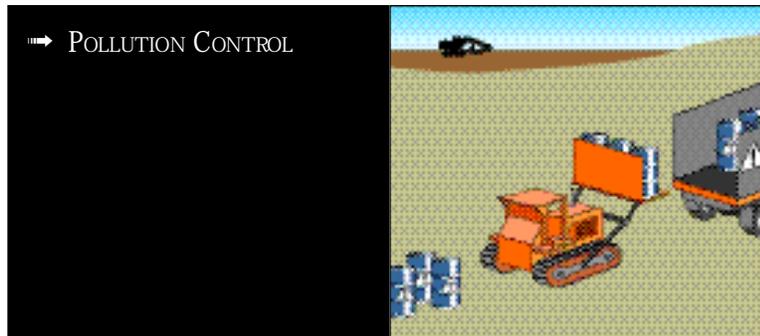
**Application:** Applicable to all nonhazardous materials.

- Reusable materials:**
- doors
  - banisters
  - floorboards
  - windows
  - 2x4s
  - old, dense lumber
- Recyclable materials:**
- metal framing
  - wood (framing, etc.)
  - concrete, brick and cement mortar
  - asphalt
  - plate glass
  - cleared vegetation, tree trimmings, plant material
- Non-recyclable:**
- dry paint; nonhazardous paint chips and dust from dry stripping and sand blasting
  - absorbent materials (cat litter, sand, rags, mats) used to absorb nonhazardous spills. Materials used to absorb oil-based spills must be disposed of as hazardous waste.;
  - steel and metal scraps
  - pipe and electrical cuttings
  - ground and/or broken paving materials
  - domestic wastes (containers, cans, cups, bags etc.)
  - other demolition waste

- 
- Practices:
- ⇨ Reuse and recycle construction materials and waste when possible (see *Resources* for a list of recycling and disposal services).
  - ⇨ Designate waste collection areas away from streets, gutters, storm drains, and waterways, and close to construction entrances.
  - ⇨ Cover dumpsters securely at night and during rainy weather.
  - ⇨ Replace/exchange leaky dumpsters.
  - ⇨ Collect and properly dispose of leaking material from dumpsters.
  - ⇨ Return dumpsters to company for cleaning when necessary.
  - ⇨ Arrange for adequate debris disposal schedule to ensure dumpsters do not overflow.
  - ⇨ Clean and sweep roadways and paved areas where work is being conducted at the end of every working day.
- Limitations:
- ⚠ Temporary stockpiling of certain construction wastes may necessitate stringent drainage-related controls during the wet season.
- Inspection and Maintenance:
- ⇒ Foreman and/or construction supervisor should monitor on-site solid waste storage and disposal procedures.
  - ⇒ Site should be routinely policed for litter and debris.
  - ⇒ Dumpsters should be inspected for leaks and secure covers.

---

## H A Z A R D O U S   W A S T E   M A N A G E M E N T



- Purpose:* Proper handling and disposal of hazardous waste eliminates or minimizes the discharge of such pollutants to stormdrains and waterways.
- Application:*
- petroleum products such as oil, fuel, and grease
  - asphalt products, including roofing tar
  - concrete curing compounds
  - herbicides and pesticides
  - chemical additives used for soil stabilization
  - acids for cleaning masonry
  - septic wastes
  - paints and solvents
  - stains and wood preservatives
  - materials which have been used to absorb hazardous spills
  - hazardous demolition waste (such as lead paint, asbestos)
  - any material considered a hazardous waste by the State of California
- Practices:*
- ⇨ Properly label and store all hazardous wastes.
  - ⇨ Dispose of hazardous waste only at authorized treatment, storage and disposal facilities. Illegal dumping of hazardous waste is a violation subject to fine and/or time in jail. Contact your local agency for disposal site information.
  - ⇨ Use licensed hazardous waste haulers for threshold quantities as required by state and federal regulations.
  - ⇨ Be sure that trailers carrying hazardous materials are covered during transit. Illegal transit of hazardous waste is a violation subject to fine and/or jail time.

---

*Limitations:*

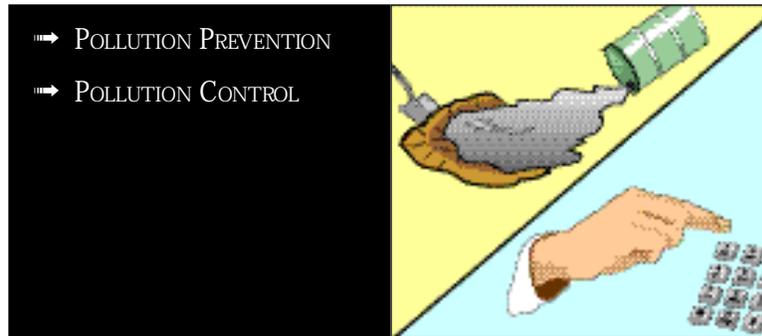
- ⚠ This practice is not intended to address site-assessments and pre-existing contamination.
- ⚠ Major contamination, large spills, and other serious hazardous waste incidents require immediate response from specialists.
- ⚠ Demolition activities and potential pre-existing materials, such as asbestos, are not addressed by this manual.

*Inspection and  
Maintenance:*

- ➡ Check to make sure all wastes are properly labeled and stored.
- ➡ Monitor hazardous waste disposal procedures.

---

## S P I L L P R E V E N T I O N A N D C O N T R O L



*Purpose:*

Prevention and control of spills minimizes or eliminates the discharge of hazardous and nonhazardous materials to the storm drain system and to watercourses.

*Application:*

- Solid and liquid materials, including, but not limited to:
  - Fuels
  - Lubricants
  - Other petroleum distillates
  - Deicing/anti-icing chemicals
  - Paints, solvents
  - Cement, mortar
  - Soil stabilizers
  - Herbicides
  - Fertilizers
  - Growth inhibitors
- Storage areas for chemicals and/or hazardous substances
- Fuel areas
- Vehicles/equipment transporting and handling chemicals and other hazardous substances

*Practices:*

- ⇔ Notify the State Office of Emergency Service (OES) at 800-852-7550 when a hazardous spill occurs. Construction sites located near natural watercourses, canals, and reservoirs are at highest risk of an uncontained spill contaminating surface waters.

- 
- ⇨ Locate chemical and/or hazardous materials storage and handling areas away from natural watercourses, canals, reservoirs and storm drains.
  - ⇨ Store chemicals and/or hazardous materials in areas not susceptible to rain and provide secondary containment in case of leaks or spills.
  - ⇨ Immediately clean up spills and properly dispose of contaminated soils and clean up materials:
    - dry spills should be swept, not washed/hosed.
    - wet spills on impermeable surfaces should be absorbed, and absorbent materials properly disposed.
    - wet spills on soil should be dug up and all exposed soils properly disposed.
  - ⇨ For fueling areas, provide secondary containment with enough capacity to contain a spill.
  - ⇨ Use only a reputable, licensed company to clean up large spills and dispose contaminated materials.

*Limitations:*

- ✦ Procedures and practices presented herein are general. Contractor should identify appropriate practices for the specific materials used or stored on site.

*Inspection and  
Maintenance:*

- ⇒ Verify weekly that sufficient spill control clean up materials are located near material storage, unloading and use areas, as well as fueling areas.
- ⇒ Inspect containment structures for storage and fueling areas.
- ⇒ Fueling areas and storage tanks should be inspected on a regular basis.
- ⇒ Update spill prevention and control plans and stock appropriate clean up materials whenever changes occur in the types of chemical on site.

---

## VEHICLE AND EQUIPMENT SERVICE

⇒ POLLUTION PREVENTION

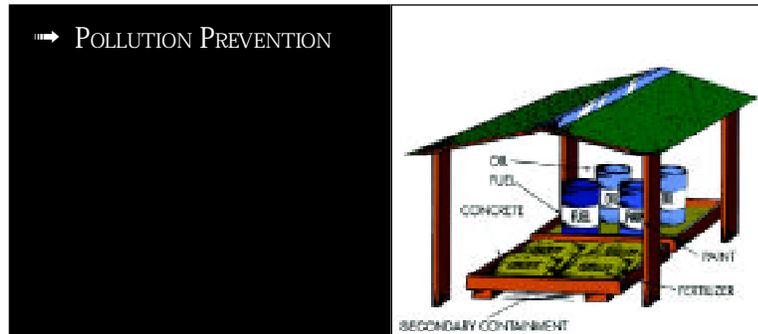
⇒ POLLUTION CONTROL



- Purpose:* Prevention and control of leaks from equipment and vehicles and proper management of wash water eliminates or minimizes discharge of toxic pollutants to the storm drain system or watercourses.
- Application:*
- Fueling areas
  - Maintenance and storage/parking areas
  - Cleaning/wash areas
- Practices:*
- ⇨ Conduct fueling, major maintenance/repair, and washing off-site whenever feasible.
  - ⇨ Regularly maintain and frequently inspect vehicles and equipment for damaged hoses, leaky gaskets, or other service problems.
  - ⇨ Clearly designate vehicle/equipment service areas away from waterways, storm drains, curbs and gutters.
  - ⇨ Properly contain areas with berms, sandbags, or other barriers.
  - ⇨ Only use water for any on-site cleaning. Do not use soap, solvents, degreasers, steam cleaning, or similar methods.
  - ⇨ Use drip pans/drip cloths if necessary to drain and replace fluids on-site.
  - ⇨ Collect all spent fluids, store in separate labeled containers, recycle when possible, and properly dispose (generally as hazardous waste).
- Limitations:*
- ⚠ Some municipalities may require pretreatment and monitoring of wash water discharges to sanitary sewer.
- Inspection and Maintenance:*
- ⇒ Inspect containment structures (such as berms) to ensure they are intact.
  - ⇒ Maintain waste fluid containers in leak proof condition.
  - ⇒ Regularly service sumps associated with wash areas.

---

## MATERIAL DELIVERY, HANDLING AND STORAGE



*Purpose:* Wet and dry building materials with the potential to pollute runoff should be handled and delivered with care and stored under cover and/or surrounded by berms when rain is forecast or during wet weather.

*Application:* Construction sites with delivery, handling/preparation, and storage of the following materials:

- Soil
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster or related products
- Concrete compounds
- Asphalt and concrete components
- Petroleum products such as fuel, oil, and grease
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Other materials that may be detrimental if released to the environment

*Practices:*

- ⇨ Train employees and subcontractors in proper material delivery, handling, and storage practices.
- ⇨ Purchase, transport to site, and use only the amount needed for the work on site.
- ⇨ Purchase and use nonhazardous and environmentally-friendly materials when possible.
- ⇨ Label and store all hazardous materials according to local, state, and federal regulations.

- 
- ⇨ Keep inventory of hazardous material for use in emergency.
  - ⇨ Store granular materials at least 10 feet from waterways, storm drains, curbs and gutters.
  - ⇨ Install barriers around storage areas to prevent contact with runoff.
  - ⇨ Provide indoor coverage, a temporary roof, or a secure impermeable tarp for plaster or other powders. These can create large quantities of suspended solids in runoff, which may be toxic to aquatic life and cause serious environmental harm. Water quality and air quality can be protected with secure cover.
  - ⇨ Provide a temporary roof, or secured plastic sheeting or tarp for stockpiled materials and wastes.
  - ⇨ Provide storage in accordance with secondary containment regulations and provide secondary cover for containers of paint, chemicals, solvents, and other hazardous materials during rainy periods.
  - ⇨ Use mats during delivery and storage.
  - ⇨ Control dust daily with reclaimed water.
  - ⇨ Do not apply hazardous chemicals outdoors during wet weather.
  - ⇨ Have proper storage instructions posted at all times in an open and conspicuous location.
  - ⇨ Keep ample supply of appropriate spill clean up materials near storage areas.

*Limitations:*

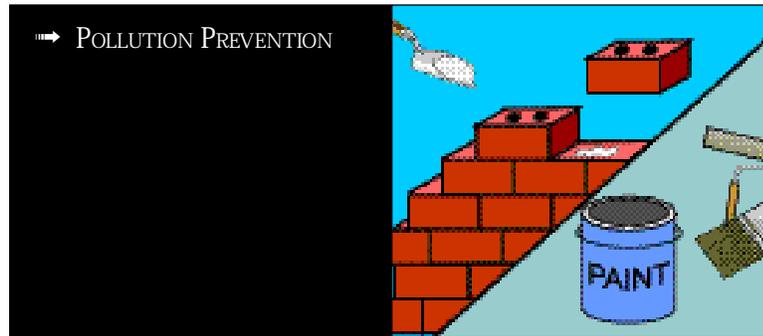
- ♣ Space limitations may preclude indoor storage
- ♣ Storage sheds must meet building and code requirements.
- ♣ Alternative materials which are less hazardous or polluting may be more difficult to obtain or may require different preparation and use.
- ♣ Materials must be stored according to fire code requirements.

*Inspection and Maintenance:*

- ⇒ Inspect storage areas before and after rainfall events, and at least weekly throughout the job.
- ⇒ Inspect to ensure that designated storage areas are kept clean and well organized.
- ⇒ Repair and/or replace perimeter controls, containment structures, and covers as necessary to ensure their proper functioning.
- ⇒ Spot check employees and subcontractors monthly throughout the job to ensure appropriate practices are being employed.

---

## PAINTS AND LIQUID MATERIALS



*Purpose:*

Hazardous and nonhazardous paint-related materials, paint wastes, adhesives and cleaning fluids must be recycled when possible and disposed of properly to prevent contact with stormwater and discharge into storm drains and water-courses.

*Application:*

Hazardous liquid residues from:- paints

- glues
- thinners
- solvents
- cleaning fluids

Nonhazardous dry materials:

- paint cans
- used brushes
- rags
- absorbent materials
- drop cloths

Paint removal wastes, including:

- chemical paint stripping residues
- paint chips and dusts
- sand blasting material
- wash water

*Practices:*

For paints, adhesives, and related materials:

- ⇨ Use safer products when available and possible.
- ⇨ Designate area for cleaning of painting equipment and tools.
- ⇨ Never clean brushes or rinse containers into a street, gutter, storm drain, or creek.

- 
- ⇨ For water-based paints, paint out brushes to the extent possible and rinse to a drain leading to the sanitary sewer (i.e. indoor plumbing). Where not possible, clean with water, disperse wash water over soil, and spade in.
  - ⇨ For oil-based paints, paint out brushes to the extent possible; filter and reuse thinner/solvents.
  - ⇨ Recycle, donate or return unwanted water-based (latex) paint to supplier.
  - ⇨ Recycle empty, dry paint cans as metal, after checking with recycling and disposal services.
  - ⇨ Dispose of dried latex paint, old brushes, rollers, etc. in garbage.
  - ⇨ Dispose of non-recyclable thinners, sludges, and unwanted paint as hazardous waste.

For paint removal wastes:

- ⇨ Pre-1970 paint should be tested for lead content.
- ⇨ Keep all paint wastes away from the gutter, street, and storm drains.
- ⇨ Sweep up non-hazardous paint chips and dust from dry stripping and sand blasting, or collect in plastic drop cloths; dispose of in garbage.
- ⇨ Cover or berm storm drain inlets during stripping of building exteriors with high pressure water. Collect wash water in tank and pump to the sewer; call the local wastewater authority to determine if the paint contains toxic pollutants and must be disposed of as hazardous waste.
- ⇨ Dispose chemical paint stripping residue and chips and dust from marine paints or paints containing lead or tributyl tin as hazardous waste.
- ⇨ Wash water free of oil based paint, solvents or chemicals can be discharged onto a dirt area and spaded into the soil.
- ⇨ Shovel or sweep any debris that remains in the gutter and dispose of in garbage.

*Limitations:*

- ⚠ Hazardous wastes that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- ⚠ Safer, alternative products may not be as readily available.

*Inspection and Maintenance:*

- ➡ Spot check employees and subcontractors monthly throughout the job to ensure appropriate practices are being employed.

---

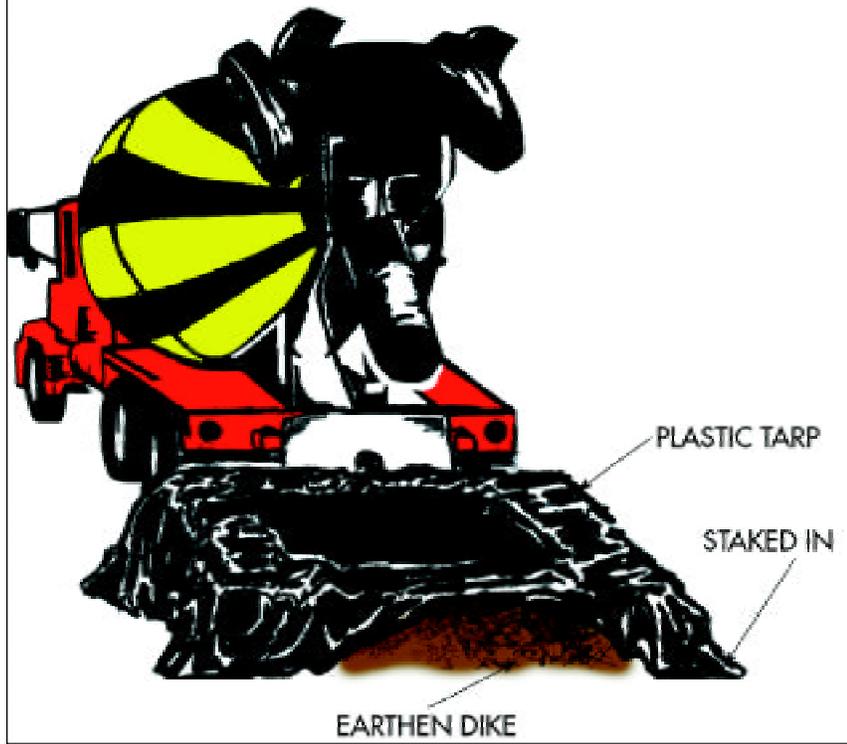
## HANDLING & DISPOSAL OF CONCRETE AND CEMENT



- Purpose:* Concrete and cement-related mortars are toxic to fish and the aquatic environment and require proper handling and disposal to minimize or eliminate discharges to gutters, storm drains, and watercourses.
- Application:*
- stored wet and dry concrete and cement mortar materials
  - on-site preparation and use of concrete and cement mortar
  - equipment wash-out
  - concrete dust and debris from demolition activities
- Practices:*
- ⇨ Avoid mixing excess amounts of fresh concrete or cement mortar on-site.
  - ⇨ Store dry and wet materials away from waterways and storm drains; cover and contain to protect from rainfall and prevent runoff.
  - ⇨ Never dispose of wash-out into the street, storm drains, drainage ditches, or watercourses. Wash out concrete transit mixers only in designated wash-out areas where the water will flow into temporary pit in dirt area or onto stockpiles of aggregate base or sand.
  - ⇨ Identify location for waste water pit away from watercourses and storm drains. Dig a pit large enough to hold waste. Pump water from pit to the sanitary sewer, where allowed. When possible, recycle wash-out by pumping back into mixers for reuse. If neither practice is feasible, let water percolate through soil and dispose of settled, hardened concrete with trash.
- Limitations:*
- 🔔 An appropriate wash out area must be identified.
- Inspection and Maintenance:*
- ⇒ Foreman and/or construction supervisor should monitor on-site concrete wash-out, waste storage and disposal procedures at least weekly.

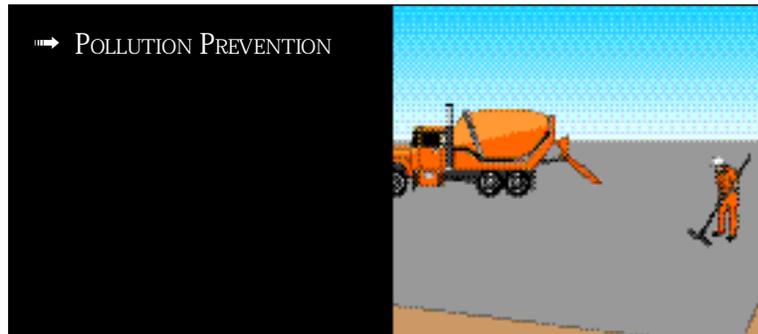
---

CONCRETE WASHOUT AREA



---

## PAVEMENT CONSTRUCTION MANAGEMENT



- Purpose:* Proper management of pavement construction materials and activities minimizes or eliminates discharges to gutters, storm drains, and watercourses resulting from on-site road paving, surfacing, and asphalt removal activities.
- Application:*
- application of concrete, asphalt, and seal coat during paving, surfacing, and resurfacing
  - storage of paving equipment
  - saw-cutting and sawcut slurry
  - concrete cleaning (including rinse water and sweeping)
  - concrete and asphalt removal
- Practices:*
- ⇨ Apply concrete, asphalt, and seal coat during dry weather to prevent contaminants from contacting stormwater runoff.
  - ⇨ Cover storm drain inlets and manholes when paving or applying seal coat, tack seal, slurry seal, fog seal, or similar materials.
  - ⇨ Always park paving machines over drip pans or absorbent materials, since they tend to drip continuously.
  - ⇨ Protect drainage ways by using earth dikes, straw bales, sand bags, or other controls which will divert or trap and filter runoff.

- 
- ⇨ When making saw-cuts:
    - use as little water as possible.
    - cover each catch basin completely with filter fabric and contain the slurry by placing barriers around the catch basin (straw bales, sand bags, gravel dams).
    - shovel, absorb or vacuum the slurry residue from pavement or gutter and remove from site at the end of the day or job (whichever is sooner).
    - immediately remove any sawcut slurry entering storm drain.
  - ⇨ When washing down exposed aggregate concrete:
    - wash only when wash water can either: flow into a dirt area, drain onto a bermed surface from which it can be pumped and disposed of in sanitary sewer or by a hazardous waste disposal program, or be vacuumed from a catchment created by blocking a storm drain inlet.
    - if necessary, place straw bales downslope, or divert runoff with temporary berms.
    - make sure runoff does not reach gutters or storm drains.
    - allow aggregate rinse to settle, and pump the water to the sanitary sewer if allowed by local waste water authority.
  - ⇨ Collect and return sweepings from exposed aggregate concrete to stockpile or dispose with trash; never wash into a street or storm drain.
  - ⇨ Recycle broken concrete and asphalt.

*Inspection and  
Maintenance:*

- ⇒ Inspect and maintain machinery regularly to minimize leaks and drips.
- ⇒ Inspect inlet protection measures before and after rainfall events. During extended storms, inspect at least every day. If subjected to non-stormwater flows, inspect daily.
- ⇒ Maintain inlet protection so that water is not allowed to back up onto areas subject to traffic. If such back up occurs, the protective device must be removed and alternative measures deployed.
- ⇒ Check with employees and subcontractors to ensure that measures are being followed.

*Limitations:*

- ⚠ Finer solids are not effectively removed by filtration systems.
- ⚠ Proper management limits paving opportunities during wet weather.

---

## CONTAMINATED SOIL AND WATER MANAGEMENT



*Purpose:*

Soil, ponded stormwater, and groundwater may become contaminated if exposed to hazardous materials and should be properly managed to prevent health hazards and minimize or eliminate discharge of pollutants to the storm drain system and watercourses.

*Application:*

- Areas of previous commercial or industrial activity.
- Sites with history of illegal dumping on site or adjacent properties.
- Sites subject to Superfund, state, or local cleanup order.
- Ponded stormwater, groundwater, or dewatering areas which exhibit an oily sheen or smell of petroleum.
- Soils which appear discolored, smell of petroleum, or exhibit other unusual properties.
- Site where abandoned underground storage tanks, drums, or other buried debris are encountered during construction activities.
- On site or adjacent site spills of pesticides and herbicides; fertilizers; detergents; plaster and other products; petroleum products such as fuel, oil, and grease; or other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.
- Highway construction projects, especially those in highly urbanized or industrial areas, where soil contamination may have occurred due to spills, illicit discharges, and underground storage tanks.
- Highway widening projects in older areas where median and shoulder soils may have been contaminated by transportation-related lead deposits.

---

Limitations:

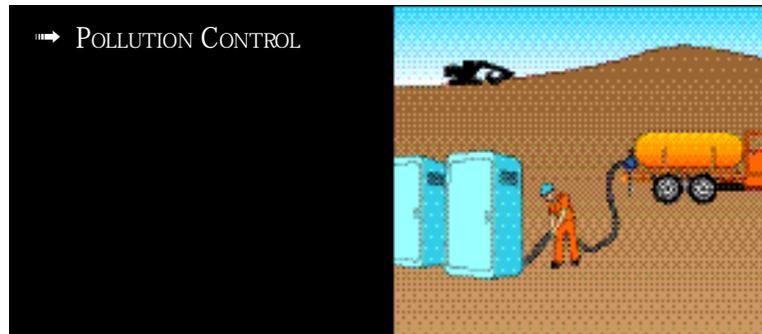
- The contractor should identify appropriate practices and procedures for the specific contaminants known to exist or discovered on site.
- Excavation, transport, and disposal of contaminated material and hazardous waste must be in accordance with the rules and regulations of the following agencies:
  - United States Department of Transportation (USDOT)
  - United States Environmental Protection Agency (USEPA)
  - California Environmental Protection Agency (CAL-EPA)
  - Department of Toxic Substances Control (DTSC)
  - California Division of Occupational Safety and Health Administration (CAL-OSHA)
  - Local Regulatory Agencies

*Practices:*

- ⇨ Inspect sites for contamination, particularly when preexisting site conditions make contamination likely, when spills are reported, or when leaks are detected.
- ⇨ If project is in an area of known contamination or contamination is suspected, the water should be contained and held for testing. Call the appropriate local agency and/or the regional water quality control board for further guidance.
- ⇨ Never discharge contaminated soil and water to street, gutter, or storm drain.

---

## SANITARY / SEPTIC WASTE MANAGEMENT



- Purpose:* Leaking and portable toilets are a potential health and environmental hazard. Proper management will minimize or eliminate human and natural resource exposure to hazards.
- Application:*
- portable toilets
  - other portable or temporary septic systems
- Limitations:*
- ⚠ The leasing company must have a permit to dispose of waste to the sanitary sewer.
- Practices:*
- ↔ Inspect facilities for leaks.
- Inspection and Maintenance:*
- ↔ Monitor on-site sanitary/septic waste storage and disposal procedures at least weekly.
  - ↔ Be sure the leasing company adequately maintains, promptly repairs, and replaces units as needed.

---

## LANDSCAPING MANAGEMENT

- ⇒ EROSION CONTROL
- ⇒ SEDIMENT CONTROL
- ⇒ POLLUTION PREVENTION



- Purpose:* Proper use and management of soils, materials, and chemicals used in landscaping eliminates or minimizes erosion and the discharge of pollutants to the storm drain system or watercourses.
- Application:*
- modification of soils in preparation for landscaping
  - planting of trees, shrubs, grasses and other vegetation
  - use of fertilizers, pesticides and other chemicals
  - storage of materials
- Practices:*
- ⇨ Use plant vegetation that is native, non-invasive, drought tolerant, and pest tolerant to decrease chemical and labor use over the short/long term.
  - ⇨ Store stockpiles and landscaping materials under tarps to protect from wind and rain.
  - ⇨ Schedule landscaping-related grading and excavation for dry weather.
  - ⇨ Use check dams or ditches to divert runoff away from storm drains.
  - ⇨ Protect storm drains with sediment control measures.
  - ⇨ Minimize use of chemicals:
    - purchase less toxic alternatives
    - purchase only amount necessary
    - use only the minimum amount necessary
  - ⇨ Rinse all chemical containers, using rinsewater as product. Recycle or dispose of rinsed containers in garbage.
  - ⇨ Check on disposal guidelines for chemicals (many are hazardous wastes).
- Limitations:*
- ⚠ Plants that are native, non-invasive, drought tolerant, and pest tolerant may not be readily available from suppliers and vendors .
- Inspection and Maintenance:*
- ⇒ Inspect areas being revegetated for establishment of new vegetation. Add plantings, replant, and control erosion where necessary.

---

## WHAT CAN GO WRONG?

The difference between the schedule for SWPPP implementation and actual progress of the project is a common problem in achieving Permit compliance.

An erosion control plan is always based on a grading plan, which defines the sequence of grading and the schedule. However, the grading plan often undergoes modification, and all too often the erosion control plan is not updated accordingly. Therefore, as the rainy season draws near, the erosion control plan is often out of date.

### PROBLEM

A common situation is where the grading has proceeded slower than expected and continues into the rainy season, and the erosion control plan does not address this situation. The result is unavoidable erosion because it is too late in the season to apply vegetation or other erosion control measures.

### SOLUTION

A solution to this problem is to require October 1st (or other dates depending on geographic regions) as a cut-off date for mass grading, and to adjust grading targets accordingly. A builder should realize that if a project is running four weeks late (into the rainy season) the rain will wait for grading to be completed.

Another common reason that erosion and sediment control measures fail is either:

- (1) they were not installed correctly, or
- (2) they were not maintained properly.

It is imperative that the measures be inspected for proper installation, as well as maintained for proper performance.

## WHAT ARE COMMON INSTALLATION PROBLEMS?

There are many common installation problems that can result in failure of an erosion or sediment control measure. The contractor must carefully follow the project plans, specifications and product manufacturer's guidelines to avoid installation-related failures and costly repairs. Common installation problems and their respective corrective measures are provided on the following pages.

PROBLEM	CORRECTIVE MEASURES
Sediment flowing under or over silt fence. Concentrated flow discharging down a slope. Damaged silt fence. Silt fence buried underneath sediment.	Bury the toe of silt fences. Silt fence should be level on the slope contours, otherwise a "flume" will be created resulting in concentrated flow. Do not place silt fence across concentrated flow and expect it to function properly. Ensure that sediment buildup is frequently removed.
Straw bales found removed and carried downstream or damaged.	Embed straw bales into a 4" deep trench when used for sedimentation control. Stake straw bales securely.
Check dam washed out on the sides resulting in discharge flowing around the dam.	Install check dams with the center lower than the sides to allow the control of discharge over the top of the dam.
Accumulated material in sediment traps and basins resulting in overflow and decrease in sediment holding capacity.	Regularly clean out sediment traps and basins for effective performance.
Sediment being discharged off the toe of slopes causing damage to sediment barriers.	Place sediment barriers away from the toe of slopes to allow room for sediment accumulation. Regularly remove sediment buildup.
Relying on sediment control measures alone to keep sediment from leaving the site, without including erosion control measures to form a composite system.	Do not rely on sediment control measures alone to keep sediment from leaving the site, particularly if soil is fine-grained; include erosion control measures to form a composite system.
Increased runoff and erosion of smoothly graded slopes.	Finish slopes with a rough texture to promote infiltration and decrease runoff velocity and erosion.
Roughening the slope surface texture has little effect on erosion control.	Track walk slopes up-and-down the slope rather than across the slope to reduce erosion.
Evidence of erosion occurring in areas where vegetative control measures have been applied.	Seed must be properly and evenly distributed over bare areas to produce uniform vegetation cover. Check for needed seed, fertilizer, and/or water.
Mulched areas are not completely covered or the mulch has blown away.	Apply adequate amounts (2 tons per acre) of surface mulches or tackifier for the site conditions. Place mulch with a tackifier or mechanically crimp it so as to minimize wash off or blowing.

PROBLEM	CORRECTIVE MEASURES
Rolled erosion control blankets have moved downslope and are not covering intended areas, or have "pillowed" with accumulations of sediment underneath.	Use enough staples to hold rolled erosion control blankets in place. Do not allow water to flow under the material.
Slope failures and large erosion areas.	Do not rely on surficial erosion control measures to address inadequate drainage and slope stability problems.
Sediment and soil are tracked offsite from construction trucks and equipment even though gravel is in place at the entrance and exit to the site.	Do not rely solely on gravel construction entrances to construction sites. Consider installing wheel wash facilities to prevent tracking of sediment off site.
Ponding occurring around protected storm drain inlets.	Install storm drain inlet protection that filters the flow and discharges it, rather than just diverts the flow.
Erosion occurring around and underneath a discharging storm drain outlet.	Provide an energy dissipator at discharging storm drain outlet pipes to prevent unprotected soil from eroding.
A sediment basin is short-circuited and discharge is highly sediment-laden.	Ensure that sediment basins are designed long enough to allow sediment particles to settle before flow is discharged.
Rill and gully development on and around unpaved roads resulting in transport of sediment downstream.	Provide rolling dips and waterbars on unpaved roads to prevent rill and gully development and transport of sediment.
Billowing dust clouds being formed due to wind and site traffic conditions.	Provide adequate dust control, such as wetting, for traffic and wind conditions.

---

## M A I N T E N A N C E

Once properly installed, erosion and sediment control measures must be operated and maintained using specific guidelines and procedures.

Examples are as follows:

**Hydraulic erosion control applications** (including binders, bonded fiber matrices, dry straw mulch, and hydraulic mulches)

- should be monitored for short term performance (e.g., longevity of surface treatment)
- should be monitored for long term erosion control performance (e.g., vegetation establishment)
- loss of mulch material and seed through sheet and rill erosion should be repaired through reapplication
- general surface slippage or lack of vegetation establishment should be investigated and treated on a site-specific basis with mitigation or repairs as appropriate

**Rolled erosion control materials** (such as jute netting, biodegradable or synthetic mats or blankets)

- should have adequate staples to hold the material in complete contact with the ground
- material should not bridge over the soil
- no new rills or gullies should develop under the material
- no trapped soil should pillow under the material
- the material should allow the seeded or natural vegetation to emerge in a timely manner through the mat itself
- netting should remain on the ground and not be lifted by the plants where it would become a mowing problem or hazard to wildlife

**Silt fences**

- should be inspected and sediment removed before overtopping the device or causing flow diversions (in most cases, this occurs when the accumulation is one-third the height of the fabric)
- breaks or overtopped areas should be replaced or repaired immediately
- fences should be removed and the accumulated sediment dispersed to a stable area when the surrounding vegetation provides effective erosion protection.

---

### **Check dams**

- should be checked for undermining and/or short circuiting and repaired or replaced if necessary
- check dams should be cleaned after each storm event or when accumulated sediment reaches one-third the height of the dam

### **Temporary and permanent sediment basins**

- should be cleaned of accumulated sediment after every significant storm event, or when sediment reaches thirty percent of the basin capacity
- removed sediment should be properly disposed of in a stable area that is not susceptible to erosion

### **Straw bale barriers** (or gravel bag or sand bag barriers)

- should be inspected after every storm event
- accumulated sediment should be removed when it reaches one-third the height of the barrier
- removed sediment should be properly disposed of in a stable area that is not susceptible to erosion

### **Stabilized gravel construction entrances**

- should be inspected for the transport of sediment onto public rights-of-way
- any tracked sediment should be removed immediately
- no washing of sediment into the storm drain

### **Inlet filters** (for storm drains)

- should be inspected and cleaned after each storm event and repaired promptly
- sediment should be removed after each storm event and deposited in a stable area where it will not be subject to erosion
- if the gravel becomes clogged with sediment, the gravel must be carefully removed from the inlet and either cleaned or replaced

### **Slope drains**

- should be inspected after every storm event and repairs should be made prior to next storm event
- should be checked for scour holes and undermining, particularly at inlet and outlet points

---

**Rolling dips and waterbars** (on roads)

- should be inspected periodically and after major storm events
- sediment should be removed from the flow areas, and erosion damage should be repaired prior to next storm event
- outlet areas should be checked for erosion, and repairs made promptly

**Lined drainage channels and energy dissipators**

- should be inspected at regular intervals and after major storms
- debris should be removed and repairs made where necessary
- special attention should be given to outlets and points where concentrated flow enters the channel
- eroded areas should be repaired prior to the next storm event
- check for sediment accumulation, piping, bank instability, and scour holes, and repair promptly
- outlet areas shall be checked for erosion, and repairs made promptly

---

## W H Y D O I N S P E C T I O N S A N D W H E N ?

The control measures identified in the SWPPP are intended to minimize the transport of pollutants to receiving waters. The performance of the measures is dependent on how the measures are operated and maintained, and the severity of the weather conditions for one to five years following their implementation. To provide for the continued performance of the measures, they must be inspected before, during, and after significant storm events.

The General Permit requires inspection of the site before, during, and after storm events, so that the effectiveness of controls is observed first-hand. During seasonal wet periods, the site should be inspected at least weekly. All disturbed areas of the site, areas for material storage, locations where vehicles enter or exit the site, and all erosion and sediment controls that are identified as part of the plan must be inspected. The problem areas must be documented, and control measures identified and implemented immediately. This effort must continue for the duration of time it takes for the site to be fully stabilized and the permanent measures to be in place and performing adequately. An annual certification that the site is in compliance with the General Permit and the SWPPP is required by July 1st of each year. Inspections form the basis for this certification.

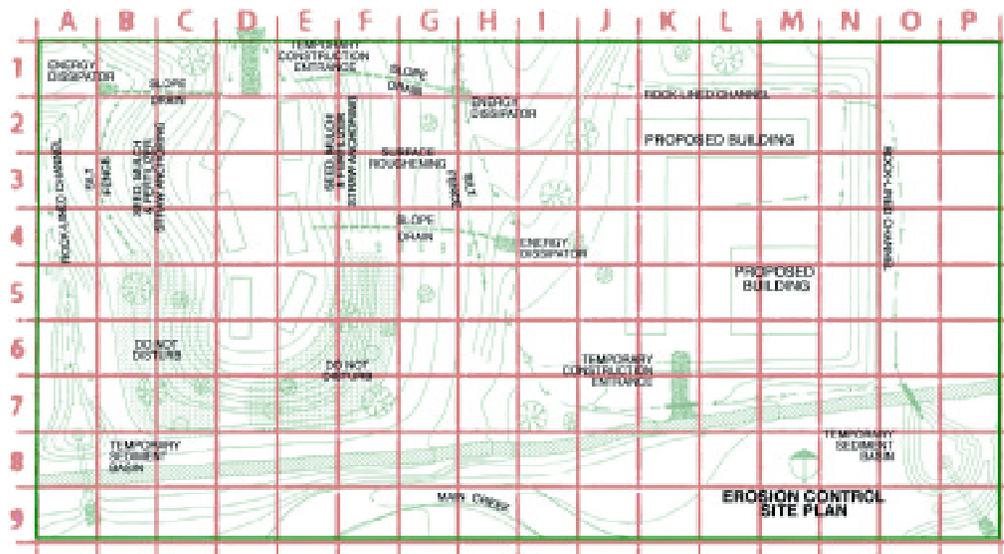
Qualified inspectors should be highly familiar with the requirements of the General Permit and the intent of regulations. The inspector must also be familiar with the project SWPPP and all the measures to be implemented at the site, as well as their proper installation and maintenance. The inspector should also be knowledgeable about how to make emergency repairs and evaluate appropriate control measure alternatives.

---

## I N S P E C T I O N P R O C E D U R E S

Following installation of erosion and sediment controls, as well as other control measures, a maintenance designee should meet with the contractor to review the SWPPP. A walk-through or site inspection should be performed to ascertain that all measures have been implemented in the field, that erosion is being controlled, and that transport of sediment and other pollutants into critical areas or off of the site is being prevented. Any improper installations or repairs necessary to complete the job should be noted at this time.

The SWPPP requires that all erosion and sediment controls be shown on a map of the site. To facilitate the identification of inspection locations that will be visited routinely, a grid may be overlain on the site map, and a grid reference associated with each inspection location, as shown below. These grid locations may then be cross-referenced to the inspection checklists.



---

## INSPECTION CHECKLISTS

The Pre-Storm, Post-Storm and Weekly Report (below) is to be used with the map on Page 120. The coordinates on this sample chart correspond with the coordinates of that map. This Inspection Checklist may be used for pre-storm inspection reports, post-storm inspection reports and weekly inspection reports.

### Pre-Storm, Post-Storm and Weekly Inspection Report

Date of Inspection: \_\_\_\_\_ Time: \_\_\_\_\_ Weather Conditions: \_\_\_\_\_

Location/ Coordinate	BMPs Implemented	Status	Actions Taken	Inspected by	Sample & Analysis
6A, 7A, 8A	Settlement Pond				
9A	Energy Dissipator				TSS Turb.
8O, 8P	Settlement Pond				
9P	Energy Dissipator				TSS Turb.
1D	Rock Egress Pad				

---

## R E C O R D I N G   S I T E   I N S P E C T I O N S

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

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

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

## W H A T   S H O U L D   B E   I N S P E C T E D ?

Site inspections must identify all areas where BMPs have been implemented and check them for proper functioning and efficiency, including:

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

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

A reportable quantity release report should also be kept for the site that provides the date, type of material spilled, approximate quantity, and agencies notified. This form must be completed on any occasion that a reportable quantity (as established under 40 CFR Parts 110, 117, or 302) spill occurs at the site.

---

## WHAT SHOULD THE INSPECTOR BE LOOKING FOR?

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

## HOW DOES INSPECTION RELATE TO CERTIFICATION?

All dischargers under the General Permit must annually certify that their construction activity is in compliance with the requirements of the General Permit and the site's SWPPP by July 1st of each year. This certification should be based on the site inspections described above and should be attached to the SWPPP. The Regional Board also requires submittal of the certification as part of an Annual Compliance Certification Report.

## CONFRONTING PROBLEMS

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

## WHEN ARE INSPECTION REPORTS REQUIRED?

Inspection reports must be prepared weekly and before and after all significant storm events (0.25 inches or more). They must include information on damages or deficiencies, maintenance or repair activities, monitoring information, and vegetation establishment. Inspection reports must be kept with the SWPPP during site construction and for a period of three years after completion of final site stabilization.

---

## STORM WATER POLLUTION PREVENTION PLAN CHECKLIST

The following is an example of a checklist to be used in evaluating the adequacy of a Storm Water Pollution Prevention Plan.

**(1) LOCATION INFORMATION**

- Project Location
- Road/Street Profiles (Planned and Existing)
- Scale

**(2) TOPOGRAPHIC FEATURES**

- Property line
- Legend, scale, north Indicator
- Existing contours
- Limit and acreage of disturbed area
- Wetland limits
- Water Bodies/Features: drainage ways, seeps, springs, lakes, streams, ponds, dams, rock outcrops
- Planned and existing buildings (including elevations)
- Land use of surrounding areas
- Easements
- Storage areas: Stockpile, waste, etc.

**(3) VEGETATIVE STABILIZATION**

- Areas and acreage to be stabilized
- Planned vegetation (with details of plants, seed, mulch and fertilizer)
- Specifications for temporary and permanent vegetation
- Method of soil preparation

**(4) EROSION CONTROL MEASURES**

- Legend
- Construction details for temporary and permanent measures
- Design calculations for controls
- Maintenance requirements and

- responsible person during construction
- Maintenance requirements and responsible persons for permanent measures

**(5) SITE DRAINAGE FEATURES**

- Name of receiving watercourse(s)
- Name of municipal operator (for stormwater discharges)
- Existing and planned drainage patterns (including off-site areas that drain through the projects)
- Acreage
- Soils information
- Size and location of culverts and sewers
- Design calculations and construction details for culverts and storm sewers (including soils reports)
- Design calculations for peak discharges of runoff (including construction phase and final runoff coefficients)
- Design calculations, cross sections and method for stabilizing existing and planned channels
- Design calculations and construction details of energy dissipators
- Design calculations and construction details to control groundwater-seeps/high water table/etc.

**(6) OTHER REQUIREMENTS**

- Nature and purpose of construction
- Ownership Form / 24 hour contact
- Construction sequence including installation and removal of controls

**EROSION AND SEDIMENT CONTROL PLAN CHECKLIST**

The following is an example of a Storm Water Pollution Prevention Plan (SWPPP) checklist for use by municipal staff:

<u>EROSION AND SEDIMENT CONTROL PLAN REVIEW CHECKLIST</u>	
PROJECT NUMBER: _____	ENGINEER / PHONE NUMBER: _____
REVISION DATE: _____	ASSIGNED TO:: _____
RE: _____ _____ _____ _____	SUBMITTAL REVIEW DATES DATES: AND INITIALS: _____ _____ _____
_____	DESIGN APPROVAL DATE: _____
<p>Your submission for Erosion and Sediment Control Plan approval has been reviewed. The review was made per the following minimum acceptable criteria checklist. Please return this checklist with your resubmittal.</p> <p><b>LEGEND:</b>  <u>    </u> Acceptable      <u>  X  </u> Unacceptable      <u>  INC  </u> Incomplete  <u>  R  </u> Required      <u>  N/A  </u> Not Applicable      <u>  NR  </u> Not Reviewed</p> <p><b>REVIEW:</b>  <u>    </u> 1st                      <u>    </u> 2nd                      <u>    </u> 3rd</p> <p><b>SUPPORTING INFORMATION:</b>  <u>    </u> Transmittal explaining purpose of submission  <u>    </u> Sediment Control/Stormwater Mgmt. Application (<i>First time submissions only</i>)  <u>    </u> Storm Drain Plans</p>	

---

## R E F E R E N C E S

1. **MANUALS OF STANDARDS FOR EROSION AND SEDIMENT CONTROL**—There are a number of good manuals currently available including the Association of Bay Area Governments *Manual of Standards for Erosion and Sediment Control Measures (second edition, May 1995)*, the *State Water Resources Control Boards California Stormwater Best Management Practice Handbook—Construction Activity* (1993), the Bay Area Stormwater Management Agencies Association *Start at the Source—Residential Site Planning and Design Manual for Stormwater Quality Protection*, the Caltrans Storm Water Quality Handbooks (1997), the North Carolina Department of Environment, Health, and Natural Resources *Erosion and Sediment Control Planning and Design Manual*, and others.
2. **AGENCIES**—There are a number of local agencies who can provide technical assistance, including the Regional Boards, the State Board, local flood control district, local planning and building departments, local Clean Water Programs, the Natural Resources Conservation Service, the United States Geologic Service, the State of California Department of Fish and Game, and the United States Fish and Wildlife Service.
3. **INTERNATIONAL EROSION CONTROL ASSOCIATION**—The International Erosion Control Association (IECA) annually provides an erosion control Products and Services Directory, erosion control conference proceedings, and technical assistance. The IECA has a Western Chapter that includes the State of California, and addresses erosion issues that are unique to the Western United States. The IECA may be reached at (800) 455-4322.
4. **CERTIFICATION PROGRAM**—The IECA and Soil and Water Conservation Society co-sponsor the Certified Professional in Erosion and Sediment Control (CPESC) certification program that is designed to provide certification for those with adequate erosion and sediment control qualifications and experience. Some jurisdictions are considering requiring erosion control plan preparers to have this certification. For information call (800) 455-4322.
5. **PRODUCT DESIGN SOFTWARE AND STANDARD DRAWINGS AND SPECIFICATIONS** —There are a number of erosion control, channel and slope lining software packages available to assist in the design of various systems. These are available from product manufacturers. Additionally, there are software packages available that provide standardized drawings and specifications for a wide range of erosion and sediment control measures. Information is available through the IECA at (800) 455-4322.

- 
6. **COMPARATIVE EROSION CONTROL PRODUCT PERFORMANCE DATA**—The Utah Water Research Laboratory, the Texas Transportation Institute, and other research institutes perform field and laboratory comparative tests of erosion and sediment control products and techniques, and publish the results in industry publications such as *Erosion Control* magazine and the IECA conference proceedings.
  7. **EROSION CONTROL MAGAZINE**—An industry-specific magazine is published that provides case studies, research results, current technologies, and other up-to-date industry information. To subscribe, call (805) 681-1300.
  8. **WORKSHOPS AND SHORT COURSES**—The San Francisco Estuary Project, the Regional Water Quality Control Board San Francisco Bay Region and the Bay Area Stormwater Management Agencies Association conduct workshops on erosion and stormwater pollution control topics. The International Erosion Control Association also sponsors a series of on-going educational short courses. Contact the San Francisco Estuary Project at (510) 622-2419 for more information.
  9. **VIDEOS**—“*Hold on to Your Dirt: Preventing Erosion from Construction Sites*” and “*Keep it Clean: Preventing Pollution from Construction Sites*” are available from Friends of the San Francisco Estuary. Call (510) 622-2419 to order.
  10. **GUIDELINES FOR CONSTRUCTION PROJECTS** includes the State NPDES General Permit for Construction Activity, Notice-of-Intent to Comply form and line instructions, proposed framework for preparing a Storm Water Pollution Prevention Plan and explanation of terms, information on permits needed for streambed alteration. Available from Friends of the San Francisco Estuary. Call (510) 622-2419 to order.

*The Erosion and Sediment Control Field Inspectors Manual*  
is available from Friends of the San Francisco Estuary.  
Call (510) 622-2419 to order.