

EROSION AND SEDIMENT CONTROL  
BEST MANAGEMENT PRACTICES:  
REFERENCE MANUAL

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THE STATE OF MONTANA  
DEPARTMENT OF TRANSPORTATION

*in cooperation with*  
THE U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL HIGHWAY ADMINISTRATION

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*March 2003*

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RESEARCH PROGRAMS

# **Erosion and Sediment Control Best Management Practices: Reference Manual**

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## Acronyms

AASHTO	American Association of Highway and Transportation Officials
AC	Asphalt Concrete
ADL	Aerially Deposited Lead
Ar	Arsenic
ASTM	American Society of Testing and Materials
BMPs	Best Management Practice
BOD	Biochemical Oxygen Demand
Cd	Cadmium
COD	Chemical Oxygen Demand
CPESC	Certified Professional in Erosion and Sediment Control
Cu	Copper
CWA	Clean Water Act
DEQ	Montana Department of Environmental Quality
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highways Administration
g/m <sup>2</sup>	Gram per square meter
HDPE	High Density Polyethylene
Hg	Mercury
kg/ha	Kilogram per hectare
Kn	Kilonewtons
Kpa	Kilopascal
l/ha	Liter per hectare
l/m <sup>2</sup>	Liter per square meter
L:W	Length to width
Lbs/acre	Pounds per acre
M	Meter
m <sup>3</sup> /s	Cubic meter per second
MDT	Montana Department of Transportation
Mm	Millimeter
MPDES	Montana Pollution Discharge Elimination System
MSDA	Material Safety Data Sheets
Ni	Nickel
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
°C	Degree Celsius
OSHA	Occupational Safety and Health Administration
Pb	Lead
PCCP	Portland Cement Concrete Pavement
PE	Professional Engineer
PLS	Pure Live Seed
PMS	Project Management System
RWQCB	Regional Water Quality Control Board
SWPPP	Stormwater Pollution and Prevention Plan
USDOT	United States Department of Transportation
USLE	Universal Soil Loss Equation
V:H	Vertical to Horizontal
WPCM	Water Pollution Control Manager
Zn	Zinc
Caltrans	State of California Department of Transportation

# Section 1 Introduction and Background

## 1.1 Purpose and Scope

The purpose of this Erosion and Sediment Control Manual is to describe the procedures and methods to reduce erosion and sedimentation associated with highway-related pre-construction, construction, and post construction activities. The processes of soil erosion and deposition are natural, ongoing geological mechanisms caused by the transportation and settlement of soil particles through mechanisms like water or wind. While these mechanisms are natural processes that provide stream and floodplain formation and shaping, construction activities can accelerate these natural processes and produce more sediment than are beneficial to waterways. Highway construction activities occur in both rural and urbanized areas. In both circumstances, two mechanisms can occur that increase erosion and thereby increase sediment in waterways. First, construction activities and urbanization can significantly increase the impervious area, preventing precipitation from infiltrating into the soil. The resulting increase in the volume of runoff from a given area often results in higher water velocities in streams and drainage channels, thus increasing the potential for soils to be eroded. Secondly, construction activities generally necessitate the removal of natural ground cover that acts to hold topsoil in place during precipitation events. Removal of this vegetation leaves soil unprotected against storm runoff. Consequently, erosion and sedimentation are increased drastically, which results in reduced water drainage and storage capacities. This increase in erosion and sediment can cause flooding and significant degradation of the water quality in the receiving water bodies. Contaminants that are bound to sediment particles can also be transported into the waterways through storm water runoff. These contaminants, in combination with the sediment, can decrease water quality, harming both wildlife and vegetation.

The Environmental Protection Agency (EPA) recommends that a management systems approach be used to achieve effective construction storm water management as opposed to an approach that focuses on individual storm water practices. A management systems approach addresses numerous individual practices and evaluates the overall cost and effectiveness of the entire storm water control system. Within this manual, numerous Best Management Practices (BMPs) that are currently utilized for erosion and sediment control are described in detail. These BMPs are the tools that designers, contractors, construction, and maintenance staff can use to create an erosion and sediment control management plan that will control the unwanted release of pollutants to Montana's waterways. This manual also provides guidance for the design, construction, and post-construction phase implementations of BMPs for construction activities. The organization of this manual is shown below.

- Section 1 provides the purpose and scope of this manual and background information on the federal and state regulations.
- Section 2 describes the concepts and impacts of erosion and sedimentation.
- Section 3 includes a list and description of BMPs useful for temporary erosion and sedimentation control.
- Section 4 provides a description of activities and tools to be used for temporary erosion and sediment control during the design process.

- Section 5 describes temporary erosion and sediment control procedures to follow during the construction phase.
- Section 6 provides information on the post-construction phase BMPs and tools to be utilized during this process.

Much of the text in Section 1 is direct language taken from the Montana Department of Environmental Quality, the U.S. Environmental Protection Agency, and the Federal Highway Administration’s web sites. (<http://www.epa.gov/>; <http://www.fhwa.dot.gov/>, and <http://www.deq.state.mt.us/>)

## 1.2 Erosion and Sediment Control Contact List

Agency	Telephone Number
Montana Department of Environmental Quality (DEQ) Permitting/Compliance Division – Water Protection Bureau	(406) 444-3080
Environmental Protection Agency (EPA) Region 8	(303) 312-6312
Montana Department of Transportation (MDT) Districts	
Billings	(406) 252-4138
Butte	(406) 494-9600
Glendive	(406) 377-5296
Great Falls	(406) 454-5880
Missoula	(406) 523-5800
MDT- Environmental Services Bureau	(406) 444-7228
MDT- Erosion & Sediment Control	(406) 444-7224

## 1.3 Regulations and Permits

### 1.3.1 Federal Requirements

The Clean Water Act (CWA) prohibits the discharge of any pollutant to waters of the United States from a point source (well defined location) unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Phase I of the NPDES storm water program addresses, among other discharges, discharges from large construction activities disturbing 2 ha (5 acres) or more of land. Phase II of the NPDES storm water program addresses small construction activities disturbing between 0.4 and 2 ha (1 and 5 acres). Those sites disturbing less than 0.4 ha (1 acre) are regulated as small construction activity in the cases that these sites are part of a larger planned disturbance between 0.4 ha and 2 ha (1 and 5 acres). The permitting authority can also require a NPDES permit if the permitting authority decides that potential for violation of water quality standards or significant contribution of pollutants exists. Phase II became final on December 8, 1999 with small construction permits applications due by March 10, 2003, with specific compliance dates set by the NPDES permitting authority of each State (EPA – Storm water Phase II Final Rule).

The specific requirements for storm water controls on construction activities will be defined by the NPDES permitting authority, which is the DEQ unless the construction site is located on Tribal lands. If the construction site is located on Tribal land, the EPA region 8 will be the permitting authority. In the

state of Montana (not including Tribal lands), a Montana Pollution Discharge Elimination System (MPDES) permit will be required. Existing Phase I general permits for large construction activities will be used as a guide for the Phase II permits for small construction activities. To obtain a General Permit under the MPDES from DEQ, a Notice of Intent (NOI) package for storm water discharges associated with construction activities must be prepared, submitted, and approved by DEQ.

### **1.3.2 MPDES Storm Water Discharge General Permit**

DEQ, under the authority of the Montana Water Quality act, regulates the discharge of pollutants into state waters through the adoption of water quality standards and the permit application process. A MPDES permit is required from DEQ for storm water discharge associated with construction activity. This includes a discharge from construction activities due to disturbance from clearing, grading, and excavation, except for operations that result in the disturbance of less than one acre of total land area. Construction activity also includes the disturbance of less than 0.4 hectare (one acre) of total land area that is a part of a larger common plan of development or sale, if the larger common plan will ultimately disturb 0.4 hectare (one acre) or more. Regardless of the acreage of disturbance, construction activity includes any other activity designated by DEQ to have the potential for contribution to a violation of a water quality standard or for significant contribution of pollutants to surface waters. For storm water discharge associated with construction activity which has disturbance less than 2 hectare (five acres), the acreage of disturbance does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

The MPDES permit application , requirements, and forms are included in Appendices B through H.

#### **1.3.2.1 DEQ Notice of Intent**

Federal and State guidance states that any person who is the operator of a storm water discharge associated with construction activity which requires coverage under the General Permit shall submit a complete Notice of Intent (NOI) package to the regulatory authority. The NOI package shall consist of the following submittals:

- A signed and complete NOI form;
- A signed and complete Storm Water Pollution Prevention Plan (SWPPP); and
- Required application and annual fees.

Upon receipt of the complete NOI package, the regulatory authority will provide a confirmation letter acknowledging the receipt of the package to the identified operator. If a complete NOI package is not submitted, compliance for storm water discharge associated with construction activity under the General Permit will not initiate until all required items are received by the regulatory authority. The operator should submit complete NOI packages, with all components submitted at the same time, to ensure efficient NOI processing by the regulatory authority, to prevent delay of construction activity, and to minimize potential storm water discharge compliance problems.

Effective immediately upon the submittal of a complete NOI package for coverage under the General Permit and lasting though the expiration date, the following limitations apply:

- There must be no discharge of process wastewater pollutants to surface waters. Discharges to surface waters of material other than storm water must be in compliance with a NPDES permit other than the General Permit.
- All discharges to surface waters covered by the General Permit must be composed entirely of storm water. Discharges must consist of water generated only through rainfall precipitation and snowmelt.
- A discharge of storm water associated with construction activity must not cause or contribute to a violation of water quality standards.

The NOI form and package requirements are included in Appendices C and D of this manual.

### **1.3.2.2 SWPPP**

In order to characterize the construction activity, potential sources of pollutants, and BMPs to ensure pollutants do not reach surface waters, operators are required to develop and implement a SWPPP. A SWPPP replaces what was formerly referred to as an Erosion Control Plan. The SWPPP must be submitted to regulatory agencies at the same time as the NOI. SWPPP guidance can be found in EPA's web site (<http://cfpub.epa.gov/npdes/stormwater/cpermit.cfm>). At a minimum the SWPPP must include the following information:

1. Site Description: Each plan must at a minimum, provide a description of the following:
  - a. The nature of the construction activity, including a proposed implementation schedule for major activities.
  - b. Estimates of the total area of the site and the area of the site that is expected to undergo disturbance related to construction activity.
  - c. Site map(s) indicating:
    - Areas of total development and, at a minimum, areas of "disturbance" related to construction activity (including support activities related to a construction site, concrete or asphalt batch plants, equipment staging yards, material storage areas, material borrow areas, etc.);
    - Drainage patterns;
    - Approximate slopes anticipated after major grading activities;
    - Approximate staging areas for soils or wastes;
    - Areas used for the storage of fuel(s);
    - Location of all erosion and sediment control measures or structures;
    - Areas where vegetative measures are to be implemented;

- The location of impervious structures (including buildings, roads, parking lots, outdoor storage areas, etc.) after construction is completed;
  - The location of all surface waters on or near to the construction activity site (including perennial and intermittent water bodies, ephemeral streams, springs, wetlands with standing water, etc.);
  - The boundary of the 100-year floodplain, if determined; and
  - A north arrow and map scale.
- d. The American Association of State Highway and Transportation Officials (AASHTO) soil classification and erodibility of sediment and other earth material to be disturbed at the project site, including cut/fill material to be used.
- e. For a storm water discharge associated with construction activity with construction-related disturbance of 2 ha (5 acres) or more of total land area, an estimate of the runoff coefficient of the site and the increase in impervious area after the construction addressed in the NOI is completed.
- f. The names of receiving surface waters and a description of the size, type, and location of each point source discharge or outfall. If there is no distinguishable point source discharge or outfall to the receiving surface waters, a description of storm water runoff flow and drainage patterns into the receiving surface waters must be provided. If the discharge is to a municipal separate storm sewer, the location of any storm sewer discharge into receiving surface waters.
- g. A description of storm water discharges from support activities related to a construction site (e.g. concrete or asphalt batch plants, equipment staging yards, material storage areas, etc.).

2. BMPs and Storm Water Management Controls (Montana Department of Environmental Quality Permit for Storm Water Discharges Associated with Construction Activity).

Each operator(s) covered by the General Permit shall develop, as part of the SWPPP, a description of BMPs and storm water management controls appropriate for the site, including a brief description of applicable local erosion and sediment control requirements. The following minimum components must be addressed, including a schedule for implementation, unless otherwise authorized in writing by the Department.

- a. A description of stabilization measures which must, to the degree practicable, preserve existing vegetation and re-vegetate areas of construction-related disturbance as soon as possible after grading or construction. In developing vegetative measures, the operator(s) shall consider: temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffer/filter strips, grassed waterways, erosion control blankets, and tree and shrub planting.
- b. A description of structural measures which indicates how, to the degree practicable, the operator(s) will divert storm water flows from exposed soil, store these flows, or otherwise limit runoff from exposed areas of the site. In developing structural measures, the operator(s) shall

consider: straw bale dikes, silt fences, earth dikes, brush barriers, drainage swales, check dams, subsurface drains, pipe slope drains, rock outlet protection, drain inlet and outlet protection, temporary drain diversions, sediment traps, temporary sediment basins, infiltration trenches or basins, and retaining walls. The operator(s) should also consider the proximity of structural measures with respect to floodplains, and if there are other alternatives, avoid the placement of structural BMPs within the floodplain.

- c. None of the temporary control structures, including silt fences and straw bale dikes, shall be removed until permanent vegetation and site stabilization has taken place. The only exception to this would be where temporary control structures need to be moved or removed in order to allow continuing construction activities to occur, in which case equivalent measures must be implemented to ensure the same level of protection in minimizing potential pollutant discharges.
- d. Off-site vehicle tracking of sediments from the construction site must be controlled or minimized, particularly onto paved road surfaces, in order to minimize the potential impairment of storm water quality.
- e. When trucking saturated soils from the site, either tight leak-proof trucks must be used or loads must be required to drain until drippage has been reduced to less than 3.75 liters (1 gallon) per hour before leaving the site.

The SWPPP form and requirements can be found in Appendix E.

### **1.3.3 AASHTO Highway Drainage Manual and FHWA Final Rule**

On July 26, 1994, the Federal Highway Administration (FHWA) published its Final Rule adopting AASHTO Guidelines to be followed on all projects funded under title 23, United State Code. As a part of this rule, state highway agencies were directed to apply these guidelines or their own more stringent guidelines.

With its Final Rule, the FHWA committed to ensuring that all highway construction projects are located, designed, constructed, and maintained according to standards that will minimize erosion and control associated sedimentation. Volume III of the AASHTO Highway Drainage Guidelines provides excellent guidance concerning these factors. The following is a summary of some of the important issues.

- This regulation and the accompanying guidelines apply to all projects funded under title 23 United States Code. This includes projects on or off the National Highway System.
- Erosion and sediment control plan sheets shall be included in the plans and specifications for all applicable projects, not just larger or more complex projects. It is no longer satisfactory to specify that the contractor is responsible for all damages resulting from the construction operation or to leave the development of erosion and sediment control to the contractor or to project personnel after the project has been awarded.
- Erosion and sediment control plan sheets shall be developed by qualified personnel.

- As a minimum, erosion and sediment control plan sheets should identify erosion and sediment sensitive areas and provide a mechanism for minimizing any adverse effects. It is not acceptable to provide a bid item for various erosion and sediment control items without including a corresponding plan indicating how and where these items shall be placed.
- During construction, erosion and sediment control plan sheets should be periodically evaluated to assess the effectiveness of the implemented management practices. Erosion and sediment control plan sheets should be revised and updated as needed to ensure that the intended purpose is achieved.

## **1.4 Designer, Engineer/Inspector, Contractor, and Post-Construction Responsibilities**

The four principle parties involved in designing, implementing, and monitoring of erosion and sediment controls are the designer, engineer/inspector, contractor, and post construction personnel. Each party has specific roles and responsibilities that are described below.

### **Designer Responsibilities**

- Research construction project site conditions.
- Understand the scope of the construction project including duration of the construction and the time of year construction will commence.
- Submit the NOI package with all the required submittals to the DEQ or to the EPA if the construction site is located on Tribal land.
- Ensure that topography and drainage are clearly delineated within the SWPPP.
- Provide a SWPPP and erosion and sediment control plan sheets with sufficient bid items to address erosion and sediment throughout project construction.

### **Engineer/Inspector Responsibilities**

- Have knowledge and understanding of the SWPPP and general permit conditions.
- Ensure the contractor submits revision to the SWPPP if required.
- Ensure contractor maintains the erosion and sediment control facilities as needed.
- Know how to properly install BMPs to control erosion and contain sediment.
- Ensure that contractor and project comply with all applicable permits.

### **Contractor Responsibilities**

- Bid on job with knowledge of site conditions.
- Construct BMPs as described on plans and specifications.
- Maintain erosion control facilities and modify when needed to be effective.

- Update SWPPP as work progresses and modify plan as conditions change.
- Be familiar with requirements of general permits.
- Inspect BMP installation during construction activities.

### **Post-Construction Personnel Responsibilities**

- Monitor BMPs for effectiveness.
- Maintain all erosion and sedimentation controls after construction activities are completed.
- Remove temporary BMPs after sufficient reestablishment of vegetation.

## **1.5 DEQ Notice of Termination**

When a site has been finally stabilized or when the operator at a site changes, the operator shall submit a standard DEQ Notice of Termination (NOT) form. The NOT form can be found in Appendices G and H. Failure to submit a NOT shall result in additional annual permit fee accumulation until notification has been received.