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Developing Stormwater Pollution Prevention Plans

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Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the primary components and regulatory purpose of a Stormwater Pollution Prevention Plan (SWPPP).
- **Evaluate** the environmental impacts of construction-related stormwater runoff and impervious surfaces.
- **Select** appropriate categories of Best Management Practices (BMPs) to mitigate specific types of soil erosion.

Executive Summary: A SWPPP is a site-specific, legally required document that identifies potential pollution sources and describes the exact practices—both structural and non-structural—an operator will use to prevent contaminated runoff from leaving a construction site.

Value of This Course

For engineers and operators responsible for erosion and sediment control (ESC), this course provides a systematic framework for developing and implementing an effective **Stormwater Pollution Prevention Plan (SWPPP)**.

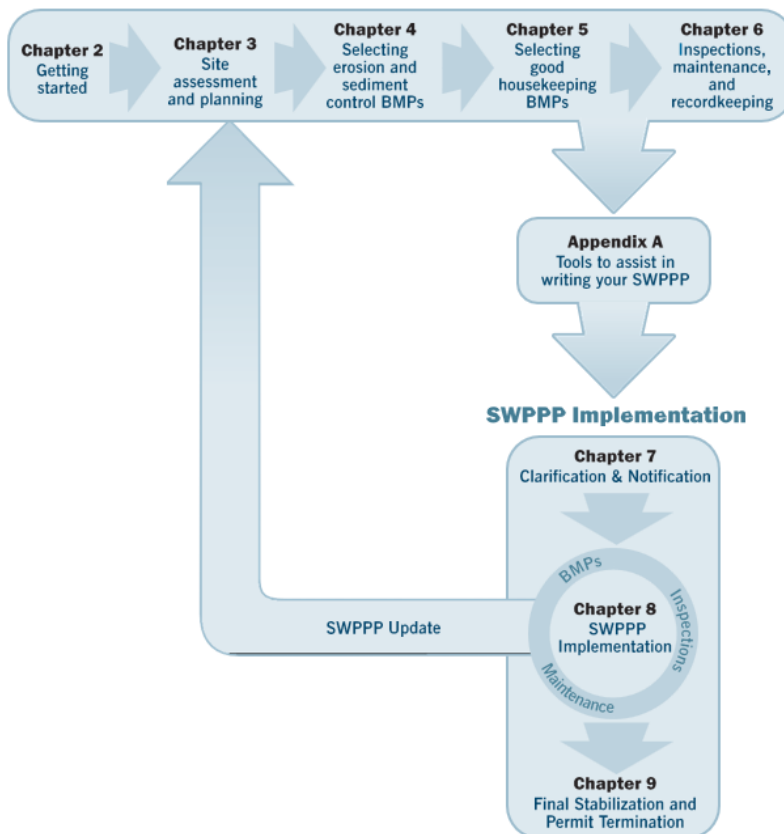


Figure 1. SWPPP Process



Defining the SWPPP

A SWPPP is more than a simple erosion control plan; it is a comprehensive, written strategy that:

- **Identifies** potential sources of stormwater pollution at the construction site.
- **Describes** specific practices to reduce pollutants in discharges, primarily by controlling the volume of runoff and facilitating **soil infiltration**.
- **Identifies** the exact procedures an operator will implement to maintain compliance with a construction general permit.

⚠ Safety Constraint: Failure to implement a SWPPP can result in significant administrative and financial fines from the EPA or state environmental agencies.

What Is Stormwater Runoff and What Are Its Impacts?

Stormwater runoff is rain or snowmelt that flows over land surfaces instead of percolating into the soil. While it occurs naturally in small amounts, **impervious surfaces**—such as buildings, roads, and parking lots—drastically alter site hydrology.

Hydrologic and Environmental Consequences

- **Increased Volume and Velocity:** Leads to severe stream bank erosion and flooding.
- **Decreased Infiltration:** Reduces groundwater recharge and can negatively impact local drinking water supplies.
- **Pollutant Transport:** Runoff collects trash, debris, oil, grease, pesticides, and other toxics.
- **Habitat Degradation:** Changes in water temperature and sediment loads are detrimental to aquatic life and human health.

The Sediment Threat

Soil exposed by construction is highly susceptible to erosion. Unstabilized sites can lose **35–45 tons of sediment per acre annually**. Excess sediment clouds water, reduces sunlight for aquatic plants, clogs fish gills, and smothers spawning areas.

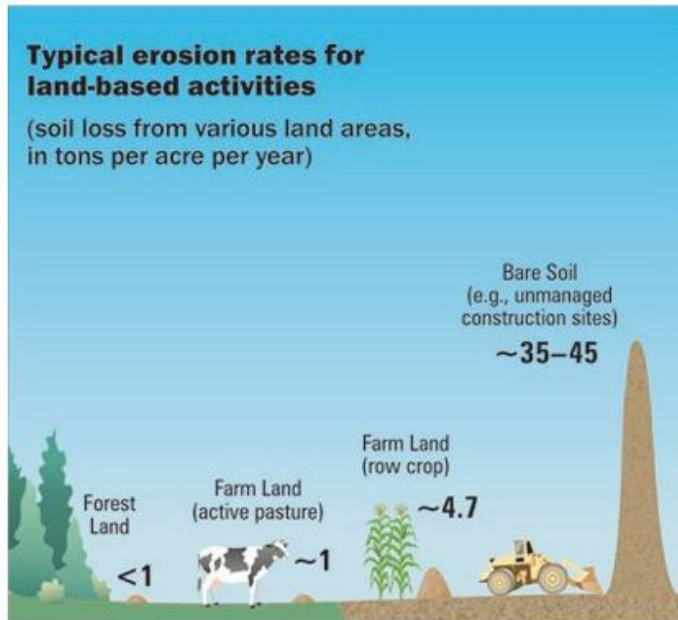


Figure 2. Figure 2. Typical erosion rates from land-based activities. (Dunne, T. and L. Leopold, 1978; NRCS, 2000; NRCS, 2006; ASCE and WEF, 1992)

Factors Influencing Erosion

- **Climate:** The frequency, intensity, and duration of rainfall are the primary drivers of erosion.
- **Topography:** Longer and steeper slopes significantly increase erosion potential.
- **Soils:** Texture, structure, organic matter, and permeability all dictate how easily soil dislodges.
- **Vegetative Cover:** This is a critical defense that absorbs raindrop energy, slows runoff velocity, and binds soil particles.

Design Tip: Plan major soil disturbance activities for periods of historically lower rainfall to minimize ESC failure.

How Can Construction Site Operators Prevent Stormwater Pollution?

Prevention is managed through **Best Management Practices (BMPs)**. These are categorized into structural and non-structural controls.

BMP Categories

- **Structural BMPs:** Physical installations such as silt fences, sedimentation ponds, erosion control blankets, and seeding.
- **Non-Structural BMPs:** Operational practices including staff training, equipment maintenance, and routine street sweeping.

Types of Erosion to Address

The SWPPP must account for the progression of soil loss:

Erosion Type	Description
Raindrop	The initial dislodging of soil particles caused by raindrop impact.
Sheet	Uniform removal of soil without visible water channels.
Rill	Formation of concentrated runoff creating many small channels.
Gully	Highly concentrated runoff cutting deep into the soil along flow lines.
Streambank	Erosion of unstable banks caused by flowing water.

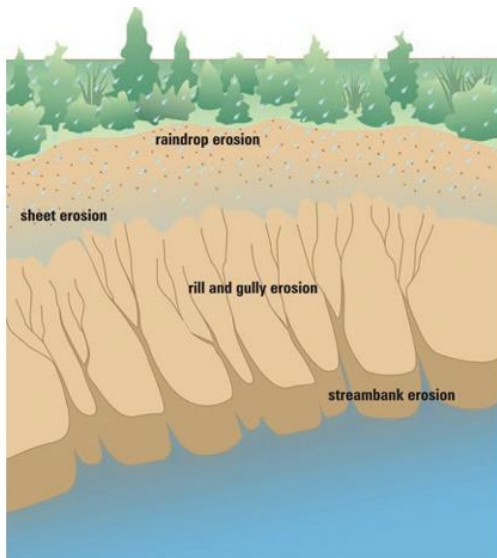


Figure 3. Types of erosion.

Erosion vs. Sedimentation

Erosion is the process of the land surface being worn away by water or wind.

Sedimentation is the settling out of soil particles from suspension.


Key Principle: It is significantly less expensive to prevent erosion than it is to capture sediment once it has left the site.

Course Structure and Documentation

A formal SWPPP includes:

- Detailed site descriptions and major activity phases.
- Clearly defined roles for contractors and subcontractors.
- Inspection schedules and logs.
- A living record of plan modifications and updates.



 **Calculation Note:** When designing ESC measures, engineers must account for slope length and steepness. Use diversions or fiber rolls to break up long slopes to reduce runoff velocity.

Checkpoint Quiz

1. Which of the following is considered the primary pollutant of concern at most construction sites?

- a) Oil and grease
- b) Pesticides
- c) Sediment
- d) High pH waste

Answer: (c). While other toxics are present, sediment is explicitly identified as the primary pollutant resulting from construction activities.

2. What is the fundamental difference between structural and non-structural BMPs?

- a) Structural BMPs are required by law, while non-structural are optional.
- b) Structural BMPs involve physical installations, while non-structural involve operational practices and training.
- c) Structural BMPs only address sedimentation, while non-structural address erosion.
- d) There is no difference; the terms are used interchangeably.

Answer: (b). Structural BMPs involve physical installations, while non-structural involve operational practices. Structural controls include physical items like silt fences and ponds, whereas non-structural include activities like training and maintenance.

3. According to the "Erosion vs. Sedimentation" principle, which approach is typically more cost-effective?

- a) Installing large-scale sedimentation basins at the site perimeter.
- b) Implementing robust erosion control measures to keep soil in place.
- c) Relying on street sweeping as the primary pollutant removal method.
- d) Treating all discharged water through a municipal filtration system.

Answer: (b). Implementing robust erosion control measures to keep soil in place. The manual states it is usually easier and less expensive to prevent erosion than to control sediment once it has been dislodged.



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