Module 1: Introduction & Overview of Erosion & Sediment Control – NDDOT Erosion & Sediment Control – Construction Course

NDDOT Erosion & Sediment Control – Construction Course

Module 1: Introduction & Overview of Erosion & Sediment Control

Course Instructors

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NDDoH Division of Water Quality Representative
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Partners

NDSU
UPPER GREAT PLAINS
TRANSPORTATION INSTITUTE

North Dakota
DEPARTMENT OF HEALTH

Housekeeping

• Agenda
• Breaks
• Restrooms
• Lunch
• Courtesies
• Course Materials
Module 1: Introduction & Overview of Erosion & Sediment Control – NDDOT Erosion & Sediment Control – Construction Course

<table>
<thead>
<tr>
<th>Topic</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module 1 – Introduction</td>
<td>2 hours</td>
</tr>
<tr>
<td>Module 2 – Regulations and Special Provisions</td>
<td>3 hours</td>
</tr>
<tr>
<td>Module 3 – Temporary &amp; Permanent ESCMs</td>
<td>2.5 hours</td>
</tr>
<tr>
<td>Module 4 – SWPPP</td>
<td>2 hours</td>
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<tr>
<td>Final Exam</td>
<td>1.5 hour cap</td>
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</table>

Participant Expectations

**Attendance:**
- Required

**Written Exam:**
- Open Book
- 80% Pass
- Remediation

**Certification Requirements:**
- Project Engineer
- Prime Contractor
- Sub-contractor

**Recertification:**
- 3 years
- TBD
What are the course’s learning objectives?

1. Develop a working knowledge of regulatory agencies and regulations

2. Understand what erosion and sediment control measures identified in the plans and be able to review their applicability for installation
What are the course’s learning objectives?

3. Effectively manage the erosion and sediment control plans, installation, and maintenance

4. Evaluate the bid quantities and make adjustments for varying site conditions

5. Understand the requirements of the SWPPP and know the procedures for maintaining them

Participant Introductions

What is your name?

Where are you from?

What is your job?

How many years of erosion and sediment design experience do you have?

What do you hope to learn from this course?
What are the module’s learning objectives?

1. Identify:
   - Erosion and sediment control principles
   - Why erosion and sediment control is important
   - Wastes in runoff and effects on receiving waters
   - Types of erosion mechanisms
   - Two main types of soil erosion on construction sites

2. Identify mileposts in the construction process

Basic Engineering Principles

Planning

Design

Construction

Operation
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Data Collection and Analysis

Facility Planning & Design

Planning/Design Erosion/Sediment Controls

Types, placement, sizing

Protects the Environment

Human

Environment

Public Health

Environmental Health
Era of Environmental Awareness

NEPA  National Environmental Policy Act
EPA  Environmental Protection Agency
**CWA**  Clean Water Act
LEED  Leadership in Energy and Environmental Design
NPDES  National Pollutant Discharge Elimination System \((40\text{ CFR 122.26})\)

Water Pollution

Water is the “Universal Solvent”

Anthropogenic (human caused)

Point Source

Dispersed Source (nonpoint source)
Nonpoint Source Pollution from Construction

Removal of surface vegetation
Stripping and stockpiling topsoil
Placement of erodible soil on or near streets
Pumping water from excavations
Vehicle tracking

Sediment/Sedimentation

Particles suspended in construction runoff water that settle out and can be harmful to fish, wildlife, and aquatic species.
Other Impacts:

Changes in water chemistry
Influx of poisonous chemicals
Growth of undesirable plants/algae
Flattening of streambed channels
Increased possibility of flooding

Environmental Sensitivity

Environmental Commitments:
– Wetland impacts
– Wildlife
– Cultural resources
Activity

At your tables, make a list of what else besides soil would be found in construction site runoff.

Average Values of Highway Runoff
(Barrett Et Al., 1994)

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Concentration (ppm)</th>
<th>Load Lb./ac./year</th>
<th>Load Lb./ac./event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatile Solids</td>
<td>57-242</td>
<td>160-2244</td>
<td>9.36</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.056-0.929</td>
<td>0.196-9.27</td>
<td>0.004-0.022</td>
</tr>
<tr>
<td>Iron</td>
<td>2.429-10.3</td>
<td>3.90-25.7</td>
<td>0.50</td>
</tr>
<tr>
<td>Mercury</td>
<td>3.22</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td>Total Coliforms</td>
<td>570-6200</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fecal Coliforms</td>
<td>50-590</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>2.7-27</td>
<td>4.32-683.7</td>
<td>0.08-0.14</td>
</tr>
</tbody>
</table>
Erosion Mechanisms

Erosion Mechanisms
Erosion Mechanisms

Two main types of soil erosion experienced on construction sites are:

– Water
– Wind

Levels of Water Erosions:

– Raindrop (splash)
– Interrill (sheet)
– Rill
– Gully
– Stream & channel bank
Erosion Mechanisms

Raindrop (Splash) Erosion:

A $\frac{1}{4}$” diameter raindrop can impact the ground at speeds up to 20 mph

Approximately 80% of erosion problems on construction sites are a result of raindrop impacts
Erosion Mechanisms

Interill (Sheet) Erosion:
Runoff over the site as a thin, uniform layer
Approximately 1/16” to 1/8” deep
Will typically pick up and transport soil particles dislodged by raindrop impacts

Rill Erosion
Erosion Mechanisms

Gully Erosion:

A larger channel caused by concentrated flow of surface and storm water over unprotected, erodible soil

Typically formed by multiple rills joining together
Erosion Mechanisms

Sedimentation

The settling or deposition of eroded material after it has been transported

**Bed Load:**

Soil particles that are dragged or rolled along the bed of the channel

**Saltation:**

Soil particles are skipped or bounced along the bottom
Sedimentation

**Suspension:**

Particles are picked up by current and carried long distances

Fine and light soil particles (silts and clays)

**Colloidal Suspension:**

Includes fine colloidal soil particles that may never settle to the bed
Erosion Mechanisms (USDA and Colorado State Ext.)

Soil particles come in various shapes and sizes

<table>
<thead>
<tr>
<th>Soil Size Classification</th>
<th>Soil Particle Diameter (mm) [in]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse Sand</td>
<td>0.5-1 [0.020-0.039]</td>
</tr>
<tr>
<td>Medium Sand</td>
<td>0.25-0.5 [0.010-0.020]</td>
</tr>
<tr>
<td>Fine Sand</td>
<td>0.08-0.1 [0.001-0.004]</td>
</tr>
<tr>
<td>Silt</td>
<td>0.002-0.05 [7.87E-05-0.002]</td>
</tr>
<tr>
<td>Clay</td>
<td>&lt;0.0001 [3.94E-06]</td>
</tr>
</tbody>
</table>

Particles are eroded and transported

Particles are transported

Particles are deposited
<table>
<thead>
<tr>
<th>Soil Size Classification</th>
<th>Settling Velocity</th>
<th>Time to Settle 1 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel</td>
<td>1.67 – 3.33 ft/sec</td>
<td>0.3 – 0.6 seconds</td>
</tr>
<tr>
<td>Sand</td>
<td>0.008 – 0.33 ft/sec</td>
<td>3 – 120 seconds</td>
</tr>
<tr>
<td>Silt</td>
<td>0.02 – 0.03 ft/min</td>
<td>30 – 60 minutes</td>
</tr>
<tr>
<td>Clay</td>
<td>0.005 – 0.010 ft/day</td>
<td>100 – 200 days</td>
</tr>
<tr>
<td>Colloids</td>
<td>0.02 – 1.6 ft/year</td>
<td>&gt;200 days</td>
</tr>
</tbody>
</table>

**Turbidity**

Nephelometric Turbidity Units (NTU) is a common method of expressing turbidity of water
Wind Erosion

Wind erosion is similar to water erosion except the movement of air is responsible for the movement of the soil.

Raindrop erosion as well as disturbing the soil with equipment and vehicles can cause soil particles to become dislodged and more easily transported by wind.

Wind Erosion

Wind erosion is influenced by multiple factors:

- Wind velocity
- Surface roughness
- Surface cover
- Moisture level of the top layer of soil

Construction Site Runoff Research:

70 construction site runoff samples from the Birmingham, AL area

Suspended solid concentrations in the samples ranged from 100 to more than 25,000 mg/L (median about 4,000 mg/L)

Turbidity ranged from 300 to greater than 50,000 NTU (average of 4,000 NTU)
Erosion Facts (USDA NRCS Soil Quality – Urban Technical Note No. 1 “Erosion and Sedimentation on Construction Sites”)

Construction sites can erode at a rate of 100 to 500 tons/acre/year
– 100 times greater than cropland
– 2,000 times greater than woodlands

Project Management
Who is a project manager?

Contract administration
Designers
Contract owner (prime)
Project superintendent
Sub-contractor
All

Typical Operations
1. Assigned to Project
2. Bid Opening
3. SWPPP Development
4. Pre-Construction Conference
5. Site Visit
6. Mobilization
7. Start of Construction
8. Project Closeout
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Typical Operations

Assigned to Project  Bid Opening  SWPPP Development

Pre-Construction  Site Visit  Mobilization  Start of Construction  Project Closeout

Earthwork  Clear & Grub  Final Grading

Review and Update SWPPP  Inspections, Maintenance/Repairs

Plan Schedule (Phasing)

Step 1 Assigned to Project

Review plans and specs

Site Visit

– Constructability

– Areas of special concern

Changes to design documents
Step 2 Pre-Construction Conference

Roles and Responsibilities

   ESC Supervisor

Review Permits

Documentation

Potential Concerns

Step 3 Pre-Job Startup

Site visit

   – Areas of concern

      High risk

      Existing conditions

   – Constructability
Step 4 Mobilization

Location of documents
Service/Storage areas
Plants/Stockpiles
Sanitation
Track out
Protected areas

Step 5 Construction

Install ESCMs
Site Prep
Inspect, maintain, and repair
Step 6 Remove Temporary ESCMs

ESCMs – proper

Sediment

Stabilize

– Device

– Site location

Which to remove as we go/which stay or are added to benefit Perm ESCMs

Step 7 Winterizing (if needed)

Stabilization

Spring thaw/runoff

PLAN AHEAD
Step 8 Close Out

Notice of termination

Permanent installation
  – ASAP
  – What temps stay?
  – Vegetation established

Tips

Understand the Plan

Know the Limitations

Communicate your Concerns

Insist on Regularly Scheduled Meetings
What are the module’s takeaway points?

Effective erosion and sediment control must be designed into each specific project

Erosion is easier to control than sedimentation

Improper erosion and sediment control negatively affects the environment, waters, and wildlife

Wind erosion can have the same ill effects as water erosion

What are the module’s takeaway points?

The construction process has many stages and ESC is a part of each stage

Standard specifications and contact documents must be read, understood, and executed to assure compliance regulations

Your role in the process is vital to effective and successful completion of projects
What’s next?

Module 2: Regulations and Special Provisions

Module 3: Temporary & Permanent Erosion & Sediment Control Measures

Module 4: Stormwater Pollution Prevention Plan (SWPPP)

Exam