TABLE OF CONTENTS

Chapter 10: Erosion Control and Storm Water Quality

Section 10-1 General Introduction
- 10-1-1 .....Purpose and Objectives
  - 1.1.....Originator
  - 1.2.....Purpose
  - 1.3.....Chapter Organization
  - 1.4.....Glossary
- 10-1-2 .....Applicable Laws and Regulations
  - 2.1.....Federal, State, and Local Laws and Regulations
  - 2.2.....NR 216 and NPDES Permitting
  - 2.3.....Municipal Storm Water Discharge Permits
  - 2.4.....Wis. Adm. Code, Chapter Trans 401
  - 2.5.....Administration Rules for Erosion and Sediment Control on Highway Construction Projects
- 10-1-3 .....Erosion Control Plan
  - 3.1.....Limit Off-Site Effects
  - 3.2.....Facilitate Construction and Minimize Cost
  - 3.3.....Laws & Regulations
- 10-1-5 .....The Erosion Process
- 10-1-10 .....Basic Principles of Erosion and Sediment Control

Section 10-5 Developing An Erosion Control Plan
- 10-5-1 .....Communication and Coordination
  - 1.1.....Internal Communication and Coordination
  - 1.2.....External Communication and Coordination
    - 1.2.1 .....With the Department of Natural Resources (DNR)
- 10-5-5 .....Planning and Location Considerations
- 10-5-10 .....Erosion Sensitive Areas
- 10-5-15 .....Environmental and Customer Sensitive Areas
- 10-5-20 .....Soils Investigation
- 10-5-25 .....Geometric Considerations
  - 25.1.....Introduction
  - 25.2.....Topography
  - 25.3.....Alignment and Grade
  - 25.4.....Cross Sections
  - 25.5.....Proper Shaping for Erosion Control
  - 25.6.....Cut-To-Fill Transitions (Cut Runouts)
  - 25.7.....Culverts
  - Attachment 25.1....Erosion Control Prevention
  - Attachment 25.2....Erosion Control At Cut To Fill Transition
  - Attachment 25.3....Transition From Cut of Fill
- 10-5-30 .....Drainage Guidance For Erosion Control
  - 30.1.....Natural Drainage
  - 30.2.....Adjacent Areas
  - 30.3.....Local Input
  - 30.4.....Storm Design Guidance and Channel Capacity
  - 30.5.....Storm Water Runoff
- 10-5-35 .....Channel and Slope Matrics
  - Attachment 35.1....Channel Erosion Control Matrix
  - Attachment 35.2....Slope Erosion Control Matrix
- 10-5-40 .....Calculating Shear Stress in Channels

Attachment 40.1....Manning's Roughness Coefficients Table
Attachment 40.2....Nomograph for Flow in Triangular Channels
10-5-45 .....Analyzing Costs
45.1.....Cost vs. Effectiveness
10-5-50 .....Estimating Erosion Control Quantities
50.1.....Mobilization for Erosion Control
50.2.....Emergency Mobilization for Erosion Control
10-5-55 .....Erosion Control Plan Preparation
55.1.....Introduction
55.2.....Special Provisions
55.3.....Construction Plans
10-5-60 .....Checklist for Erosion Control Plans
Attachment 60.1....Erosion Control Plan Checklist
Attachment 60.2....Runoff Coefficient Table
10-5-65 .....Construction Considerations
10-5-70 .....Maintenance Considerations

Section 10-10 Erosion and Sediment Control Devices

10-10-1 .....Devices and Measures Available
1.1.....Introduction
1.2.....Devices Available
1.2.1 .....Erosion Control Devices
1.2.2 .....Sediment Control Devices
1.2.3 .....Runoff Diversion Devices
1.3.....Devices Required On All Grading Projects
1.4.....Temporary vs. Permanent Measures
1.4.1 .....Temporary Measures
1.4.2 .....Permanent Measures
Attachment 1.1.....Erosion Control Measures
Attachment 1.2.....Summary of Control Measure Applications
Attachment 1.3.....Example of Selected control Measures Used in Combination
10-10-3 .....Vegetation
10-10-6 .....Seeding
6.1.....Definition
6.1.1 .....Temporary Seed
6.1.2 .....Permanent Seed
6.1.3 .....Native Seed
6.1.4 .....Borrow Pit Seed
6.1.5 .....Dormant Seed
6.2.....Application
6.2.1 .....Temporary Seeding:
6.2.2 .....Permanent Seeding:
6.2.3 .....Native Seeding:
6.2.4 .....Borrow Pit Seeding:
6.3.....Design Guidance
6.3.1 .....Temporary Seeding
6.3.2 .....Permanent Seeding
6.3.3 .....Native Seeding
6.3.4 .....Borrow Pit Seeding
10-10-8 .....Water
8.1.....Definition
8.2.....Application
8.3.....Design Guidance
8.4.....Considerations
8.5.....Estimating Quantities
10-10-9 .....Sodding
9.1.....Definition

9.2.....Application
9.3.....Design Guidance
9.4.....Limitations
10-10-10 .....Mowing
10.1.....Definition
10.2.....Application
10.3.....Design Guidance
10.4.....Considerations
10.5.....Estimating Quantities
10-10-11 .....Topsoil
11.1.....Definition
11.2.....Application
11.3.....Design Considerations
10-10-12 .....Fertilizer
12.1.....Definition
12.2.....Application
12.3.....Design Considerations
10-10-13 .....Mulching
13.1.....Definition
13.2.....Application
13.3.....Design Considerations
10-10-15 .....Erosion Mat
15.1.....Definition
15.2.....Application
15.3.....Design Guidance
15.4.....Erosion Mat Classes and Types
15.4.1 .....Class I
15.4.2 .....Class II
15.4.3 .....Class III
15.5.....General Performance Measures
15.5.1 .....Maximum Acceptable Sediment Loss Standards
15.5.2 .....Minimum Acceptable Vegetation Density Standards
15.5.3 .....Netting
Attachment 15.1....Erosion Mat
10-10-17 .....Interlocking Cells
17.1.....Definition
17.2.....Application
17.3.....Design Guidance
17.3.1 .....Cellular Confinement Structures (Plastic or Fabric Pavers)
17.3.2 .....Articulated Concrete Blocks
10-10-19 .....Riprap or Grouted Riprap
19.1.....Definition
19.2.....Application
19.3.....Riprap
19.4.....Grouted Riprap
19.5.....Design Guidance
10-10-21 .....Erosion Bale Barriers
21.1.....Definition
21.2.....Application
21.3.....Limitations
21.4.....Design Guidance
21.5.....Estimating Quantities
10-10-22 .....Temporary Ditch Checks
22.1.....Definition
22.2.....Application
22.3.....Limitations
22.4.....Design Guidance

22.5.....Estimating Quantities
10-10-23.....Silt Fence
23.1.....Definition
23.2.....Application
23.3.....Limitations
23.4.....Design Guidance
23.5.....Estimating Quantities
10-10-25.....Stone or Rock Ditch Checks
25.1.....Definition
25.2.....Application
25.3.....Design Guidance
10-10-27.....Storm Drain Inlet Protection
27.1.....Definition
27.2.....Application
27.3.....Design Guidance
27.3.1.....General Criteria Applicable to All Inlet Protection Devices
27.3.2.....Criteria Applicable to Unpaved Areas or the Pre-Paving Phase of Construction
27.3.3.....Criteria Applicable to Post-Paving/Curbing Phase of Construction
10-10-29.....Culvert Inlet Protection
29.1.....Definition
29.2.....Application
29.3.....Design Guidance
10-10-31.....Outlet Protection
31.1.....Definition
31.2.....Application
31.3.....Design Guidance
10-10-33.....Subsurface Drains
33.1.....Definition
33.2.....Application
33.3.....Design Guidance
10-10-37.....Diversion Dikes/Intercepting Embankments
37.1.....Definition
37.2.....Application
37.3.....Design Guidance
10-10-39.....Benching
39.1.....Definition
39.2.....Application
39.3.....Design Guidance
Attachment 39.1....Benched Slope Examples
10-10-41.....Dust Control
41.1.....Definition
41.2.....Application
41.3.....Design Guidance
10-10-42.....Tracking Pads
42.1.....Definition
42.2.....Application
42.3.....Design Guidance
42.4.....Considerations
42.5.....Estimating Quantities
10-10-43.....Silt Screen
43.1.....Definition
43.2.....Application
43.3.....Design Guidance
10-10-45.....Turbidity Barrier
45.1.....Definition
45.2.....Application
45.3.....Design Guidance

10-10-47 .....Soil Stabilizer, Type B (Land Application of Polymers)
47.1.....Definition
47.2.....Application
47.3.....Design Guidance
10-10-48 .....Water Application of Polymers
48.1.....Definition
48.2.....Application
48.3.....Design Guidance
10-10-49 .....Intermittent Channels
49.1.....Definition
49.2.....Application
49.3.....Design Guidance
10-10-51 .....Sediment Traps and Basins
51.1.....Definition
51.2.....Application
51.3.....Design Guidance
51.3.1 .....Sediment Traps
51.3.2 .....Sediment Basins
10-10-55 .....Safety Fence
55.1.....Definition
55.2.....Application
55.3.....Design Guidance
10-10-57 .....Other Devices
57.1.....Pipe Down Drains
57.2.....Preformed Apron Endwalls
57.3.....Mortar Rubble Masonry or Concrete Masonry
57.4.....Anti-Seepage Collar
57.5.....Weep Holes
57.6.....Scour Hole
57.7.....Flumes
57.8.....Gabions
57.9.....Bin Type Retaining Walls
57.10.....Sheeting
57.11.....Structure Protection
57.11.1 ...Surface Drains
57.11.2 ...Slope Paving

Section 10-15 Appendix

10-15-1 .....Glossary
10-15-5 .....Erosion Control CADD Cells
Attachment 5.1.....Runoff Coefficient Table
Attachment 5.2.....Detail of Sod Slopes at Structures
Attachment 5.3.....Sod Detail for Ditches
Attachment 5.4.....Sod Inlet Sediment Filter
Attachment 5.5.....Sod Treatment at Culverts
Attachment 5.6.....Detail of Sod Flume
Attachment 5.7.....Sod Flume Detail at Curb Ends
Attachment 5.8.....Sod Flume Detail at Curb Ends
Attachment 5.9.....Detail of Sod Flume
Attachment 5.10....Erosion Mat Detail for Ditches
Attachment 5.11....Erosion Mat Treatment at Culverts
Attachment 5.12....Detail for Heavy Riprap in Ditches
Attachment 5.13....Detail for Special Ditch with Heavy Riprap & Geotextile Fabric
Attachment 5.14....Detail for Heavy Riprap Ditch
Attachment 5.15....Detail for Riprap in Ditches
Attachment 5.16....Detail for Medium Random Riprap in Ditches
Attachment 5.17....Detail for Special Ditch with Medium Random Riprap & Geotextile Fabric

Attachment 5.18....Detail for Special Ditch with Riprap and Geotextile Fabric
Attachment 5.19....Medium Random Riprap Treatment at Culverts
Attachment 5.20....Riprap Treatment at Culverts
Attachment 5.21....Sod Heavy Riprap & Geotextile Fabric Detail at Apron Endwalls
Attachment 5.22....Sod Heavy Riprap & Geotextile Fabric Detail at Apron Endwalls
Attachment 5.23....Sod Medium Random Riprap & Geotextile Fabric
Attachment 5.24....Heavy Riprap Treatment at Culverts
Attachment 5.25....Erosion Bale Inlet Sediment Barrier
Attachment 5.26....Silt Fence Inlet Sediment Barrier
Attachment 5.27....Plan View Filter Berm
Attachment 5.28....Permanent Stone Ditch Check
Attachment 5.29....Coarse Aggregate Sediment Filter for Inlets
Attachment 5.30....Curb Inlet Sediment Barrier (Sandbag Type)
Attachment 5.31....Curb Inlet Sediment Barrier (Sandbag Type)
Attachment 5.32....Coarse Aggregate Sediment Filter For Drop Inlets
Attachment 5.33....Culvert Inlet Sediment Trap
Attachment 5.34....Silt Screen Detail
Attachment 5.35....Turbidity Barrier Detail
Attachment 5.36....Typical Excavated Sediment Trap
Attachment 5.37....Sediment Basin & Outlet Detail
Attachment 5.38....Silting Pond Detail
Attachment 5.39....Temporary Flexible Slope Drain
Attachment 5.40....Concrete Surface Drain
Attachment 5.41....Split Concrete Block Wall
Attachment 5.42....Typical Section of Temporary Channel Change
Attachment 5.43....Detail for Split concrete Block Retaining Wall
10-15-10 .....References

Section 10-25 Stormwater Quality

10-25-1 .....Stormwater Control Measure Selection
1.1.....Introduction
1.2.....Determining Project Water Quality Objective Goals
1.2.1 .....Total Suspended Solids
1.2.2 .....Peak Discharge
1.2.3 .....Infiltration
1.2.4 .....Buffer Areas
1.2.5 .....Timing
1.2.6 .....Swales
1.3.....Stormwater Report Development
1.4.....Stormwater Quality Matrix
1.5.....Stormwater Technical Standard and Procedure Links
1.6.....Stormwater Retrofit Projects
Attachment 1.1.....Attachment 1.1 Post Construction Stormwater Quality Management Goals
Attachment 1.2.....Attachment 1.2 Treatment Efficiencies for WisDOT Stormwater Control Practicies as Required for Highway Facilities Covered Under TRANS 401
10-25-5 .....The Effects of Urbanization on Stormwater Quality
5.1.....Introduction
5.2.....Urbanization
5.3.....Hydrologic Changes
5.4.....Pollutants
5.4.1 .....Sediment
5.4.2 .....Nutrients
5.4.3 .....Oxygen Demanding Materials
5.4.4 .....Bacteria
5.4.5 .....Trace Metals
5.4.6 .....Pesticides
5.4.7 .....Other Toxic Chemicals
5.4.8 .....Chlorides

5.4.9 .....Temperatures
5.5.....References

Section 10-30 Stormwater Quality Analysis

10-30-1 .....Project Stormwater Quality Analysis Process
1.1.....Description and Purpose
1.2.....Water Quality Analysis Instructions
1.3.....Stormwater Report Applicability
1.4.....Water Quality Spreadsheet Description
1.4.1 .....Water Quality Summary
1.4.2 .....Complete "Water Quality Results Discussion" Narrative
1.4.3 .....Water Quality Control Practice Worksheets
Attachment 1.1.....Water Quality Results Summary Sheet
Attachment 1.2.....Water Quality - Wet Detention Ponds Summary Sheet
Attachment 1.3.....Water Quality - Catchbasins Summary Sheet

Section 10-35 Stormwater Control Measure Selection

10-35-1 .....Stormwater Quality Practice Selection
1.1.....Introduction
1.2.....Project Scoping for Stormwater Quality
1.3.....Physical Site Suitability
1.4.....Cost Effectiveness
1.5.....Maintenance Requirements
1.6.....Effect on Other Resources
1.7.....Public Acceptance
1.8.....Suspended Solids Reduction Design Process
1.9.....Effectiveness in Reducing Peak Discharges
1.9.1 .....2-Year Design Flow Peak Discharge Analysis
10-35-5 .....Grass Swales
5.1.....Description and Purpose
5.2.....Target Pollutants
5.3.....Planning Issues
5.3.1 .....WisDOT Design Requirements
5.3.2 .....Site Assessment
5.3.3 .....Grass Swale Design Considerations
5.4.....Design Recommendations
5.4.1 .....Grass Swale Water Quality Analysis using the WisDOT Stormwater Report Spreadsheet
5.4.2 .....Other Design Criteria
5.5.....Maintenance
5.5.1 .....Maintenance Requirements
5.5.2 .....Maintenance Plan
5.6.....Grass Swale Water Quality Design Example
5.7.....References
Attachment 5.1.....Grass Swale Analysis Summary Spreadsheet
10-35-10 .....Filter Strips
10.1.....Description and Purpose
10.2.....Targeted Pollutants
10.3.....Effectiveness
10.4.....Planning Issues
10.4.1 .....WisDOT Design Requirements
10.4.2 .....Site Assessment
10.4.3 .....Filter Strip Design Considerations
10.5.....Design Recommendations
10.5.1 .....Filter Strip Design Charts
10.5.2 .....Filter Strip Water Quality Analysis Using the WisDOT Stormwater Report Spreadsheets
10.5.3 .....Other Design Criteria

10.6.....Maintenance
10.6.1 .....Maintenance Requirements
10.6.2 .....Maintenance Plan
10.7.....Filter Strip Water Quality Design Example
10.8.....References
Attachment 10.1....Filter Strip Water Quality Design Charts
Attachment 10.2....Filter Strip Analysis Summary Spreadsheet
Attachment 10.3....Filter Strip Sand Amendment Analysis
10-35-15 .....Wet Detention Pond Stormwater Quality Design
15.1.....Description and Purpose
15.2.....Target Pollutants
15.3.....Effectiveness
15.4.....Planning Issues
15.4.1 .....Initial Coordination
15.4.2 .....DOT Design Requirements
15.4.3 .....Federal State and Local Laws
15.4.4 .....Site Assessment
15.4.5 .....Planning Considerations
15.5.....Design Recommendations
15.5.1 .....Water Quality Design Guidelines
15.5.2 .....Other Pond Criteria
15.5.3 .....Safety Requirements
15.5.4 .....Design Considerations
15.6.....Maintenance
15.6.1 .....Maintenance Requirements
15.6.2 .....Maintenance Plan
15.6.3 .....Maintenance Considerations
15.7.....Wet Detention Pond Water Quality Analysis Using the WisDOT Stormwater Report Spreadsheet
15.8.....References
Attachment 15.1....Attachment 15.1 Calculation of Preliminary Permanent Pool Surface Area for TSS Reduction
Attachment 15.2....Attachment 15.2 Pond Volume/Discharge Design Curve
Attachment 15.3....Attachment 15.3 Rainfall and Runoff Tables
Attachment 15.4....Attachment 15.4 Conceptual Pond Design Illustrations
Attachment 15.5....Attachment 15.5 Wet Detention Pond Analysis Summary Spreadsheet
10-35-20 .....Catchbasin Design and Maintenance
20.1.....Description and Purpose
20.2.....Target Pollutants
20.3.....Effectiveness
20.4.....Planning Issues
20.4.1 .....DOT Design Requirements
20.4.2 .....Site Assessment
20.4.3 .....Catchbasin Design Considerations
20.5.....Design Recommendations
20.5.1 .....Catchbasin Design Charts
20.5.2 .....Catchbasin Water Quality Analysis Using the WisDOT Stormwater Report Spreadsheet
20.5.3 .....Other Design Criteria
20.5.4 .....Design Considerations
20.6.....Maintenance
20.6.1 .....Maintenance Requirements
20.6.2 .....Maintenance Plan
20.6.3 .....Maintenance Considerations for Mosquito Prevention
20.7.....Catchbasin Water Quality Design Example
20.8.....References
Attachment 20.1....Typical Cross Section Type 5 Illustration

Attachment 20.2....Catchbasin Water Quality Design Charts for Cross Section Type 5
Attachment 20.3....Typical Cross Section Type 8 Illustration
Attachment 20.4....Catchbasin Water Quality Design Charts for Cross Section Type 8
Attachment 20.5....Catchbasin Analysis Summary Spreadsheet

Section 10-40 Maintenance Best Management Practices (BMPs)

10-40-1 .....Introduction
10-40-5 .....Street Sweeping
5.1.....Description and Purpose
5.2.....Target Pollutants
5.3.....Planning Considerations