IMPROVEMENTS IN SILT FENCE INSTALLATIONS DETERMINED THROUGH FULL-SCALE TESTING

ENVIRONMENTAL AND SUSTAINABILITY ISSUES

WESLEY DONALD, Ph. D.
BLAKE WHITMAN, Ph. D.
WESLEY ZECH, Ph. D.

Training & Meeting Center Inlet Protection Demo Station Hydroseeding Demo Station Stockpile Management Ditch Check Demo Station Silt Fence Installation Floating Turbidity Barrier Silt Fence & Slope Interrupters Slope drains & Outlets Protection Construction Exit Pad Sediment Basin Research Channelized Flow Research Rainfall Simulator Research & ECBs Sediment Barrier Research Surface Skimmer Testing Catch Basin Insert Testing Apparatus

CONSTRUCTION ACTIVITIES ARE THE LARGEST HUMAN INDUCED NON-POINT SOURCE OF SEDIMENT

NEEDS: IMPROVE PERFORMANCE OF EXISTING PRACTICES, ADVANCE E&SC DESIGN STANDARDS, INSURE PROPER IMPLEMENTATION

SMALL-SCALE SEDIMENT BARRIER TESTS (MOD. ASTM D5141)

SMALL-SCALE SEDIMENT BARRIER

Geotextile Performance Evaluations
SMALL-SCALE SEDIMENT BARRIER
Geotextile Performance Evaluations

Nonwoven – Needle Punched
Nonwoven – Spunbond
Woven – Blue Stripe
Woven – Red Stripe
Woven – Green Stripe

HYDRAULIC ANALYSES

<table>
<thead>
<tr>
<th>Installation</th>
<th>Effluent Flow (gpm/ft²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonwoven Fabric</td>
</tr>
<tr>
<td></td>
<td>Needle Punched</td>
</tr>
<tr>
<td>I1</td>
<td>1.49</td>
</tr>
<tr>
<td>I2</td>
<td>1.29</td>
</tr>
<tr>
<td>I3</td>
<td>1.59</td>
</tr>
<tr>
<td>Average</td>
<td>1.46</td>
</tr>
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</table>

Published (ASTM D4491)
150 180 93 95.5 141

SEDIMENT RETENTION

<table>
<thead>
<tr>
<th>Installation</th>
<th>Sediment Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonwoven Fabric</td>
</tr>
<tr>
<td></td>
<td>Needle Punched</td>
</tr>
<tr>
<td>I1</td>
<td>97%</td>
</tr>
<tr>
<td>I2</td>
<td>96%</td>
</tr>
<tr>
<td>I3</td>
<td>98%</td>
</tr>
<tr>
<td>Average</td>
<td>97%</td>
</tr>
</tbody>
</table>

Note: Based on dry soil weights pre and post-testing

SEDIMENT BARRIER TEST APPARATUS DESIGN

Equilibrium Tank
Pole Barn
Access Doors
Collection Tank

THEORETICAL FLOW RATE

- **Design Storm**
  - 2-yr, 24-hr rainfall event
  - State Avg. 4.43 in.
  - Type III SCS distribution

- **Hydrologic Soil Characteristics**
  - Newly graded; CN=88.5

- **Silt Fence Design**
  - ½ ac drainage per 100 LF reinforced

<table>
<thead>
<tr>
<th>Representative Drainage Area ac (ha)</th>
<th>Scaled-Down Drainage Area ac (ha)</th>
<th>Peak Flow m³/s (m³/s)</th>
<th>Avg. Flow for 30 Min Peak m³/s</th>
<th>Total Vol. 30 Min Test m³</th>
<th>Total Vol. 30 Min Test Gal (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.50 (0.20)</td>
<td>0.30 (0.12)</td>
<td>0.34 (0.12)</td>
<td>0.07 (0.005)</td>
<td>919 (334)</td>
<td>2019 (782)</td>
</tr>
</tbody>
</table>
THEORETICAL SEDIMENT RATE

- Modified Universal Soil Loss Equation (MUSLE)

\[
S = 11.8(Q_{p})^{0.58}K \times LS \times C \times P
\]

- Sediment Rate: 37.6 lb./min. (30 min. test duration)

<table>
<thead>
<tr>
<th>Drainage Area (ac)</th>
<th>Q</th>
<th>q_p</th>
<th>K</th>
<th>LS</th>
<th>C</th>
<th>P</th>
<th>S (Metric Tons)</th>
<th>S (U.S. Tons)</th>
<th>S (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>300 (1,024)</td>
<td>0.33 (0.01)</td>
<td>0.55</td>
<td>1.04</td>
<td>2</td>
<td>1</td>
<td>0.51</td>
<td>0.56</td>
<td>1.127</td>
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DATA COLLECTION

- Structural
  - Post Deflection
  - Fence Sag
  - Overtopping
  - Undermining
- Hydraulic
  - Impoundment Depth & Length
  - Catch Basin Depth
- Sediment Retention
- Pre Survey
- Post Survey
- Water Quality
  - Turbidity
  - Total Suspended Solids (TSS)

SILT FENCE MODIFICATION TESTING OBJECTIVES

- Establish a performance baseline using the Standard ALDOT Trenched Silt Fence Installation
- Develop alternative installation strategies by varying:
  - Fence Height
  - T-Post Weight
  - T-Post Spacing
  - Geotextile Entrench Location
- Assess the performance of each alternative based on:
  - Structural Integrity
  - Sediment Retention
  - Water Quality
  - Statistical Relevance
- Identify the most effective installation

BASELINE - STANDARD ALDOT INSTALLATION

- Fence Height: 32 in.
- T-Post Weight: 0.95 lb./ft
- T-Post Spacing: 10 ft
- Geotextile Entrench Location: Direct trench to 6 in. offset

HOW CAN THIS INSTALLATION BE IMPROVED?

1. Increase T-Post Weight → 0.95 lb./ft to 1.25 lb./ft
2. Reduce T-Post Spacing → 10 ft to 5 ft
3. Reduce Fence Height → 32 in. to 24 in.
4. Trenching → Direct Trench to 6 in. Offset
INSTALLATION ISSUES – BACKSIDE COMPACTION

SILT FENCE INSTALLATION MODIFICATIONS

<table>
<thead>
<tr>
<th>Installation ID</th>
<th>T-Post Weight (lb./ft)</th>
<th>T-Post Spacing (ft)</th>
<th>Fence Height (in.)</th>
<th>Trench Offset (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD</td>
<td>0.95</td>
<td>10</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>M1</td>
<td>1.25</td>
<td>10</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>M2</td>
<td>0.95</td>
<td>5</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>M3</td>
<td>1.25</td>
<td>5</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>M4</td>
<td>0.95</td>
<td>10</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>M5</td>
<td>0.95</td>
<td>5</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>M6</td>
<td>1.25</td>
<td>10</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>M7</td>
<td>1.25</td>
<td>5</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>M8</td>
<td>1.25</td>
<td>5</td>
<td>24</td>
<td>6</td>
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M8 TRENCH OFFSET

M8 TRENCH OFFSET

M8 TRENCH OFFSET

M8 TRENCH OFFSET
### M8 Structural Evaluation

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Failure Time</th>
<th>Failure Observation</th>
<th>T-Post Deflection (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>-</td>
<td>-</td>
<td>0.03 (Avg. of 3)</td>
</tr>
<tr>
<td>P2</td>
<td>-</td>
<td>-</td>
<td>0.08 (Avg. of 3)</td>
</tr>
<tr>
<td>P3</td>
<td>-</td>
<td>-</td>
<td>0.10 (Avg. of 3)</td>
</tr>
</tbody>
</table>

#### Sediment Retention

<table>
<thead>
<tr>
<th>Installation</th>
<th>STD</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
<th>M7</th>
<th>M8</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>87%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>100%</td>
</tr>
<tr>
<td>I2</td>
<td>87%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>91%</td>
</tr>
<tr>
<td>I3</td>
<td>75%*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>98%</td>
</tr>
<tr>
<td>Average</td>
<td>83%</td>
<td>53%</td>
<td>76%</td>
<td>87%</td>
<td>90%</td>
<td>95%</td>
<td>96%</td>
<td>93%</td>
</tr>
</tbody>
</table>

*Note: * indicates overtopping occurred.

#### Water Quality – Sampling Locations

#### Water Quality Analysis
WATER QUALITY ANALYSIS

DEWATERING WEIR EVALUATION

Minimal Structural Deflection
96% Sediment Retention
4 hr Theoretical Dewatering Time

SILT FENCE INSTALLATION RECOMMENDATION

Specify a minimum T-post weight of 1.25 lb./ft
Specify a maximum T-post spacing of 6 ft in areas of concentrated impoundment
Specify a minimum fence height of 24 in.
Install dewatering boards in areas of concentrated impoundment
Indicate silt fence shall be installed a minimum of 6 ft from slope toe
Indicate geotextile T-post loop over and 1 ft ring fastener spacing
Implement a 6 in. offset when trench/slice geotextiles

Questions?

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AU-ESCTF
WESLEY DONALD
donalwn@auburn.edu