SITE 19

Stream Restoration/Bank Stabilization in Park

Index Sheet No.: 23
Raw Data Name: TA 29-31

Estimated Construction Cost: $10,300-$15,500
**Project Description**

<table>
<thead>
<tr>
<th>Drainage Area (acres)</th>
<th>Impervious Area (acres)</th>
<th>% Impervious</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 19</td>
<td>149.5</td>
<td>31.5</td>
</tr>
</tbody>
</table>

**Location**

Site 19 is located in a public park off of Broad Street and approximately 0.25 miles north of Rosemary Street/E. Main Street.

**Problem Description**

Site 19 consists approximately 165 feet of an incised reach of Tanyard Branch, with actively eroding, vertical banks and lack of a riparian buffer. Upstream of the site, the stream is completely piped, and emerges from a culvert after passing under Broad Street, where it then flows through a town-owned park. The eroding streambanks are likely the result of what was observed to be repeated mowing up to the stream (mechanical stresses on the channel) and a lack of riparian buffer to resist the high shear stress coming from the concentrated flow discharge of the upstream pipe network. The eroding stream banks are causing export of sediment and associated nutrients. A preliminary investigation of streambank erosion potential using the BANCS model indicates that approximately 29 tons of sediment is being exported from the site each year. Concomitant nutrient export associated with the sediment has also been calculated and is listed in Table 19.1.

**Table 19.1**

<table>
<thead>
<tr>
<th></th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Total Sediment Export</td>
<td>28.3 tons/year</td>
<td>0.5 tons/year</td>
</tr>
<tr>
<td>Erosion per length of Channel</td>
<td>2.4 tons/yr/ft</td>
<td>0 tons/yr/ft</td>
</tr>
<tr>
<td>Pounds of Nitrogen</td>
<td>56.6 lbs/year</td>
<td>1 lbs/year</td>
</tr>
<tr>
<td>Pounds of Phosphorus</td>
<td>28.3 lbs/year</td>
<td>0.5 lbs/year</td>
</tr>
</tbody>
</table>

**Proposed Solution**

As with other bank stabilization/restoration projects, this site could benefit primarily from a change in the stream cross-section that provides the following:
- a bankfull bench that gives the stream a floodplain to access, thus significantly reducing near bank stress during above-bankfull events
- reduced slopes on the bank, at a maximum of 2:1, thus reducing potential for bank erosion
- vegetated banks with woody plants that will provide stabilization through rooting mass

In areas of fill soils, additional toe or bank protection using methods such as Bio-D or blocks or soil layering techniques may be necessary (see Appendix A- Details.)

Changes to the profile (riffle-pool sequence) could also be implemented at this site to restore in-stream habitat, but at a greater project cost (see Alternatives). The preferred alternative is one in which the banks are laid back and the streambank erosion reduced to the maximum extent possible. Calculated sediment and nutrient reductions as a result of this treatment are shown in Table 19.1.

In addition to the changes in stream cross-section, the banks of the stream should be planted with deep rooting plants that will provide banks stabilization through their rooting mass. As this site is located in an urban park, the needs of safety, aesthetics and functionality need to be met with a choice of plant species. While trees are preferred in the stabilization of stream banks, low-growing grasses and perennials may be more appropriate to a park setting. If low growing grasses pose a problem due to public concerns of thick brush, the select trees may provide stability with maintenance to the herb layer.

**Constraints**

Land acquisition is not a constraint here, as the stream travels through land owned by the Town of Chapel Hill.

Limited space available in the park may constrain the width of the buffer. Public relations and perception of re-vegetation may hinder the improvements to this site.

**Alternatives**

There are three alternatives at this site that could be implemented, based on available funds.

Alternative 1: Rather than laying back banks and incurring the expense of earthwork, brush matting (see Details) could be laid on all banks, providing a certain degree of resistance of erosive flows and reducing bank erosion. The riparian buffer area could then be re-vegetated with low-growing plants, as mentioned above.

Alternative 2: To reduce bank erosion rates to the greatest extent, lay back the stream banks at a maximum 2:1 slope and construct a bankfull bench. Then re-vegetate the riparian buffer with low-growing plants.
Alternative 3: In addition to the treatment of Alternative 2, modify the profile of the stream, constructing pools at each meander bend of the existing channel. This will lead to further dissipation of energy, while improving in-stream habitat.

**Cost-Estimate Breakdown**

Tables 19.2, 19.3 and 19.4 show a conceptual itemized cost estimate for all three alternatives. These costs represent construction costs only.

**Table 19.2**  
**SITE 18 ALTERNATIVE 1**

<table>
<thead>
<tr>
<th>Pay Item Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Bid Price</th>
<th>Bid Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Safety Fence</td>
<td>700.00</td>
<td>LF</td>
<td>2.50</td>
<td>$1,750</td>
</tr>
<tr>
<td>Site Preparation and Planting</td>
<td>0.13</td>
<td>Ac</td>
<td>7500.00</td>
<td>$975</td>
</tr>
<tr>
<td>Brush Matting</td>
<td>75.00</td>
<td>LF</td>
<td>50.00</td>
<td>$3,750</td>
</tr>
<tr>
<td>Construction Entrance</td>
<td>1.00</td>
<td>Ea</td>
<td>2500.00</td>
<td>$2,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>$8,975</td>
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</table>

Mobilization (5%)  
Contingencies (10%)  

**Total + Mobilization and Contingencies $10,321**

**Table 19.3**  
**SITE 18 ALTERNATIVE 2**

<table>
<thead>
<tr>
<th>Pay Item Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Bid Price</th>
<th>Bid Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation</td>
<td>250.00</td>
<td>CY</td>
<td>15.00</td>
<td>$3,750</td>
</tr>
<tr>
<td>Site Preparation and Planting</td>
<td>0.13</td>
<td>Ac</td>
<td>7500.00</td>
<td>$975</td>
</tr>
<tr>
<td>Silt Fence</td>
<td>600.00</td>
<td>LF</td>
<td>3.75</td>
<td>$2,250</td>
</tr>
<tr>
<td>Bio -D Blocks for Bank Stabilization</td>
<td>75.00</td>
<td>LF</td>
<td>20.00</td>
<td>$1,500</td>
</tr>
<tr>
<td>Construction Safety Fence</td>
<td>700.00</td>
<td>LF</td>
<td>2.50</td>
<td>$1,750</td>
</tr>
<tr>
<td>Construction Entrance</td>
<td>1.00</td>
<td>Ea</td>
<td>2500.00</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td>$12,725</td>
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Mobilization (5%)  
Contingencies (10%)  

**Total + Mobilization and Contingencies $14,634**
Table 19.4
SITE 18 ALTERNATIVE 3

<table>
<thead>
<tr>
<th>Pay Item Description</th>
<th>Estimated Quantity</th>
<th>Unit</th>
<th>Unit Bid Price</th>
<th>Bid Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavation</td>
<td>300.00</td>
<td>CY</td>
<td>15.00</td>
<td>$4,500</td>
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<tr>
<td>Site Preparation and Planting</td>
<td>0.13 Ac</td>
<td></td>
<td>7500.00</td>
<td>$975</td>
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<tr>
<td>Silt Fence</td>
<td>600.00</td>
<td>LF</td>
<td>3.75</td>
<td>$2,250</td>
</tr>
<tr>
<td>Bio -D Blocks for Bank Stabilization</td>
<td>75.00 LF</td>
<td></td>
<td>20.00</td>
<td>$1,500</td>
</tr>
<tr>
<td>Construction Safety Fence</td>
<td>700.00</td>
<td>LF</td>
<td>2.50</td>
<td>$1,750</td>
</tr>
<tr>
<td>Construction Entrance</td>
<td>1.00</td>
<td>Ea</td>
<td>2500.00</td>
<td>$2,500</td>
</tr>
</tbody>
</table>

Total                                           |                    |      |                | $13,475    |

Mobilization (5%)                                | 1.00               | LS   |                | $674       |
Contingencies (10%)                              | 1.00               | LS   |                | $1,348     |

Total + Mobilization and Contingencies          |                    |      |                | $15,496    |
ALTERNATIVE 1:
LAY BRUSH MATING ON BOTH BANKS AND REVEGETATE WITH LOW-GROWING GRASS

ALTERNATIVE 2:
LAY BACK BANKS WITH BANKFULL BENCH AND VEGETATE WITH LOW-GROWING GRASS

ALTERNATIVE 3:
LAY BACK BANKS AND MODIFY PROFILE AND GEOMETRY

Legend:
- Stormwater Lines
- Impervious Surfaces
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow
- Contours

CONCEPTUAL PLAN VIEW
BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site Identification For Stormwater Structures and Retrofits

1 inch equals 50 feet
ALTERNATIVE 1:
Lay brush matting on both banks and revegetate with low-growing grass.

ALTERNATIVE 2:
Lay back banks with bankfull bench and vegetate with low-growing grass.

ALTERNATIVE 3:
Lay back banks and modify profile and geometry.

ALTERNATIVE 2 AND 3:
Add dissipation pool at head of project.

LAY BACK BANKS TO BANKFULL
MAX 2:1 SLOPE
EXISTING GROUND
DESIGN GROUND
BANKFULL

AERIAL PHOTO VIEW
BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site Identification For
Stormwater Structures and Retrofits

Legend
- Stormwater Lines
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow

1 inch equals 50 feet