Arboretum Amphitheater Design And Stormwater Control Plan for the Auburn University Donald E. Davis Arboretum

NAS SOLUTIONS:
Nicholas Burgess • Ashley Kinsey • Sarah Grace Miller

Background
The Donald E. Davis Arboretum is a 13.5-acre facility located on Auburn University’s campus designed to display and preserve living plant collections and native Southeastern plant communities, to inspire an understanding of the natural world and our connection to it, and to promote education, research and outreach. Storm water runoff onto the Arboretum property (immediately west of College Street and south of the President’s residence, Figure 1) creates erosive forces that threaten the habitat and utility of the Arboretum space. With the 7,000 square-foot expansion of the President’s residence due to be completed Fall 2017, storm water runoff flows are expected to increase.

Problem Statement
Goal: To design an earthen amphitheater for guests and to reduce the erosion from high flows, while maintaining the aesthetic integrity of the Arboretum.

Design Constraints
- Channel conveyance must accommodate a 25- or 50-year, 24-hour storm event with peak flows of 17.67 cfs and 20.05 cfs, respectively
- Amphitheater must accommodate 100-150 people, with a maximum height of six feet from base elevation and terraces with widths of four feet to accommodate lawn mowers
- Gravel Access Road must sustain a fully aggregate-loaded dump truck weighing approximately 35 tons for Arboretum maintenance

Design Objectives
1. Create a stormwater control plan for the Arboretum property to limit erosion due to high intensity storm runoff by designing a combination of bioretention cells and an engineered channel
2. Design an earthen amphitheater facing the arboretum pond using tiered retaining walls to entertain guest for weddings and events
3. Design a new gravel access road that runs through the Arboretum and crosses north of the proposed amphitheater

Proposed Design

Structural Analysis

Engineered Channel
The triangular, stone-set concrete channel was designed to closely follow the natural flow of the site’s storm water to eliminate potential erosion from misdirected water (Figure 3)
- Conveys 100-year, 24-hour storm
- 4.5 feet wide, 1 foot deep
- 2:1 slope ratio

Bioretention Cells
To make the engineered channel more ecologically friendly and aesthetically pleasing, a series of bioretention cells receiving water from the channel are designed to increase infiltration and improve water quality. This will also provide a natural buffer between the community and the channel. Two pedestrian walking bridges are designed to safely connect the two sides of the channel.

Gravel Access Road
The depression in the current topography renders trucks immobile from mud after a rain event. By combining the gravel road with the engineered channel, this problem is amended (Figures 4 and 5).

Cost Analysis
To reduce construction costs and decrease the project’s carbon footprint, all material prices were sourced from local businesses.

<table>
<thead>
<tr>
<th>Design Items</th>
<th>Cost Estimates*</th>
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</thead>
<tbody>
<tr>
<td>Amphitheater</td>
<td>$19,000</td>
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<tr>
<td>Bioretention Cells</td>
<td>$8,200</td>
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<tr>
<td>Concrete Channel</td>
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<tr>
<td>Excavation</td>
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<tr>
<td>Channel Crossing</td>
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<tr>
<td>Gravel Access Road</td>
<td>$2,700</td>
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<tr>
<td><strong>Total Cost:</strong></td>
<td><strong>$39,300</strong></td>
</tr>
</tbody>
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* All costs include labor

Overview
Amphitheater:
- Seats 130 guests on tiered earthen retaining walls north of the pond
- First access ramp is ADA-approved slope (8.3%) to accommodate all members of the Auburn community

Engineered Channel:
- Triangular, stone-set design
- Top width of 4.5 feet and depth of 1 foot conveys water from the Garden Drive parking lot to the Arboretum pond
- Offers protection from a 100-year, 24-hour storm event
- Will convey future increased flows post-Presidents residence construction

Bioretention cells:
- Receive water from the channel for increased infiltration and water quality
- Aesthetic and educational value

Gravel access road:
- Runs north through the property behind the proposed amphitheater
- Concrete slab crossing allows trucks to safely cross the channel

Acknowledgements
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