

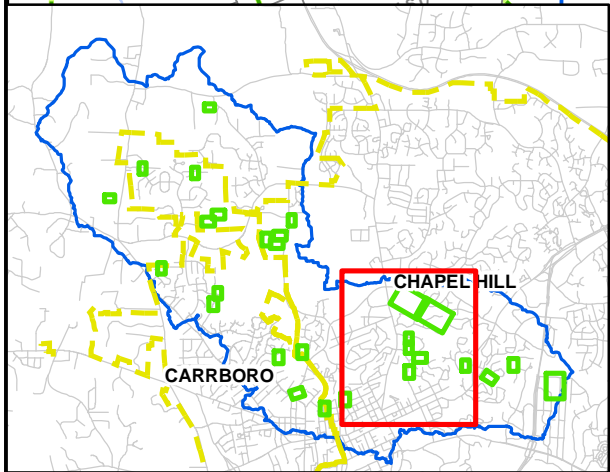
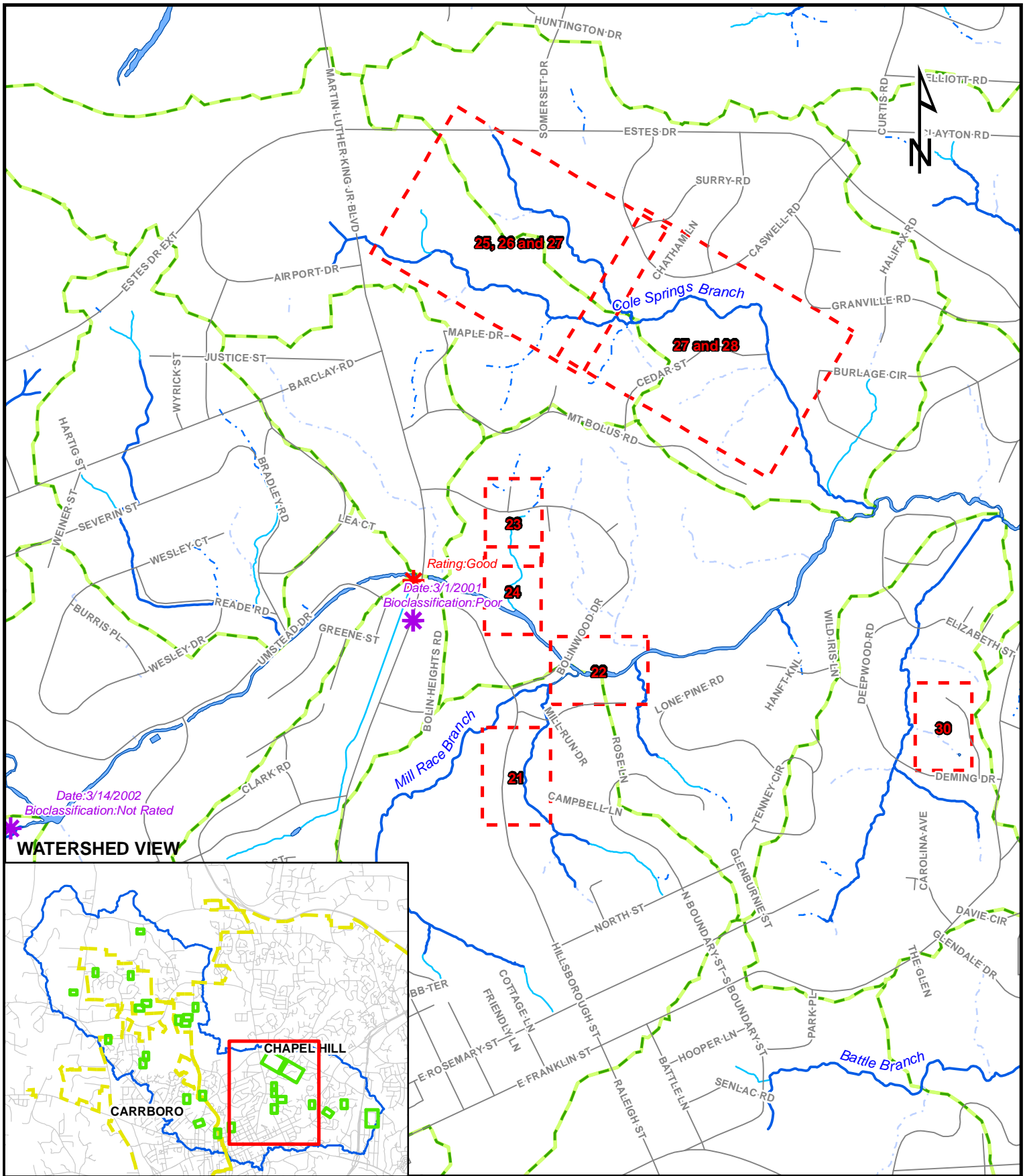
## **SITE 24**

### **Construction of Bioretention Cells for Pollutant Removal at Apartment Complex**

Index Sheet No.: 25  
Raw Data Name: BD 55



Estimated Construction Cost: \$107,500



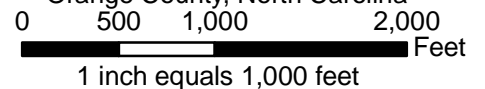
**Legend**

- Ambient Monitoring
- Benthic Monitoring
- Fish Sampling
- Municipal Boundary
- Orange County Roads
- Subwatersheds
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow



**SITE 24  
VICINITY MAP**

Geomorphic Analysis and Identification of Potential Sites for Stormwater BMPs  
Orange County, North Carolina



**Project Description**

	Drainage Area (acres)	Impervious Area (acres)	% Impervious
Site 24	18.0	2.9	16.2%

**Location**

Site 24 is located on the western edge of an apartment complex adjacent to Bolinwood Drive, and to the north of the Bolin Creek Greenway.

**Problem Description**

Site24 consists of 140 feet of an incised, actively eroding stream (low bank height approximately 4 feet). A very prominent headcut (approximately 3’ vertical in 1’ horizontal) marks the top of this site (upstream). The head cut is active and undercut, demonstrating a high degree of mobility. A BEHI rating of “extreme” was found for the entire length of the channel. Likely causes of this incision are the increase in peak flows of the contributing drainage area due to development, headcut effects caused by the past construction of the greenway downstream, and possible stream modification during the construction of the adjacent apartment complex. The stream flows into Bolin Creek only 70 feet downstream of the site, after passing under the Bolin Creek Greenway.

Using a modified BANCS model, it is estimated that approximately 377.5 tons of sediment are being exported from the site each year. Concomitant nutrient export associated with the sediment has also been calculated and is listed in **Table 24.1**.

**Table 24.1**

Pre-Treatment	
Estimated Total Sediment Export	377.5 tons/year
Erosion per length of Channel	2.7 tons/yr/ft
Pounds of Nitrogen	755 lbs/year
Pounds of Phosphorus	377.5 lbs/year
Post-Treatment	
Estimated Total Sediment Export	0.3 tons/year
Erosion per length of Channel	0 tons/yr/ft
Pounds of Nitrogen	0.6 lbs/year
Pounds of Phosphorus	0.3 lbs/year

**Proposed Solution**

The contributing drainage area of the stream at Site 24 is comprised of 16% impervious area, consisting of large homes, driveways, parking pads, apartment complexes and roads. Treatment of the runoff of this area is warranted especially by the fact that the

*Bolin Creek Watershed  
Geomorphic Analysis and Potential Site Identification for Stormwater BMPs and Retrofits*

stream flows directly into Bolin Creek after only a short distance, without any intervening storage or detention. However, space is limited within the site, which is composed of young pines and hardwoods, and a relatively narrow valley (man made). Thus, the preferred solution is the construction of a “bio-grade step”, which is a series of small bio-retention cells filled with a filter media, such as a mixture of sand fines and organic matter (see Appendix A-Details). Ideally, this media will have a filtration rate of 1.0 to 2.0 inches per hour, to optimize pollution removal (Schueler, et. al., 2007). Each cell is connected to the other through a seepage or drain layer, thus allowing stormwater to filter through each cell and augment baseflow to the receiving channel. The combination of the underground storage volume that results from each cell can create a significant reduction in runoff volume to receiving waters and attenuates the peak flow rates. The individual cells must drain over time to regain the available storage volume for the next rain event. Below the bio-grade step, an energy dissipation, stilling/ boulder basin(see Appendix A-Details), should be built to dissipate any overflow before reaching the greenway and Bolin Creek.

**Table 24.2**

SITE 24	Pollutant Load (lbs)		
	TN	TP	TSS
EXISTING CONDITION	9.50	0.96	129.14
BIORETENTION TREATMENT REMOVAL %	35.00%	45.00%	85.00%
NET REDUCTION	3.33	0.43	109.77
FUTURE CONDITION	6.18	0.53	19.37

**Constraints**

The channel on which treatment is proposed is labeled as “intermittent” by Chapel Hill GIS stream data. This stream status was not verified during the course of this study. If this is the case, construction of an in-line bioretention area may not be allowed under NCDWQ rules. Earth Tech observations just upstream of this site indicate that this reach is likely to be ephemeral due to the lack of a clearly defined channel upstream of the head cut. Obviously, the scour channel downstream of the headcut gives the impression of a stream. It would require further analysis to determine the status of the channel.

The site is partially owned by the Town of Chapel Hill, and partially owned by a private landowner. If the proposed treatment is to be implemented, drainage and access easements must be acquired from the private landowner, as well as a maintenance agreement. Alternatively, a smaller length of channel could be treated using only the land owned by the Town of Chapel Hill.

**Alternatives**

If this reach classifies as intermittent, another approach would be warranted, such as bank stabilization and installation of grade control to limit the headcut. However, this is not treated as a formal alternative by this report.

*Bolin Creek Watershed  
Geomorphic Analysis and Potential Site Identification for Stormwater BMPs and Retrofits*

**Cost-Estimate Breakdown**

**Table 24.3** shows a conceptual itemized cost estimate for Site 24. These costs represent construction and maintenance costs only. The cost for the bio-grade step is derived from a cost per cubic foot treated for bioretention areas as reported by Schueler, et. al. (2007).

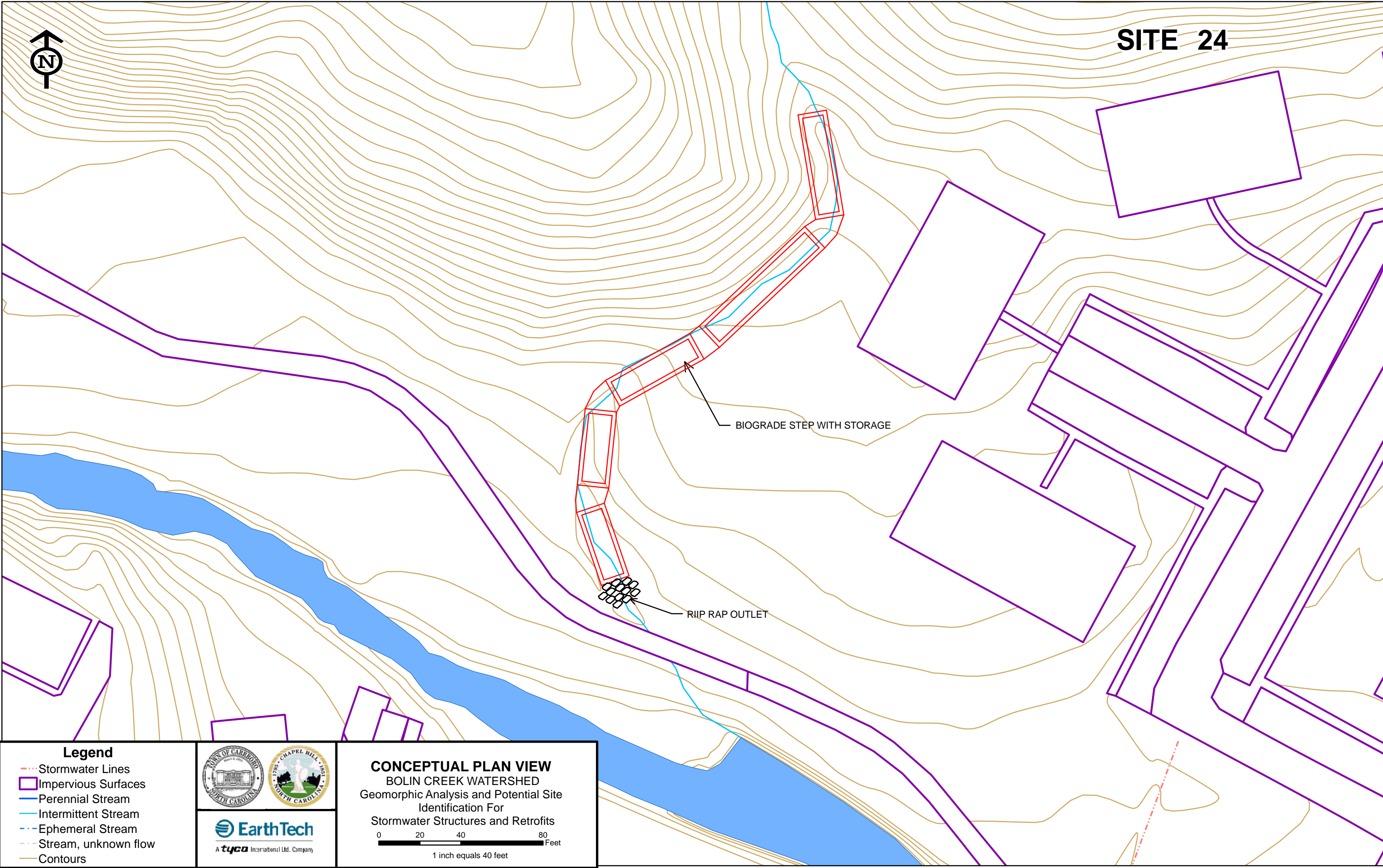
**Table 24.3**  
SITE 24 Construction Cost

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Biograde Step	7410.0	CF	12.62	\$93,514
<b>Total</b>				<b>\$93,514</b>
Mobilization (5%)	1.00	LS		\$4,676
Contingencies (10%)	1.00	LS		\$9,351
Total + Mobilization and Contingencies				<b>\$107,541</b>
<b>Maintenance Costs</b>				
Maintenance (5% of base construction cost of BMP)	1.0	Year		<b>\$5,377</b>

*Bolin Creek Watershed  
Geomorphologic Analysis and Potential Site Identification for Stormwater BMPs and Retrofits*

This page intentionally left blank.

**SITE 24**

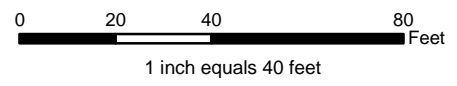


**Legend**

- 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





**SITE 24**



BIOGRADE STEP WITH STORAGE

RIIP RAP OUTLET

**Legend**

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



**AERIAL PHOTO VIEW**

**BOLIN CREEK WATERSHED**  
Geomorphic Analysis and Potential Site  
Identification For  
Stormwater Structures and Retrofits

