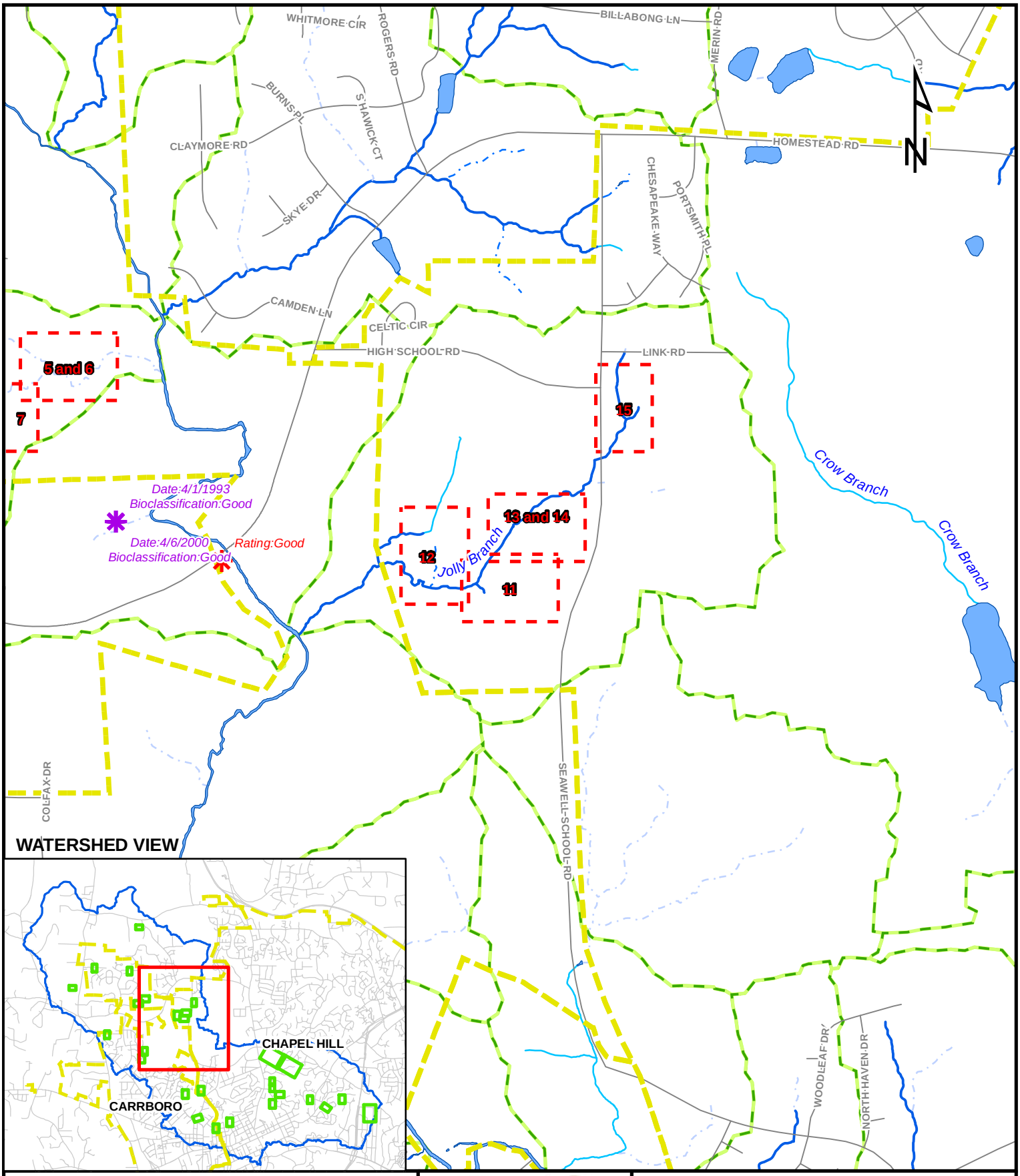
SITE 11

BMP retrofits at Smith Middle School

Index Sheet No.: 16
Raw Data Name: IJ 34

Estimated Construction Cost: $30,000-$110,000



Legend

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

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SITE 11
VICINITY MAP

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

0 500 1,000 2,000 Feet

1 inch equals 1,000 feet

Project Description

	Drainage Area (acres)	Impervious Area (acres)	% Impervious
Site 16-01	10.8	4.1	38.0%

Location

Site 11 is just north of the soccer field and track at Smith Middle School, which is located off Seawell School Road.

Problem Description

At Smith Middle School, it appears that most of the stormwater that collects on the schools rooftops and parking lots is routed to an outlet pipe at the northwestern corner of the school site. This outlet pipe, which is approximately 36" in diameter, currently has no water quality treatment in the form of retention or detention downstream of it. Instead, the pipe discharges stormwater into a pre-formed scour hole, then into a concentrated channel that flows into the nearby perennial stream, Jolly Branch. Thus, the pollutants collecting on-site flow into Jolly Branch with no treatment. Additionally, field observations indicate that the concentrated flows that leave the small pre-formed scour hole is causing erosion and will continue to degrade the floodplain and stream channel over time.

Sites 11 through 15 are in close proximity to each other, and could therefore be integrated amongst themselves as a single package. In addition, other similar opportunities for the work proposed here are present throughout the three surrounding campuses, as well as other parts of the Jolly Branch watershed.

Proposed Solution

Site 11 offers a good location for stormwater BMP retrofits, with the added benefit of public exposure and educational opportunities for students of the surrounding schools. The primary location for a Stormwater BMP is at the outlet pipe on the northwestern corner of the school property. Here, the pre-formed scour hole that was constructed can be expanded, and dug out to create a wet detention pond (wet pond). The wet detention pond will contain a permanent pool that will allow aquatic vegetation to thrive in the structure year-round. The floodplain has sufficient room to allow for this retrofit. The pond should have a boulder basin underneath the outlet pipe to provide energy dissipation.

The outlet structure of the wet detention pond should consist of a riser pipe, and then a level spreader just downhill of the pond. It is important that the level-spreader be used, so as to prevent flow from concentrating into an incised channel before reaching Jolly Branch. The floodplain along the channel provides ample room to install a level spreader parallel with the channel.

Any tree removal that is necessary can provide an opportunity to educate the students of neighboring schools about forest secession and how gap communities can dramatically increase diversity.

Pollutant reduction rates as a result of stormwater treatment are shown in **Table 11.1**.

Table 11.1

SITE 11	Pollutant Load (lbs)		
	TN	TP	TSS
EXISTING CONDITION	10.97	1.22	284.48
WET DETENTION TREATMENT	25.00%	40.00%	85.00%
NET REDUCTION	2.74	0.49	241.81
FUTURE CONDITION	8.23	0.73	42.67

Constraints

The recommended treatment may require removal of a few trees in order to excavate the necessary volume for the wet detention pond.

The site is located on public land, therefore and acquisition should not prove to be a constraint.

Alternatives

In addition the treatment mentioned above, several additional treatments could be implemented at this site to further capture and treat stormwater.

Alternative 1: consists of the treatment outlined above, with the construction of a wet detention pond with an energy dissipater basin and level spreader.

Alternative 2: consists of the treatment of Alternative 1, with the addition of the construction of an underground filtration area into which the stormwater system of the school is re-routed. This filtration area could be built beneath the existing soccer field, and would contain an aggregate material that would allow the stormwater to infiltrate into the surrounding soil. An overflow pipe would be built at a certain elevation within this area to allow any volume above the water quality treatment volume to discharge into the pipe outlet and wet detention pond constructed in Alternative 1. Construction of this system would also require a flow-splitting device to be placed before stormwater reaches the primary outlet.

Several drop inlets are located in the lawn areas around Smith Middle School, and each of these has the potential to harbor a small bio-retention area. In this way, the runoff of the rooftop would be treated immediately before entering the stormwater system of the school.

Cost-Estimate Breakdown

Tables 11.2 and 11.3 shows a conceptual itemized cost estimate for both alternatives at Site 11. These costs represent construction and maintenance costs only. The cost for the bioretention areas are derived from a cost per cubic foot treated for bioretention areas as reported by Schueler, et. al. (2007). In the same study, the cost of an underground

infiltration area, similar to that proposed at this site, was stated to be similar to that of the cost of a bioretention area, therefore these two costs are the same. The cost for the wet detention pond is derived from an equation developed by Brown and Schueler (1997).

Table 11.2
SITE 11 Alternative 1

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Wet Detention Pond	3762.0	CF	Equation Derived	$26,368
			Total	$26,368
Mobilization (5%)	1.0	LS		$1,318
Contingencies (10%)	1.0	LS		$2,637
	Total + Mobilization and Contingencies			**$30,323**
Maintenance Costs				
Maintenance (5% of base construction cost)	1.0	Year		**$1,516**

Table 11.3
SITE 11 Alternative 2

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Wet Detention Pond	3762.0	CF	Equation Derived	$26,368
Bioretention Areas (x4)	3040.0	CF	12.62	$38,365
Underground Storage Area	2500.0	CF	12.62	$31,550
			Total	$96,283
Mobilization (5%)	1.0	LS		$4,814
Contingencies (10%)	1.0	LS		$9,628
	Total + Mobilization and Contingencies			**$110,725**
Maintenance Costs				
Maintenance (5% of base construction cost)	1.0	Year		**$5,536**

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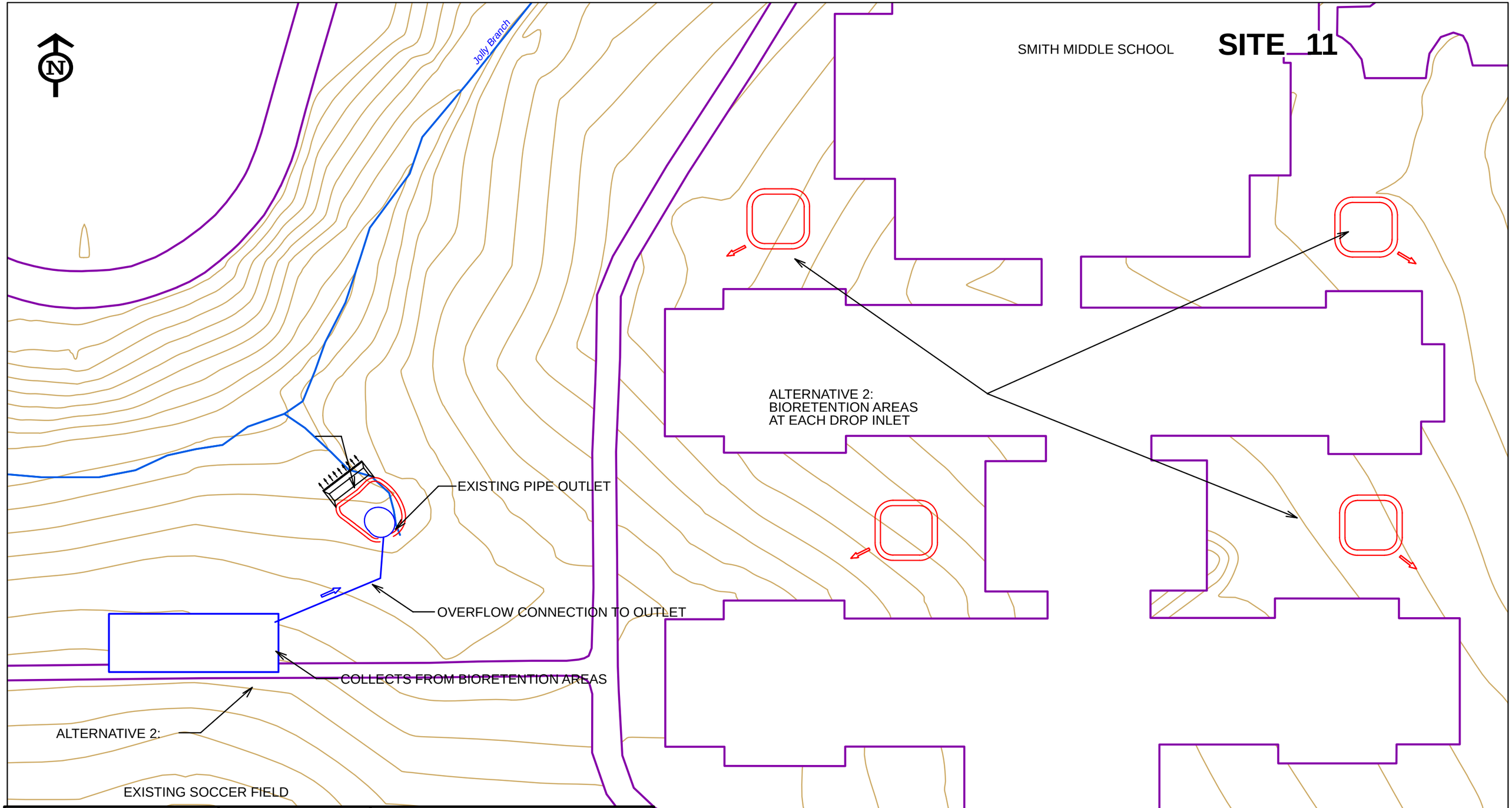

Legend

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

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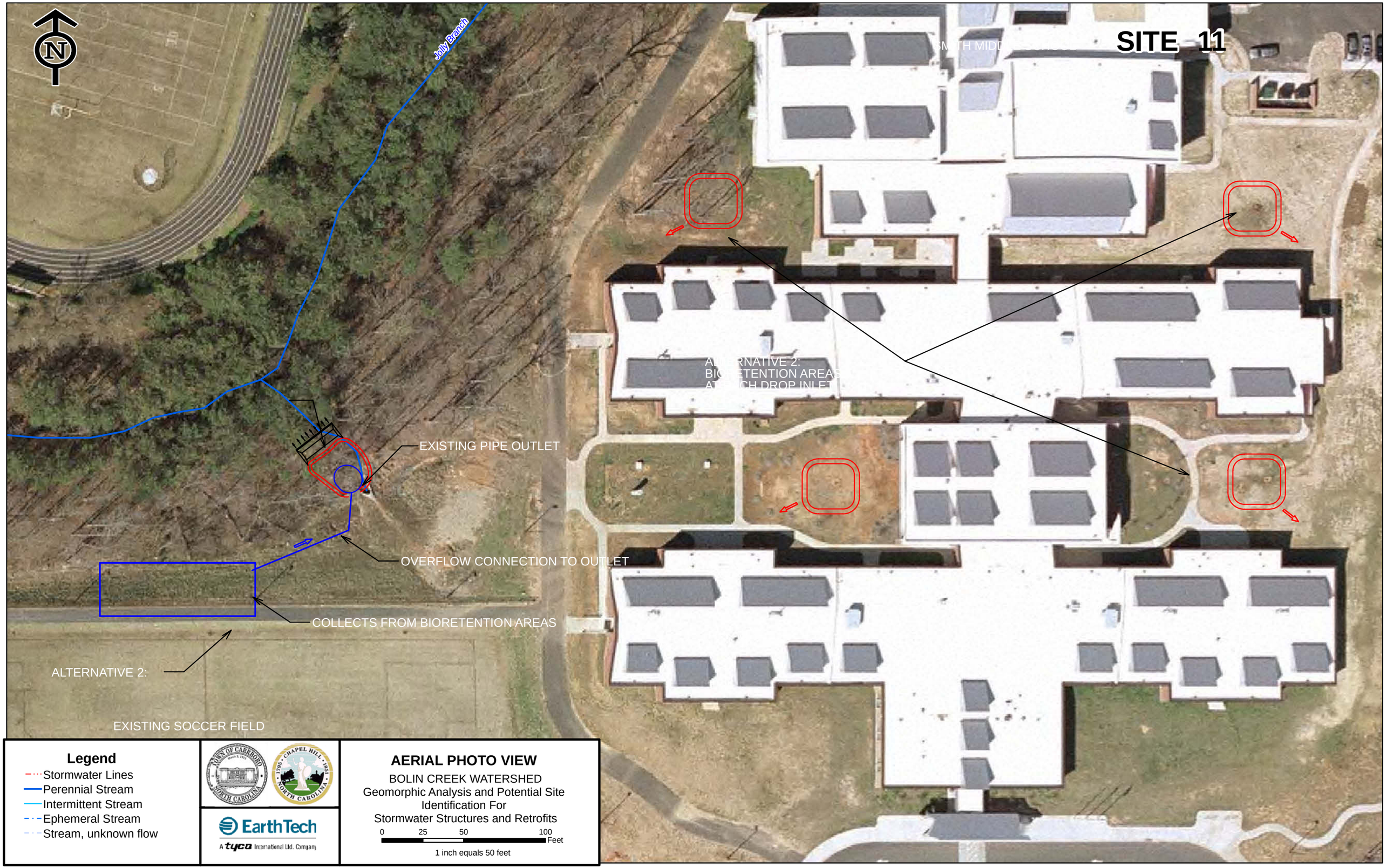
CONCEPTUAL PLAN VIEW
BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site Identification For
Stormwater Structures and Retrofits

0 25 50 100 Feet

1 inch equals 50 feet



Legend

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

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AERIAL PHOTO VIEW

BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site Identification For
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0 25 50 100 Feet

1 inch equals 50 feet