



## Project Closeout Summary—Brown Branch (2008)

<b>Project ID &amp; Status</b>	<b>Project Setting &amp; Classifications</b>	<b>Project Timeline</b>																
<p><b>Project Name/Number:</b> <b>Brown Branch</b></p> <p><b>EEP ID :</b> 279</p> <p><b>County:</b> Caldwell</p> <p><b>Project Type:</b> Stream Restoration</p> <p><b>Current Status:</b> 5 Years of Monitoring complete</p>	<p>Basin: Catawba</p> <p>Physiographic Region: Mountain</p> <p>Drainage: 1.1 SM</p> <p>Watershed: Rural &lt;5%</p> <p>Ecoregion: 66d</p> <p>USGS Hydro Unit: 03050101</p> <p>NCDWQ Subbasin: 11-38-32-13</p> <p>Thermal Regime: Cold</p> <p>Trout Water: Yes</p>	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><b>Milestone</b></th> <th style="text-align: left;"><b>Date</b></th> </tr> </thead> <tbody> <tr> <td>Construction Completed</td> <td>Jan 2003</td> </tr> <tr> <td>Site Planted</td> <td>Feb 2003</td> </tr> <tr> <td>Monitoring Year-1</td> <td>Fall 2003</td> </tr> <tr> <td>Monitoring Year-2</td> <td>Fall 2004</td> </tr> <tr> <td>Monitoring Year-3</td> <td>Fall 2005</td> </tr> <tr> <td>Monitoring Year-4</td> <td>Fall 2006</td> </tr> <tr> <td>Monitoring Year-5</td> <td>Fall 2007</td> </tr> </tbody> </table>	<b>Milestone</b>	<b>Date</b>	Construction Completed	Jan 2003	Site Planted	Feb 2003	Monitoring Year-1	Fall 2003	Monitoring Year-2	Fall 2004	Monitoring Year-3	Fall 2005	Monitoring Year-4	Fall 2006	Monitoring Year-5	Fall 2007
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**Table 1. Project Restoration Components and Mitigation Assets**

Stream						
Drainage/Hydrology Component				Ratio		
	Approach	Level	Multip	Feet	SMU	
Brown Branch Mainstem	PI	R	1.00	5107	5107	
Enhancement Segments 1 & 2	Bank Stabil and Planting	EII	0.40	120	48	

**Asset Summary**

Level	Ratio	Multip	Feet	SMU
R	1:1	1.00	5107	5107
EII	2.5:1	0.40	120	48
			<b>5227</b>	<b>5155</b>

### **Project Background and Summary**

The project is just within the mountain physiographic region in a rural watershed of 1.1 square miles and includes approximately 5,107 feet of restoration (PI) and 120 feet of EII. A straightened, overwide and incised F channel lacking bedform due to bank failure and the attendant sedimentation was restored to a C/E channel type with an reference-appropriate width to depth, entrenchment ratio and profile. Pattern more in keeping with reference was introduced as well. The design also included a focus on the introduction of wood in the channel and on the floodplain. Large wood snags and logs were placed on the floodplain for roughness and riparian habitat. Log vanes and cover/scour logs were also included as part of the channel design. The design also included the introduction of an appropriate riparian vegetation community, which included approximately 11 pocket wetland/vernal pool complexes on the alignment of the pre-existing channel, which now reside on the inner meanders of the new alignment.

### **Goals and Objectives**

1. Reduce water quality stressors through reduction of fine sediment exported to the watershed by reducing bank erosion and providing temporary sediment floodplain storage through the restoration of an appropriate dimension and profile with the associated floodplain access.
2. Enhancement of in-stream habitat through the introduction of pattern, structure, wood, and an appropriate riparian buffer community.
3. Improve habitat functions and aesthetic value of the riparian corridor by planting the buffer with an appropriate riparian community and introducing wood and snags to the floodplain.

### **Success Criteria**

#### Morphological and substrate Success criteria

- Stable stream type persists
- Pools maintain depth in meanders and at structures and riffles persist in straight reaches
- Dimensional parameters generally are maintained within 25% of design/As-built or within 25% of reference ratios
- No rapid, systemic, severe bank erosion
- No systemic development of mid-channel bars
- Pattern sinuosity is maintained (modest lateral migration of the thalweg and no avulsions)
- Pool to pool spacing is maintained
- Headcuts are not large or plentiful and riffle slopes are maintained
- Riffles maintain D50 in gravel range and may coarsen

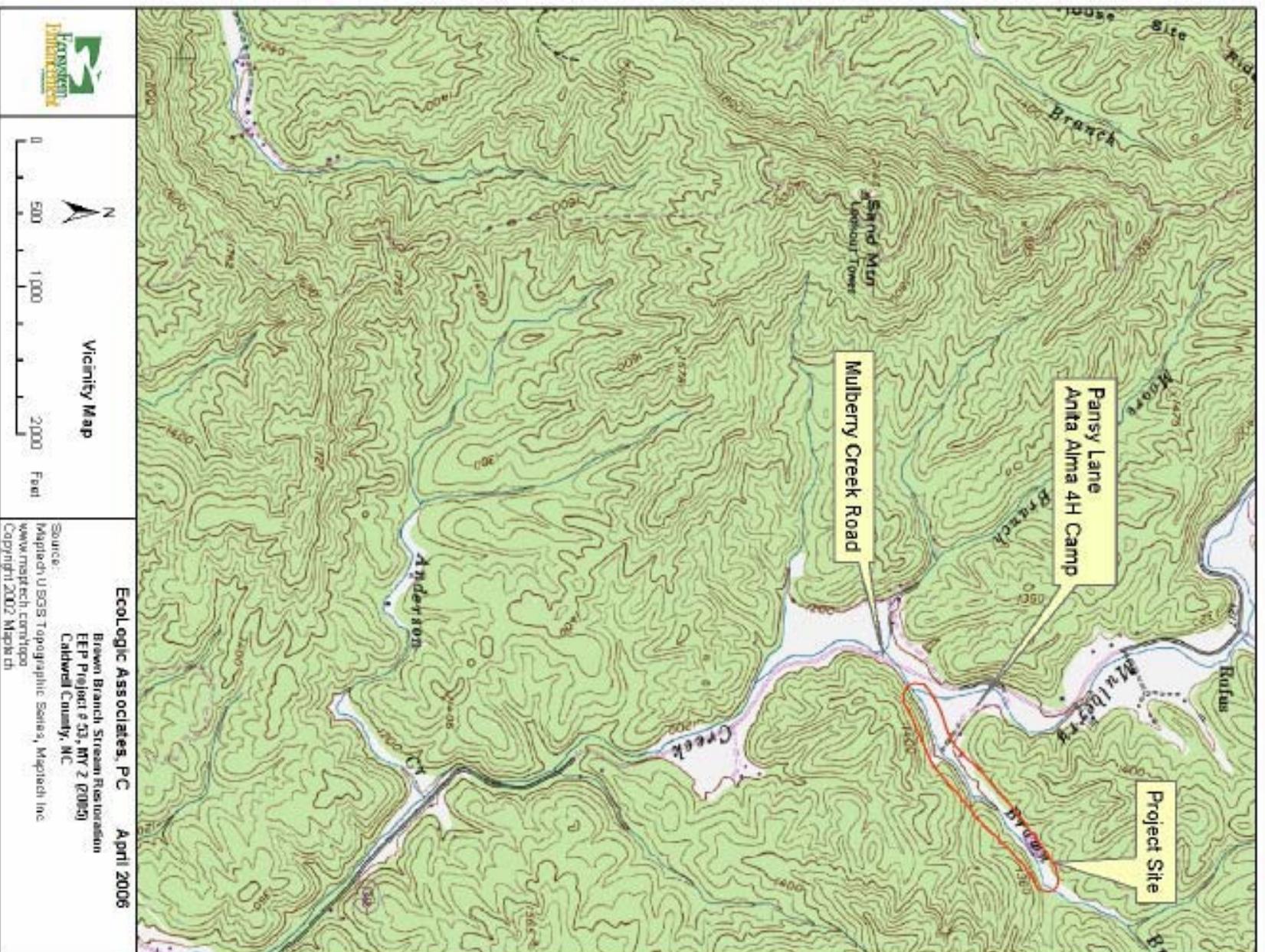
#### Hydrological Criteria

- 2 bankfull events

#### Vegetation Criteria

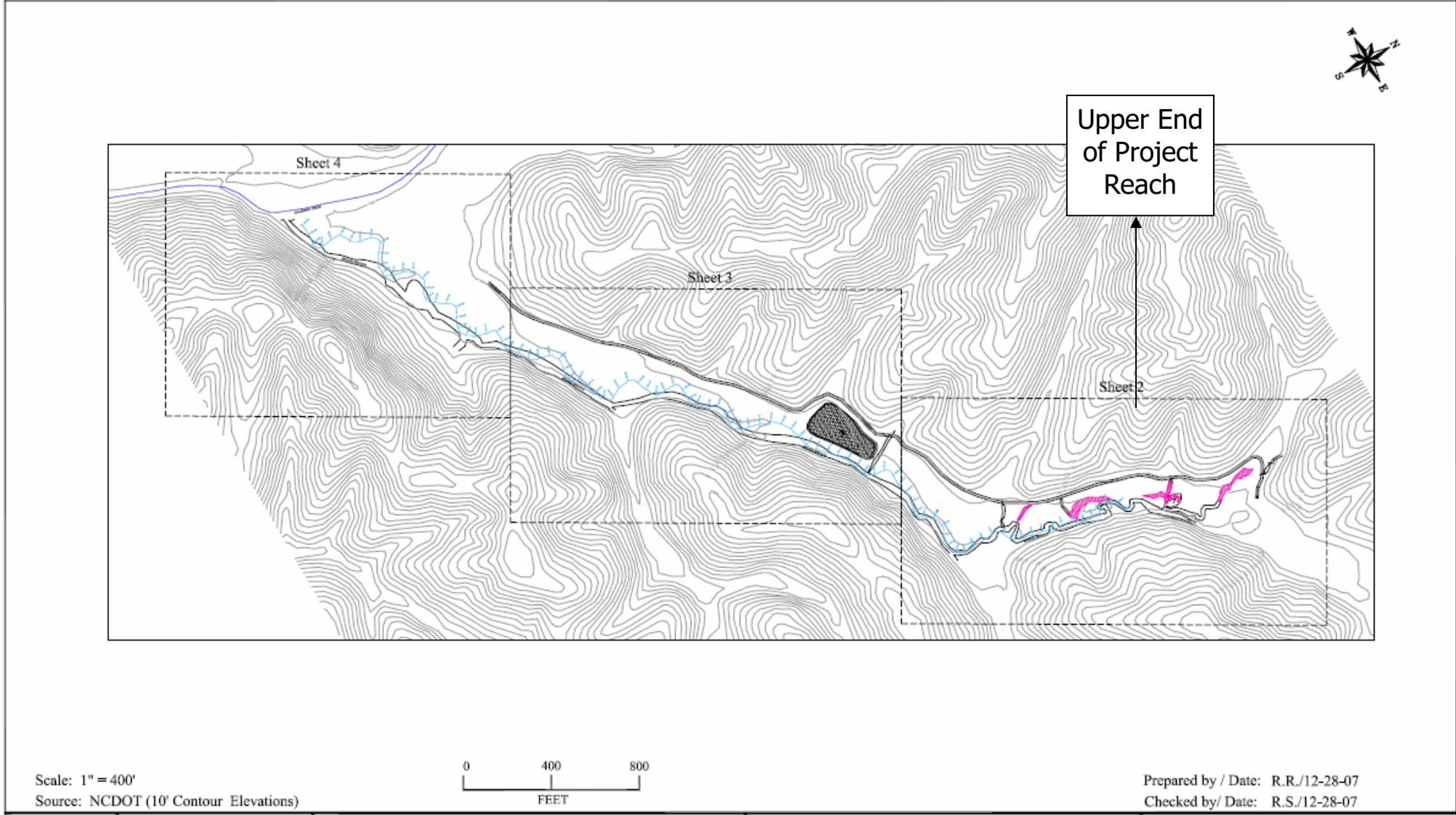
- $\geq 260$  stems/acre @ year-5
- At least 6 of the planted species are among the living stems

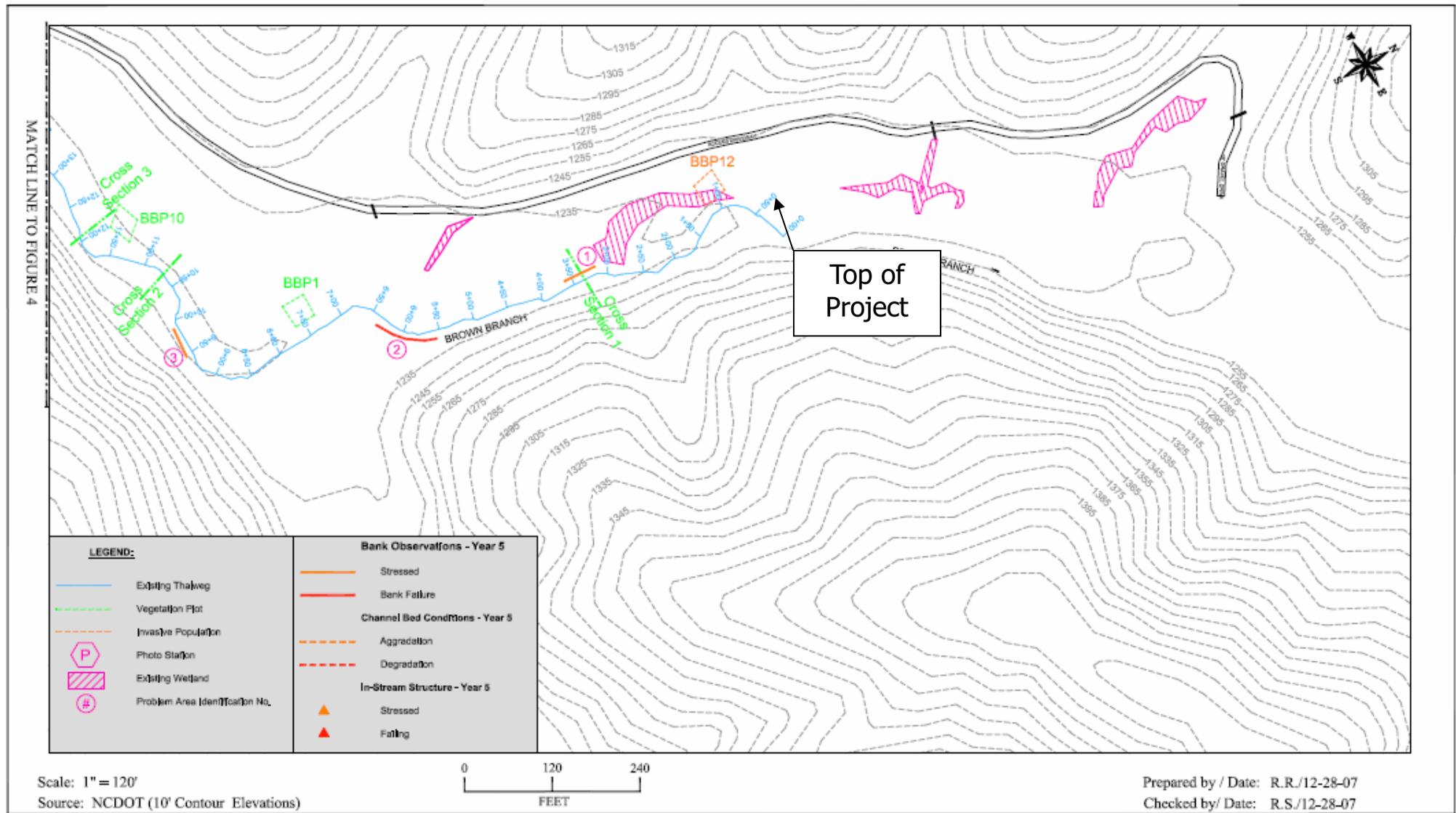
## Project Vicinity Map

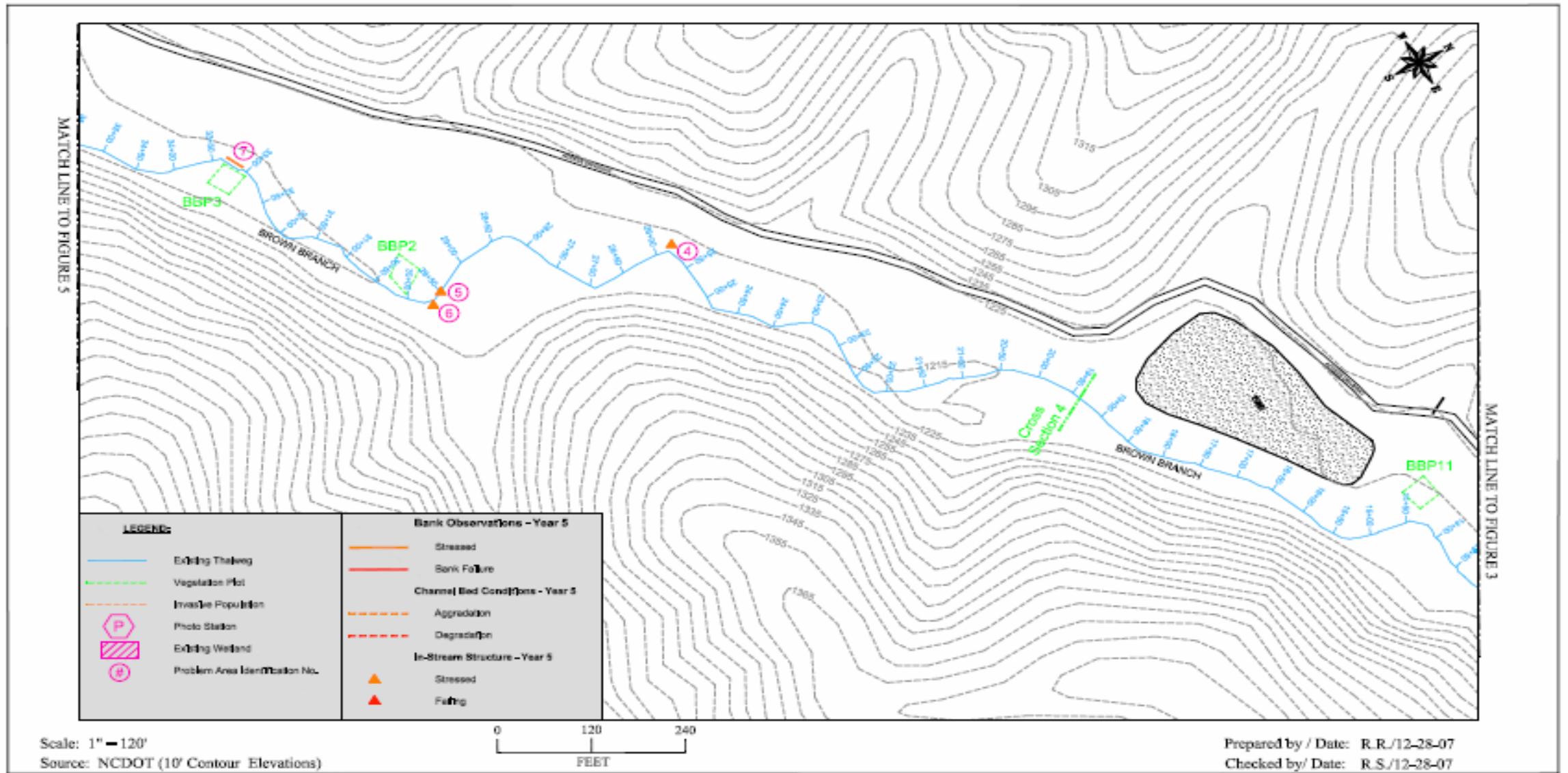


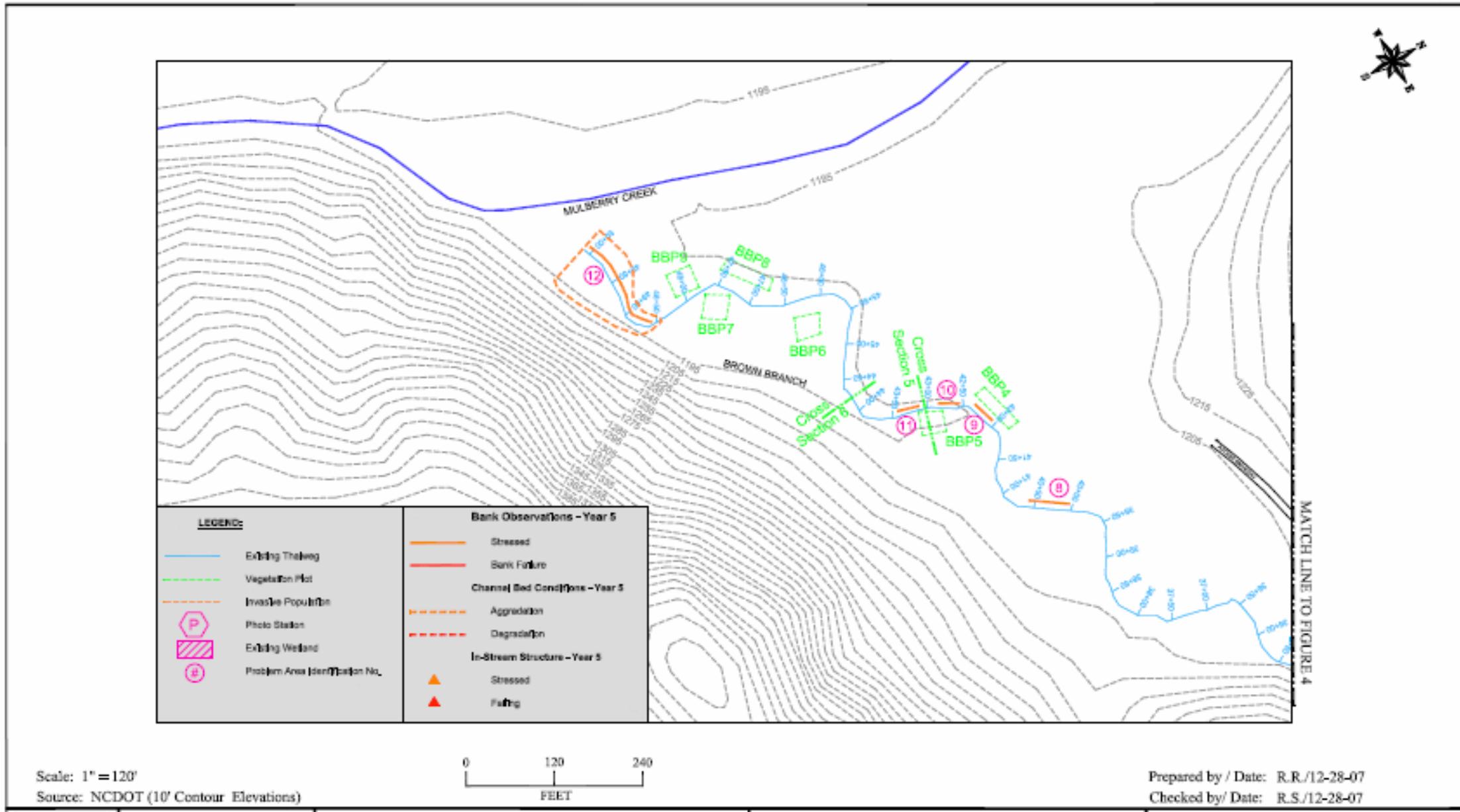
### Directions to Brown Branch:

- From US-321 ALT/N Main St. in Lenoir NC:
- Left onto NC-90/Walway Rd. NW
- Continue on NC-90/Walway RdNW 1.3 mi.
- Left onto NC-90/Colettesville
- Continue on NC90/Colettesville 4.0 mi.
- Right on Mulberry Creek Rd.
- Continue on Mulberry Creek Rd. 3.5 mi.
- Right onto Anita Alta 4-HCamp Brown Branch on right









**Pre-Construction Site Conditions**



**Post-Construction Site Conditions– May 2007 Photos**



**Post-Construction Site Conditions— Dec 2007 Photos**



## **Morphological Stability**

### **Dimension and Profile**

The projects' dimension exhibited some localized instability through the course of the monitoring period. It was overwhelmingly stable in that 99% of the banks footage was reported to be stable or have stabilized by 2007. BEHI estimates indicated a generally low hazard category with very low sediment export estimates. Cross-sections demonstrated some adjustment post construction. Some cross-sections had to be reset by the monitoring firm in 2006, because one or more markers could not be found. They generally exhibited stability. Riffle cross-section 1 was built narrower and smaller than design targets. Shortly after construction it enlarged to design targets and has remained consistent. Riffle Cross-section 3 has exhibited stability. Riffle cross-section 5 exhibited a mid-channel bar (see below), but has remained consistent after the development of this feature. Meander Pool cross-sections maintained consistency in depth over the monitoring period except for cross-section 6. It was in the lower section and subject to the combination of beaver and drought. Meander pool depths were generally less than design max depth targets, although the visual assessments indicated 96% of expected pool features were present and the projects profile indicated distinctive pools with definition and depths greater than the As-built state. The overall profile slope remained consistent. Although riffle facet slopes were lower than design targets in the earlier phases of monitoring, they demonstrated increases in the years 4 and 5. The overall profile did not demonstrate any systemic issues other than the top 200 feet of the project appeared to downcut ~ 0.5 feet between the As-built and Year-5. Comparisons of riffle head elevations between the 2003 and 2007 profiles did not demonstrate any other significant continuous length of channel that moved vertically. The bottom 1000 feet of the project exhibited several mid-channel bars indicating lesser transport competence in this area. This totaled less than 2% of the project footage. The onset of these bars is thought to be sourced from bank erosion in this area that was not flushed due to lower velocities from beaver and drought and subsequently stabilize with vegetation. Currently, these bars are not presenting a problem due to floodplain access. It is believed that most of these will become an inner berm feature and produce a narrower channel below the top of bank in subsequent years. (see plots and data in following pages)

### **Substrate Data**

In year 4 the D50 for all riffle cross-sections was within the medium gravel range. The D84 was exhibiting coarse gravel bordering on cobble, but 2007 exhibited a fining in these riffles. It was offered by the monitoring firm in the report narrative that this was likely due to the very low drought flows and the onset of beaver at the bottom of the project in the latter half of 2006. With continued narrowing, the channel should return to demonstrating a coarsening of the substrate.

### **General Stability Criteria**

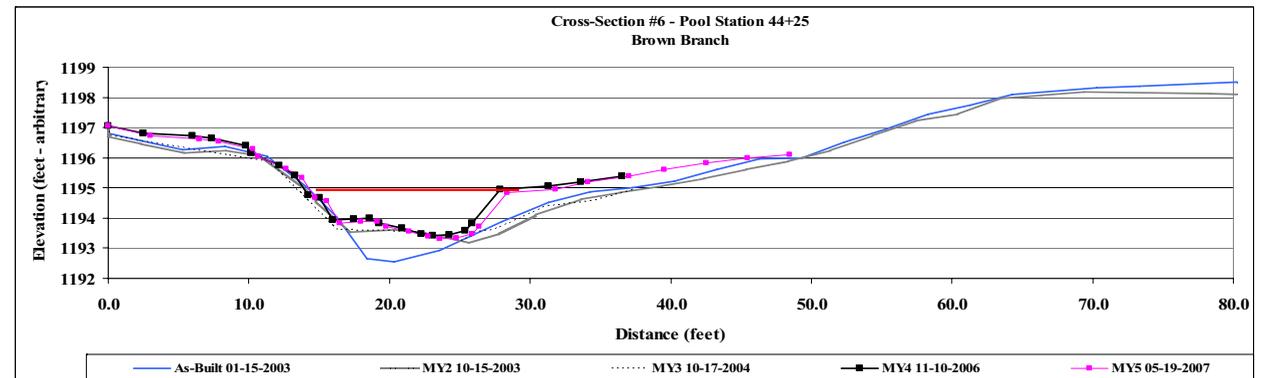
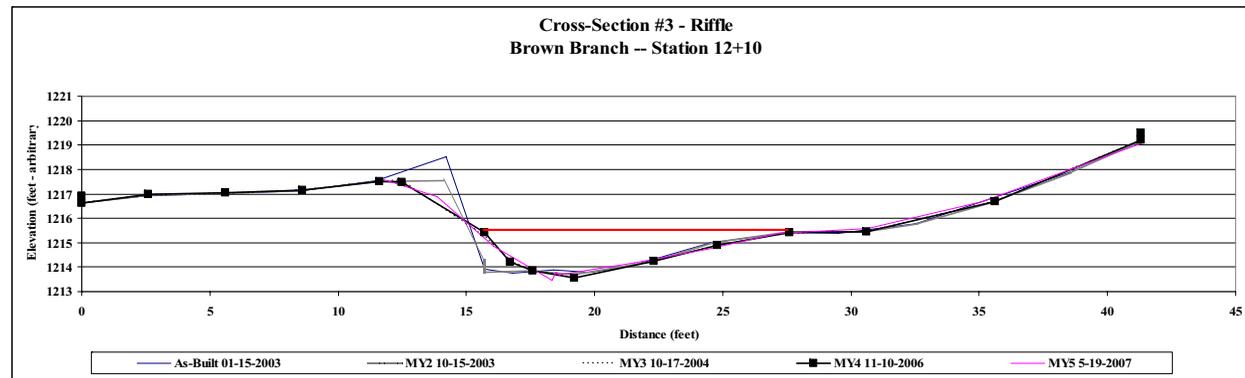
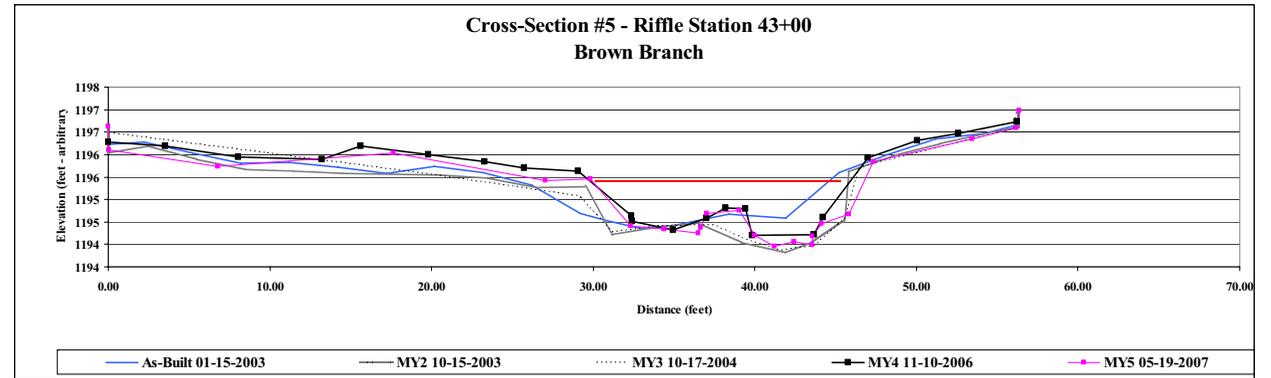
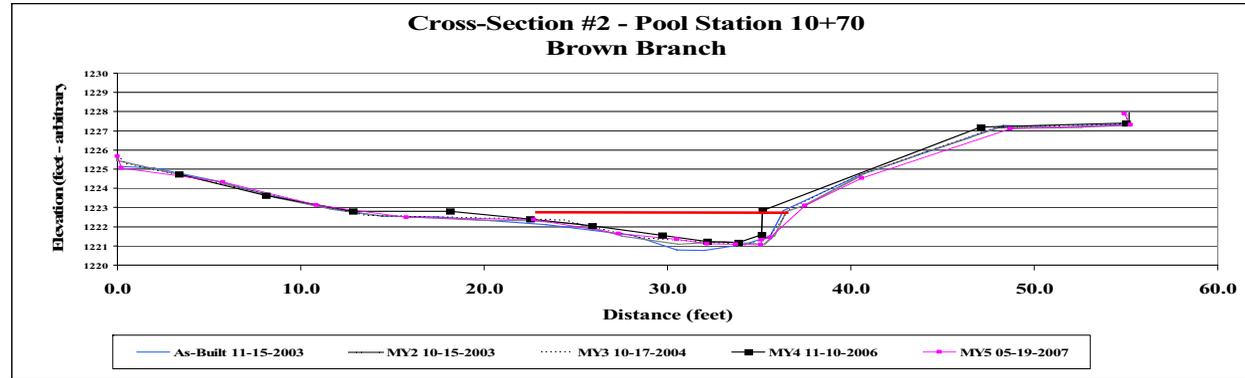
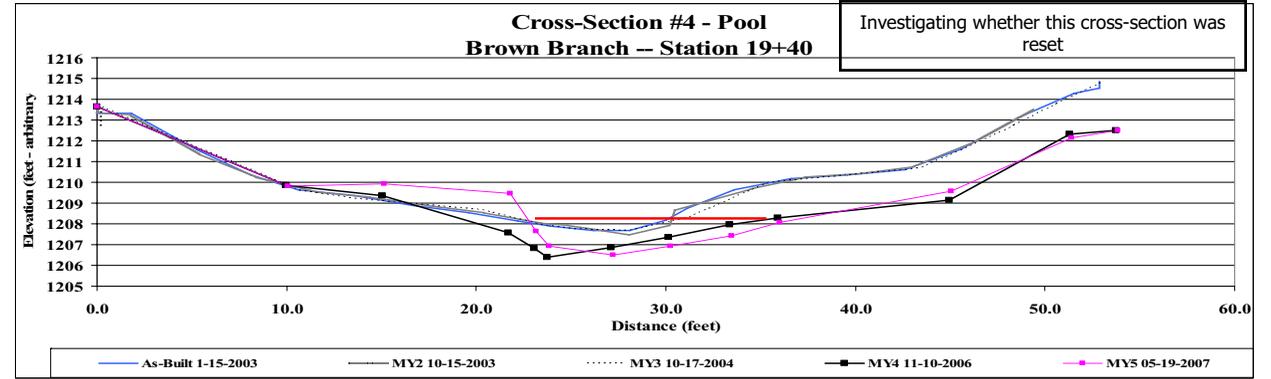
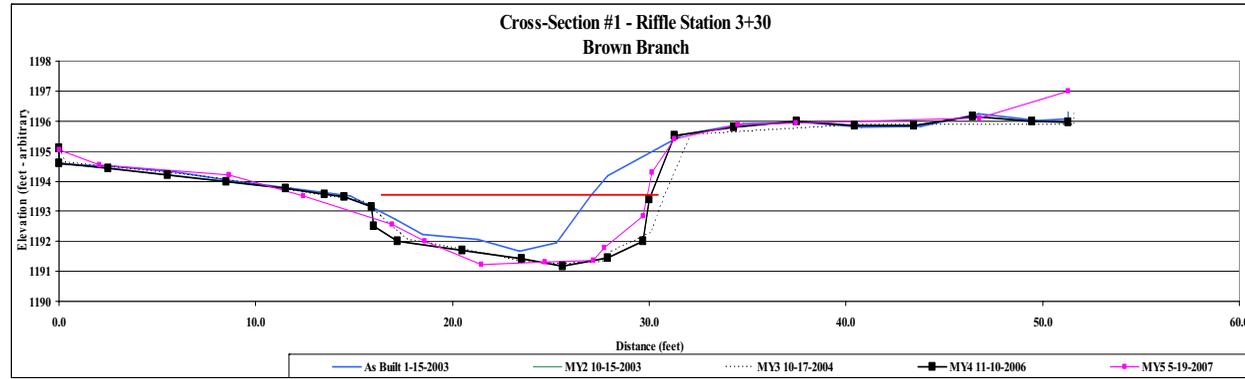
The site exhibited general morphological stability and met the success criteria detailed on page 2. An exception was the substrate criteria for the aforementioned reasons. The area with mid-channel bar formations represent a small proportion of the overall project and are believed to have formed for the same reasons described for substrate issues.

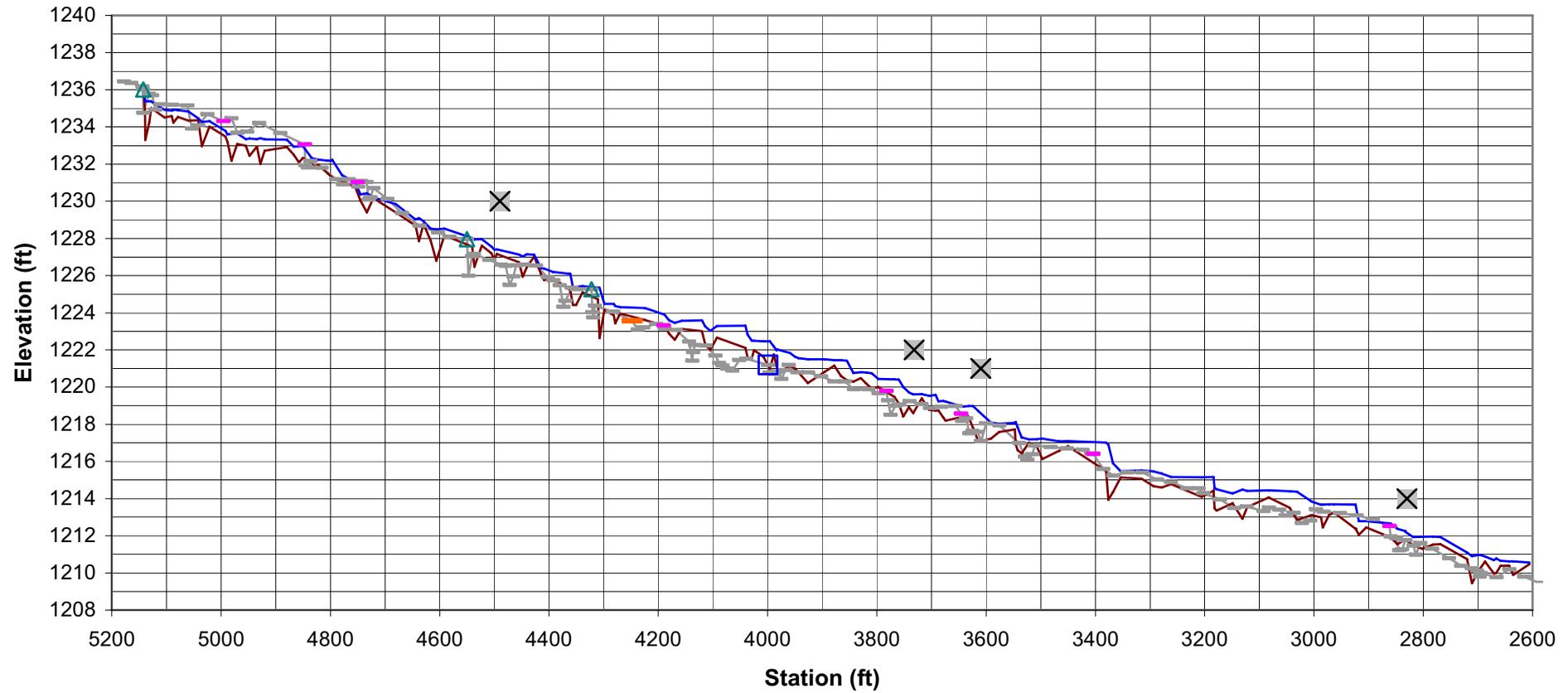
### **Hydrology**

The data record from the monitoring reports indicate that bankfull events occurred in December 2006, 2005 and 2004 (remnants of hurricanes Frances and Ivan).

### **Benthos**

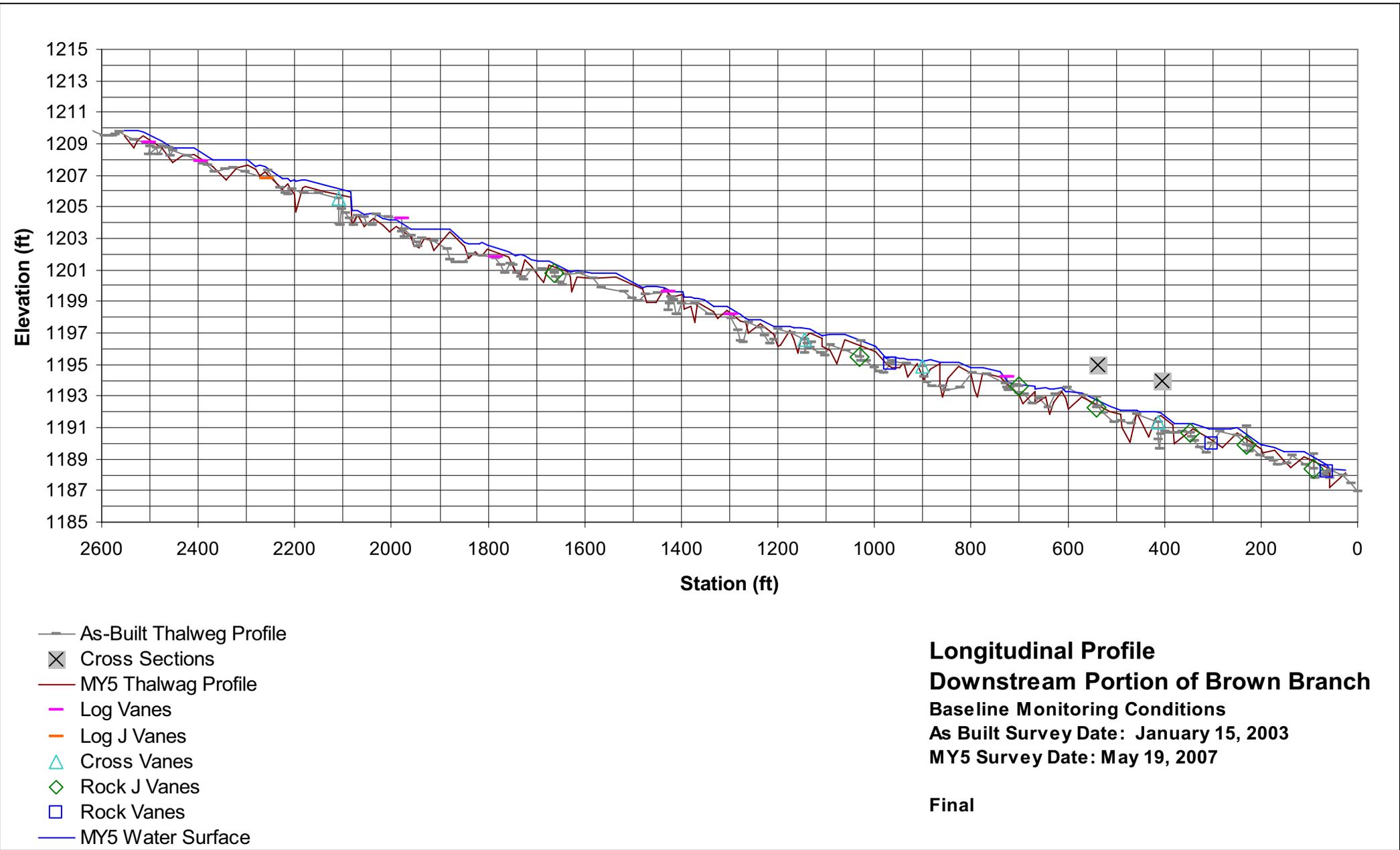
Marobenthos were assessed by David Penrose of DWQ and NCSU. The sampling included an upstream reference (site 1), a site within the project extent (site 2), and a site below the restoration project (site 3). Sites 2 and 3 were compared to the upstream reference site, site #1. The following narrative and the data tables and plots were produced by Mr. Penrose. "Except for the initial increase in common taxa percentage at site #2 in June the DIC values at both sites have increased above background appearing to stabilize at site #2 near 52% though they are somewhat more variable at site #3. These data suggest that the restoration of Brown Branch has improved biological integrity of the feature. Note the increase in the number of indicator taxa at both sites 2 and 3 following restoration" (a noticeable decline at site #2 in also noted)". See table and plot in later pages.





- As-Built Thalweg Profile
- × Cross Sections
- MY5 Thalweg Profile
- Log Vanes
- Log J Vanes
- △ Cross Vanes
- Rock Vane
- MY5 Water Surface

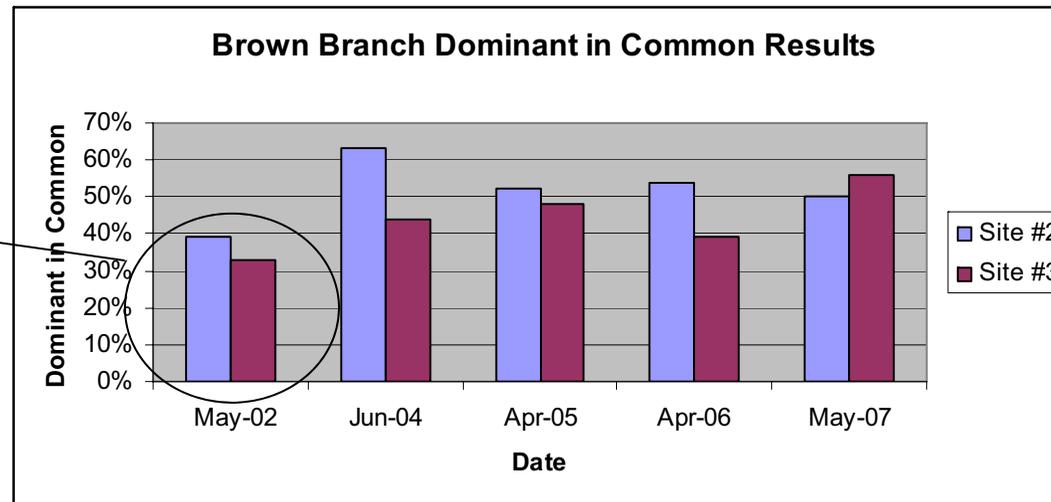
**Longitudinal Profile**  
**Upstream Portion of Brown Branch**  
 Baseline Monitoring Conditions  
 As Built Survey Date: January 15, 2003  
 MY5 Survey Date: May 19, 2007



# Macrobenthos Data

Metric/Survey	Site #1, upstream ref					Site #2					Site #3				
	4/02	6/04*	4/05	4/06	5/07	4/02	6/04*	4/05	4/06	5/07	4/02	6/04*	4/05	4/06	5/07
Total taxa richness	57	50	53	47	55	57	59	61	53	44	67	59	52	65	64
EPT taxa richness	33	23	34	22	28	31	32	36	27	26	33	32	30	34	38
EPT abundance	133	111	110	105	117	87	142	122	108	103	119	167	90	104	139
Dominant in Common Taxa**	-	-	-	-	-	39%	63%	52%	54%	50%	33%	44%	48%	39%	56%
# Indicator species	23	16	27	20	20	13	12	24	20	13	14	10	21	20	22

Pre-Construction



## 2008 Brown Branch Vegetation Data

### Summary

The data in table 1 suggests substantial mortality of planted stems has occurred in years 1-3. However, after evaluating the site and reviewing the 3 different monitoring approaches that were applied during years 1-3, EEP believes the data is inconsistent and does not reflect the actual condition of the woody vegetation within the easement. The data in table 2 more accurately characterizes the year 5 condition of the buffer with an average planted stem density of 401.4 stems per acre, including live stakes. Without live stakes included, the average stems per acre estimate for year 5 is 176.2. However, given the size of the watershed and the easement width, EEP believes counting live stakes toward the year 5 260 minimum stem requirement is appropriate. Moreover, the vigor of the sampled vegetation was most recently categorized as good (70%), with the most dominant of 28 species being *Platanus occidentalis*.

**Table 1**

Stem Counts Per Acre by Plot																				
		Plots																		
MY	CY	Ave	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Y1	2003	2584.3	2200	640	1820	80	1860	1130	10360											
Y2	2004	240.0	160	240	200	400	200													
Y3	2005	328.2	243	162	121	202	647	931	445	445	486	405	40	0	81	81	364	121	202	931
Y4	2006	See Table 2 CVS-EEP Protocol Project Summary																		
Y5	2007	See Table 2 CVS-EEP Protocol Project Summary																		

**Table 2**

Project/Status		Requirements/Approach				Living Stems						Species		Vigor								
name	year	req'd stems	plots	Sampling Dates		Planted & Natural Total Live	Planted				#	Most Dominant Species (most stems per project)	% of stems									
				Start	End		All planted		Excl. Live Stake					4	3	2	1	0				
						per acre	per acre	diff to req	mort.	per acre	diff to req	Species Name		excel	good	weak	unlike to surv year	dead	miss	unkn	other	
Brown Branch	4	288	12	09/28/06	10/31/06	1085.9	438.4	150.4	0.8%	192.2	-95.8	27	<i>Platanus occidentalis</i>	32.8%	81%	16%	2%		1%			
Brown Branch	5	260	12	07/17/07	07/18/07	1315.2	401.4	141.4	6.1%	176.2	-83.8	28	<i>Platanus occidentalis</i>	23.8%	22%	70%	2%		1%	5%		

## Brown Branch Vegetation Plot Photos (1-4) Taken in 2006

Plot 1



Plot 2



Plot 3



Plot 4

