Little Alamance Creek (Burlington Park) Stream Restoration
2016 Monitoring Report
Monitoring Year 5 of 5

Alamance County, NC
Cape Fear River Basin
Cataloging Unit: 03030002
NCDMS Project Number: 92372
NCDMS Contract Number: 4998

Submitted To:

North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Final – 2016 Monitoring Report – Year 5 of 5

Project Construction Completed: 2012
Data Collection for Monitoring Year 5 of 5
Report Submitted: November 2016

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Submitted to:
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Raleigh, NC 27699-1652

Prepared by:
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November 2016

Final

3e EEE Consulting, Inc.
Environmental, Engineering and Educational Solutions

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APPENDICES, FIGURES, and TABLES

1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The primary goals of this stream restoration project focus on improving water quality, enhancing flood attenuation, and restoring aquatic habitat. These goals will be accomplished by the following objectives:

- Reducing non-point sources of pollution associated with former lawn maintenance in the park area by providing a vegetative buffer adjacent to Little Alamance Creek and its unnamed tributary (UT) and the installation of stormwater best management practices to treat surface runoff. The riparian buffer will remain in a State-owned conservation easement in perpetuity.

- Reducing sedimentation on-site and in downstream receiving waters through a reduction of bank erosion associated with current vegetation maintenance practices and by providing a forested vegetative buffer adjacent to Little Alamance Creek and its tributary.

- Reestablishing stream stability and the capacity to transport watershed flows and sediment loads by restoring stable dimension, pattern, and profile.

- Promoting floodwater attenuation through increased flood storage capacity by construction of bankfull benches along Little Alamance Creek and its tributary.

- Improving aquatic habitat by enhancing stream bed variability.

The Site consists of 2,738 linear feet of enhanced (Level I and II) channel along Little Alamance Creek and its UT. The project is located in City Park in the City of Burlington, Alamance County, North Carolina (Figure 1). The surrounding land use is recreational and the project is easily accessible by the public. Little Alamance Creek and its UT are located in the 8-digit Hydrologic Unit Code (HUC) 03030002; the 14-digit Local Watershed Unit HUC 03030002-040010; and the North Carolina Division of Water Resources (NCDWR) Subbasin 03-06-03 (NCDWR, 2005). The project lies within the Southern Outer Piedmont ecoregion of the Piedmont physiographic province of NC (Griffith *et al.,* 2002). The North Carolina Division of Mitigation Services (NCDMS) has identified the Cape Fear HUC 03030002, and in particular Little Alamance Creek, in their Local Watershed Plan as needing repair along with conservation opportunities. Watersheds in this plan exhibit the need and opportunity for stream and riparian buffer restoration (NCDEQ, 2001). In 2000, Little Alamance Creek was listed as impaired by the NCDWR due to poor stream biological ratings (NCDMS, 2008).

The Little Alamance Creek Stream Restoration Site was originally planted in April, 2012. On September 11, 2012, the site was inspected at 15 locations by NCDMS and vegetative sampling reported higher mortality than contractually permissible. Of the 15 inspection plots, 6 did not meet the 80 percent survival warranty. The areas identified as needing supplemental planting were re-planted on December 12, 2012. For purposes of long term monitoring, 8 vegetation sampling plots were established in 2013, Monitoring Year (MY) 1. In September 2014, MY3, vegetation plots (VP) 3 and 4 were moved to avoid the utility easements. Additional planting occurred on December

2, 2014 after MY3. The right bank of Reaches 6 and 7 was replanted. This replanting added additional stems to VP7 and 8. In June of 2015, MY4, the City of Burlington took steps to control populations of invasive plant species with herbicide treatments. This invasive control effort affected planted and volunteer species in addition to the targeted invasive vegetation in the project area. A detailed report of the results of the treatment was prepared and submitted to NCDMS in September 2015. October 2016, MY5 efforts report that the majority of the site is not meeting the planted stem success criteria. Only VP6 and 7 have met the 288 stems per acre success requirement (Appendix C; Table 7). VP3 and 8 failed to meet the stems per acre success requirement by less than 10% (Appendix C; Table 7). Volunteer species are establishing on site as expected and thus increasing the overall stems per acre. Volunteer species have increased the stems per acre over 320 for all plots (Appendix C; Table 8). Volunteer species are also colonizing the treatment areas of concern identified in the September 2015 report.

EEE Consulting, Inc. (EEE) has identified and evaluated vegetation and stream problem areas (VPA/SPA) during all prior years' monitoring field efforts, and evaluated those areas during the MY5 site visit. Problem areas were labeled numerically as identified throughout all prior monitoring years. Problem area labels were merged during each monitoring year as they increased and overlapped spatially throughout the site. No new stream or vegetation problem areas were identified during the MY5 site visit Locations of problem areas are identified below and in Figure 2. A supplemental photo log of these problem areas is included within the support files for MY5.

Vegetation Problem Areas

Name	Station#/Range	MY5 Comments
VPA 3	11+50 to 11+80 Mainstem RT Bank	*Ligustrum sinense* absent from location. Affected by flood event. Trees and other small vegetation have been cut down and trampled by human activity.
VPA 6	29+50 to 32+00 Mainstem LT Bank	*Cuscuta sp.* and *Ipomoea hederacea* absent from location. *Securigera varia* and fresh beaver chews are present. Tall tree that fell in the easement has been moved by flood event and is no longer in Veg Plot 6.
VPA 9	32+50 to 33+00 Mainstem LT Bank	Bare soil area has not changed.
VPA 12	33+50 to 34+50 Mainstem RT Bank	*Acalypha virginica, Artemisia vulgaris*, and *Convolvulus arvensis* are present around VP8. VPA size reduced.
VPA 16	35+00 Mainstem RT Bank	*Artemisia vulgaris* removed from left bank, no change to right bank. Affected by flooding.
VPA 17	14+50 to 14+75 Mainstem RT Bank	No change to *Lonicera japonica. Cuscuta sp.* and *Calystegia sp.* absent from location. Affected by flooding.
VPA 22	28+75 to 29+25 Mainstem RT Bank	*Artemisia vulgaris* appears as invasive mat. *Securigera varia* is absent.

Vegetation Problem Area Adjustments

Name	Station#/Range	MY5 Comments
Removed from CCPV – Problems resolved		
VPA 1	11+40 to 11+60 UT RT&LT Bank	Invasive species *Rosa multiflora* and *Ipomoea hederacea* not present. Affected by flood event.
VPA 4	13+50 to 14+00 Mainstem RT Bank	Invasive species *Ligustrum sinense* and *Cuscuta sp.* not present. Affected by flood event.
VPA 8	16+75 Mainstem RT Bank	Level spreader absent of debris and surrounding area well maintained. *Cuscuta sp.* not present.
VPA 10	31+25 Mainstem RT Bank	No new mowing in the easement was present. Vegetation regrowth occurring.
VPA 13	27+10 Mainstem RT&LT Bank	*Cuscuta sp.* absent from location. Affected by flood event.
VPA 14	14+00 Mainstem LT Bank	*Cuscuta sp.* absent from location. Affected by flood event.
VPA 19	25+50 Mainstem LT Bank	*Cuscuta sp*. absent from location. Affected by flood event.
VPA 20	15+00 to 15+50 Mainstem LT Bank (both sides of ped bridge)	*Calystegia sp*. absent from location. Affected by flood event.
VPA 21	30+25 Mainstem RT Bank	Drainage ditch dug in easement from greenway path to RT bank has been filled in with sediment and vegetation.

Stream Problem Areas

Name	Station#/Range	MY5 Comments
SPA 1	11+50 to 14+50 UT RT bank; 12+50 to 14+50 UT LT bank.	Small lateral bar identified in MY4 submerged due to beaver dam. Water stagnant and flooded. Increased severity and length of erosion throughout reach.
SPA 2	11+00 to 12+00 Mainstem LT bank	Beaver dam downstream causing high stagnant water above ordinary high water mark. Alluvial deposition throughout banks. Eroded areas submerged.
SPA 3	14+50 to 15+00 Mainstem RT &LT bank.	Beaver dam now present just below confluence of mainstem and UT. Eroded areas submerged.
SPA 4	28+60 to 32+25 Mainstem RT bank 28+75 Mainstem LT bank.	Increase in severity of erosion. New beaver activity. Increased scour around RCP on LT bank.
SPA 5	10+00 to 10+25 UT RT bank	No change in erosion.
SPA 7	17+75 to 18+00 Mainstem RT bank	No change in erosion.
SPA 9	35+25 to 35+50 Mainstem RT&LT bank	No change in erosion.
SPA 12	25+25 to 25+75 Mainstem RT&LT bank	Increase scour on both banks.
SPA 13	22+50 to 22+75 Mainstem RT bank	No change in erosion.

Name	Station#/Range	MY5 Comments
SPA 17	27+15 to 27+25 Mainstem RT&LT bank	Increase in scour and debris buildup along banks from flooding. Previously undercut bank is now mass wasting. Gravel along railroad tracks and in a pile. Gravel has no erosion or sediment control measures and enters the stream directly.
SPA 24	13+25 to 13+50 Mainstem RT bank	Vegetation is covering the erosion. Burrows are submerged. No apparent change.
SPA 26	34+00 to 34+50 Mainstem RT&LT bank	No change in erosion and stormwater outfall damage.

Wetland mitigation is not a part of this project.

Summary information/data related to the occurrence of items such as beaver encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan (formerly the Restoration Plan). This document is available on NCDMS's website. All raw data supporting the tables and figures in the appendices is available from NCDMS upon request.

2.0 METHODOLOGY

All monitoring methodologies follow NCDMS's 2011 *Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation* (NCDMS, 2011). This monitoring report is consistent with NCDMS's *Monitoring Report Template Version 1.5* adopted June 8, 2012. GPS data was collected using sub-meter accuracy Trimble Geo XH handheld unit. Survey data was obtained using Nikon NPL-322 Total Station with rod and prism. Rod height varied from 4.44 US survey feet to 11.98 US survey feet. Stream and vegetation problem areas were identified and noted in the field on As-Built Plan Sheets prepared by ARCADIS G&M of North Carolina (ARCADIS, 2012). Twenty permanent photo stations were established during the project set up by EEE and photographs were taken from these locations (Figure 2). Photographs were taken using an iPad Theodolite application.

2.1 STREAM SURVEY METHODOLOGY

Prior to Year 1 monitoring efforts, EEE established eight permanent riffle cross-sections and six permanent pool cross sections (Figure 2). Surveyed and GPS points were collected on both banks of each established cross section, marked with steel electrical metallic tubing (EMT) driven into the ground. Yellow plastic caps were attached to each pin for safety and visual assistance. The entire length of mitigation, 2,725 linear feet of stream profile, was surveyed. Stream monitoring and geomorphological surveys were performed consistent with the USACE 2003 *Stream Mitigation Guidelines* and the USDA 1994 Forest Service Manual *Stream Channel Reference Sites: An Illustrated Guide to Field Technique* (USACE, 2003; Harrelson *et al*, 1994). Stream survey data was collected using a Nikon NPL-322 total station with a Recon data logger and is georeferenced in NAD83-State Plane Feet-FIPS3200. Data were analyzed using RIVERMorph.

Pebble counts were conducted consistent with the 1954 Wolman Pebble Count technique (modified by Rosgen, 1996). A random sample of 100 pebbles from each cross section was collected within the wetted perimeter of the channel. Samples were not taken from the banks. Photographs were taken at each cross section from the left bank looking towards the right bank (Appendix B: Photo Log 1).

2.1 VEGETATION SURVEY METHODOLOGY

Prior to Year 1 monitoring efforts, EEE established eight vegetation plots per the CVS-DMS vegetation monitoring protocol (Figure 2). Five plots are 10 meters by 10 meters in size and two plots, (VP6 and 7) are 20 meters by 5 meters in size. Per request of DMS, prior to Year 3 monitoring, VP3 and 4 were relocated so that they no longer intersect utility easements (Figure 2). All four corners of each established vegetation plot were surveyed and GPS points were collected. Vegetation monitoring was performed in accordance with the 2008 CVS-DMS Protocol for Recording Vegetation for Level 1-2 Plot Sampling Only, Version 4.2 (Lee *et al*, 2008). Level 2 sampling was performed for each vegetation plot. Each corner of the vegetation plot was marked with steel EMT driven into the ground. Because the project is within a public park, minimal flagging was used to mark the stems and the vegetation plot corner pins. Orange plastic caps were attached to each pin for safety and visual assistance. Minimal orange flagging was used to mark only planted stems during vegetation counts. Photographs were taken at each vegetation plot from the southwest corner facing the northeast corner (Appendix B: Photo Log 2).

3.0 REFERENCES

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Griffith, Glenn, J. Omemik, J. Comstock, 2002. Ecoregions of North Carolina Regional Descriptions. U.S. Department of Agriculture, Natural Resources Conservation Service. Corvallis. OR.

Harrelson, Cheryl C., C.L. Rawlins, John P. Potyondy, 1994. US Department of Agriculture, Forest Service. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. Available URL: http://www.fs.fed.us/rm/pubs_rm/rm_gtr245.pdf. [Date Accessed: 4 January 2013].

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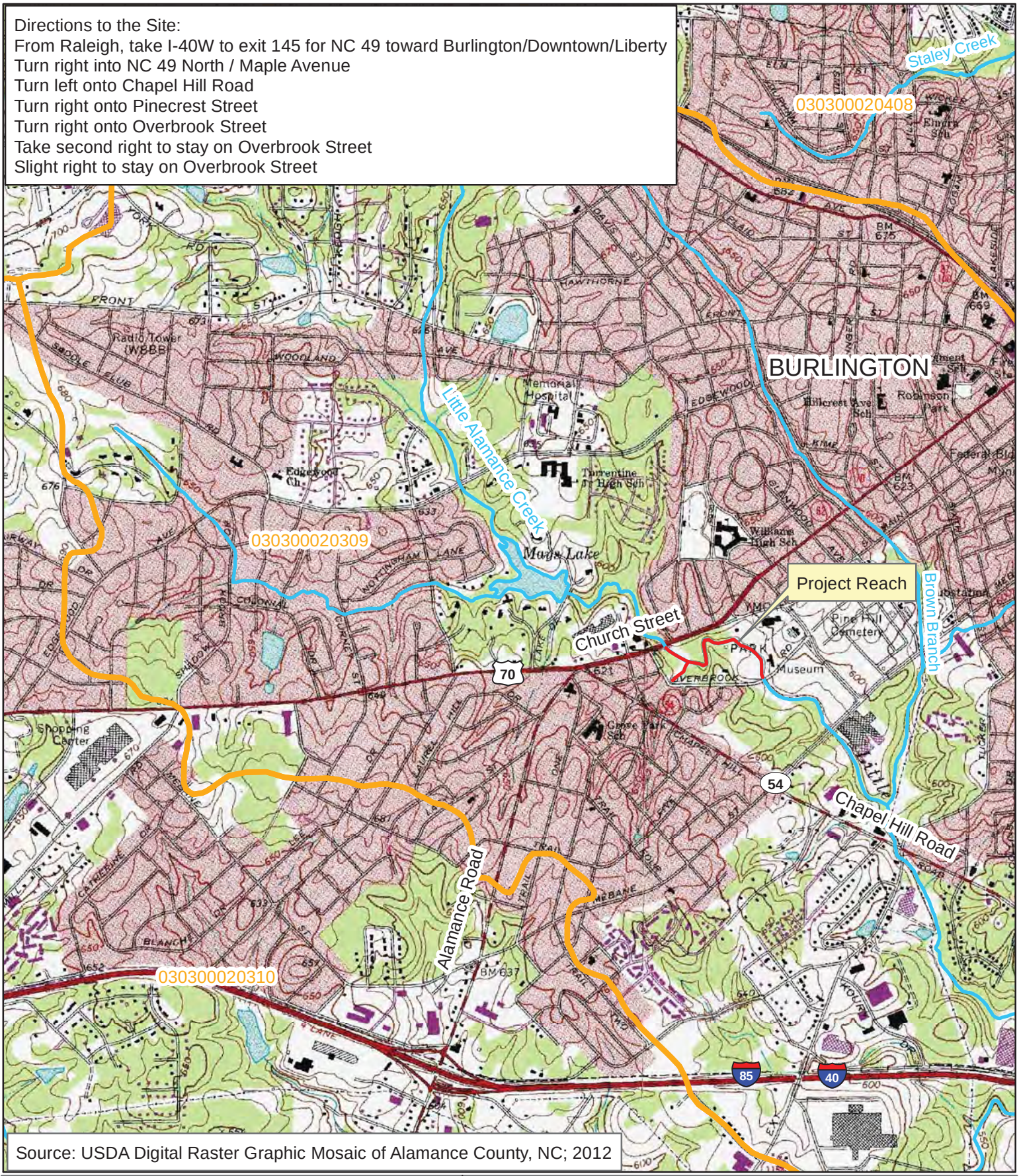
Rosgen, D.L., 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs. CO.

US Army Corps of Engineers, 2003. Stream Mitigation Guidelines. Prepared by: USACE, NCDWR, USEPA, NCWRC. Available URL: http://www.in.gov/idem/files/headwater_nc_stream_mitigation_guide.pdf. [Date Accessed: 4 January 2013].

Appendix A:
Project Vicinity Map and Background Tables

Directions to the Site:
From Raleigh, take I-40W to exit 145 for NC 49 toward Burlington/Downtown/Liberty
Turn right into NC 49 North / Maple Avenue
Turn left onto Chapel Hill Road
Turn right onto Pinecrest Street
Turn right onto Overbrook Street
Take second right to stay on Overbrook Street
Slight right to stay on Overbrook Street



Legend

- Project Reach
- Streams
- 12 Digit HUC

N

0 750 1,500 3,000 Feet

Figure 1: Vicinity Map
Little Alamance Creek (Burlington Park) Stream Restoration
Alamance County
NCDMS Project Number: 92372

EEE Consulting, Inc.
Cary, NC

Monitoring Year 5 of 5
November 2016

Table 1. Project Components and Mitigation Credits
Little Alamance Creek (Burlington Park) / #92372

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	1,651.33	0							

Project Components

Project Component -or- Reach ID	Stationing/Location *	Existing Footage/Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage**	Mitigation Ratio
Reach I (EII)	10+25-10+75	32.5	PIII	R	55	2.5:1
Reach I (EI)	10+75-11+75 12+25-15+00	412.5	__	R	390	1.5:1
Reach II –Tributary (EI)	10+25-14+75	432.5	PIII	R	434	1.5:1
Reach III (EII)	15+50-19+00	327.5	__	R	295	2.5:1
Reach IV (EI)	19+30-21+25 21+60-26+25	632.5	PIII	R	641	1.5:1
Reach V (EII)	26+50-27+25	57.5	__	__	65	0
Reach VI (EII)	27+75-28+75	102.5	__	R	100	2.5:1
Reach VI (EI)	31+75-33+00	147.5	__	R	130	1.5:1
Reach VI (R)	28+75-31+50	278	PI	R	282	1:01
Reach VII (EII)	33+50-36+50	315	__	R	315	2.5:1

Component Summation

Restoration Level	Stream Credit Length** (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	282					
Enhancement						
Enhancement I	1,063.33					
Enhancement II	306					
Creation						
Preservation						
High Quality Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes
LS	Reach 1		
LS	Reach 4		

BMP Elements

BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer

* Mitigation Credit reflects 50% reduced credits from pre-existing sewer easements at perpendicular stream crossings.
Reach 3 has 2 perpendicular sewer crossings measuring 30' each. Mitigation ratio = 2.5:1, with 50% reduction = 12 credits.
Reach 5 has 1 perpendicular sewer crossing. Mitigation ratio = 0.
Reach 6 has 1 perpendicular sewer crossing measuring 26 feet. Mitigation ratio = 1.5:1, with a 50% reduction = 9 credits.
**Stationing/Location are based on the stationing provided in Record Drawings dated 10/2012

Table 2. Project Activity and Reporting History
Little Alamance Creek (Burlington Park) Stream Restoration/EEP Number (92372)

Elapsed Time Since Grading Complete: 5 yrs 4 months
Elapsed Time Since Planting Complete: 5 yrs 4 months
Number of Reporting Years[1]: 5

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution Date	Nov-06	N/A
Categorical Exclusion	Sep-07	N/A
404 Permit Date	Apr-08	N/A
Restoration Plan	Jan-08	N/A
Final Design – Construction Plans	Sep-10	N/A
Construction	Feb-12	Apr-12
Seeding, bare roots, and live stake planting	Feb-12	Apr-12
Bare Root - Supplemental Planting	N/A	Dec-12
Mitigation Plan / As-built (Year 0 Monitoring - baseline)	N/A	N/A
Year 1 Monitoring	Mar-13	Jun-13
Year 2 Monitoring	Nov-13	Jan-14
Year 3 Monitoring	Oct-14	Nov-14
Year 4 Monitoring	Sep-15	Oct-15
Year 5 Monitoring	Oct-16	Nov-16

Due to contracting delays, no baseline data was collected for this project. Although there are no baseline cross sections to compare with MY1 (2013) measurements, the 2013 cross sections will serve as an adequate baseline for the remaining monitoring period. Similarly, no baseline vegetation data was collected until March 2013, approximately 13 months after planting occurred in February 2012.

Bolded items are examples of those items that are not standard, but may come up and should be included
Non-bolded items represent events that are standard components over the course of a typical project.
The above are obviously not the extent of potential relevant project activities, but are just provided as example as part of this exhibit.
If planting and morphology are on split monitoring schedules that should be made clear in the table
1 = Equals the number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372)	
Designer	ARCADIS G&M of North Carolina, Inc 801 Corporate Drive, Suite 300 Raleigh, NC 27607
Primary project design POC	Robert Lepsic (919) 854-1282 ext. 195
Construction Contractor	Shamrock Environmental Corporation 6106 Corporate Park Drive Browns Summit, NC 27214
Construction contractor POC	(336) 375-1989
Survey Contractor	Turner Land Surveying, PLLC 3201 Glenridge Drive Raleigh, NC 27604
Survey contractor POC	Elisabeth Turner (919) 875-1378
Planting Contractor	Carolina Wetland Services 550 East Westinghouse Boulevard Charlotte, NC 28273
Planting contractor POC	(704) 527-1177
Seeding Contractor	Information Not available
Contractor point of contact	POC name and phone
Seed Mix Sources	Information Not available
Nursery Stock Suppliers	Native, Inc. (704) 527-1177
Monitoring Performers	EEE Consulting, Inc. 601 Cascade Pointe Lane Suite 101 Cary, NC 27513
Stream Monitoring POC	Ray Bode, PWS (919) 650-2463 ext. 225
Vegetation Monitoring POC	Tina Sekula, PWS (919) 650-2463 ext. 223

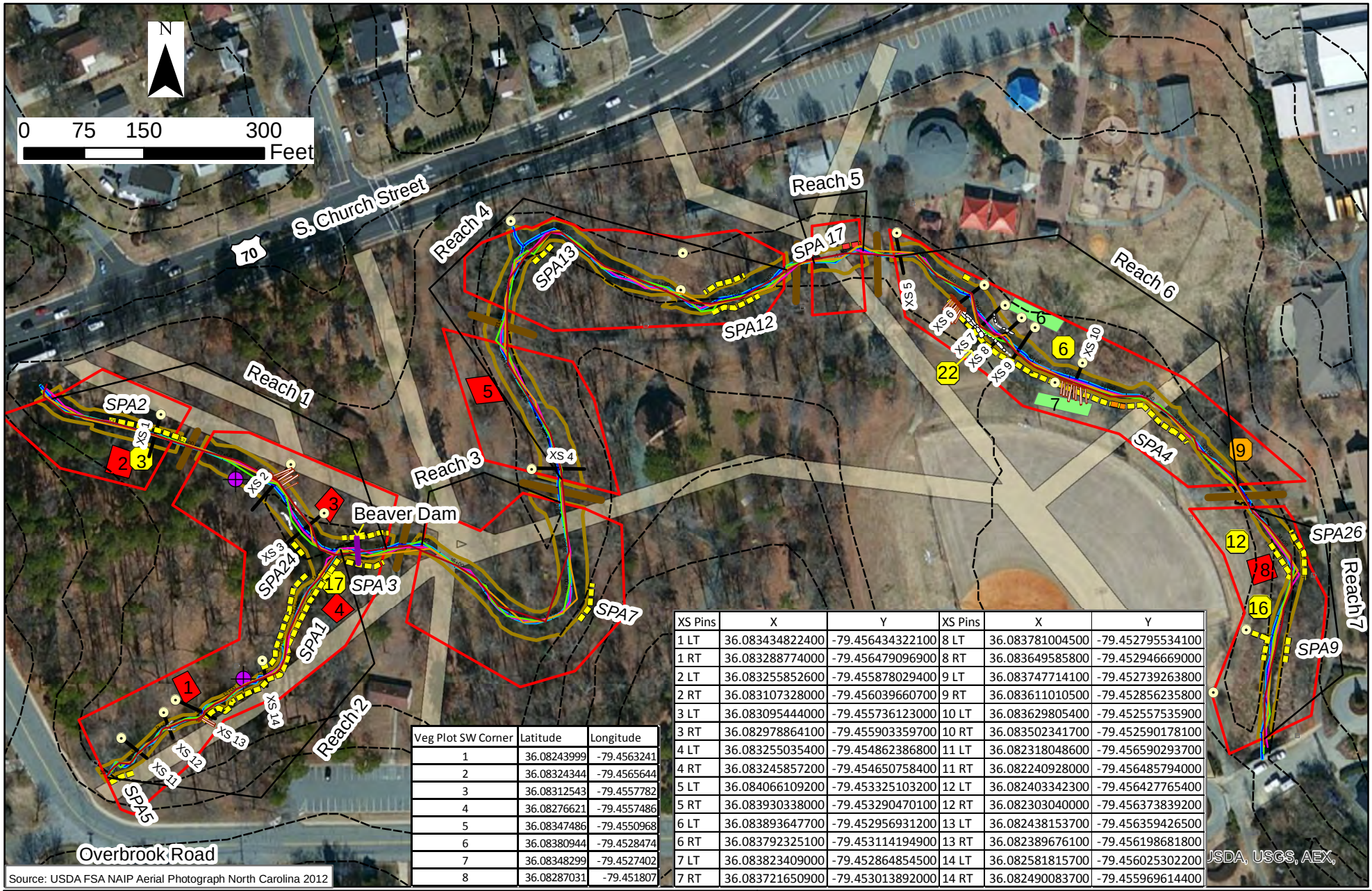
Table 4. Project Attribute Table
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372)

Project Information	
Project Name	Little Alamance Creek (Burlington Park) Stream Restoration
County	Alamance County
Project Area (acres)	7.06 acres
Project Coordinates (latitude and longitude)	36.083566 ; -79.454233
Project Watershed Characteristics	
Physiographic Province	Piedmont
River Basin	Cape Fear
USGS Hydrologic Unit 8-digit: 03030002	USGS Hydrologic Unit 14-digit: 3030002040010
DWQ Sub-basin	03-06-03
Project Drainage Area (acres)	2690 acres
Project Drainage Area Percentage of Impervious Area	40 percent
CGIA Land Use Classification	Forest Land

Reach Summary Information							
Parameters	Reach I	Trib	Reach III	Reach IV	Reach V	Reach VI	Reach VII
Length of Reach (linear feet)	445 lf	432.5 lf	327.5 lf	632.5 lf	57.5 lf	528 lf	315 lf
Valley Classification	Type VIII	Type VIII	Type VIII	Type VIII	Type VIII	Type VIII	Type VIII
Drainage area (acres)	2600 ac	124 ac	2630 ac	2650 ac	2655 ac	2680 ac	2690 ac
NCDWQ Stream Identification Score	47.5	33	47.5	47.5	47.5	47.5	47.5
NCDWQ Water Quality Classification	WS-V;NSW	WS-V;NSW	WS-V;NSW	WS-V;NSW	WS-V;NSW	WS-V;NSW	WS-V;NSW
Morphological Description (stream type)	C/E5/1	E4/1	C/E5/1	C/E5/1	C/E5/1	C/E5/1	C/E5/1
Evolutionary Trend	C4/1	C4/1	C4/1	C4/1	C4/1	C4/1	C4/1
Underlying Mapped Soils	Cecil fine sandy loam (CbC2)						
Drainage Class	Well drained						
Soil Hydric Class	Non-Hydric						
Slope	6 to 10 percent slopes						
FEMA Classification	AE Floodzone	No Study	AE Floodzone	AE Floodzone	AE Floodzone	AE Floodzone	AE Floodzone
Native Vegetation Community	Mixed Mesic Forest						
Percent composition of exotic invasive vegetation	5 percent						

Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	Nationwide Permit 27 (Action ID SAW-2008-01198)
Waters of the United States - Section 401	Yes	Yes	Nationwide Permit 27 (Action ID SAW-2008-01198)
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	FEMA Floodplain Consistency Checklist (Categorical Exclusion)
Essential Fisheries Habitat	No	N/A	N/A

Appendix B:
Visual Assessment Data



Veg Plot SW Corner	Latitude	Longitude
1	36.08243999	-79.4563241
2	36.08324344	-79.4565644
3	36.08312543	-79.4557782
4	36.08276621	-79.4557486
5	36.08347486	-79.4550968
6	36.08380944	-79.4528474
7	36.08348299	-79.4527402
8	36.08287031	-79.451807

XS Pins	X	Y	XS Pins	X	Y
1 LT	36.083434822400	-79.456434322100	8 LT	36.083781004500	-79.452795534100
1 RT	36.083288774000	-79.456479096900	8 RT	36.083649585800	-79.452946669000
2 LT	36.083255852600	-79.455878029400	9 LT	36.083747714100	-79.452739263800
2 RT	36.083107328000	-79.456039660700	9 RT	36.083611010500	-79.452856235800
3 LT	36.083095444000	-79.455736123000	10 LT	36.083629805400	-79.452557535900
3 RT	36.082978864100	-79.455903359700	10 RT	36.083502341700	-79.452590178100
4 LT	36.083255035400	-79.454862386800	11 LT	36.082318048600	-79.456590293700
4 RT	36.083245857200	-79.454650758400	11 RT	36.082240928000	-79.456485794000
5 LT	36.084066109200	-79.453325103200	12 LT	36.082403342300	-79.456427765400
5 RT	36.083930338000	-79.453290470100	12 RT	36.082303040000	-79.456373839200
6 LT	36.083893647700	-79.452956931200	13 LT	36.082438153700	-79.456359426500
6 RT	36.083792325100	-79.453114194900	13 RT	36.082389676100	-79.456198681800
7 LT	36.083823409000	-79.452864854500	14 LT	36.082581815700	-79.456025302200
7 RT	36.083721650900	-79.453013892000	14 RT	36.082490083700	-79.455969614400

- Crest Gauges
- Photostations
- Existing Crossings
- Cross Sections
- Conservation Easement
- Contours (4ft)
- Designed Top of Bank
- Designed Centerline
- MY 5 Thalweg
- MY4 Thalweg
- MY3 Thalweg
- MY2 Thalweg
- MY1 Thalweg
- Structures
- VP Criteria Not Met
- VP Criteria Met
- Utility Easement

Vegetation Problem Areas
- Bare soil
- Invasive

Stream Problem Areas
- Scour
- Undercut
- Mass Wasting

Current Condition Plan View
Little Alamance Creek (Burlington Park) Stream Restoration
Alamance County
NCDMS Project Number: 92372

EEE Consulting, Inc.
Cary, NC

Monitoring Year 5 of 5
November 2016

LANDMARK SURVEYING, INC.

Property Information:
Owner: City of Burlington
Alamance County Parcel ID# 8864790671
Alamance County Tax Map # 104-442-217

Deed References: Deed Book 98 Page 220
Deed Book 136 Page46

Refernce Boundary Survey Plat prepared by
City of Burlington Engineering Department
Entitled Final Plat Property of, City of Burlington
City Park Map #1, Dated September 14, 1995

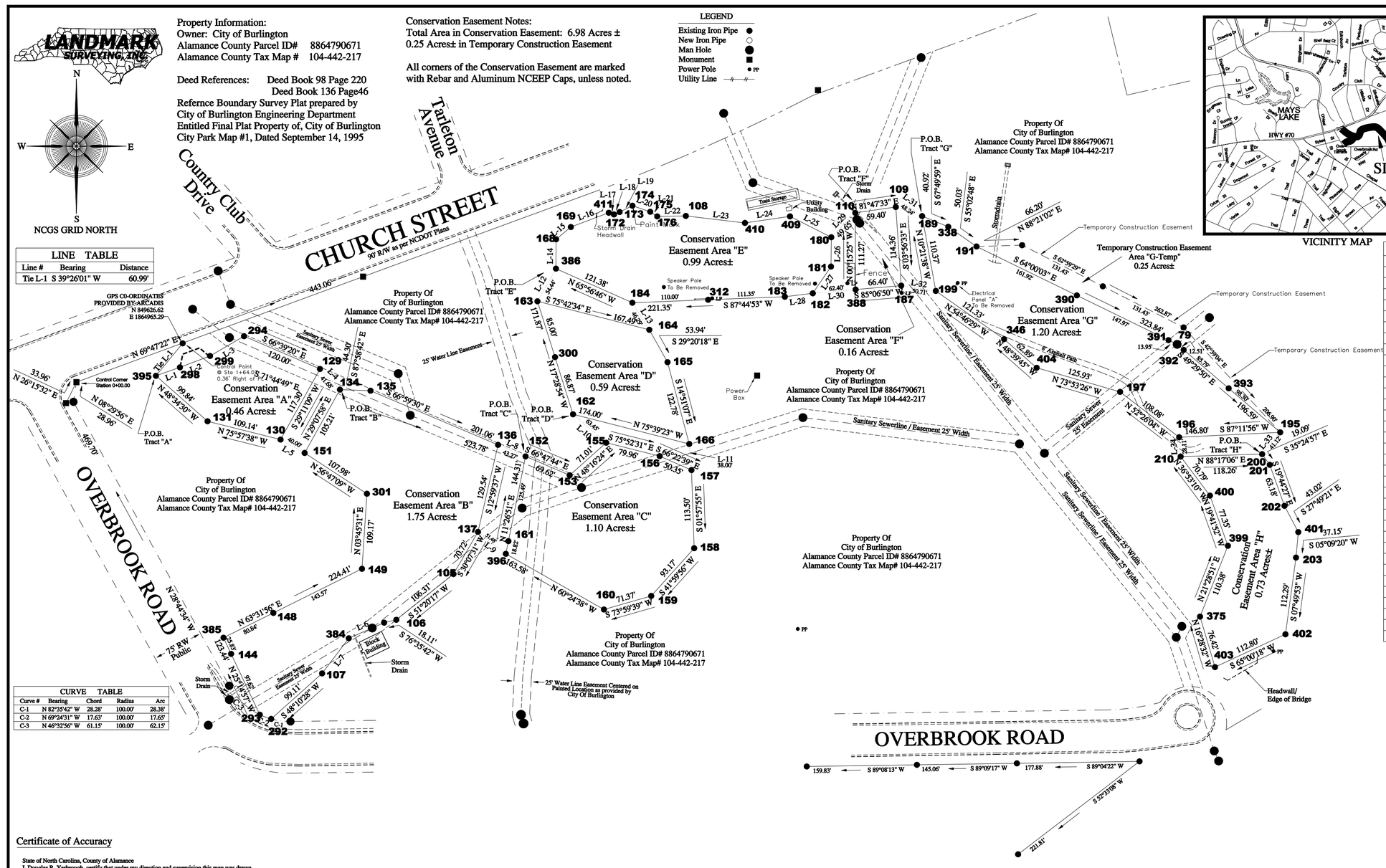
Conservation Easement Notes:
Total Area in Conservation Easement: 6.98 Acres ±
0.25 Acres± in Temporary Construction Easement

All corners of the Conservation Easement are marked with Rebar and Aluminum NCEEP Caps, unless noted.

LEGEND
Existing Iron Pipe
New Iron Pipe
Man Hole
Monument
Power Pole
Utility Line

N
W E
S
NCGS GRID NORTH

LINE TABLE		
Line #	Bearing	Distance
Tie L-1	S 39°26'01" W	60.99'



VICINITY MAP

LINE TABLE		
Line #	Bearing	Distance
L-1	N 70°36'20" E	36.93'
L-2	N 69°20'21" E	46.63'
L-3	N 59°47'13" E	57.06'
L-4	S 43°59'57" E	41.68'
L-5	S 60°52'02" E	40.00'
L-6	S 66°12'35" W	56.03'
L-7	S 37°12'39" W	64.04'
L-8	S 67°18'44" E	43.27'
L-9	N 51°42'28" W	51.48'
L-10	N 49°25'20" W	63.45'
L-11	S 04°58'22" E	38.00'
L-12	N 29°35'00" E	54.44'
L-13	S 32°05'35" E	46.29'
L-14	N 00°16'40" E	42.66'
L-15	N 50°22'34" E	27.84'
L-16	N 69°21'29" E	58.74'
L-17	S 71°40'25" E	7.97'
L-18	N 66°26'32" E	8.90'
L-19	N 63°50'04" E	20.72'
L-20	S 71°13'11" E	27.32'
L-21	S 56°14'03" E	12.12'
L-22	N 88°59'18" E	41.52'
L-23	S 83°12'35" E	86.33'
L-24	N 81°39'06" E	66.07'
L-25	S 63°06'28" E	67.20'
L-26	S 00°33'50" W	42.52'
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Curve #	Bearing	Chord	Radius	Arc
C-1	N 82°35'42" W	28.28'	100.00'	28.38'
C-2	N 69°24'31" W	17.63'	100.00'	17.65'
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Certificate of Accuracy

State of North Carolina, County of Alamance
I, Douglas R. Yarbrough, certify that under my direction and supervision this map was drawn from an actual field land survey made by me; that the error of closure as calculated by latitudes and and departures is: 1 : 10,000 for the perimeter and 1 :10,000 for platting of interior lot lines; that the boundaries not surveyed are shown as broken lines plotted from deed information found in deed book 136 , page 46 ; that this map was prepared in a accordance with GS 47-30 as amended; that the survey was requested by the owner or his duly authorized agent; that all required monuments and markers have been installed; that all new lines calculated from data not obtained in the field are indicated by a "C"; and that this plat is within the Jurisdiction of the City of Burlington.

Witness my hand and seal this 5th day of May , 2008 .

Douglas R. Yarbrough, Professional Land Surveyor L-3395

I, Douglas R. Yarbrough, Professional Land Surveyor, L-3395, Certify To one of the following:

- ☐ A. This survey creates a subdivision of land within the area of a county or municipality that has an ordinance that regulates parcels of land.
- ☐ B. This survey is located in such portion of a county or municipality that is unregulated as to an ordinance that regulates parcels of land.
- ☐ C. Any one of the following:
  1. That the survey is of an existing parcel or parcels of land and does not create a new street or change an existing street;
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- ■ D. This survey is of another category, such as the recombination of existing parcels, a court-ordered survey, or other exception to the definition of subdivision.
- ☐ E. The information available to the surveyor is such that the surveyor is unable to make a determination to the best of his or her professional ability as to provisions contained in 1 - 4 above.

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I, (we) hereby certify that I (we) am (are) the owner(s) if the property, shown and described hereon, which was conveyed to me (us) by deed as recorded in deed book 136 , page 46 , and that I(we) hereby acknowledge this plat and allotment to be my(our) free act and deed and do hereby dedicate to public use as streets, rights-of-way, and easements forever, all areas so shown or indicated on said plat.

OWNER Date

OWNER Date

OWNER Date

County of Alamance, State of North Carolina
I, a notary public of the county and state aforesaid, certify that _____

_____

_____

, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

Witness my hand and official stamp or seal, this _____, day of _____ , 20__.

Notary Public

My commission expires _____

Planning Director Certification

NO APPROVAL REQUIRED UNDER SECTION 33-1 OF THE CODE OF ORDINANCES OF THE THE CITY OF BURLINGTON.

PLANNING DIRECTOR

City of Burlington Certification

Recommended by the Burlington Planning and Zoning

Commission on the _____ day of _____ , 20___ .
Chairman of Planning and Zoning Commission

_____ ,

_____ date.

Approved by the Burlington City Council on the

_____ day of _____ , 20____, provided that the plat be recorded within sixty (60) days of final approval.
City Clerk

_____ ,

_____date.

Review Officer Certification

State of North Carolina, County of Alamance

I, _____ , Review Officer of Alamance County, certify that the map or plat to which this certification is affixed meets all statutory requirements for recording.

Review Officer Date

Final Plat
Conservation Easement for the State of North Carolina, Ecosystem Enhancement Program, Little Alamance Creek at Burlington Park
SPO#001-AAAG EEP#92372

BURLINGTON TOWNSHIP ALAMANCE COUNTY NORTH CAROLINA

DATE: 05/01/2008 SCALE 1" = 100'

GRAPHIC SCALE
0' 50' 100' 200' 300'

LANDMARK SURVEYING, INC. - 109 EAST HARDEN STREET - GRAHAM, NC 27253
PHONE: (336) 229-6275 - FACSIMILE: (336) 227-5919 - EMAIL: dylandmark@triad.rr.com

Job Number: 08-04-01 - Drawing Name: Y080401 NCEEP Little Alamance Creek
Field Crew: DWM & RMW - Drawn By: DRY - Checked By: _____

Revisions: 05/20/08 Revisions to Conservation Easement Boundaries,after 05/08/02008 walk-through with C.O.B. Representitives & NCEEP Staff.
06/20/08 Revisions to Conservation Easement Boundaries,after 06/05/02008- 2nd walk-through with C.O.B. Representitives & NCEEP Staff.
07/15/08 Revisions to Conservation Easement Boundary Area "B" as per meeting with C.O.B. Representitives and NCEEP Staff.

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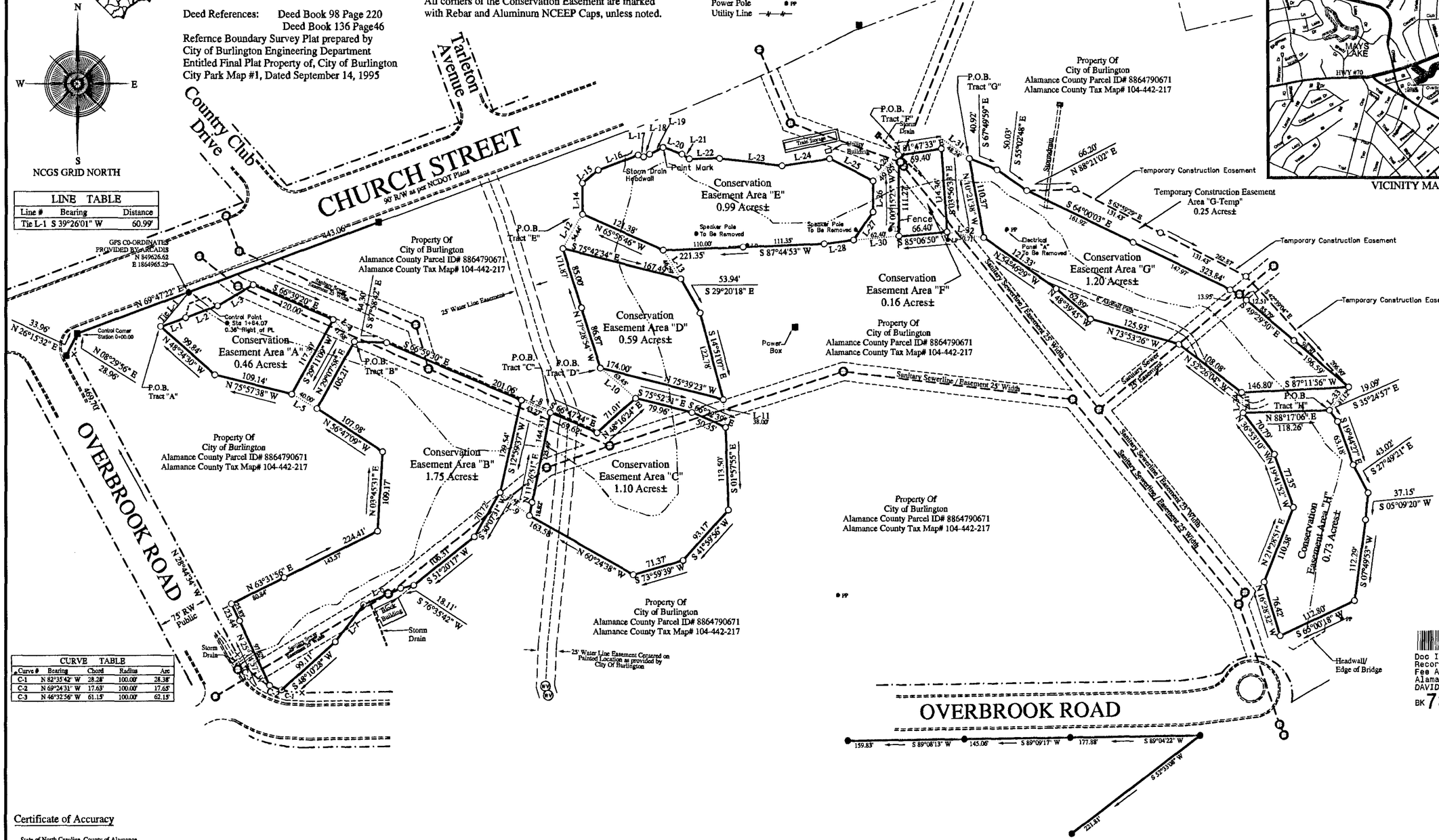

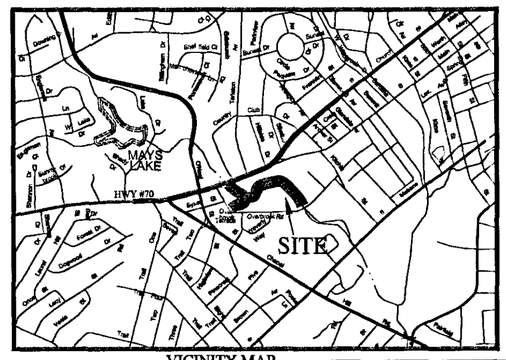

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Doc ID: 009918410001 Type: CRP
Recorded: 02/09/2009 at 02:24:46 PM
Fee Amt: $21.00 Page 1 of 1
Alamance, NC
DAVID J.P. BARBER REGISTER OF DEEDS
BK 73 PG 122
138D82

Certificate of Accuracy

State of North Carolina, County of Alamance
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Witness my hand and seal this 5th day of May, 2008

Douglas R. Yarbrough, Professional Land Surveyor, L-3395

NORTH CAROLINA PROFESSIONAL SEAL L-3395 LAND SURVEYOR DOUGLAS R. YARBROUGH

I, Douglas R. Yarbrough, Professional Land Surveyor, L-3395, Certify To one of the following:

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OWNER Date 2-5-09

OWNER Date

OWNER Date

County of Alamance, State of North Carolina
I, a notary public of the county and state aforesaid, certify that Ronnie K. Wall, personally appeared before me this day and acknowledged the execution of the foregoing instrument.
Witness my hand and official stamp or seal, this 5 day of Feb. 2009

JONDEEN D. TERRY NOTARY PUBLIC ALAMANCE COUNTY, N.C.

Notary Public
My commission expires 11-20-2011

Planning Director Certification

NO APPROVAL REQUIRED UNDER SECTION 33-1 OF THE CODE OF ORDINANCES OF THE THE CITY OF BURLINGTON.
2-6-09
PLANNING DIRECTOR

City of Burlington Certification

Recommended by the Burlington Planning and Zoning Commission on the ____ day of ____, 20__.
Chairman of Planning and Zoning Commission

date.

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City Clerk

date.

Review Officer Certification

State of North Carolina, County of Alamance

I, J. Daniel Shaffer, Review Officer of Alamance County, certify that the map or plat to which this certification is affixed meets all statutory requirements for recording.

Review Officer 2/6/09 Date

Final Plat
Conservation Easement for the State of North Carolina, Ecosystem Enhancement Program, Little Alamance Creek at Burlington Park
SPO#001-AAAG EEP#92372

BURLINGTON TOWNSHIP ALAMANCE COUNTY NORTH CAROLINA

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07/15/08 Revisions to Conservation Easement Boundary Area "B" as per meeting with C.O.B. Representitives and NCEEP Staff.

Figure 5: Conservation Easement Coordinate List

AREA "A"

NORTH	EAST	Point #
849579.51554	1864926.55171	395
849591.77729	1864961.38155	298
849608.22978	1865005.01204	299
849636.94197	1865054.31867	294
849589.39149	1865164.49481	129
849486.98274	1865107.29342	130
849513.45974	1865001.41137	131
849579.51554	1864926.55171	395

AREA “B”

NORTH	EAST	Point #
849559.40556	1865193.45108	134
849557.84265	1865237.72626	35
849479.25598	1865422.79011	136
849353.03468	1865393.66448	137
849291.86683	1865358.17065	105
849225.45240	1865275.15897	106
849221.25010	1865257.53874	140
849198.64891	1865206.27156	384
849147.64645	1865167.54338	107
849081.54893	1865093.68513	292
849087.74837	1865077.18420	293
849176.03999	1865035.54448	144
849199.39922	1865024.52791	385
849235.42971	1865096.89567	148
849299.41895	1865225.41897	149
849408.35898	1865232.57548	301
849467.50926	1865142.23314	151
849559.40556	1865193.45108	134

AREA “C”

NORTH	EAST	Point #
849462.56616	1865462.71229	152
849435.13638	1865526.69686	153
849482.39703	1865579.69130	155
849462.88378	1865657.23514	156
849442.70621	1865703.37024	157
849329.27516	1865707.26253	158
849260.03559	1865644.92151	159
849240.35724	1865576.32112	160
849321.13162	1865434.07191	396
849339.57571	1865437.80714	161
849462.56616	1865462.71229	152

AREA “D”

NORTH	EAST	Point #
849523.67028	1865531.49915	162
849606.54503	1865505.41990	300
849687.60418	1865479.86867	163
849646.26097	1865642.17633	164
849599.23801	1865668.60583	165
849480.56349	1865700.07636	166
849523.67028	1865531.49915	162

AREA “E”

NORTH	EAST	Point #
849734.94933	1865506.74625	386
849777.61339	1865506.95303	168
849795.36536	1865528.39325	169
849816.07420	1865583.36623	411
849813.56859	1865590.93079	172
849817.12503	1865599.08756	173
849826.26238	1865617.68539	174
849817.46632	1865643.55279	175
849810.73250	1865653.62464	176
849811.46562	1865695.14176	108
849801.25856	1865780.86612	410
849810.85135	1865846.23666	409
849780.45763	1865906.16581	180
849737.93964	1865905.74732	181
849699.19996	1865879.24506	182
849694.17460	1865838.75955	183
849689.79904	1865727.49867	312
849685.47681	1865617.58282	184
849734.94933	1865506.74625	386

AREA “F”

NORTH	EAST	Point #
849815.92160	1865940.90924	110
849824.39775	1865999.70351	109
849710.30838	1866007.56636	187
849704.65272	1865941.40823	388
849815.92160	1865940.90924	110

AREA “G”

NORTH	EAST	Point #
849811.20595	1866037.84131	189
849795.76690	1866075.73608	338
849767.10290	1866116.74370	191
849696.12266	1866262.27953	390
849631.25699	1866395.27823	391
849625.14242	1866407.81537	79 MH
849617.01962	1866417.32501	392
849561.30036	1866482.55746	393
849497.45831	1866557.29954	195
849490.28422	1866410.67696	196
849556.17669	1866325.00704	197
849591.11839	1866204.02424	404
849632.65737	1866156.80372	346
849702.64017	1866057.68956	199
849811.20595	1866037.84131	189

AREA “H”

NORTH	EAST	Point #
849465.79522	1866531.05945	200
849450.23363	1866542.12494	201
849390.76406	1866563.46603	202
849352.71701	1866583.54506	401
849315.71724	1866580.20684	203
849204.47066	1866564.90566	402
849156.80929	1866462.67261	403
849229.09022	1866442.93365	375
849332.80632	1866481.41733	399
849405.63461	1866455.34439	400
849462.25590	1866412.85336	210
849465.79522	1866531.05945	200

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Mainstem**
Assessed Length **2275 lf**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	6	6			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	4	4			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	4	4			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	4	4			100%			
		2. Thalweg centering at downstream of meander (Glide)	4	4			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			14	875	81%	9	400	90%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			1	10	99%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			1	25	99%	0	0	100%
				Totals	16	910	80%	9	400	89%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	6	6			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	6			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	4	6			67%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			100%			

Table 5 **Visual Stream Morphology Stability Assessment**
Reach ID **Trib**
Assessed Length **450 lf**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	99%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	2	2			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	2	2			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	2	2			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	2	2			100%			
		2. Thalweg centering at downstream of meander (Glide)	2	2			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			3	525	42%	2	500	97%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	3	525	42%	2	500	97%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	1	1			100%			

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **7.06 ac**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Orange Point	1	0.01	0.1%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.01 acres	Red veg plot polygons	6	0.06	0.8%
			Total	7	0.07	1.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	VPA 3	1	0.25	3.5%
			Cumulative Total	8	0.32	4.5%

Easement Acreage[2] **7.06 ac**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Yellow Point	5 points	1.00	14.2%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	N/A	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Photo Log 1: Established Photo Stations

Photo Station 1, rail line at bollard 172, facing east: April 3, 2013

Photo Station 1, rail line at bollard 172, facing east: October 15, 2013

Photo Station 1, rail line at bollard 172, facing east: September 30, 2014

Photo Station 1, rail line at bollard 172, facing east: September 3, 2015

Photo Station 1, rail line at bollard 172, facing east: October 5, 2016

Photo Station 2, level spreader at bollard 410, facing east: April 3, 2013

Photo Station 2, level spreader at bollard 410, facing east: October 15, 2013

Photo Station 2, level spreader at bollard 410, facing east: September 30, 2014

Photo Station 2, level spreader at bollard 410, facing east: September 3, 2015

Photo Station 2, level spreader at bollard 410, facing east: October 5, 2016

Photo Station 3, rail line discharge, facing south: April 3, 2013

Photo Station 3, rail line discharge, facing south: October 15, 2013

Photo Station 3, rail line discharge, facing south: September 30, 2014

Photo Station 3, rail line discharge, facing south: September 3, 2015

Photo Station 3, rail line discharge, facing south: October 5, 2016

Photo Station 4, discharge at bollard 312, facing west: April 3, 2013

Photo Station 4, discharge at bollard 312, facing west: October 15, 2013

Photo Station 4, discharge at bollard 312, facing west: September 30, 2014

Photo Station 4, discharge at bollard 312, facing west: September 3, 2015

Photo Station 4, discharge at bollard 312, facing west: October 5, 2016

Photo Station 5, view of easement facing northwest: April 3, 2013

Photo Station 5, view of easement facing northwest: October 15, 2013

Photo Station 5, facing northwest: September 30, 2014

Photo Station 5, facing northwest: September 3, 2015

Photo Station 5, view of easement facing northwest: October 5, 2016

Photo Station 6, VP 7 at bollard 401:
April 3, 2013

Photo Station 6, VP 7 at bollard 401:
October 15, 2013

Photo Station 6, VP 7 at bollard 401:
September 30, 2014

Photo Station 6, VP 7 at bollard 401:
September 3, 2015

Photo Station 6, VP 7 at bollard 401:
October 5, 2016

Photo Station 7, XS 1, facing right bank:
April 3, 2013

Photo Station 7, XS 1, facing right bank:
October 15, 2013

Photo Station 7, XS 1, facing right bank:
September 30, 2014

Photo Station 7, XS 1, facing right bank:
September 3, 2015

Photo Station 7, XS 1, facing right bank:
March 31, 2016

Photo Station 8, XS 2, facing right bank:
April 3, 2013

Photo Station 8, XS 2, facing right bank:
October 15, 2013

Photo Station 8, XS 2, facing right bank:
September 30, 2014

Photo Station 8, XS 2, facing right bank:
September 3, 2015

Photo Station 8, XS 2, facing right bank:
March 31, 2016

Photo Station 9, XS 3, facing right bank:
April 3, 2013

Photo Station 9, XS 3, facing right bank:
October 15, 2013

Photo Station 9, XS 3, facing right bank:
September 30, 2014

Photo Station 9, XS 3, facing right bank:
September 3, 2015

Photo Station 9, XS 3, facing right bank:
March 31, 2016

Photo Station 10, XS 4, facing right bank:
April 3, 2013

Photo Station 10, XS 4, facing right bank:
October 15, 2013

Photo Station 10, XS 4, facing right bank:
September 30, 2014

Photo Station 10, XS 4, facing right bank:
September 3, 2015

Photo Station 10, XS 4, facing right bank:
March 31, 2016

Photo Station 11, XS 5, facing right bank:
April 3, 2013

Photo Station 11, XS 5, facing right bank:
October 15, 2013

Photo Station 11, XS 5, facing right bank:
September 30, 2014

Photo Station 11, XS 5, facing right bank:
September 3, 2015

Photo Station 11, XS 5, facing right bank:
March 31, 2016

Photo Station 12, XS 6, facing right bank:
April 3, 2013

Photo Station 12, XS 6, facing right bank:
October 15, 2013

Photo Station 12, XS 6, facing right bank:
September 30, 2014

Photo Station 12, XS 6, facing right bank:
September 3, 2015

Photo Station 12, XS 6, facing right bank:
March 31, 2016

Photo Station 13, XS 7, facing right bank:
April 3, 2013

Photo Station 13, XS 7, facing right bank:
October 15, 2013

Photo Station 13, XS 7, facing right bank:
September 30, 2014

Photo Station 13, XS 7, facing right bank:
September 3, 2015

Photo Station 13, XS 7, facing right bank:
March 31, 2016

Photo Station 14, XS 8, facing right bank: April 3, 2013

Photo Station 14, XS 8, facing right bank: October 15, 2013

Photo Station 14, XS 8, facing right bank: September 30, 2014

Photo Station 14, XS 8, facing right bank: September 3, 2015

Photo Station 14, XS 8, facing right bank: March 31, 2016

Photo Station 15, XS 9, facing right bank:
April 3, 2013

Photo Station 15, XS 9, facing right bank:
October 15, 2013

Photo Station 15, XS 9, facing right bank:
September 30, 2014

Photo Station 15, XS 9, facing right bank:
September 3, 2015

Photo Station 15, XS 9, facing right bank:
March 31, 2016

Photo Station 16, XS 10, facing right bank:
April 3, 2013

Photo Station 16, XS 10, facing right bank:
October 15, 2013

Photo Station 16, XS 10, facing right bank:
September 30, 2014

Photo Station 16, XS 10, facing right bank:
September 3, 2015

Photo Station 16, XS 10, facing right bank:
March 31, 2016

Photo Station 17, XS 11, facing right bank: April 3, 2013

Photo Station 17, XS 11, facing right bank: October 15, 2013

Photo Station 17, XS 11, facing right bank: September 30, 2014

Photo Station 17, XS 11, facing right bank: September 3, 2015

Photo Station 17, XS 11, facing right bank: March 31, 2016

Photo Station 18, XS 12, facing right bank: April 3, 2013

Photo Station 18, XS 12, facing right bank: October 15, 2013

Photo Station 18, XS 12, facing right bank: September 30, 2014

Photo Station 18, XS 12, facing right bank: September 3, 2015

Photo Station 18, XS 12, facing right bank: March 31, 2016

Photo Station 19, XS 13, facing right bank: April 3, 2013

Photo Station 19, XS 13, facing right bank: October 15, 2013

Photo Station 19, XS 13, facing right bank: September 30, 2014

Photo Station 19, XS 13, facing right bank: September 3, 2015

Photo Station 19, XS 13, facing right bank: March 31, 2016

Photo Station 20, XS 14, facing right bank:
April 3, 2013

Photo Station 20, XS 14, facing right bank:
October 15, 2013

Photo Station 20, XS 14, facing right bank:
September 30, 2014

Photo Station 20, XS 14, facing right bank:
September 3, 2015

Photo Station 20, XS 14, facing right bank:
March 31, 2016

Photo Log 2: Vegetation Monitoring Plot Photos

Veg Plot 1, view from southwest corner:
March 27, 2013

Veg Plot 1, view from southwest corner:
October 15, 2013

Veg Plot 1, view from southwest corner:
September 30, 2014

Veg Plot 1, view from southwest corner:
September 3, 2015

Veg Plot 1, view from southwest corner:
October 5, 2016

Veg Plot 2, view from southwest corner:
March 27, 2013

Veg Plot 2, view from southwest corner:
October 15, 2013

Veg Plot 2, view from southwest corner:
September 30, 2014

Veg Plot 2, view from southwest corner:
September 3, 2015

Veg Plot 2, view from southwest corner:
October 5, 2016

Veg Plot 3, view from southwest corner:
March 27, 2013

Veg Plot 3, view from southwest corner:
October 15, 2013

Veg Plot 3, view from southwest corner (relocated):
September 30, 2014

Veg Plot 3, view from southwest corner (relocated):
September 3, 2015

Veg Plot 3, view from southwest corner (relocated):
October 5, 2016

Veg Plot 4, view from southwest corner:
March 27, 2013

Veg Plot 4, view from southwest corner:
October 15, 2013

Veg Plot 4, view from southwest corner (relocated):
September 30, 2014

Veg Plot 4, view from southwest corner (relocated):
September 3, 2015

Veg Plot 4, view from southwest corner (relocated):
October 5, 2016

Veg Plot 5, view from southwest corner:
March 27, 2013

Veg Plot 5, view from southwest corner:
October 15, 2013

Veg Plot 5, view from southwest corner:
September 30, 2014

Veg Plot 5, view from southwest corner:
September 3, 2015

Veg Plot 5, view from southwest corner:
October 5, 2016

Veg Plot 6, view from southwest corner:
April 3, 2013

Veg Plot 6, view from southwest corner:
October 15, 2013

Veg Plot 6, view from southwest corner:
September 30, 2014

Veg Plot 6, view from southwest corner:
September 3, 2015

Veg Plot 6, view from southwest corner:
October 5, 2016

Veg Plot 7, view from southwest corner:
April 3, 2013

Veg Plot 7, view from southwest corner:
October 15, 2013

Veg Plot 7, view from southwest corner:
September 30, 2014

Veg Plot 7, view from southwest corner:
September 3, 2015

Veg Plot 7, view from southwest corner:
October 5, 2016

Veg Plot 8, view from southwest corner:
April 3, 2013

Veg Plot 8, view from southwest corner:
October 15, 2013

Veg Plot 8, view from southwest corner:
September 30, 2014

Veg Plot 8, view from southwest corner:
September 3, 2015

Veg Plot 8, view from southwest corner:
October 5, 2016

Appendix C:

Vegetation Plot Data

Table 7: Vegetation Plot Success by Project Asset Type
Table 8: CVS Stem Count Total and Planted with/without Livestakes by Plot and Species

Table 7:
Little Alamance (#92372)
Year 5 (05-Oct-2016)
Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
1	n/a	4	0	0	95	**99**	15
2	n/a	4	0	0	19	**23**	1
3	n/a	6	0	0	16	**22**	0
4	n/a	3	0	0	29	**32**	4
5	n/a	2	0	0	26	**28**	0
6	n/a	8	0	0	65	**73**	0
7	n/a	9	0	0	15	**24**	0
8	n/a	6	0	0	9	**15**	0

Wetland/Stream Vegetation Totals
(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	162	3845	4006	No
2	162	769	931	No
3	243	647	890	No, but close
4	121	1174	1295	No
5	81	1052	1133	No
6	324	2630	2954	Yes
7	364	607	971	Yes
8	243	364	607	No, but close
Project Avg	**212**	**1386**	**1599**	**No**

Color for Density
- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

Riparian Buffer Vegetation Totals
(per acre)

Plot #	Riparian Buffer Stems[1]	Success Criteria Met?
1	n/a	
2	n/a	
3	n/a	
4	n/a	
5	n/a	
6	n/a	
7	n/a	
8	n/a	
Project Avg	**n/a**	

Stem Class	characteristics
[1]Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

DMS Project Code 92372. Project Name: Little Alamance

Table 8

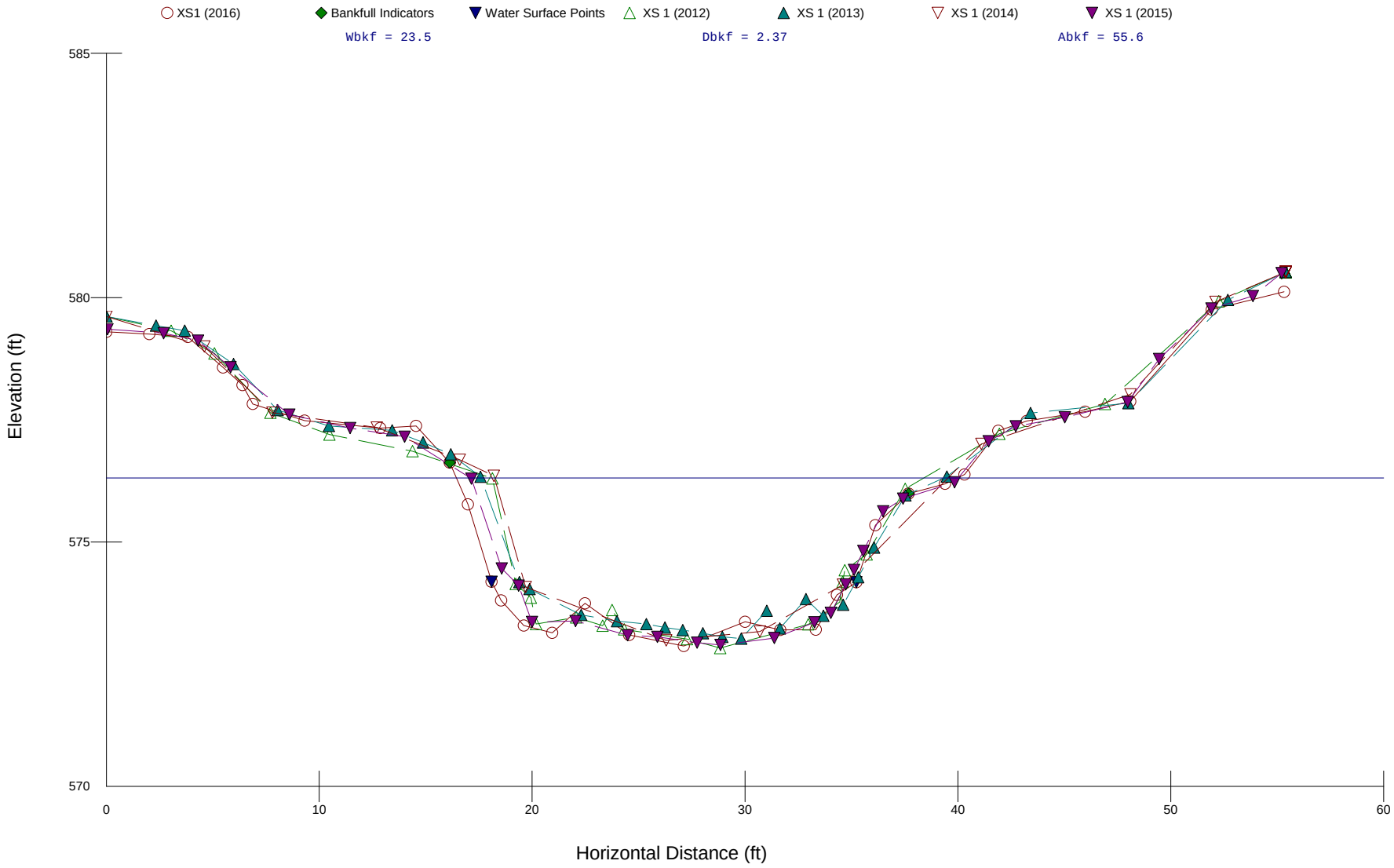
Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2016)																								Annual Means														
			92372-01-0001			92372-01-0002			92372-01-0003			92372-01-0004			92372-01-0005			92372-01-0006			92372-01-0007			92372-01-0008			MY5 (2016)			MY4 (2015)			MY3 (2014)			MY2 (2013)			MY1 (2013)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															1			1			2						4			1									1
Acer rubrum	red maple	Tree			3						1			1						30			4						39			76			1						2
Acer saccharinum	silver maple	Tree																		23									23			1									
Asimina triloba	pawpaw	Tree																2	2	7							2	2	7	1	1	1	2	2	2	5	5	5			
Baccharis halimifolia	eastern baccharis	Shrub																																	1						1
Betula nigra	river birch	Tree			43	2	2	2													3	3	4	1	1	3	6	6	52	7	7	7	4	4	4	8	9	10	7	7	7
Carpinus caroliniana	American hornbeam	Tree																3	3	3				1	1	1	4	4	4	5	5	5	4	4	4	3	3	3	8	8	8
Carya	hickory	Tree															1									1			2						2						
Carya alba	mockernut hickory	Tree																																				1			
Carya cordiformis	bitternut hickory	Tree													1	1	1										1	1	1	2	2	2	1	1	1				2	2	2
Carya glabra	pignut hickory	Tree																																				1			
Carya illinoinensis	pecan	Tree																																				2			
Carya ovata	shagbark hickory	Tree																																		1	1	1	2	2	2
Celtis laevigata	sugarberry	Tree			2												1												3			2				1	1	1	13	13	15
Celtis occidentalis	common hackberry	Tree										1	1	1													1	1	1	1	1	1	1	1	2						
Cercis canadensis	eastern redbud	Tree						7			1			2							1	1	1	1	1	2	2	2	13	2	2	3			1						5
Cornus amomum	silky dogwood	Shrub				1	1	2						2			1				1	1	1	2	2	2	4	4	8	5	5	5	5	5	5	5	5	5	6	6	6
Cornus florida	flowering dogwood	Tree	1	1	1				1	1	1																2	2	2	3	3	3	5	5	5	3	3	4	3	3	3
Diospyros virginiana	common persimmon	Tree							1	1	2	1	1	1			4										2	2	7	2	2	5	4	4	29			13			
DONTKNOW: unsure record																																							1	1	1
Euonymus americanus																																									1
Fraxinus americana	white ash	Tree																																							1
Fraxinus pennsylvanica	green ash	Tree			1			1			1			7							2	2	2	1	1	1	3	3	13	3	3	13			11				2	2	2
Hamamelis virginiana	American witchhazel	Tree																1	1	1							1	1	1			1						1			
Ilex opaca	American holly	Tree	1	1	1																						1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
Juglans nigra	black walnut	Tree						1									3												4						2						
Juniperus virginiana	eastern redcedar	Tree						1															2						3												
Liquidambar styraciflua	sweetgum	Tree			17						1						1						1						20			3			1			2			6
Liriodendron tulipifera	tuliptree	Tree			5			2						4			2												13				1	1	2						
Morus rubra	red mulberry	Tree									2			1						2			1						6												9
Photinia	chokeberry				15			1						4															20			22			21						12
Platanus occidentalis	American sycamore	Tree							2	2	2				1	1	7			3	1	1	1			3	4	4	16	5	5	5	5	5	5	4	4	5	3	3	3
Prunus serotina	black cherry	Tree			4			2						3						1			1						11			5						1			3
Quercus	oak	Tree																																				1			
Quercus alba	white oak	Tree																																	1						
Quercus coccinea	scarlet oak	Tree																																	1						20
Quercus falcata	southern red oak	Tree			3																								3						18						
Quercus lyrata	overcup oak	Tree									8			3			5												16			10									
Quercus michauxii	swamp chestnut oak	Tree															1												1			1									
Quercus nigra	water oak	Tree																																				7			
Quercus pagoda	cherrybark oak	Tree	1	1	1				1	1	1																2	2	2	2	2	2	2	2	2	1	1	1	9	9	9
Quercus palustris	pin oak	Tree																																				49			
Quercus phellos	willow oak	Tree												1									2						3			3			5						
Quercus rubra	northern red oak	Tree																														1									
Quercus velutina	black oak	Tree																																							1
Salix nigra	black willow	Tree																																						1	1
Sambucus canadensis	Common Elderberry	Shrub							1	1	2	1	1	1				1	1	1	1	1	1				4	4	5	4	4	7	6	6	8	4	4	4	5	5	5
Sambucus nigra	European black elderb	Shrub																					1			2			3												
Ulmus americana	American elm	Tree																																	1						
Ulmus rubra	slippery elm	Tree			2			3						1															6			2			4			7			
Viburnum dentatum	southern arrowwood	Shrub	1	1	1	1	1	1										1	1	1							3	3	3	3	3	3	3	3	3	2	2	2	3	3	3
Viburnum nudum	possumhaw	Shrub																																		1	1	1			
Viburnum prunifolium	blackhaw	shrub																												3	3	3	3	3	3	3	3	3	3	3	3
		Stem count	4	4	99	4	4	23	6	6	22	3	3	32	2	2	28	8	8	73	9	9	24	6	6	15	42	42	316	49	49	194	48	48	147	43	44	132	69	70	134
		size (ares)	1			1			1			1			1			1			1			1			8			8			8			8			8		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.20			0.20			0.20			0.20			0.20		
		Species count	4	4	14	3	3	11	5	5	11	3	3	14	2	2	12	5	5	11	6	6	14	5	5	8	16	16	34	16	16	29	15	15	29	14	14	25	15	16	28
		Stems per ACRE	161.9	161.9	4006	161.9	161.9	930.8	242.8	242.8	890.3	121.4	121.4	1295	80.94	80.94	1133	323.7	323.7	2954	364.2	364.2	971.2	242.8	242.8	607	212.5	212.5	1599	247.9	247.9	981.4	242.8	242.8	743.6	217.5	222.6	667.7	349	354.1	677.8

Appendix D:
Stream Survey Data

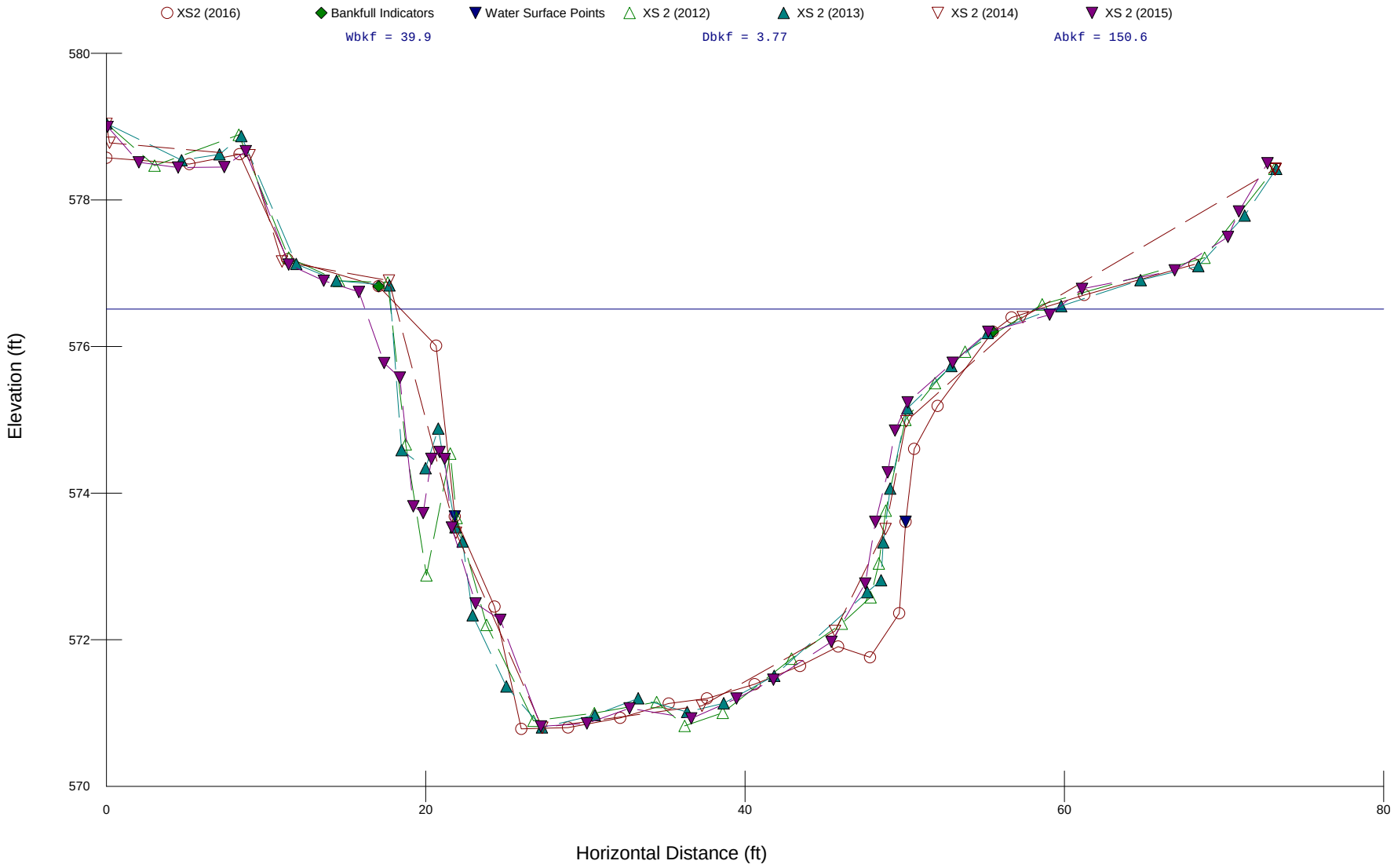
Figures 6: Cross Sections with Annual Overlays
Figures 7: Longitudinal Profiles with Annual Overlays
Figures 8: Pebble Counts with Annual Overlays
Table 9: Stream Bank Erosion Pin Data Table
Table 10a: Baseline Stream Data Summary
Table 10b: Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Table 11a: Monitoring – Cross Section Morphology Data Table
Table 11b: Monitoring – Stream Reach Morphology Data Table

Figures 6: Cross Section with Annual Overlays

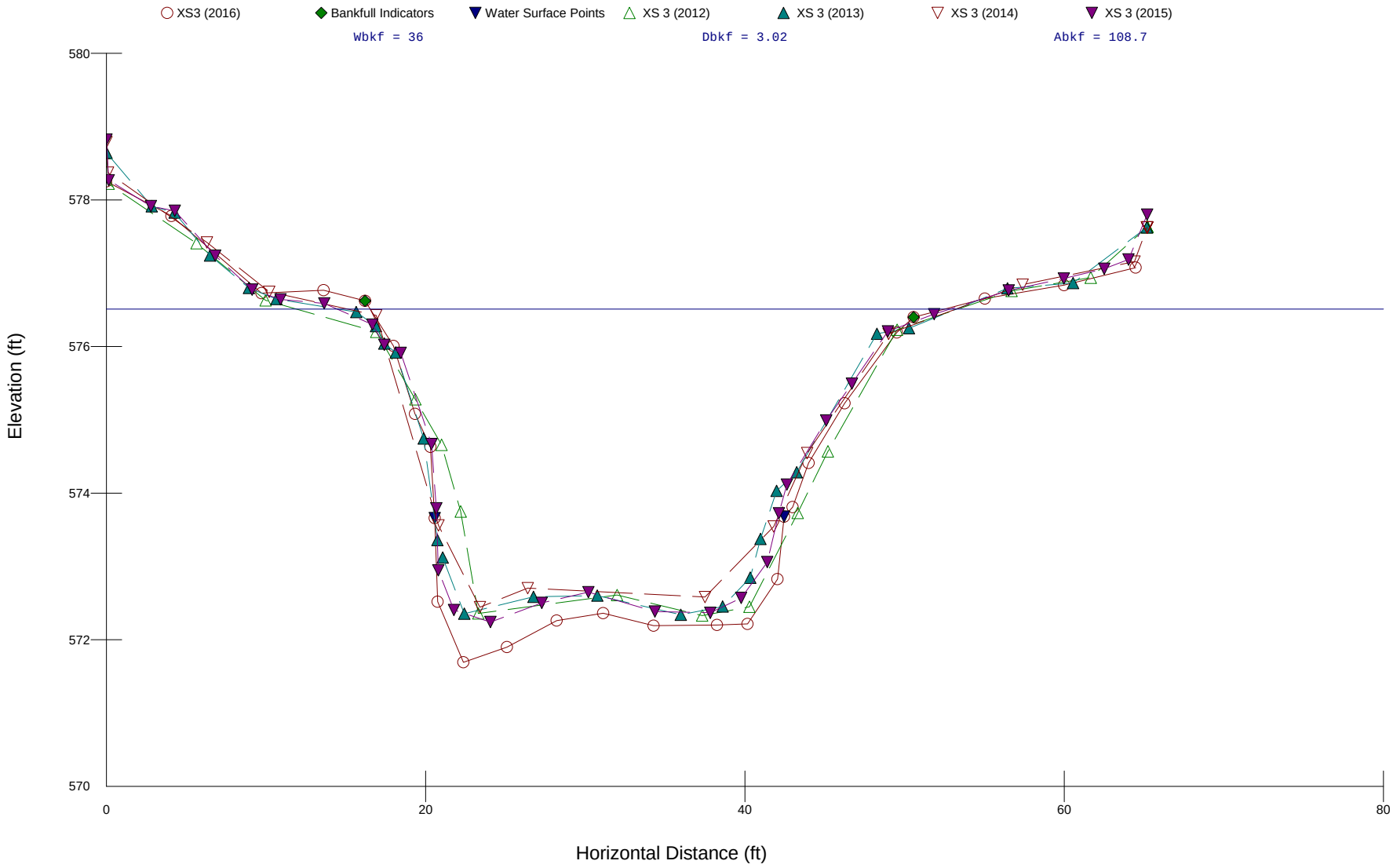
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 1, XS 1
Riffle
Station 11+58.48



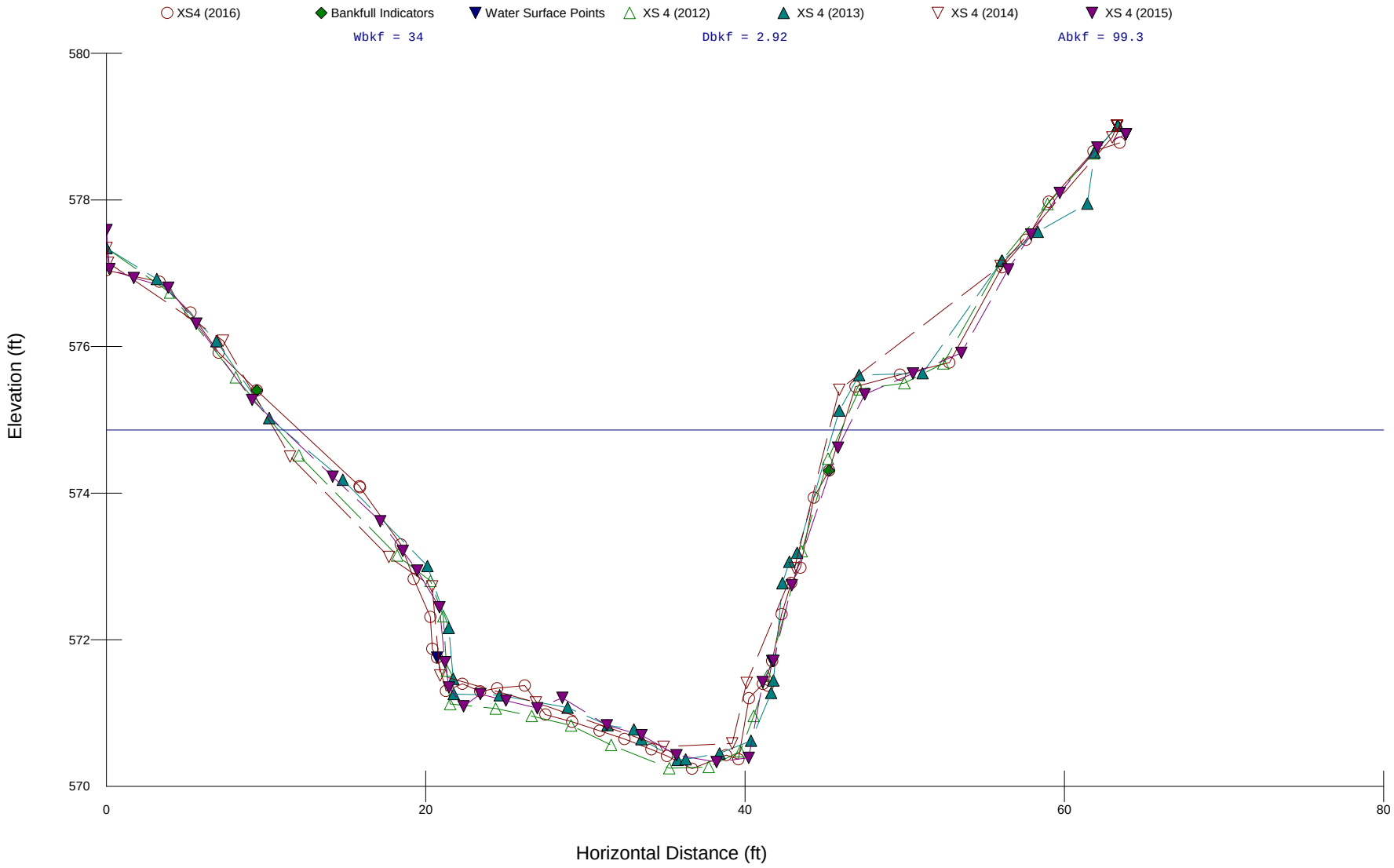
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 1, XS 2
Pool
Station 13+23.79



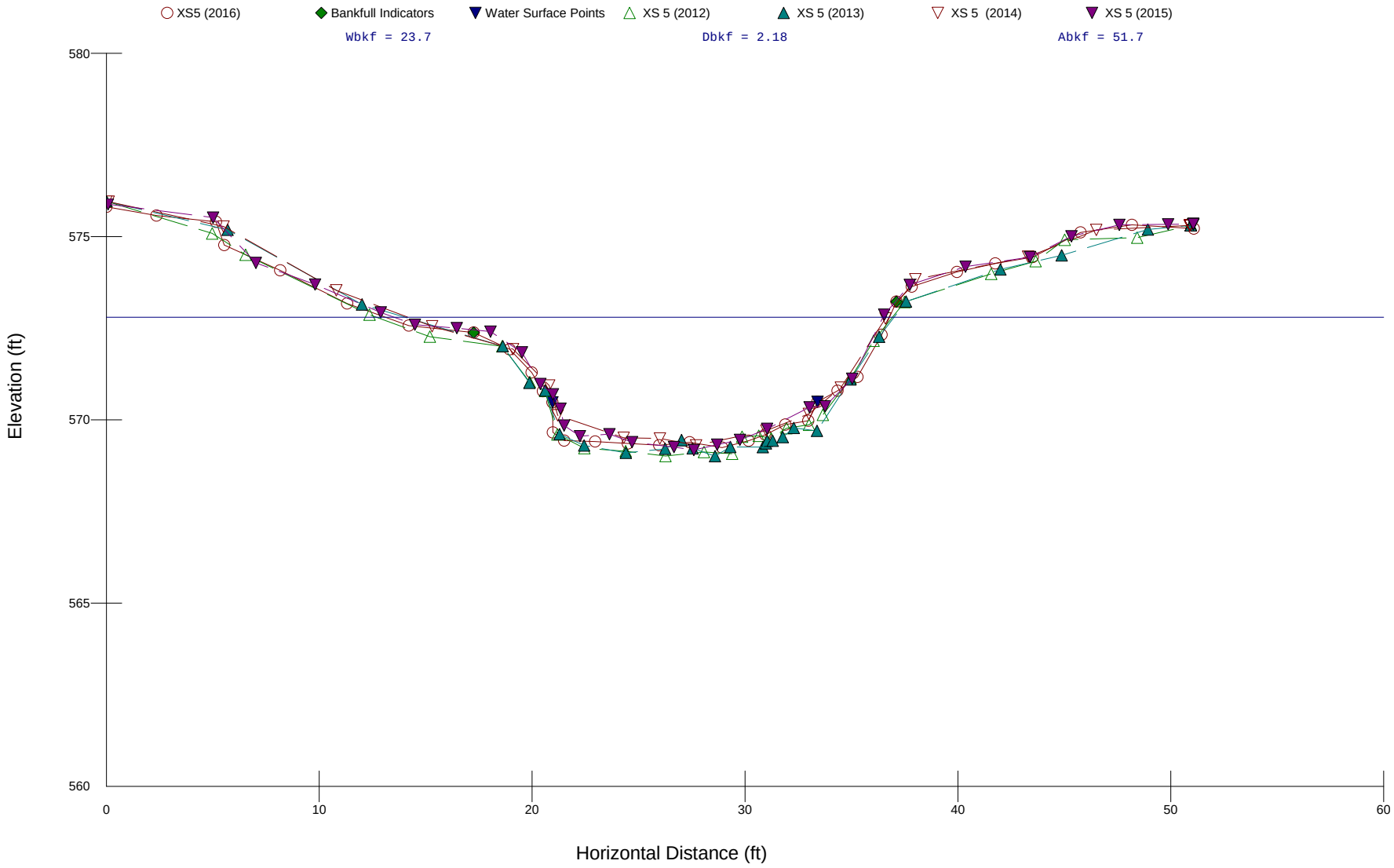
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 1, XS 3
Pool
Station 13+62.29



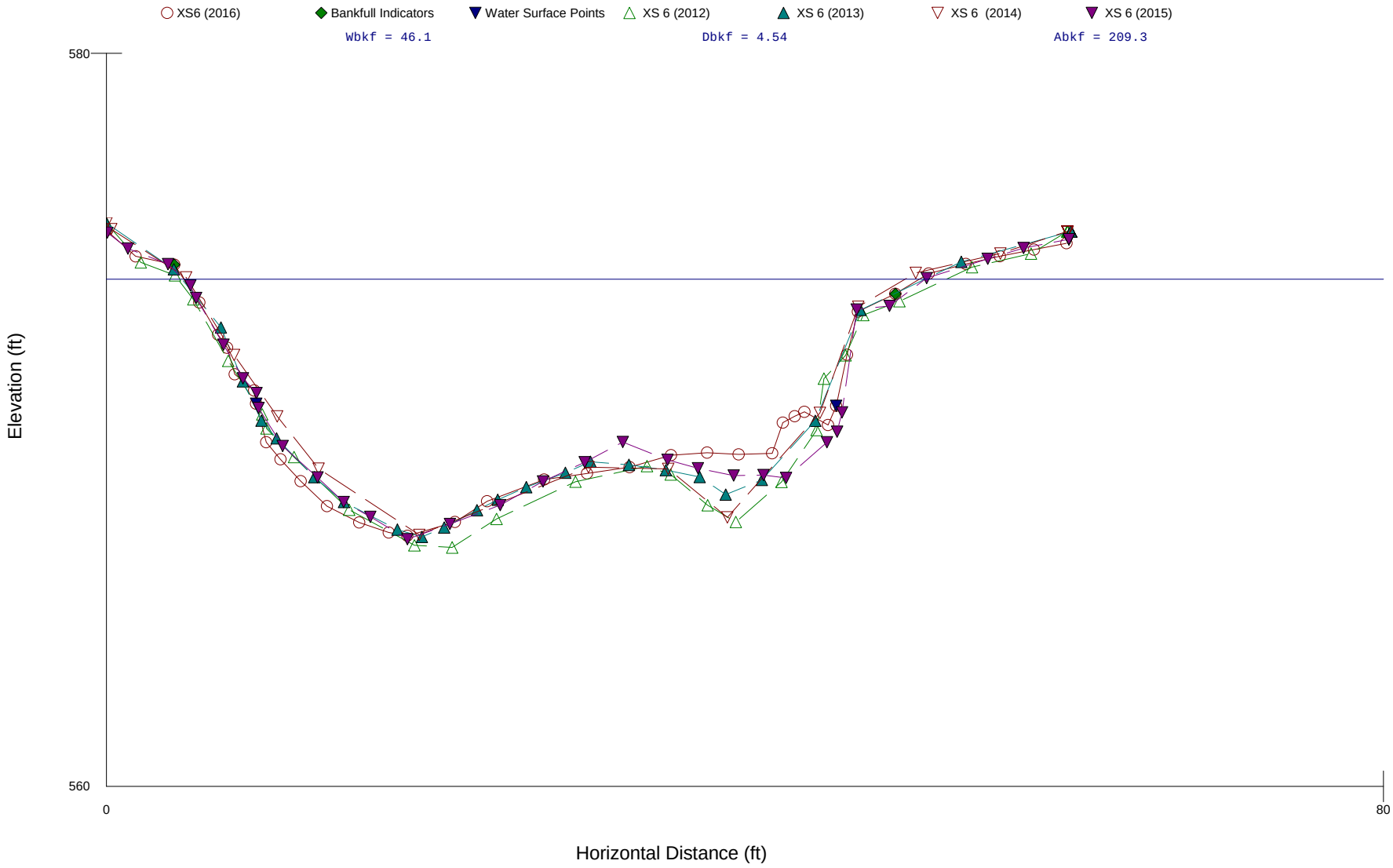
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 4, XS 4
Riffle
Station 19+69.54



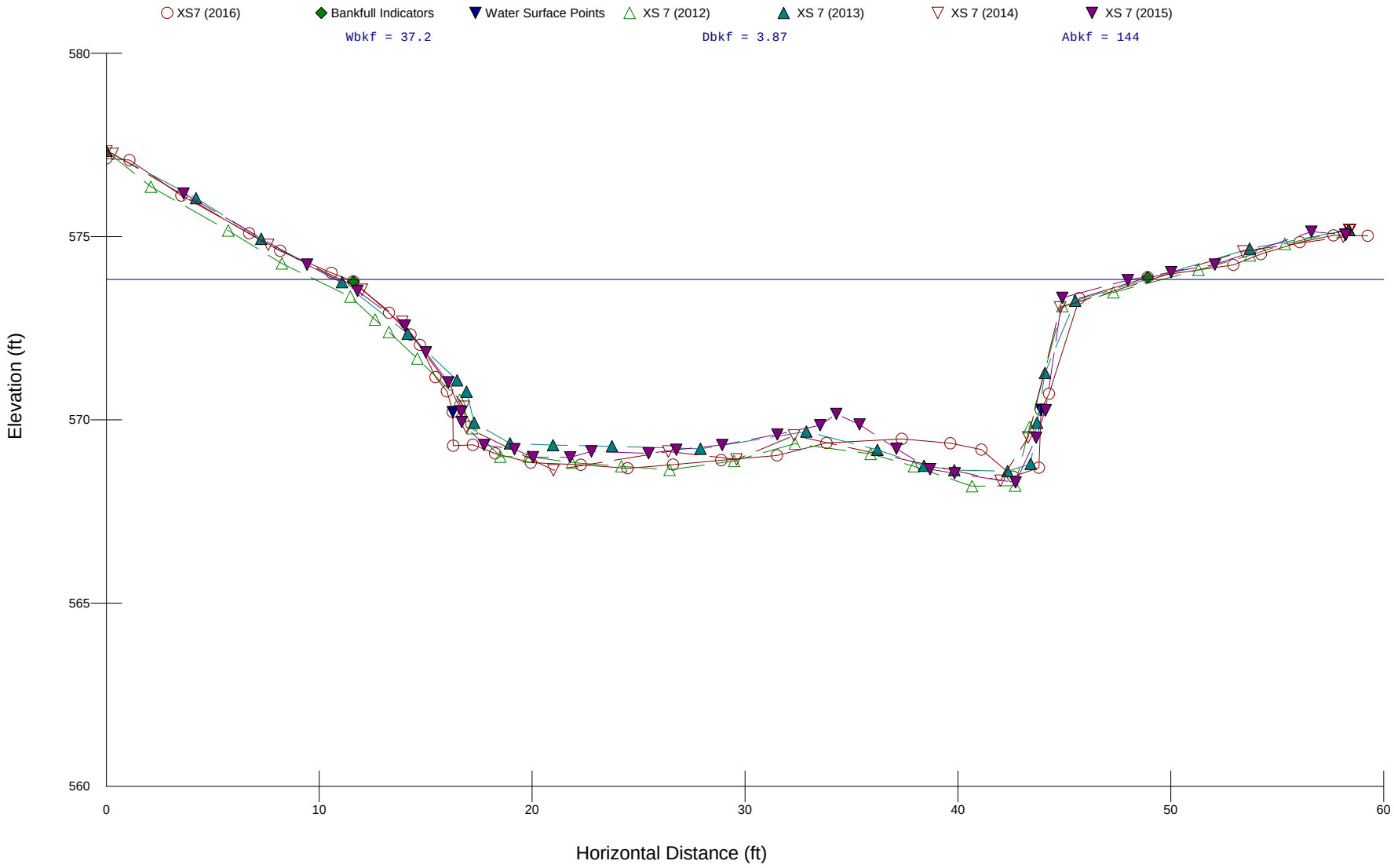
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 5
Riffle
Station 27+95.78



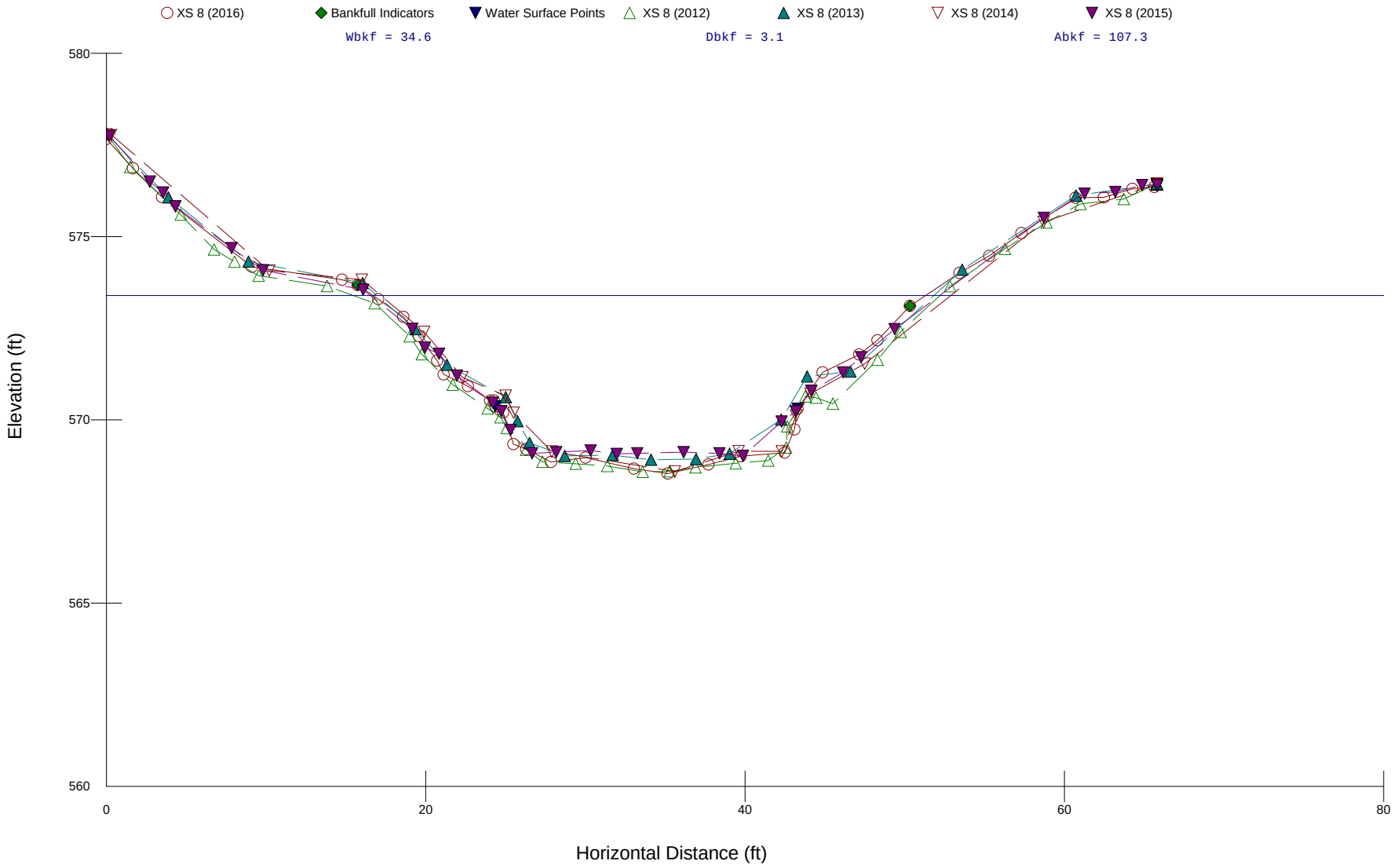
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 6
Pool
Station 28+83.61



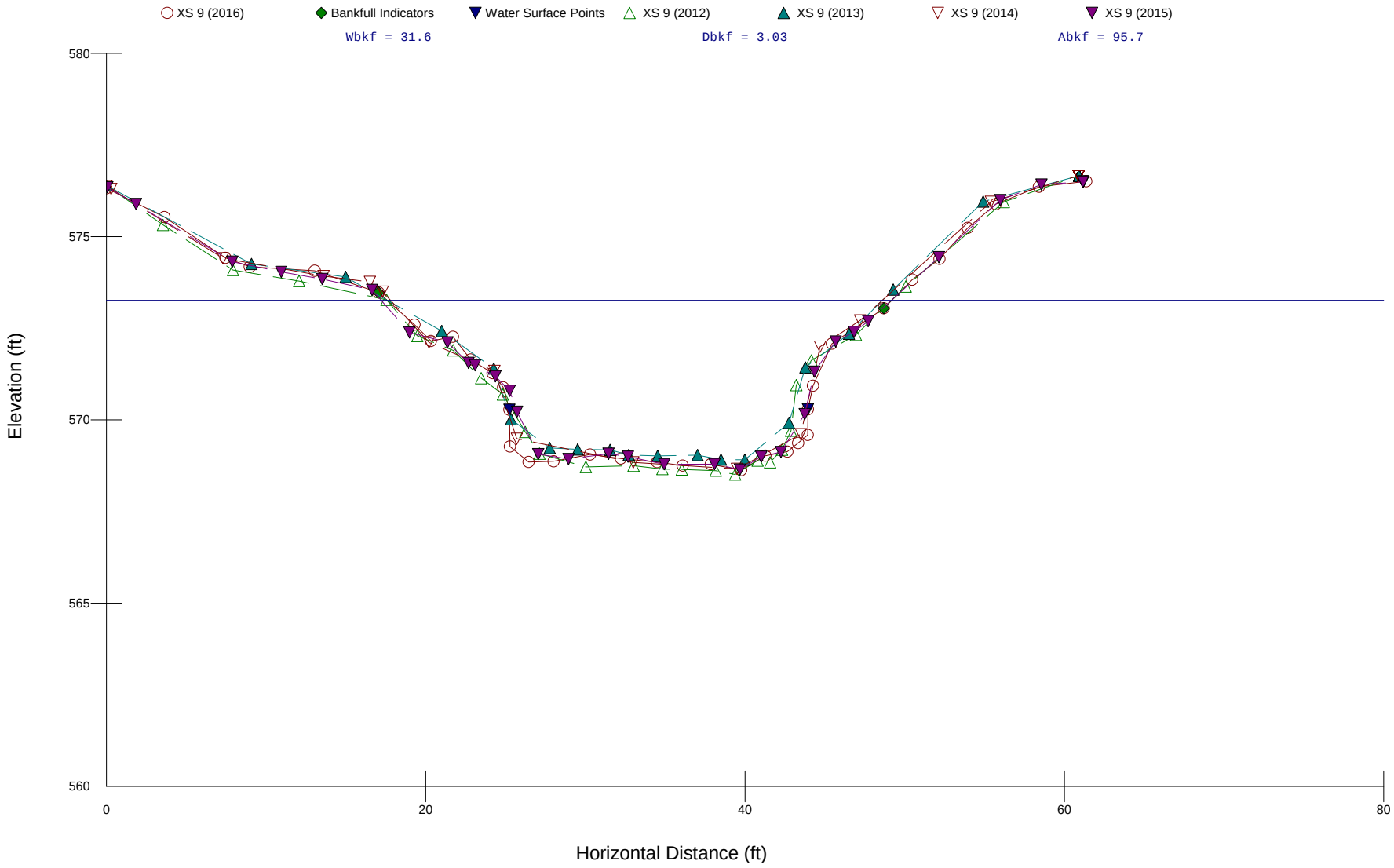
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 7
Pool
Station 29+17.31



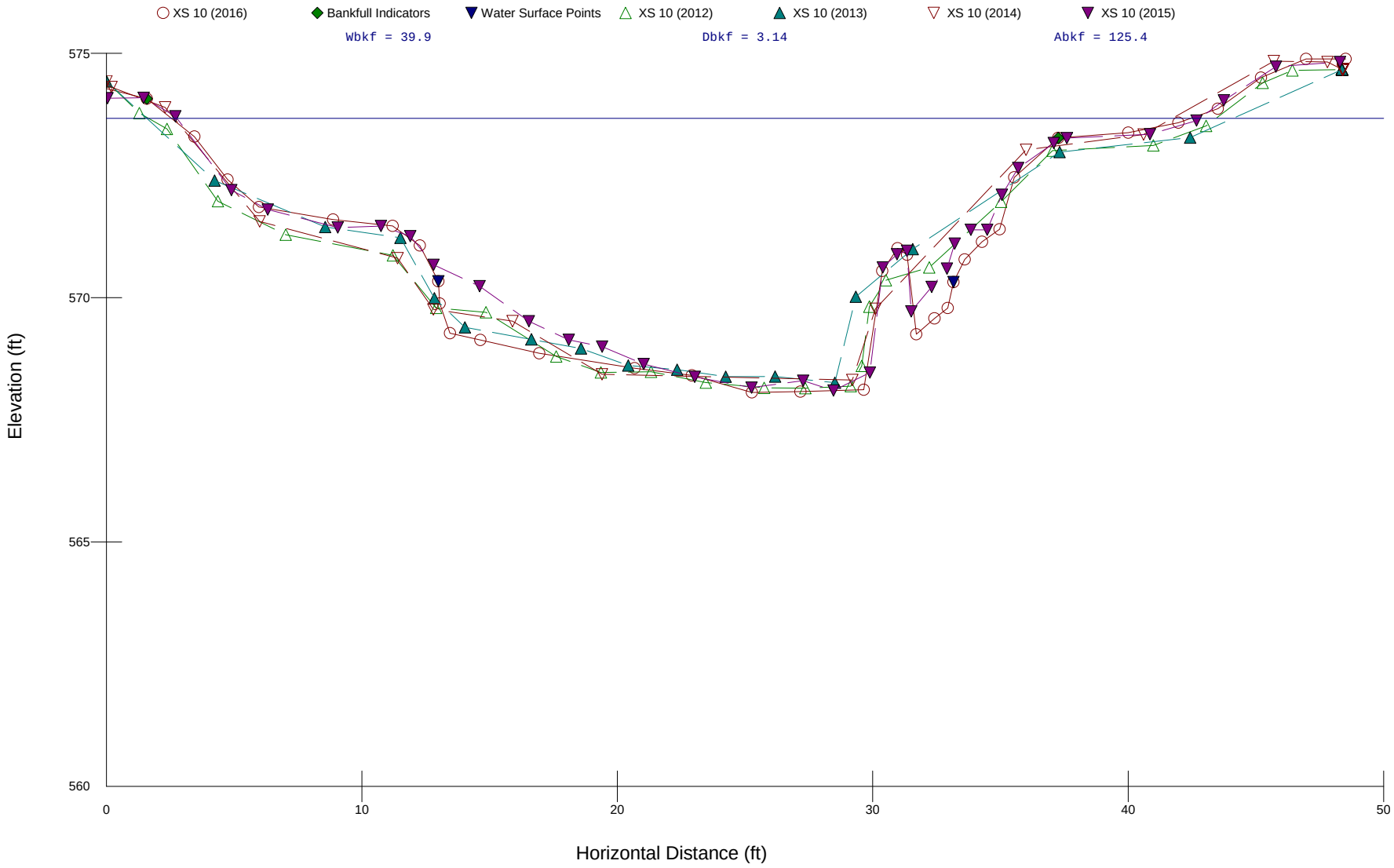
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 8
Riffle
Station 29+35.63



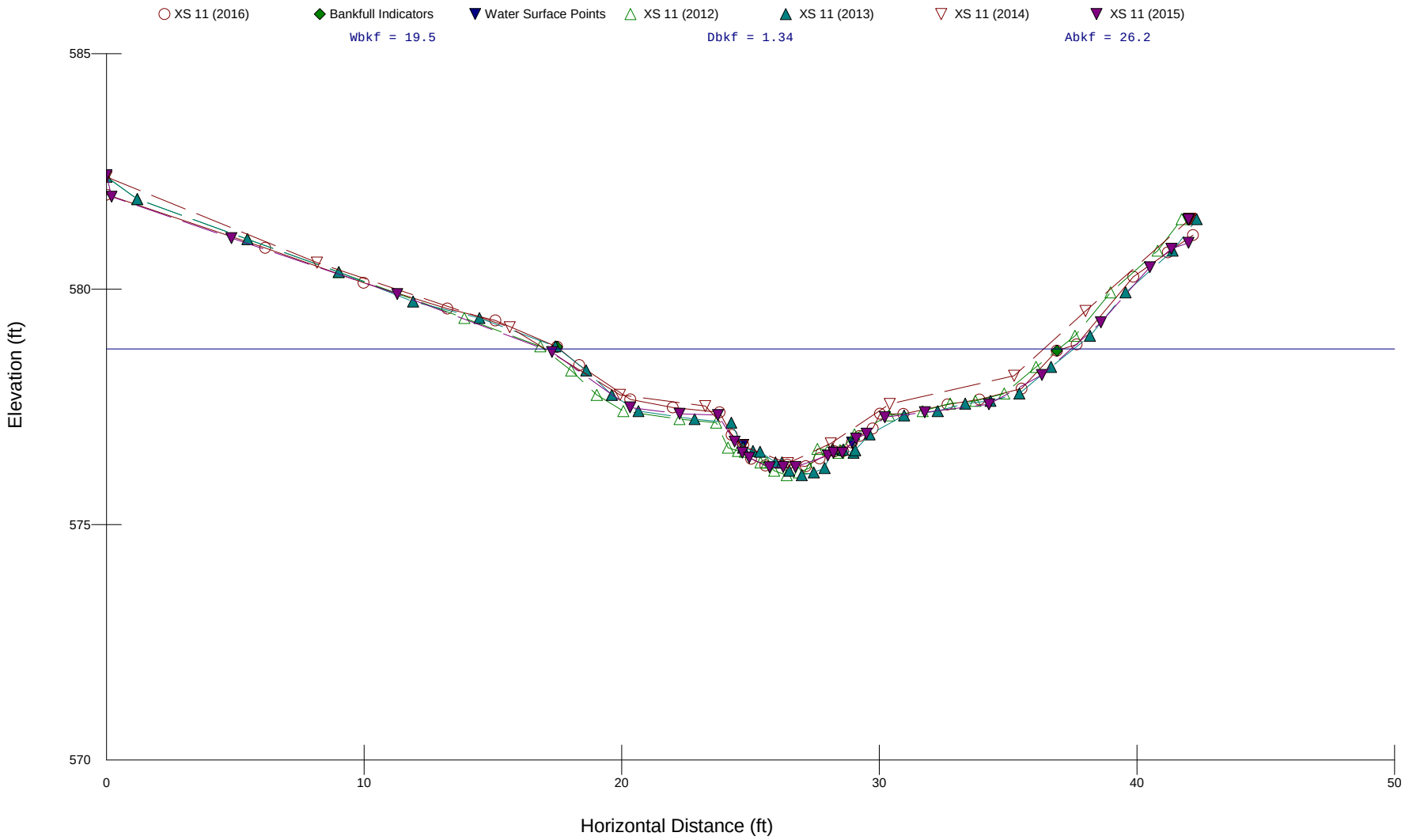
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 9
Riffle
Station 29+57.75



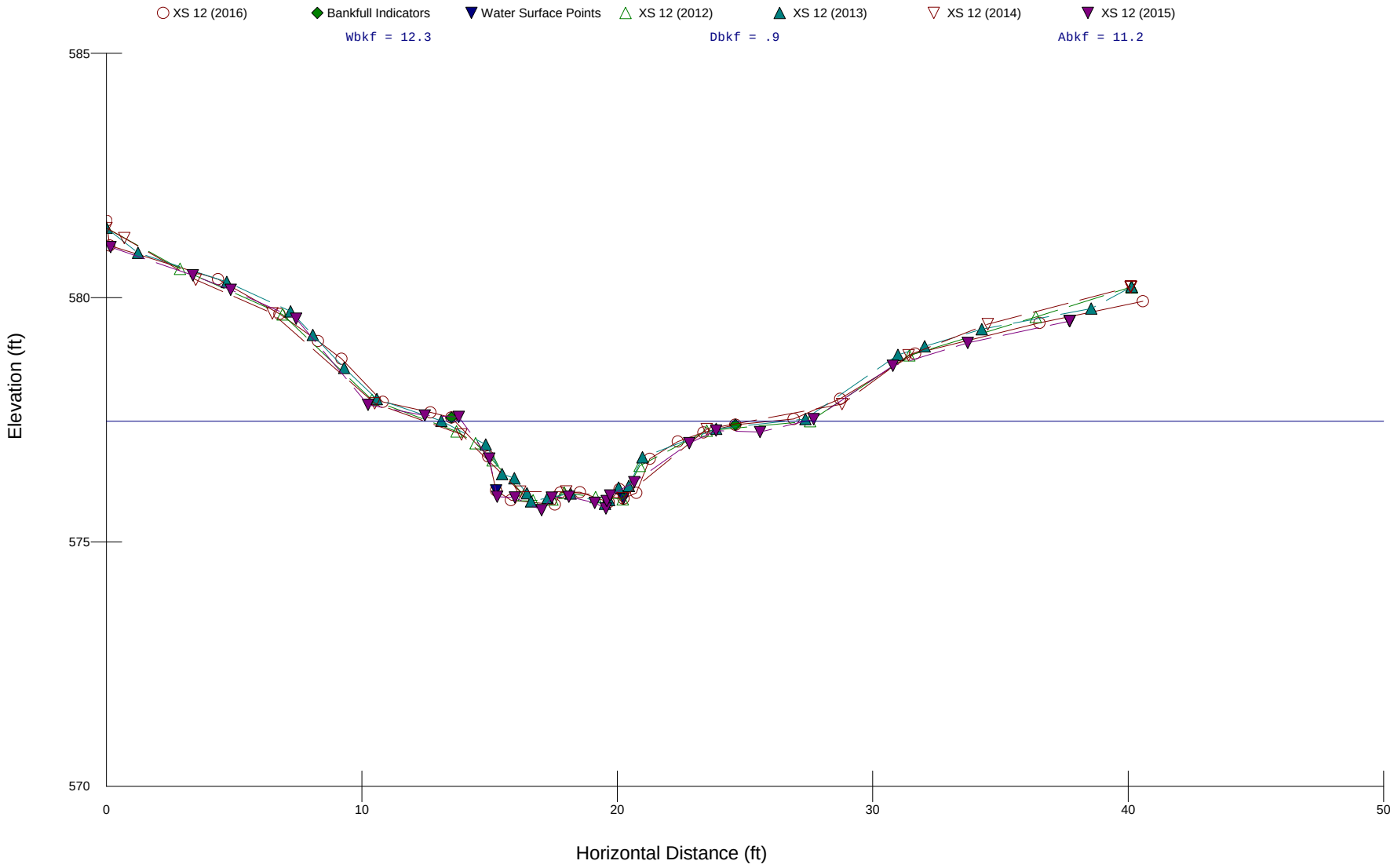
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 10
Riffle
Station 30+56.75



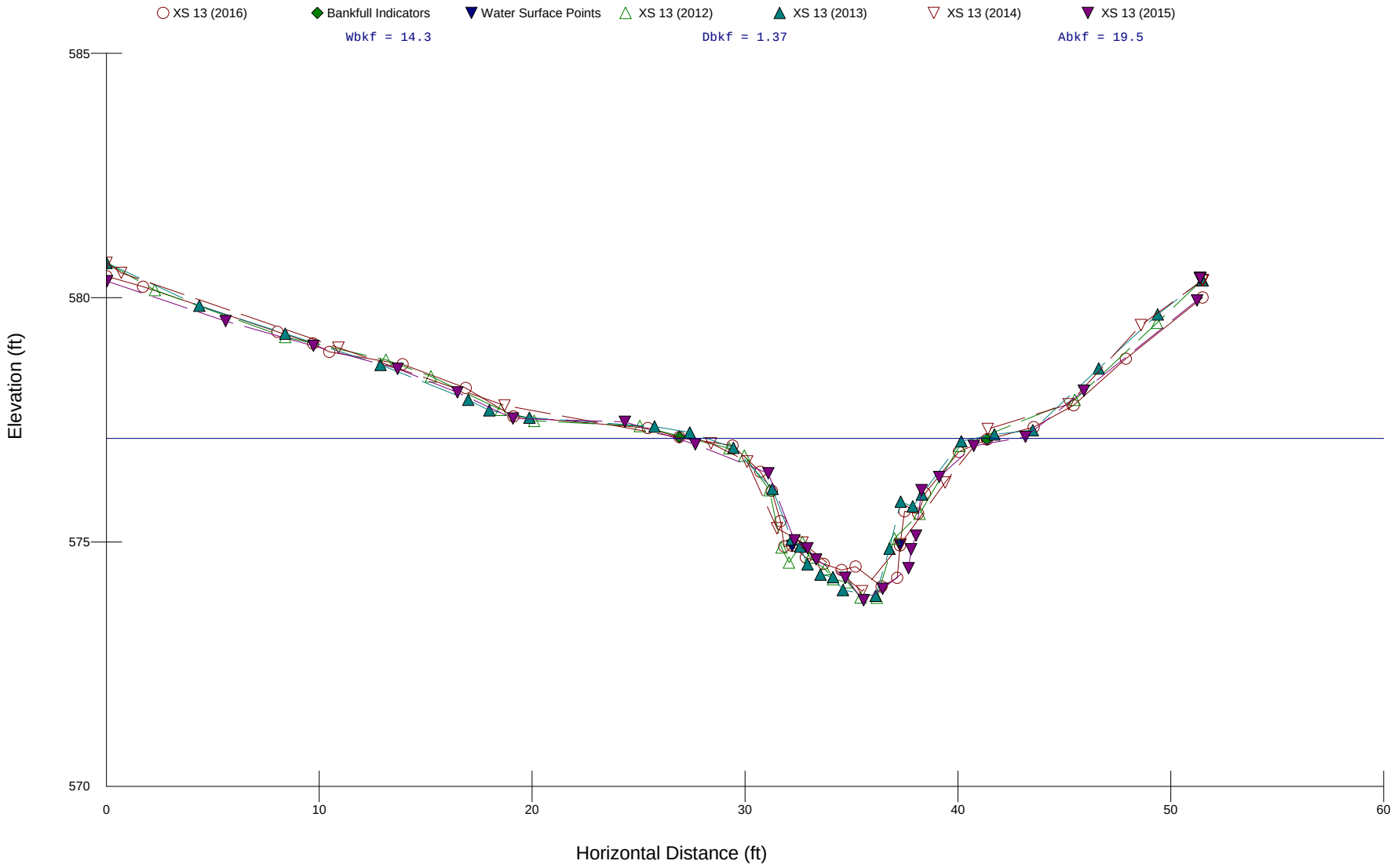
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 11
Pool
Station 10+50.94



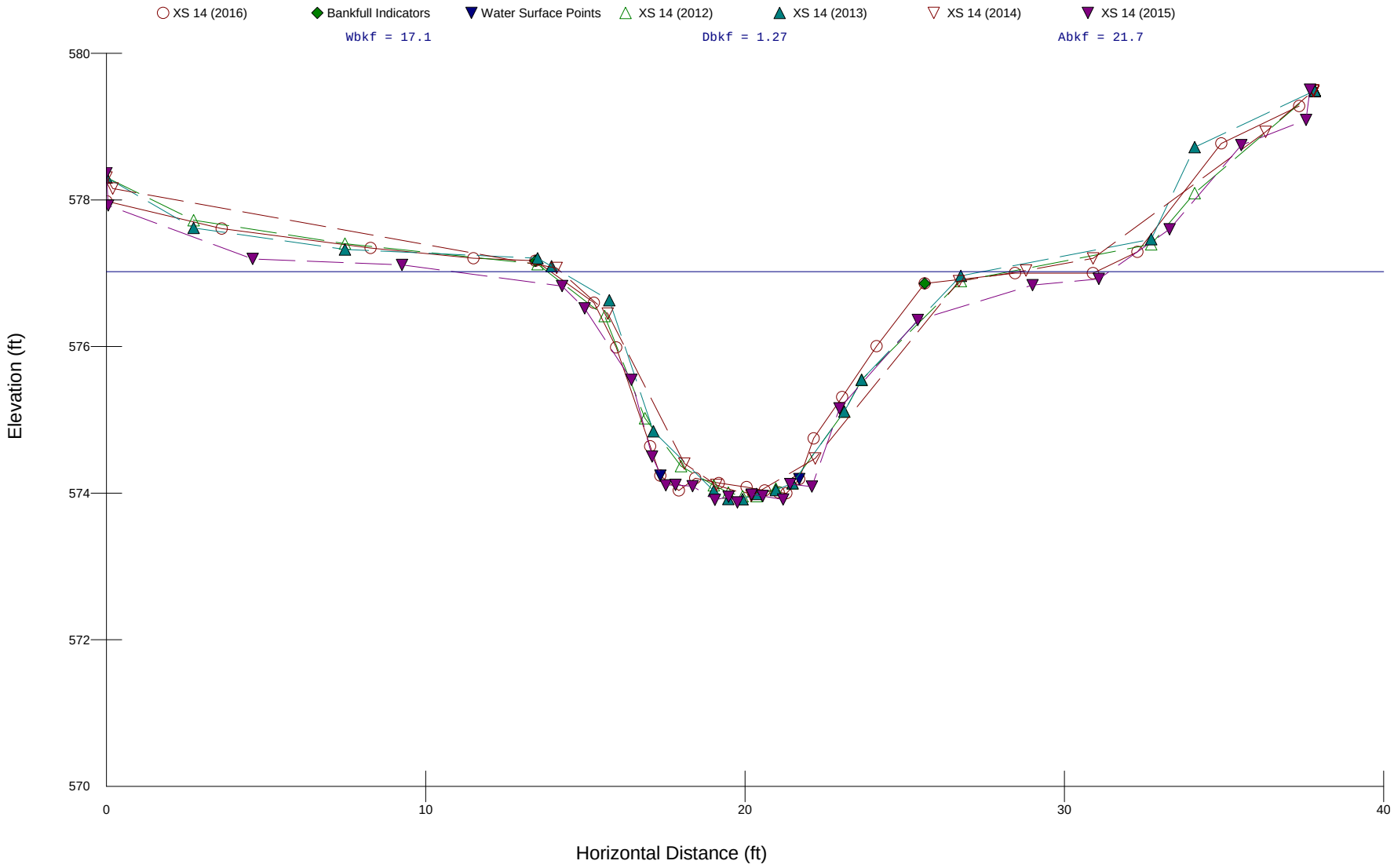
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 12
Riffle
Station 11+03.18



Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 13
Pool
Station 11+49.64

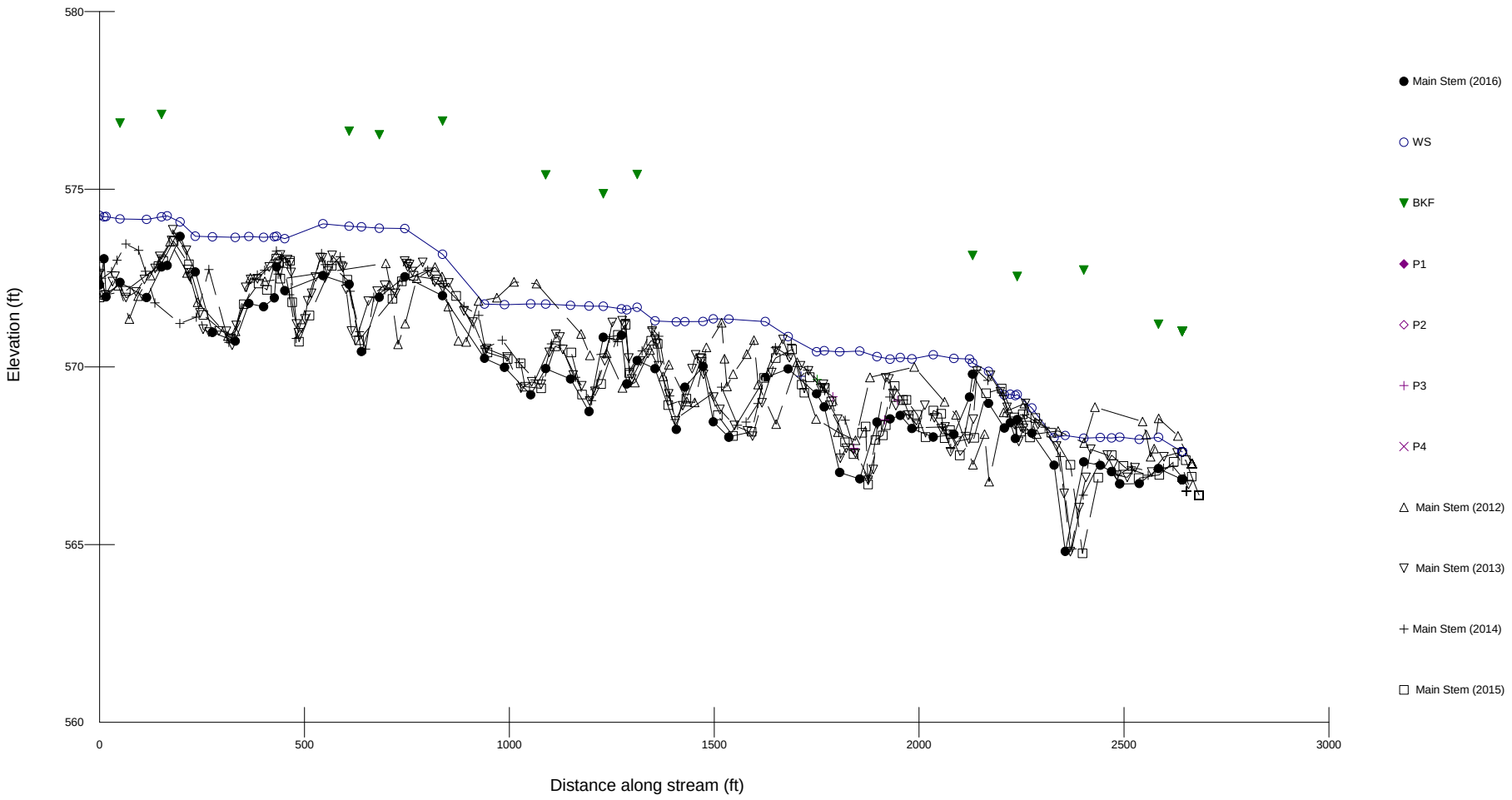


Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 14
Riffle
Station 12+50.43

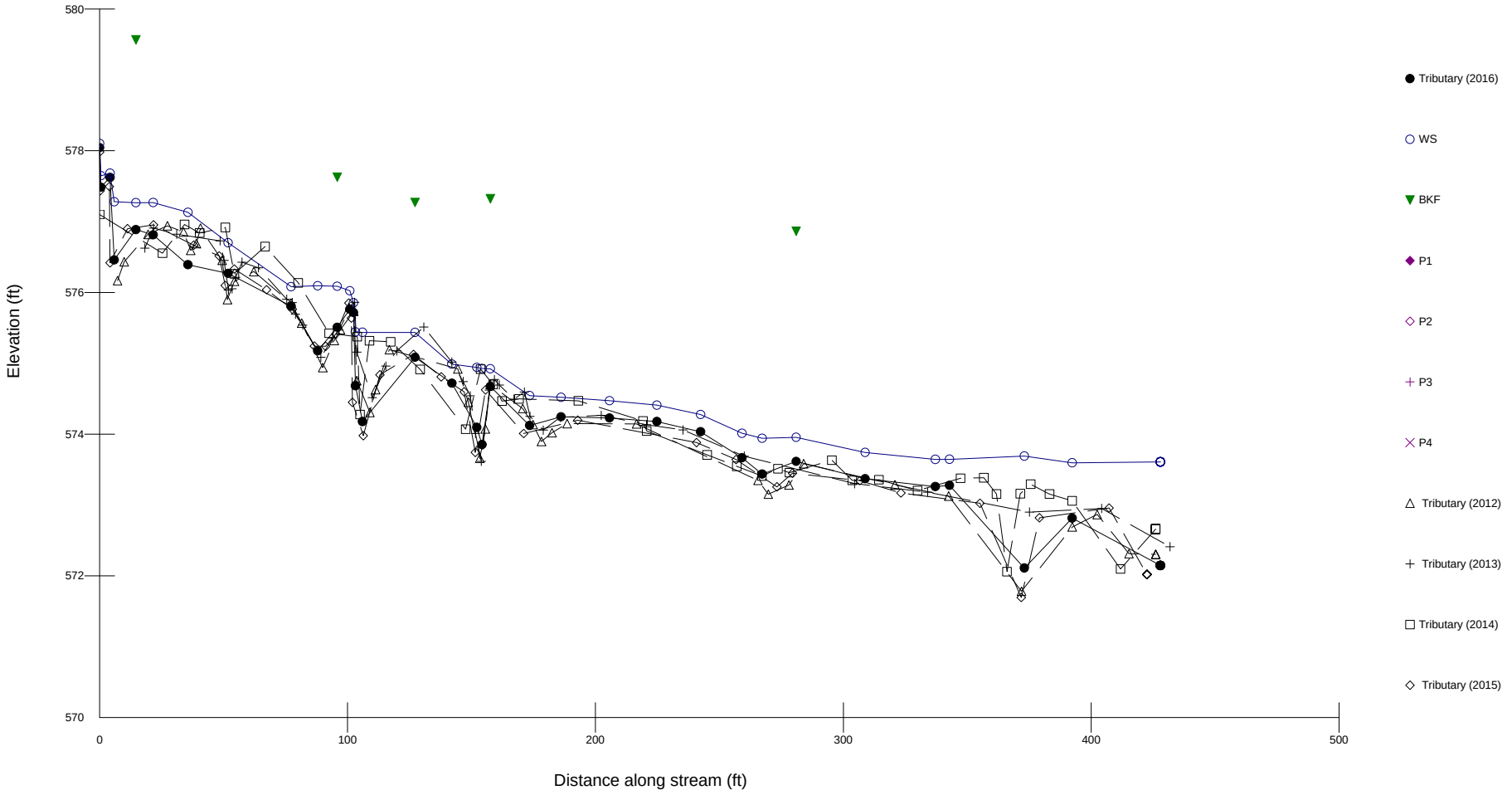


Figures 7: Longitudinal Profiles with Annual Overlays

Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Main Stem
Station 0+0.00 to 29+68.44

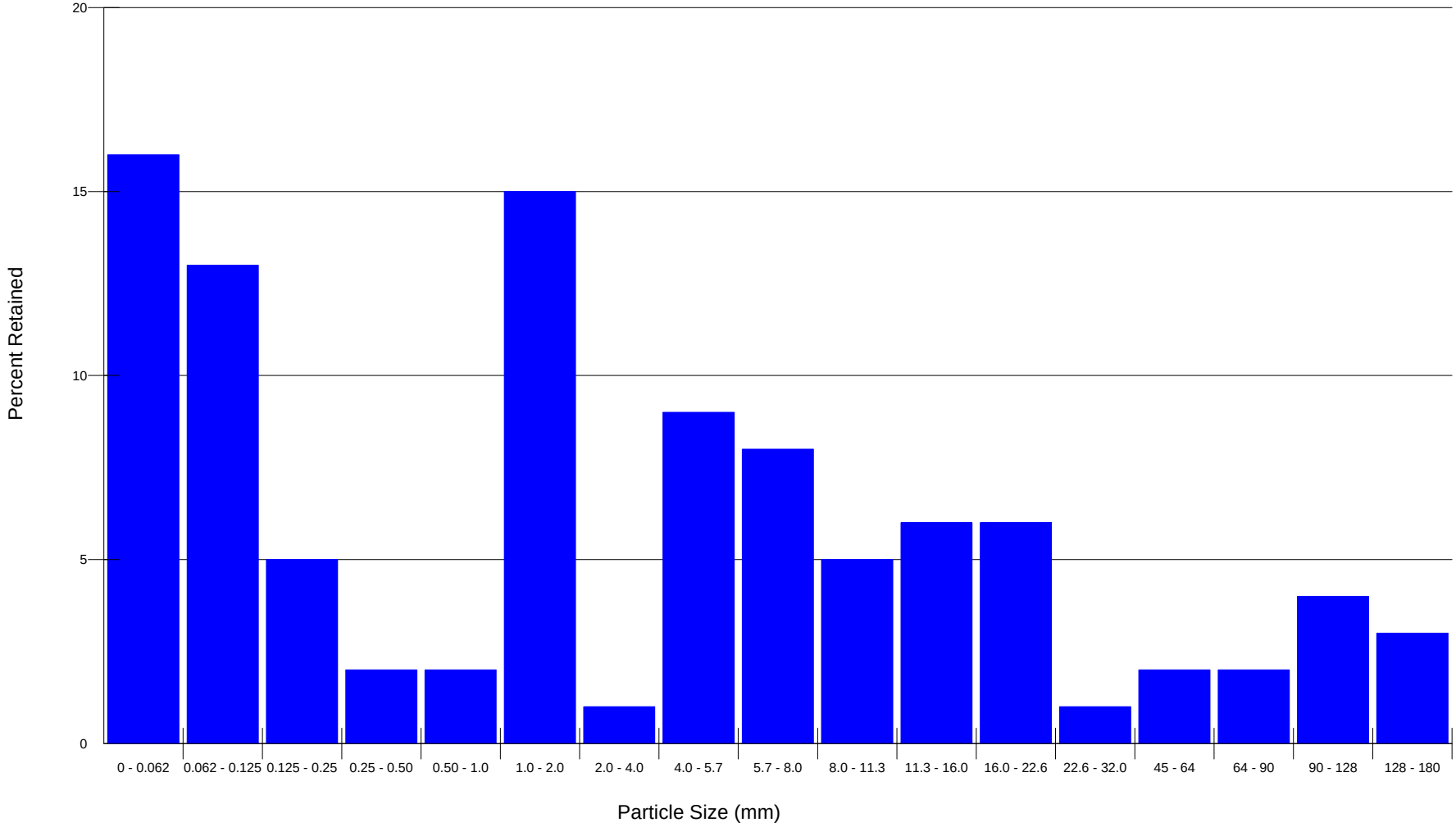


Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Tributary
Station 10+0.00 to 14+40.85

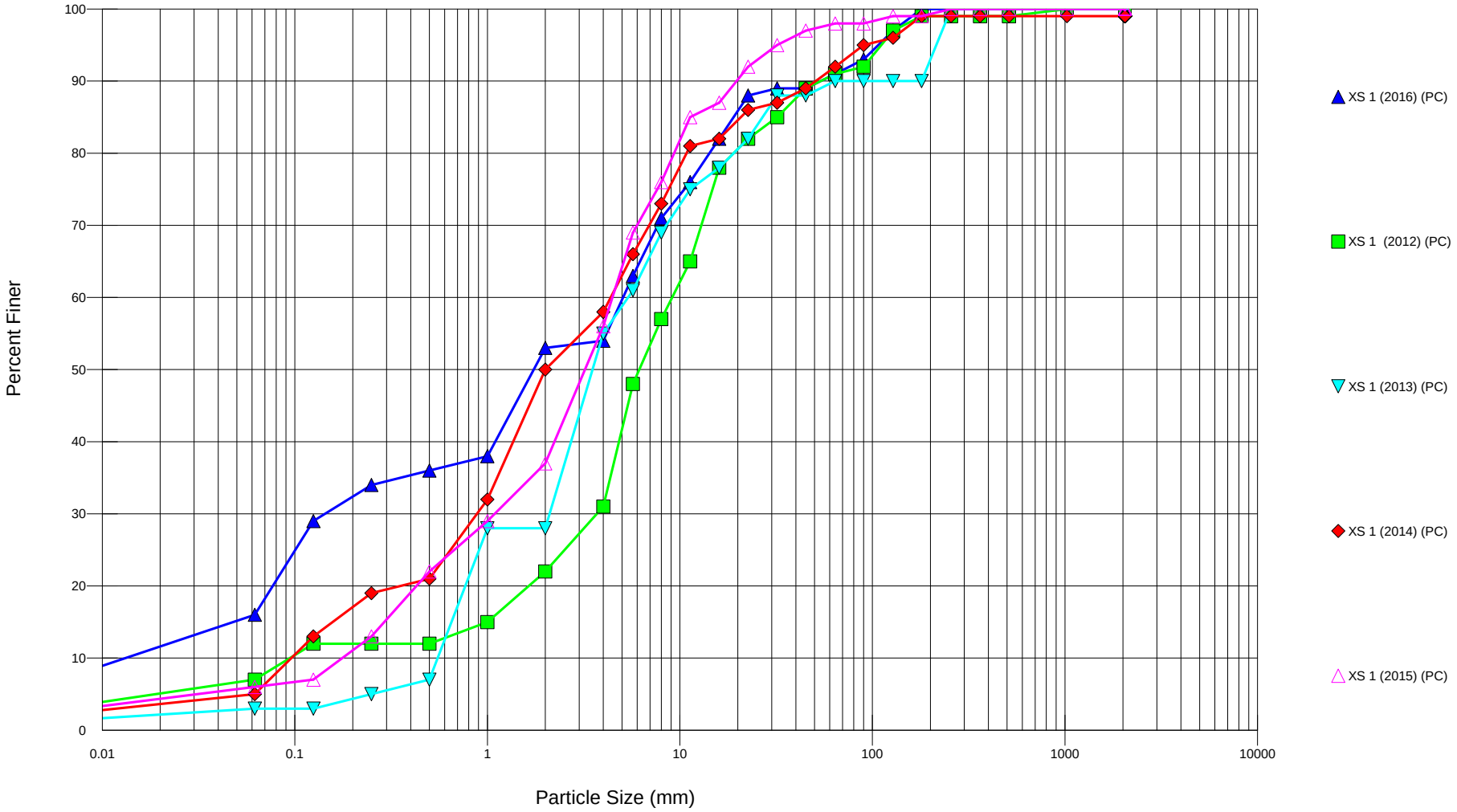


Figures 8: Pebble Counts with Annual Overlays

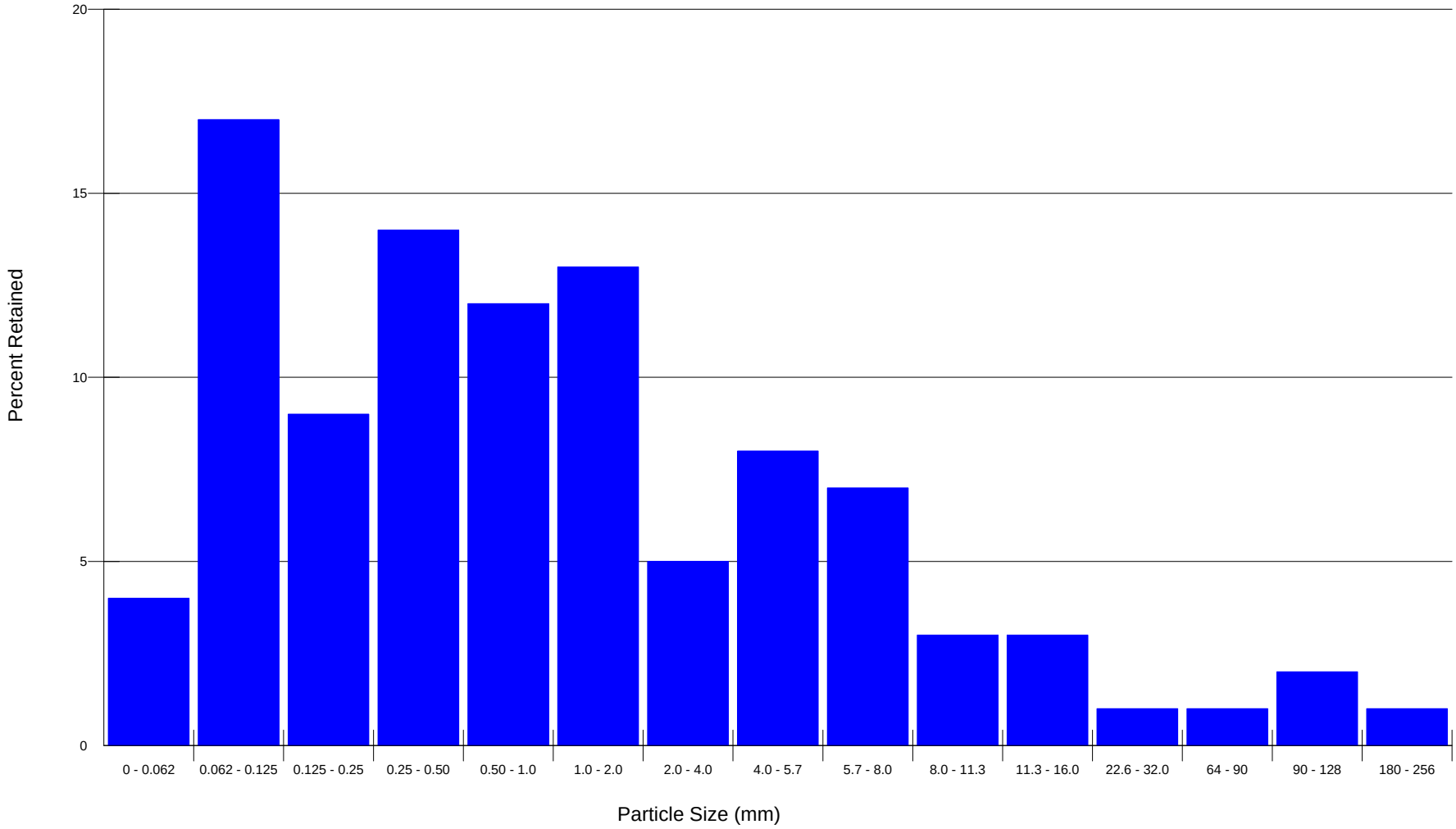
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 1, XS 1 Riffle Station 11+58.48
D50: 1.8 mm
D84: 18.2 mm
D95: 109 mm



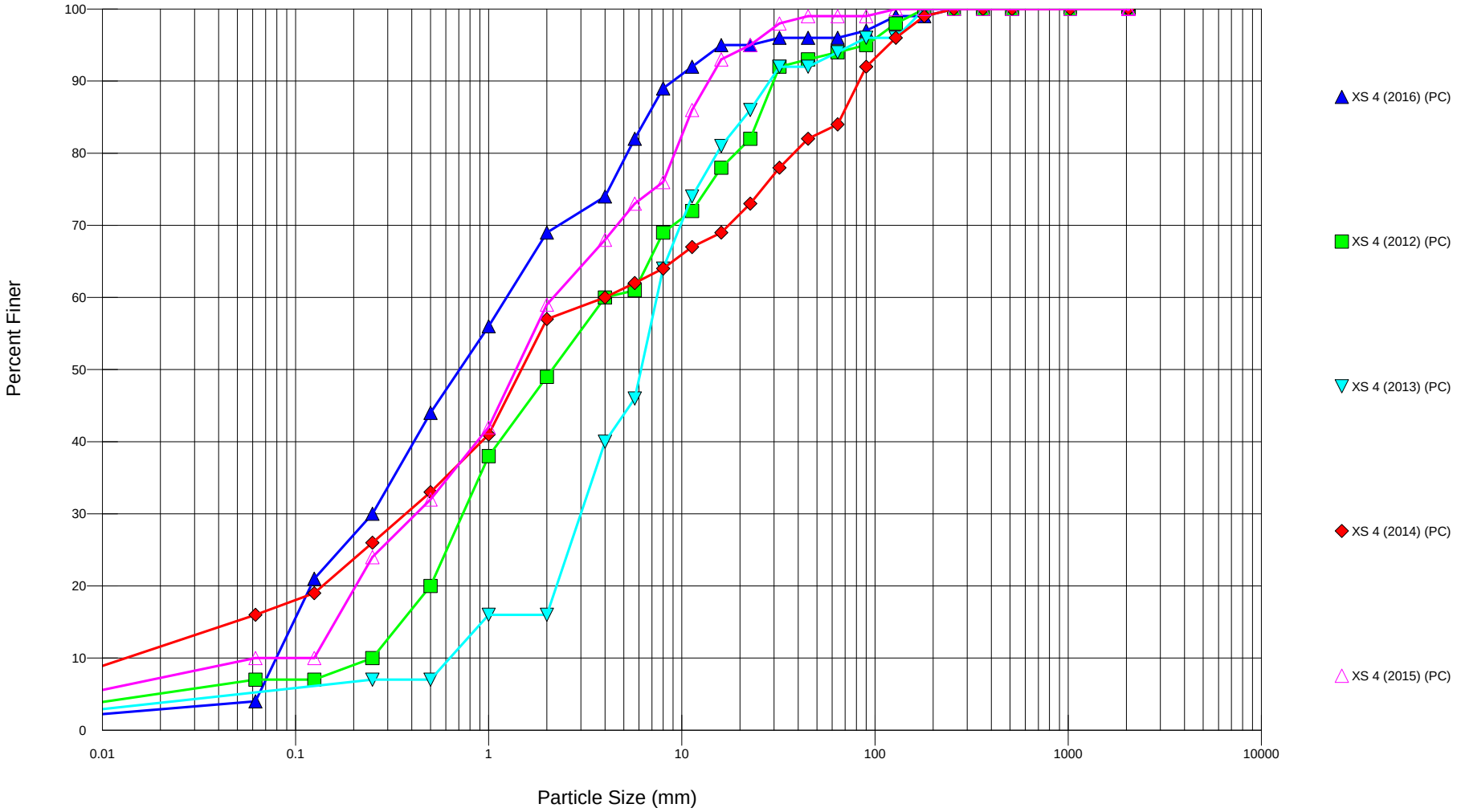
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 1, XS 1 Riffle Station 11+58.48
D50: 1.8 mm
D84: 18.2 mm
D95: 109 mm



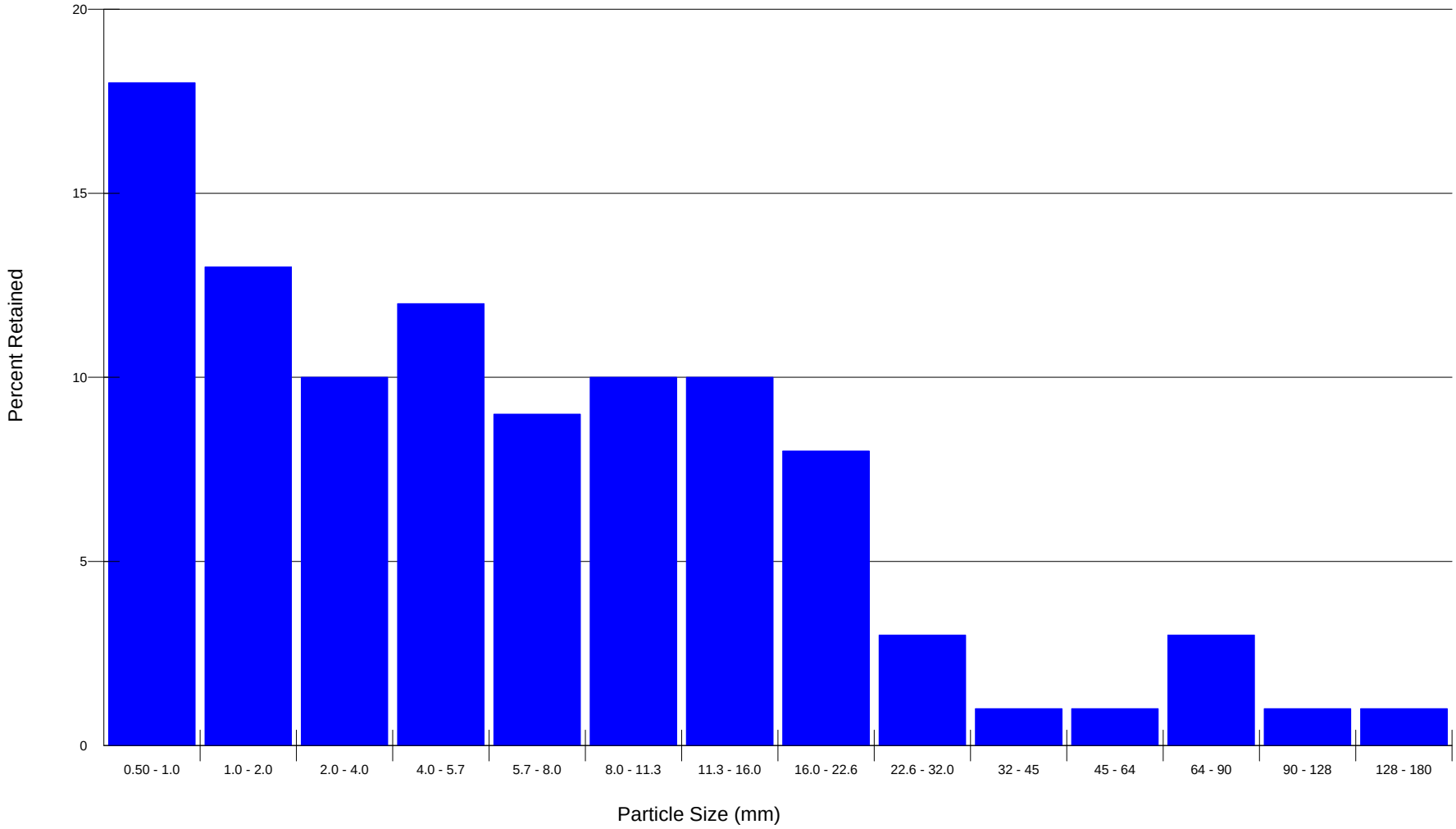
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 4, XS 4 Riffle Station 19+69.54
D50: 0.75 mm
D84: 6.36 mm
D95: 16 mm



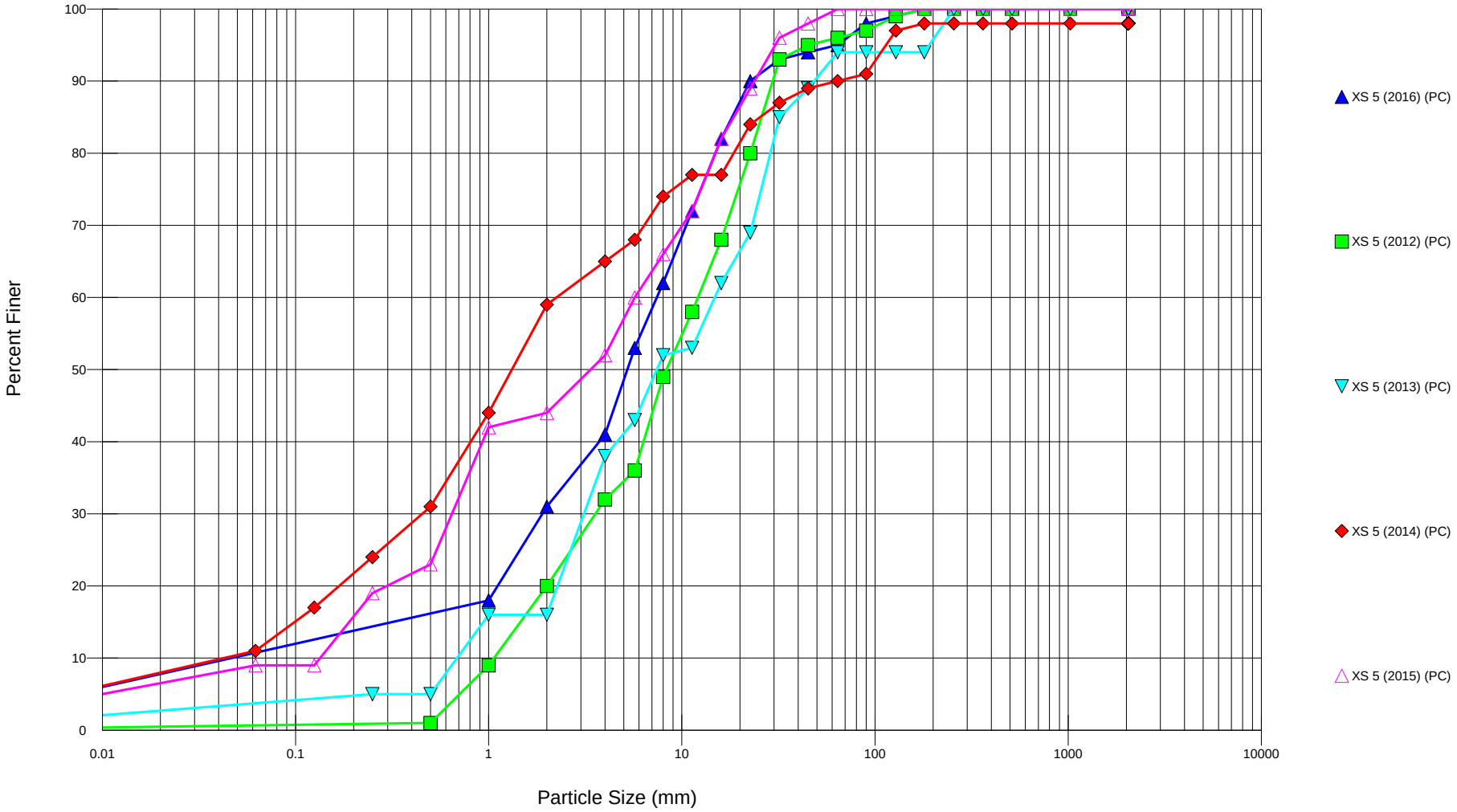
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 4, XS 4 Riffle Station 19+69.54
D50: 0.75 mm
D84: 6.36 mm
D95: 16 mm



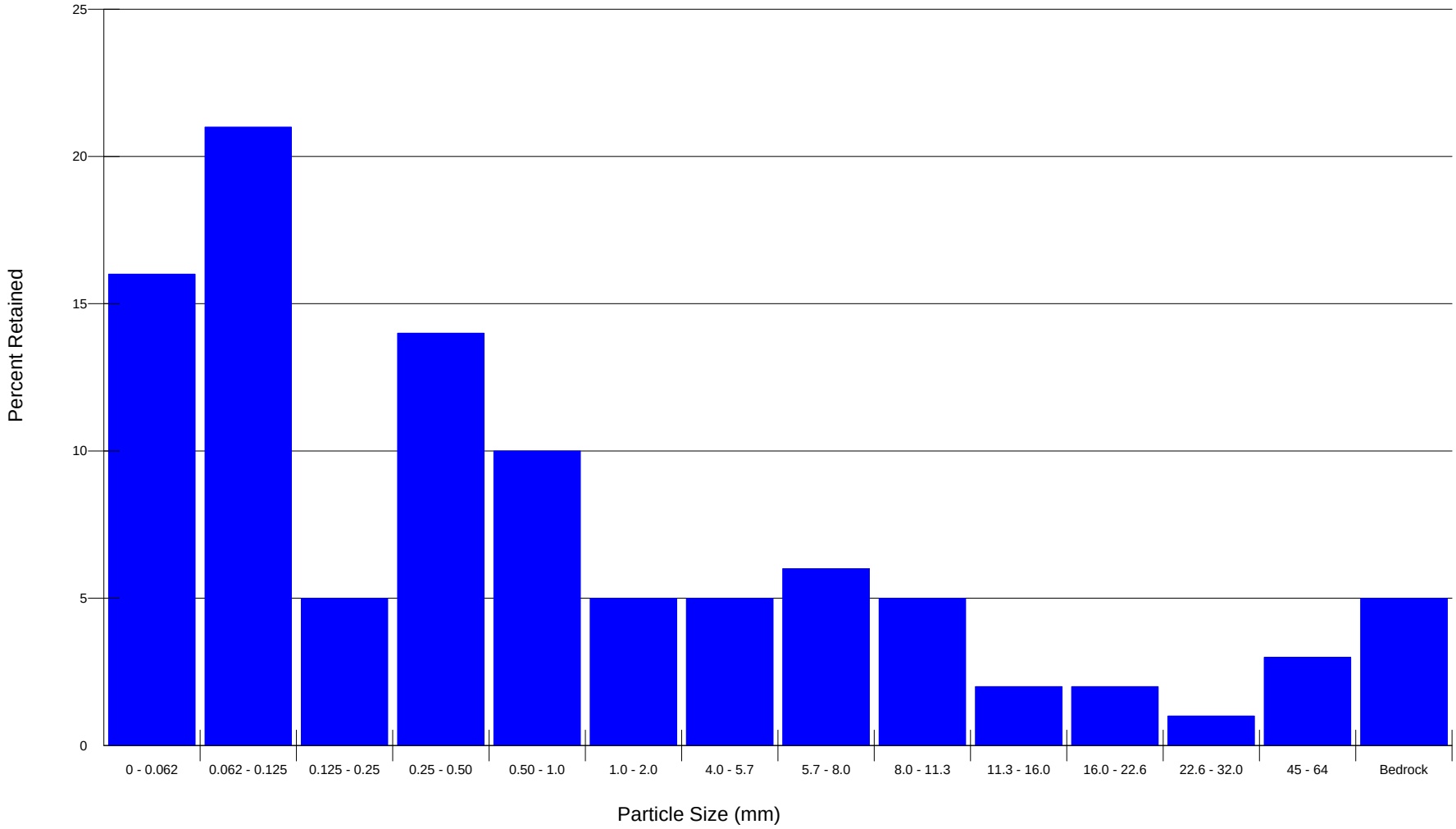
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 5 Riffle Station 27+95.78
D50: 5.27 mm
D84: 17.65 mm
D95: 64 mm



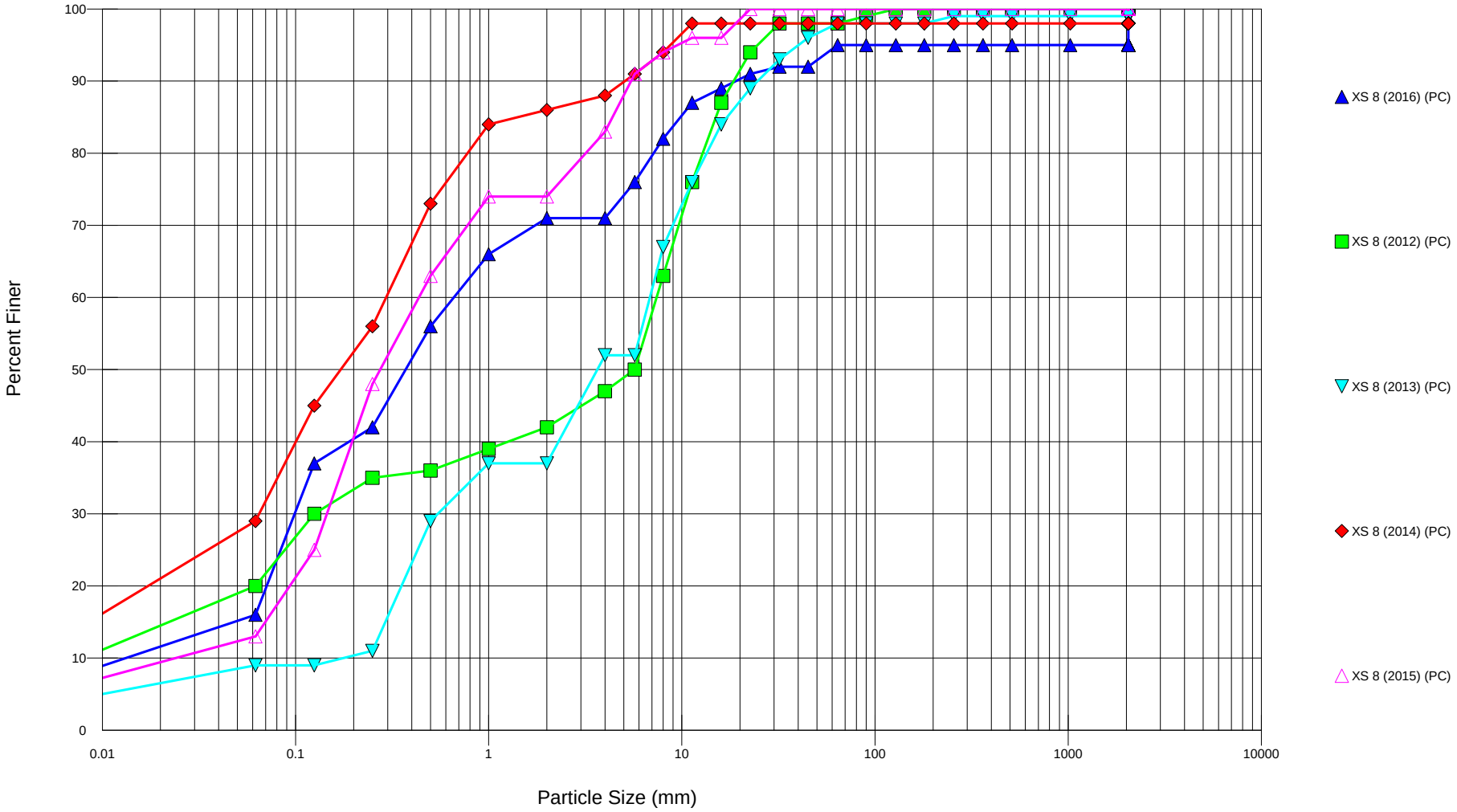
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 5 Riffle Station 27+95.78
D50: 5.27 mm
D84: 17.65 mm
D95: 64 mm



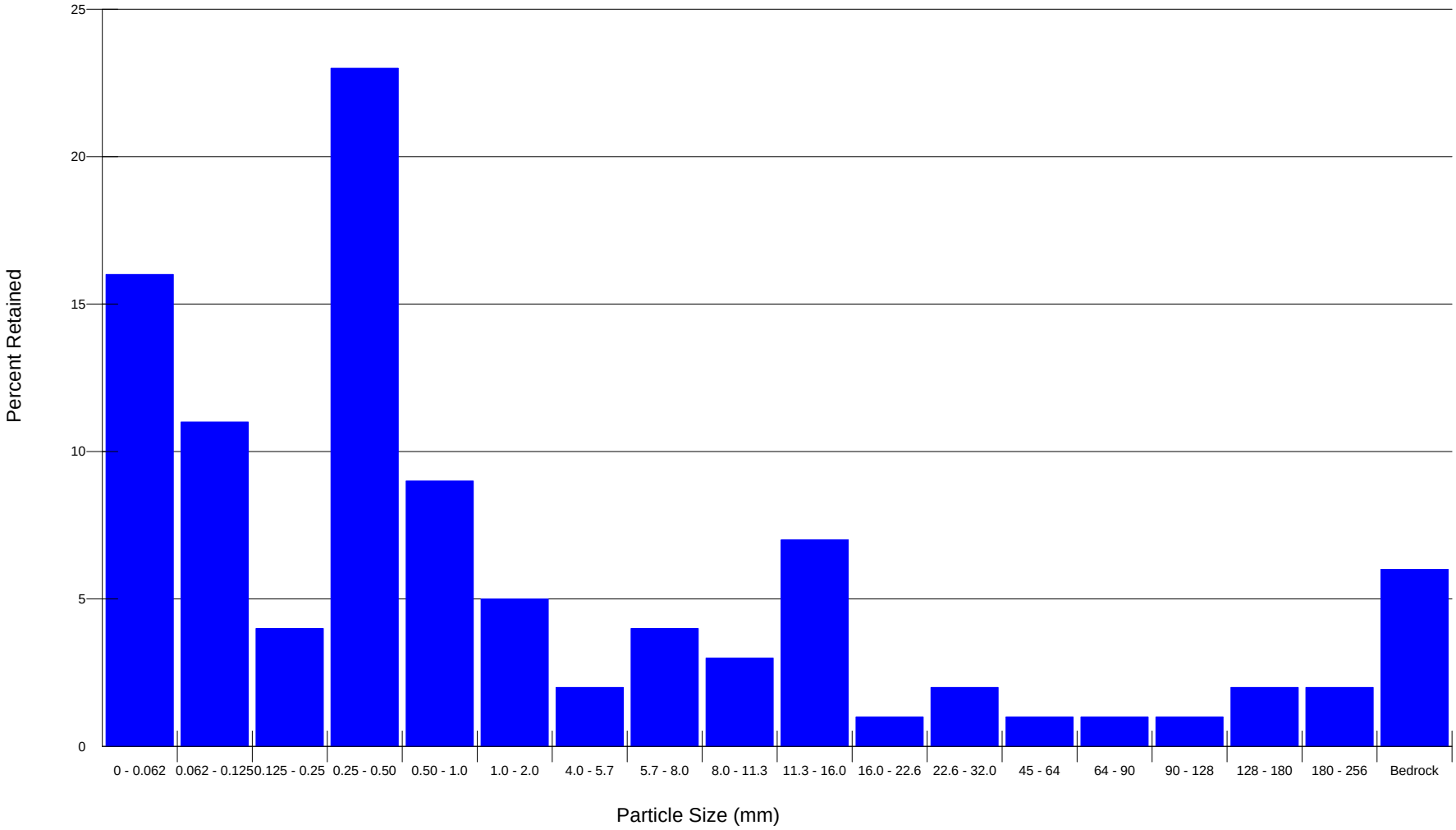
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 8 Riffle Station 29+35.63
D50: 0.39 mm
D84: 9.32 mm
D95: 64 mm



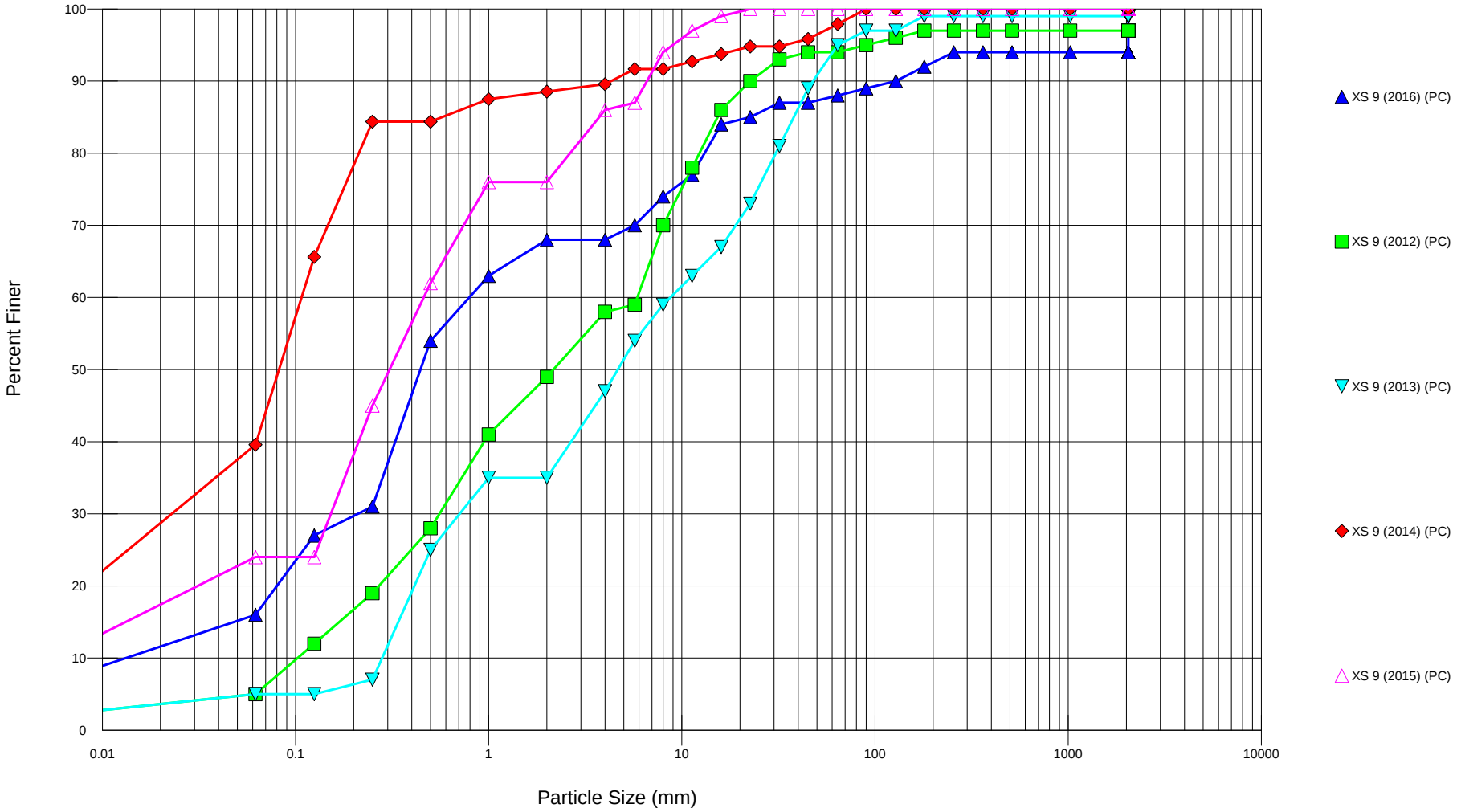
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 8 Riffle Station 29+35.63
D50: 0.39 mm
D84: 9.32 mm
D95: 64 mm



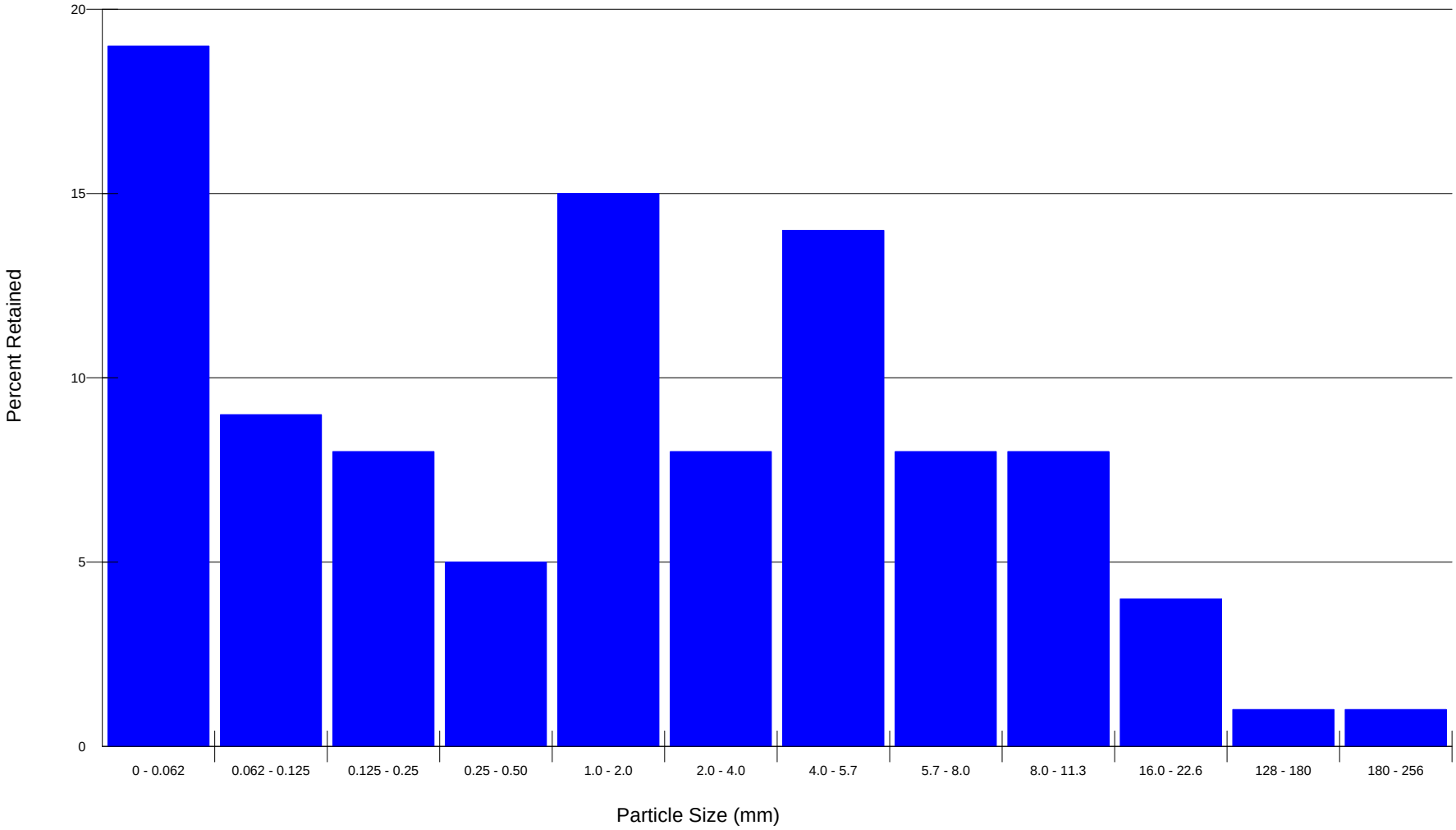
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 9 Riffle Station 29+57.75
D50: 0.46 mm
D84: 16 mm
D95: Bedrock



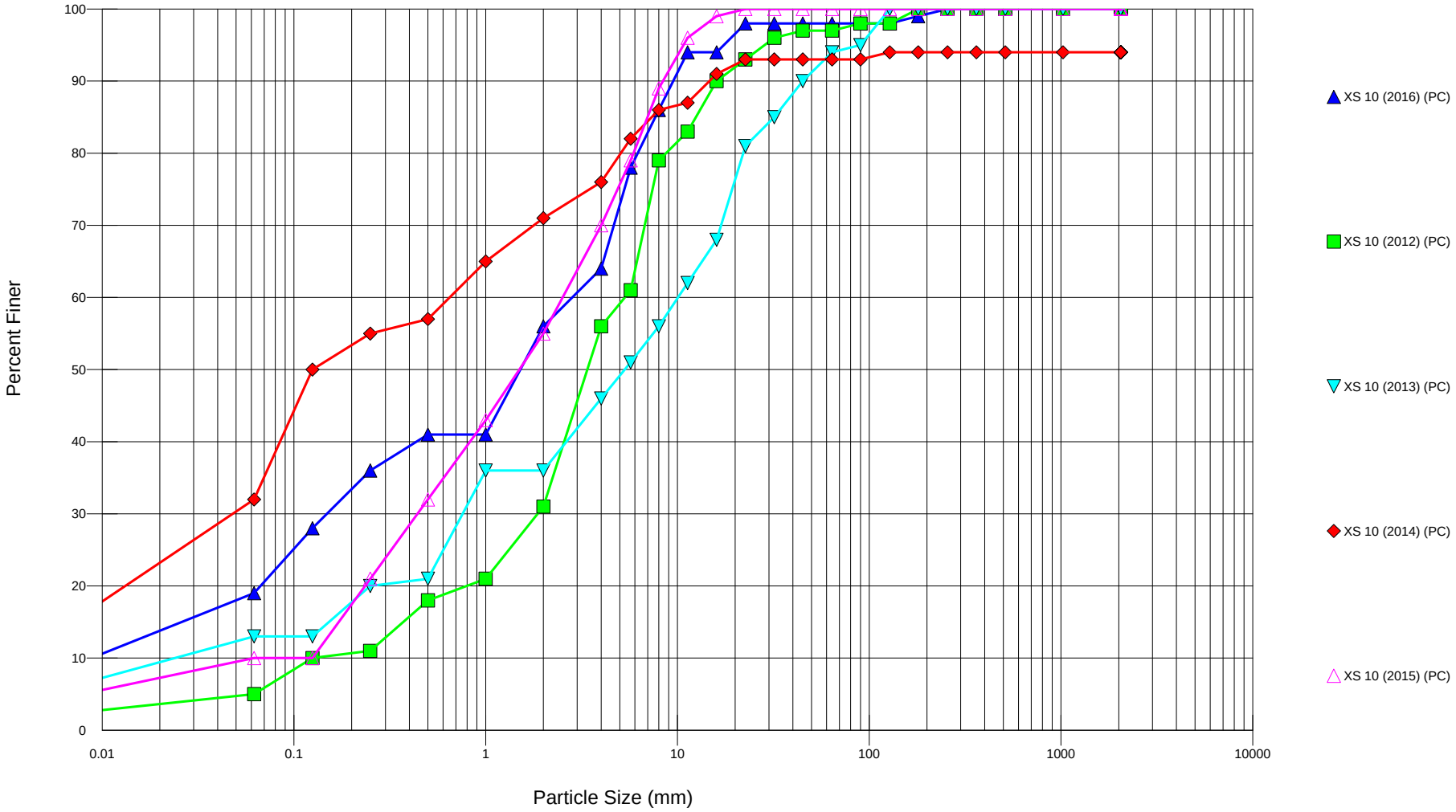
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 9 Riffle Station 29+57.75
D50: 0.46 mm
D84: 16 mm
D95: Bedrock



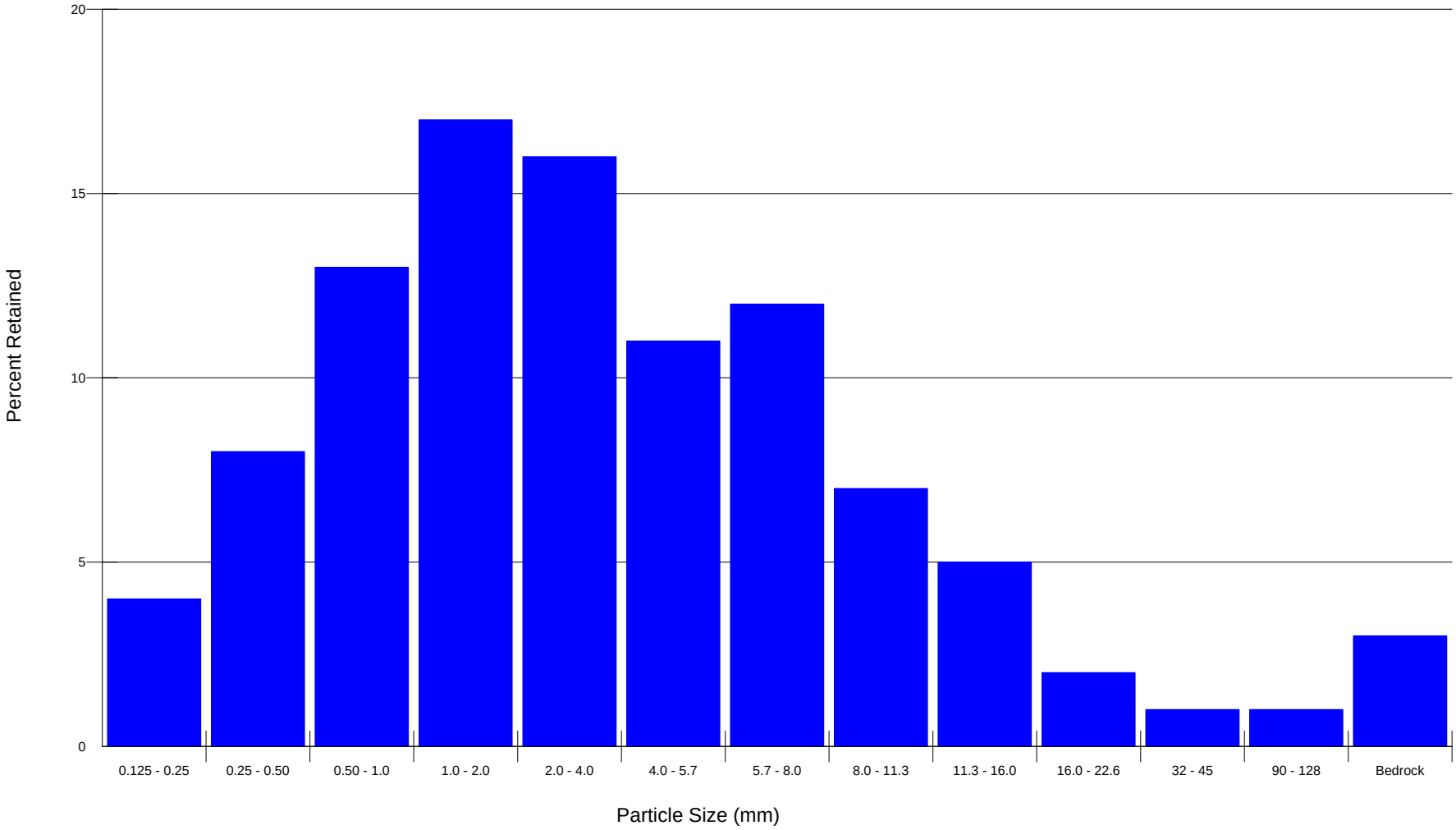
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 10 Riffle Station 30+56.75
D50: 1.6 mm
D84: 7.42 mm
D95: 17.65 mm



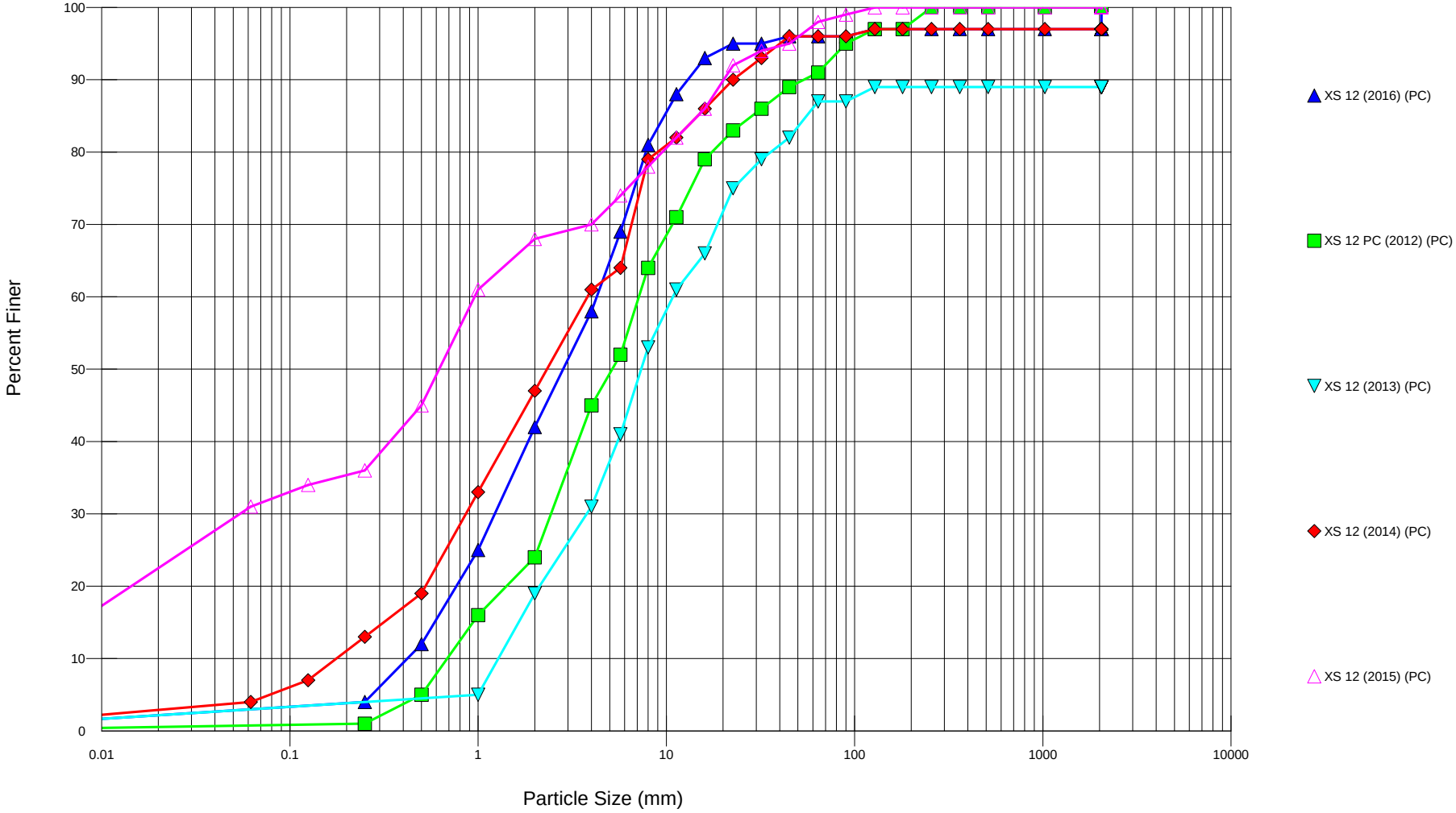
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 6, XS 10 Riffle Station 30+56.75
D50: 1.6 mm
D84: 7.42 mm
D95: 17.65 mm



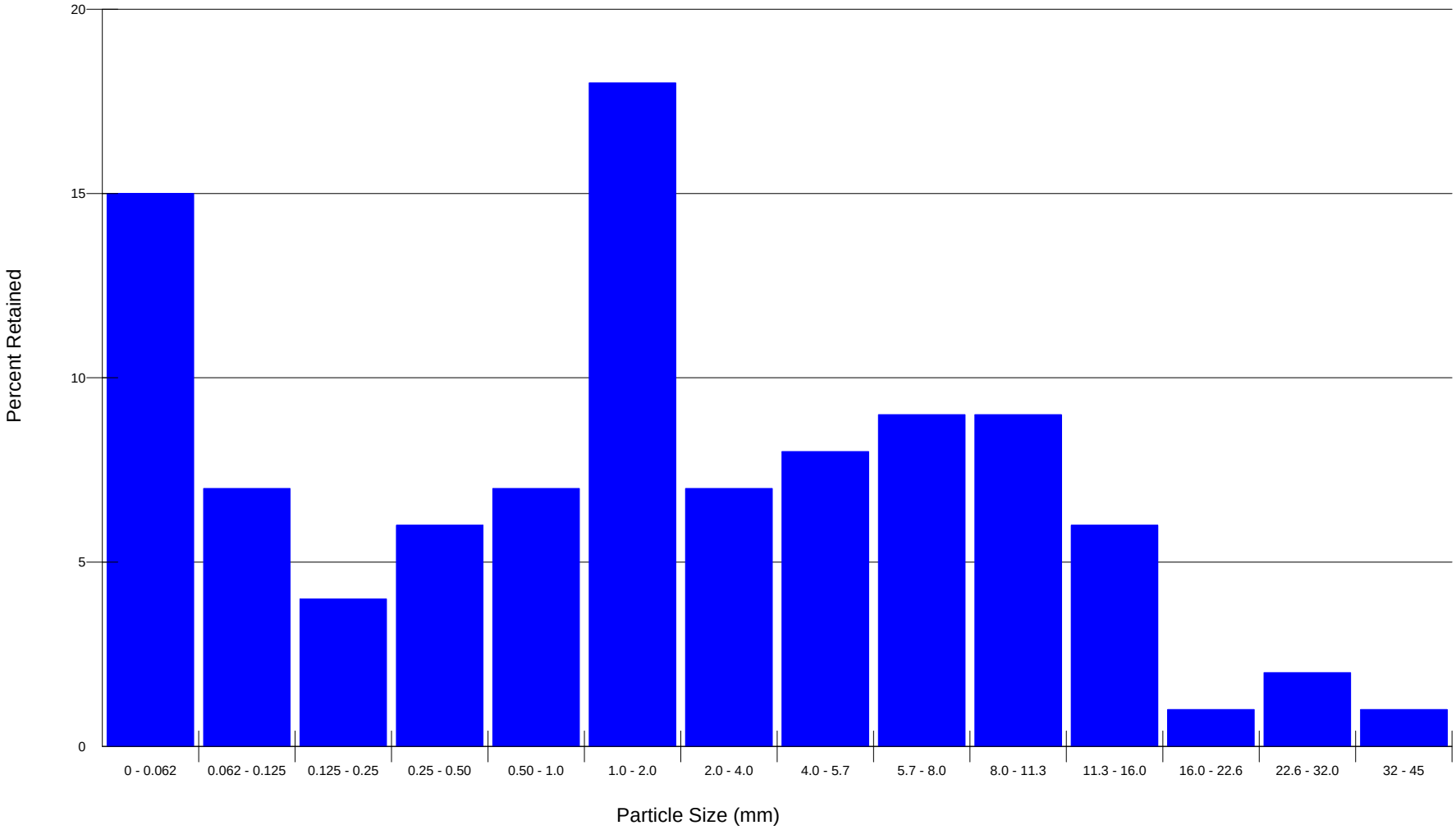
Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 12 Riffle Station 11+03.18
D50: 3 mm
D84: 9.41 mm
D95: 22.6 mm



Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 12 Riffle Station 11+03.18
D50: 3 mm
D84: 9.41 mm
D95: 22.6 mm



Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 14 Riffle Station 12+50.43
D50: 1.61 mm
D84: 9.1 mm
D95: 15.22 mm



Little Alamance Creek (Burlington Park) Stream Restoration
DMS No. 92372
Reach 2, XS 14 Riffle Station 12+50.43
D50: 1.61 mm
D84: 9.1 mm
D95: 15.22 mm

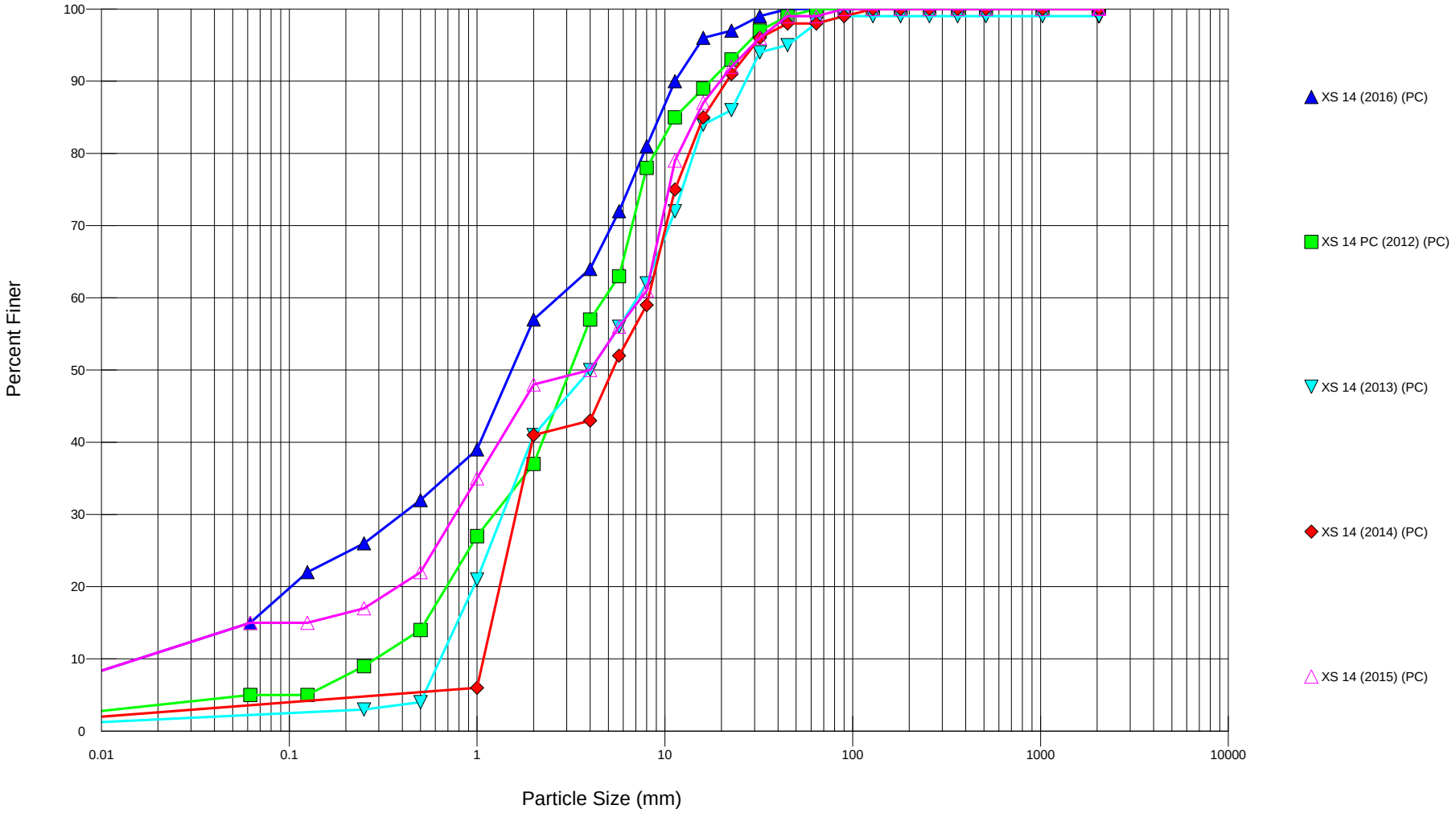


Table 9: Stream Bank Erosion Pin Data Table

Per discussions with NCDMS, bank pins are not required and therefore were not installed by EEE Consulting.

Table 10a. Baseline Stream Data Summary
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Mainstem (2275 lf)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					31.8	36.2		42.5				15.1						36.2		19.3	26.3		36.6		
Floodprone Width (ft)					70	94		120				30						>80		47.2	52.7		65.7		
Bankfull Mean Depth (ft)					2.2	2.6		2.9				1.6						2.6		2.09	2.53		3.08		
[1]Bankfull Max Depth (ft)					3.9	4		4.1				2.6						4		2.96	3.61		4.6		
Bankfull Cross Sectional Area (ft^2)					79.3	95		125				24.3						95		40.83	68.78		112.77		
Width/Depth Ratio					11.6	14		17				9.3						13.8		7.85	10.31		12.26		
Entrenchment Ratio					2.1	2.6		3.8				2						>2.2		1.645	2.079		2.488		
[1]Bank Height Ratio					1	1.2		1.4				1						1		0.32	0.66		0.83		
Profile																									
Riffle Length (ft)																				62	159.33	137.16	353.24	119.9	5
Riffle Slope (ft/ft)					0.0028	0.0126		0.0254									0.003	0.013	0.025	0.0001	0.003326	0.00345	0.00983	0.0033	5
Pool Length (ft)					107.9	293.7		505.4									107.9	293.7	505.4	37.58	99.32	90.19	182.26	44.37	14
Pool Max depth (ft)					5.5	6.1		6.9									5.5	6.1	6.9	3.03	4.4	4.525	5.91	0.8265	10
Pool Spacing (ft)					313.7	473.1		749.5									313.7	473.1	749.5	48.85	147.39	92.07	347.97	115.45	9
Pattern																									
Channel Beltwidth (ft)					33	70		255									33	70	255	87.3	233		462		
Radius of Curvature (ft)					45	115		220									45	115	220	51.2	118.8		280.7		
Rc:Bankfull width (ft/ft)					1.2	3.2		6.1									1.2	3.2	6.1	2	4.5		10.7		
Meander Wavelength (ft)					227	361		559									227	361	559	436.2	454.6		475.2		
Meander Width Ratio					0.9	1.9		7									0.9	1.9	7	7.7	17.3		24.1		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					30												30			0.26					
Max part size (mm) mobilized at bankfull					80															55.7					
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					C/E/5/1						C/E4						C 4/1			E4					
Bankfull Velocity (fps)					2.5												2.5								
Bankfull Discharge (cfs)					237.5																				
Valley length (ft)																									
Channel Thalweg length (ft)																				2968.4					
Sinuosity (ft)					1.2												1.2			1.2					
Water Surface Slope (Channel) (ft/ft)					0.0024												0.0024			0.0024					
BF slope (ft/ft)																				0.00258					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Unnamed Tributary (450 lf)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					10.9	12		13					15.1				10.9	12	13	9.86	9.89		9.91		
Floodprone Width (ft)					27	33.5		40					30				27	33.5	40	8.5	12.5		16.5		
Bankfull Mean Depth (ft)					1.1	1.3		1.5					1.6				1.1	1.3	1.5	0.86	1.27		1.67		
[1]Bankfull Max Depth (ft)					2	2		2.1					2.6				2	2	2.1	1.43	2.17		2.91		
Bankfull Cross Sectional Area (ft^2)					14.8	15.8		16.7					24.3				14.8	15.8	16.7	8.5	12.5		16.5		
Width/Depth Ratio					7.1	9.3		11.5					9.3				7.1	9.3	11.5	5.9	8.71		11.52		
Entrenchment Ratio					2.1	2.9		3.7					2				2.1	2.9	3.7	2.25	3.38		4.52		
[1]Bank Height Ratio					1	1.2		1.3					1					1		0.99	1.27		2.56		
Profile																									
Riffle Length (ft)																				26.98	41.87		59.91		
Riffle Slope (ft/ft)					0.0145	0.0252		0.0498									0.015	0.0252	0.05	0.0058	0.0104		0.0177		
Pool Length (ft)					4	18.2		163									4	18.2	163	12.96	28.2		60.96		
Pool Max depth (ft)						2.4												2.4		0.74	2.06		3.26		
Pool Spacing (ft)					23.4	34.1		54.8									23.4	34.1	54.8	12.52	30.1		60.61		
Pattern																									
Channel Beltwidth (ft)					13.5	24.6		33.7									13.5	24.6	33.7	5.5	10.39		18.97		
Radius of Curvature (ft)					15	29		55									15	29	55	5.22	15.81		31.25		
Rc:Bankfull width (ft/ft)					1.2	2.4		4.6									1.2	2.4	4.6	1.547	1.784		2.02		
Meander Wavelength (ft)					55.8	83.9		111.9									55.8	83.9	111.9	135.67	172.42		209.17		
Meander Width Ratio					4.7	7		9.3									4.7	7	9.3	0.556	1.051		1.918		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.71												0.71								
Max part size (mm) mobilized at bankfull					48																				
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					E4/1						C/E4						C4/1			E4					
Bankfull Velocity (fps)					4.4												4.4								
Bankfull Discharge (cfs)					68.7																				
Valley length (ft)																									
Channel Thalweg length (ft)																									
Sinuosity (ft)					1.1												1.1								
Water Surface Slope (Channel) (ft/ft)					0.0095												0.0095								
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Mainstem (2275 lf)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																												
[1]SC% / Sa% / G% / C% / B% / Be%																												
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.2	0.7	2.4	138	216																							
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																												
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																												

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Unnamed Tributary (450 lf)

Parameter	Pre-Existing Condition							Reference Reach(es) Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																												
[1]SC% / Sa% / G% / C% / B% / Be%																												
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)	0.2	0.5	3.4	19	53																							
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10																												
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0																												

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design survey), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-constrution distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section surveys and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Mainstem (2275 lf)

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	NAD 83 NC State Plane feet							NAD 83 NC State Plane feet							NAD 83 NC State Plane feet							NAD 83 NC State Plane feet							NAD 83 NC State Plane feet						
Bankfull Width (ft)	19.3	19.3	19.63	21.4	22.73	23.52		35.68	35.68	37.23	39.09	43.91	39.94		32.55	32.55	33.33	35.39	31.53	35.96		25.62	25.62	22.6	25.57	32.28	33.97		19.43	19.43	19.44	16.57	22.06	23.68	
Floodprone Width (ft)	48.01	48.01	45.1	51.7	51.5	51.91		73.15	73.2	73.27	73.2	72.64	68.15		65.21	65.21	65.18	65.2	65.2	64.48		47.46	47.46	43	39.5	61.28	63.47		47.21	47.21	44.04	36.08	50.98	51.08	
Bankfull Mean Depth (ft)	2.46	2.46	2.17	2.37	2.34	2.37		3.62	3.62	3.67	3.63	3.44	3.77		2.74	2.74	2.67	2.64	2.75	3.02		2.09	2.09	1.97	1.8	2.64	2.92		2.1	2.1	2.17	1.88	2.06	2.18	
Bankfull Max Depth (ft)	3.26	3.26	2.92	3.36	3.37	3.44		5.1	5.1	5.38	5.6	5.77	5.73		3.87	3.87	3.91	3.98	3.88	4.82		2.96	2.96	2.65	2.59	4.09	4.62		3.15	3.15	2.98	2.63	3.46	3.56	
Bankfull Cross Sectional Area (ft^2)	47.41	47.41	42.63	50.8	53.29	55.63		129	129	136.8	142.1	153.2	150.6		89.22	89.22	88.97	93.46	86.56	108.7		53.43	53.43	44.54	45.93	85.15	99.31		40.83	40.83	42.26	31.1	45.35	51.65	
Bankfull Width/Depth Ratio	7.85	7.85	9.05	9.04	9.71	9.92		9.86	9.86	10.14	10.77	12.58	10.59		11.88	11.88	12.48	13.41	11.47	10.36		12.26	12.26	11.47	14.21	12.23	11.63		9.25	9.25	8.96	8.81	10.71	10.86	
Bankfull Entrenchment Ratio	2.49	2.49	2.3	2.41	2.27	2.21		2.05	2.05	1.97	1.87	1.65	1.71		2	2	1.96	1.84	2.07	2.09		1.85	1.85	1.9	1.54	1.9	1.87		2.43	2.43	2.27	2.18	2.31	2.16	
Bankfull Bank Height Ratio	1.06	1.06	1.01	1.05	1.02	1		1	1	1	1.03	1	1		1	1	1	1	1	1		1.75	1.75	1.31	1.28	1.21	1.03		1	1	1	1	1	1	
Cross Sectional Area between end pins (ft^2)	176.8	176.8	172.2	174.8	171.9	170.5		257.2	257.2	267	250.4	265	263.8		159.1	159.1	158.4	158.5	169.7	175.8		219.1	219.1	207.7	210.7	230.2	231.3		141.3	141.3	138.7	135.3	135.9	136.3	
d50 (mm)	6.21	6.21	3.63	2.0	3.37	1.8		-	-	-	-	-	-		-	-	-	-	-	-		2.18	2.18	6.21	1.56	1.47	0.75		8.37	8.37	7.49	1.4	3.5	5.27	
	Cross Section 6 (Pool)							**Cross Section 7 (Pool)**							**Cross Section 8 (Riffle)**							**Cross Section 9 (Riffle)**							**Cross Section 10 (Riffle)**						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	NAD 83 NC State Plane feet							NAD 83 NC State Plane feet							NAD 83 NC State Plane feet							NAD 83 NC State Plane feet							NAD 83 NC State Plane feet						
Bankfull Width (ft)	36.6	36.6	40.9	40.98	39.35	41.71		31.31	31.31	33.33	31.76	30.68	32.71		34.88	34.88	36.62	38.12	26.99	34.6		21.79	21.79	25.66	23.84	23.19	24.15		30.6	30.6	34.3	32.4	29.14	30.81	
Floodprone Width (ft)	60.21	60.21	60.42	60.2	60.23	60.15		56.8	56.8	58.36	58.4	54.58	59.26		65.72	65.72	65.79	65.8	48.2	65.64		47.34	47.34	52.87	49.87	48.51	52.44		48.37	48.37	48.37	48.4	48.24	48.51	
Bankfull Mean Depth (ft)	3.08	3.08	4.25	4.29	3.49	4.22		3.15	3.15	3.47	3.61	3.12	3.65		3.08	3.08	3.08	3.18	2.02	3.1		2.34	2.34	2.45	2.43	2.33	2.67		2.25	2.25	2.72	3.06	2.11	2.71	
Bankfull Max Depth (ft)	4.6	4.6	6.19	6.23	5.31	6.25		4.21	4.21	4.65	4.73	4.28	4.67		4.6	4.6	4.82	5.23	2.82	4.86		3.11	3.11	3.51	3.33	3.2	3.54		3.81	3.81	4.72	4.72	3.85	4.38	
Bankfull Cross Sectional Area (ft^2)	112.8	112.8	174.2	174.9	137.5	175.9		98.77	98.77	115.8	114.9	95.72	119.43		107.3	107.3	112.6	121.4	54.48	107.3		50.91	50.91	62.79	57.88	53.97	64.56		68.86	68.86	93.13	99.06	61.59	83.58	
Bankfull Width/Depth Ratio	11.88	11.88	9.64	9.55	11.28	9.88		9.94	9.94	9.61	8.8	9.83	8.96		11.32	11.32	11.89	11.99	13.36	11.16		9.31	9.31	10.47	9.81	9.95	9.04		13.6	13.6	12.61	10.59	13.81	11.37	
Bankfull Entrenchment Ratio	1.65	1.65	1.48	1.47	1.53	1.44		1.81	1.81	1.75	1.84	1.78	1.81		1.88	1.88	1.8	1.73	1.79	1.9		2.17	2.17	2.06	2.09	2.09	2.17		1.58	1.58	1.41	1.49	1.66	1.57	
Bankfull Bank Height Ratio	1.38	1.38	1	1.1	1	1		1.06	1.06	1	1	1	1		1.02	1.02	1	1	1	1		1	1	1	1	1	1.1		1.28	1.28	1	1.1	1	1	
Cross Sectional Area between end pins (ft^2)	295	295	292.9	285.7	277.2	267.3		210.6	210.6	197.4	200.6	200.6	206.9		271.4	271.4	248.8	262.1	262.2	259		245.3	245.3	229.9	235.3	237.7	241.7		162.4	162.4	166.5	160.4	140.7	155.5	
d50 (mm)	-	-	-	-	-	-		-	-	-	-	-	-		5.7	5.7	3.73	0.18	0.28	0.39		2.22	2.22	4.73	0.09	0.32	0.46		3.52	3.52	5.36	0.13	1.58	1.6	

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Unnamed Tributary (450 lf)

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	NAD 83 NC State Plane feet							NAD 83 State Plane feet							NAD 83 State Plane feet							NAD 83 State Plane feet						
Bankfull Width (ft)	15.57	15.57	19.85	19.4	18.88	19.52		9.91	9.91	10.26	10.17	13.94	12.34		9.86	9.86	10.49	12.48	13.13	14.26		10.08	10.08	9.16	12.13	14.76	10.55	
Floodprone Width (ft)	24.74	24.74	41.54	39.5	33.5	37.91		22.32	22.32	22.38	22.57	29.3	25.99		44.52	44.52	46.56	46.74	50.02	49.31		36.5	36.2	37.12	37.8	37.69	37.42	
Bankfull Mean Depth (ft)	0.69	0.69	1.38	1.4	1.16	1.34		0.86	0.86	0.83	0.91	0.93	0.9		1.67	1.67	1.61	1.55	1.44	1.37		1.52	1.52	1.64	1.67	1.48	1.72	
Bankfull Max Depth (ft)	1.7	1.7	2.78	2.66	2.2	2.49		1.43	1.43	1.54	1.41	1.89	1.7		2.91	2.91	3.03	3.03	3.18	3.03		2.46	2.46	2.71	2.93	2.96	2.73	
Bankfull Cross Sectional Area (ft^2)	10.73	10.73	27.45	27.17	21.89	26.25		8.5	8.5	8.5	9.22	12.93	11.16		16.5	16.5	16.85	19.32	18.97	19.49		15.37	15.37	15	20.31	21.81	18.16	
Bankfull Width/Depth Ratio	22.57	22.57	14.38	13.88	16.28	14.57		11.52	11.52	12.36	11.18	14.99	13.71		5.9	5.9	6.52	8.05	9.12	10.41		6.63	6.63	5.59	7.26	9.97	6.13	
Bankfull Entrenchment Ratio	1.59	1.59	2.09	2.03	1.77	1.94		2.25	2.25	2.18	2.22	2.1	2.11		4.51	4.51	4.44	3.75	3.81	3.46		3.59	3.59	4.05	3.12	2.55	3.55	
Bankfull Bank Height Ratio	1	1	1	1	1	1		1	1	1	1	1	1		1	1	1	1	1	1		1.19	1.19	1.1	1	1	1	
Cross Sectional Area between end pins (ft^2)	113.4	113.4	110.8	112.4	114.3	111.6		76.3	76.3	74.7	77.4	80.3	82.9		133.6	133.6	129.9	130.4	135.9	142.6		60.3	60.3	54.3	54.4	54.6	61.8	
d50 (mm)	-	-	-	-	-	-		5.21	5.21	7.42	2.43	0.66	3		-	-	-	-	-	-		3.3	3.3	4.0	5.32	4	1.61	

1 = Widths and depths for monitoring resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Mainstem (2275 lf)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	19.3	26.3	23.71	36.6	6.7	6	19.3	26.3	23.71	36.6	6.7	6	19.4	26.4	24.13	36.62	7.4	6	16.57	26.32	24.71	38.12	7.8	6	22.06	25.52	23.63	32.28	3.62	6	23.52	28.45	27.5	34.6	5.28	6
Floodprone Width (ft)	47.2	52.7	47.74	65.7	7.8	6	47.2	52.7	47.74	65.7	7.8	6	43	49.86	46.74	65.8	8.6	6	36.08	45.56	49.14	65.8	10.5	6	48.2	51.89	49.75	61.28	4.7	6	48.5	55.5	52.17	65.6	7.16	6
Bankfull Mean Depth (ft)	2.09	2.53	2.3	3.08	0.36	6	2.09	2.53	2.3	3.08	0.36	6	1.97	2.43	2.31	3.08	0.41	6	1.8	2.45	2.4	3.18	0.58	6	2	2.25	2.2	2.64	0.24	6	2.18	2.65	2.69	3.1	0.34	6
[1]Bankfull Max Depth (ft)	2.96	3.61	3.19	4.6	0.64	6	2.96	3.61	3.19	4.6	0.64	6	2.65	3.6	3.245	4.82	0.94	6	2.59	3.64	3.35	5.23	1.1	6	2.82	3.48	3.55	4.09	0.4	6	3.44	4.06	3.97	4.86	0.63	6
Bankfull Cross Sectional Area (ft^2)	40.83	68.78	52.17	112.77	24.7	6	40.83	68.78	52.17	112.77	24.7	6	42.26	66.34	53.665	112.64	29.9	6	31.1	67.69	54.34	121.36	34.8	6	45.35	59.11	55.43	85.15	13.59	6	51.65	77.01	74.07	107.33	23.3	6
Width/Depth Ratio	7.85	10.31	10.32	12.26	2.4	6	7.85	10.31	10.32	12.26	2.4	6	8.96	10.74	10.97	12.61	1.5	6	8.81	10.74	10.2	14.2	2.1	6	9.74	11.69	11.47	14.16	1.68	6	9.04	10.6	11.01	11.63	0.99	6
Entrenchment Ratio	1.645	2.079	2.02	2.488	0.37	6	1.645	2.079	2.02	2.488	0.37	6	1.41	1.96	1.98	2.3	0.33	6	1.49	1.91	1.91	2.4	0.4	6	1.7	2	2	2.31	0.25	6	1.57	1.98	2.03	2.21	0.248	6
[1]Bank Height Ratio	0.99	1	1	1.01	0.006	6	0.99	1	1	1.01	0.006	6	0.98	0.995	0.992	1.00	0.006	6	1	1.07	1.03	1.28	0.1	6	1	1.04	1	1.21	0.084	6	1	1.02	1	1.1	0.04	6
Profile																																				
Riffle Length (ft)	62	159.33	137.16	353.24	119.9	5	62	159.33	137.16	353.24	119.9	5	26.55	52.64	42.12	101.02	29.9	5	37.37	97.15	96.3	209.34	70.18	5	22.48	90.74	79.63	208.67	70.17	5	77.33	120.16	93.2	200.27	51.9	5
Riffle Slope (ft/ft)	0.0001	0.003326	0.00345	0.00983	0.0033	5	0.0001	0.003326	0.00345	0.00983	0.0033	5	0.00389	0.0116	0.0133	0.018	0.007	5	0.00080	0.00516	0.0068	0.01095	0.0036	5	0.00781	0.01606	0.0139	0.03425	0.0105	5	0.0112	0.01625	0.0114	0.03437	0.01	5
Pool Length (ft)	37.58	99.32	90.19	182.26	44.37	14	37.58	99.32	90.19	182.26	44.37	14	24.23	124.2	132.17	217.92	55.56	14	46.9	102.84	81.03	217.65	58.7	14	23.01	69.84	62.32	124.62	28.84	14	34.29	77.95	74.29	120.01	25.04	14
Pool Max depth (ft)	3.03	4.4	4.525	5.91	0.8265	14	3.03	4.4	4.525	5.91	0.8265	14	1.3	2.45	2.63	3.21	0.963	14	1.65	2.72	2.59	3.76	0.573	14	1.7	2.65	2.68	3.44	0.484	14	4.55	5.94	6.26	7.55	0.761	14
Pool Spacing (ft)	48.85	147.39	92.07	347.97	115.45	9	48.85	147.39	92.07	347.97	115.45	9	31.69	86.5	69.97	214.55	58.43	9	14.24	71.27	40.31	167.91	54.02	9	49.82	184.67	155.21	327.66	83.26	9	91.44	133.52	140.96	302.88	71.23	9
Pattern																																				
Channel Beltwidth (ft)	87.3	233		462																																
Radius of Curvature (ft)	51.2	118.8		280.7																																
Rc:Bankfull width (ft/ft)	2	4.5		10.7																																
Meander Wavelength (ft)	436.2	454.6		475.2																																
Meander Width Ratio	7.7	17.3		24.1																																

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	E4						E4						E4						E4						E4						E4					
Channel Thalweg length (ft)	2673						2673						2673						2673						2673						2673					
Sinuosity (ft)	1.6						1.6						1.6						1.6						1.6						1.6					
Water Surface Slope (Channel) (ft/ft)	0.00242						0.00242						0.00248						0.00248						0.00248						0.00248					
BF slope (ft/ft)	0.00237						0.00237						0.00238						0.00239						0.00239						0.00239					
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Little Alamance Creek (Burlington Park) Stream Restoration/DMS Number (92372) Unnamed Tributary (450 lf)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	9.86	9.89		9.91			9.86	9.89		9.91			9.16	9.71		10.26			10.17	11.15		12.13			12.32	12.64		12.95			10.55	11.44		12.34		
Floodprone Width (ft)	8.5	12.5		16.5			8.5	12.5		16.5			22.38	29.75		37.12			22.57	30.185		37.8			26.7	32.17		37.63			25.99	31.71		37.42		
Bankfull Mean Depth (ft)	0.86	1.27		1.67			0.86	1.27		1.67			0.83	1.24		1.64			0.91	1.29		1.67			0.87	1.19		1.51			0.9	1.31		1.72		
[1]Bankfull Max Depth (ft)	1.43	2.17		2.91			1.43	2.17		2.91			1.54	2.13		2.17			1.41	2.17		2.93			1.77	2.24		2.72			1.7	2.22		2.73		
Bankfull Cross Sectional Area (ft^2)	8.5	12.5		16.5			8.5	12.5		16.5			5.33	9.18		12.36			9.22	14.765		20.31			11.31	14.94		18.57			11.16	14.66		18.16		
Width/Depth Ratio	5.9	8.71		11.5			5.9	8.71		11.5			4.05	8.21		12.36			7.26	9.22		11.18			8.16	11.53		14.89			6.13	9.92		13.71		
Entrenchment Ratio	2.25	3.38		4.52			2.25	3.38		4.52			1.1	1.64		2.18			2.22	2.67		3.12			2.06	2.56		3.06			2.11	2.83		3.55		
[1]Bank Height Ratio	0.99	1.27		2.56			1	1.27		2.56			1	1.29		1.6			1	1		1			1	1		1			1	1		1		
Profile																																				
Riffle Length (ft)	27	41.9		59.9			27	41.9		59.9			15.83	29.07		61.12			14.82	34.85		54.87			13.3	30.09		46.8			15.83	38		56.72		
Riffle Slope (ft/ft)	0.01	0.01		0.02			0.01	0.01		0.02			0.003	0.022		0.046			0.011	0.022		0.034			0.0253	0.03101		0.03674			0.009	0.016		0.0243		
Pool Length (ft)	13	28.2		61			13	28.2		61			8.2	16.84		23.12			11.04	24.13		37.21			9.5	16.15		22.81			10.88	18.63		25.06		
Pool Max depth (ft)	0.74	2.06		3.26			0.74	2.06		3.26			0.63	1.33		2.22			1.08	1.25		1.41			0.65	1.3		1.95			2.49	3.07		3.54		
Pool Spacing (ft)	12.5	30.1		60.6			12.5	30.1		60.6			12.03	14.78		14.88			13.41	27.86		42.32			24.7	29.93		35.13			17.48	32.97		48.47		
Pattern																																				
Channel Beltwidth (ft)	5.5	10.4		19																																
Radius of Curvature (ft)	5.22	15.8		31.3																																
Rc:Bankfull width (ft/ft)	1.55	1.78		2.02																																
Meander Wavelength (ft)	136	172		209																																
Meander Width Ratio	0.56	1.05		1.92																																

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Additional Reach Parameters																																				
Rosgen Classification	E 4						E 4						E 4						E 4						E 4						E 4					
Channel Thalweg length (ft)	426						426						426						426						426						426					
Sinuosity (ft)	1.02						1.02						1.02						1.02						1.02						1.02					
Water Surface Slope (Channel) (ft/ft)	0.00758						0.00758						0.00766						0.00755						0.00755						0.00755					
BF slope (ft/ft)	0.00728						0.00728						0.00754						0.00766						0.00766						0.00766					
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
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1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.
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4. = Of value/needed only if the n exceeds 3

Appendix E:
Hydrologic Data

Table 12: Verification of Bankfull Events
Figure 9: Monthly Rainfall Data

Crest gauges were installed during MY1 field work. In July of MY2, there was a short period of several heavy rainfall events. As a result, Little Alamance Creek flooded, overtopping the crest gauge, such that the gauge did not accurately record the flood event. In MY3 and MY4, the mainstem experienced flooding that overtopped the crest gauge. The UT gauge did collect reportable data (Table 12). In MY5 both the mainstem and the UT experienced a severe flood event that overtopped the crest gauges. This event damaged park equipment and vegetation throughout the easement. Photographs of MY2 and MY5 storm events are shown below.

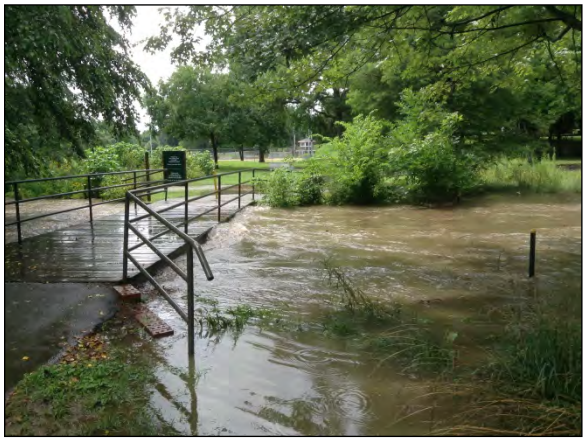
Table 12. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Stream ID	Crest Gauge Heights (Above Bankfull)
6/3/2013	6/3/2013	Photos*	Little Alamance Creek	N/A
6/3/2013	6/3/2013	Photos*	Unnamed Tributary	N/A
9/29/2014	Unknown	Crest Gauge	Little Alamance Creek	>4 ft (>2.55) ft
9/29/2014	Unknown	Crest Gauge	Unnamed Tributary	3.35 ft (1.9) ft
4/10/2015	Unknown	Crest Gauge	Little Alamance Creek	>4 ft (>2.55) ft
4/10/2015	Unknown	Crest Gauge	Unnamed Tributary	2.8 ft (2.52) ft
9/25/2015	Unknown	Crest Gauge	Little Alamance Creek	2.2 ft (0.76) ft
9/25/2015	Unknown	Crest Gauge	Unnamed Tributary	3.3 ft (3.01) ft
10/5/2016	Unknown	Photos*	Little Alamance Creek	>4 ft (>2.55) ft
10/5/2016	Unknown	Photos*	Unnamed Tributary	>4 ft (>2.55) ft

***** Refers to photographs of the July 2013 and the 2016 storm events shown at the beginning of Appendix E.

July 2013 Storm Event

View of Rail Road at PS1
July 3, 2013



Bridge at XS 5
July 3, 2013

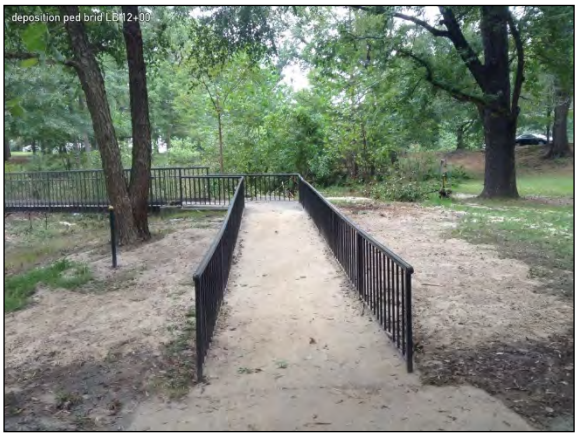
View of water gauge on main tributary
July 3, 2013

View of Bridge at XS 4
July 3, 2013

View from XS 7
July 3, 2013

View from PS 2, level spreader
July 3, 2013

2016 Storm Event



Alluvial deposition from flooding on the pedestrian bridge at XS1.

Wrack line from flooding on picnic tables near VP5. Tables were moved by flood waters.

Wrack line and debris from flooding including a picnic table at the train bridge closest to VP5.

Damage to train garage from debris in flash flood event.

Wrack line and debris from flooding on baseball field near VP8.

Damage to birdhouse and vegetation from flood event at XS3.

Crest Gauge Photographs

Crest gauge, main stem. Cork overtopped gauge.
September 29, 2014

Crest gauge, UT. Cork at 3.35 ft.
September 29, 2014

Crest gauge, main stem. Cork overtopped gauge.
April 10, 2015

Crest gauge, UT. Cork at 2.8 ft.
April 10, 2015

Crest gauge, main stem. Cork at 2.2 ft.
September 25, 2015

Crest gauge, main stem. Cork at 3.3 ft.
September 25, 2015

Crest gauge, main stem. Cork overtopped gauge. October 5, 2016

Crest gauge, UT. Cork overtopped gauge. October 5, 2016

Figure 9: Monthly Rainfall Data