Coddle Creek Tributary
(Indian Run) Stream Restoration
EEP Project # 94
DENR Contract # 5360

Annual Monitoring Report Year 5 of 5
Cabarrus County, North Carolina

Prepared for:

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

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Report Submission: January 2017

Prepared by:

SEPI Engineering and Construction
1025 Wade Avenue
Raleigh, NC 27605

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1.0 EXECUTIVE SUMMARY

The Coddle Creek Tributary (Indian Run) Stream Restoration Project, completed in March 2011, enhanced (level 1) or restored a total of 2,270 linear feet of stream in the Upper Rocky River watershed including restoring 6.17 acres of riparian buffer. In addition, approximately 1,540 linear feet of stream was preserved within the 19.61 acre conservation easement. The project is located in the USGS Hydrologic Unit (HU) 03040105020010 of the Yadkin Pee-Dee River Basin. This HU is within the Division of Mitigation Service's (DMS) Upper Rocky River Local Watershed Plan and is also listed as a Targeted Local Watershed (TLW) in DMS's Lower Yadkin Pee-Dee River Basin Restoration Priorities Plan 2009. The project site, which is protected by a 19.61-acre permanent conservation easement held by the State of North Carolina, is situated in Cabarrus County in the Southern Outer Piedmont ecoregion of the Piedmont physiographic province. Coddle Creek, from 0.2 miles upstream of NC Highway 73 (NC-73) to Rocky River, is currently listed on the NC 303(d) List as impaired due to turbidity (NCDENR 2012). In addition to the current non-supporting use classification for the lower portions of Coddle Creek, anticipated high rates of development in the watershed pose critical challenges in managing the region's aquatic resources. The project goals and objectives are listed below.

Project Goals

- Improve local water quality by reestablishing stream stability and capacity to transport watershed flows and sediment load.
- Provide additional floodplain storage by increasing the capacity of the stream to mitigate flood flows.
- Restore aquatic and riparian habitat.
- Reducing non-point source sedimentation and nutrient inputs into the project reaches.

Project Objectives

- Restore/Enhance (level 1) 2,270 linear feet of stable stream channel morphology, supported by instream habitat and grade/bank stabilization structures.
- Preserve 1540 linear feet of stream within the conservation easement.
- Eliminate accelerated bank erosion by creating a bankfull bench, floodplain, and laying back slopes.
- Reestablish a native riparian buffer.

Vegetation Assessment

The vegetative success of the restoration site is based on criteria established in the USACE Stream Mitigation Guidelines (2003). Vegetation monitoring will be considered successful if a minimum of 260 planted stems/acre are surviving at the end of five years. The interim measure of vegetative success for the site will be the survival of a minimum of 320 planted stems/acre in year three and 288 stems/acre at the end of year four. The Monitoring Year 5 (MY5) stem counts are located in Tables 7 and 9 in Appendix C. Currently, only Vegetation Plot 8, which contains 202 stems per acre, is not meeting the year 5 success criteria (260 stems/acre). However, when including volunteer stems, Plot 8 exceeds the success criteria. Vegetation throughout the reach appears to be growing at acceptable rates and the mortality rate appears to be fairly low. Areas noted in previous monitoring years as having sparse vegetation or being bare now include herbaceous plants and small woody stems. The MY0 through MY5 stem counts Annual Means are located in Table 9a in Appendix C.

Cattails (*Typha latifolia*) growth has notably decreased throughout both reaches. Only one area of cattails was noted during monitoring in the Lower Reach at 10+60 to 10+78. The location of the cattails are noted on the Current Conditions Plan View (CCPV) and represent approximately 18 linear feet of the reach or 1% of the total reach. Other invasive plant species noted include kudzu vine (*Pueraria lobata*) and mimosa (*Albizia julibrissin*). The areas of kudzu and mimosa are too small to map. A DMS invasive species contractor will be treating the site in 2017 prior to project closeout. No new easement encroachments were noted.

Stream Assessment

The upper and lower reaches of the restoration project were observed to be in stable condition and the channel's profile and cross-sections adjusted minimally from the baseline conditions. The channel accesses its floodplain and evidence of bankfull events were observed during Year 5 monitoring. This evidence included the presence of wrack lines, sediment deposits, and a crest gauge reading of 6.5" above bankfull. There were at least 6 bankfull events between MY1 and MY5. Bankfull events were evidenced by crest gauge data in each of the 5 monitoring years with an additional bankfull event occurring between 9/22/2015 and 6/23/2016. The project site meets the hydrology success criteria of at least two bankfull events occurring in separate years. The substrate continues to show a gradual change to more coarse material in both reaches with the exception of Cross Section 8 which showed a decrease in material size. Minor channel adjustments in the form of bank erosion, bare banks and channel vegetation were observed in the Lower Reach and are most likely due to the backwater effect of the beaver dams observed at Sta. 10+75 and 14+04. The bare bank area is located from Sta. 14+04 to 14+49. The relict beaver lodge is still present outside of the channel at Sta. 14+04. Both beaver dams were removed in June and October, 2016, respectively. A beaver dam in the Upper Reach was observed at Sta. 26+60 in May 2016. The dam was subsequently removed in June 2016. No direct effects from the beaver dam were observed in the Upper Reach.

Two areas of bar formation encountered in MY04 at Sta. 25+29 to 25+62 and Sta. 22+75 were still present. The bar formation at Sta. 26+50 to 26+67 on the upper reach in MY04 was not present this monitoring year. Areas of bank erosion noted in previous monitoring reports were stable this year and will continue to be monitored. The terrace rill at approximately Sta. 18+00 on the left bank of the upper reach was noted in the Monitoring Year 1 report is still stable. The headcut at Sta. 17+75 on the lower reach is also stable. The beaver dams identified in the MY5 2016 Site Assessment Report and located at Sta. 26+00 (Upper Reach), and Sta. 10+75 (Lower Reach) have since been removed by the USDA Animal and Plant Health Inspection Service (USDA-APHIS). All problem areas are noted on the CCPV sheets in Appendix B. USDA-APHIS is continuing its monthly inspection schedule for beaver and beaver dam removal for this project.

Pebble count data for the cross sections indicate similar or coarser values compared to baseline except in Cross Section 8. This indicates a good movement of material at least in the upstream parts of the upper reach. The smaller particle size at cross section 8 may be an effect from the upstream beaver dam which was removed this monitoring year. It will take longer for coarser material to progress to the lower reach from upstream areas. Since the cross section dimensions have remained relatively the same for the lower reach, the sections are stable despite the smaller bed material.

Summary information/data related to the occurrence of items such as beaver or 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 documentation formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the

Mitigation Plan (formerly the Restoration Plan) documents available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

2.0 METHODOLOGY

The following methods were utilized during the Year 5 monitoring for data collection and post-processing:

- Geomorphic topographic data collections were performed in the field using a survey grade GPS such that each survey point has three-dimensional coordinates, and is georeferenced (NAD83-State Plane Feet – FIPS3200).
- Longitudinal stationing was developed using the as-built survey thalweg as a baseline.
- The particle size distribution protocol used was the Modified-Wolman pebble count.
- The CVS Level 2 methodology was utilized for the vegetation plot data collection.

3.0 REFERENCES

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HDR Engineering, Inc. 2009. Indian Run Stream Restoration Final Plans (90%).

HDR Engineering, Inc. 2011. Baseline Monitoring and As Built Baseline Report.

HDR Engineering, Inc. 2012. Monitoring Report Year 1 of 5.

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. (http://cvs.bio.unc.edu/methods.htm)

North Carolina Ecosystem Enhancement Program. 2011. Procedure Guidance and Content Requirements for EEP Monitoring Reports. Version 1.4 (http://www.nceep.net/business/EEP_Mon_Rep_Temp_1.3_01-15-10.pdf)

SEPI Engineering & Construction, Inc. 2013. Coddle Creek Tributary (Indian Run) Annual Monitoring Report Year 2 of 5.

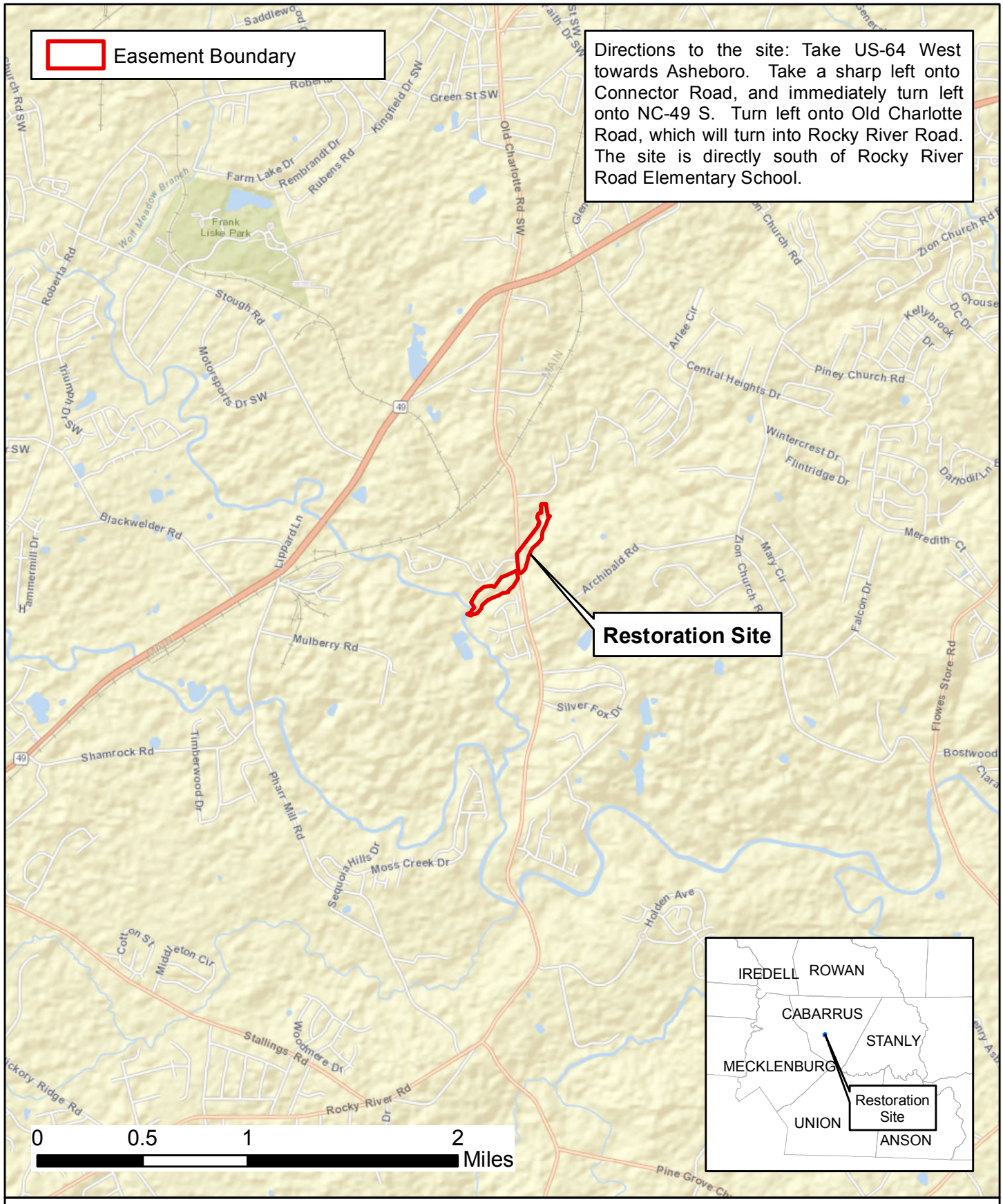
SEPI Engineering & Construction, Inc. 2014. Coddle Creek Tributary (Indian Run) Annual Monitoring Report Year 3 of 5.

SEPI Engineering & Construction, Inc. 2015. Coddle Creek Tributary (Indian Run) Annual Monitoring Report Year 4 of 5.

U.S. Army Corps of Engineers, Wilmington District. 2003. Stream Mitigation Guidelines. North Carolina Division of Water Quality (DWQ), U.S. Environmental Protection Agency, Region IV (EPA), Natural Resources Conservation Service (NRCS) and the North Carolina Wildlife Resources Commission (WRC).

Appendix A

Project Vicinity Map and Background Tables



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Restoration Site Vicinity

Coddle Creek Tributary (Indian Run)
Monitoring Year 5 Cabarrus County, NC
January 2017 Project # 94 Figure 1

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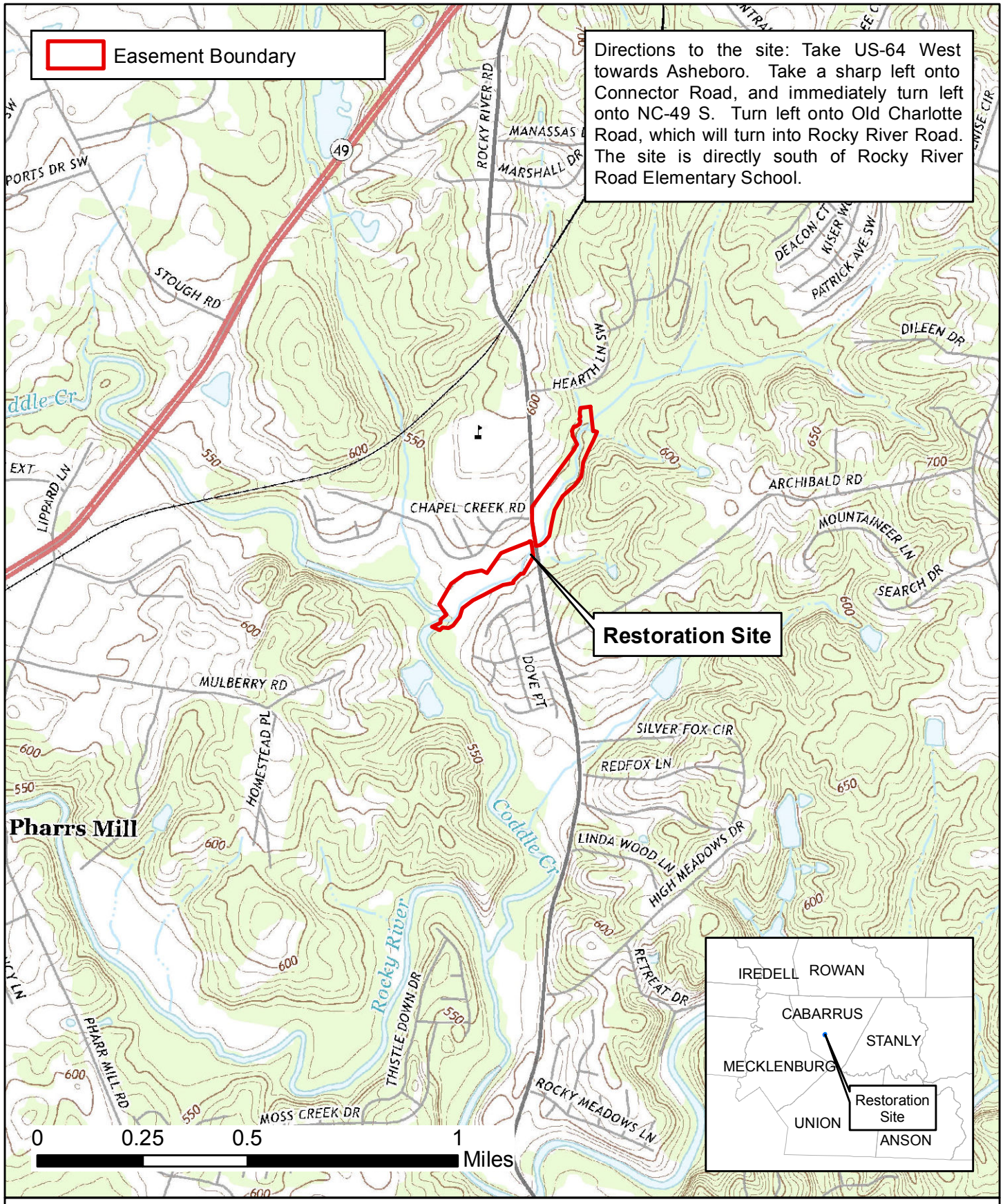

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USGS Concord SE Quadrangle, 2013

Coddle Creek Tributary (Indian Run)
Monitoring Year 5 Cabarrus County, NC
January 2017 Project # 94 Figure 2

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Table 1a. Project Components									
Coddle Creek Tributary (Indian Run) / 94									
Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements	Comment
Reach 1 - Upper	1275 lf	E (Level 1)	P3	1275 lf	15+00-26+26 & 26+46-27+95	1.5:1	850		Restored bankfull dimension within the existing channel, utilized a partial floodplain bench to restore floodprone conditions, and enhanced existing pattern and profile.
Reach 1 - Upper	20 lf	E (Level 1)	P3	20 lf	26+26-26+46	3:1	7		Restored bankfull dimension within the existing channel, utilized a partial floodplain bench to restore floodprone conditions, and enhanced existing pattern and profile.
Reach 1 - Upper	415 lf	P		415 lf	07+52-09+10 & 09+34-11+72 & 14+45-14+64	10:1	42		Preserved channel in its existing condition within the conservation easement.
Reach 1 - Upper	327 lf	P		297 lf*	09+10-9+34 & 11+72-14+45	20:1	15		Preserved channel in its existing condition within the utility easement. *30 feet of sanitary sewer easement will not receive mitigation credits
Reach 2 - Lower	735 lf	R	P2	975 lf	10+00-19+75	1:1	975		Fully restored pattern, dimension and profile, excavated a new channel within an adjoining floodplain bench to restore floodplain conditions.
Reach 2 - Lower	434 lf	P		434 lf	21+72-23+58 & 24+45-26+93	20:1	22		Preserved channel in its existing condition within the utility easement.
Reach 2 - Lower	394 lf	P		394 lf	19+75-21+72 & 23+58-24+45 & 26+93-28+03	10:1	39		Preserved channel in its existing condition within the conservation easement.

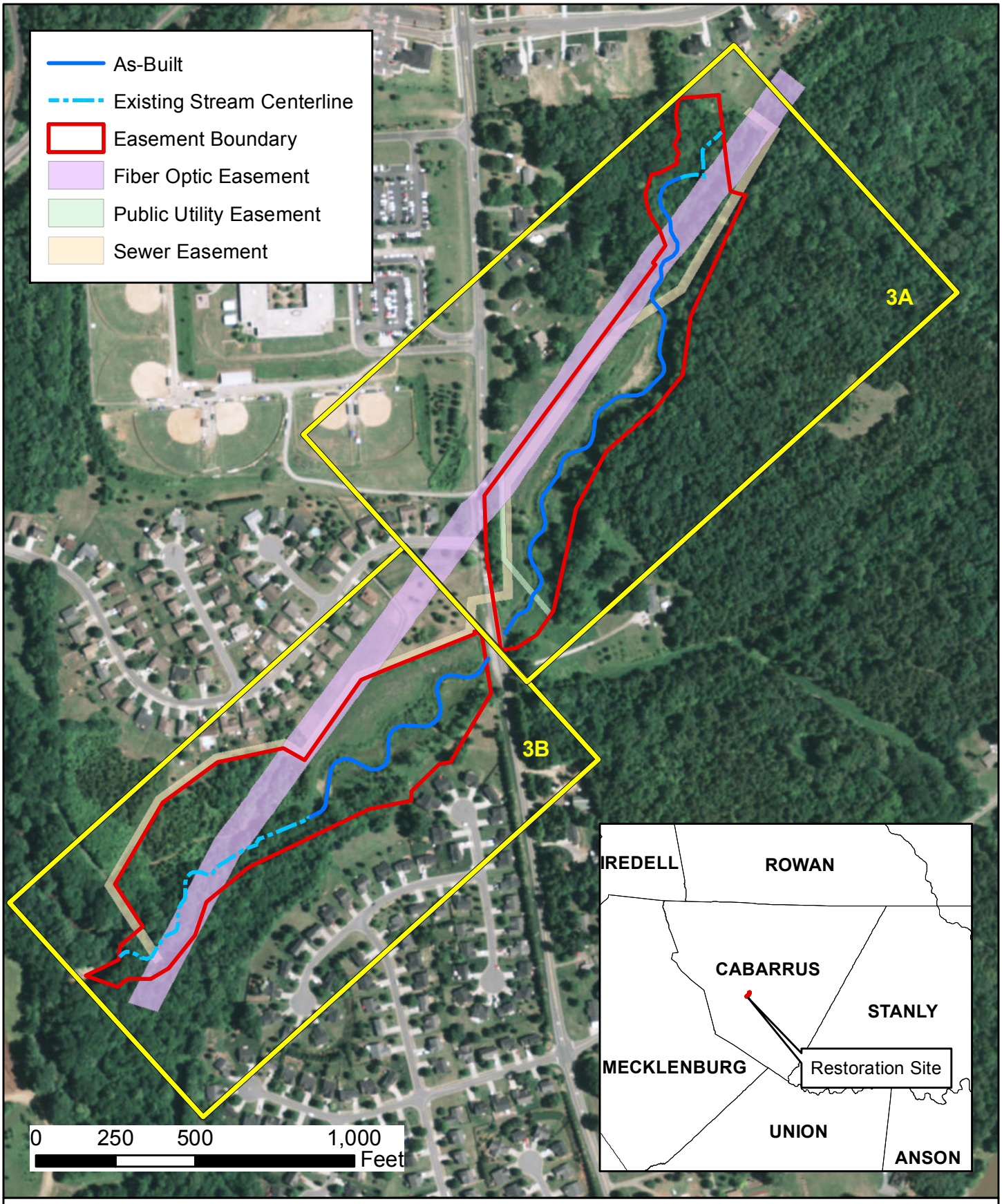
Table 1b. Component Summations Coddle Creek Tributary (Indian Run) / 94								
Restoration Level	Stream (lf)	Stream Mitigation Units	Riparian Wetland (Ac)		Planted Area (Ac)	Potential Buffer Area (Ac)	Total Conservation Area (Ac)	BMP
			Riverine	Non-Riverine				
Restoration (Lower)	975	975			4.21	2.58	10.11	
Enhancement (Upper)	1295	857			4.30	3.59	9.50	
Preservation	1540	118				1.89		
Totals (Feet/Acres)	3,810				8.51	8.06	19.61	
TOTAL SMU's		1,950						

Table 2. Project Activity and Reporting History Coddle Creek Tributary (Indian Run) / 94		
Elapsed Time Since Grading Complete: 4 yrs 8 months		
Elapsed Time Since Planting Complete: 4 yrs 8 Months		
Number of Reporting Years: 4		
Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	Jun-07	Aug-07
Final Design – Construction Plans	Jun-07	Jul-09
Construction/Grading	NA	Mar-11
Planting	NA	Mar-11
Final Inspection	NA	Mar-11
Monitoring – baseline)	May-11	Aug-11
Year 1 Monitoring	5/29/2012 - 5/30/2012	Sep-12
Year 2 Monitoring	Nov-13	Mar-14
Year 3 Monitoring	Oct-14	Dec-14
Year 4 Monitoring	Oct-15	Nov-15
Year 5 Monitoring	Oct and Dec 2016	Jan-17

Table 3. Project Contacts Table Coddle Creek Tributary (Indian Run) / 94	
Designer	HDR Engineering Inc. of the Carolinas 3733 National Drive, Suite 207, Raleigh, NC 27612
Primary project design POC	Jonathan Henderson, PE (919) 785-1118
Construction Contractor	Land Mechanic Designs, Inc. 126 Circle G Lane, Willow Spring, NC 27592
Construction contractor POC	Lloyd Glover, (919) 639-6132
Survey Contractor	Stewart Proctor Pllc 319 Chapanoke Road #106, Raleigh, NC 27603
Survey contractor POC	Herb Proctor, (919) 799-1855
Planting Contractor	HARP, Inc. 301 McCullough Drive, 4th Floor, Charlotte, NC 28262
Planting contractor POC	Alan Peoples, (704) 841-2841
Seeding Contractor	Land Mechanic Designs, Inc. 126 Circle G Lane, Willow Spring, NC 27592
Contractor point of contact	Lloyd Glover, (919) 639-6132
Seed Mix Sources	Green Resource, Charlotte, NC Phone: (704) 927-3100
Nursery Stock Suppliers	Cure Nursery, Pittsboro, NC - (919) 542-6186 ArborGen, Blenheim, SC - (843) 528-3203 Foggy Mountain Nursery llc, Creston, NC - (336) 384-5323 Habitat and Restoration Plants, Lexington, NC - (336) 362-6776 NC Division of Forest Resources, Greensboro, NC - (919) 731-7988
Monitoring Performers - Baseline & Year 1	HDR Engineering Inc. of the Carolinas 3733 National Drive, Suite 207, Raleigh, NC 27612
Monitoring Performers - Years 2 - 5	SEPI Engineering & Construction, Inc. 1025 Wade Avenue, Raleigh, NC 27605
Stream Monitoring POC	Phil Beach, PWS and Jason Hales, PWS (919) 787-9977
Vegetation Monitoring POC	Elisabeth Webster, and Jason Hales, PWS (919) 787-9977

Table 4. Project Attribute Table Coddle Creek Tributary (Indian Run) / 94		
Project County	Cabarrus	
Physiographic Region	Piedmont	
Ecoregion	Southern Outer Piedmont	
Project River Basin	Yadkin / Pee Dee	
USGS HUC for Project (14 digit)	3040105020010	
NCDWQ Sub-basin for Project	03 - 07 - 11	
Within extent of EEP Watershed Plan?	Upper Rocky River	
WRC Hab Class (Warm, Cool, Cold)	Warm	
% of project easement fenced or demarcated	100% marked with EEP easement signage	
Beaver activity observed during design phase?	No	
Restoration Component Attribute Table		
	UPPER	LOWER
Drainage area (ac)	1.5	
Stream order	2nd	
Restored length (feet)	1295	975
Perennial or Intermittent	Per	
Watershed type (Rural, Urban, Developing etc.)	Devel.	
Watershed LULC Distribution (e.g.)		
Medium Density Residential	11	
Low Density Residential / Open Fields/ Lawns	34	
Forested	52	
Watershed impervious cover (%)	3	
NCDWQ AU/Index number	-	
NCDWQ classification	C	
303d listed?	No	
Upstream of a 303d listed segment?	Yes	
Reasons for 303d listing or stressor	Bio. Integ.	Turbidity
Total acreage of easement	9.5	10.11
Total vegetated acreage within the easement	9.5	10.11
Total planted acreage as part of the restoration	4.3	4.21
Rosgen classification of pre-existing	Imp. C4	Ditch
Rosgen classification of As-built	C4	C4
Valley type	VIII	VIII
Valley slope	0.63%	0.61%
Valley side slope range (e.g. 2-3.%)	-	-
Valley toe slope range (e.g. 2-3.%)	-	-
Cowardin classification	NA	
Trout waters designation	No	
Species of concern, endangered etc.? (Y/N)	No	
Dominant soil series and characteristics		
Series	Chewacla	
Depth	U	U
Clay%	U	U
K	U	U
T	U	U

Appendix B
Visual Assessment Data



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Current Conditions Plan View Site Index

Coddle Creek Tributary (Indian Run) Year 5
Cabarrus County, NC
January 2017 Project # 94 Figure 3

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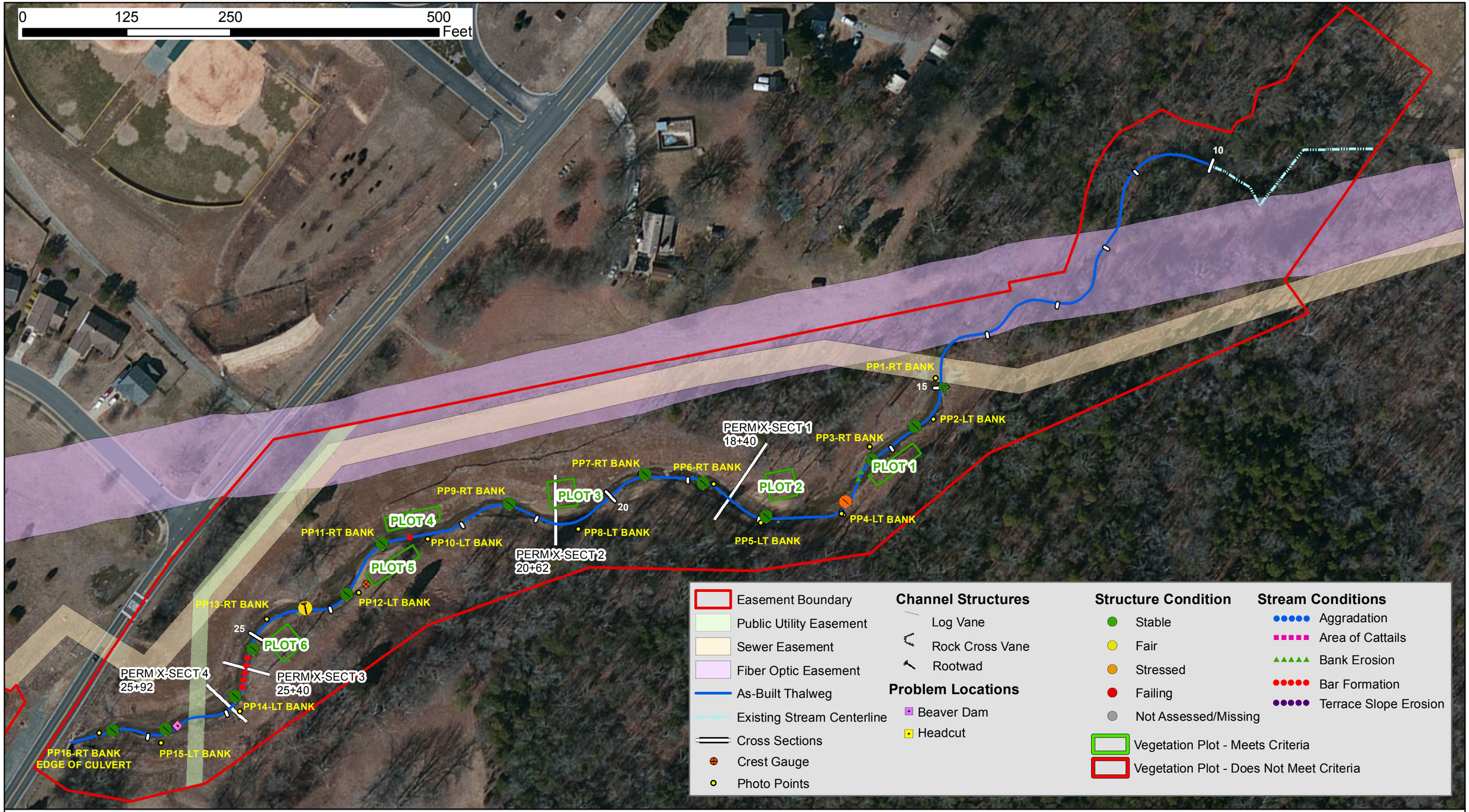

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Coddle Creek Tributary (Indian Run) Year 5 Annual Report

Current Conditions Plan View - Upper Reach

Cabarrus County, NC

January 2017

Project #94

Figure 3A

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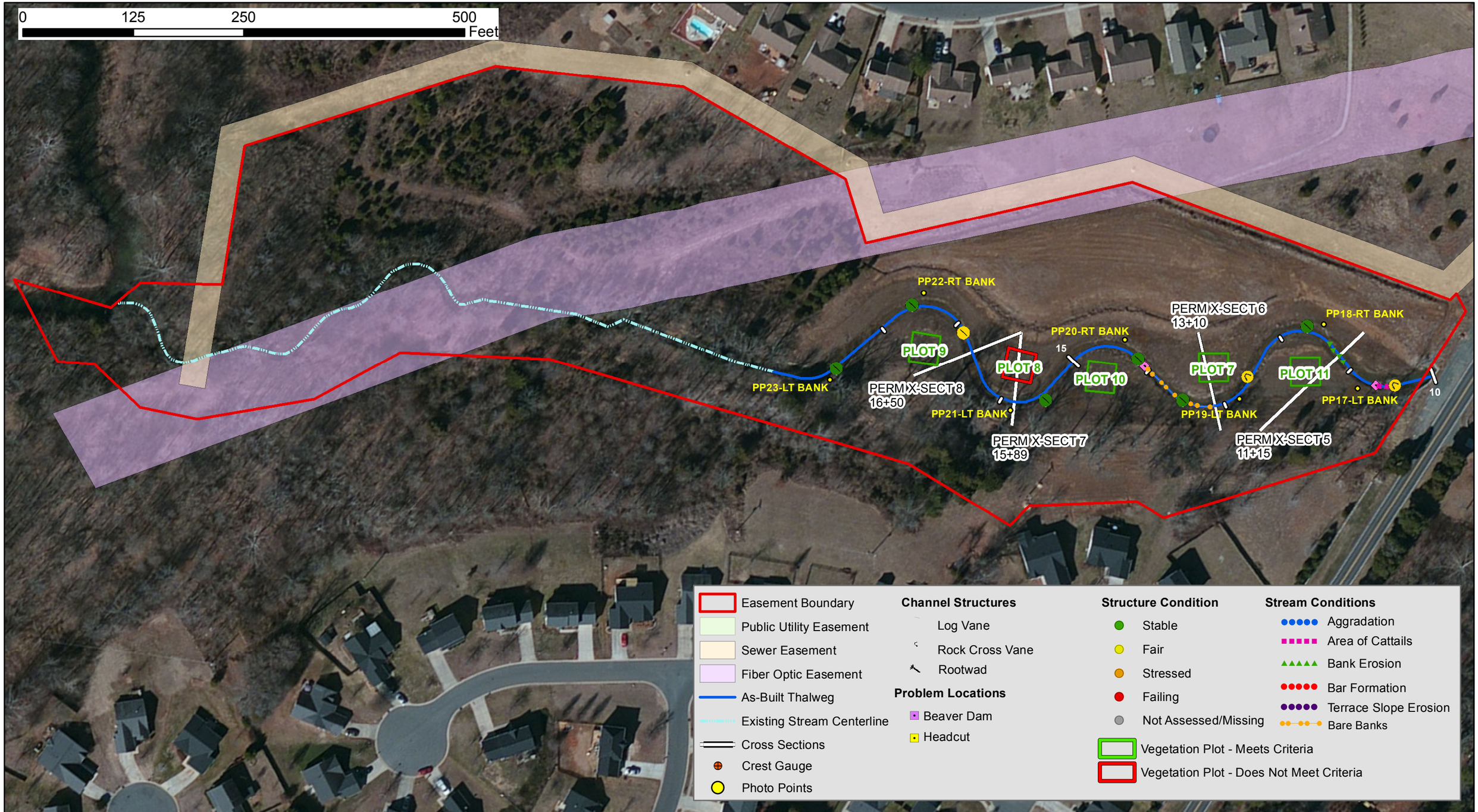

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Coddle Creek Tributary (Indian Run) Year 5 Annual Report

Current Conditions Plan View - Lower Reach

Cabarrus County, NC

January 2017

Project #94

Figure 3B

Prepared by:
SEPI
ENGINEERING & CONSTRUCTION

Table 5a **Visual Stream Morphology Stability Assessment**
Reach ID **Upper Reach**
Assessed Length **1295**

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	11	11			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	15	15			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	15	15			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	15	15			100%			
		2. Thalweg centering at downstream of meander (Glide)	15	15			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	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	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	14	14			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	14	14			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)	13	13			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	13	13			100%			

Table 5b **Visual Stream Morphology Stability Assessment**
Reach ID **Lower Reach**
Assessed Length **975**

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)	6	7			86%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	7	7			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	7	7			100%			
		2. Thalweg centering at downstream of meander (Glide)	7	7			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	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	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	9	9			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	9			89%			
	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)	9	9			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	8	9			89%			

*Riffles were not supplied with coarse substrate in the as-built condition. Aside from minor aggradation, riffles remain stable.

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **8.51**

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	Pattern and Color	1	0.004	0.0005
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
			Total	1	0.00	0.0%
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	Pattern and Color	0	0.00	0.0%
			Cumulative Total	1	0.00	0.0%

Easement Acreage[2] **19.61**

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	Pattern and Color	0	0.00	1.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Station 1 Downstream (Year 5 -10/18/2016)

Photo Station 1 Upstream (Year 5 -10/18/2016)

Photo Station 2 Downstream (Year 5 -10/18/2016)

Photo Station 2 Upstream (Year 5 -10/18/2016)

Photo Station 3 Downstream (Year 5 -10/18/2016)

Photo Station 3 Upstream (Year 5 -10/18/2016)

Photo Station 4 Downstream (Year 5 -10/18/2016)

Photo Station 4 Upstream (Year 5 -10/18/2016)

Photo Station 5 Downstream (Year 5 -10/18/2016)

Photo Station 5 Upstream (Year 5 -10/18/2016

Photo Station 6 Downstream (Year 5 -10/18/2016)

Photo Station 6 Upstream (Year 5 -10/18/2016)

Photo Station 7 Downstream (Year 5 -10/18/2016)

Photo Station 7 Upstream (Year 5 -10/18/2016)

Photo Station 8 Downstream (Year 5 -10/18/2016)

Photo Station 8 Upstream (Year 5 -10/18/2016)

Photo Station 9 Downstream (Year 5 -10/18/2016)

Photo Station 9 Upstream (Year 5 -10/18/2016)

Photo Station 10 Downstream (Year 5 -10/18/2016)

Photo Station 10 Upstream (Year 5 -10/18/2016)

Photo Station 11 Downstream (Year 5 -10/18/2016)

Photo Station 11 Upstream (Year 5 -10/18/2016)

Photo Station 12 Downstream (Year 5 -10/18/2016)

Photo Station 12 Upstream (Year 5 -10/18/2016)

Photo Station 13 Downstream (Year 5 -10/18/2016)

Photo Station 13 Upstream (Year 5 -10/18/2016)

Photo Station 14 Downstream (Year 5 -10/18/2016)

Photo Station 14 Upstream (Year 5 -10/18/2016)

Photo Station 15 Downstream (Year 5 -10/18/2016)

Photo Station 15 Upstream (Year 5 -10/18/2016)

Photo Station 16 Downstream (Year 5 -10/18/2016)

Photo Station 16 Upstream (Year 5 -10/18/2016)

Photo Station 17 Downstream (Year 5 -12/14/2016)

Photo Station 17 Upstream (Year 5 -12/14/2016)

Photo Station 18 Downstream (Year 5 -12/14/2016)

Photo Station 18 Upstream (Year 5 -12/14/2016)

Photo Station 19 Downstream (Year 5 -12/14/2016)

Photo Station 19 Upstream (Year 5 -12/14/2016)

Photo Station 20 Downstream (Year 5 -12/14/2016)

Photo Station 20 Upstream (Year 5 -12/14/2016)

Photo Station 21 Downstream (Year 5 -12/14/2016)

Photo Station 21 Upstream (Year 5 -12/14/2016)

Photo Station 22 Downstream (Year 5 -12/14/2016)

Photo Station 22 Upstream (Year 5 -12/14/2016)

Photo Station 23 Downstream (Year 5 -12/14/2016)

Photo Station 23 Upstream (Year 5 -12/14/2016)

Vegetation Plot 1 – 5m x 20m (Year 5 of 5) 10/20/2016

Vegetation Plot 2 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 3 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 4 – 5m x 20m (Year 5 of 5) 10/20/2016

Vegetation Plot 5 – 5m x 20m (Year 5 of 5) 10/20/2016

Vegetation Plot 6 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 7 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 8 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 9 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 10 – 10m x 10m (Year 5 of 5) 10/20/2016

Vegetation Plot 11 – 10m x 10m (Year 5 of 5) 10/20/2016

Appendix C
Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary Coddle Creek Tributary (Indian Run) - 94		
Plot	Planted Stems/Ac	Meeting Criteria
1	1093	Yes
2	364	Yes
3	688	Yes
4	445	Yes
5	728	Yes
6	688	Yes
7	405	Yes
8	202	No
9	526	Yes
10	445	Yes
11	486	Yes

Table 8. CVS Vegetation Plot Metadata
Coddle Creek Tributary (Indian Run) - 94

Report Prepared By	Philip Beach
Date Prepared	1/5/2017 14:06
database name	CoddleCr(IndianRun)_94_MY5_2016_CVS .mdb
database location	G:\Environmental\NCEEP Coddle Creek SMS\MY05\Annual Report\Coddle_Cr(IndianRun)_94_MY5_2016_DRAFT\Support Files\3 - Vegetation Plot Data
computer name	W69
file size	50987008

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stem
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.)
Vigor	Frequency distribution of vigor classes for stems for all plots
Vigor by Spp	Frequency distribution of vigor classes listed by species
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each
Damage by Spp	Damage values tallied by type for each species
Damage by Plot	Damage values tallied by type for each plot
Planted Stems by Plot and S	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are exclude

PROJECT SUMMARY----------	
Project Code	94
project Name	Indian Run Tributary to Coddle Creek
Description	Stream Restoration
River Basin	Yadkin-Pee Dee
length(ft)	2270
stream-to-edge width (ft)	100
area (sq m)	42173.71
Required Plots (calculated)	11
Sampled Plots	11

Table 9. Planted and Total Stem Counts (Species by Plot with Annual Means)
EEP Project Code 94. Project Name: Indian Run Tributary to Coddle Creek

Scientific Name	Common Name	Species Type	094-HDR-0001			094-HDR-0002			094-HDR-0003			094-HDR-0004			094-HDR-0005			094-HDR-0006			094-HDR-0007			094-HDR-0008			094-HDR-0009			094-HDR-0010			094-HDR-0011			MY5 (2016)		
			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																			8			8														16
Acer rubrum	red maple	Tree	10	10	10	3	3	3	4	4	4				5	5	5	3	3	3	1	1	1													26	26	26
Albizia julibrissin	silktree	Exotic															6																					6
Alnus serrulata	hazel alder	Shrub	5	5	5						3	2	2	2	5	5	5	2	2	2	5	5	5			3	1	1	2	1	1	1				21	21	28
Baccharis halimifolia	eastern baccharis	Shrub						1																														1
Betula nigra	river birch	Tree			30			8						3	3	3	3	3	3	3							4	4	6	2	2	2	7	7	7	19	19	62
Carya glabra	pignut hickory	Tree																					2															2
Celtis laevigata	sugarberry	Tree																									1	1	1							1	1	1
Cornus amomum	silky dogwood	Shrub	1	1	1	2	2	2				5	5	5				3	3	3	3	3	3	1	1	1	6	6	6	1	1	1	1	1	1	23	23	23
Diospyros virginiana	common persimmon	Tree							1	1	1							1	1	1							1	1	1							3	3	3
Fraxinus pennsylvanica	green ash	Tree	6	6	6	3	3	3	7	7	7	2	2	2	2	2	2									1										20	20	21
Juglans nigra	black walnut	Tree																1	1	1																1	1	1
Liquidambar styraciflua	sweetgum	Tree									4						9			5																		18
Morella cerifera	wax myrtle	shrub												1																		1						2
Nyssa sylvatica	blackgum	Tree	1	1	1				2	2	2									1												1				3	3	5
Pinus taeda	loblolly pine	Tree												1																		3						4
Platanus occidentalis	American sycamore	Tree			5			34			10			40			21			12									2									124
Populus deltoides	eastern cottonwood	Tree			2						1			8									22			34			34			6			40			147
Quercus lyrata	overcup oak	Tree																																	1	1	1	1	1	1
Quercus nigra	water oak	Tree							1	1	1				1	1	1	1	1	1										1	1	1				4	4	4
Quercus phellos	willow oak	Tree	4	4	4	1	1	2	2	2	2	2	2	2	1	1	1	1	1	1													3	3	3	14	14	15
Rhus copallinum var. copall	flameleaf sumac	shrub						1																														1
Salix nigra	black willow	Tree			2											1	4		1	1	1	1	1	4	4	4				6	6	6				11	13	18
Sambucus canadensis	Common Elderberry	Shrub																1	1	1																1	1	1
Ulmus americana	American elm	Tree																		1																		1
		Stem count	27	27	66	9	9	54	17	17	35	11	11	64	17	18	57	16	17	44	10	10	42	5	5	43	13	13	52	11	11	22	12	12	52	148	150	531
		size (ares)	1			1			1			1			1			1			1			1			1			1			1			11		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.27		
		Species count	6	6	10	4	4	8	6	6	10	4	4	9	6	7	10	9	10	15	4	4	7	2	2	5	5	5	7	5	5	9	4	4	5	14	14	25
		Stems per ACRE	1092.7	1093	2671	364.22	364.2	2185	687.97	688	1416	445.15	445.2	2590	687.97	728.4	2307	647.5	688	1781	404.69	404.7	1700	202.34	202.3	1740	526.09	526.1	2104	445.15	445.2	890.3	485.62	485.6	2104	544.49	551.8	1954

Table 9a. Planted and Total Stem Counts (Annual Means MY0 - MY5)

EEP Project Code 94. Project Name: Indian Run Tributary to Coddle Creek

Scientific Name	Common Name	Species Type	MY5 (2016)			MY4 (2015)			MY3 (2014)			MY2 (2013)			MY1 (2012)			MY0 (2011)		
			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			16			28			13			1			9			
Acer rubrum	red maple	Tree	26	26	26	26	26	33	26	26	26	23	23	24	28	28	36	30	30	38
Albizia julibrissin	silktree	Exotic			6			4			1									
Alnus serrulata	hazel alder	Shrub	21	21	28	21	21	41	21	21	32	21	21	31	21	21	21	19	19	19
Baccharis halimifolia	eastern baccharis	Shrub			1						1			1						
Betula nigra	river birch	Tree	19	19	62	19	19	160	19	19	194	19	19	865	20	20	674	28	28	28
Callicarpa americana	American beautyberr	Shrub							1	1	1	5	5	5	7	7	7	8	8	8
Calycanthus floridus	eastern sweetshrub	Shrub										1	1	1	1	1	1	2	2	2
Carpinus caroliniana	American hornbeam	Tree						1												
Carya glabra	pignut hickory	Tree			2															
Celtis laevigata	sugarberry	Tree	1	1	1	1	1	4			1	1	1	1	10	10	10	15	15	15
Cephalanthus occidentalis	common buttonbush	Shrub						2												
Cornus amomum	silky dogwood	Shrub	23	23	23	30	30	35	30	30	39	29	29	31	34	34	34	32	32	32
Diospyros virginiana	common persimmon	Tree	3	3	3	5	5	5	7	7	8	4	4	4	18	18	18	21	21	21
Fraxinus pennsylvanica	green ash	Tree	20	20	21	21	21	24	21	21	22	20	20	21	21	21	21	21	21	21
Juglans nigra	black walnut	Tree	1	1	1	1	1	2	2	2	2	2	2	2	5	5	5	6	6	6
Ligustrum sinense	Chinese privet	Exotic						1			1			1						
Liquidambar styraciflua	sweetgum	Tree			18			23			47			17			9			
Liriodendron tulipifera	tuliptree	Tree						1			1									
Morella cerifera	wax myrtle	shrub			2			2			3			1						
Nyssa sylvatica	blackgum	Tree	3	3	5	5	5	6	3	3	4	3	3	3						
Pinus taeda	loblolly pine	Tree			4			4			1			2						
Platanus occidentalis	American sycamore	Tree			124			694			829			679			1536			
Populus deltoides	eastern cottonwood	Tree			147			487			538			174			662			655
Prunus serotina	black cherry	Tree						1												
Quercus lyrata	overcup oak	Tree	1	1	1	1	1	1	1	1	1	1	1	2						
Quercus nigra	water oak	Tree	4	4	4	5	5	5	4	4	4	6	6	8	8	8	8	12	12	12
Quercus phellos	willow oak	Tree	14	14	15	16	16	19	14	14	18	16	16	16	21	21	21	21	21	21
Quercus rubra	northern red oak	Tree						1												
Rhus copallinum var. copallinum	flameleaf sumac	shrub			1															
Salix nigra	black willow	Tree	11	13	18	13	15	27	12	14	28	14	16	24	11	13	18	6	8	8
Sambucus canadensis	Common Elderberry	Shrub	1	1	1	1	1	2	1	1	1	1	1	7	2	2	2	2	2	2
Ulmus	elm	Tree												2			33			
Ulmus americana	American elm	Tree			1			1												
Ulmus rubra	slippery elm	Tree												31						
		Stem count	148	150	531	165	167	1614	162	164	1816	166	168	1954	207	209	3125	223	225	888
		size (ares)	11			11			11			11			11			11		
		size (ACRES)	0.27			0.27			0.27			0.27			0.27			0.27		
		Species count	14	14	25	14	14	28	14	14	25	16	16	26	14	14	19	14	14	15
		Stems per ACRE	544	552	1954	607.03	614	5937	595.99	603	6681	611	618	7189	762	769	11497	820	828	3267

Appendix D
Stream Survey Data

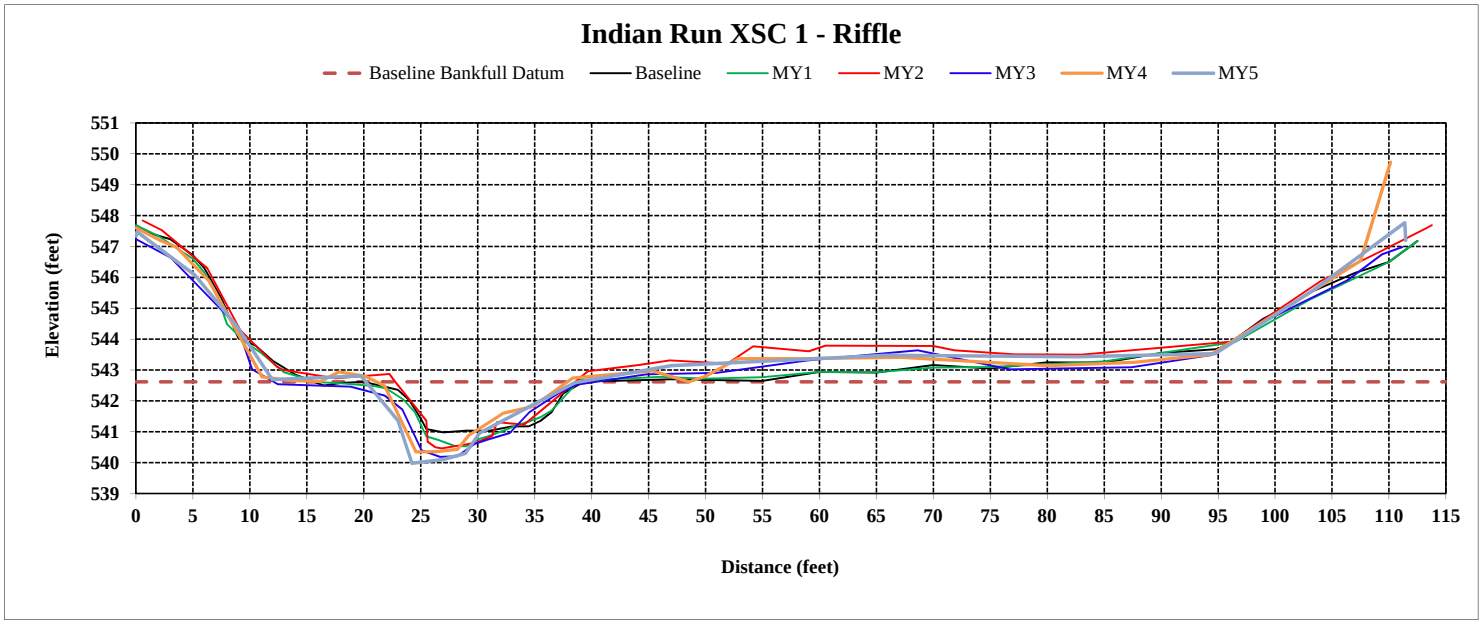
Station	Elevation
0	547.34
0.11	547.48
5.2	546.07
8.72	544.5
11.97	542.69
19.77	542.81
23	541.37
24.23	539.98
26.94	540.1
28.93	540.3
30.18	540.96
33.14	541.54
38.55	542.59
46.97	543.14
65.92	543.48
82.63	543.43
94.76	543.53
103.29	545.57
111.38	547.77
111.47	547.2

Reach	Indian Run, Upper Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-1, Riffle, Upper Reach, 18+40
Drainage Area (Sq Mi)	1.5
Date	12/14/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	542.62
Bankfull Cross Sectional Area, ft^2	28.43
Bankfull Width, ft	18.77
Max Depth at Bankfull, ft	2.64
Mean Depth at Bankfull, ft	1.51
Width/Depth Ratio	12.40
Flood Prone Width, ft	93.00
Flood Prone Area Elevation	545.26
Entrenchment Ratio	4.95
Bank Height Ratio	1.03

Stream Type	C4

Sta. 18+40 Looking Downstream



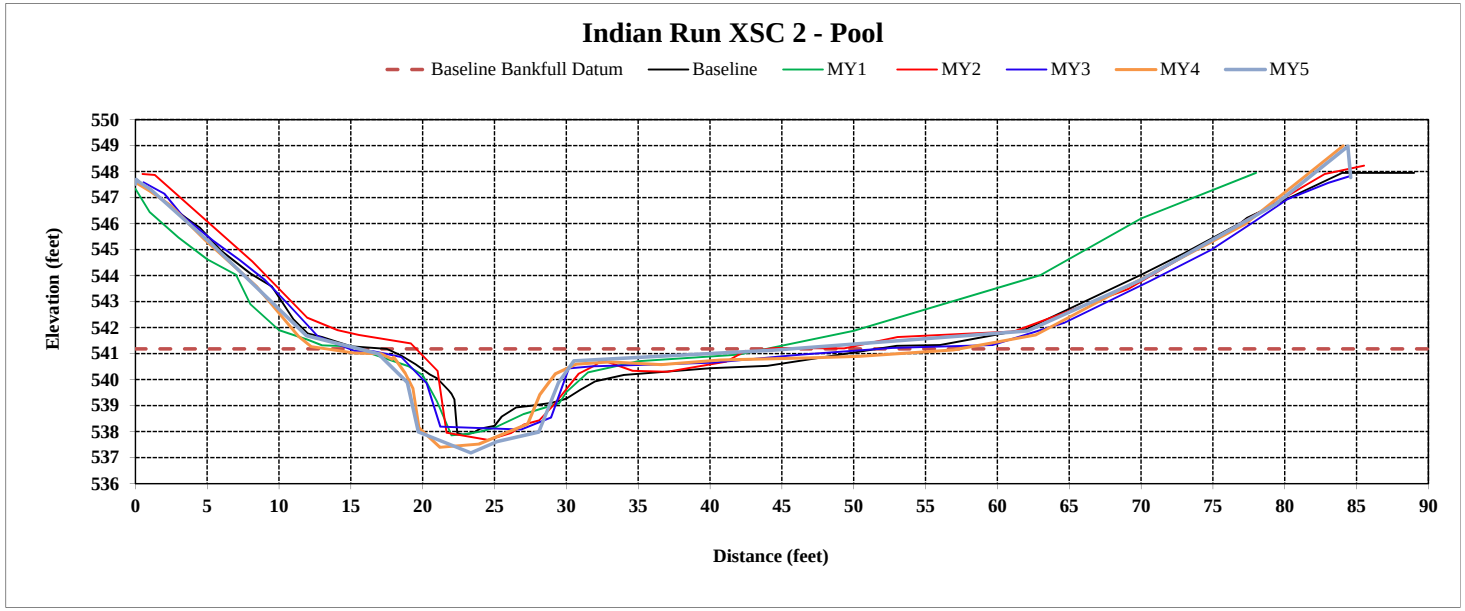
Station	Elevation
0	547.52
0.06	547.7
0.3	547.59
1.06	547.32
5.31	545.21
11.9	541.69
16.89	541
18.93	539.89
19.7	537.99
23.35	537.18
25.19	537.62
28.07	537.98
29.45	539.89
30.52	540.72
44.42	541.13
62.1	541.87
70.03	543.84
79.33	546.73
84.39	548.97
84.59	547.77

Reach	Indian Run, Upper Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-2, Pool, Upper Reach, 20+62
Drainage Area (Sq Mi)	1.5
Date	12/14/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	541.18
Bankfull Cross Sectional Area, ft^2	34.47
Bankfull Width, ft	27.53
Max Depth at Bankfull, ft	4.00
Mean Depth at Bankfull, ft	1.25
Width/Depth Ratio	21.99
Flood Prone Width, ft	67.50
Flood Prone Area Elevation	545.18
Entrenchment Ratio	2.45
Bank Height Ratio	0.68

Stream Type	C4

Sta. 20+62 Looking Downstream



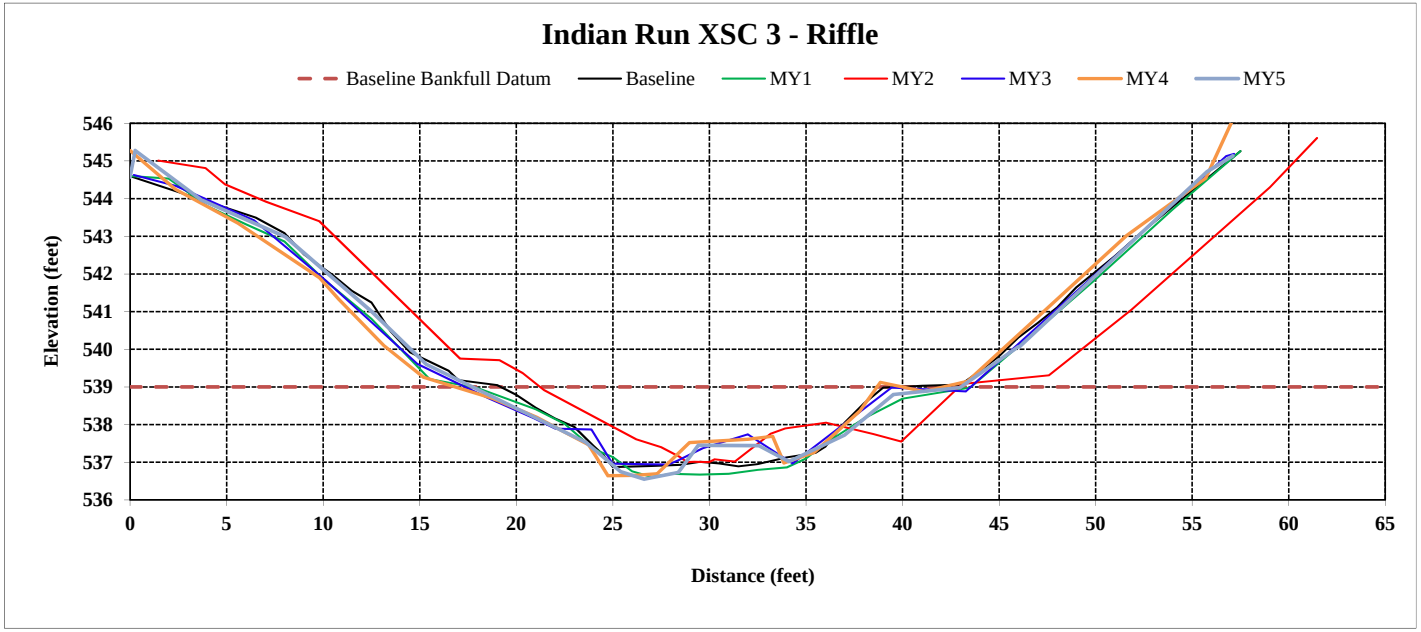
Station	Elevation
0	544.57
0.26	545.28
3.7	543.96
8.06	542.98
12.56	540.98
15.33	539.6
23.6	537.53
25.4	536.75
26.56	537.04
26.63	536.55
28.39	536.73
29.42	537.45
32.57	537.44
34.12	537.02
36.99	537.72
39.53	538.8
42.97	538.98
45.97	540.06
46.08	540.08
50.65	542.26
55.75	544.71
57.11	545.14

Reach	Indian Run, Upper Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-3, Riffle, Upper Reach, 25+40
Drainage Area (Sq Mi)	1.5
Date	12/14/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	539.00
Bankfull Cross Sectional Area, ft^2	38.28
Bankfull Width, ft	24.20
Max Depth at Bankfull, ft	2.45
Mean Depth at Bankfull, ft	1.58
Width/Depth Ratio	15.30
Flood Prone Width, ft	35.50
Flood Prone Area Elevation	541.45
Entrenchment Ratio	1.47
Bank Height Ratio	0.99

Stream Type	C4

Sta. 25+40 Looking Downstream



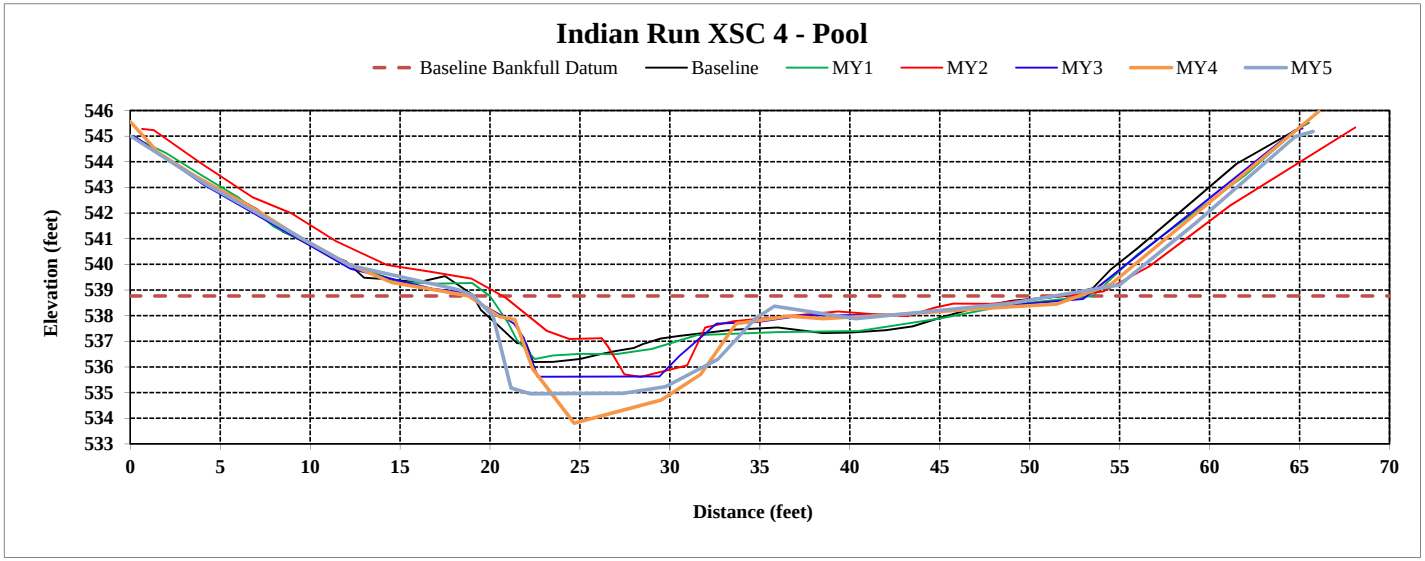
Station	Elevation
0	545.01
4.17	543.14
12.21	539.96
18.24	539.01
19.02	538.8
20.17	537.98
21.16	535.18
22.26	534.95
24.84	534.96
27.37	534.97
29.76	535.23
32.66	536.3
34.75	537.89
35.8	538.37
40.35	537.88
48.96	538.48
55	539.2
59.23	541.61
64.76	544.98
65.75	545.18

Reach	Indian Run, Upper Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-4, Pool, Upper Reach, 25+92
Drainage Area (Sq Mi)	1.5
Date	12/15/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	538.77
Bankfull Cross Sectional Area, ft^2	48.09
Bankfull Width, ft	35.98
Max Depth at Bankfull, ft	3.82
Mean Depth at Bankfull, ft	1.34
Width/Depth Ratio	26.92
Flood Prone Width, ft	54.00
Flood Prone Area Elevation	542.59
Entrenchment Ratio	1.50
Bank Height Ratio	0.77

Stream Type	C4

Sta. 25+92 Looking Downstream



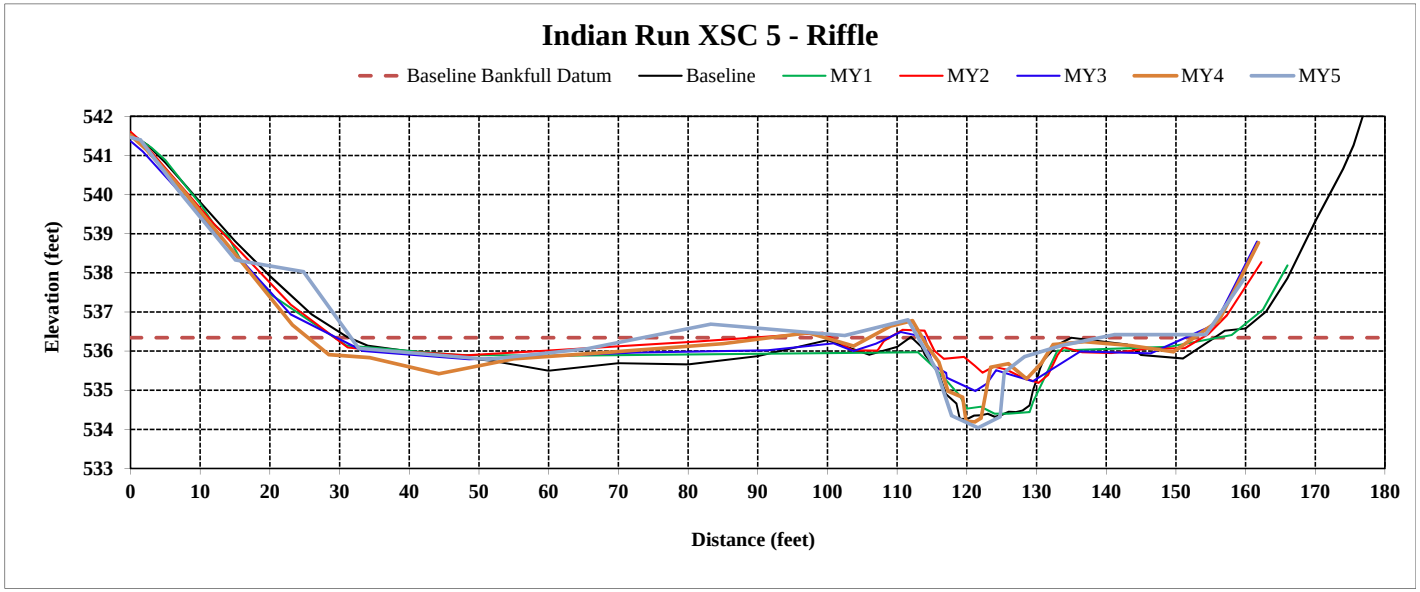
Station	Elevation
0	541.46
1.42	541.4
6.93	540.09
15.07	538.33
24.83	538.03
32.73	536.07
51.3	535.79
65.45	536.06
83.27	536.69
102.48	536.4
111.56	536.8
115.64	535.52
117.82	534.35
121.6	534.04
124.78	534.32
125.37	535.46
128.29	535.86
133.58	536.14
141.12	536.42
154.29	536.42
159.76	537.84

Reach	Indian Run, Lower Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-5, Riffle, Lower Reach, 11+15
Drainage Area (Sq Mi)	1.5
Date	12/15/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	536.34
Bankfull Cross Sectional Area, ft^2	31.80
Bankfull Width, ft	22.02
Max Depth at Bankfull, ft	2.30
Mean Depth at Bankfull, ft	1.44
Width/Depth Ratio	15.25
Flood Prone Width, ft	148.00
Flood Prone Area Elevation	538.64
Entrenchment Ratio	6.72
Bank Height Ratio	0.62

Stream Type	C4

Sta. 11+15 Looking Downstream



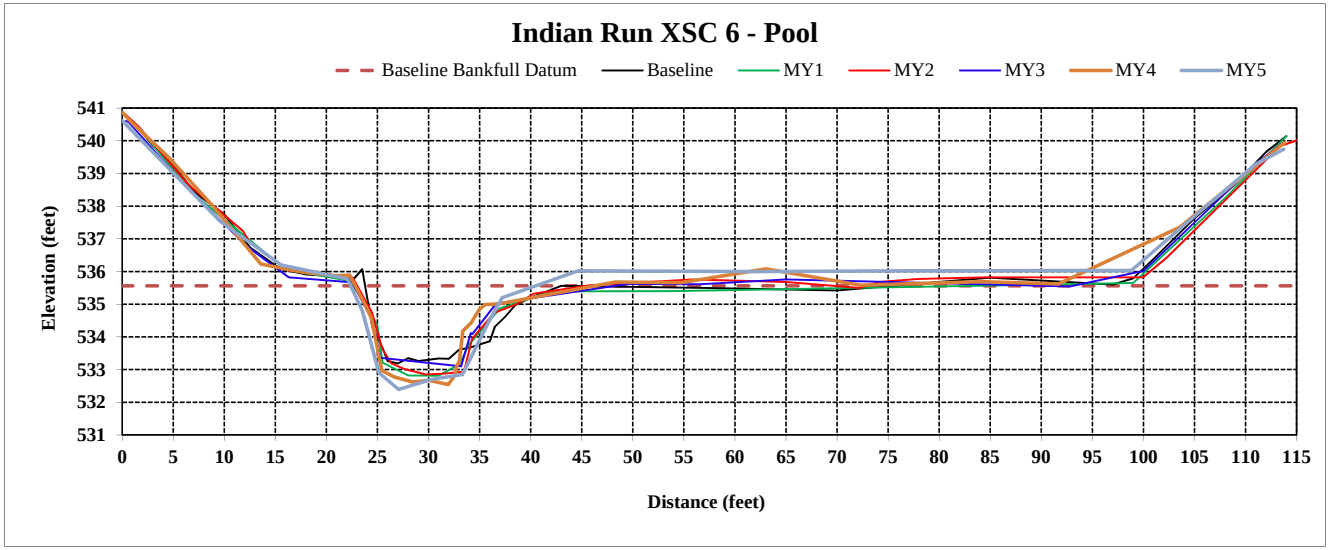
Station	Elevation
0	540.62
3.63	539.46
9.6	537.54
15.58	536.2
22.07	535.77
23.52	534.8
25.15	532.9
27.07	532.39
30.3	532.7
33.33	532.85
35.83	534.43
37.21	535.2
44.65	536.02
62.37	536
76.37	536.02
98.82	536.03
103.96	537.41
110.98	539.28
113.75	539.74

Reach	Indian Run, Lower Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-6, Pool, Lower Reach, 13+10
Drainage Area (Sq Mi)	1.5
Date	12/15/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	535.56
Bankfull Cross Sectional Area, ft^2	35.57
Bankfull Width, ft	22.58
Max Depth at Bankfull, ft	3.17
Mean Depth at Bankfull, ft	1.58
Width/Depth Ratio	14.33
Flood Prone Width, ft	105.00
Flood Prone Area Elevation	538.73
Entrenchment Ratio	4.65
Bank Height Ratio	0.64

Stream Type	C4

Sta. 13+10 Looking Downstream



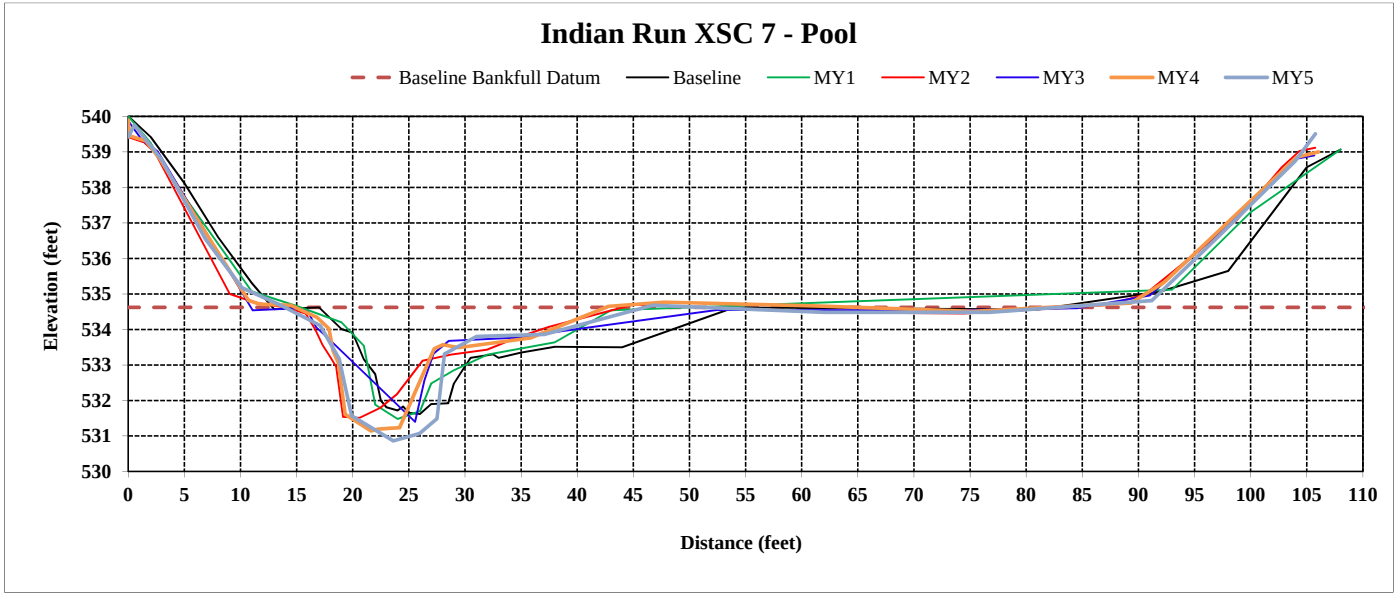
Station	Elevation
0	539.42
0.55	539.76
2.96	538.79
6.9	536.54
10.15	535.17
13.54	534.69
17.1	534.11
18.8	533.17
19.9	531.57
23.62	530.86
25.96	531.07
27.51	531.49
28.18	533.31
31.03	533.8
37.06	533.86
46.71	534.68
62.02	534.48
76.73	534.48
91.18	534.81
97.2	536.64
103.96	538.74
105.77	539.51

Reach	Indian Run, Lower Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-7, Pool, Lower Reach, 15+89
Drainage Area (Sq Mi)	1.5
Date	12/15/2016
Observers	J. Hales, A. Craig

SUMMARY DATA	
Baseline Bankfull Datum, ft	534.62
Bankfull Cross Sectional Area, ft^2	46.26
Bankfull Width, ft	33.17
Max Depth at Bankfull, ft	3.76
Mean Depth at Bankfull, ft	1.39
Width/Depth Ratio	23.79
Flood Prone Width, ft	99.50
Flood Prone Area Elevation	538.38
Entrenchment Ratio	3.00
Bank Height Ratio	1.02

Stream Type	C4

Sta. 15+89 Looking Downstream



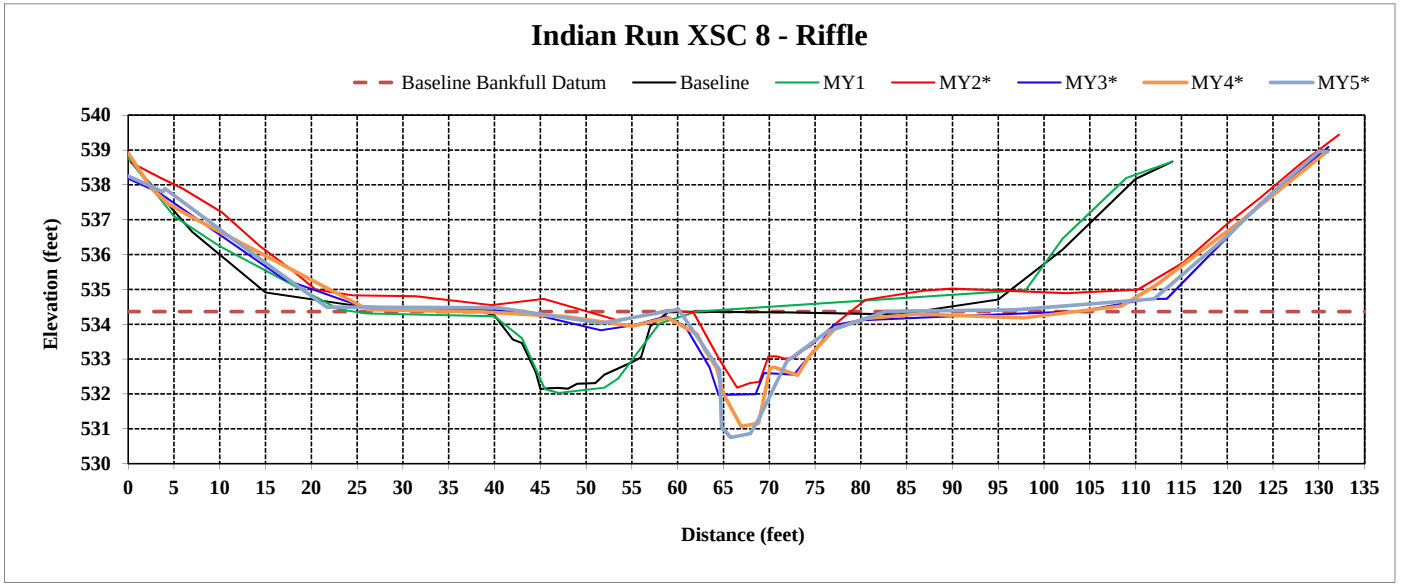
Station	Elevation
0	538.25
3.81	537.8
4.02	537.89
12.18	536.3
21.68	534.49
40.48	534.47
51.68	534.03
60.1	534.43
64.59	532.69
64.8	531.05
65.79	530.75
67.93	530.86
68.78	531.25
71.92	532.94
76.37	533.79
82.78	534.37
96.87	534.41
112.04	534.73
119.77	536.48
126.22	538.09
130.03	538.96
130.95	538.95

Reach	Indian Run, Lower Reach
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-8, Riffle, Lower Reach, 16+50
Drainage Area (Sq Mi)	1.5
Date	12/15/2016
Observers	J. Hales, A. Craig

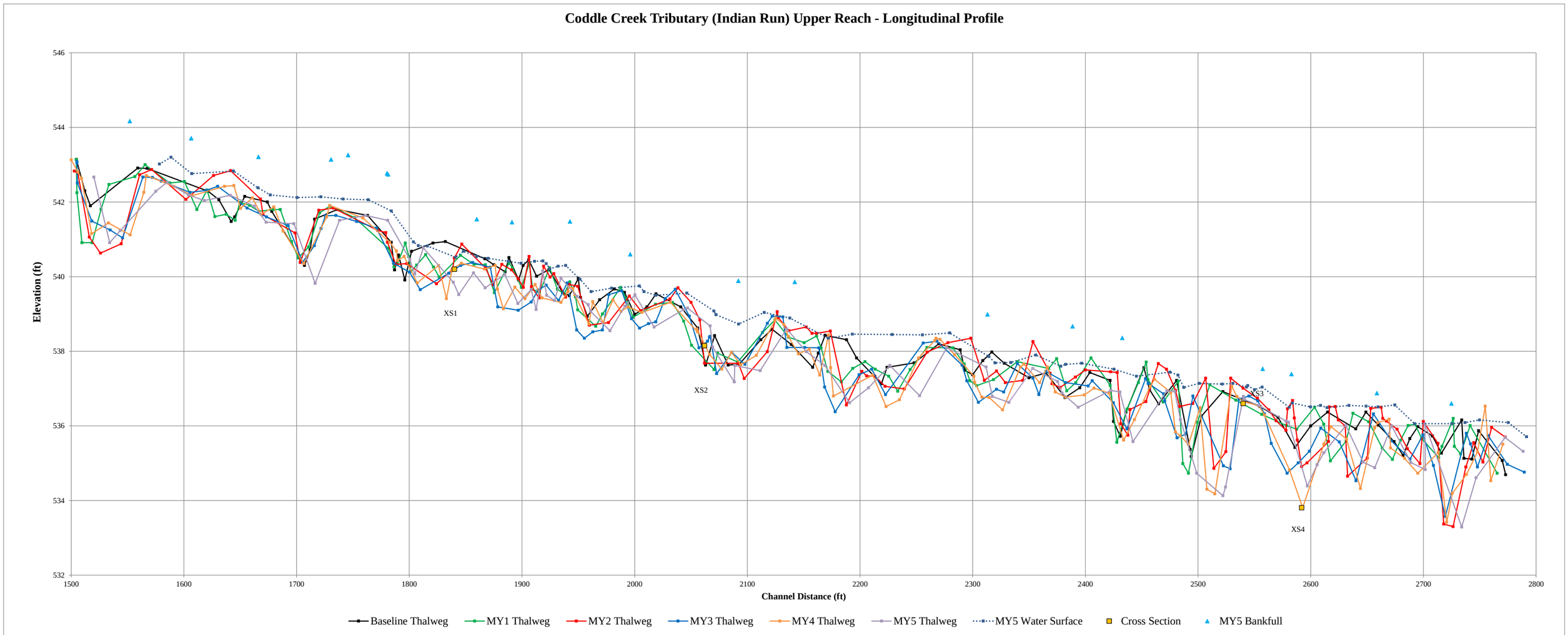
SUMMARY DATA	
Baseline Bankfull Datum, ft	534.36
Bankfull Cross Sectional Area, ft^2	19.73
Bankfull Width, ft	38.48
Max Depth at Bankfull, ft	3.29
Mean Depth at Bankfull, ft	0.51
Width/Depth Ratio	75.06
Flood Prone Width, ft	124.00
Flood Prone Area Elevation	537.65
Entrenchment Ratio	3.22
Bank Height Ratio	0.96

Stream Type	C4

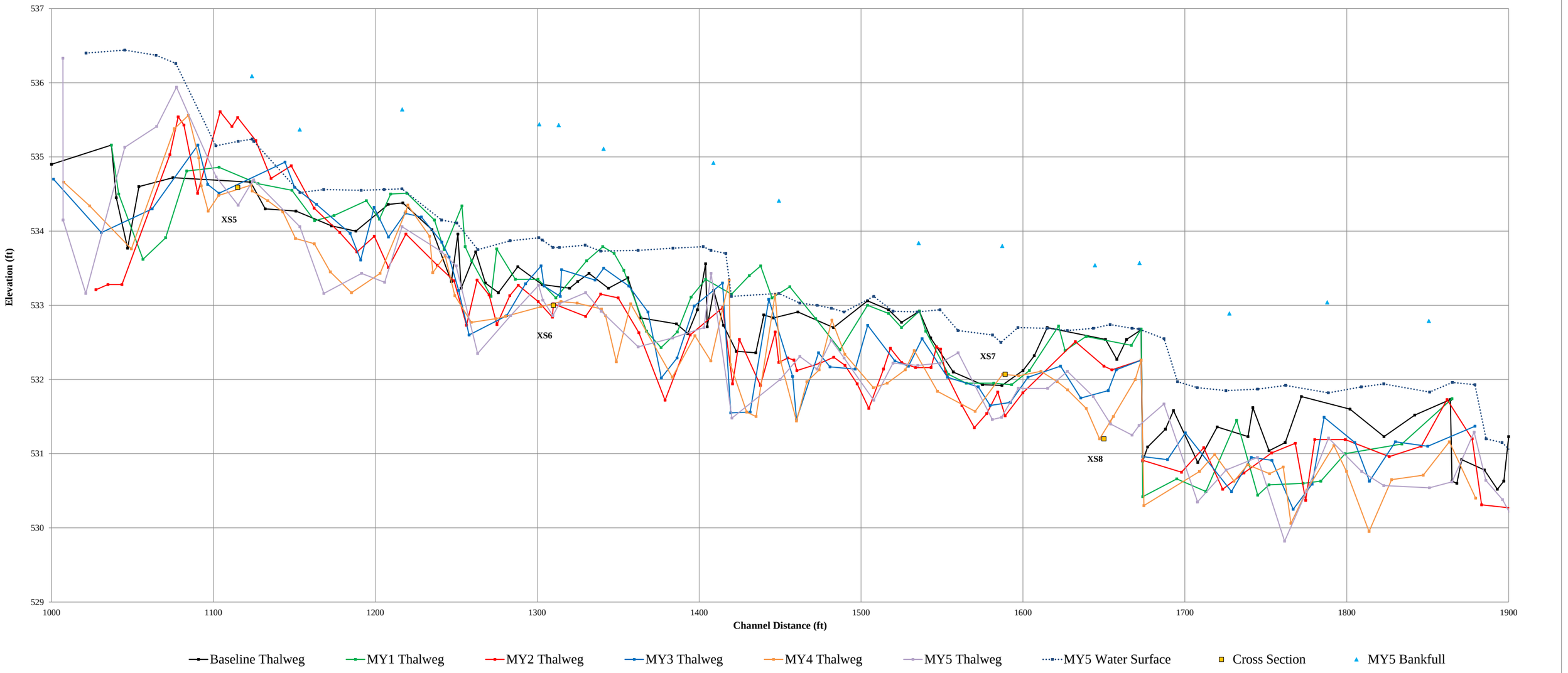
Sta. 16+50 Looking Upstream



*The pins for XS8 were not located in the field. The location of the cross section for MY4 and MY5 is approximate and was set during MY2.


Coddle Creek Tributary (Indian Run) Upper Reach - Longitudinal Profile
Elevation (ft)
546
544
542
540
538
536
534
532
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
Channel Distance (ft)
XS1
XS2
XS3
XS4
Baseline Thalweg
MY1 Thalweg
MY2 Thalweg
MY3 Thalweg
MY4 Thalweg
MY5 Thalweg
MY5 Water Surface
Cross Section
MY5 Bankfull

Coddle Creek Tributary (Indian Run) Lower Reach - Longitudinal Profile

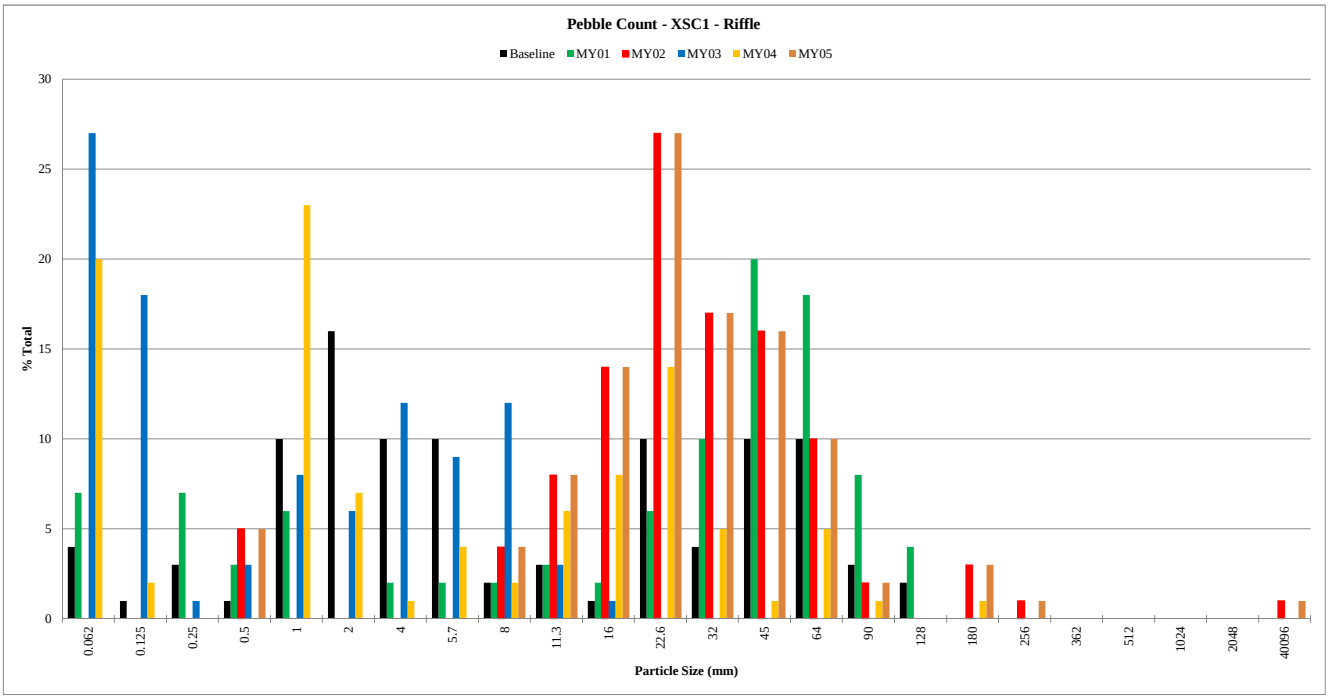


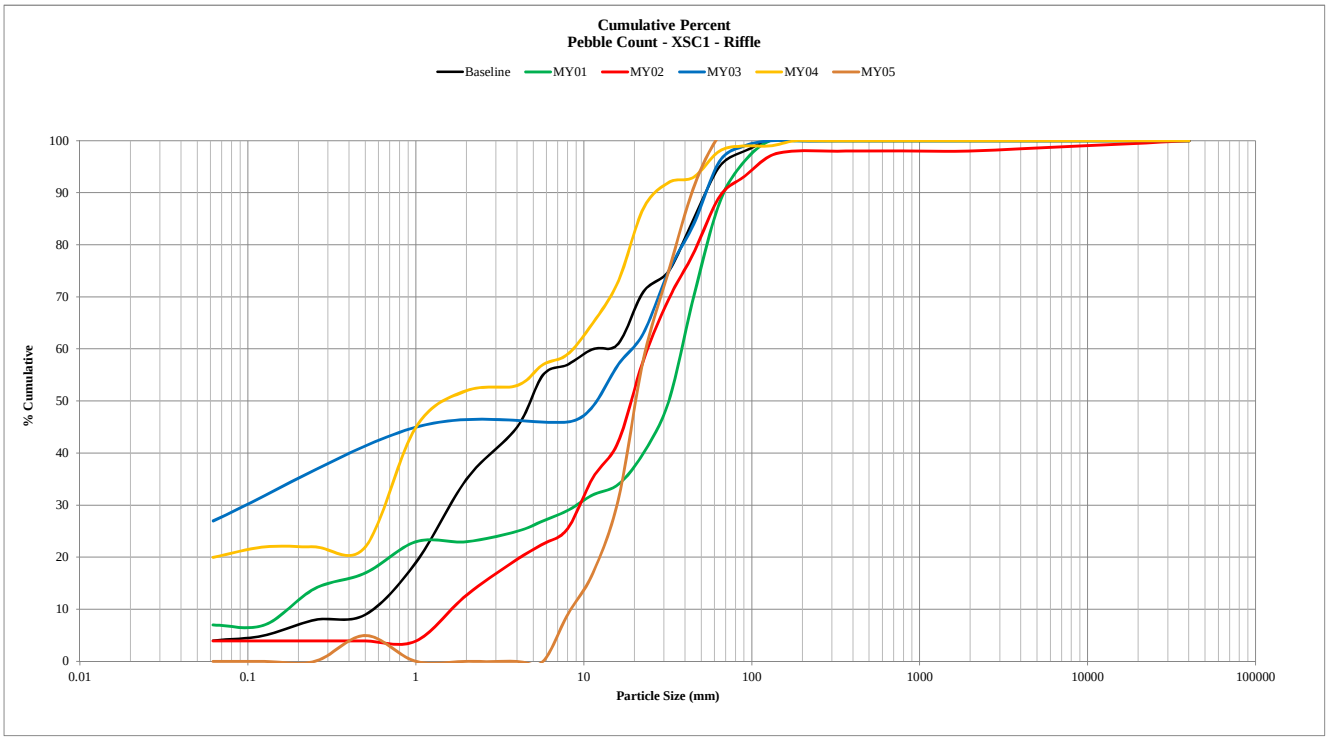
Coddle Creek Triburaty - Indian Run - UR - XS1 Riffle Pebble Count

Location: STA 18+40

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	SAND	0	0	0
	Very Fine	0.062-0.125		0	0	0
	Fine	0.125-0.25		0	0	0
	Medium	0.25-0.50		5	5	5
	Coarse	0.50-1.0		0	0	0
0.04-0.08	Very Coarse	1.0-2		0	0	0
0.08-0.16	Very Fine	2-4	GRAVEL	0	0	0
0.16-0.22	Fine	4-5.7		0	0	0
0.22-0.31	Fine	5.7-8		4	4	9
0.31-0.44	Medium	8-11.3		8	8	17
0.44-0.63	Medium	11.3-16		14	14	31
0.63-0.89	Coarse	16-22.6		27	27	58
0.89-1.26	Coarse	22.6-32		17	17	75
1.26-1.77	Very Coarse	32-45		16	16	91
1.77-2.5	Very Coarse	45-64		10	10	101
2.5-3.5	Small	64-90	COBBLE	2	2	103
3.5-5.0	Small	90-128		0	0	103
5.0-7.1	Medium	128-180		3	3	106
7.1-10.1	Large	180-256		1	1	107
10.1-14.3	Small	256-362	BOULDER	0	0	107
14.3-20	Small	362-512		0	0	107
20-40	Medium	512-1024		0	0	107
40-80	Large	1024-2048		0	0	107
	Bedrock	Bedrock	Bedrock	1	1	108
			Total Counted	108		

Summary Data	
D50	22.6
D84	55
D95	60


Pebble Count - XSC1 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Total
0
5
10
15
20
25
30
0.062
0.125
0.25
0.5
1
2
4
5.7
8
11.3
16
22.6
32
45
64
90
128
180
256
362
512
1024
2048
4096
Particle Size (mm)

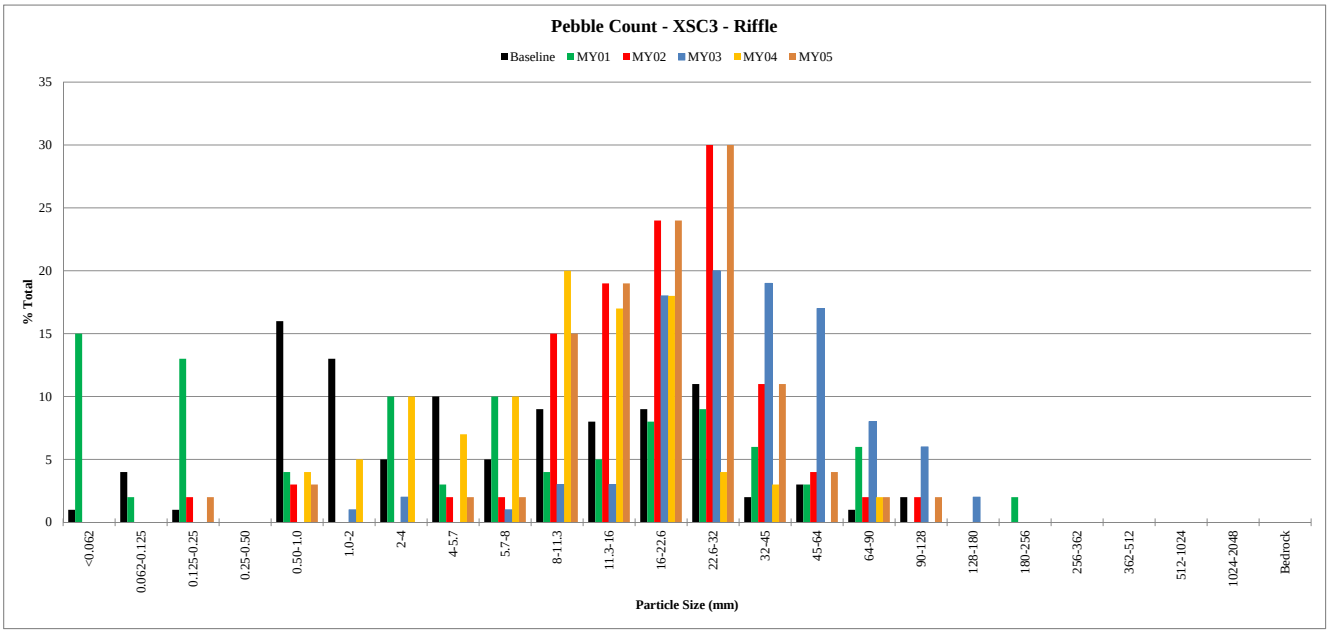

Cumulative Percent
Pebble Count - XSC1 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Cumulative
0
10
20
30
40
50
60
70
80
90
100
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

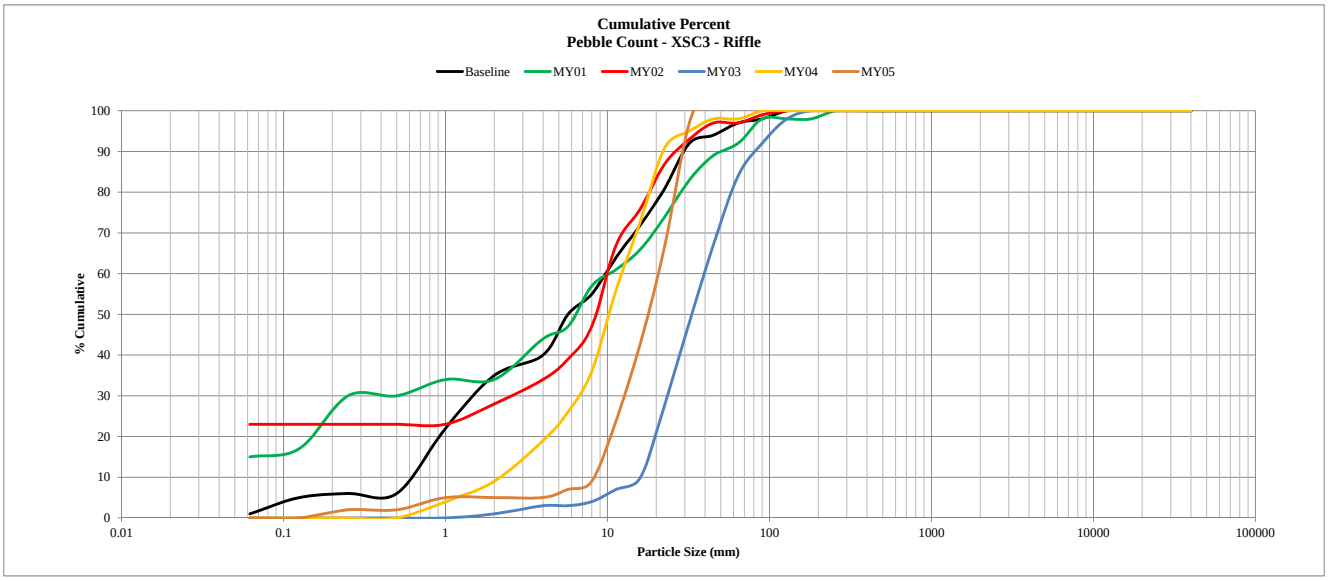
Coddle Creek Tributary - Indian Run -UR - XS3 Riffle Pebble Count

Location: STA 25+40

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		0	0	0
	Very Fine	0.062-0.125	S	0	0	0
	Fine	0.125-0.25	A	2	2	2
	Medium	0.25-0.50	N	0	0	2
	Coarse	0.50-1.0	D	3	3	5
0.04-0.08	Very Coarse	1.0-2		0	0	5
0.08-0.16	Very Fine	2-4		0	0	5
0.16-0.22	Fine	4-5.7		2	2	7
0.22-0.31	Fine	5.7-8	G	2	2	9
0.31-0.44	Medium	8-11.3	R	15	15	24
0.44-0.63	Medium	11.3-16	A	19	19	43
0.63-0.89	Coarse	16-22.6	V	24	24	67
0.89-1.26	Coarse	22.6-32	E	30	30	97
1.26-1.77	Very Coarse	32-45	L	11	11	108
1.77-2.5	Very Coarse	45-64		4	4	112
2.5-3.5	Small	64-90	C	2	2	114
3.5-5.0	Small	90-128	O	2	2	116
5.0-7.1	Medium	128-180	B	0	0	116
7.1-10.1	Large	180-256	B L E	0	0	116
10.1-14.3	Small	256-362	B	0	0	116
14.3-20	Small	362-512	O	0	0	116
20-40	Medium	512-1024	U L D	0	0	116
40-80	Large	1024-2048	E R	0	0	116
	Bedrock	Bedrock	Bedrock	0	0	116
			Total Counted	116		

Summary Data	
D50	18
D84	28
D95	32


Pebble Count - XSC3 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Total
35
30
25
20
15
10
5
0
<0.062
0.062-0.125
0.125-0.25
0.25-0.50
0.50-1.0
1.0-2
2-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
Bedrock
Particle Size (mm)

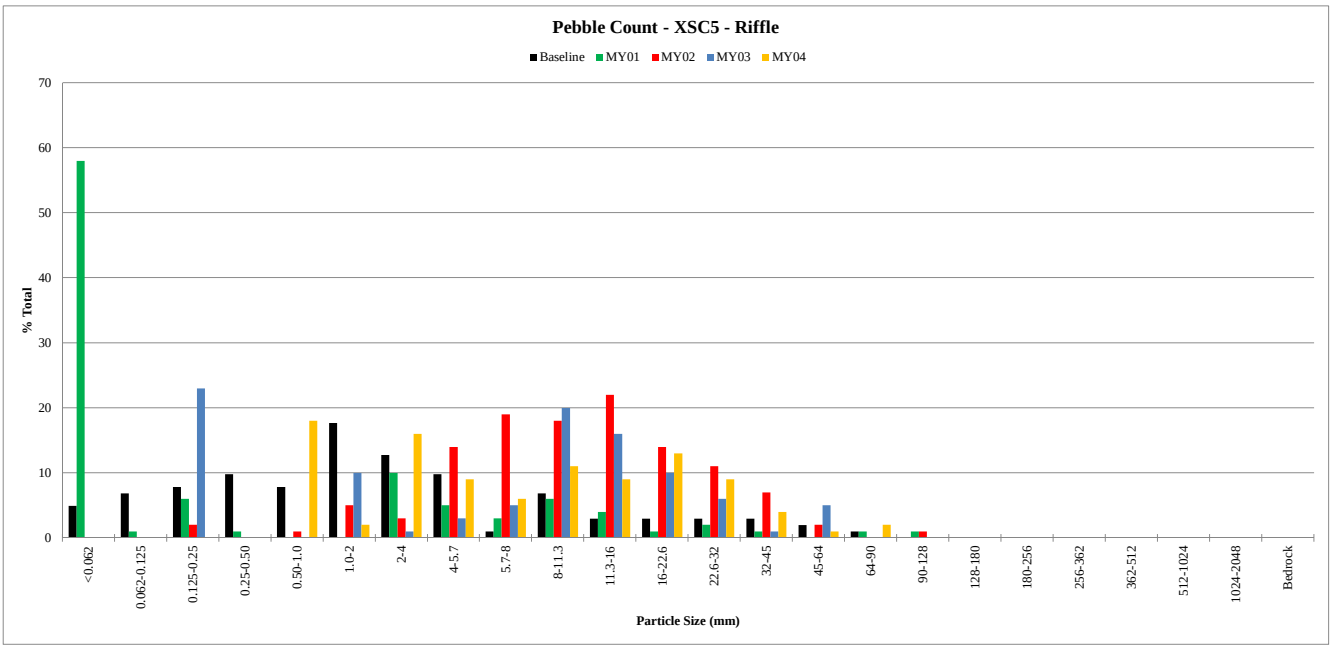

Cumulative Percent
Pebble Count - XSC3 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

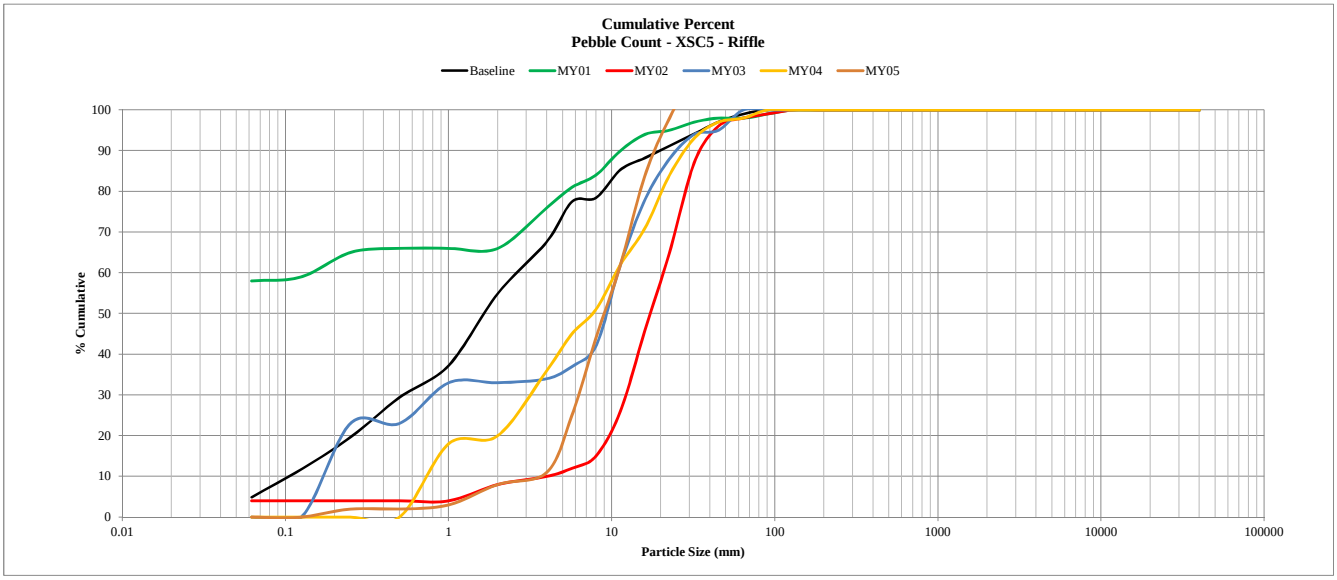
Coddle Creek Tributary - Indian Run - LR - XS5 Riffle Pebble Count

Location: STA 11+15

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		0	0	0
	Very Fine	0.062-0.125	S	0	0	0
	Fine	0.125-0.25	A	2	2	2
	Medium	0.25-0.50	N	0	0	2
	Coarse	0.50-1.0	D	1	1	3
0.04-0.08	Very Coarse	1.0-2		5	5	8
0.08-0.16	Very Fine	2-4		3	3	11
0.16-0.22	Fine	4-5.7		14	14	25
0.22-0.31	Fine	5.7-8	G	19	19	44
0.31-0.44	Medium	8-11.3	R	18	18	62
0.44-0.63	Medium	11.3-16	A	22	22	84
0.63-0.89	Coarse	16-22.6	V	14	14	98
0.89-1.26	Coarse	22.6-32	E	11	11	109
1.26-1.77	Very Coarse	32-45	L	7	7	116
1.77-2.5	Very Coarse	45-64		2	2	118
2.5-3.5	Small	64-90	C	0	0	118
3.5-5.0	Small	90-128	O	1	1	119
5.0-7.1	Medium	128-180	B	0	0	119
7.1-10.1	Large	180-256	B L E	0	0	119
10.1-14.3	Small	256-362	B	0	0	119
14.3-20	Small	362-512	O	0	0	119
20-40	Medium	512-1024	U L D	0	0	119
40-80	Large	1024-2048	E R	0	0	119
	Bedrock	Bedrock	Bedrock	0	0	119
			Total Counted	119		

Summary Data	
D50	9
D84	16
D95	23


Pebble Count - XSC5 - Riffle
Baseline
MY01
MY02
MY03
MY04
% Total
70
60
50
40
30
20
10
0
<0.062
0.062-0.125
0.125-0.25
0.25-0.50
0.50-1.0
1.0-2
2-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
Bedrock
Particle Size (mm)

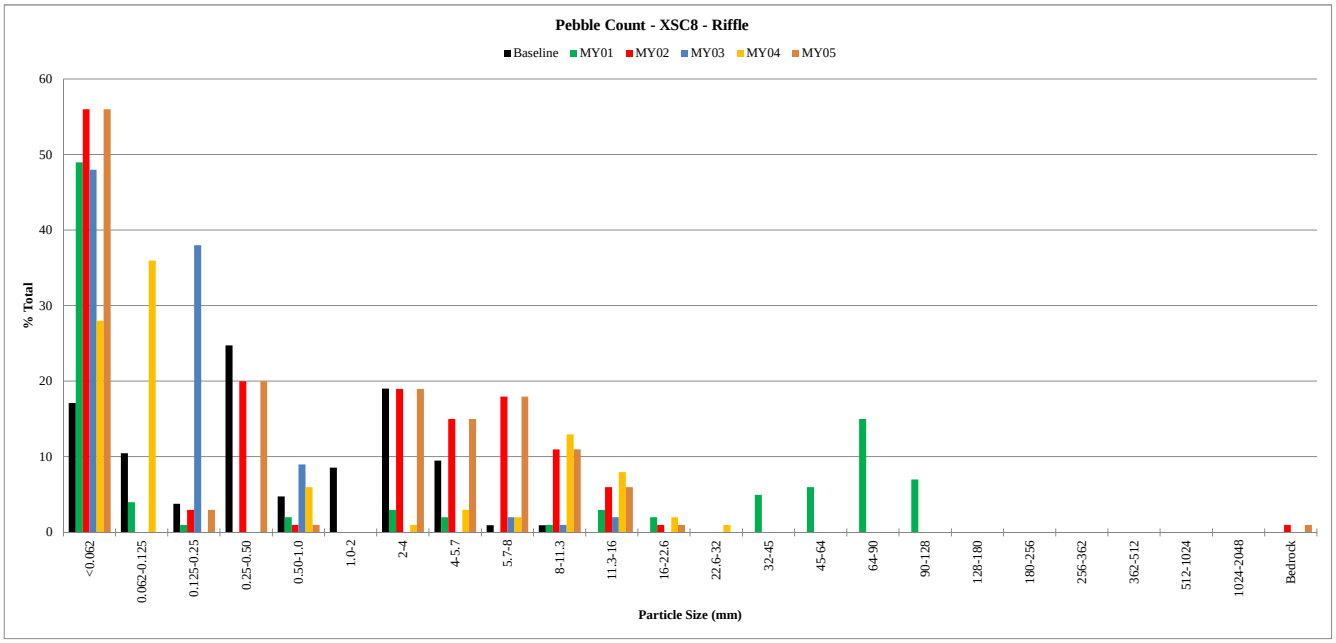

Cumulative Percent
Pebble Count - XSC5 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

Coddle Creek Tributary - Indian Run - LR - XS8 Riffle Pebble Count

Location: STA 16+50

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062		56	56	56
	Very Fine	0.062-0.125	S	0	0	56
	Fine	0.125-0.25	A	3	3	59
	Medium	0.25-0.50	N	20	20	79
	Coarse	0.50-1.0	D	1	1	80
0.04-0.08	Very Coarse	1.0-2		0	0	80
0.08-0.16	Very Fine	2-4		19	19	99
0.16-0.22	Fine	4-5.7		15	15	114
0.22-0.31	Fine	5.7-8	G	18	18	132
0.31-0.44	Medium	8-11.3	R	11	11	143
0.44-0.63	Medium	11.3-16	A	6	6	149
0.63-0.89	Coarse	16-22.6	V	1	1	150
0.89-1.26	Coarse	22.6-32	E	0	0	150
1.26-1.77	Very Coarse	32-45	L	0	0	150
1.77-2.5	Very Coarse	45-64		0	0	150
2.5-3.5	Small	64-90	C	0	0	150
3.5-5.0	Small	90-128	O	0	0	150
5.0-7.1	Medium	128-180	B	0	0	150
7.1-10.1	Large	180-256	B L E	0	0	150
10.1-14.3	Small	256-362	B	0	0	150
14.3-20	Small	362-512	O U	0	0	150
20-40	Medium	512-1024	L D	0	0	150
40-80	Large	1024-2048	E R	0	0	150
	Bedrock	Bedrock	Bedrock	1	1	151
			Total Counted	151		

Summary Data	
D50	0
D84	2.5
D95	3.5


Pebble Count - XSC8 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Total
60
50
40
30
20
10
0
<0.062
0.062-0.125
0.125-0.25
0.25-0.50
0.50-1.0
1.0-2
2-4
4-5.7
5.7-8
8-11.3
11.3-16
16-22.6
22.6-32
32-45
45-64
64-90
90-128
128-180
180-256
256-362
362-512
512-1024
1024-2048
Bedrock
Particle Size (mm)

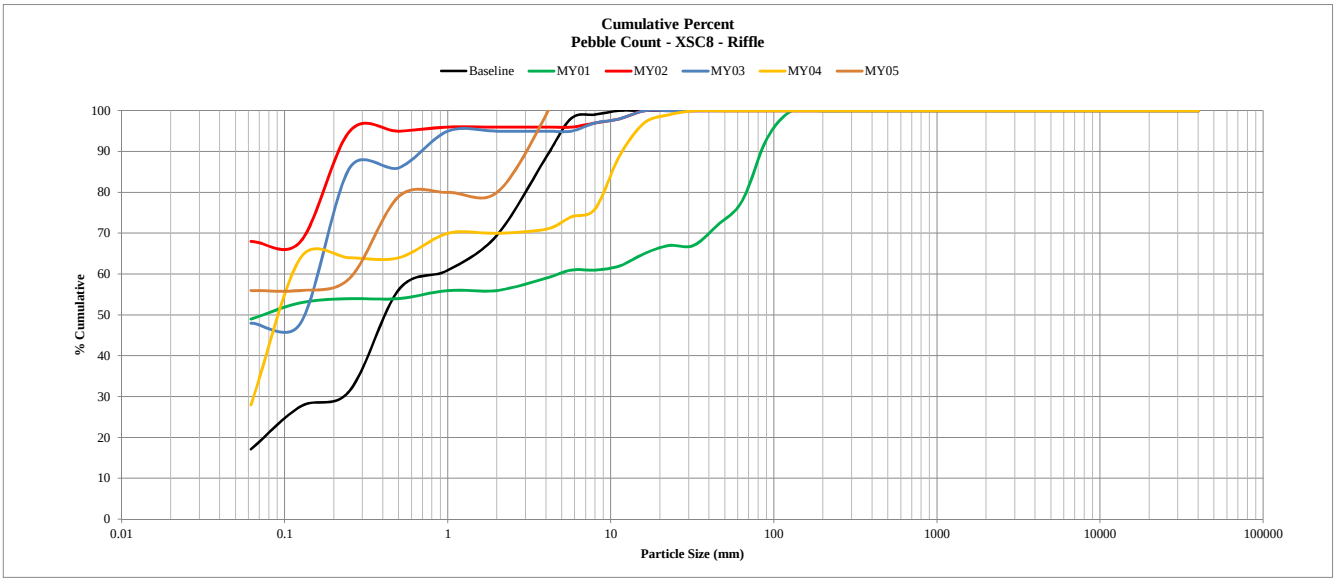

Cumulative Percent
Pebble Count - XSC8 - Riffle
Baseline
MY01
MY02
MY03
MY04
MY05
% Cumulative
100
90
80
70
60
50
40
30
20
10
0
0.01
0.1
1
10
100
1000
10000
100000
Particle Size (mm)

Table 10a. Baseline Stream Data Summary
Coddle Creek Tributary (Indian Run) / 94 - Segment/Reach: Upper (1295 feet)

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)							20.0				8.0			9.2				20.0		19.3	20.1		20.8		2
Floodprone Width (ft)							53.7				20.0			92.0				35.0		35.4	62.1		88.7		2
Bankfull Mean Depth (ft)							3.1				1.2			1.5				1.6		1.0	1.2		1.4		2
[1]Bankfull Max Depth (ft)							4.6				1.3			1.9				1.8		1.6	1.9		2.1		2
Bankfull Cross Sectional Area (ft^2)							61.3				11.3			12.3				29.3		19.9	24.7		29.5		2
Width/Depth Ratio							6.5				5.3			7.5				12.0		14.7	16.8		18.8		2
Entrenchment Ratio							2.7				2.5			10.0				1.8		1.7	3.2		4.6		2
[1]Bank Height Ratio											1.6			1.7				1.0		1.0	1.0		1.0		2
Profile																									
Riffle Length (ft)							11.5													11.0	27.9	24.5	62.0	16.2	8
Riffle Slope (ft/ft)							0.027				0.017			0.033				0.0117		0.006	0.013	0.011	0.031	0.008	8
Pool Length (ft)							40				10.8			14.0						18.0	31.6	30.0	55.0	12.2	7
Pool Max depth (ft)							4.79				2.0			2.7				2.85		2.6	3.3	3.3	3.8	0.5	6
Pool Spacing (ft)							10				4.4			47.2			52.0		101.0	47.0	91.4	91.0	126.0	25.4	7
Pattern																									
Channel Beltwidth (ft)							130.0				20.0			69.0			50.0		173.0	50.0	55.6	54.0	67.0	6.7	5
Radius of Curvature (ft)							25.0				6.0			37.0			20.0		60.0	30.0	44.9	50.0	65.0	9.0	16
Rc:Bankfull width (ft/ft)							1.3				0.7			4.6			0.7		4.6	1.6	2.2		3.1		
Meander Wavelength (ft)							115.0				48.0			85.0			104.0		213.0	135.0	168.4	171.5	208.0	21.3	8
Meander Width Ratio							5.8				2.5			8.6			2.5		8.6	2.6	2.8		3.2		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2							0.53										0.47			0.42					
Max part size (mm) mobilized at bankfull							38.7										35.4			32.0					
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							Impaired C4							C4			C4			C4					
Bankfull Velocity (fps)							5.4										3.49								
Bankfull Discharge (cfs)							328.4																		
Valley length (ft)							1638										1548			1122					
Channel Thalweg length (ft)							1900										1796			1295					
Sinuosity (ft)							1.16							1.3			1.16			1.15					
Water Surface Slope (Channel) (ft/ft)							0.0051							0.0061 - 0.0130			0.0047			0.0056					
BF slope (ft/ft)							0.0051										0.0047			0.0057					
[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
Coddle Creek Tributary (Indian Run) / 94 - Segment/Reach: Lower (975 feet)

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)							20.0				8.0			9.2				20.0		20.4	21.7		22.9		2
Floodprone Width (ft)							75.0				20.0			92.0				100.0		96.4	123.4		150.3		2
Bankfull Mean Depth (ft)							3.7				1.2			1.5				1.7		1.3	1.3		1.3		2
[1]Bankfull Max Depth (ft)							5.1				1.3			1.9				1.8		2.1	2.2		2.2		2
Bankfull Cross Sectional Area (ft^2)							74.5				11.3			12.3				29.3		27.1	28.0		28.8		2
Width/Depth Ratio							5.4				5.3			7.5				12.0		15.3	16.8		18.2		2
Entrenchment Ratio							3.8				2.5			10.0				5.0		4.7	5.7		6.6		2
[1]Bank Height Ratio											1.6			1.7				1.1		1.0	1.0		1.0		2
Profile																									
Riffle Length (ft)							6.0													18.0	32.0	31.0	48.0	12.3	5
Riffle Slope (ft/ft)							0.035				0.017			0.033				0.0114		0.0057	0.0090	0.0076	0.0150	0.0042	4
Pool Length (ft)							81.0				10.8			14.0						14.0	47.4	35.0	48.0	30.5	7
Pool Max depth (ft)							5.8				2.0			2.7				2.85		2.4	3.0	3.1	3.5	0.4	6
Pool Spacing (ft)							7.5				4.4			47.2			52		101	92.0	112.8	114.0	131.0	19.7	4
Pattern																									
Channel Beltwidth (ft)											20.0			69.0			50.0		173.0	67.0	77.2	75.0	89.0	9.1	5
Radius of Curvature (ft)											6.0			37.0			35.0		56.0	45.0	48.9	50.0	50.0	3.9	7
Rc:Bankfull width (ft/ft)											0.7			4.6			0.7		4.6	2.2	2.3		2.2		
Meander Wavelength (ft)											48.0			85.0			104.0		213.0	190.0	204.2	210.0	211.0	9.4	5
Meander Width Ratio											2.5			8.6			2.5		8.6	3.3	3.6		3.9		
Transport parameters																									
Reach Shear Stress (competency) lbf^2							0.53											0.36					0.34		
Max part size (mm) mobilized at bankfull							38.7											27.3					25.4		
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification							Modified Channel							C4				C4					C4		
Bankfull Velocity (fps)							5.9											3.49							
Bankfull Discharge (cfs)							442.9																		
Valley length (ft)							1550											1550					763		
Channel Thalweg length (ft)							1700											1922					975		
Sinuosity (ft)							1.1							1.3				1.24					1.28		
Water Surface Slope (Channel) (ft/ft)							0.0052							0.0061 - 0.0130				0.0035					0.0042		
BF slope (ft/ft)							0.0052											0.0035					0.0042		
[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 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Coddle Creek Tributary (Indian Run) / 94 Segment/Reach: Upper (1295', XS 1-4) and Lower (975', XS 5-8)

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)													
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	542.62	542.62	542.62	542.62	542.62	542.62		541.18	541.18	541.18	541.18	541.2	541.2		539.00	539.00	539.00	539.00	539.00	539		538.77	538.77	538.77	538.77	538.77	538.77								
Bankfull Width (ft)	19.31	22.90	16	19.93	16.51	18.77		34.10	35.59	23	30.49	40	27.53		20.80	25.86	21.66	21.9	21.86	24.2		33.00	33.51	29.34	33.96	34	35.98								
Floodprone Width (ft)	88.70	92.50	91	96	92	93		56.20	60.70	65	64.5	67.5	67.5		35.40	37.80	36.9	35.2	37	35.5		45.70	47.90	51.5	55	59	54								
Bankfull Mean Depth (ft)	1.03	0.99	1.71	1.12	1.25	1.51		1.20	1.16	1.82	0.94	0.89	1.25		1.40	1.31	1.13	1.02	1.59	1.79		1.30	1.30	1.06	1	1.69	1.34								
Bankfull Max Depth (ft)	1.60	2.09	2.16	2.43	2.27	2.64		3.30	3.32	3.5	3.1	3.78	4		2.10	2.39	2	2.06	2.36	2.45		2.60	2.46	3.16	3.15	4.96	3.82								
Bankfull Cross Sectional Area (ft²)	19.90	22.60	27.3	22.3	20.72	28.43		39.43	41.46	41.97	28.8	35.52	34.47		29.50	33.89	24.53	22.34	34.75	38.3		43.50	43.72	30.99	33.86	57.6	48.09								
Bankfull Width/Depth Ratio	18.80	23.20	7.41	17.81	13.16	12.4		29.50	30.55	12.6	32.28	45.05	21.99		14.70	19.73	19.13	21.47	13.75	13.5		25.00	25.68	27.78	34.06	20.07	26.92								
Bankfull Entrenchment Ratio	4.60	4.04	5.69	4.82	5.57	4.95		1.60	1.71	2.83	2.12	1.69	2.45		1.70	1.46	1.7	1.61	1.69	1.47		1.40	1.43	1.76	1.62	1.74	1.5								
Bankfull Bank Height Ratio	1.00	0.98	1.16	0.93	0.94	1.03		1.00	1.00	1	0.9	0.95	0.68		1.00	1.00	1.04	0.85	1.05	0.99		1.00	1.00	0.96	0.96	1.00	0.77								
Cross Sectional Area between end pins (ft²)	421.80	411.70	429.37	433.7	458.5	427.1615		457.50	471.20	455.94	451.7	458.9	440.5		248.40	262.10	264.04	232.26	289.8	248.8588		358.10	361.90	349.78	362.21	416.8	378.688								
d50 (mm)	4.90	32.00	19	11.3	2	22.6		12.00	27.00						6.00	6.50	8.5	33	10	18		0.34	4.40												
	Cross Section 5 (Riffle)							**Cross Section 6 (Pool)**							**Cross Section 7 (Pool)**							**Cross Section 8 (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	536.34	536.34	536.34	536.34	536.3	536.34		535.56	535.56	535.56	535.56	535.6	535.6		534.62	534.62	534.62	534.62	534.62	534.62		534.36	534.36	534.36	534.36	534.36	534.36								
Bankfull Width (ft)	22.90	19.98	18.49	37	22.9	22.02		19.30	19.03	22.11	26.48	26	22.6		69.30	34.53	31.01	36.4	28.31	33.17		20.40	22.02	16.78	32.52	38.48	38.48								
Floodprone Width (ft)	150.30	150.10	138	139.5	145.5	148		95.20	104.40	100.4	99	100.5	105		93.00	99.00	96	96	98	99.5		96.40	95.60	89.5	112	121	124								
Bankfull Mean Depth (ft)	1.30	1.40	0.97	0.61	0.75	1.44		1.50	1.40	1.58	1.16	1.44	1.58		0.70	1.07	1.20	0.9	1.4	1.39		1.30	1.30	1.18	0.81	0.76	1.42								
Bankfull Max Depth (ft)	2.10	1.94	1.15	1.36	2.15	2.3		2.40	2.75	2.71	2.46	3.02	3.17		3.00	3.14	3.11	3.22	3.48	3.76		2.20	2.33	2.18	2.39	3.29	3.29								
Bankfull Cross Sectional Area (ft²)	28.80	27.92	18	22.7	17.21	31.8		28.20	26.71	34.9	30.82	37.45	35.57		48.90	37.08	37.17	32.89	39.5	46.3		27.10	28.64	19.78	26.2	29.3	19.73								
Bankfull Width/Depth Ratio	18.20	14.30	18.99	60.31	30.47	15.25		13.10	13.56	14.01	22.75	18.05	14.3		96.30	32.16	25.87	40.28	20.29	23.79		15.30	16.93	14.28	40.36	50.54	27.1								
Bankfull Entrenchment Ratio	6.60	7.51	7.46	3.77	6.35	6.72		5.00	5.49	4.54	3.74	3.87	4.65		1.30	2.87	3.1	2.64	3.46	3		4.70	4.34	5.33	3.44	3.14	3.22								
Bankfull Bank Height Ratio	1.00	0.83	0.79	1.01	0.9	0.62		1.00	0.94	1.00	1.02	1.04	0.64		1.00	1.00	1.03	0.96	1.00	1.01		1.00	0.94	0.99	0.95	0.95	0.96								
Cross Sectional Area between end pins (ft²)	823.40	870.60	807.93	780.65	805.4	754.6968		467.00	467.40	540.64	520.1	533.6	501.2		458.80	441.30	480.99	423.02	529.8	487.499		442.50	431.60	444.59	442.99	530.4	442.04								
d50 (mm)	1.60	0.062	17	9	8	9		0.30	0.29						0.82	0.15						0.42	0.074	0.062	0.125	0.09	0.062								

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
Coddle Creek Tributary (Indian Run) / 94 - Segment/Reach: Upper (1295 feet)

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	20.1		20.8		2	22.9	24.4		25.9		2	16	18.8		21.6		2	19.9	20.92		21.9		2	16.5	19.2		21.9		2	18.7	21.5		24.2		2
Floodprone Width (ft)	35.4	62.1		88.7		2	37.8	65.2		92.5		2	36.9	63.9		91		2	35.2	65.6		96		2	37	64.5		92		2	35.5	64.3		93		2
Bankfull Mean Depth (ft)	1.0	1.2		1.4		2	1.0	1.2		1.3		2	1.71	1.42		1.13		2	1.02	1.07		1.12		2	1.25	1.42		1.59		2	1.51	1.56		1.6		2
[1]Bankfull Max Depth (ft)	1.6	1.9		2.1		2	1.7	2.1	2.1	2.4	0.2	10	2	2.1		2.16		2	2.06	2.25		2.43		2	2.27	2.32		2.36		2	2.45	2.55		2.64		2
Bankfull Cross Sectional Area (ft[2])	19.9	24.7		29.5		2	22.6	28.2		33.9		2	24.53	25.9		27.3		2	22.3	22.32		22.3		2	20.7	27.7		34.8		2	28.4	33.4		38.3		2
Width/Depth Ratio	14.7	16.8		18.8		2	19.7	21.5		23.2		2	7.41	13.27		19.13		2	17.8	19.64		21.5		2	13.2	13.5		13.8		2	12.4	13.9		15.3		2
Entrenchment Ratio	1.7	3.2		4.6		2	1.5	2.8		4.0		2	1.7	3.7		5.69		2	1.61	3.22		4.82		2	1.69	3.63		5.57		2	1.47	3.21		4.95		2
[1]Bank Height Ratio	1.0	1.0		1.0		2	1.0	1.0		1.0		2	1.04	1.1		1.16		2	0.85	0.89		0.93		2	0.94	1		1.05		2	0.99	1.01		1.03		2
Profile																																				
Riffle Length (ft)	11.0	27.9	24.5	62.0	16.2	8	4	13.1	12	23	6.6	11	12.1	25.2	26	39	19	5	13.6	28.2	27.8	45.5	12.5	6	10.4	18.2	15.4	29.6	7.29	6	13.8	22.7	19.6	34.9	9.06	6
Riffle Slope (ft/ft)	0.0060	0.0126	0.0107	0.0310	0.0078	8	0.0077	0.0234	0.0236	0.0425	0.0124	11	0.02	0.02	0.03	0.03	0.01	5	0.01	0.015	0.013	0.03	0.01	6	0.01	0.02	0.02	0.04	0.01	6	0.01	0.04	0.02	0.11	0.04	6
Pool Length (ft)	18.0	31.6	30.0	55.0	12.2	7	13	25.2	20	63	13.3	15	25	48.7	50.1	67.8	21.5	5	25	33.14	32.2	45.3	6.92	6	22.7	38.9	38.6	68.8	15.6	7	25.4	47.4	49.7	67.9	13.4	7
Pool Max depth (ft)	2.6	3.3	3.3	3.8	0.5	6	2.37	3.23	3.3	4.33	0.63	15	2.3	3.3	3.4	4.3	1	5	2.01	2.35	2.22	3.18	0.44	6	1.02	2.41	2.52	3.36	0.72	7	1.4	2.39	2.59	2.99	0.57	7
Pool Spacing (ft)	47.0	91.4	91.0	126.0	25.4	7	35	80.9	80	122.5	30.3	10	83.8	125.9	127	158.8	37.6	5	47.1	84.6	72.9	159.8	43.1	6	51.3	79.1	86.9	103	23.6	7	59.8	80.1	79.3	110	17.4	7
Pattern																																				
Channel Beltwidth (ft)	50.0	55.6	54.0	67.0	6.7	5																														
Radius of Curvature (ft)	30.0	44.9	50.0	65.0	9.0	16																														
Rc:Bankfull width (ft/ft)	1.6	2.2		3.1																																
Meander Wavelength (ft)	135.0	168.4	171.5	208.0	21.3	8																														
Meander Width Ratio	2.6	2.8		3.2																																

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	C4						C4						C4						C4						C4						C4					
Channel Thalweg length (ft)	1295						1295						1295						1295						1295						1295					
Sinuosity (ft)	1.15						1.15						1.15						1.15						1.15						1.15					
Water Surface Slope (Channel) (ft/ft)	0.0056						0.0058						0.0054						0.0057						0.0062						0.0057					
BF slope (ft/ft)	0.0057						0.0055						0.0054						0.006						0.0061						0.0064					
[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							2.3						0						3						0						1					
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 11c. Monitoring Data - Stream Reach Data Summary
Coddle Creek Tributary (Indian Run) / 94 - Segment/Reach: Lower (975 feet)

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)	20.4	21.7		22.9		2	20.0	21.0		22.0		2	16.78	17.64		18.49		2	32.5	34.76		37		2	22.9	30.7		38.5		2	22	30.3		38.5		2
Floodprone Width (ft)	96.4	123.4		150.3		2	95.6	122.9		150.1		2	89.5	113.8		138		2	112	125.8		139.5		2	121	133		146		2	124	136		148		2
Bankfull Mean Depth (ft)	1.3	1.3		1.3		2	1.3	1.4		1.4		2	0.97	1.07		1.18		2	0.61	0.71		0.81		2	0.75	0.76		0.76		2	1.42	1.43		1.44		2
[1]Bankfull Max Depth (ft)	2.1	2.2		2.2		2	1.9	2.2	2.2	2.4	0.2	7	1.15	1.66		2.18		2	1.36	1.875		2.39		2	2.15	2.72		3.29		2	2.3	2.8		3.29		2
Bankfull Cross Sectional Area (ft[2])	27.1	28.0		28.8		2	27.9	28.3		28.6		2	18	18.89		19.78		2	22.7	24.45		26.2		2	17.2	23.3		29.3		2	19.7	25.8		31.8		2
Width/Depth Ratio	15.3	16.8		18.2		2	14.3	15.6		16.9		2	14.28	16.63		18.99		2	40.4	50.34		60.31		2	30.5	40.5		50.5		2	15.3	21.2		27		2
Entrenchment Ratio	4.7	5.7		6.6		2	4.3	5.9		7.5		2	5.33	6.39		7.46		2	3.44	3.605		3.77		2	3.14	3.46		3.77		2	3.22	4.97		6.72		2
[1]Bank Height Ratio	1.0	1.0		1.0		2	0.8	0.9		0.9		2	0.79	0.89		0.99		2	0.95	0.98		1.01		2	0.95	0.98		1.01		2	0.61	0.79		0.96		2
Profile																																				
Riffle Length (ft)	18.0	32.0	31.0	48.0	12.3	5	4.0	13.5	14.5	24.0	7.2	6	10.78	18.17	17.8	27.19	6.16	6	15.5	17.35	17.1	19.46	1.83	5	6.44	12.4	13.5	16.5	4.01	5	9.67	20.2	16	33.4	10.2	5
Riffle Slope (ft/ft)	0.0057	0.0090	0.0076	0.0150	0.0042	4	0.0088	0.0141	0.0152	0.0188	0.0036	6	0.004	0.012	0.012	0.021	0.007	6	0.016	0.030	0.029	0.033	0.010	5	0.01	0.03	0.02	0.09	0.03	5	0.02	0.02	0.02	0.03	0	5
Pool Length (ft)	14.0	47.4	35.0	48.0	30.5	7	26.0	45.6	48.0	71.0	17.6	7	16.41	41.3	45.6	66.8	18.7	5	14.8	26.27	28.57	41.33	11.1	5	16.1	35.5	37.4	53.1	13.6	5	38.1	47.6	43.7	63	9.78	5
Pool Max depth (ft)	2.4	3.0	3.1	3.5	0.4	6	2.4	3.0	2.8	3.9	0.5	7	14.79	18.1	18.4	20.7	2.17	5	2.41	2.84	3.07	3.21	0.39	5	1.76	1.98	1.93	2.42	0.26	5	2.26	2.83	2.85	3.27	0.42	5
Pool Spacing (ft)	92.0	112.8	114.0	131.0	19.7	4	45.0	93.1	107.0	141.0	38.0	6	67.6	122.2	123	176.1	44.7	4	40.6	50.48	47.13	66.96	10.7	5	23.9	41.7	47.5	62.8	17	5	46.5	61.2	52.6	86.3	17.7	5
Pattern																																				
Channel Beltwidth (ft)	67.0	77.2	75.0	89.0	9.1	5																														
Radius of Curvature (ft)	45.0	48.9	50.0	50.0	3.9	7																														
Rc:Bankfull width (ft/ft)	2.2	2.3		2.2																																
Meander Wavelength (ft)	190.0	204.2	210.0	211.0	9.4	5																														
Meander Width Ratio	3.3	3.6		3.9																																

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	C4						C4						C4						C4						C4						C4					
Channel Thalweg length (ft)	975						975						975						975						975						975					
Sinuosity (ft)	1.28						1.28						1.28						1.28						1.28						1.28					
Water Surface Slope (Channel) (ft/ft)	0.0042						0.0042						0.0051						0.0051						0.0049						0.005					
BF slope (ft/ft)	0.0042						0.0046						0.0054						0.005						0.0045						0.005					
[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							0						0						0						0						1					
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

Appendix E
Hydrologic Data

Table 12. Verification of Bankfull Events			
Coddle Creek Tributary (Indian Run)/ 94 Segment/Reach: 2270 feet			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo**
5/30/2012	Between 5/11/2011 - 5/30/2012	Visual observation of wrack lines; stream gauge	Photo in MY1 Report
11/4/2013	Between 5/30/2012 - 11/04/2013	Visual observation of wrack lines; stream gauge	Photo in MY2 Report
9/19/2014	Between 11/04/2013 - 9/19/2014	Visual observation of wrack lines; stream gauge reading at 35" above bankfull	Photo in MY3 Report
9/22/2015	Between 9/19/2014 - 9/22/2015	Visual observation of wrack lines; stream gauge reading at 10.5" above bankfull	Photo in MY4 Report
6/23/2016	Between 9/22/2015 - 6/23/2016	Visual observation of wrack lines; stream gauge reading at 4.5" above bankfull	No photo taken
10/19/2016 and 12/14/16	Between 6/23/2016 - 12/14/2016	Visual observation of wrack lines; stream gauge reading at 6.5" above bankfull	Photos below

Photo 1. Stream gauge 6.5" above bankfull 10/19/16.

Photo 2. Wrack lines observed in Upper Reach 12/14/16.