Year 2 Monitoring Report
Final
Hudson Property

DMS Project ID #: 95361
DMS Contract #: 004638
USACE Action ID# SAW-2012-01394
Beaufort County, North Carolina

Submitted: December 2017

Submitted to/Prepared for:
NC Department of Environment and Natural Resources
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:
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January 18, 2018

Jeff Schaffer
Eastern Supervisor/Project Manager
State of North Carolina Environmental Quality Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652
(919) 707 - 8976

Re: Draft Year 2 Monitoring Report for Hudson Property Stream Restoration Project (95361)
Tar-Pamlico River Basin; CU 03020105
Beaufort County, NC
Contract No. 004638

Dear Mr. Schaffer:

This letter is in response to your comments concerning the review of the Draft Monitoring Year 2 Report and digital submittals. To aid in clarity, your comments are italicized below and followed by a response.

1. *The digital data and drawings have been reviewed and determined to meet DMS requirements. However, DMS is calling to your attention that while Albemarle did provide reach breakdowns for each reach, in future submittals, please provide the reach lengths and mitigation approaches as required by contract and stated in DMS's Format, Data Requirements, and Content Guidance for Electronic Drawings Submitted to EEP version 1.0 (03/27/08).*

   Future submissions will include reach lengths and mitigation approaches as specified by DMS.

2. *Section 9.0: The report references the presence of bankfull events during monitoring year 2. Please state whether this is the second year that bankfull events have occurred on the site that would meet the bankfull standard for success.*

   Bankfull events occurred during Year 1 and Year 2 monitoring. The site is meeting the bankfull standard for success. A note has been added to Section 9.0 to clarify this point.

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3. Appendix B, CCPV: On the Reach 1 sheet, vegetation plot 4 shows as meeting success while the data says otherwise. Please correct.

   Vegetation plot 4 in Appendix B, CCPV Reach 1 sheet has been corrected.

4. *Appendix C, Table 7: The "PnoLS" column in Table 7 is for providing the number of planted stems in each vegetation plot, not including live stakes. In looking at this report, is see that Albemarle is including red maple, privet, sweetgum, wax myrtle and loblolly pine which were not listed as planted stems in the Baseline Report. Please review this table and ensure that any volunteer species and/or invasive species are included in the T (total) column only. This could show that more plots that number 4 are not meeting success.*

   Appendix C, Table 7 has been corrected. Volunteer species and/or invasive species are now represented in the T (total) column only. Stems per acre Only plot number continue to meet requirements except for plot number 4.

5. *Appendix D, Table 11 (all): DMS realizes that there are various methods used to calculate Bank Height Ratio from year to year. One of these is to hold the bankfull depth static (denominator) while allowing the Low Top of Bank max depth (numerator) to vary. Another method that has been proposed and is being evaluated is to hold the As-built cross-sectional area static within each year's new cross-section and allow that to determine the max bankfull depth for each year. However, if there are large changes in the W/D ratio either method can make for somewhat distorted BHR values depending upon the direction and magnitude of the change in the W/D ratio. Please update the calculations to reflect changes observed in the overlays and explain in detail as footnote with the tables that describes the method bywhich Albemarle is calculating Bank Height Ratio and Entrenchment Ratio. In addition, please provide context to any observed changes in these calculated ratios in the report narrative. Albemarle must be prepared to defend the method used for credit release and justify through context whether or not any changes observed in a cross section represent an issue.*

   After consideration of the protocols and the project, it was decided to hold the As-built cross-sectional area static within each year's new cross-section and allow that to determine the max bankfull depth for each year. The geomorphology monitoring data has been updated to reflect this change for Years 1 and 2. Changing the fixed baseline to the cross-sectional area improved our ability to interpret changes from Year 1 to Year 2 and did not reveal any Bankfull Bank Height Ratios of concern. Please see updates to cross sections as well as to Appendix D, Table 11.

Table of Contents

1.0 PROJECT SUMMARY

The mitigation area is 13.49 acres located within a larger 106-acre property owned by Charles Hudson. It is located in Beaufort County, NC and the Tar-Pamlico River Basin. Mitigation components include five stream reaches totalling 2,891 linear feet contained within a Conservation Easement. Construction was completed in 2015 and planting completed in 2016. The first of seven monitoring years was initiated in 2016. Year 2 monitoring was completed in November 2017.

2.0 PROJECT GOALS AND OBJECTIVES

The project goals of the Hudson property per the approved mitigation plan are as follows:

- Improve and sustain hydrologic connectivity/interaction and storm flow/flood attenuation.
- Reduce nutrient and sediment stressors to the reach and receiving watershed.
- Provide uplift in water quality functions.
- Improve aquatic and terrestrial habitats (complexity, quality).
- Improve and maintain riparian buffer habitat.

The project goals will be addressed through the following project objectives:

- Implement a sustainable, reference-based, rehabilitation of the reach dimension, pattern, and profile to provide needed capacity and competency.
- Support the removal of barriers to anadromous fish movement and to help improve nursery and spawning habitats.
- Strategically install stream structures and plantings designed to maintain vertical and lateral stability and improve habitat diversity/complexity.
- Provide a sustainable and functional bankfull floodplain feature.
- Enhance and maintain hydrologic connection between stream and adjacent floodplain/riparian corridors.
- Utilize the additional width of the swamp runs to provide natural filters for sediment and nutrients and diffuse flow from upstream runoff.
- Install, augment, and maintain appropriate riparian buffer with sufficient density and robustness to support native forest succession.
- Water quality enhancement through riparian forest planting and woody material installation, and increased floodplain interaction/overbank flooding.
- Restore the existing ditched streams to single and multi-thread headwater systems with forested riparian buffers.
- Provide ecologically sound construction techniques that will require minimal grading and disturbance.

3.0 PROJECT SUCCESS CRITERIA

3.1 Stream Restoration Performance Standards

Single Thread Channels (Reaches 1 - 4) and Swamp Run (Reach 5)

Groundwater monitoring wells are installed in and near the thalweg of all five reaches. The wells are equipped with continuous–reading gauges capable of documenting sustained flow. Per the approved Mitigation Plan, each reach must exhibit water flow for at least 30 consecutive days during years with normal rainfall (demonstrating at least intermittent stream status). All restored channels shall receive sufficient flow through the

monitoring period to maintain an Ordinary High-Water Mark (OHWM). Field indicators of flow events include a natural line impressed on the bank; shelving; changes in soil characteristics; destruction of terrestrial vegetation; presence of litter and debris; wracking; vegetation matted down, bent or absent; sediment sorting; leaf litter disturbed or washed away; scour; deposition; bed and bank formation; water staining; or change in plant community. In addition, two overbank flows shall be documented for each reach during the monitoring period using continuously monitored pressure transducers and crest gauges. All collected data and field indicators of water flow shall be documented in each monitoring report. Seven flow monitoring stations are located on Reaches 1 – 4, three are located in Reach 5.

3.2 Stream Channel Restoration Stability Performance Standards

Headwater System (Reach 5)

All stream areas shall remain stable with no areas of excessive erosion such as evidence of bank sloughing or actively eroding banks due to the exceedance in critical bank height and lack of deep rooted stream bank vegetation.

Single Thread Channels (Reaches 1 - 4)

1. Bank Height Ratio (BHR) shall not exceed 1.2 within restored reaches of the stream channel.
2. Entrenchment Ratio (ER) shall be no less than 2.2 within restored reaches of the stream channel.
3. The stream project shall remain stable and all other performance standards shall be met through two separate bankfull events, occurring in separate years, during the 7-year post construction monitoring period.
4. Three bank pin arrays and 11 cross sections are located on Reaches 1 - 4

3.3 Planted Vegetation Performance Standards

1. At least 320 three-year-old planted stems/acre must be present after year three. At year five, density must be no less than 260 five-year-old planted stems/acre. At year 7, density must be no less than 210 seven-year-old planted stems/acre.
2. If this performance standard is met by year 5 and stem density is trending toward success (i.e., no less than 260 five-year-old stems/acre) monitoring of vegetation on the site may be terminated provided written approval is provided by the USACE in consultation with the North Carolina Interagency Review Team (NCIRT).
3. Thirteen vegetation plot samples are located within the project area.

4.0 SITE CONDITIONS AND DESCRIPTION

The Hudson property is 13.49 acres located in Beaufort County, NC and the Tar-Pamlico River Basin. The majority of the site is used for crop production, primarily corn, soybeans and wheat. As a result of the lowering of local water tables and in some cases the complete elimination of ground and surface water interaction, the degradation of water quality and downstream anadromous fish spawning and nursery habitat has occurred. Hydric soils are present on site, meaning that the pre-existing site conditions were appropriate for raising the water table and re-establishing normal base flow conditions (See Figure 1 -Vicinity Map).

5.0 MITIGATION COMPONENTS

Mitigation components are limited to five reaches: Reach 1: 833 lf; Reach 2: 532 lf; Reach 3: 445 lf; Reach 4: 437 lf; Reach 5: 644 lf, for a total restored stream footage of 2,891linear feet (Table 1).

6.0 DESIGN APPROACH

A natural design approach was used to restore the natural sinuosity and flow of the headwater streams which existed prior to channelization. Grading was done to decrease sediment load and erosion rate while allowing for floodplain connectivity and storage for overland flow. Banks were graded down to distribute flow velocity and the banks and riparian buffers were planted to stabilize the channel and create habitat. A combination of Priority 1 and Priority II restoration types were used. Where the proposed channels tie into the existing, non-restored channels, Priority II restoration was used.

7.0 CONSTRUCTION AND PLANTING TIMELINE

Construction commenced in December 2014 with the installation of recommended erosion control practices and was completed in May 2015. Planting was officially concluded in early January 2016. (Table 2 – Project History Table)

8.0 PLAN DEVIATIONS

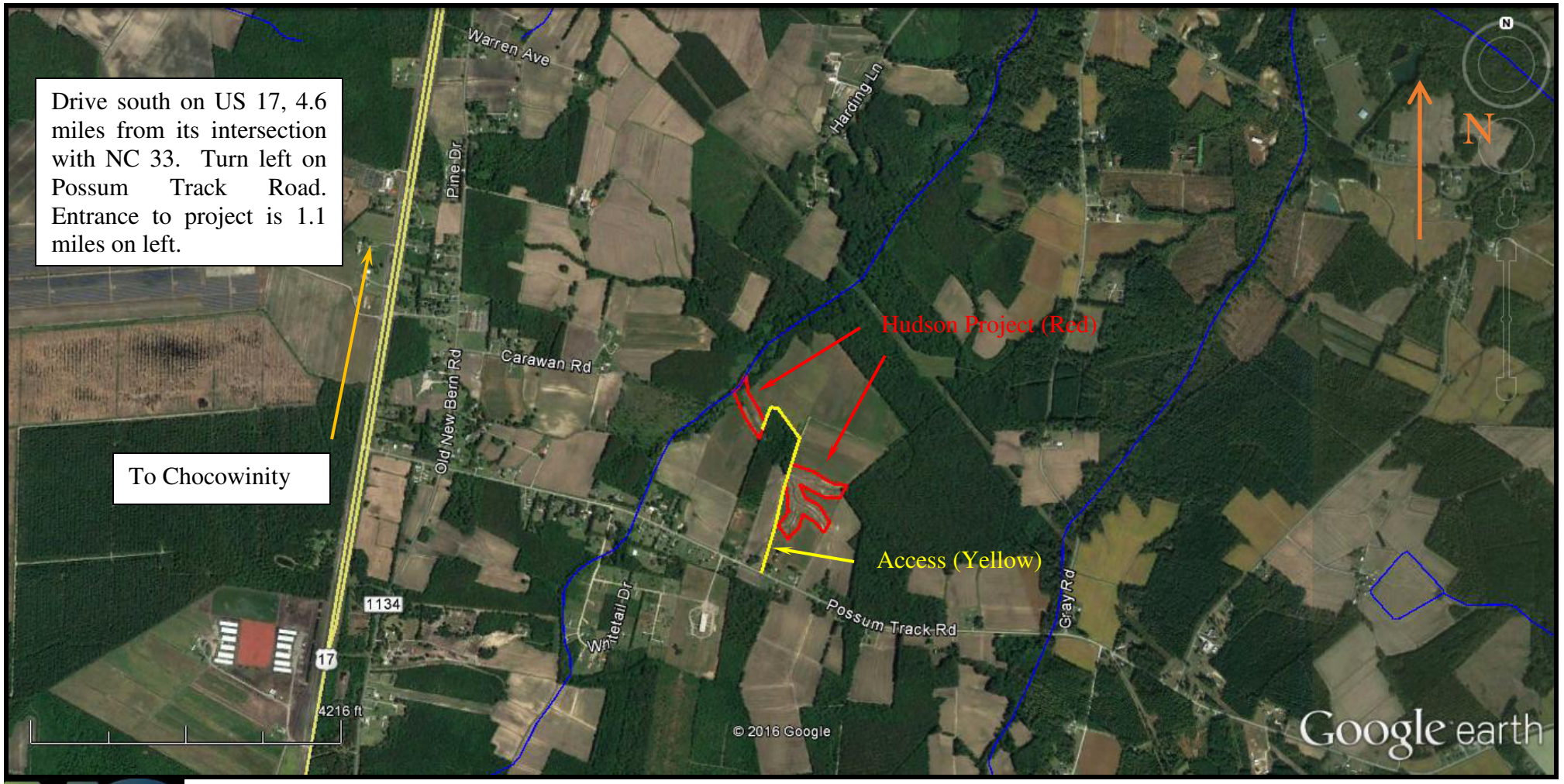
There were no significant deviations between construction plans and the As-built conditions.

9.0 PROJECT PERFORMANCE

The Hudson stream restoration project is currently meeting functional goals and objectives. Annual monitoring took place in November and revealed the presence of bankfull events, floodplain connectivity, and lateral and vertical stability. In-stream structures were observed to be functioning as intended with minimal scouring of the channel's banks or bed. Bankfull events occurred during Year 1 and Year 2 monitoring. The site is meeting the bankfull standard for success. The entire length of the project is currently exhibiting fully vegetated banks with both herbaceous and woody plants. Overall, woody plantings within the riparian buffer are meeting project goals with some dieback of planted stems and introduction of other woody vegetation in 8 out of 13 vegetation monitoring plots. Year 1 Monitoring identified some areas where woody survivability was low; these areas will be spot planted in December 2017. After planting, stem counts will be verified within plots and a report addendum submitted. Stream gauges indicated base flow and bankfull events at 10 out of 10 locations. Bank pins could not be located due to dense vegetative growth. Aggradation was noted on Reaches 2 and 3, however both reaches remain stable. Stream cross sections are meeting objectives in 11 out of 11 locations. A field meeting with NC Division of Mitigation Services and the USACE in June 2017, identified corrective measures necessary on Reach 5 to raise the stream invert to create a wider swamp run. Regrading was completed in October 2017. No additional corrective measures are necessary and monitoring will continue as scheduled.

10.0 METHODS AND REFERENCES

Monitoring methodology did not differ from the approved Mitigation Plan. Cross-section dimensions were collected using standard survey methods. Vegetation assessment was done according to the Level 2 protocol specified by the Carolina Vegetation Survey. Hydrology monitoring wells were installed per ERDC TN-WRAP-00-02 "Installing Monitoring Wells/Piezometers in Wetlands" dated 2000. Groundwater levels were recorded using the U20-001-01 water level data loggers manufactured by Onset Computer. The loggers were installed in the wells per the manufacturer's instructions.



Environmental Quality

Figure 1 - Vicinity Map
Hudson Stream Mitigation Project
DMS Project #95361
Beaufort County, NC

APPENDIX A: PROJECT BACKGROUND TABLES

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts

Table 4. Project Information and Attributes

Table 1: Project Components and Mitigation Credits
Hudson Property, Beaufort County
EEP Project Number: 95361

Mitigation Credits

	Stream		Riparian wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	2,891								

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 1		766 LF	PI		833 LF	1:1
Reach 2		516 LF	PI/PII		532 LF	1:1
Reach 3		611 LF	PI/PII		445 LF	1:1
Reach 4		503 LF	PI/PII		437 LF	1:1
Reach 5		689 LF	PI		644 LF	1:1
Total		3,085 LF			2,891 LF	

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration	2,891 LF					
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes
FB	Adjacent to stream	Buffer	100 feet on either side of stream centerline

Table 2: Project Activity and Reporting History Hudson Property- EEP Project Number 95361		
Activity, Deliverable, or Milestone	**Data Collection Complete**	**Actual Completion or Delivery**
Project Institution	N/A	June 2012
Mitigation Plan	July 2014	Oct 2014
Permits Issued	March 2013	May 2014
Final Design Construction	March 2013	May 2014
Construction	N/A	May 2015
Containerized, Bare Root, and B&B Planting	N/A	January 2016
Baseline Monitoring Document (Year 0 - Baseline)	January 2016	August 2016
Year 1 Monitoring	September 2016	Final: January 2017
Year 2 Monitoring	November 2017	December 2017
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3: Project Contacts Hudson Property- EEP Project Number: 95361	
Primary Project Design POC	Ecotone, Inc. Scott McGill (410) 420-2600 P.O. Box 5, Jarrettsville, MD 21084
Construction Contractor POC	Riverside Excavation, Inc. Car Baynor (252) 943-8633
Survey Contractor POC	True Line Surveying Curk Lane (919) 359-0427
Planting and Seeding Contractor POC	Carolina Silvics, Inc. Mary Margaret McKinney (252) 482-8491 908 Indian Trail Road, Edenton, NC 27932
Seed Mix Sources	Ernst Conservation Seeds, LLP, Meadville, PA
Nursery Stock Suppliers	Carolina Silvics, Inc.
Monitoring Performers Stream and Vegetation POC	Ecotone, Inc. Scott McGill (410) 420-2600 P.O. Box 5, Jarrettsville, MD 21084

Table 4: Project information **Hudson Property- EEP Project Number: 95361**					
Project name	HUDSON PROPERTY				
County	BEAUFORT				
Project Area (ac)	13.4 AC				
Project Coordinates (Lat and Long)	77˚ 06" 13.62' W / 35˚ 26" 53.20' N				
4.1 Project Watershed Summary Information					
Physiographic province	INNER COASTAL PLAIN				
River basin	TAR-PAMLICO RIVER BASIN				
USGS Hydrologic Unit 8-digit	03020104	USGS Hydrologic Unit 14-digit	03020104010010		
DWQ Sub-basin	CHOCOWINITY CREEK – HORSE BRANCH				
Project Drainage Area (acres)	190.86				
Project Drainage Area Percentage of Impervious Area	1.2 % (2.24 acres)				
CGIA Land Use Classification	2.01.01.07 Annual Row Crop Rotation				
4.2 Reach Summary Information					
Parameters	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5
Length of reach (linear feet)	766	516	611	503	689
Valley classification	VIII	VIII	VIII	VIII	VIII
Drainage area (acres)	40.51	74.63	35.21	150.35	190.86
NCDWR stream identification score	20.75	20.75	20.75	20.75	28
NCDWR Water Quality Classification	C;NSW	C;NSW	C;NSW	C;NSW	C;NSW
Morphological Description (stream type)	G5-G6	G5-G6	G5-G6	G5-G6	G5-G6
Evolutionary trend	Early (CEM)	Early (CEM)	Early (CEM)	Early (CEM)	Early (CEM)
Underlying mapped soils	GoA & CrB	CrB & Ly	CrB & Ly	CrB	CrB & Me
Drainage class	MW	MW & SP	MW & SP	MW	MW & P
Soil Hydric status	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric	Hydric
Slope (ft/ft)	0.009	0.006	0.008	0.004	0.003
FEMA classification	N/A	N/A	N/A	N/A	AE/X
Native vegetation community	Pasture/Crop	Pasture/Crop	Pasture/Crop	Pasture/Crop	Pasture/Crop
Percent composition of exotic invasive vegetation	N/A	N/A	N/A	N/A	N/A
4.3 Regulatory Considerations					
Regulation	Applicable?	Resolved?	Supporting Documents		
Waters of the United States – Section 404	YES	YES	Supporting Documents		
Waters of the United States – Section 401	YES	YES	SAW-2012-01394		
Endangered Species Act	NO	YES	NA		
Historic Preservation Act	NO	YES	NA		
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	NO	YES	NA		
FEMA Floodplain Compliance	NO	YES	NA		
Essential Fisheries Habitat	NO	YES	NA		

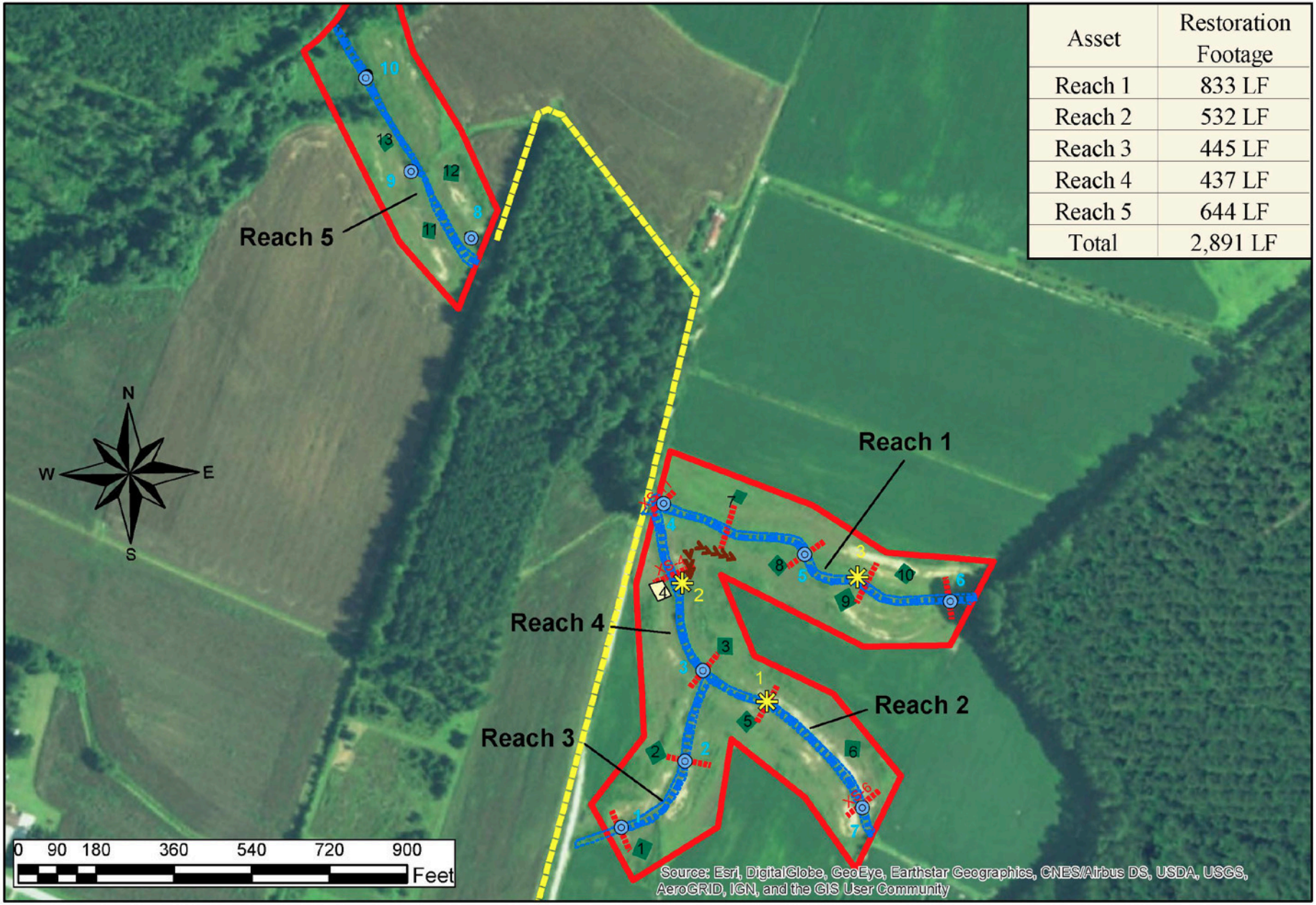
APPENDIX B: VISUAL ASSESSMENT DATA

Current Condition Plan View

Table 5. Visual Stream Morphology Stability Assessment (Reach 1-4)

Table 6. Vegetation Condition Assessment Table

Site Photos



Asset	Restoration Footage
Reach 1	833 LF
Reach 2	532 LF
Reach 3	445 LF
Reach 4	437 LF
Reach 5	644 LF
Total	2,891 LF

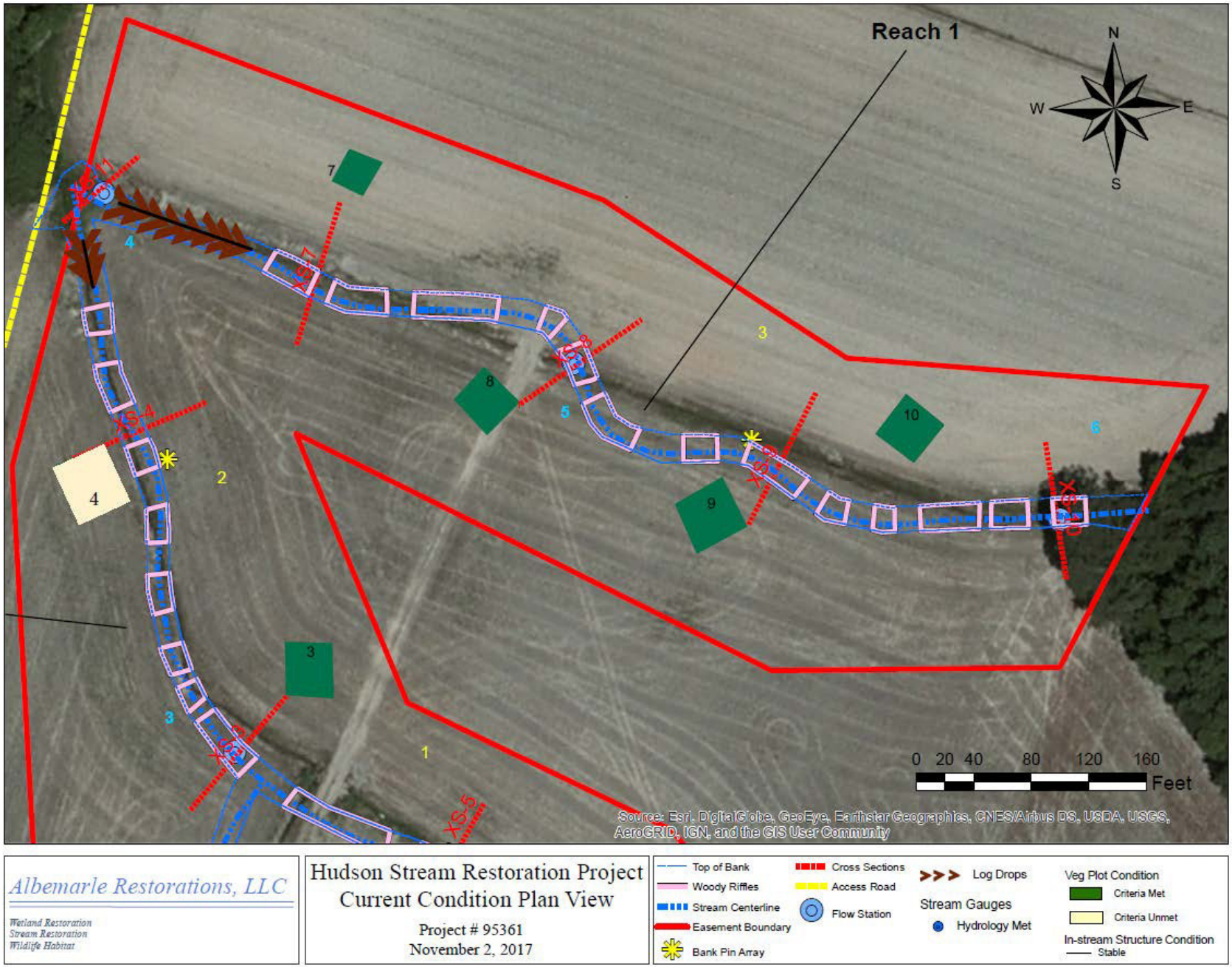
Albemarle Restorations, LLC

Wetland Restoration
Stream Restoration
Wildlife Habitat

Hudson Stream Restoration Project
Current Condition Plan View

Project # 95361
November 2, 2017

Flow Station
Bank Pin Array
Top of Bank
Cross Sections
Access Road
Stream Centerline
Easement Boundary
Woody Riffles
Log Drops
Stream Gauges
Hydrology Met
Veg Plot Condition
Criteria Met
Criteria Unmet
In-stream Structure Condition
- Stable


Reach 1
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Feet
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Albemarle Restorations, LLC
Wetland Restoration
Stream Restoration
Wildlife Habitat
Hudson Stream Restoration Project
Current Condition Plan View
Project # 95361
November 2, 2017
Top of Bank
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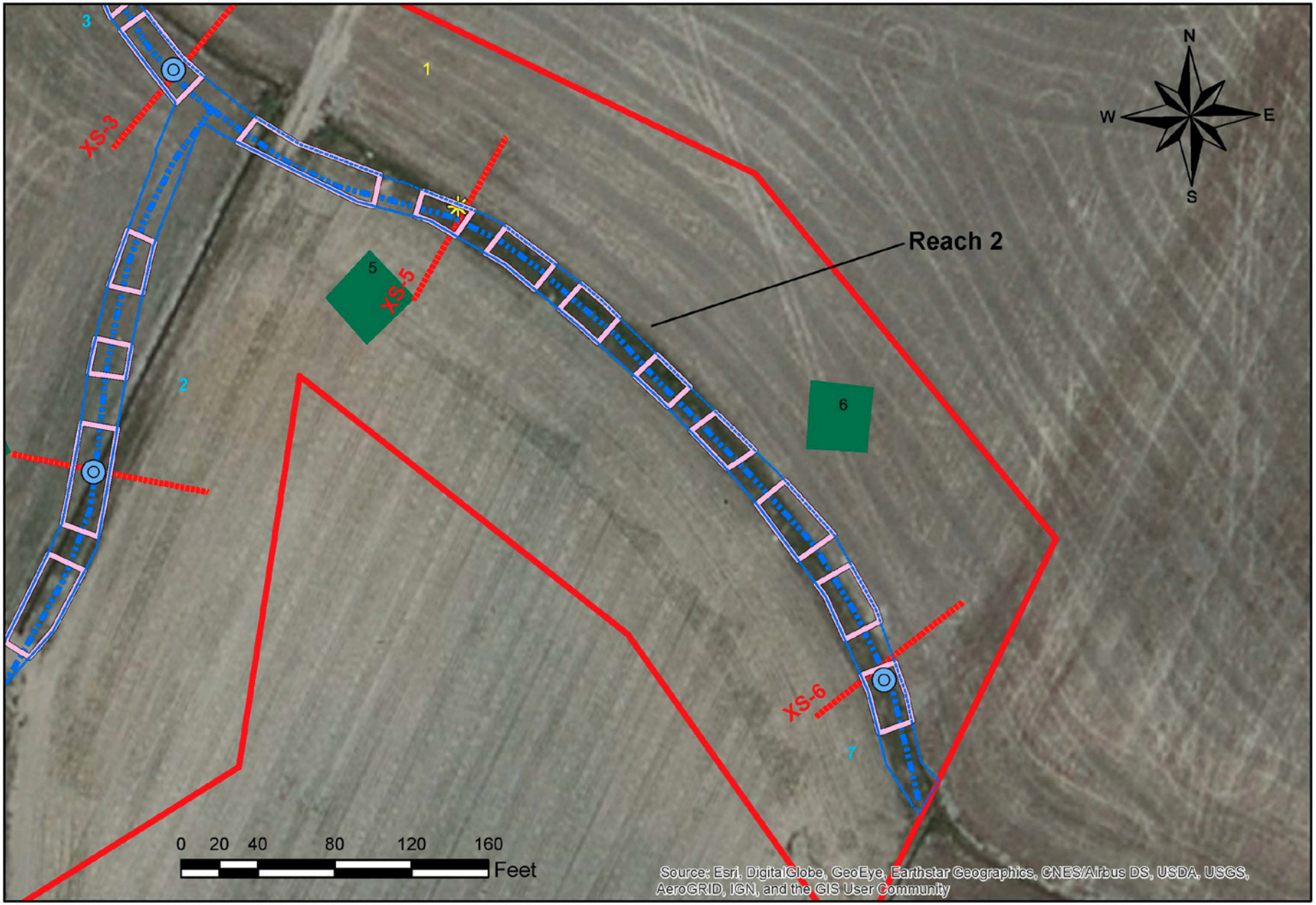

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Wetland Restoration
Stream Restoration
Wildlife Habitat

Hudson Stream Restoration Project
Current Condition Plan View

Project # 95361
November 2, 2017

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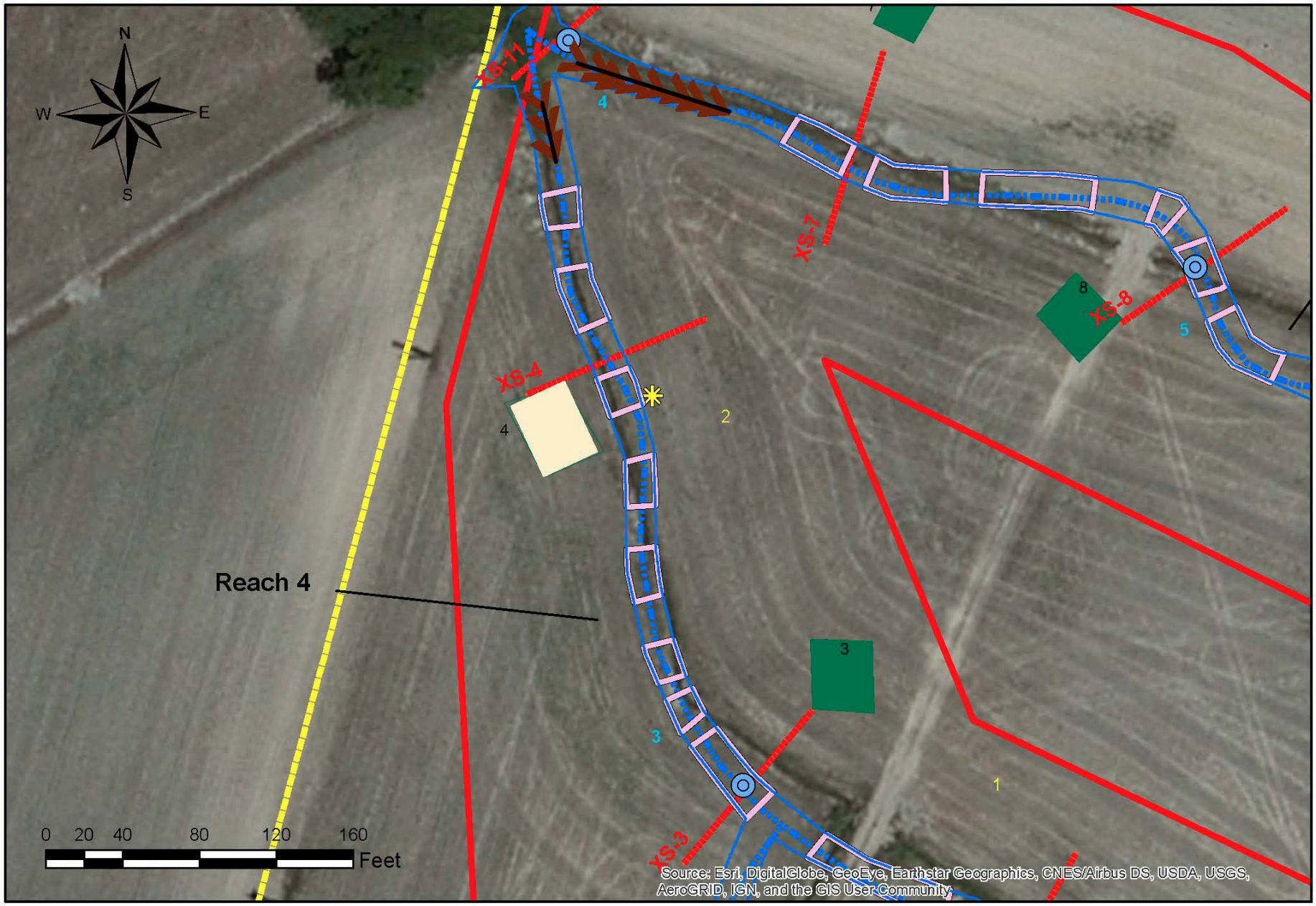

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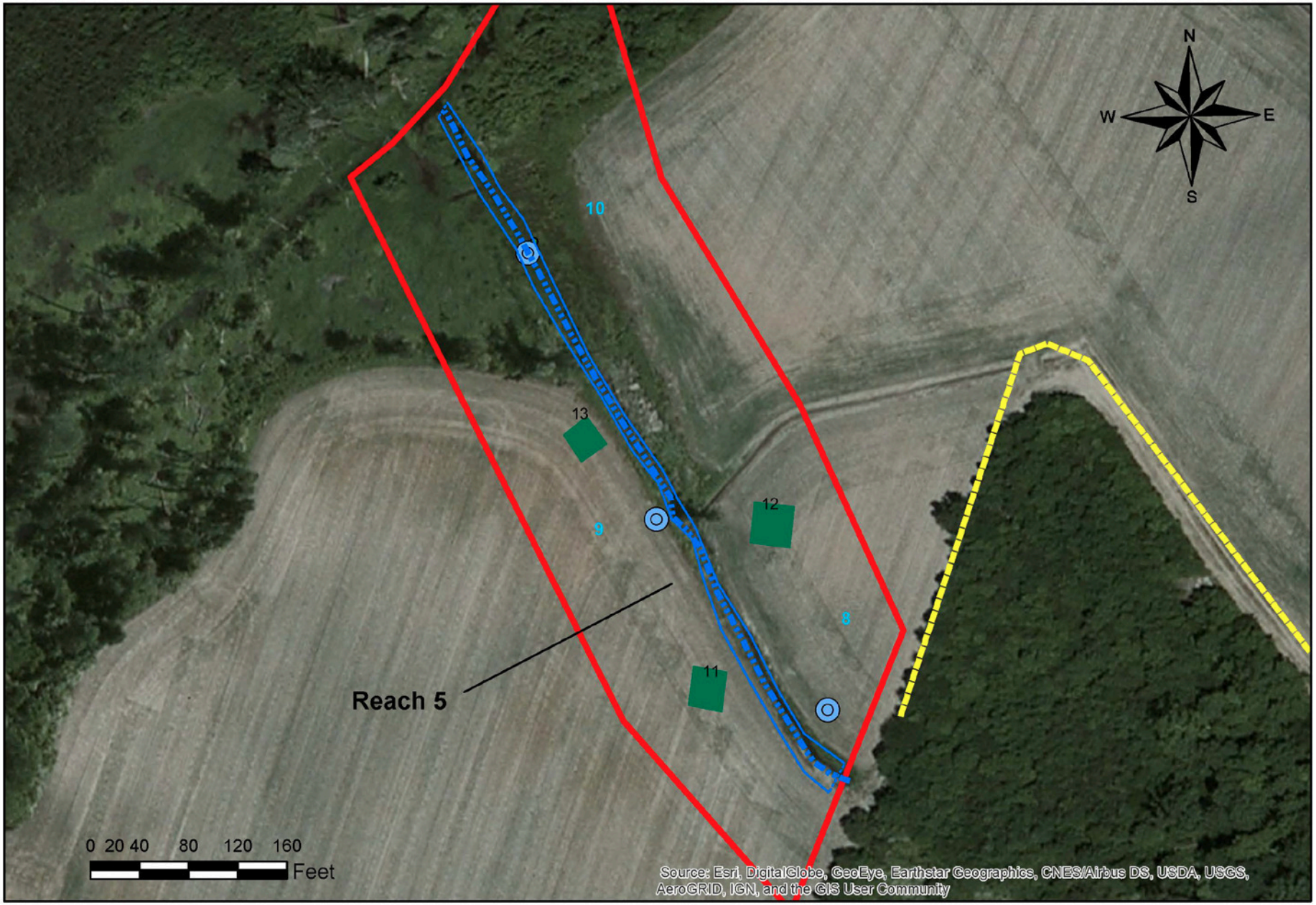
Wetland Restoration
Stream Restoration
Wildlife Habitat

Hudson Stream Restoration Project
Current Condition Plan View

Project # 95361
November 2, 2017

- Flow Station
- Top of Bank
- Woody Riffles
- Stream Centerline
- Bank Pin Array
- Easement Boundary
- Cross Sections
- Access Road
- Log Drops
- Stream Gauges
  - Hydrology Met
- Veg Plot Condition
  - Criteria Met
  - Criteria Unmet
- In-stream Structure Condition
  - Stable



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Wetland Restoration
Stream Restoration
Wildlife Habitat

Hudson Stream Restoration Project
Current Condition Plan View

Project # 95361
November 2, 2017

- Top of Bank
- Woody Riffles
- Stream Centerline
- Easement Boundary
- Bank Pin Array
- Cross Sections
- Access Road
- Flow Station
- Log Drops

Stream Gauges
- Hydrology Met

Veg Plot Condition
- Criteria Met
- Criteria Unmet

In-stream Structure Condition
- Stable

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 1								
Assessed Length		766								
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	13	13			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	5	5			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	5	5			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
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.	8	8			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.	8	8			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)	8	8			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	8			100%			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 2								
Assessed Length		516								
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	9	9			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
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.	0	0			NA			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			NA			
	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)	0	0			NA			
	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			NA			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 3								
Assessed Length		611								
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	7	7			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			100%			
	4.Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
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.	0	0			NA			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			NA			
	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)	0	0			NA			
	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			NA			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 4								
Assessed Length		503								
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	8	8			NA			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			NA			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			NA			
	4.Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA			
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.	3	3			NA			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			NA			
	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)	3	3			NA			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	3	3			NA			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 6	Vegetation Condition Assessment					
Planted Acreage	**12.42**					
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	0	0	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4 or 5 stem count criteria	0.1 acres	Pattern and Color	0	0	0.0%
			Total:	**0**	**0**	**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	0.0%
			Cumulative Total:	**0**	**0**	**0.0%**
Easement Acreage	**13.5**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale	1000 sf	Pattern and Color	0	0	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale	none	Pattern and Color	0	0	0.0%
No areas of concern are noted .						

Photo 1: Highly vegetated restoration area along Reach 2 - View North

Photo 2: View Upstream on Reach 3

Photo 3: View of Reach 5 upstream


Photo 4: View of vegetation plot

APPENDIX C: VEGETATION PLOT DATA

Table 7: Vegetation Plot Counts and Densities

Table 7: Vegetation Plot Counts and Densities

EEP Project Code 0004638. Project Name: Hudson

			Current Plot Data (MY2 2017)														
			0004638-01-0001			0004638-01-0002			0004638-01-0003			0004638-01-0004			0004638-01-0005		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree															
Ligustrum vulgare	European privet	Exotic															
Liquidambar styraciflua	sweetgum	Tree			1			1						1			2
Liriodendron tulipifera	tuliptree	Tree	1	1	2				2	2	2						
Morella cerifera	wax myrtle	shrub															
Pinus taeda	loblolly pine	Tree			5				1	1	2			5			1
Platanus occidentalis	American sycamore	Tree	3	3	3	4	4	4	4	4	4				2	2	2
Quercus alba	white oak	Tree	1	1	5	3	3	3									
Quercus bicolor	swamp white oak	Tree	4	4	4	2	2	2							1	1	1
Quercus michauxii	swamp chestnut oak	Tree															
Quercus nigra	water oak	Tree													2	2	2
Quercus phellos	willow oak	Tree	2	2	2	1	1	3	2	2	2				5	5	5
		Stem count	11	11	22	10	10	13	9	9	10	0	0	6	10	10	13
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	7	4	4	5	4	4	4	0	0	2	4	4	6
		Stems per ACRE	445.2	445.2	890.3	404.7	404.7	526.1	364.2	364.2	404.7	0	0	242.8	404.7	404.7	526.1

EEP Project Code 0004638. Project Name: Hudson

			Current Plot Data (MY2 2017)														
			0004638-01-0006			0004638-01-0007			0004638-01-0008			0004638-01-0009			0004638-01-0010		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer rubrum	red maple	Tree															
Ligustrum vulgare	European privet	Exotic															
Liquidambar styraciflua	sweetgum	Tree			1												
Liriodendron tulipifera	tuliptree	Tree													9	9	9
Morella cerifera	wax myrtle	shrub															
Pinus taeda	loblolly pine	Tree			6									7			2
Platanus occidentalis	American sycamore	Tree	2	2	2	6	6	6	5	5	5	2	2	2			2
Quercus alba	white oak	Tree															
Quercus bicolor	swamp white oak	Tree				4	4	4				1	1	1			
Quercus michauxii	swamp chestnut oak	Tree							1	1	1				1	1	1
Quercus nigra	water oak	Tree							4	4	4	4	4	4			
Quercus phellos	willow oak	Tree	6	6	7	3	3	3	2	2	2	2	2	2	2	2	4
		Stem count	8	8	16	13	13	13	12	12	12	9	9	16	12	12	18
		size (ares)	1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02		
		Species count	2	2	4	3	3	3	4	4	4	4	4	5	3	3	5
		Stems per ACRE	323.7	323.7	647.5	526.1	526.1	526.1	485.6	485.6	485.6	364.2	364.2	647.5	485.6	485.6	728.4

Table 7: Vegetation Plot Counts and Densities (Continued)

EEP Project Code 0004638. Project Name: Hudson

			Current Plot Data (MY2 2017)									Annual Means								
			0004638-01-0011			0004638-01-0012			0004638-01-0013			MY2 (2017)			MY1 (2016)			MY0 (2016)		
Scientific Name	**Common Name**	**Species Type**	**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 rubrum	red maple	Tree						9						9						
Ligustrum vulgare	European privet	Exotic									1			1						
Liquidambar styraciflua	sweetgum	Tree												6						
Liriodendron tulipifera	tuliptree	Tree	2	2	2	1	1	3				15	15	18	12	12	12	31	31	31
Morella cerifera	wax myrtle	shrub			2									2						
Pinus taeda	loblolly pine	Tree			10			15				1	1	53						
Platanus occidentalis	American sycamore	Tree	10	10	12	1	1	1	4	4	4	43	43	47	44	44	47	54	54	54
Quercus alba	white oak	Tree				1	1	1	5	5	5	10	10	14	12	12	12	16	16	16
Quercus bicolor	swamp white oak	Tree	2	2	2	3	3	3				17	17	17	19	19	19	19	19	19
Quercus michauxii	swamp chestnut oak	Tree	1	1	2	3	3	3	5	5	5	11	11	12	8	8	8	13	13	13
Quercus nigra	water oak	Tree	3	3	4	1	1	1				14	14	15	11	11	11	18	18	18
Quercus phellos	willow oak	Tree										25	25	30	24	24	25	33	33	33
		Stem count	18	18	34	10	10	36	14	14	15	136	136	224	130	130	134	184	184	184
		size (ares)	1			1			1			13			13			13		
		size (ACRES)	0.02			0.02			0.02			0.32			0.32			0.32		
		Species count	5	5	7	6	6	8	3	3	4	8	8	12	7	7	7	7	7	7
		Stems per ACRE	728.4	728.4	1376	404.7	404.7	1457	566.6	566.6	607	423.4	423.4	697.3	404.7	404.7	417.1	572.8	572.8	572.8

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%

APPENDIX D: STREAM MEASUREMENT AND GEOMORPHOLOGY DATA

Cross Sections with Annual Overlays (XS 1-11)

Table 8: Bank Pin Data

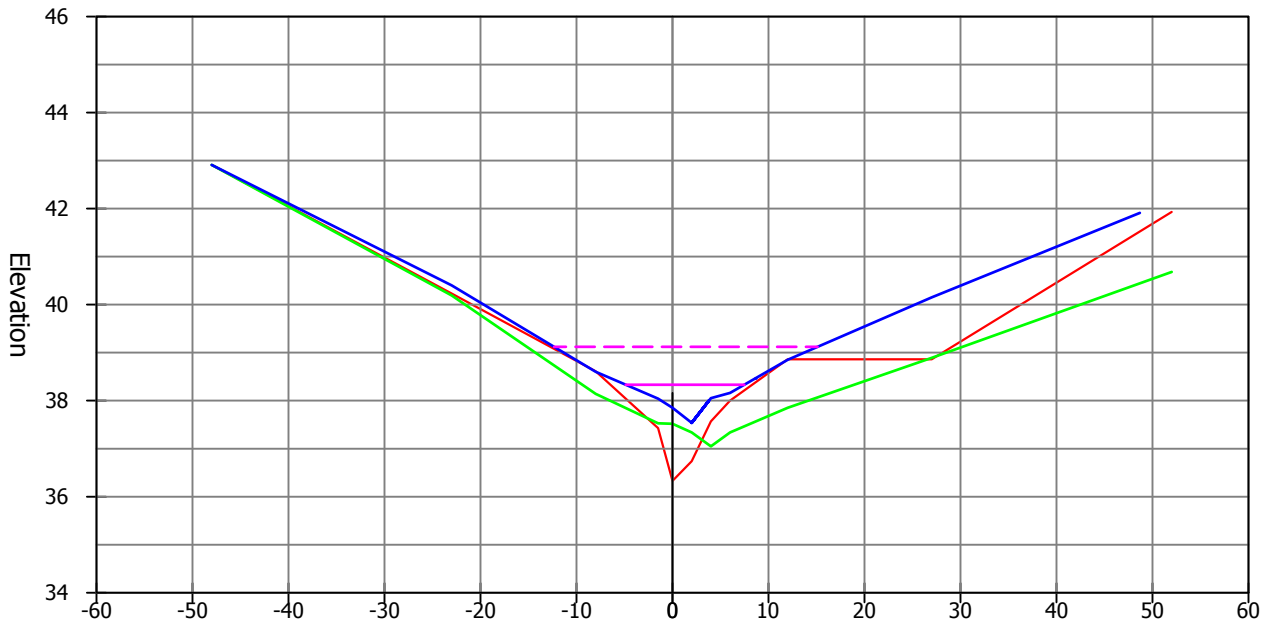
Table 10a. Baseline Stream Data Summary (Reach 1-4)

Table 11a. Monitoring Data – Dimensional Morphology Summary

Table 11b. Monitoring Data – Stream Reach Data Summary (Reach 1-4)

STATION	ELEVATION
0+00	42.91
0+25	40.40
0+40	38.60
0+46.5	38.04
0+48	37.85
0+50	37.54
0+52	38.05
0+54	38.16
0+60	38.85
0+75	40.15
1+00	41.91

Monitoring XS 1 (Pool) - REACH 3 STA 0+09



Scale: 1" = 20'
Vertical Exaggeration:5x

STREAM TYPE	C5/6

LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	38.33
BANKFULL CROSS SECTIONAL AREA:	4.00
BANKFULL WIDTH:	12.37
FLOOD PRONE AREA ELEVATION:	39.12
FLOOD PRONE WIDTH:	27.4
MAX DEPTH AT BANKFULL:	0.79
MEAN DEPTH AT BANKFULL:	0.32
W/D RATIO:	NA
ENTRENCHMENT RATIO:	NA
BANK HEIGHT RATIO:	1

Note:
Channel has aggraded as anticipated and remains stable.

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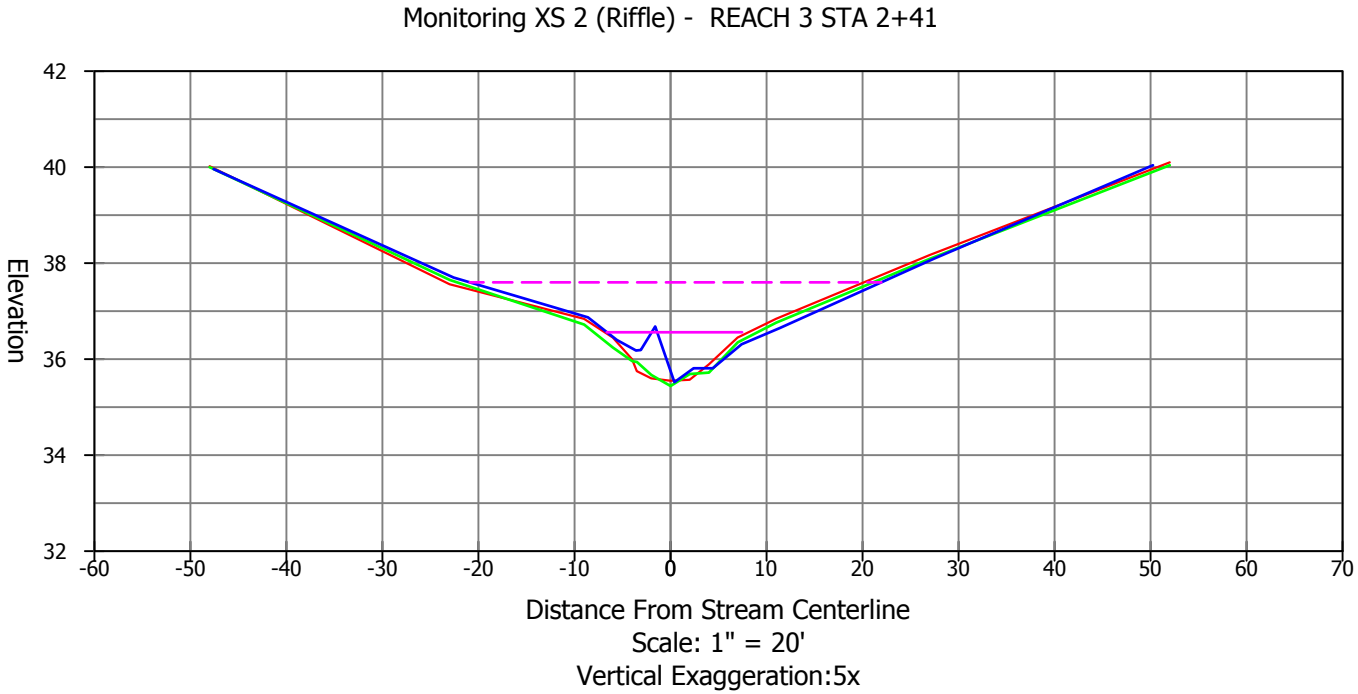
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 1
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIW

STATION	ELEVATION
0+00	39.96
0+25	37.7
0+39	36.87
0+42	36.4
0+44	36.18
0+44.5	36.19
0+46	36.68
0+48	35.52
0+50	35.81
0+52	35.81
0+55	36.31
0+59	36.65
0+75	38.09
1+00	40.04



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	36.56
BANKFULL CROSS SECTIONAL AREA:	7.07
BANKFULL WIDTH:	16.33
FLOOD PRONE AREA ELEVATION:	37.6
FLOOD PRONE WIDTH:	42.8
MAX DEPTH AT BANKFULL:	1.04
MEAN DEPTH AT BANKFULL:	0.43
W/D RATIO:	37.73
ENTRENCHMENT RATIO:	2.25
BANK HEIGHT RATIO:	1

Note:
Cross section displays survey error.
Channel remains stable and functioning.

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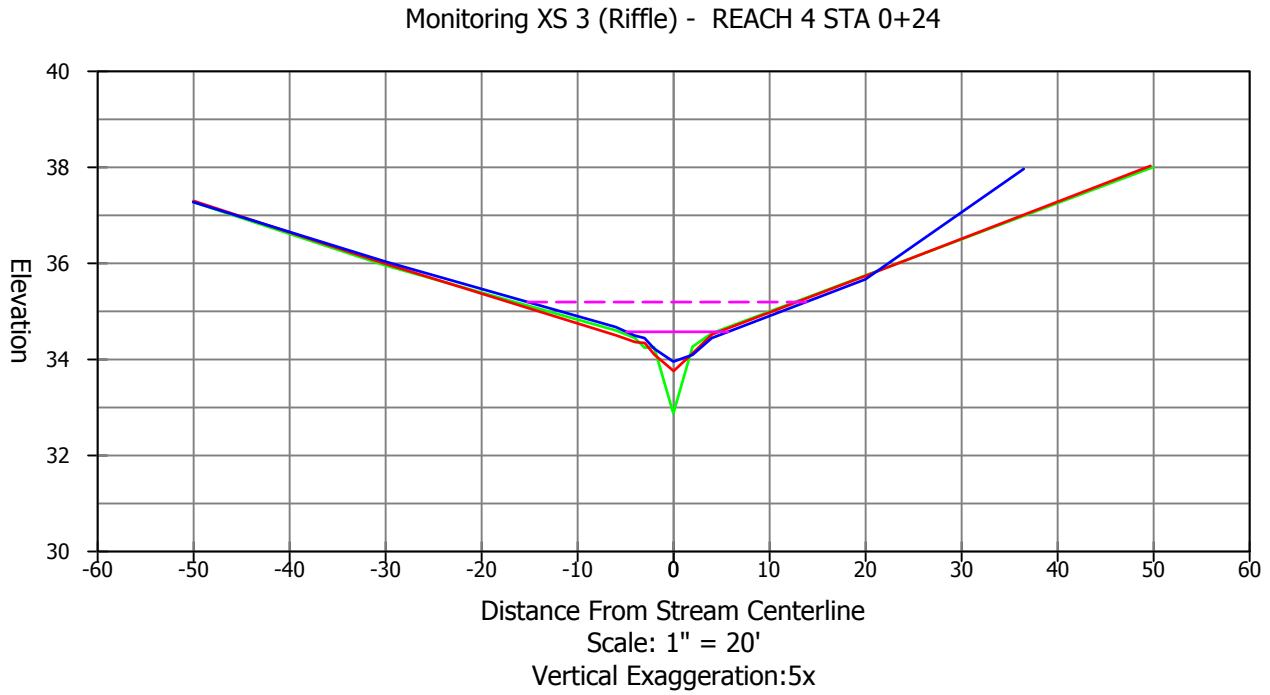
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 2
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	37.28
0+20	36.04
0+44	34.68
0+46	34.50
0+47	34.45
0+48	34.23
0+50	33.96
0+52	34.10
0+54	34.45
0+70	35.67
1+00	37.97



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	34.58
BANKFULL CROSS SECTIONAL AREA:	3.17
BANKFULL WIDTH:	10.59
FLOOD PRONE AREA ELEVATION:	35.18
FLOOD PRONE WIDTH:	29.01
MAX DEPTH AT BANKFULL:	0.62
MEAN DEPTH AT BANKFULL:	0.30
W/D RATIO:	35.39
ENTRENCHMENT RATIO:	5.47
BANK HEIGHT RATIO:	1

Note:
Minor incision occurred in Year 1, as anticipated in a small grassy system. Year 2 shows improvement as the channel re-adjusts.

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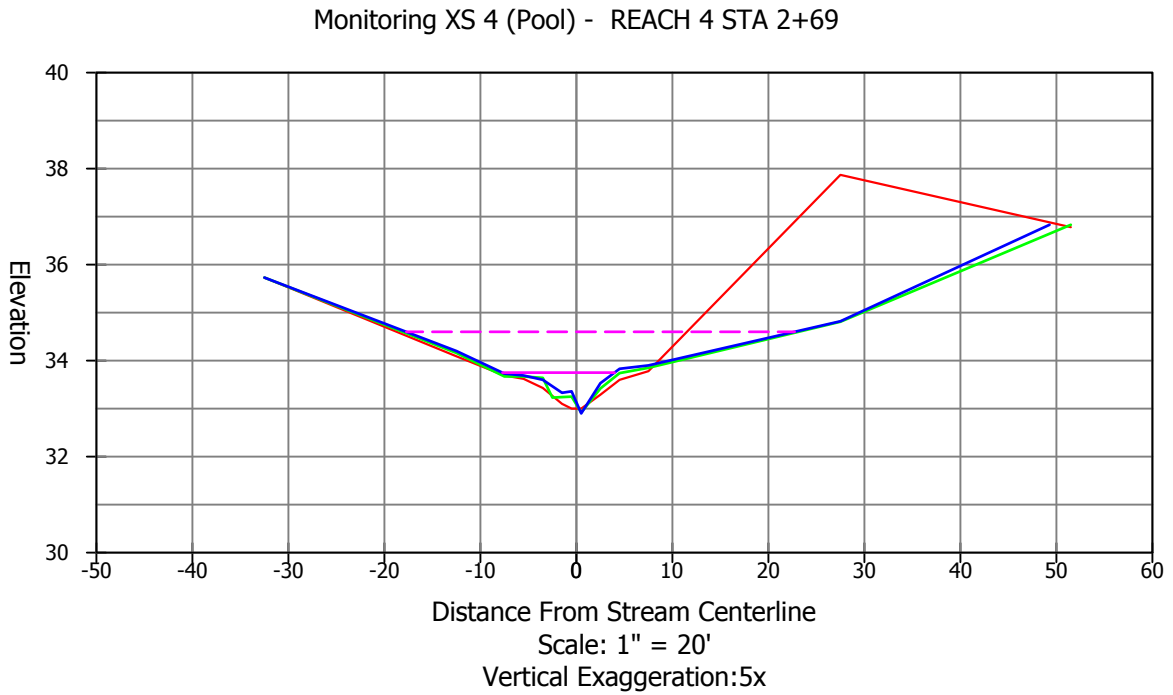
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 3
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	35.73
0+20	34.20
0+25	33.73
0+27	33.69
0+29	33.60
0+30	33.33
0+32	33.36
0+33	32.90
0+35	33.53
0+37	33.83
0+40	33.90
0+60	34.82
0+84	36.83



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	33.75
BANKFULL CROSS SECTIONAL AREA:	3.19
BANKFULL WIDTH:	11.61
FLOOD PRONE AREA ELEVATION:	34.6
FLOOD PRONE WIDTH:	40.4
MAX DEPTH AT BANKFULL:	0.85
MEAN DEPTH AT BANKFULL:	0.27
W/D RATIO:	NA
ENTRENCHMENT RATIO:	NA
BANK HEIGHT RATIO:	0.99

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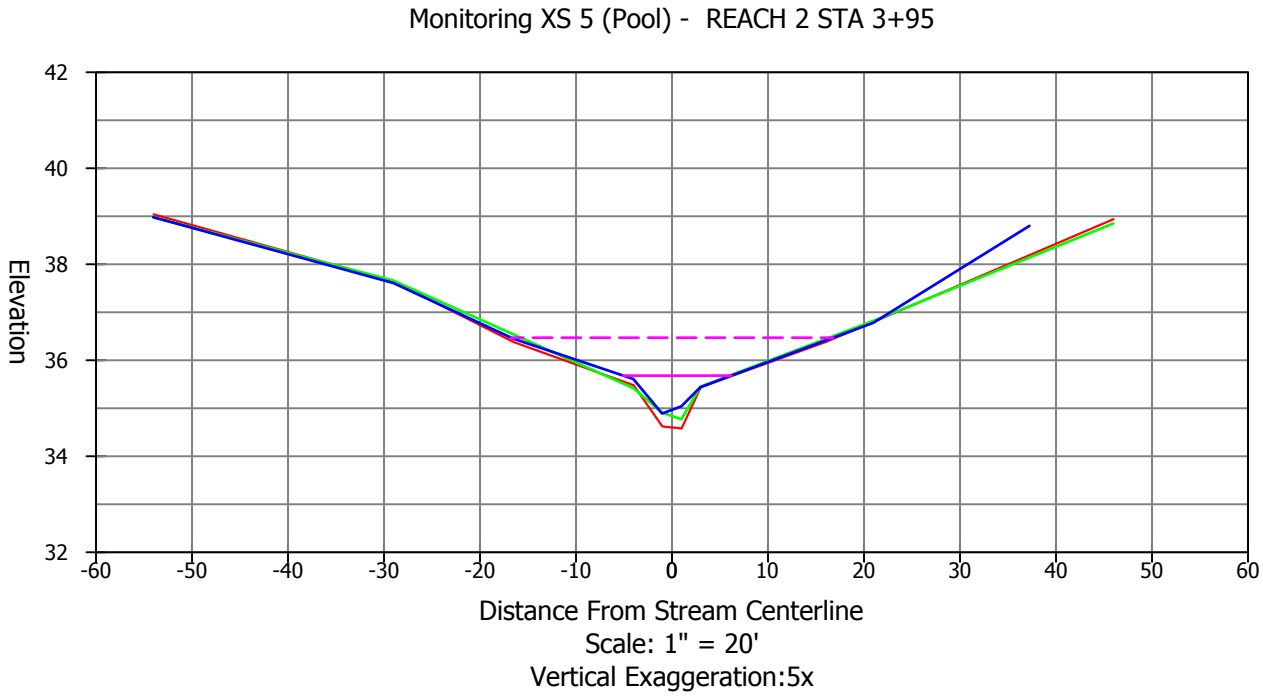
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 4
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	38.98
0+25	37.61
0+37.5	36.45
0+50	35.61
0+53	34.89
0+55	35.04
0+57	35.44
0+70	36.41
0+75	36.78
1+00	38.80



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	35.68
BANKFULL CROSS SECTIONAL AREA:	4.00
BANKFULL WIDTH:	11.04
FLOOD PRONE AREA ELEVATION:	36.38
FLOOD PRONE WIDTH:	33.5
MAX DEPTH AT BANKFULL:	0.79
MEAN DEPTH AT BANKFULL:	0.36
W/D RATIO:	NA
ENTRENCHMENT RATIO:	NA
BANK HEIGHT RATIO:	1

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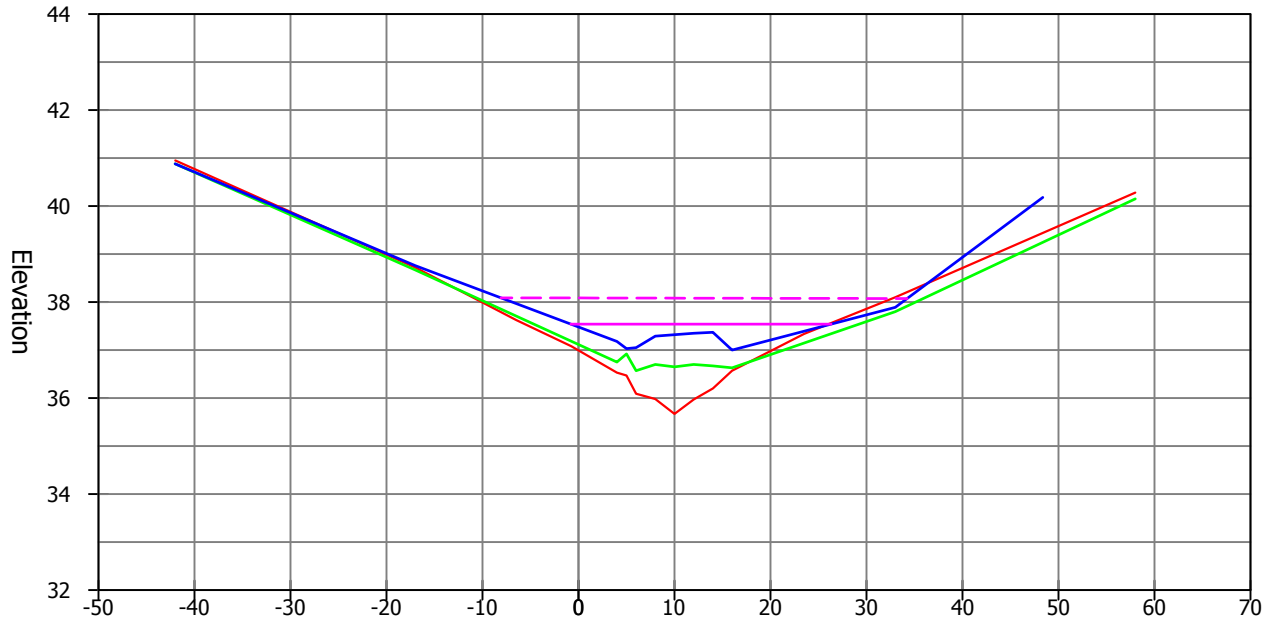
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 5
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	40.88
0+25	38.67
0+46	36.75
0+47	36.92
0+48	36.57
0+50	36.7
0+52	36.65
0+54	36.7
0+56	36.67
0+58	36.63
0+75	37.8
1+00	40.15

Monitoring XS 6 (Riffle) - REACH 2 STA 0+68



Scale: 1" = 20'
Vertical Exaggeration:5x

STREAM TYPE	C5/6

Note:
The cross section shows aggradation across the entire valley. Since aggradation was not noted during field investigation, we believe this cross section may need to be resurveyed.

LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	37.54
BANKFULL CROSS SECTIONAL AREA:	5.28
BANKFULL WIDTH:	12.51
FLOOD PRONE AREA ELEVATION:	38.08
FLOOD PRONE WIDTH:	42.3
MAX DEPTH AT BANKFULL:	0.54
MEAN DEPTH AT BANKFULL:	0.42
W/D RATIO:	29.64
ENTRENCHMENT RATIO:	2.00
BANK HEIGHT RATIO:	1

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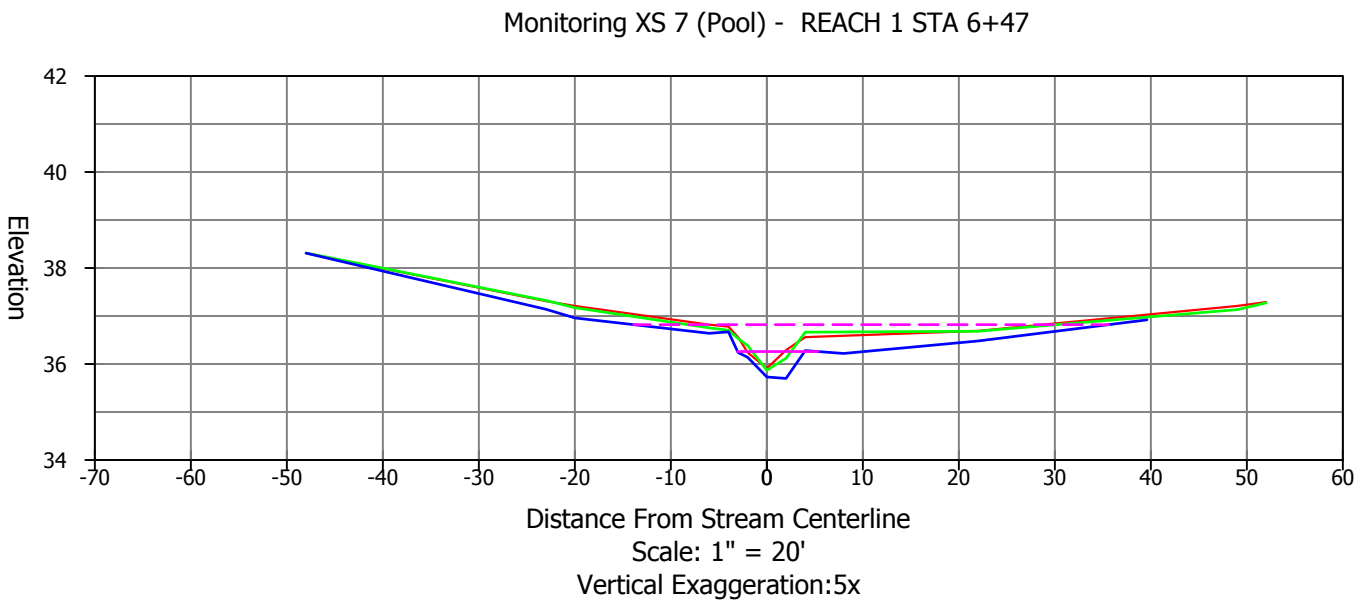
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 6
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	38.31
0+25	37.14
0+28	36.96
0+42	36.64
0+44	36.67
0+45	36.24
0+46	36.14
0+48	35.73
0+50	35.70
0+52	36.28
0+56	36.22
0+70	36.48
0+97	36.97
1+00	37.06



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

Note:
The pool is deepening as expected.

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	36.26
BANKFULL CROSS SECTIONAL AREA:	2.37
BANKFULL WIDTH:	6.99
FLOOD PRONE AREA ELEVATION:	36.82
FLOOD PRONE WIDTH:	49.4
MAX DEPTH AT BANKFULL:	0.56
MEAN DEPTH AT BANKFULL:	0.34
W/D RATIO:	NA
ENTRENCHMENT RATIO:	NA
BANK HEIGHT RATIO:	0.99

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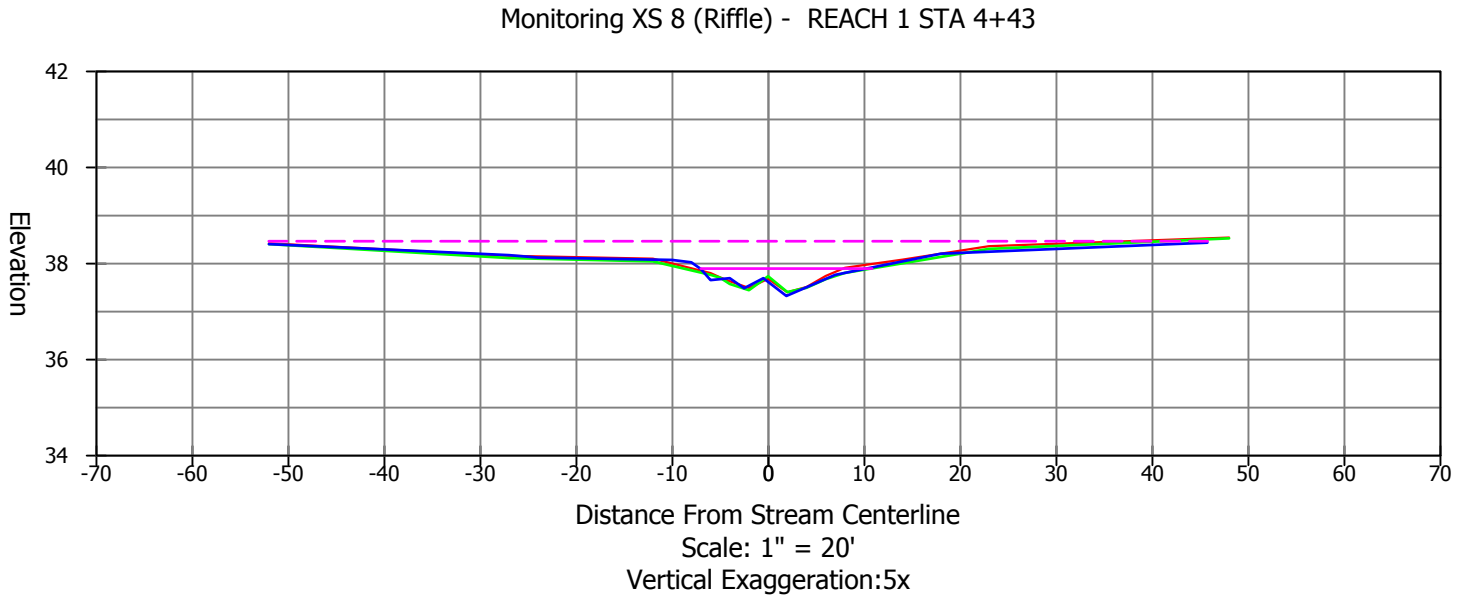
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 7
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	38.41
0+25	38.18
0+28	38.13
0+42	38.08
0+44	38.03
0+45	37.89
0+46	37.66
0+48	37.70
0+49.5	37.49
0+51.5	37.70
0+53.9	37.33
0+59	37.77
0+70	38.21
1+97	38.44
1+00	38.52



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	37.9
BANKFULL CROSS SECTIONAL AREA:	4.26
BANKFULL WIDTH:	16.10
FLOOD PRONE AREA ELEVATION:	38.46
FLOOD PRONE WIDTH:	97.7
MAX DEPTH AT BANKFULL:	0.57
MEAN DEPTH AT BANKFULL:	0.26
W/D RATIO:	60.83
ENTRENCHMENT RATIO:	5.36
BANK HEIGHT RATIO:	0.88

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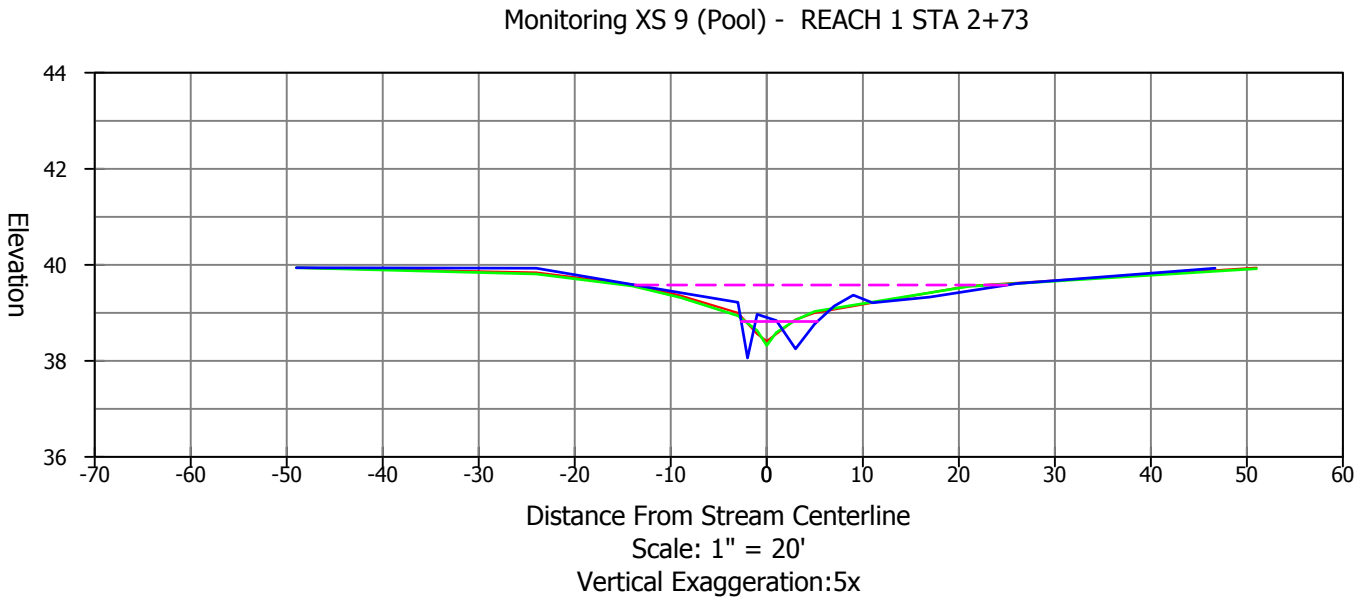
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 8
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	39.93
0+25	39.92
0+40	39.41
0+46	39.21
0+47	38.05
0+48	38.96
0+50	38.83
0+52	38.24
0+54	38.76
0+56	39.13
0+58	39.36
0+60	39.20
0+66	39.32
0+75	39.60
1+00	39.92



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	39.00
BANKFULL CROSS SECTIONAL AREA:	2.19
BANKFULL WIDTH:	7.30
FLOOD PRONE AREA ELEVATION:	39.58
FLOOD PRONE WIDTH:	38.7
MAX DEPTH AT BANKFULL:	0.76
MEAN DEPTH AT BANKFULL:	0.30
W/D RATIO:	NA
ENTRENCHMENT RATIO:	NA
BANK HEIGHT RATIO:	1.01

Note:
Reach is functioning. Cross section likely displaying an error in surveying. Field investigation did not reveal an object in obstruction causing scour in the pool.

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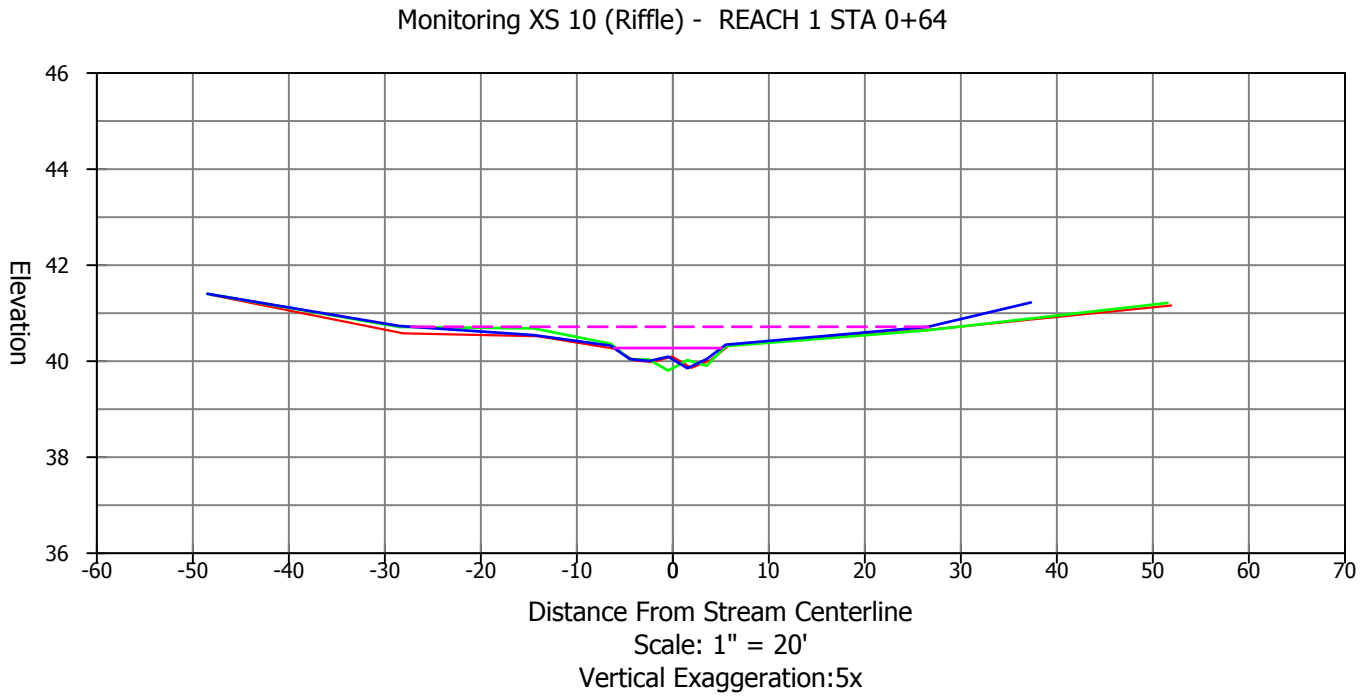
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 9
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	41.37
0+20	40.70
0+34	40.51
0+42	40.29
0+44	40.01
0+46	39.97
0+48	40.06
0+50	39.82
0+52	40.01
0+54	40.31
0+75	40.68
1+00	41.19



LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	40.24
BANKFULL CROSS SECTIONAL AREA:	2.58
BANKFULL WIDTH:	11.19
FLOOD PRONE AREA ELEVATION:	40.7
FLOOD PRONE WIDTH:	53.8
MAX DEPTH AT BANKFULL:	0.42
MEAN DEPTH AT BANKFULL:	0.23
W/D RATIO:	48.60
ENTRENCHMENT RATIO:	5.21
BANK HEIGHT RATIO:	1.12

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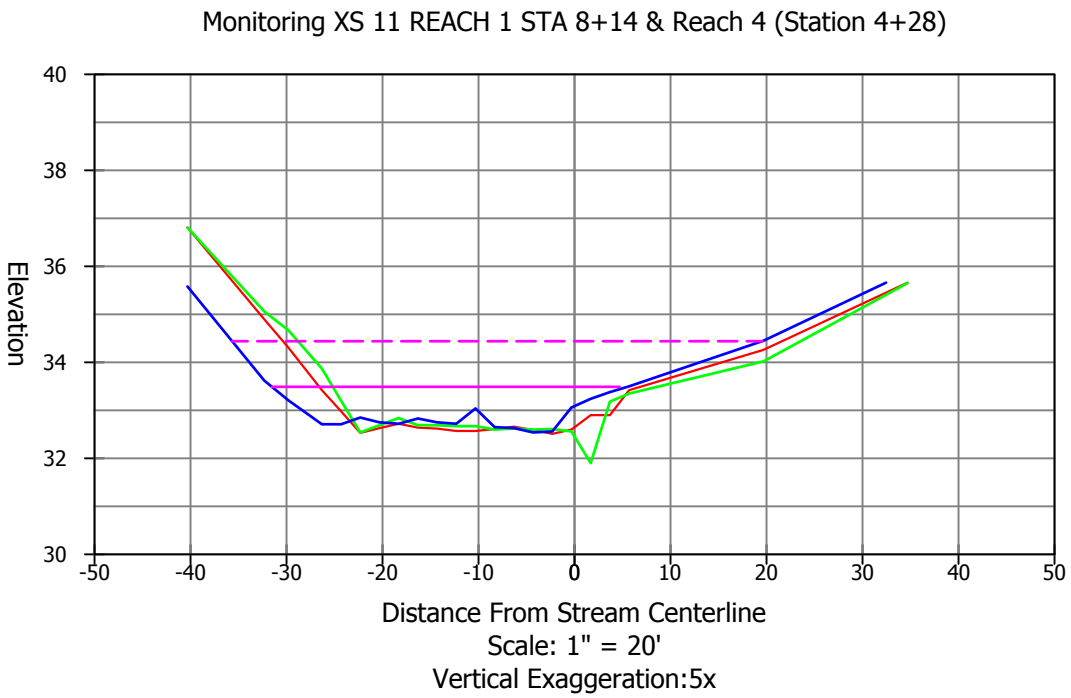
HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 10
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

STATION	ELEVATION
0+00	35.58
0+08	33.62
0+10.5	33.21
0+14	32.71
0+16	32.71
0+18	32.85
0+20	32.75
0+22	32.77
0+24	32.83
0+26	32.75
0+28	32.72
0+30	33.04
0+32	32.65
0+34	32.63
0+36	32.54
0+38	32.56
0+40	33.06
0+42	33.24
0+44	33.38
0+46	33.50
0+60	39.45
0+75	35.66



STREAM TYPE	C5/6

SUMMARY DATA (FT)	
BANKFULL ELEVATION:	33.49
BANKFULL CROSS SECTIONAL AREA:	22.54
BANKFULL WIDTH:	36.94
FLOOD PRONE AREA ELEVATION:	34.44
FLOOD PRONE WIDTH:	55.1
MAX DEPTH AT BANKFULL:	0.95
MEAN DEPTH AT BANKFULL:	0.61
W/D RATIO:	NA
ENTRENCHMENT RATIO:	NA
BANK HEIGHT RATIO:	1

LEGEND

- AS-BUILT GRADE
- YEAR 1 MONITORING GRADE
- YEAR 2 MONITORING GRADE
- BANKFULL ELEVATION
- FLOODPRONE ELEVATION

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HUDSON STREAM RESTORATION PROJECT

YEAR 2 MONITORING XS 11
PROJECT # 95361
BEAUFORT COUNTY, NORTH CAROLINA

PROJECT NO: 1269	DATE:1/22/2018	DRAWN BY: AA	CHECKED BY: DIS

Table 8: Monitoring Year 2 - Bank Pin Data

Pins arrays consist of three pins located in the middle of stream banks along meander bends

Bank Pin Array #1 @ XS 5 - Reach 2 – Station 2+69	
Pin	**Exposure**
Upstream Pin	Could not find- minor aggradation
Middle Pin	Could not find- minor aggradation
Downstream Pin	Could not find- minor aggradation

Bank Pin Array #2 @ XS 4 - Reach 2 – Station 3+95	
Pin	**Exposure**
Upstream Pin	Could not find- minor aggradation
Middle Pin	Could not find- minor aggradation
Downstream Pin	Could not find- minor aggradation

Bank Pin Array #1 @ XS 9 - Reach 1 – Station 2+73	
Pin	**Exposure**
Upstream Pin	Could not find- minor aggradation
Middle Pin	Could not find- minor aggradation
Downstream Pin	Could not find- minor aggradation

Table 10a. Baseline Stream Data Summary

Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 1

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)					3.36		3.83	6.02			19.74		21.97	24.2				9.02		11.5			16.2		2
Floodprone Width (ft)					6.47		6.91	10.5			44		64.5	85			18.06	26.74	34.89	57			83.33		2
Bankfull Mean Depth (ft)					0.45		0.52	0.6			0.7		0.75	0.82				0.42		0.22			0.26		2
[1]Bankfull Max Depth (ft)					0.56		0.87	1.07			0.85		1.02	1.18			0.44	0.53	0.61	0.4			0.51		2
Bankfull Cross Sectional Area (ft^2)					1.99		2	2.68			16.09		16.49	16.89				3.8		2.58			4.26		2
Width/Depth Ratio					5.64		7.37	13.52			24.22		29.27	34.67				21.4		52.27			62.31		2
Entrenchment Ratio					1.74		1.8	1.93			2		2.94	3.87			2	2.94	3.87	4.96			5.14		2
[1]Bank Height Ratio																				1			1		2
Profile																									
Riffle Length (ft)						N/A*					12		46.5	81			4.93	19.09	33.25						
Riffle Slope (ft/ft)						N/A*					0.004		0.011	0.017			0.006	0.016	0.025						
Pool Length (ft)						N/A*					21		30.5	40			4.72	8.41	14.98						
Pool Max depth (ft)						N/A*					1.4		1.65	1.9			0.72	0.93	1.15						
Pool Spacing (ft)						N/A*					40		59	78			16.42	26.95	35.63						
Pattern																									
Channel Beltwidth (ft)						N/A*					27		49	76			11.08	20.11	31.19						
Radius of Curvature (ft)						N/A*					90		92	95			36.94	37.76	38.99						
Rc:Bankfull width (ft/ft)						N/A*											4.10	4.19	4.32						
Meander Wavelength (ft)						N/A*					12.43		15.07	18.25			112.1	135.9	164.6						
Meander Width Ratio						N/A*											1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/f^2							0.26											0.18							
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2							0.56											0.14							
Additional Reach Parameters																									
Rosgen Classification							G5-G6						C5-C6					C5-C6				C5/6			
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)							5.6																		
Valley length (ft)							840						264												
Channel Thalweg length (ft)							846						264					833				850			
Sinuosity (ft)							1.01						1					1.04				1.04			
Water Surface Slope (Channel) (ft/ft)							0.007						0.004					0.007							
BF slope (ft/ft)																						0.006			
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10a. Baseline Stream Data Summary																									
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 2																									
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)					5.97		6.87	7.2			19.74		21.97	24.2				14.83				11.78			1
Floodprone Width (ft)					10.03		12.03	13.47			44		64.5	85			29.71	43.55	57.39			28.2			1
Bankfull Mean Depth (ft)					0.91		0.92	0.94			0.7		0.75	0.82				0.67				0.45			1
[1]Bankfull Max Depth (ft)					1.38		1.42	1.54			0.85		1.02	1.18			0.7	0.84	0.98			0.86			1
Bankfull Cross Sectional Area (ft^2)					5.59		6.32	6.58			16.09		16.49	16.89				10				5.28			1
Width/Depth Ratio					6.38		7.47	7.88			24.22		29.27	34.67				22				26.18			1
Entrenchment Ratio					1.67		1.68	1.96			2		2.94	3.87				2.94				2.39			1
[1]Bank Height Ratio																						1			1
Profile																									
Riffle Length (ft)						N/A*					12		46.5	81			8.1	31.39	54.68						
Riffle Slope (ft/ft)						N/A*					0.004		0.011	0.017			0.003	0.008	0.012						
Pool Length (ft)						N/A*					21		30.5	40			14.18	20.59	27						
Pool Max depth (ft)						N/A*					1.4		1.65	1.9			1.16	1.48	1.84						
Pool Spacing (ft)						N/A*					40		59	78			27	44.33	58.61						
Pattern																									
Channel Beltwidth (ft)						N/A*					27		49	76			18.23	33.08	51.31						
Radius of Curvature (ft)						N/A*					90		92	95			60.76	62.11	64.14						
Rc:Bankfull width (ft/ft)						N/A*											4.10	4.19	4.32						
Meander Wavelength (ft)						N/A*					12.43		15.07	18.25			184.3	223.5	270.7						
Meander Width Ratio						N/A*											1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/f^2						0.42												0.11							
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2						1.25												0.18							
Additional Reach Parameters																									
Rosgen Classification						G5-G6						C5-C6						C5-C6			C 5/6				
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)						17.2																			
Valley length (ft)						486						264													
Channel Thalweg length (ft)						516						264						532			541				
Sinuosity (ft)						1.06						1						1.05			1.05				
Water Surface Slope (Channel) (ft/ft)						0.003						0.004						0.003							
BF slope (ft/ft)																					0.0035				
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10a. Baseline Stream Data Summary																									
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 3																									
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)					3.55		4.03	5.05			19.74		21.97	24.2				10				12.5			1
Floodprone Width (ft)					5.97		6.44	9.13			44		64.5	85			20.03	29.36	38.69			32.9			1
Bankfull Mean Depth (ft)					0.55		0.79	0.84			0.7		0.75	0.82				0.5				0.57			1
[1]Bankfull Max Depth (ft)					0.88		1.15	1.44			0.85		1.02	1.18			0.52	0.63	0.72			0.85			1
Bankfull Cross Sectional Area (ft^2)					1.94		3.17	4.26			16.09		16.49	16.89				5				7.07			1
Width/Depth Ratio					5.12		5.99	6.5			24.22		29.27	34.67				20				21.95			1
Entrenchment Ratio					1.6		1.68	1.8			2		2.94	3.87			2	2.94	3.87			2.63			1
[1]Bank Height Ratio																						1			1
Profile																									
Riffle Length (ft)						N/A*					12		46.5	81			5.46	21.17	36.87						
Riffle Slope (ft/ft)						N/A*					0.004		0.011	0.017			0.005	0.014	0.021						
Pool Length (ft)						N/A*					21		30.5	40			9.56	13.88	18.21						
Pool Max depth (ft)						N/A*					1.4		1.65	1.9			0.86	1.1	1.36						
Pool Spacing (ft)						N/A*					40		59	78			18.21	29.89	39.51						
Pattern																									
Channel Beltwidth (ft)						N/A*					27		49	76			12.29	22.3	24.59						
Radius of Curvature (ft)						N/A*					90		92	95			40.96	41.88	43.24						
Rc:Bankfull width (ft/ft)						N/A*											4.10	4.19	4.32						
Meander Wavelength (ft)						N/A*					12.43		15.07	18.25			124.3	150.7	182.5						
Meander Width Ratio						N/A*											1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.37												0.14								
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2					1.02												0.18								
Additional Reach Parameters																									
Rosgen Classification					G5-G6						C5-C6						C5-C6			C 5/6					
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)					8																				
Valley length (ft)					442						264														
Channel Thalweg length (ft)					460						264						445			446					
Sinuosity (ft)					1.04						1						1.01			1.08					
Water Surface Slope (Channel) (ft/ft)					0.007						0.004						0.007								
BF slope (ft/ft)																				0.005					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10a. Baseline Stream Data Summary																									
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 4																									
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)					7.34		7.48	8.84			19.74		21.97	24.2				21.82				9.9			1
Floodprone Width (ft)					12.21		13.83	16.28			44		64.5	85			43.69	64.05	84.41			31.36			1
Bankfull Mean Depth (ft)					0.97		1	1.05			0.7		0.75	0.82				0.78				0.32			1
[1]Bankfull Max Depth (ft)					1.47		1.51	1.82			0.85		1.02	1.18			0.81	0.98	1.13			0.74			1
Bankfull Cross Sectional Area (ft^2)					7.49		7.69	8.58			16.09		16.49	16.89				17				3.17			1
Width/Depth Ratio					7.01		7.47	9.11			24.22		29.27	34.67				28				30.9			1
Entrenchment Ratio					1.63		1.84	1.88			2		2.94	3.87			2	2.94	3.87			3.17			1
[1]Bank Height Ratio																						1			1
Profile																									
Riffle Length (ft)							N/A*				12		46.5	81			11.92	46.18	80.44						
Riffle Slope (ft/ft)							N/A*				0.004		0.011	0.017			0.006	0.016	0.025						
Pool Length (ft)							N/A*				21		30.5	40			20.85	30.29	39.72						
Pool Max depth (ft)							N/A*				1.4		1.65	1.9			1.34	1.71	2.12						
Pool Spacing (ft)							N/A*				40		59	78			39.72	65.21	86.21						
Pattern																									
Channel Beltwidth (ft)							N/A*				27		49	76			26.8	48.66	75.47						
Radius of Curvature (ft)							N/A*				90		92	95			89.37	91.36	94.34						
Rc:Bankfull width (ft/ft)							N/A*										4.096	4.188	4.324						
Meander Wavelength (ft)							N/A*				12.43		15.07	18.25			271.1	328.7	398.2						
Meander Width Ratio							N/A*										1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.48												0.16								
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2					1.01												0.22								
Additional Reach Parameters																									
Rosgen Classification					G5-G6						C5-C6						C5-C6			C 5/6					
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)					26.2																				
Valley length (ft)					434						264														
Channel Thalweg length (ft)					503						264						437			447					
Sinuosity (ft)					1.16						1						1.01			1.01					
Water Surface Slope (Channel) (ft/ft)					0.003						0.004						0.003								
BF slope (ft/ft)																				0.0035					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

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

Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 1-4 (2200 feet)

	Cross Section 1 (Pool - Reach 3)							Cross Section 2 (Riffle - Reach 3)							Cross Section 3 (Riffle - Reach 4)							Cross Section 4 (Pool - Reach 4)							Cross Section 5 (Pool - Reach 2)						
Based on fixed baseline cross-sectional area[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	4.00	4.00	4.00					7.07	7.07	7.07					3.17	3.17	3.17					3.19	3.19	3.19					4.00	4.00	4.00				
Bankful Elevation (ft)	37.57	37.72	38.33					36.40	36.36	36.56					34.50	34.34	34.58					33.60	33.69	33.75					35.46	35.59	35.68				
Bankfull Width (ft)	6.30	13.97	12.37					12.50	13.83	16.33					9.90	5.90	10.59					9.79	11.95	11.61					7.55	10.69	11.04				
Floodprone Width (ft)	21.50	29.60	27.40					32.90	36.80	42.80					31.36	47.80	29.01					23.40	36.50	40.40					32.50	24.30	33.50				
Bankfull Mean Depth (ft)	0.64	0.29	0.32					0.57	0.51	0.43					0.32	0.54	0.30					0.33	0.27	0.27					0.53	0.37	0.36				
Bankfull Max Depth (ft)	1.24	0.67	0.79					0.85	0.92	1.04					0.74	1.46	0.62					0.60	0.77	0.85					0.90	0.82	0.79				
Bankfull Cross Sectional Area (ft^2)	4.00	4.00	4.00					7.07	7.07	7.07					3.17	3.17	3.17					3.19	3.19	3.19					4.00	4.00	4.00				
Bankfull Width/Depth Ratio	N/A	N/A	N/A					21.95	27.04	37.73					30.90	10.99	35.39					N/A	N/A	N/A					N/A	N/A	N/A				
Bankfull Entrenchment Ratio	N/A	N/A	N/A					2.63	2.66	2.25					3.17	8.10	5.47					N/A	N/A	N/A					N/A	N/A	N/A				
Bankfull Bank Height Ratio	1.00	1.00	1.00					1.00	1.00	1.00					1.00	1.28	1.00					1.00	1.00	0.99					1.00	1.00	1.00				
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

	Cross Section 6 (Riffle - Reach 2)							Cross Section 7 (Pool - Reach 1)							Cross Section 8 (Riffle - Reach 1)							Cross Section 9 (Pool - Reach 1)							Cross Section 10 (Riffle - Reach 1)						
Based on fixed baseline cross-sectional area[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	5.28							2.37	2.37	2.37					4.26	4.26	4.26					2.19							2.58	2.58	2.58				
Bankful Elevation (ft)	36.53	37.00	37.54					36.56	36.55	36.26					37.91	37.88	37.90					39.00	39.00	39.00					40.26	40.20	40.24				
Bankfull Width (ft)	11.78	12.51	12.51					7.00	6.66	6.99					16.20	18.66	16.10					8.00	8.53	7.30					11.50	10.80	11.19				
Floodprone Width (ft)	28.20	31.30	42.30					69.00	71.40	49.40					83.33	73.10	97.70					37.37	49.60	38.70					57.00	41.30	53.80				
Bankfull Mean Depth (ft)	0.45	0.42	0.42					0.33	0.36	0.34					0.26	0.23	0.26					0.27	0.26	0.30					0.22	0.24	0.23				
Bankfull Max Depth (ft)	0.86	0.44	0.54					0.65	0.67	0.56					0.51	0.47	0.57					0.59	0.68	0.76					0.40	0.43	0.42				
Bankfull Cross Sectional Area (ft^2)	5.28	5.28	5.28					2.37	2.37	2.37					4.26	4.26	4.26					2.19	2.19	2.19					2.58	2.58	2.58				
Bankfull Width/Depth Ratio	26.18	29.65	29.64					N/A	N/A	N/A					62.31	81.72	60.83					N/A	N/A	N/A					52.27	45.21	48.60				
Bankfull Entrenchment Ratio	2.39	2.00	2.00					N/A	N/A	N/A					5.14	4.62	5.36					N/A	N/A	N/A					4.96	5.40	5.21				
Bankfull Bank Height Ratio	1.00	1.00	1.00					1.00	1.17	0.99					1.00	0.76	0.88					1.00	1.00	1.01					1.00	1.19	1.12				
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

	Cross Section 11 (Confluence - Reach 1)						
Based on fixed baseline cross-sectional area[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used	22.54	22.54	22.54				
Bankful Elevation (ft)	33.42	33.43	33.49				
Bankfull Width (ft)	32.00	32.18	36.94				
Floodprone Width (ft)	50.34	59.50	55.10				
Bankfull Mean Depth (ft)	0.70	0.70	0.61				
Bankfull Max Depth (ft)	0.91	1.52	0.95				
Bankfull Cross Sectional Area (ft2)	22.54	22.54	22.54				
Bankfull Width/Depth Ratio	N/A	N/A	N/A				
Bankfull Entrenchment Ratio	N/A	N/A	N/A				
Bankfull Bank Height Ratio	1.00	1.00	1.00				
Cross Sectional Area between end pins (ft2)							
d50 (mm)							

1 = Widths and depths for annual measurements will be based on the baseline cross-section datum regardless of dimensional/depositional development. Input thecross section 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
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 1

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)	11.50			16.20		2	11.46			20.00		2	11.19			16.10		2																		
Floodprone Width (ft)	57.00			83.30		2	58.28			86.26		2	53.80			97.70		2																		
Bankfull Mean Depth (ft)	0.22			0.26		2	0.24			0.28		2	0.23			0.26		2																		
[1]Bankfull Max Depth (ft)	0.40			0.51		2	0.49			0.50		2	0.42			0.57		2																		
Bankfull Cross Sectional Area (ft[2])	2.58			4.26		2	3.25			4.77		2	2.58			4.26		2																		
Width/Depth Ratio	52.27			62.31		2	40.49			83.95		2	48.60			60.83		2																		
Entrenchment Ratio	4.96			5.14		2	4.31			5.08		2	5.21			5.36		2																		
[1]Bank Height Ratio	1.00			1.00		2	1.00			1.00		2	1.12			0.88		2																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C 5/6						C 5/6						C 5/6																								
Channel Thalweg length (ft)	850						850						850																								
Sinuosity (ft)	1.04						1.04						1.04																								
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)	0.006						0.006						0.006																								
[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																																				

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

2 = Bankfull for XS 6 recalculated

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 measurements 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
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 2

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)			11.78			1			12.51			1			12.51			1																		
Floodprone Width (ft)			28.2			1			25			1			42.3			1																		
Bankfull Mean Depth (ft)			0.45			1			0.11			1			0.42			1																		
[1]Bankfull Max Depth (ft)			0.86			1			0.21			1			0.54			1																		
Bankfull Cross Sectional Area (ft^2)			5.28			1			1.39			1			5.28			1																		
Width/Depth Ratio			26.2			1			112.3			1			29.64			1																		
Entrenchment Ratio			2.39			1			2			1			2			1																		
[1]Bank Height Ratio			1			1			1			1			1			1																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern									71																											
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification			C 5/5						C 5/5						C 5/5																					
Channel Thalweg length (ft)			541						541						541																					
Sinuosity (ft)			1.05						1.05						1.05																					
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)			0.0035						0.0035						0.0035																					
[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																																				

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

2 = Bankfull for XS 6 recalculated

Shaded cells indicate that these will typically not be filled in.
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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
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 3

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)			12.50			1			14.44			1			16.33			1																		
Floodprone Width (ft)			32.90			1			36.68			1			42.80			1																		
Bankfull Mean Depth (ft)			0.57			1			0.48			1			0.43			1																		
[1]Bankfull Max Depth (ft)			0.85			1			0.96			1			1.04			1																		
Bankfull Cross Sectional Area (ft[2])			7.07			1			16.24			1			7.07			1																		
Width/Depth Ratio			21.95			1			69.34			1			37.73			1																		
Entrenchment Ratio			2.63			1			2.53			1			2.25			1																		
[1]Bank Height Ratio			1.00			1			1.00			1			1.00			1																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification			C 5/6						C 5/6						C 5/6																						
Channel Thalweg length (ft)			446						446						446																						
Sinuosity (ft)			1.08						1.08						1.08																						
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)			0.005						0.005						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																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

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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
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 4

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)			9.90			1			8.27			1			10.59			1																		
Floodprone Width (ft)			31.36			1			57.96			1			29.01			1																		
Bankfull Mean Depth (ft)			0.32			1			0.52			1			0.30			1																		
[1]Bankfull Max Depth (ft)			0.74			1			1.62			1			0.62			1																		
Bankfull Cross Sectional Area (ft[2])			3.17			1			4.31			1			3.17			1																		
Width/Depth Ratio			30.90			1			15.86			1			35.39			1																		
Entrenchment Ratio			3.17			1			7.01			1			5.47			1																		
[1]Bank Height Ratio			1.00			1			1.00			1			1.00			1																		
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C 5/6						C 5/6						C 5/6																							
Channel Thalweg length (ft)	447						447						447																							
Sinuosity (ft)	1.01						1.01						1.01																							
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)	0.0035						0.0035						0.0035																							
[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																																				

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

2 = Bankfull for XS 6 recalculated

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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 9: Verification of Bankfull Events

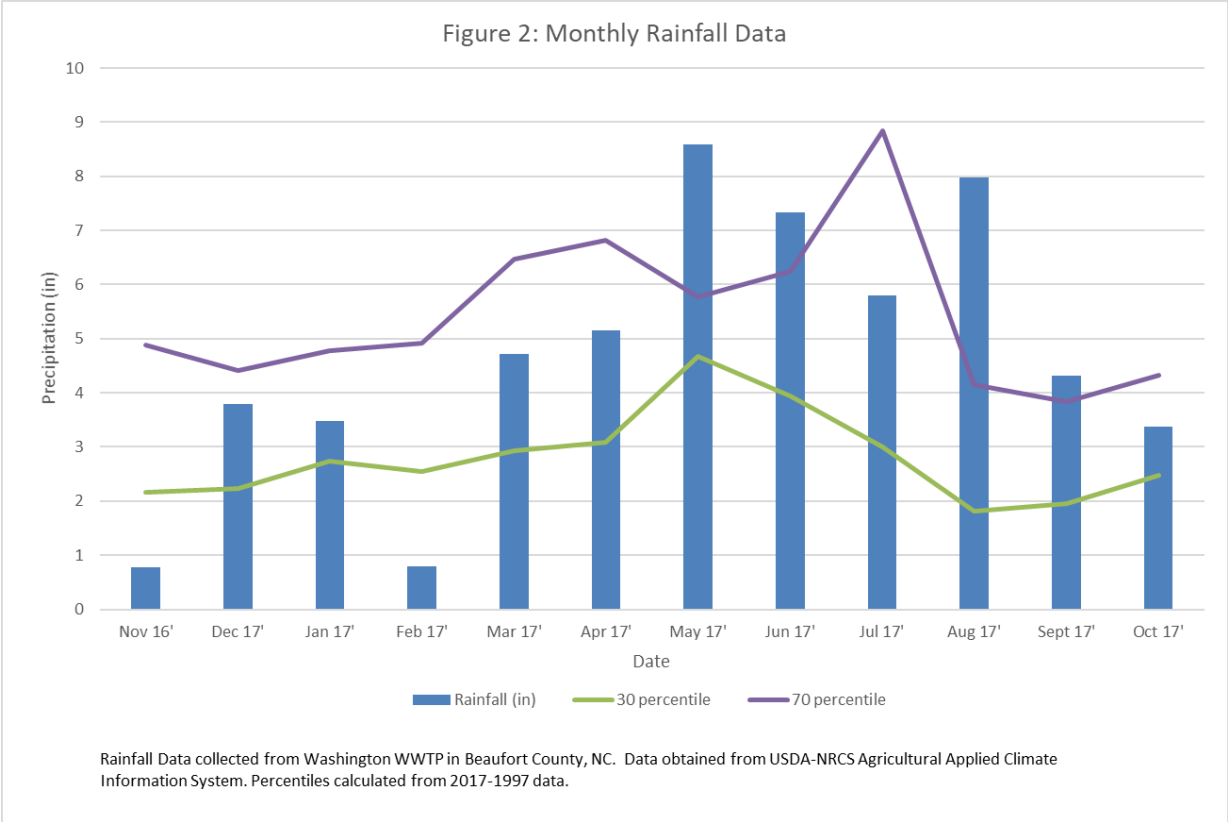
Table 12: Verification of Baseflow

Figure 2: Monthly Rainfall Data with Percentiles

Figures 3-12: Stream Surface Water Hydrology (Well 1-10)

Table 9: Verification of Bankfull Events				
Date of Observation	**Date of Occurance**	**Method**	**Greater than Qbkf Stage?**	**Notes**
11/17/17	9/29/2016-10/17/2016, 10/21-10/24, 7/16-7/17, 8/11, 8/13-8/14, 9/6- 9/8/2017	On-Site data logger	Y	Reach 1 (Well 5, 6)
11/17/17	9/29/2016-10/16/2016, 10/25, 12/18-12/28, 12/30-1/3, 1/5-1/19, 1/30-1/31, 2/1-2/6, 2/20-2/21, 3/3-3/6, 3/19-3/27, 3/29-3/30, 4/1-4/3, 4/13, 4/18-4/20, 4/28-4/30, 5/30/2017,	On-Site data logger	Y	Reach 2 (Well 7)
11/17/17	9/29/2016-11/3/2017	On-Site data logger	Y	Reach 3 (Well 1, 2)
11/17/17	9/29/2016-10/2, 10/6-10/12, 10/14-10/16, 10/25-10/29, 11/1-11/2, 11/5-11/8, 11/12, 12/4-12/5, 12/9-12/28, 12/30-1/3, 1/6-1/17, 2/2-2/6, 2/10-2/11, 2/21, 3/2-3/31, 4/2-4/3, 4/9-4/20, 4/24-4/26, 4/29-4/30, 5/5, 5/25, 5/30, 6/21, 6/24-6/25, 7/5, 7/18, 8/13-8/14, 9/9-9/11/2017	On-Site data logger	Y	Reach 4 (Well 3)
11/17/17	10/7-10/9, 12/19-12/20, 1/2, 1/7-1/10, 1/13-1/14, 3/5, 3/23-3/24, 4/24-4/25, 5/5, 5/23, 5/25, 6/24, 9/6/2017	On-Site data logger	Y	Reach 1& 4 Confluence (Well 4)

Table 12: Verification of Baseflow			
Well (Reach)	**Dates of Occurrence**	**30 Consecutive Days Minimum Flow Requirement Met?**	**Notes**
1 (Reach 3)	Various	Y	On-site data logger
2 (Reach 3)	Various	Y	On-site data logger
3 (Reach 4)	Various	Y	On-site data logger
4 (Confluence R1&4)	Various	Y	On-site data logger
5 (Reach 1)	Various	Y	On-site data logger
6 (Reach 1)	Various	Y	On-site data logger
7 (Reach 2)	Various	Y	On-site data logger
8 (Reach 5)	Various	Y	On-site data logger
9 (Reach 5)	Various	Y	On-site data logger
10 (Reach 5)	Various	Y	On-site data logger



Rainfall Data collected from Washington WWTP in Beaufort County, NC. Data obtained from USDA-NRCS Agricultural Applied Climate Information System. Percentiles calculated from 2017-1997 data.

Figure 3

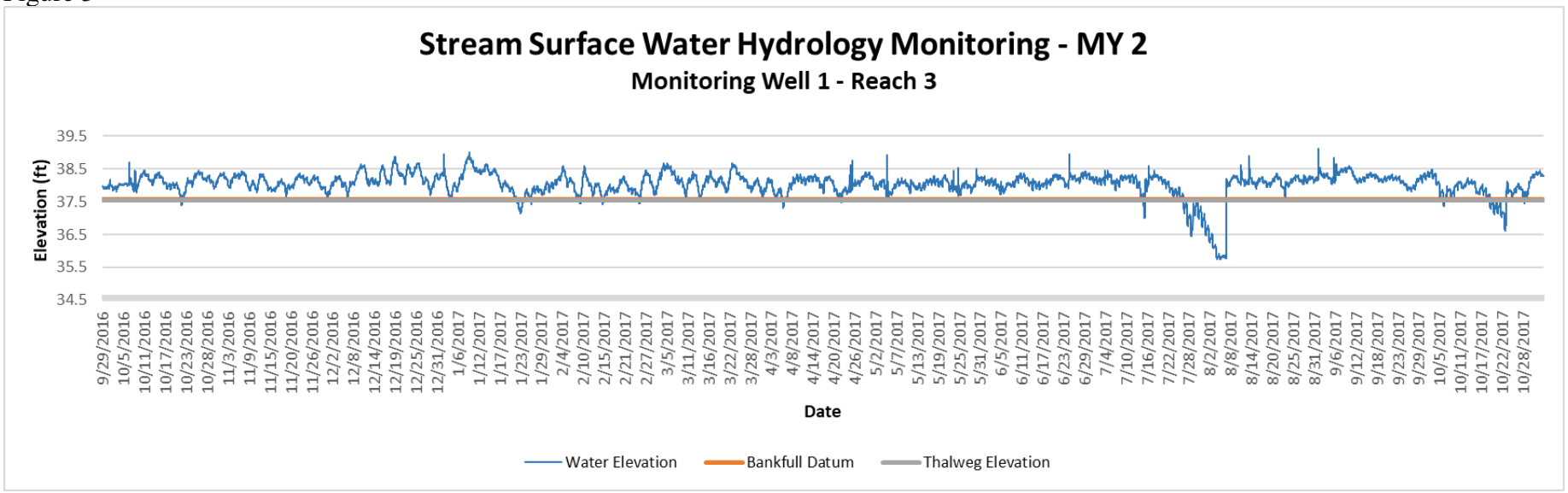


Figure 4

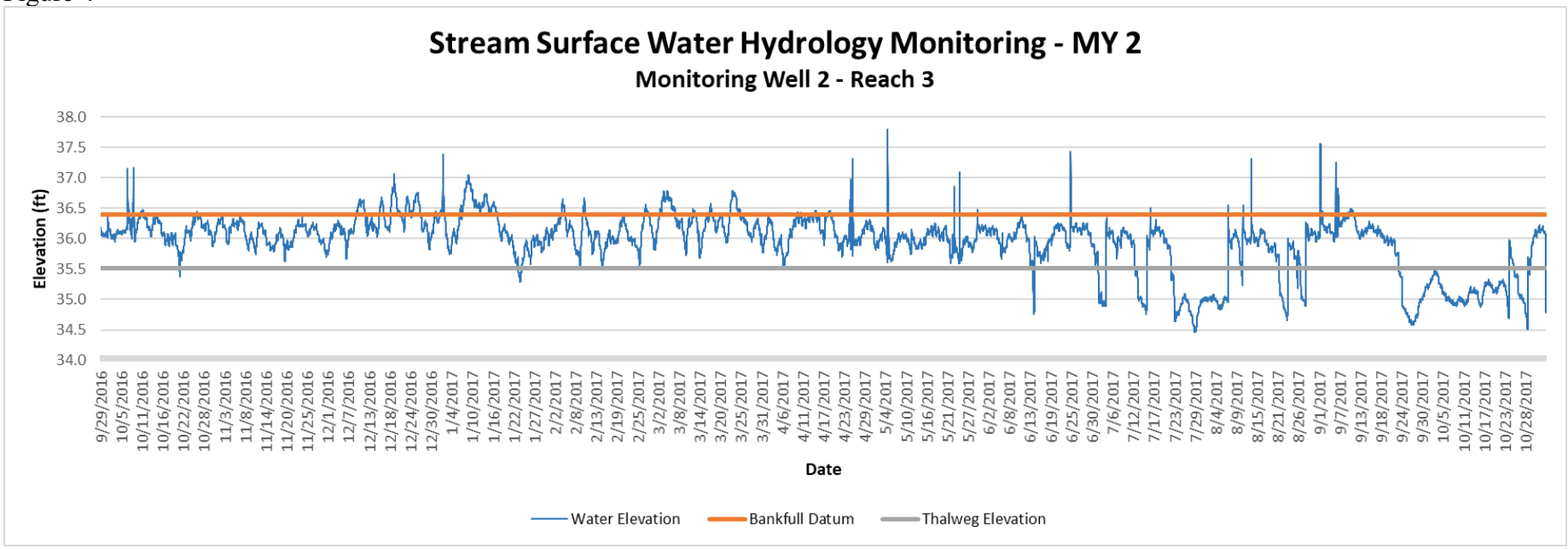


Figure 5

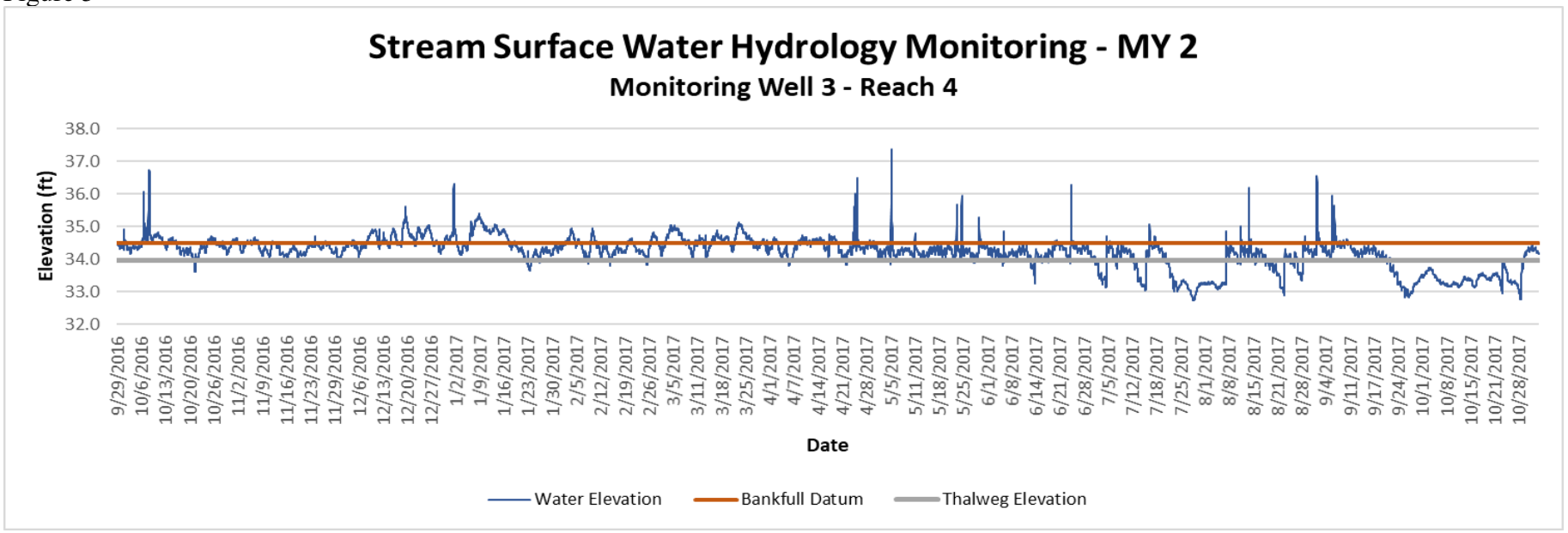


Figure 6

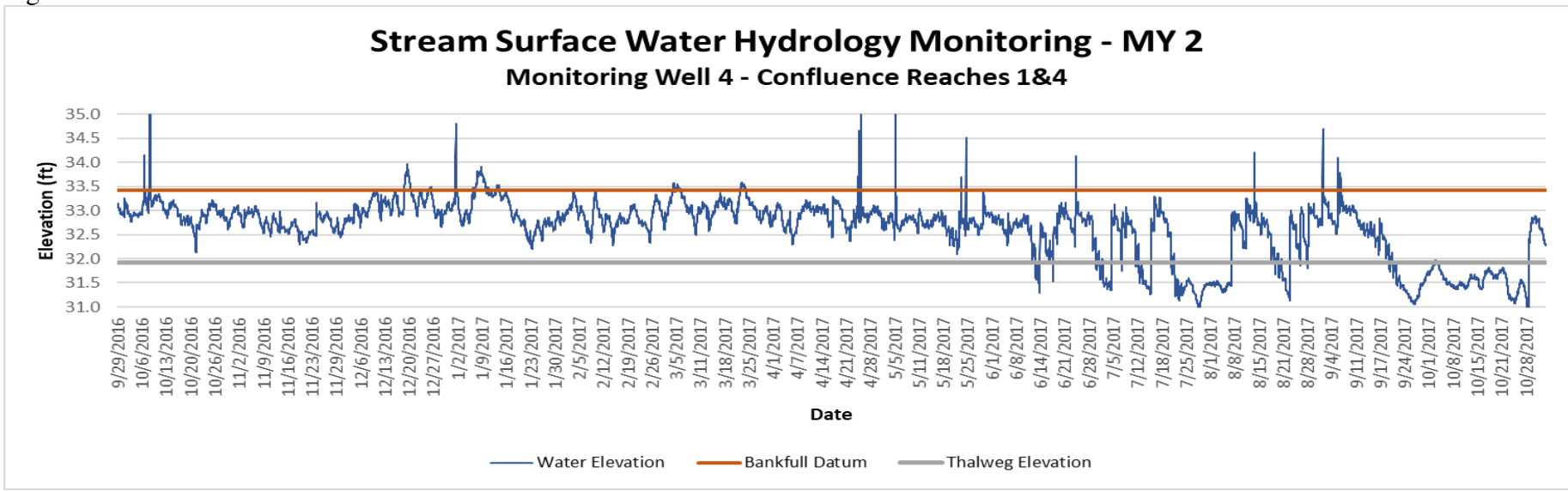


Figure 7

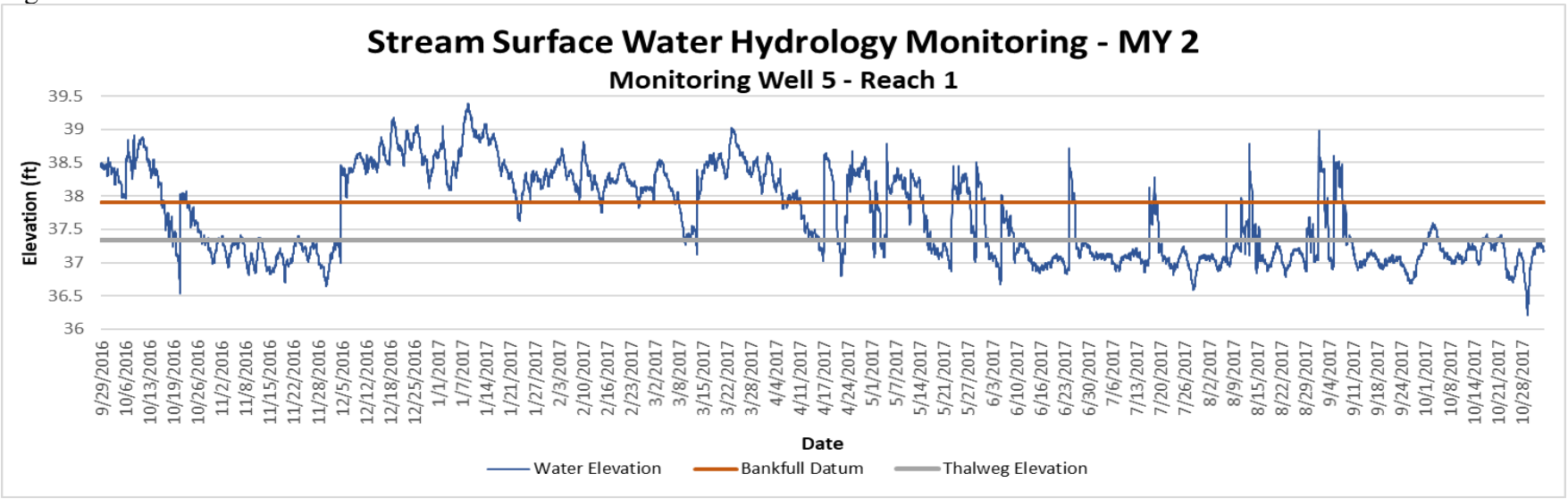


Figure 8

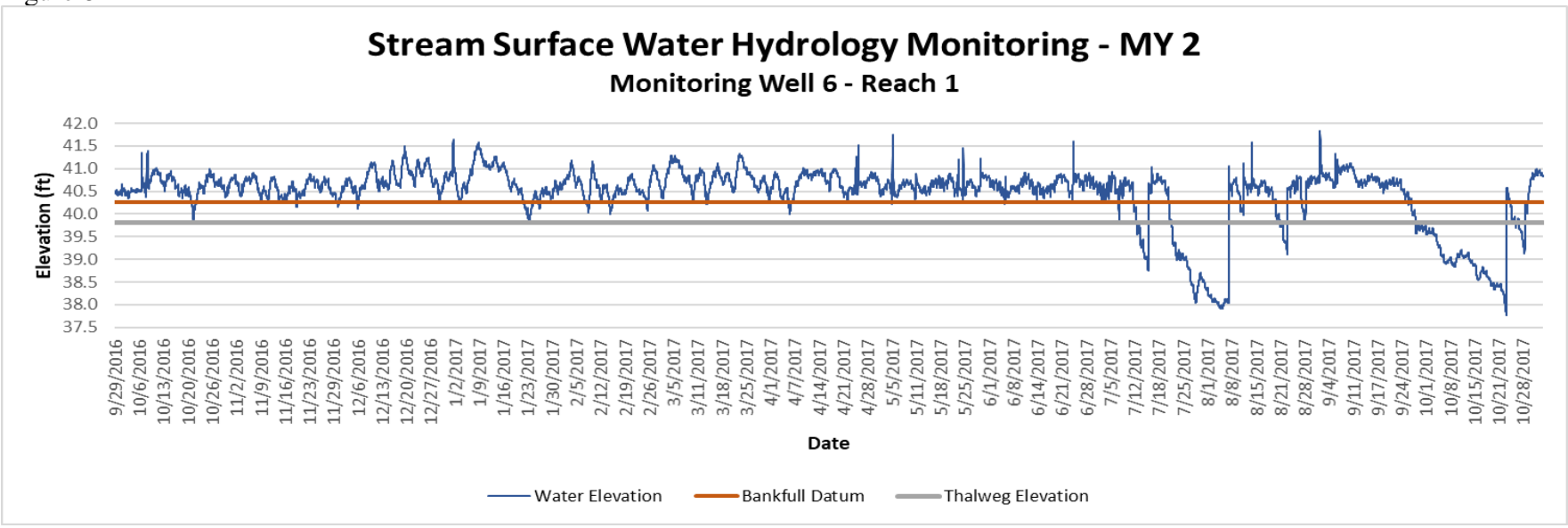


Figure 9

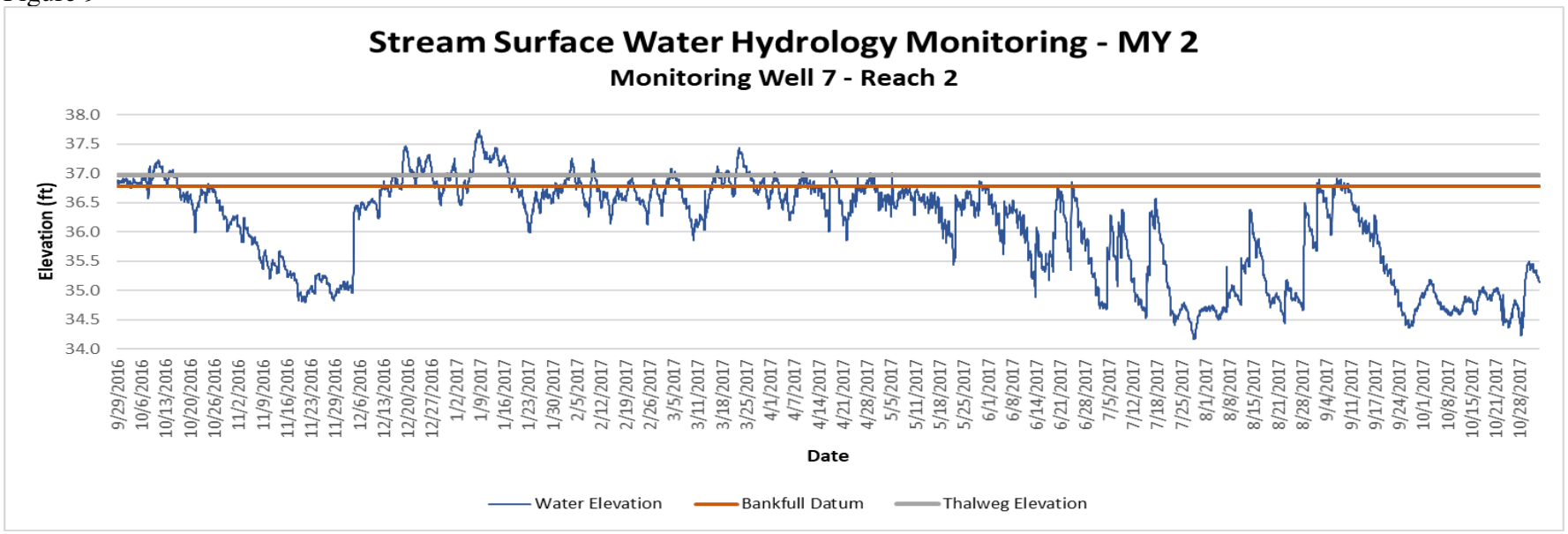


Figure 10

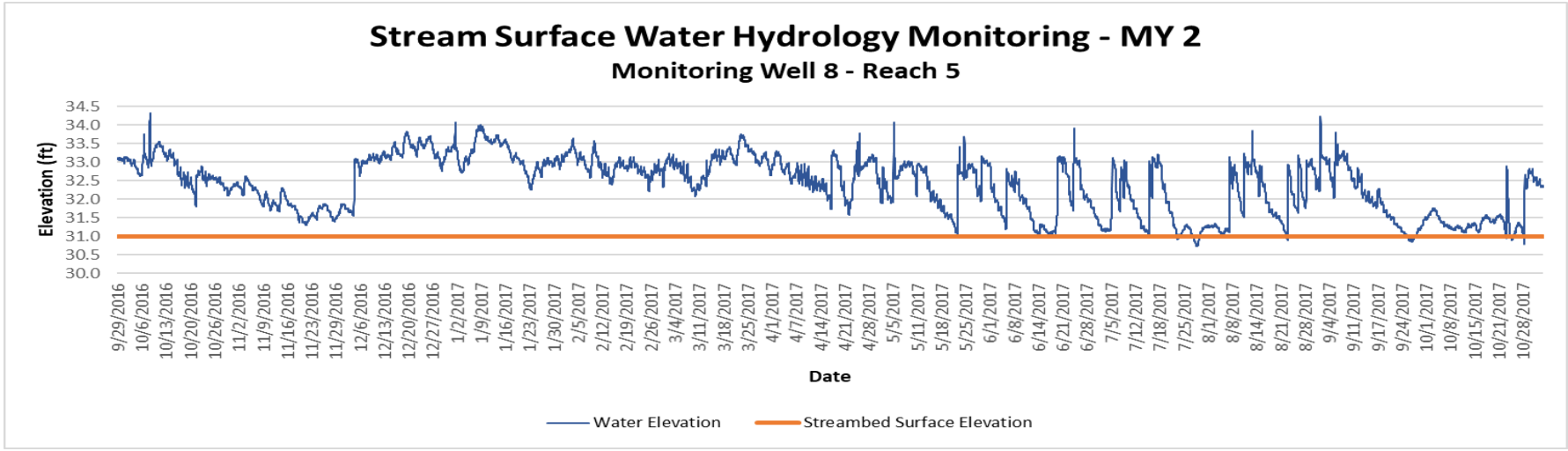


Figure 11[1]

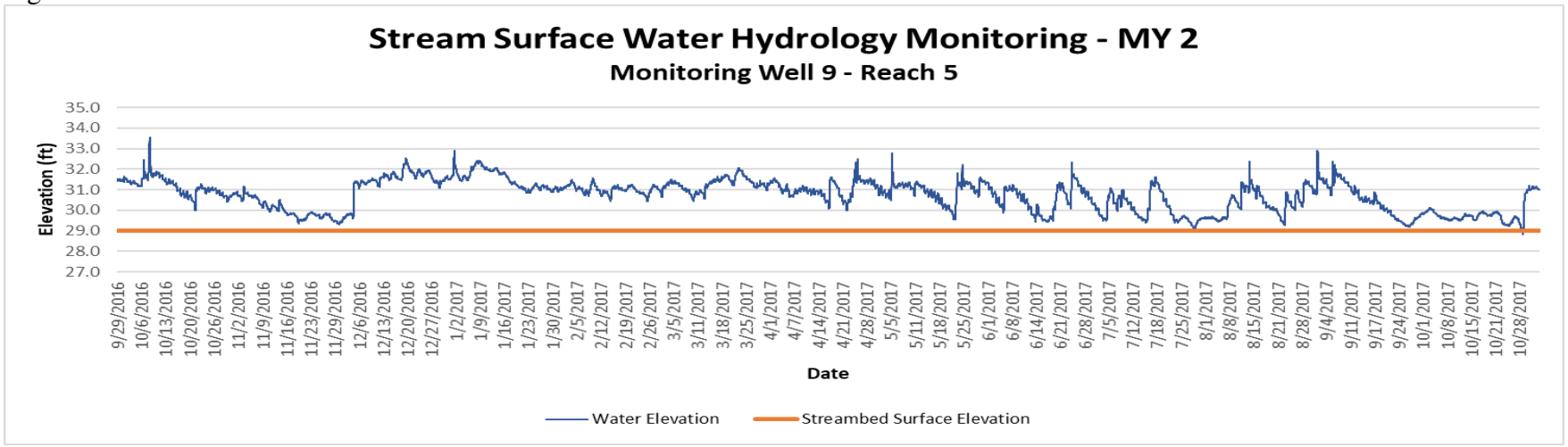
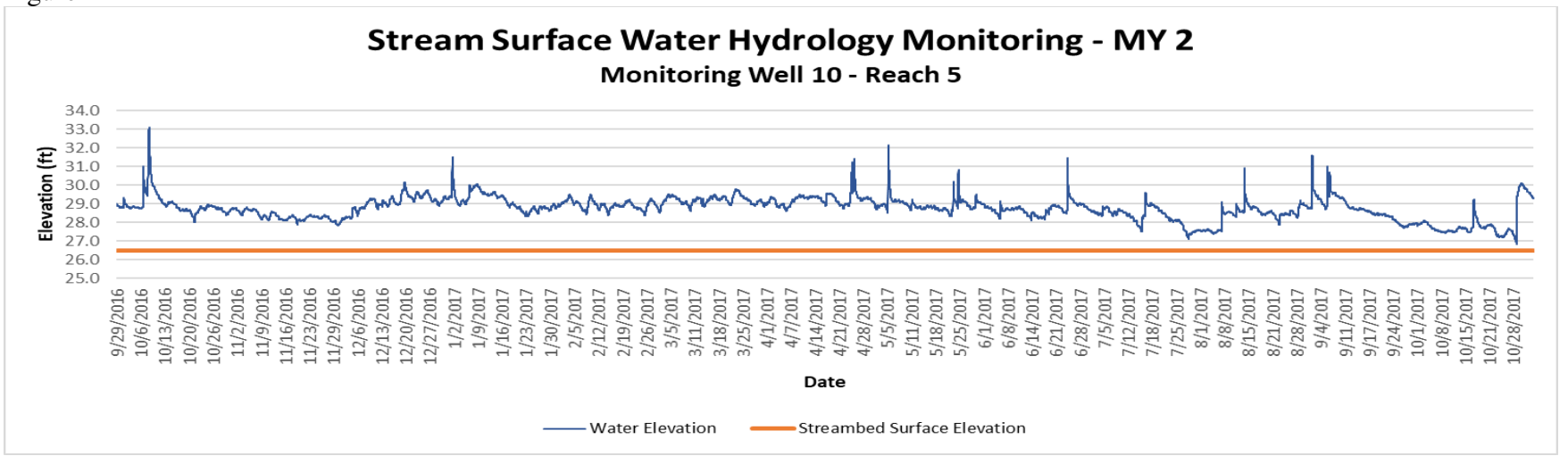


Figure 12



[1] Grading occurred in November 2017 that changed streambed surface elevation on Reach 5.