

Year 6 Monitoring Report

Hudson Property

DMS Project ID #: 95361
DMS Contract #: 004638
DWR Project #: 20140422v1
USACE Action ID# SAW-2012-01394
Beaufort County, North Carolina



Submitted: February 2022

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:
ALBEMARLE RESTORATIONS, LLC
P.O. Box 176
Fairfield, NC 27826
Tel (252) 333-0249 Fax (252) 926-9983



Ecotone, Inc.
410.420.2600 (P)
410.420.6983 (F)

February 21, 2022

Jeremiah Dow
NC DEQ Division of Mitigation Services
217 West Jones St.
Raleigh, NC 27603

RE: Hudson Monitoring Year 6 Report

Dear Mr. Dow,

Ecotone LLC has addressed the comments made on January 11, 2022 by DMS for the above referenced project. The following is a point-by-point response addressing those comments. Additionally, an updated copy of the MY6 Report will be submitted.

- 1. CCPVs should be georeferenced PDFs in the report. Additionally, the resolution is low on the CCPVs and some labels and features are difficult to read. Please submit higher resolution, georeferenced CCPVs exported from ArcMap (or ArcGIS Pro) in the report.*
Ecotone Response: All CCPVs have been updated with higher resolution images (pages 11-16).
- 2. DMS personnel walked the site on January 6 and observed dense pine in the upper portion of Reach 1. Is there any plan to thin pine in this area in MY7?*
Ecotone Response: This isolated stand of pine is a small percentage of the overall tree coverage in the project site. Considering the hardwood stem survival count, there is not an immediate need to thin the pine stand referenced here, but continued monitoring of tree survival will inform possible need for action in the future.
- 3. Please submit a feature characterizing the 20 ft. of erosion located along Reach 3.*
Ecotone Response: Erosion is now marked on CCPV of Reach 3 on page 14 of the report.
- 4. The figure for monitoring well 2 has numeric values on the x-axis instead of dates.*
Ecotone Response: Figure 4 on page 56 has been corrected to show dates on the x-axis.

Thank you for your consideration of these monitoring report comments. We appreciate your assistance with our project thus far, and we look forward to working with you to complete the review process. Feel free to contact us at 410-420-2600.

Sincerely,

Laura S. Calvert
Ecologist
Ecotone, LLC

FOREST HILL

129 Industry Lane
Forest Hill, MD 21050

www.ecotoneinc.com

Table of Contents

Contents

1.0 PROJECT SUMMARY	1
2.0 PROJECT GOALS AND OBJECTIVES	1
3.0 PROJECT SUCCESS CRITERIA	1
3.1 Stream Restoration Performance Standards	1
3.2 Stream Channel Restoration Stability Performance Standards.....	2
3.3 Planted Vegetation Performance Standards.....	2
4.0 SITE CONDITIONS AND DESCRIPTION	2
5.0 MITIGATION COMPONENTS.....	2
6.0 DESIGN APPROACH.....	3
7.0 CONSTRUCTION AND PLANTING TIMELINE	3
8.0 PLAN DEVIATIONS	3
10.0 METHODS AND REFERENCES.....	4
APPENDIX A: PROJECT BACKGROUND TABLES.....	6
APPENDIX B: VISUAL ASSESSMENT DATA	10
APPENDIX C: MY 5 VEGETATION PLOT DATA (2020).....	26
APPENDIX D: MY 5 STREAM MEASUREMENT AND GEOMORPHOLOGY	29
APPENDIX E: YEAR 6 HYDROLOGIC DATA	51
Figure 1: Vicinity Map.....	5
Figure 2: Monthly Rainfall Data with Percentiles	54
Figures 3-12: Stream Surface Water Hydrology (Wells 1-10).....	55-63
Table 1: Project Components and Mitigation Credits.....	7
Table 2: Project Activity and Reporting History	8
Table 3: Project Contacts	8
Table 4: Project Information and Attributes	9
Table 5: Visual Stream Morphology Stability Assessment (Reach 1-4)	17
Table 6: Vegetation Condition Assessment Table.....	21
Table 7: Vegetation Plot Counts and Densities	27
Table 8: Bank Pin Data.....	39
Table 10a: Baseline Stream Data Summary (Reach 1-4)	42-45
Table 11a: Monitoring Data – Dimensional Morphology Summary.....	46
Table 11b: Monitoring Data – Stream Reach Data Summary (Reach 1-4)	47-50
Table 9: Verification of Bankfull Events.....	52
Table 12: Verification of Baseflow.....	53

1.0 PROJECT SUMMARY

The Hudson Property stream restoration project 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 (USGS 03020104). 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 6 monitoring was completed on October 25, 2020.

2.0 PROJECT GOALS AND OBJECTIVES

The project goals of the Hudson Property stream restoration project 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 an appropriate riparian buffer with sufficient density and robustness to support native forest succession.
- Encourage 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 on 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

Much of the site has been 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/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 2,891 lf (Table 1).

6.0 DESIGN APPROACH

A natural design approach was used to restore channel sinuosity and flow of headwater streams, which existed prior to channelization. Grading was designed 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 October 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 bed or banks. Bankfull events were observed for Years 1 through Year 6. 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. Some dieback of planted stems occurred in previous years, but reintroduction of other woody vegetation has been noted in all monitoring plots. Tree heights range from 4-15 feet, with an approximate average of 10 feet (2020 data). Stream gauges indicated base flow and bankfull events at 9 out of 10 locations. Baseflow and bankfull events could not be confirmed at Well 10 because the well cap and logger were disturbed; the base station also malfunctioned during the monitoring effort, preventing download of the annual data. Base flow and bankfull events are assumed to have occurred based on conditions seen during monitoring and information from adjacent wells. During MY 5, bank pins could not be located due to dense vegetative growth; erosion is therefore assumed to be minimal given the vegetative stability of the reaches. Aggradation was noted on Reaches 2 and 3 in MY 5, though slightly less than in MY 3; both reaches remain stable. Stream cross sections are meeting objectives in 11 out of 11 locations.

Previous corrective measures included regrading Reach 5 to raise the stream invert to create a wider swamp run. This was identified during a field meeting with NC Division of Mitigation Services and the USACE in June 2017 and completed in October 2017. A field meeting with NC Division of Mitigation Services and the USACE in April 2018, identified two monitoring wells that required repair; repair was completed. Year 1 Monitoring identified some areas where woody survivability was low; these areas were spot planted in December 2017. In Year 3, Vegetation Plot 6, and other small areas on Reach 1 and 2, appeared to have slightly low woody survivability. These areas were spot planted in October 2019, though the areas were smaller than 0.1 acres and were not included in the CCPV. No additional corrective measures are necessary.

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.

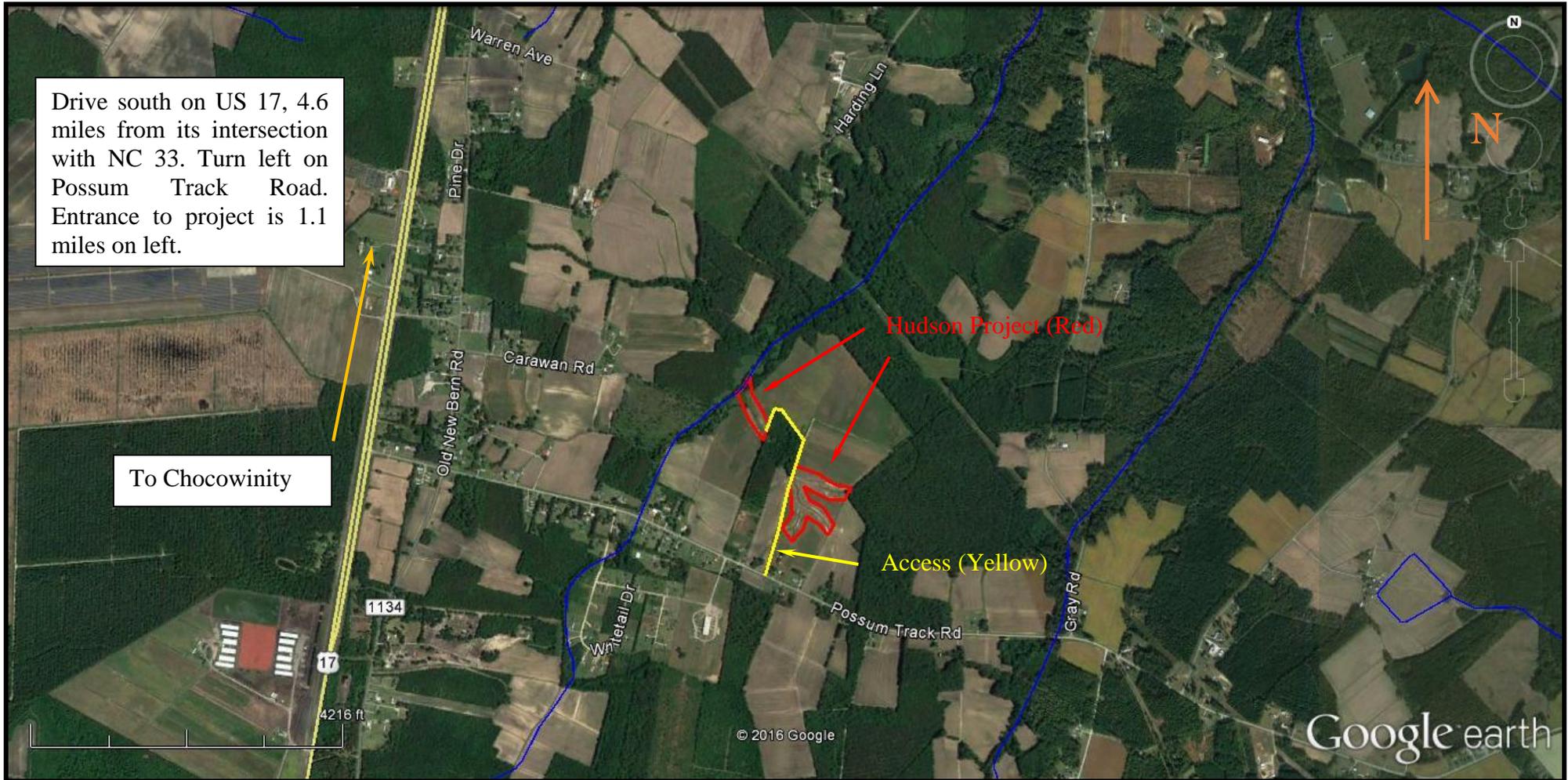


Figure 1 - Vicinity Map
Hudson Stream Mitigation Project
DMS Project #95361
Beaufort County, NC

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	Final: January 2018
Year 3 Monitoring	October 2018	Final: March 2019
Year 4 Monitoring	October 2019	Final: January 2020
Year 5 Monitoring	October 2020	Final: December 2020
Year 6 Monitoring	October 2021	Draft: November 2021
Year 7 Monitoring		

Table 3: Project Contacts Hudson Property- EEP Project Number: 95361	
Primary Project Design POC	Ecotone, Inc. Scott McGill (410) 420-2600 129 Industry Lane, Forest Hill, MD 21050
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 129 Industry Lane, Forest Hill, MD 21050

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		

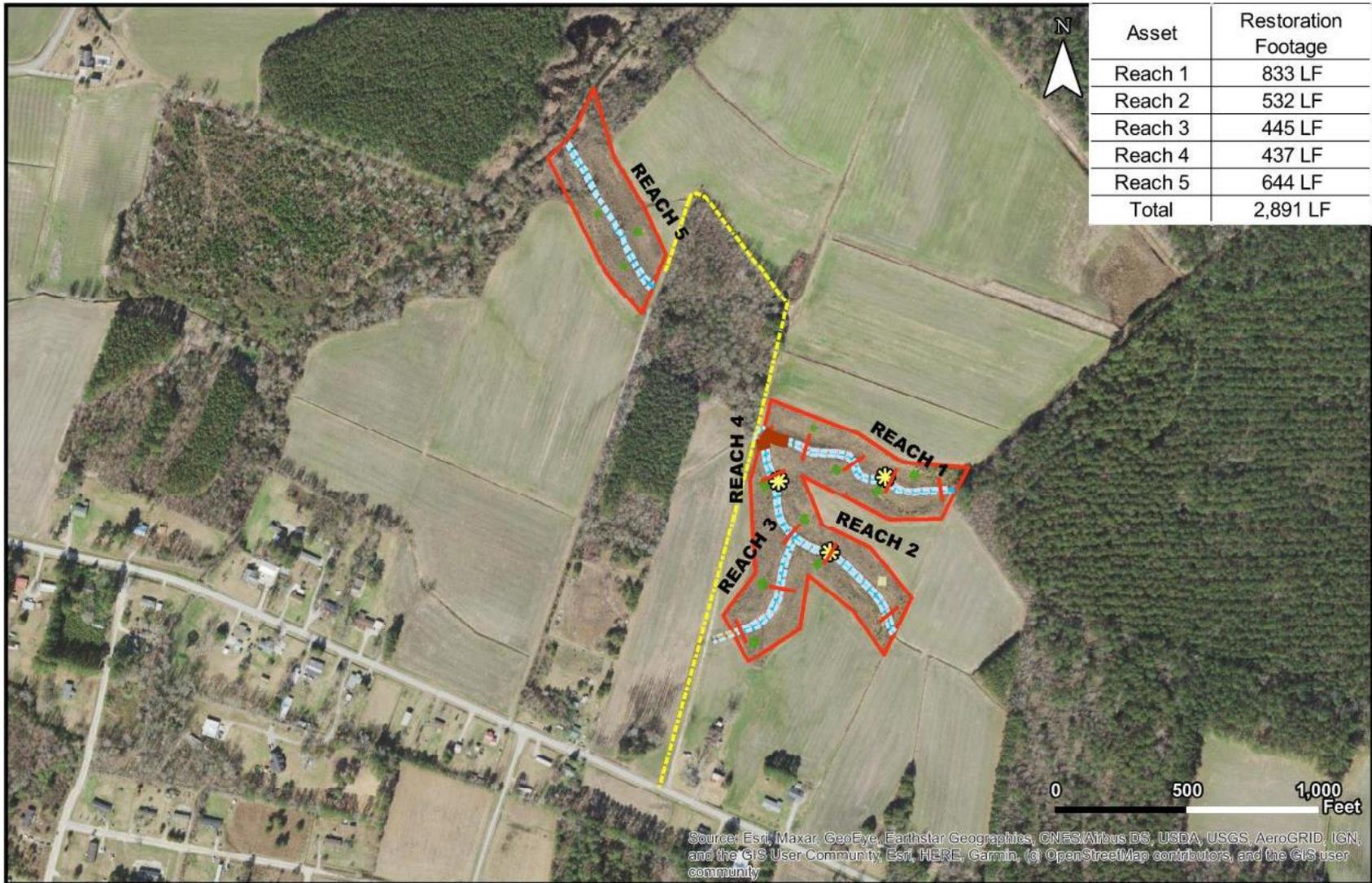
APPENDIX B: VISUAL ASSESSMENT DATA

Current Condition Plan View

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

Table 6. Vegetation Condition Assessment Table

Site Photos

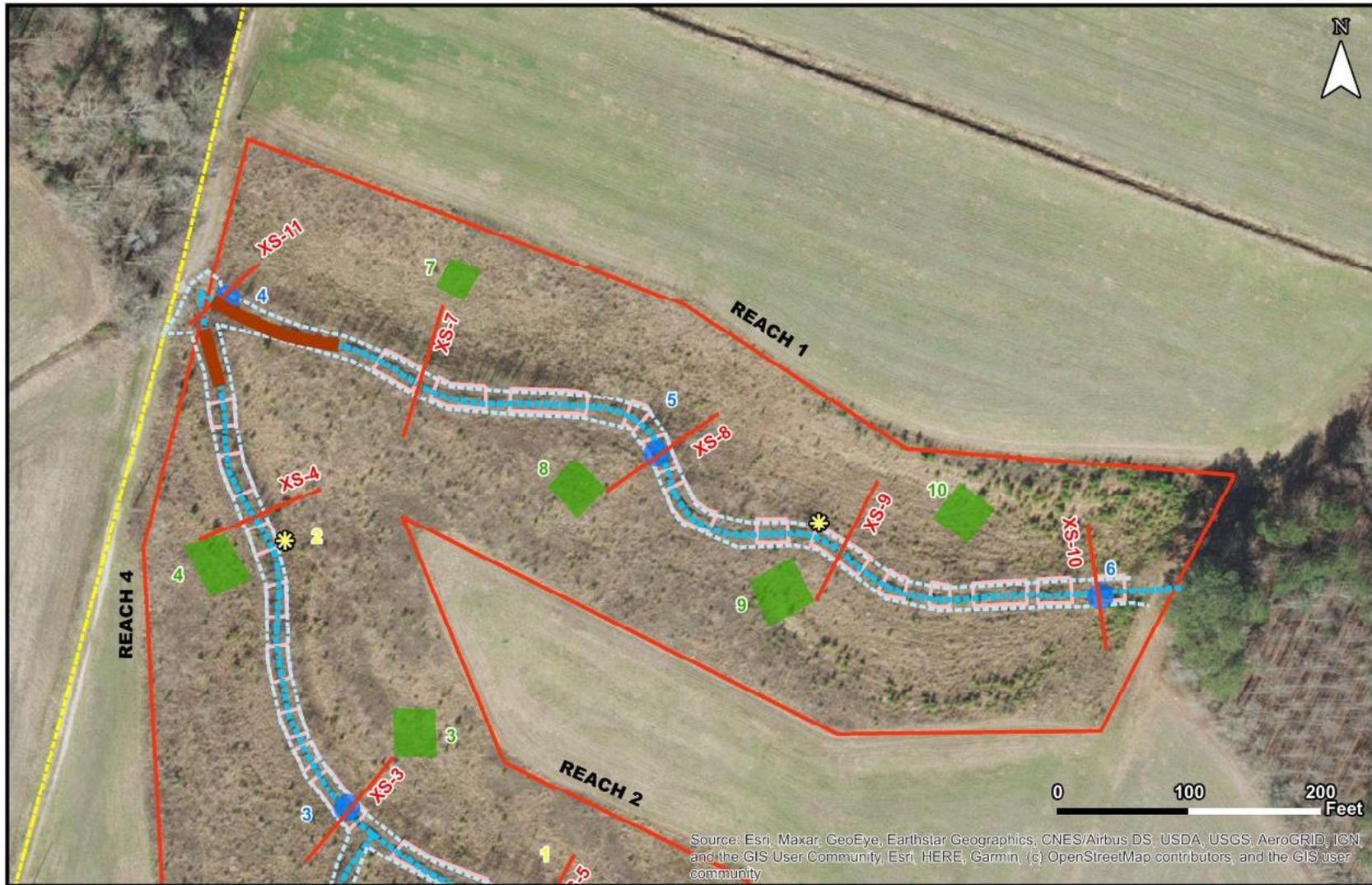


Albemarle Restorations, LLC
 Wetland Restoration
 Stream Restoration
 Wildlife Habitat

**HUDSON STREAM
 RESTORATION PROJECT
 CURRENT CONDITION PLAN VIEW**
 PROJECT #95361
 FEBRUARY 21, 2022

Log Drops	Flow Stations	Easement Boundary	Criteria Unmet
Erosion	Top Of Bank	Woody Riffles	
Cross Sections	Access Road	Criteria Met	
Bank Pin Array	Stream Centerline		

Note: Year 6 Monitoring did not require Vegetation Plot or Cross Section Survey. CCPV is based on 2020 information.



Albemarle Restorations, LLC
 Wetland Restoration
 Stream Restoration
 Wildlife Habitat

**HUDSON STREAM RESTORATION PROJECT
 CURRENT CONDITION PLAN VIEW**
 PROJECT #95361
 FEBRUARY 21, 2022

Log Drops	Flow Stations	Easement Boundary	Criteria Unmet
Erosion	Top Of Bank	Woody Riffles	Criteria Met
Cross Sections	Access Road	Criteria Met	
Bank Pin Array	Stream Centerline		

Note: Year 6 Monitoring did not require Vegetation Plot or Cross Section Survey. CCPV is based on 2020 information.



Albemarle Restorations, LLC
 Wetland Restoration
 Stream Restoration
 Wildlife Habitat

**HUDSON STREAM
 RESTORATION PROJECT
 CURRENT CONDITION PLAN VIEW**
 PROJECT #95361
 FEBRUARY 21, 2022

Log Drops	Flow Stations	Easement Boundary	Criteria Unmet
Erosion	Top Of Bank	Woody Riffles	
Cross Sections	Access Road	Criteria Met	
Bank Pin Array	Stream Centerline		

Note: Year 6 Monitoring did not require Vegetation Plot or Cross Section Survey. CCPV is based on 2020 information.



Albemarle Restorations, LLC
 Wetland Restoration
 Stream Restoration
 Wildlife Habitat

**HUDSON STREAM
 RESTORATION PROJECT
 CURRENT CONDITION PLAN VIEW**
 PROJECT #95361
 FEBRUARY 21, 2022

Log Drops	Flow Stations	Easement Boundary	Criteria Unmet
Erosion	Top Of Bank	Woody Riffles	Criteria Met
Cross Sections	Access Road	Criteria Met	
Bank Pin Array	Stream Centerline		

Note: Year 6 Monitoring did not require Vegetation Plot or Cross Section Survey. CCPV is based on 2020 information.



<p><i>Albemarle Restorations, LLC</i></p> <p><i>Wetland Restoration Stream Restoration Wildlife Habitat</i></p>	<p>HUDSON STREAM RESTORATION PROJECT</p> <p>CURRENT CONDITION PLAN VIEW</p> <p>PROJECT #95361 FEBRUARY 21, 2022</p>		<p>Log Drops</p> <p>Erosion</p> <p>Cross Sections</p> <p>Bank Pin Array</p>	<p>Flow Stations</p> <p>Top Of Bank</p> <p>Access Road</p> <p>Stream Centerline</p>	<p>Easement Boundary</p> <p>Woody Riffles</p> <p>Criteria Met</p>	<p>Criteria Unmet</p>
---	---	--	---	---	---	-----------------------

Note: Year 6 Monitoring did not require Vegetation Plot or Cross Section Survey. CCPV is based on 2020 information.



Albemarle Restorations, LLC
 Wetland Restoration
 Stream Restoration
 Wildlife Habitat

**HUDSON STREAM
 RESTORATION PROJECT
 CURRENT CONDITION PLAN VIEW**
 PROJECT #95361
 FEBRUARY 21, 2022

Log Drops	Flow Stations	Easement Boundary	Criteria Unmet
Erosion	Top Of Bank	Woody Riffles	
Cross Sections	Access Road	Criteria Met	
Bank Pin Array	Stream Centerline		

Note: Year 6 Monitoring did not require Vegetation Plot or Cross Section Survey. CCPV is based on 2020 information.

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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	13	13			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	5	5					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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*			
	Totals									
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										
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 <u>not</u> 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 \geq 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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	9	9			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	3	3					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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*			
Totals					0	0	100%	0	0	100%
2. Bank	1. <u>Scoured/Eroding</u>	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. <u>Undercut</u>	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. <u>Mass Wasting</u>	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
3. Engineered Structures	1. <u>Overall Integrity</u>	Structures physically intact with no dislodged boulders or logs.	0	0			NA			
	2. <u>Grade Control</u>	Grade control structures exhibiting maintenance of grade across the sill.	0	0			NA			
	2a. <u>Piping</u>	Structures lacking any substantial flow underneath sills or arms.	0	0			NA			
	3. <u>Bank Protection</u>	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	0	0			NA			
	4. <u>Habitat</u>	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	7	7			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	3	3					
	4. Thalweg Position	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	3	3			100%			
		1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
	Totals									
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	20	98%	0	0	98%
	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	20	98%	0	0	98%
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 <u>not</u> 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 \geq 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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%				
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%				
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	8	8			NA				
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	3	3						NA
			2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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				
Totals					0	0	100%	0	0	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%	
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 <u>not</u> 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 \geq 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 .											
*Some small areas spot planted in 2019; these areas are smaller than 0.1 acres and not included in CCPV											



Photo 1: Highly vegetated stream area with wetland along Reach 1 - View Northwest.



Photo 2: Near Cross Section 6 on Reach 2 – View Northwest.



Photo 3: View of Cross Section 1 on Reach 3 – View Northeast.



Photo 5: View near Cross Section 4 on Reach 4 –View Southeast



Photo 5: View near Cross Section 4 on Reach 4 –View Southeast (Piping).



Photo 6: View downstream of Reach 5 Swamp Run.



Photo 7: View upstream on Reach 5 Swamp Run.

APPENDIX C: MY 5 VEGETATION PLOT DATA (2020)

Table 7: Vegetation Plot Counts and Densities

Table 7: Vegetation Plot Counts and Densities (MY 5 2020)

EEP Project Code 0004638. Project Name: Hudson

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2020)																									
			0004638-01-0001			0004638-01-0002			0004638-01-0003			0004638-01-0004			0004638-01-0005			0004638-01-0006			0004638-01-0007			0004638-01-0008				
			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 rubrum	red maple	Tree																										
Baccharis halimifolia	eastern baccharis	Shrub			2							5						1					2		2			
Betula nigra	river birch	Tree																										
Juniperus virginiana	eastern redcedar	Tree																										
Ligustrum vulgare	European privet	Exotic																										
Liquidambar styraciflua	sweetgum	Tree			1			1			2			1			2			1			1		2			
Liriodendron tulipifera	tuliptree	Tree	1	1	1																							
Morella cerifera	wax myrtle	shrub			1			1						1														
Pinus echinata	shortleaf pine	Tree																										
Pinus taeda	loblolly pine	Tree			14			5			6			10			5			13								
Platanus occidentalis	American sycamore	Tree	3	3	6	4	4	4	4	4	4	5	3	3	3	2	2	2	2	2	2	2	6	6	6	5	5	5
Quercus alba	white oak	Tree	1	1	1	2	2	2				2	2	2														
Quercus bicolor	swamp white oak	Tree	4	4	4	1	1	1							1	1	1					2	2	2				
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	3	3	3	5	5	5	4	4	4	4	4	4	3	3	6	6	6	6	6	
Taxodium distichum	bald cypress	Tree													1	1	1				1	1	1					
Ulmus americana	American elm	Tree																										
Stem count			11	11	32	8	8	17	7	7	16	10	10	27	10	10	17	7	7	22	11	11	17	11	11	15		
size (ares)			1			1			1			1			1			1			1			1				
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02				
Species count			5	5	9	4	4	7	2	2	4	3	3	7	5	5	7	3	3	6	3	3	5	2	2	4		
Stems per ACRE			445.2	445.2	1295	323.7	323.7	688	283.3	283.3	647.5	404.7	404.7	1093	404.7	404.7	688	283.3	283.3	890.3	445.2	445.2	688	445.2	445.2	607		

EEP Project Code 0004638. Project Name: Hudson

Scientific Name	Common Name	Species Type	Annual Means																																
			0004638-01-0009			0004638-01-0010			0004638-01-0011			0004638-01-0012			0004638-01-0013			MY5 (2020)		MY3 (2018)		MY2 (2017)		MY1 (2016)		MY0 (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						
Acer rubrum	red maple	Tree						2																											
Baccharis halimifolia	eastern baccharis	Shrub			1						2			3																					
Betula nigra	river birch	Tree									1	1	1																						
Juniperus virginiana	eastern redcedar	Tree			1	1	1																												
Ligustrum vulgare	European privet	Exotic																																	
Liquidambar styraciflua	sweetgum	Tree						3					15			3																			
Liriodendron tulipifera	tuliptree	Tree			2	2	2				1	1	1																						
Morella cerifera	wax myrtle	shrub																																	
Pinus echinata	shortleaf pine	Tree			1																														
Pinus taeda	loblolly pine	Tree			14			12					3			1																			
Platanus occidentalis	American sycamore	Tree	5	5	5			1	10	10	10	1	1	1	4	4	4	4	49	49	54	49	49	50	46	46	50	44	44	47	54	54	54		
Quercus alba	white oak	Tree										1	1	1	5	5	5	5	11	11	11	11	11	15	12	12	16	12	12	12	16	16	16		
Quercus bicolor	swamp white oak	Tree							2	2	2	1	1	1					11	11	11	16	16	16	17	17	17	17	19	19	19	19	19	19	
Quercus michauxii	swamp chestnut oak	Tree						1	1	1	1	1	1	3	3	3	3	1	1	1	6	6	6	8	8	8	11	11	12	8	8	8	13	13	13
Quercus nigra	water oak	Tree	3	3	3				3	3	3								8	8	8	13	13	13	14	14	15	11	11	11	18	18	18	18	
Quercus phellos	willow oak	Tree	2	2	2	2	2	2						2					32	32	39	29	29	31	29	29	35	24	24	25	33	33	33	33	
Taxodium distichum	bald cypress	Tree																																	
Ulmus americana	American elm	Tree						1	1	1																									
Stem count			10	10	26	7	7	25	16	16	20	8	8	31	10	10	18	126	126	283	140	140	254	144	144	234	130	130	134	184	184	184	184		
size (ares)			1			1			1			1			1			13			13			13			13			13					
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.32			0.32			0.32			0.32			0.32					
Species count			3	3	6	5	5	9	4	4	6	6	6	10	3	3	7	11	11	17	7	7	13	7	7	12	7	7	7	7	7	7	7	7	
Stems per ACRE			404.7	404.7	1052	283.3	283.3	1012	647	647	809	324	324	1255	405	405	728	392	392	881	436	436	791	448	448	728	405	405	417	573	573	573	573		

Table 7: Vegetation Plot Counts and Densities (Continued)

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: MY 5 STREAM MEASUREMENT AND GEOMORPHOLOGY

Cross Sections with Annual Overlays (XS 1-11)

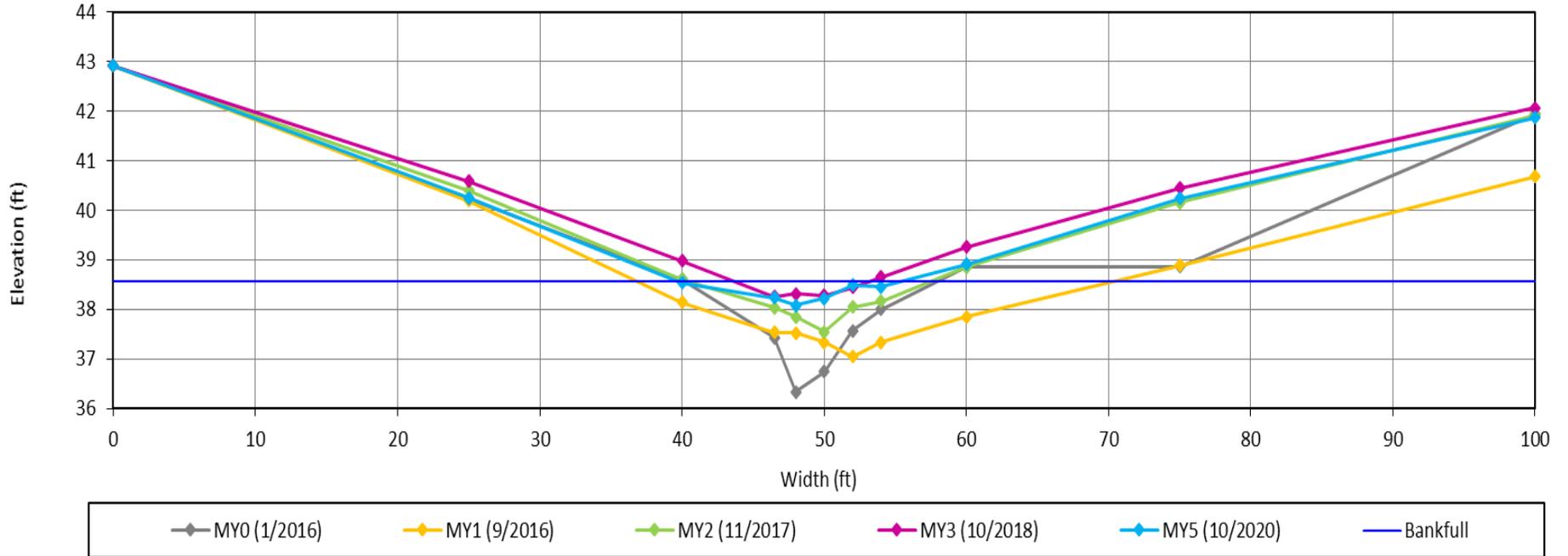
Table 8: Bank Pin Data

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

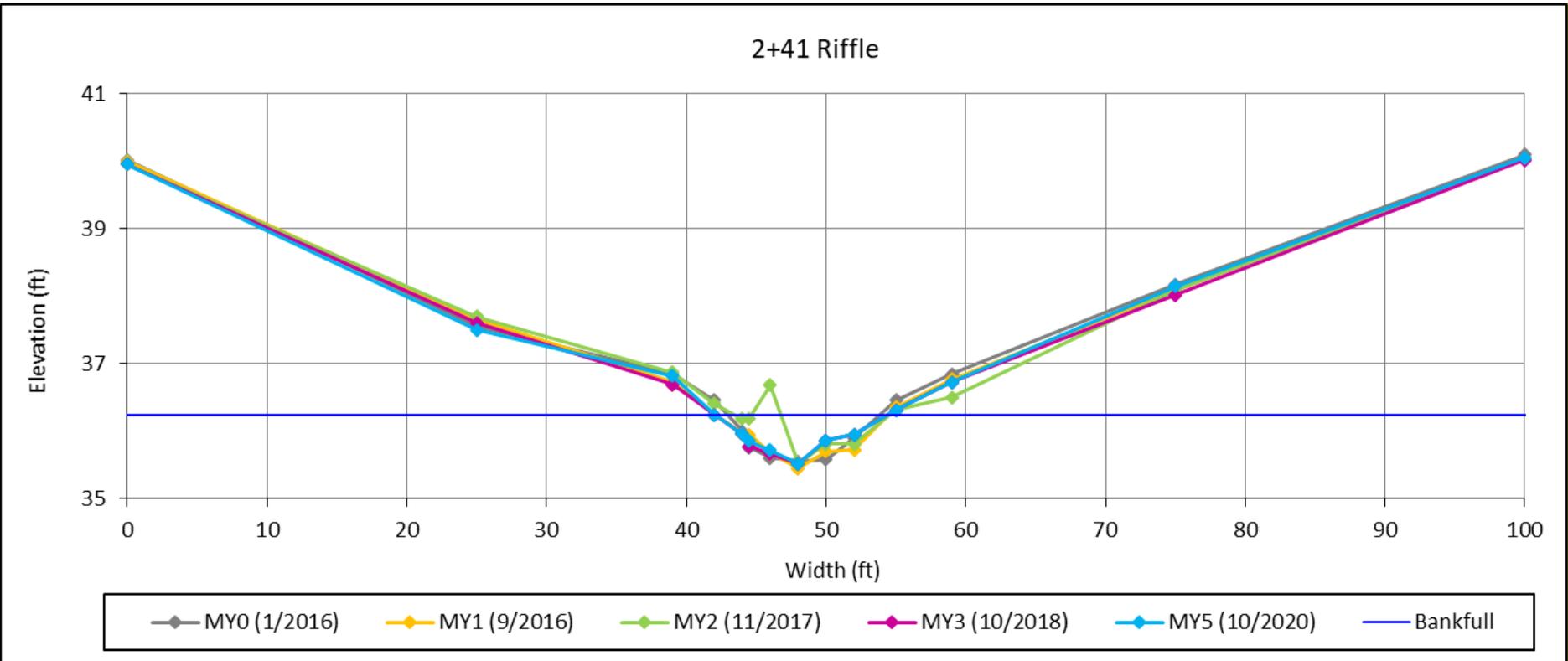
Table 11a. Monitoring Data – Dimensional Morphology Summary

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

+9 Pool

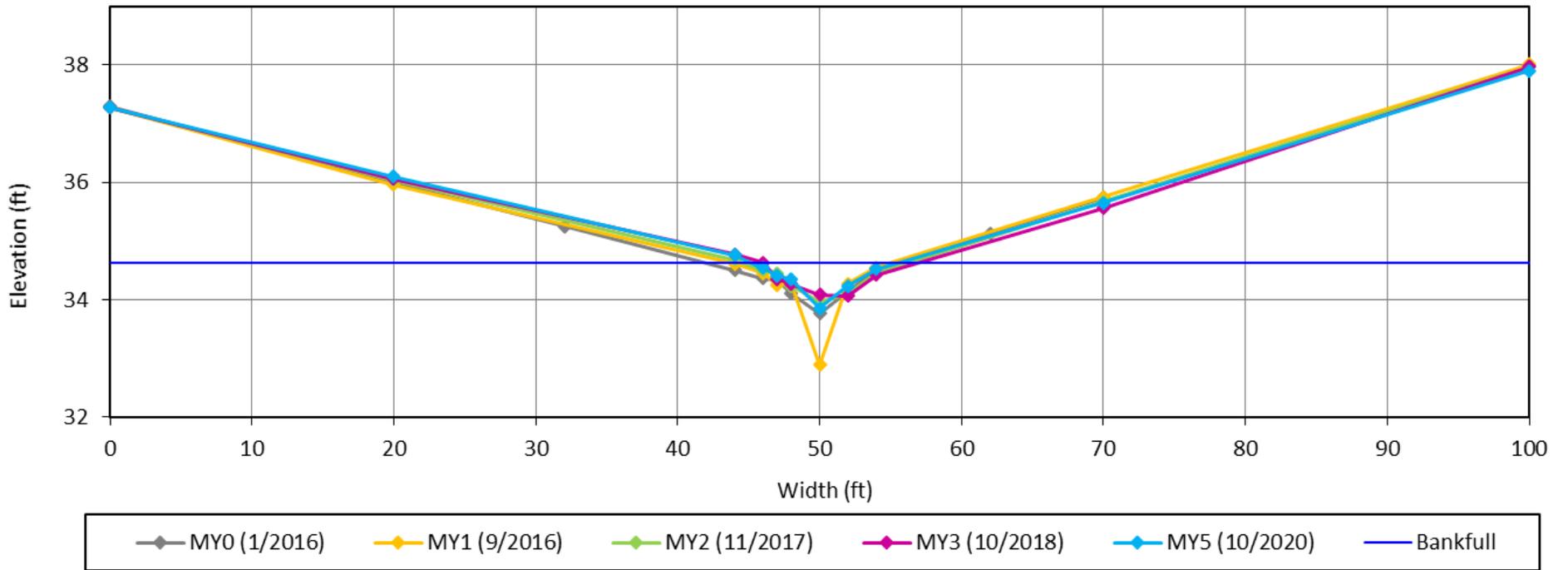


Cross Section 1 – Reach 3 (2020 Data)



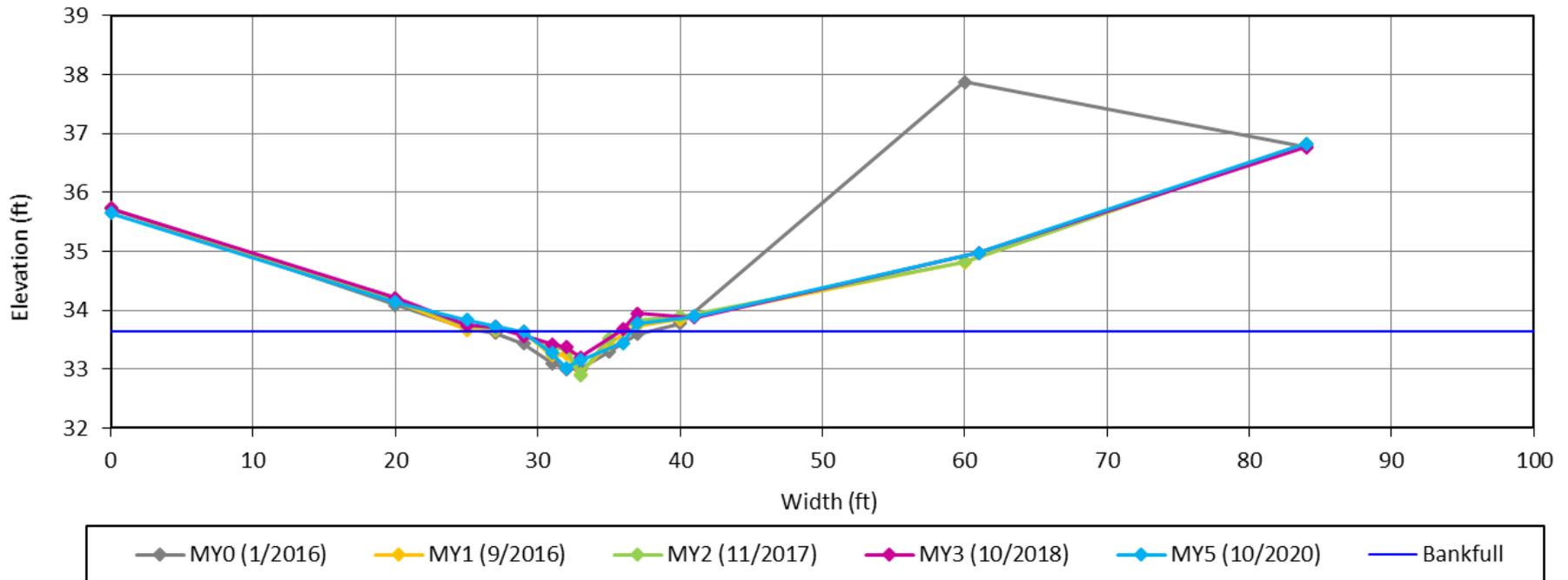
Cross Section 2 – Reach 3 (2020 Data)

+24 Riffle

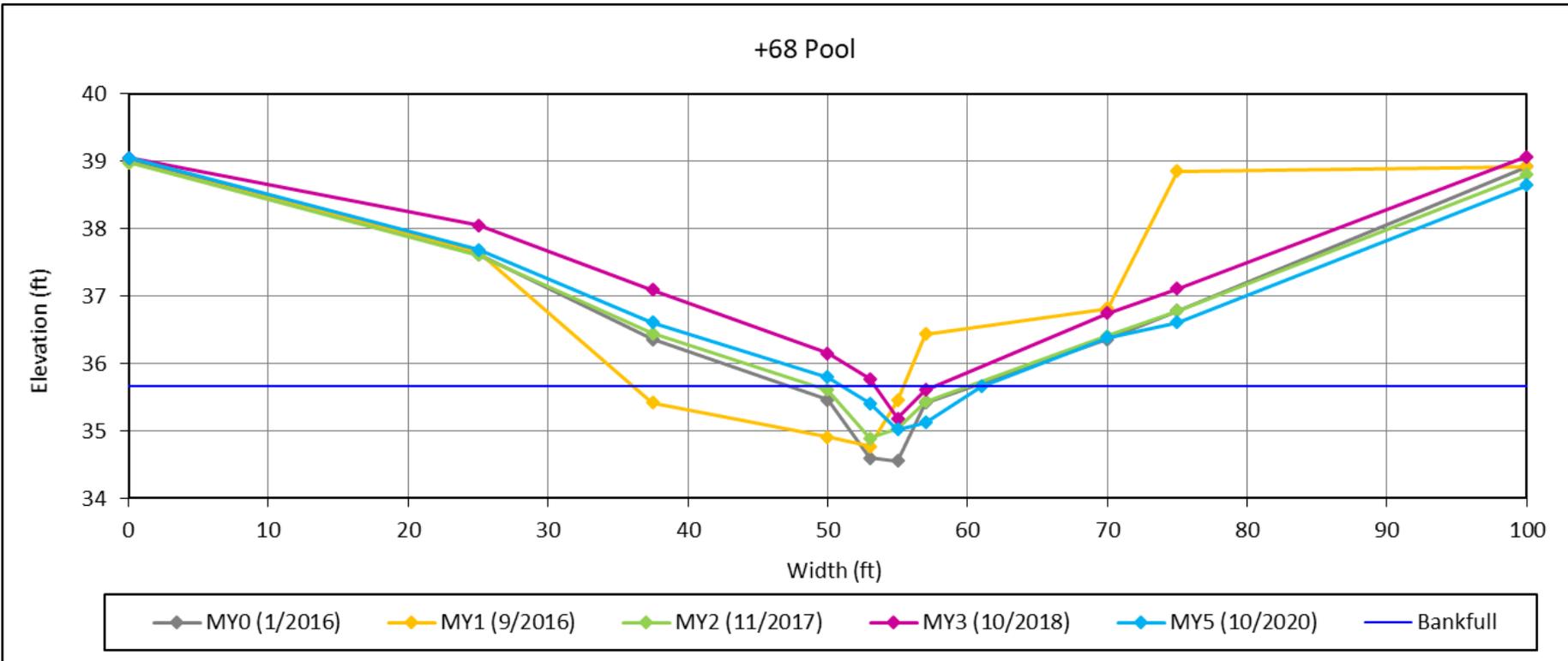


Cross Section 3 – Reach 4 (2020 Data)

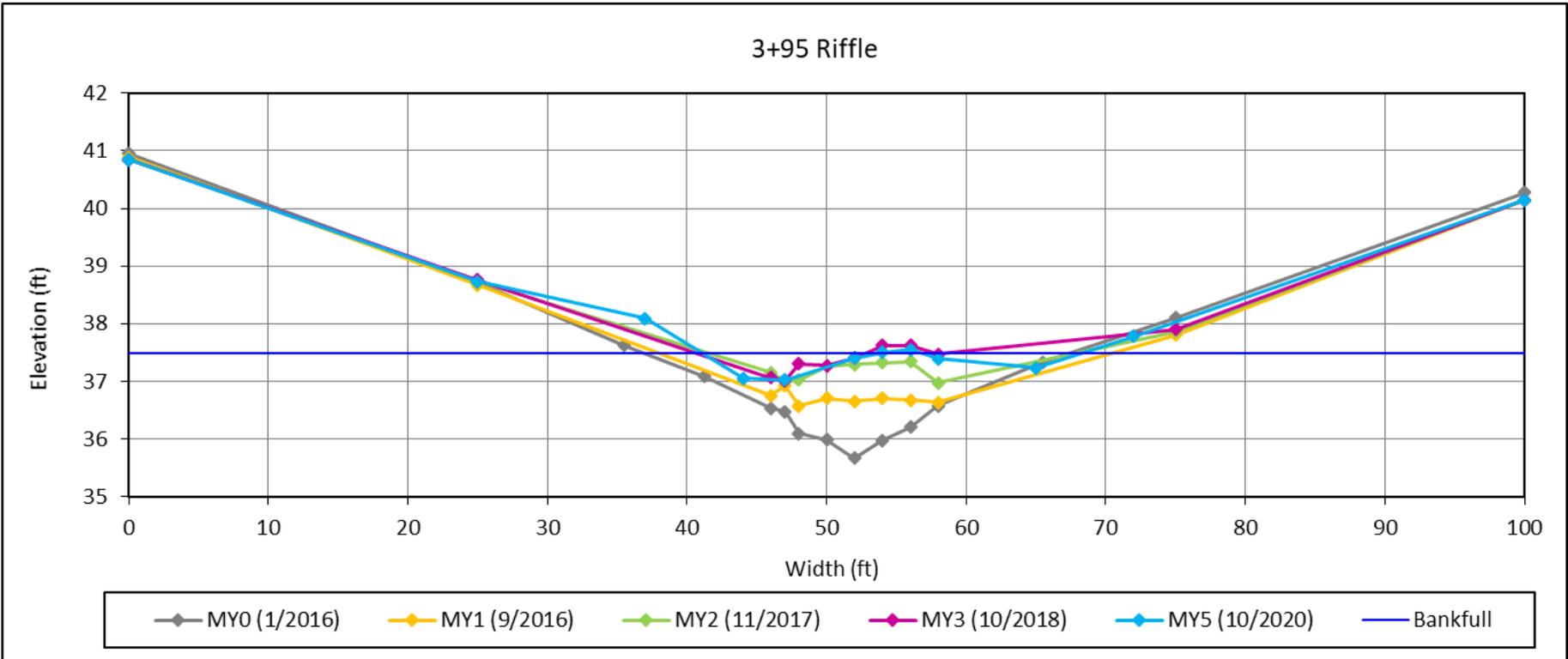
2+69 Pool



Cross Section 4 – Reach 4 (2020 Data)

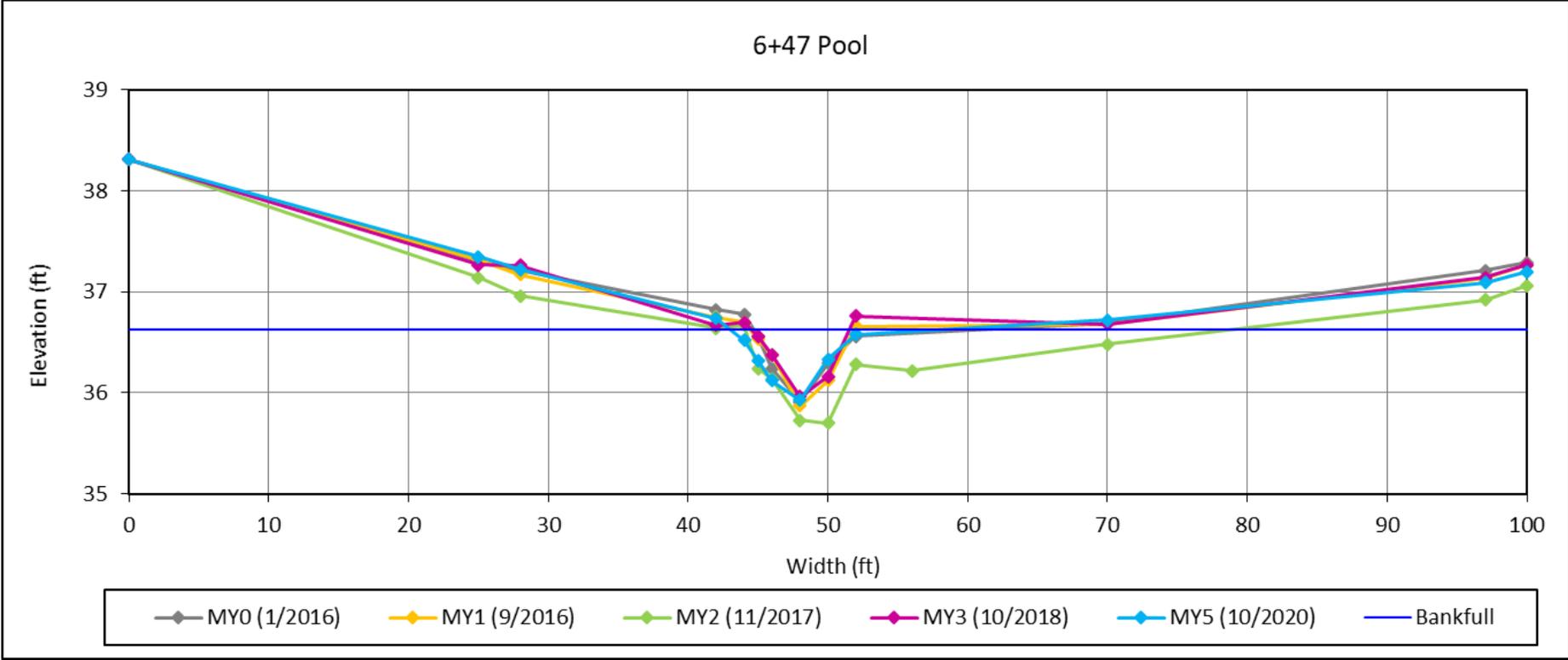


Cross Section 5 – Reach 2 (2020 Data)



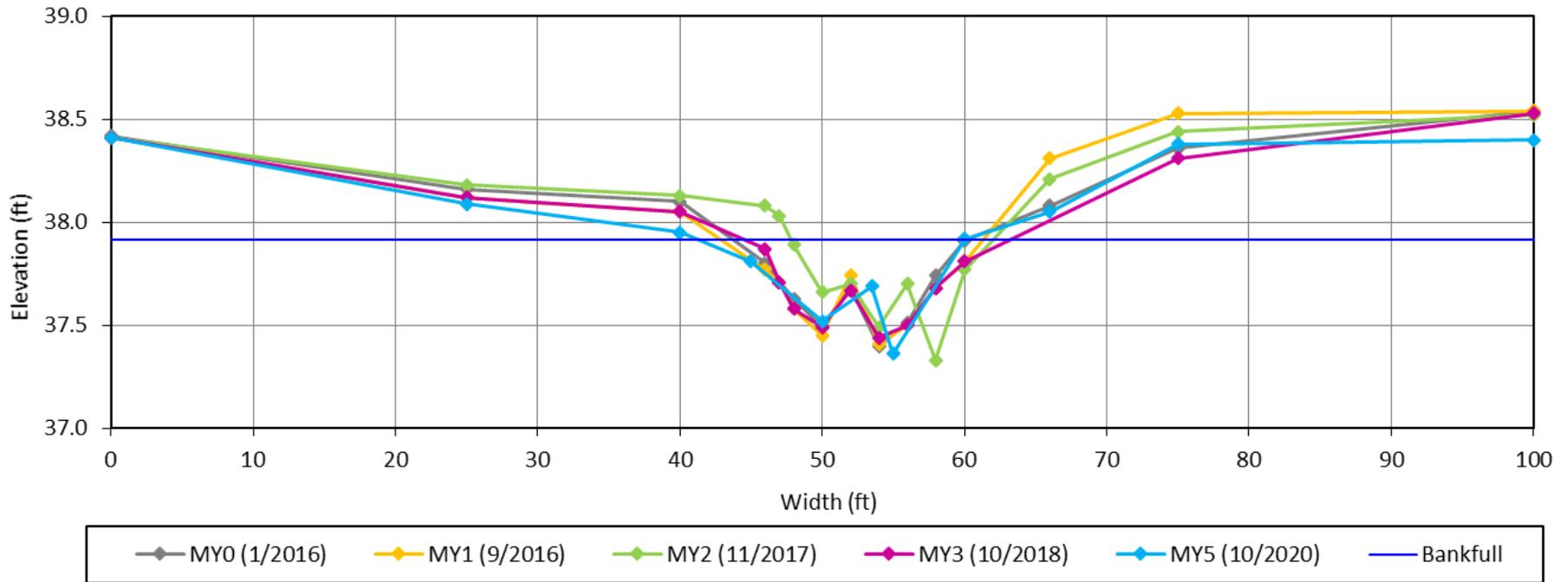
Cross Section 6 – Reach 2 (2020 Data)

6+47 Pool



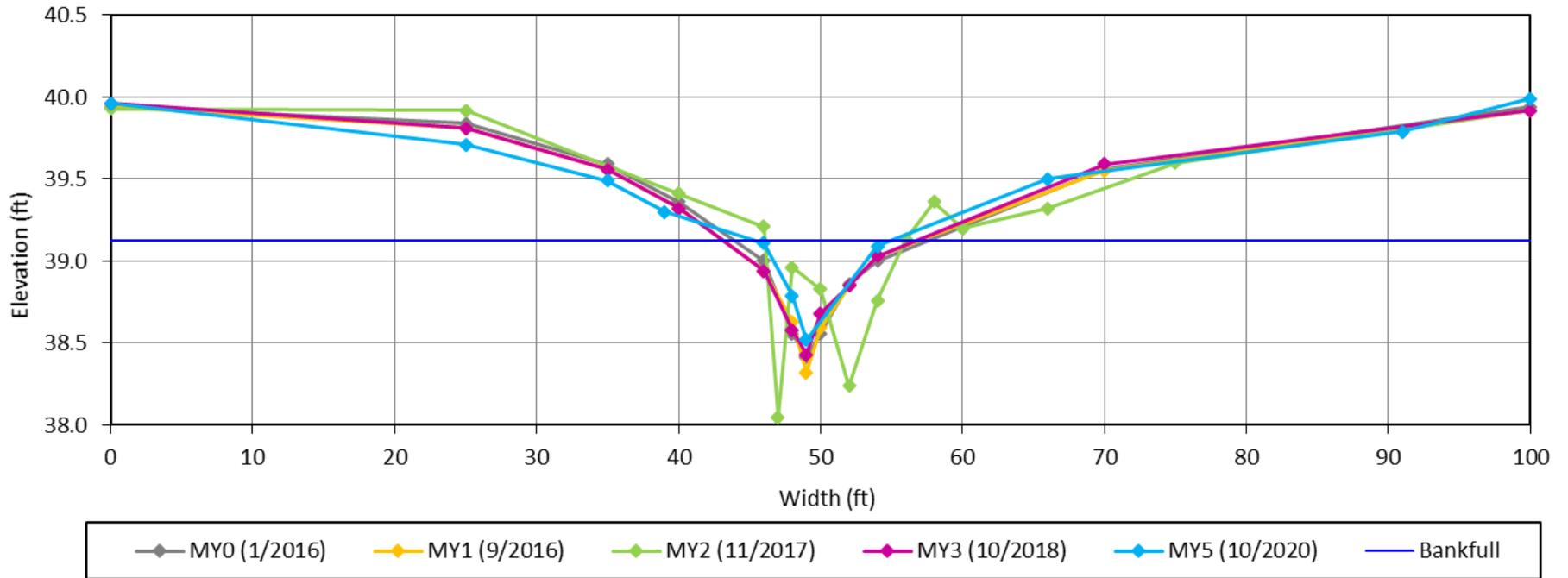
Cross Section 7 – Reach 1 (2020 Data)

4+43 Riffle



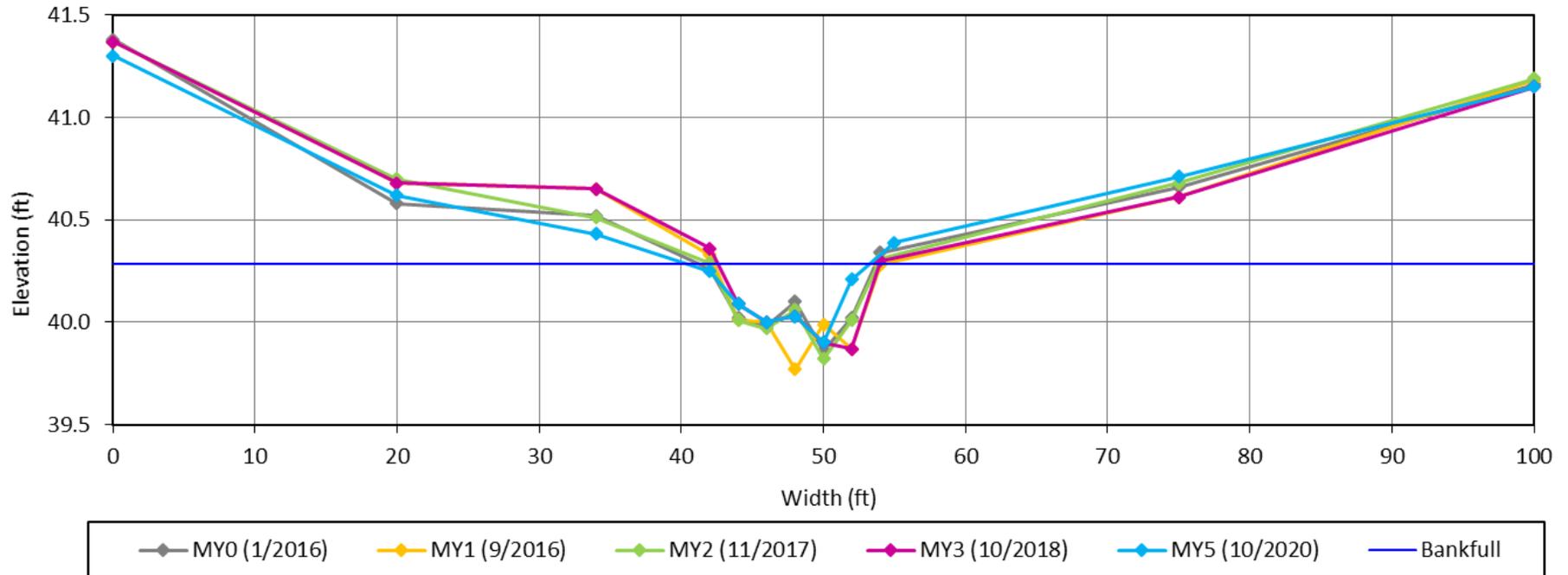
Cross Section 8 – Reach 1 (2020 Data)

2+73 Pool

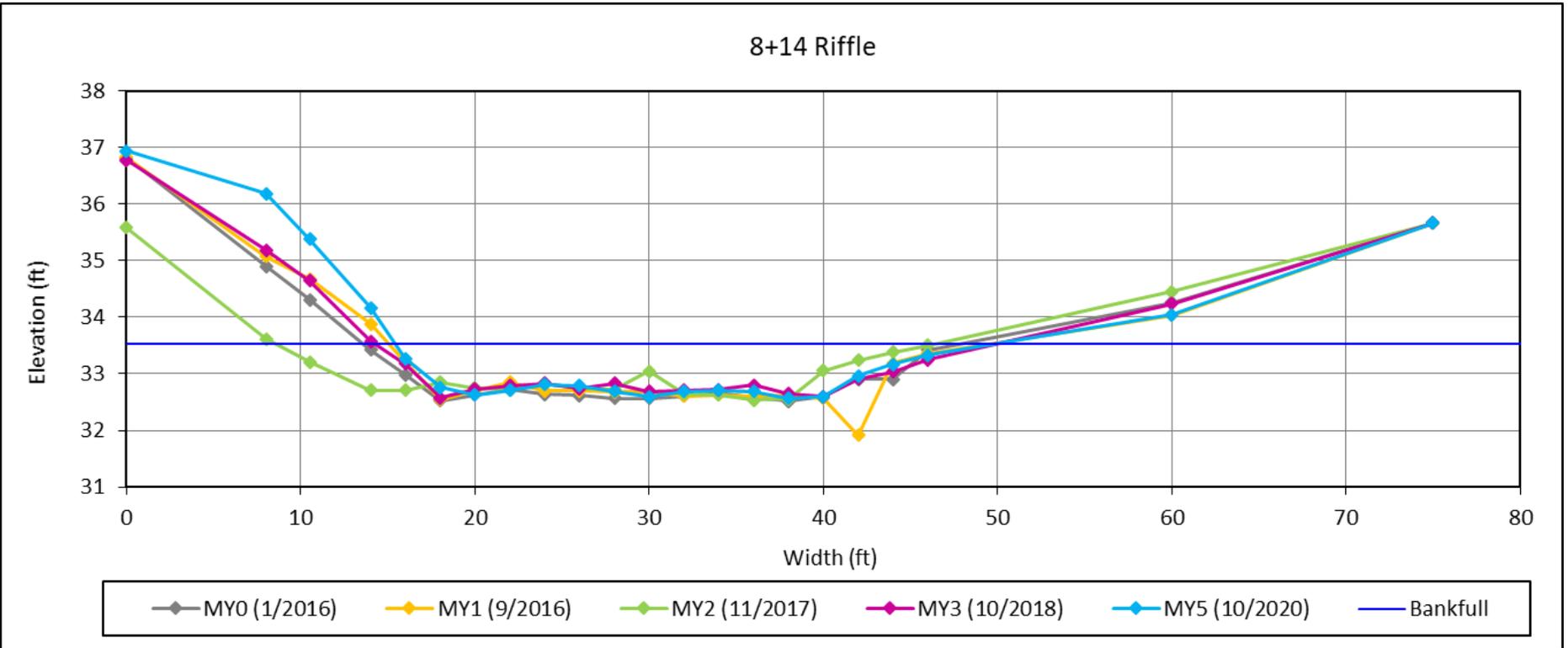


Cross Section 9 – Reach 1 (2020 Data)

+64 Riffle



Cross Section 10 – Reach 1 (2020 Data)



Cross Section 11 – Reach 1 & 4 Confluence (2020 Data)

Table 8: Monitoring Year 5 - 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 & dense vegetation
Middle Pin	Could not find- minor aggradation & dense vegetation
Downstream Pin	Could not find- minor aggradation & dense vegetation

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

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

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					
		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	
Dimension and Substrate - Riffle Only																										
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/ft 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							
		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		
Dimension and Substrate - Riffle Only																											
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/ft 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									
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					
		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	
Dimension and Substrate - Riffle Only																										
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/ft ²																		0.14								
Max part size (mm) mobilized at bankfull																										
Stream Power (transport capacity) W/m ²																		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						
		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		
Dimension and Substrate - Riffle Only																											
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								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)								
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+		
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area								36.40	36.36	36.55	36.42	36.43			34.50	34.34	34.60	34.62	34.63																		
Bank Height Ratio_Based on AB Bankfull ¹ Area								1.00	1.00	0.77	0.88	0.79			1.00	1.14	0.77	0.65	0.90																		
Thalweg Elevation	36.33	37.05	37.54	38.28	38.08			35.55	35.44	35.52	35.51	35.51			33.76	32.88	33.96	34.06	33.85			33.00	32.92	32.90	33.20	33.02			34.56	34.77	34.89	35.19	35.02				
LTOB ² Elevation	37.57	37.53	38.05	38.65	38.49			36.40	36.36	36.31	36.31	36.24			34.50	34.55	34.45	34.42	34.52			33.60	33.64	33.60	33.75	33.73			35.46	35.42	35.44	36.15	35.41				
LTOB ² Max Depth (ft)	1.24	0.48	0.51	0.37	0.50			0.85	0.92	0.79	0.80	0.70			0.74	1.67	0.49	0.36	0.70			0.60	0.72	0.70	0.55	0.60			0.90	0.65	0.55	0.96	0.60				
LTOB ² Cross Sectional Area (ft ²)	3.90	1.50	1.40	1.80	1.80			7.07	7.07	2.90	5.60	4.60			3.17	4.40	2.00	1.70	2.30			3.19	2.30	1.80	2.50	2.50			3.70	4.90	2.00	3.40	3.40				
	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)								
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+		
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	36.53	37.13	37.75	37.84	37.49										37.91	37.90	37.97	37.93	37.91											40.26	40.22	40.27	40.28	40.29			
Bank Height Ratio_Based on AB Bankfull ¹ Area	1.00	0.63	0.47	0.74	1.60										1.00	1.30	1.09	0.88	0.80											1.00	1.13	1.04	1.00	0.90			
Thalweg Elevation	35.67	36.57	36.97	37.01	37.02			35.91	35.87	35.70	35.96	35.93			37.40	37.41	37.33	37.44	37.36			38.41	38.32	38.05	38.43	38.52			39.86	39.77	39.82	39.87	39.90				
LTOB ² Elevation	36.53	36.92	37.34	37.62	37.78			36.56	36.66	36.25	36.70	36.58			37.91	38.05	38.03	37.87	37.81			39.00	39.03	39.21	39.05	39.09			40.26	40.28	40.29	40.28	40.25				
LTOB ² Max Depth (ft)	0.86	0.35	0.37	0.61	0.80			0.65	0.79	0.55	0.74	0.70			0.51	0.64	0.70	0.43	0.50			0.59	0.71	1.16	0.62	0.60			0.40	0.51	0.47	0.41	0.40				
LTOB ² Cross Sectional Area (ft ²)	5.25	2.82	1.60	2.66	13.89			2.30	3.10	2.30	3.20	3.20			4.28	7.20	5.01	3.80	2.77			2.20	2.40	5.20	2.40	2.40			2.40	3.30	2.90	2.40	2.00				
Cross Section 11 (Confluence - Reach 1)								The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:																													
Bankfull Elevation (ft) - Based on AB-Bankfull ¹ Area	33.42	33.44	33.49	33.52	33.53																																
Bank Height Ratio_Based on AB Bankfull ¹ Area	1.00	0.84	0.73	0.71	0.79																																
Thalweg Elevation	32.51	31.91	32.56	32.58	32.60																																
LTOB ² Elevation	33.42	33.19	33.24	33.25	33.33																																
LTOB ² Max Depth (ft)	0.91	1.28	0.68	0.67	0.50																																
LTOB ² Cross Sectional Area (ft ²)	22.54	14.68	14.13	13.85	16.54																																

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decreases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

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-5				MY-7																	
	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						
Dimension and Substrate - Riffle only																																				
Bankfull Width (ft)	11.50			16.20		2	11.46			20.00		2	11.19			16.10		2	11.24			17.33		2	11.20			14.90		2						
Floodprone Width (ft)	57.00			83.30		2	58.28			86.26		2	53.80			97.70		2	57.38			74.01		2	54.00			>100		2						
Bankfull Mean Depth (ft)	0.22			0.26		2	0.24			0.28		2	0.23			0.26		2	0.25			0.26		2	0.20			0.60		2						
¹ Bankfull Max Depth (ft)	0.40			0.51		2	0.49			0.50		2	0.42			0.57		2	0.40			0.45		2	0.40			0.60		2						
Bankfull Cross Sectional Area (ft ²)	2.58			4.26		2	3.25			4.77		2	2.58			4.26		2	2.58			4.26		2	2.58			4.26		2						
Width/Depth Ratio	52.27			62.31		2	40.49			83.95		2	48.60			60.83		2	38.10			38.50		2	52.20			52.20		2						
Entrenchment Ratio	4.96			5.14		2	4.31			5.08		2	5.21			5.36		2	4.27			5.10		2	4.80			---		2						
¹ Bank Height Ratio	1.00			1.00		2	1.00			1.00		2	1.12			0.88		2	0.91			1.10		2	0.80			0.90		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						C 5/6						C 5/7								
Channel Thalweg length (ft)				850						850						850						850						850								
Sinuosity (ft)				1.04						1.04						1.04						1.04						1.04								
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)				0.006						0.006						0.006						0.006						0.006								
² = Bankfull for XS 6 recalculated																																				
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

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-5						MY-7					
	Min	Mean	Med	Max	SD ¹	n	Min	Mean	Med	Max	SD ¹	n	Min	Mean	Med	Max	SD ¹	n	Min	Mean	Med	Max	SD ¹	n	Min	Mean	Med	Max	SD ¹	n	Min	Mean	Med	Max	SD ¹	n
Dimension and Substrate - Riffle only																																				
Bankfull Width (ft)			11.78			1			12.51			1			12.51			1			26.22			1			24.4			1						
Floodprone Width (ft)		28.2			1		25			1		42.3			1		48.32			1		36.3			1											
Bankfull Mean Depth (ft)		0.45			1		0.11			1		0.42			1		0.22			1		0.2			1											
¹ Bankfull Max Depth (ft)		0.86			1		0.21			1		0.54			1		0.64			1		0.5			1											
Bankfull Cross Sectional Area (ft ²)		5.28			1		1.39			1		5.28			1		5.28			1		5.28			1											
Width/Depth Ratio		26.2			1		112.3			1		29.64			1		40.9			1		112.7			1											
Entrenchment Ratio		2.39			1		2			1		2			1		1.8			1		1.5			1											
¹ Bank Height Ratio		1			1		1			1		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																																				
Channel Beltwidth (ft)							71																													
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						C 5/5						C 5/6									
Channel Thalweg length (ft)			541						541						541						541						541									
Sinuosity (ft)			1.05						1.05						1.05						1.05						1.05									
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)			0.0035						0.0035						0.0035						0.0035						0.0035									
2 = Bankfull for XS 6 recalculated																																				
³ Ri% / Ru% / P% / G% / S%																																				
³ SC% / Sa% / G% / C% / B% / Be%																																				
³ d16 / d35 / d50 / d84 / d95 /																																				
² % of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				
Shaded cells indicate that these will typically not be filled in.																																				
1 = The distributions for these parameters can include information from both the cross-section 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 3

Parameter	Baseline						MY-1						MY-2						MY-3						MY-5						MY-7					
	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
Dimension and Substrate - Riffle only																																				
Bankfull Width (ft)			12.50			1			14.44			1			16.33			1			14.80			1			13.00			1						
Floodprone Width (ft)			32.90			1			36.68			1			42.80			1			36.01			1			38.20			1						
Bankfull Mean Depth (ft)			0.57			1			0.48			1			0.43			1			0.47			1			0.50			1						
¹ Bankfull Max Depth (ft)			0.85			1			0.96			1			1.04			1			0.88			1			0.90			1						
Bankfull Cross Sectional Area (ft ²)			7.07			1			16.24			1			7.07			1			7.07			1			7.05			1						
Width/Depth Ratio			21.95			1			69.34			1			37.73			1			16.80			1			24.00			1						
Entrenchment Ratio			2.63			1			2.53			1			2.25			1			2.42			1			2.90			1						
¹ Bank Height Ratio			1.00			1			1.00			1			1.00			1			0.45			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						C 5/6						C 5/7									
Channel Thalweg length (ft)			446						446						446						446						446									
Sinuosity (ft)			1.08						1.08						1.08						1.08						1.08									
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)			0.005						0.005						0.005						0.005						0.005									
² 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

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 4

Parameter	Baseline						MY-1						MY-2						MY-3						MY-5						MY-7					
	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
Dimension and Substrate - Riffle only																																				
Bankfull Width (ft)			9.90			1			8.27			1			10.59			1			10.00			1			8.00			1						
Floodprone Width (ft)			31.36			1			57.96			1			29.01			1			25.46			1			34.20			1						
Bankfull Mean Depth (ft)			0.32			1			0.52			1			0.30			1			0.30			1			0.40			1						
¹ Bankfull Max Depth (ft)			0.74			1			1.62			1			0.62			1			0.52			1			0.80			1						
Bankfull Cross Sectional Area (ft ²)			3.17			1			4.31			1			3.17			1			3.17			1			3.17			1						
Width/Depth Ratio			30.90			1			15.86			1			35.39			1			19.23			1			20.20			1						
Entrenchment Ratio			3.17			1			7.01			1			5.47			1			2.55			1			4.30			1						
¹ Bank Height Ratio			1.00			1			1.00			1			1.00			1			0.70			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																					
² = Bankfull for XS 6 recalculated																																				
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

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

APPENDIX E: YEAR 6 HYDROLOGIC DATA

Table 9: Verification of Bankfull Events

Table 12: Verification of Baseflow

Figure 2: Monthly Rainfall Data with Percentiles

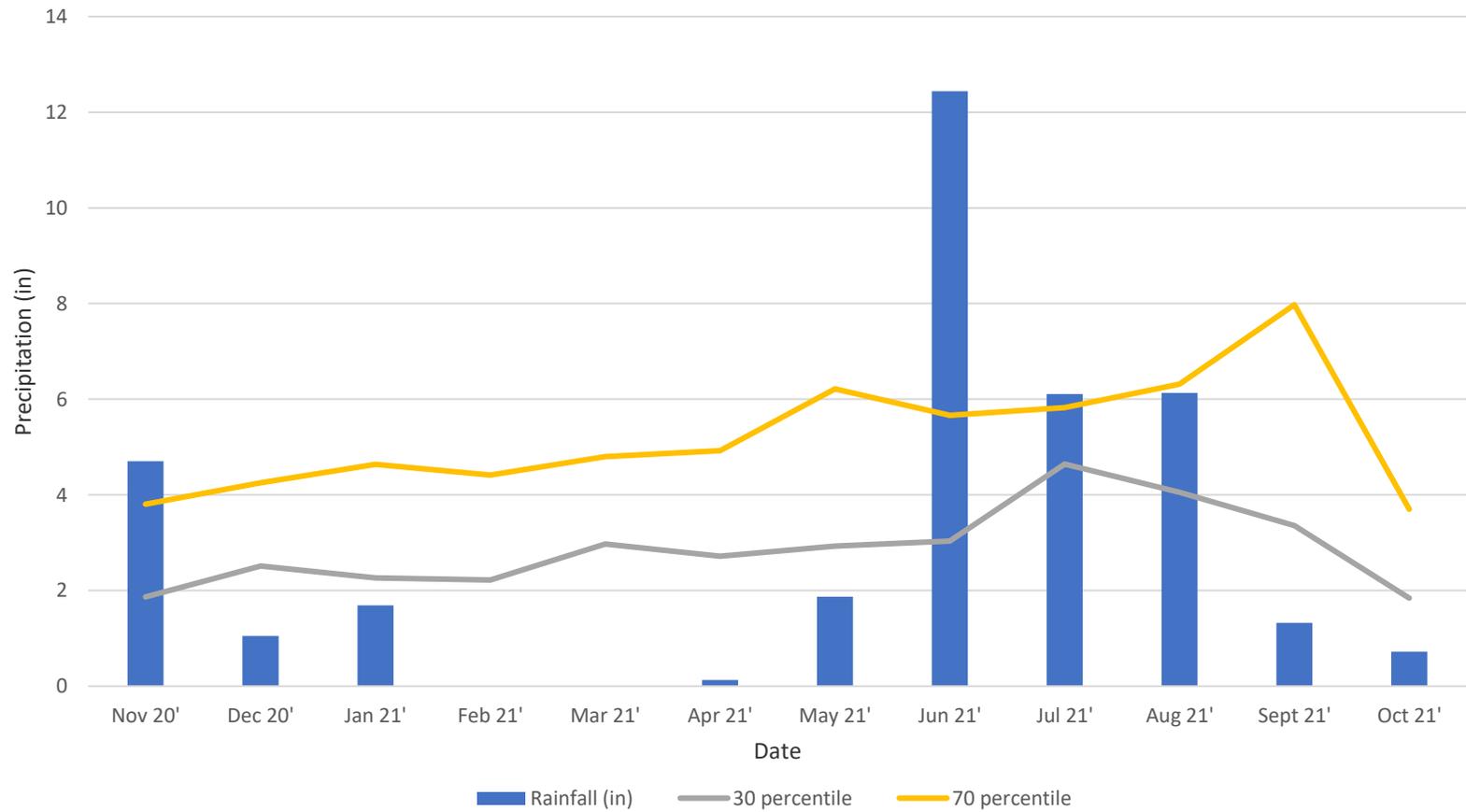
Figures 3-12: Stream Surface Water Hydrology (Well 1-10)

Table 9: Verification of Bankfull Events			
Date of Observation	Dates of Occurrence	Method	Greater than Qbkf Stage?
Reach 1 (Well 5, 6)			
10/28/2021	10/27-10/28/20, 11/1-11/8/20, 11/12-11/30/20, 12/1-12/6/20, 12/8/20-1/13/21, 1/17-1/21/21, 1/23-1/31/21, 2/4-3/3/21, 3/5-4/5/21, 4/10/21, 6/4/21, 6/7 & 8/21, 6/10 & 11/21, 6/22-6/29/21	Data logger	Y
10/28/2020	Various, including: 11/11-12/22/19, 1/4-4/26/20, 5/20-6/24, 9/15-9/21	Data logger	Y
10/23/19	Various, including: 11/11/18-4/6/19, 6/7-6/15/19	Data logger	Y
10/5/18	Various, including: 12/8-4/6/18, 5/05-5/10, 5/30-6/6, 6/14, 7/24-8/8, 8/22-8/26, 9/13-9/20	Data logger	Y
11/17/17	Various, including: 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	Data logger	Y
9/29/16	2/7-2/13/16, 3/7-3/9/16	Data logger	Y
Reach 2 (Well 7)			
10/28/2021	10/27/20-5/9/21, 5/12-5/15/21, 5/29-7/17/21, 7/19-7/23/21, 7/27-8/30/21, 9/3/21, 10/23-10/25/21	Data logger	Y
10/28/20	Various, including: 11/24/19-6/23/20, 9/18-10/28	Data logger	Y
10/23/19	Various, including: 10/5/18-5/5/19, 6/7-7/2, 7/12-7/25, 8/16-8/24, 9/6-9/14, 10/22	Data logger	Y
10/5/18	1/7-1/16/18, 1/25-2/23, 2/27, 3/24-3/27, 3/21, 4/9-4/15, 8/2-8/5, 9/13-9/20	Data logger	Y
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	Data logger	Y
9/29/16	1/29-2/1/16, 2/2-2/8/16	Data logger	Y
Reach 3 (Well 1, 2)			
10/25/21	Various, including: 10/27-12/6/20, 12/8/20-1/14/21, 1/17-1/31/21, 2/3-4/10/21, 4/13-4/14/21, 4/19-4/24/21, 4/26-4/28/21, 5/1/21, 5/12-5/13/21, 5/29-6/11/21, 6/18/21, 6/20/21, 6/22-7/1/21, 7/5-7/16/21, 7/19/21, 7/22-7/23/21, 7/27/-7/29/21, 8/2-8/19/21, 8/24-8/29/21	Data logger	Y
10/28/20	Various, including between 12/14/19-3/10/20	Data logger	Y
10/23/19	Various, including: 11/4/18, 11/11-11/15, 12/24-12/28, 12/30-12/31, 1/7/19, 1/15-1/23, 1/31-2/02. 3/13, 3/19-21, 3/27-3/28	Data logger	Y
10/5/18	12/27/2017, 1/1/18, 1/6, 1/16, 1/25-2/5, 3/27, 9/13-9/18	Data logger	Y
11/17/17	9/29/2016-11/3/2017	Data logger	Y
9/29/16	2/5-6/16, 2/18/16, 5/29/16, 6/7/16	Data logger	Y
Reach 4 (Well 3)			
10/25/21	10/31-11/2/2020, 11/4-11/9/2020, 11/12-11/15/2020, 11/18-11/21/2020, 11/24-11/26/2020, 12/3/2021, 12/13-12/16/2020, 12/18-12/20/2020, 12/22-12/24/2020, 12/27/2020-1/3/2021, 1/10-1/12/2021, 1/24/2021, 1/26/2021, 1/28/2021, 1/28-1/31/2021, 2/8-2/22/2021, 2/25-2/28/2021, 3/2/2021, 3/7-3/12/2021, 3/16 & 17/2021, 3/19-3/22/2021, 3/30-4/4/2021, 4/10/2021, 5/29/2021, 6/2-6/4/2021, 6/7/021, 6/10/2021, 6/25-6/27/2021, 6/29/2021, 08/1/2021, 8/3, 4, 6 & 7/2021, 8/15 & 18/2021	Data logger	Y
10/28/20	Various, including between 12/7-12/22/19, 1/8-1/22/20, 2/6-2/24	Data logger	Y

10/23/19	Various, including: 10/17-10/26/18, 11/4, 11/9, 11/11-11/23, 12/5-12/16, 12/25-1/2/19, 1/21-2/4, 2/8-2/11, 2-16-3/14, 3-19-3/21, 3/25-3/31, 4/1-4/7, 9/6/18	Data logger	Y
10/5/18	11/9, 11/17-11/22/17, 3/24-4/24/18, 5/22-6/10, 9/11-9/19	Data logger	Y
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	Data logger	Y
9/29/16	2/4/16, 2/18/16, 5/3/16, 6/7/16	Data logger	Y
Reach 1&4 Confluence (Well 4)			
10/25/21	10/31-11/9/20, 11/12-11/29/20, 12/2-12/4/20, 12/10-12/20/20, 12/22/20-1/4/21, 1/6-1/7/21, 1/9-1/13-21, 1/18-1/20/21, 1/23-1/31/21, 2/4/21, 2/6-2/28/21, 3/2-3/3-21, 3/6-3/23/21, 3/25/2021, 3/29-4/4/21, 4/10/21, 6/3-6/4/21, 6/7-6/10/2021, 6/12/21, 6/25-6/29/21, 7/11/21, 8/3-8/4/2021, 8/7-8/8/21, 8/15/21, 8/18/21	Data logger	Y
10/28/20	Various, including between 12/19-12/22/19, 1/8-1/23/20, 2/14-2/24, 3/7-3/23	Data logger	Y
10/23/19	Various, including: 10/18/18, 11/3, 11/8, 11/11-11/18, 11/21-11/23, 12/5-12/15, 12/24-12/31, 1/31/19-2/2, 2/18-2/27, 3/6-3/14, 4/1-4/5, 6/10, 7/12, 9/5	Data logger	Y
10/5/18	11/13, 11/17, 12/12, 12/26, 12/31/17, 1/10/18, 2/13-2/15, 3/24-3/26, 4/22, 5/31, 6/1, 7/24, 7/29, 8/8, 9/12, 9/16	Data logger	Y
11/17/17	10/7-10/9/16, 12/19-12/20/16, 1/2/16, 1/7-1/10/17, 1/13-1/14/17, 3/5/17, 3/23-3/24/17, 4/24-4/25/17, 5/5/17, 5/23/17, 5/25/17, 6/24/17, 9/6/17	Data logger	Y
9/29/16	2/4/16, 2/18/16, 5/3/16, 6/7/16	Data logger	Y

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)	N/A	N/A	Logger/Well Cap Dislodged/Base Station Malfunction

Figure 2: Monthly Rainfall Data



Rainfall Data collected from Pitt-Greenville Airport in Beaufort County, NC. Data obtained from USDA-NRCS Agricultural Applied Climate Information System. Percentiles calculated from 1997-2021 data.

Figure 3
Monitoring Well 1 – Reach 3

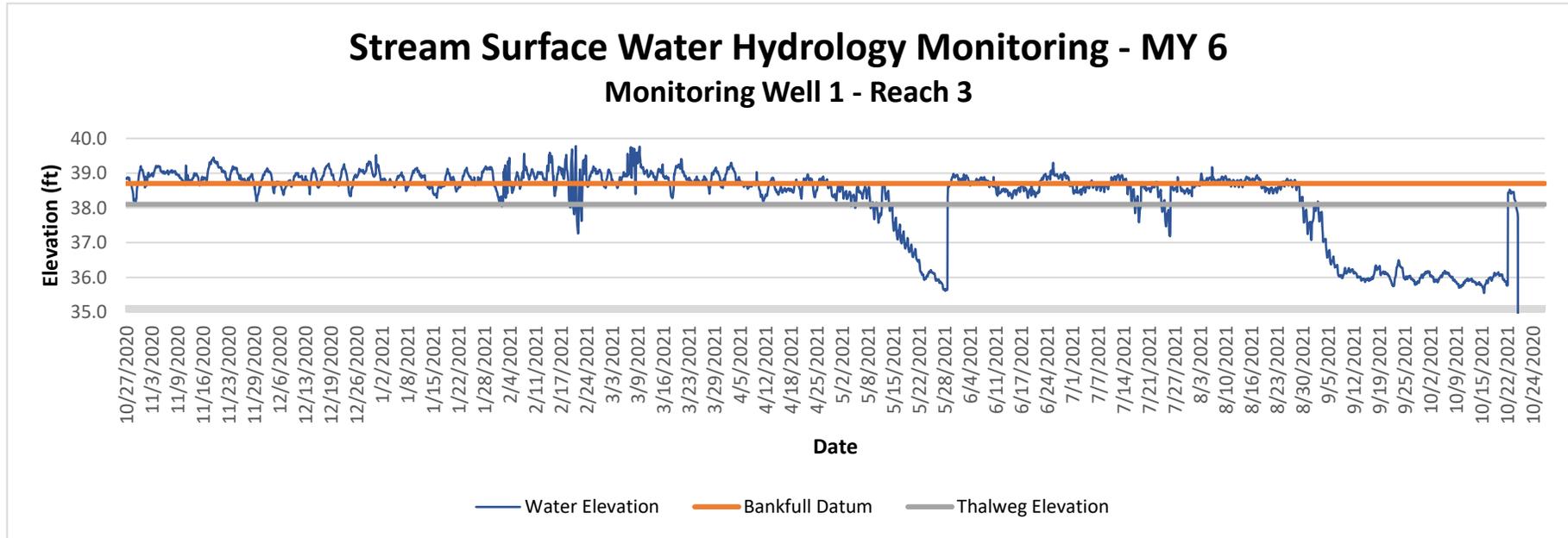


Figure 4
Monitoring Well 2 – Reach 3

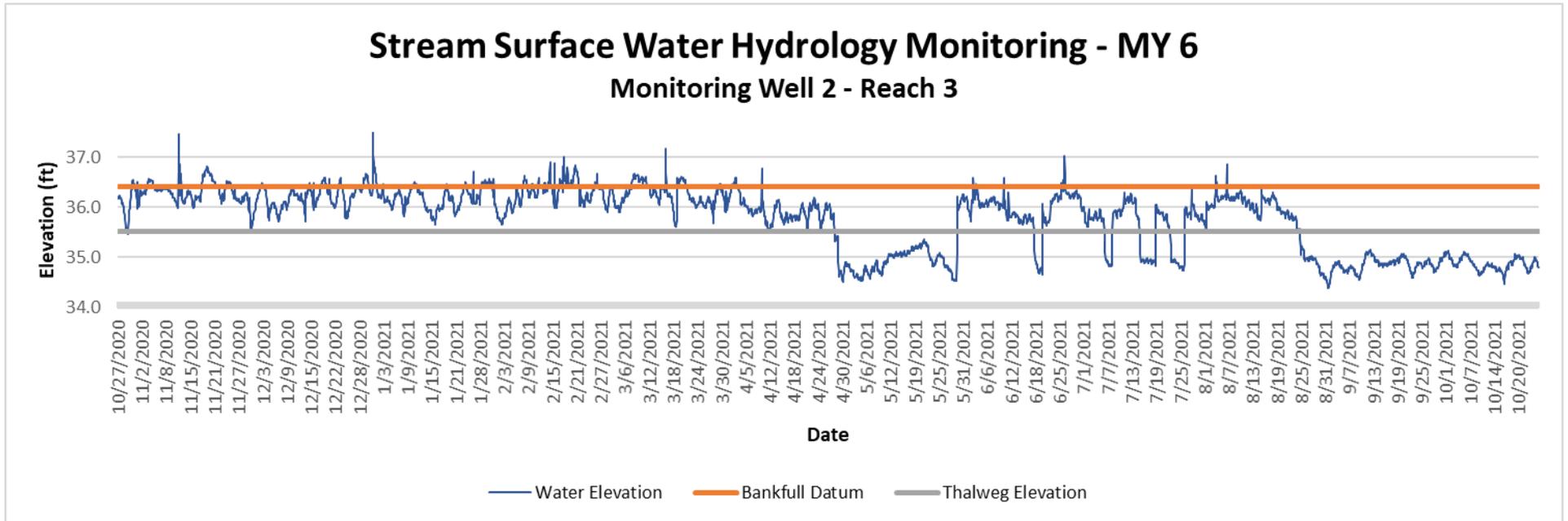


Figure 5
Monitoring Well 3 – Reach 4

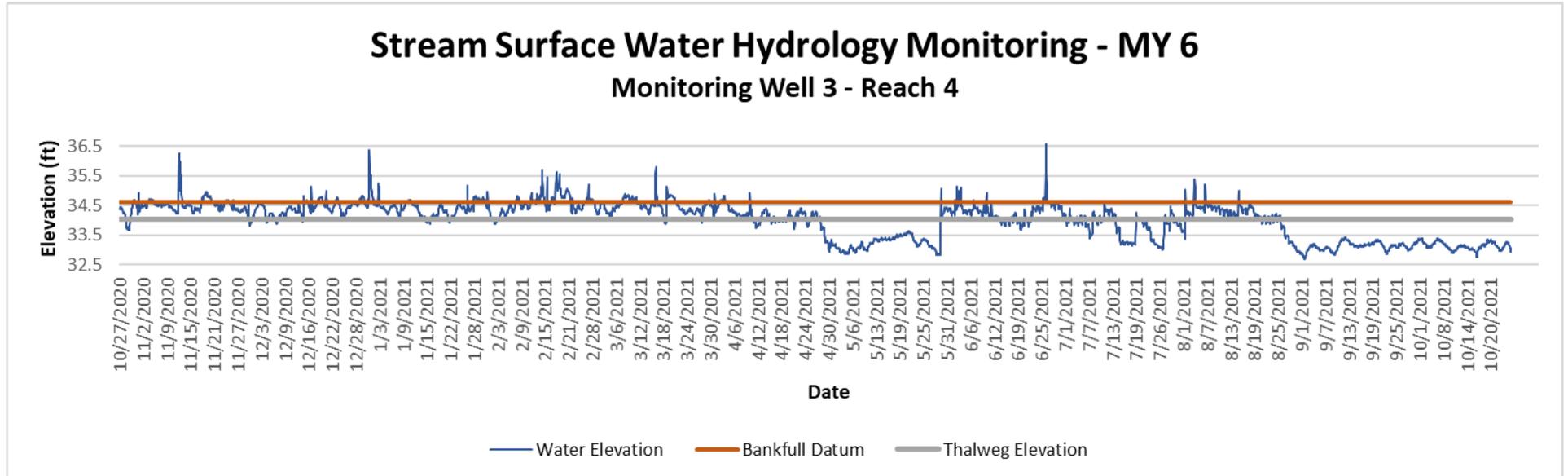


Figure 6
Monitoring Well 4 – Confluence Reaches 1 & 4

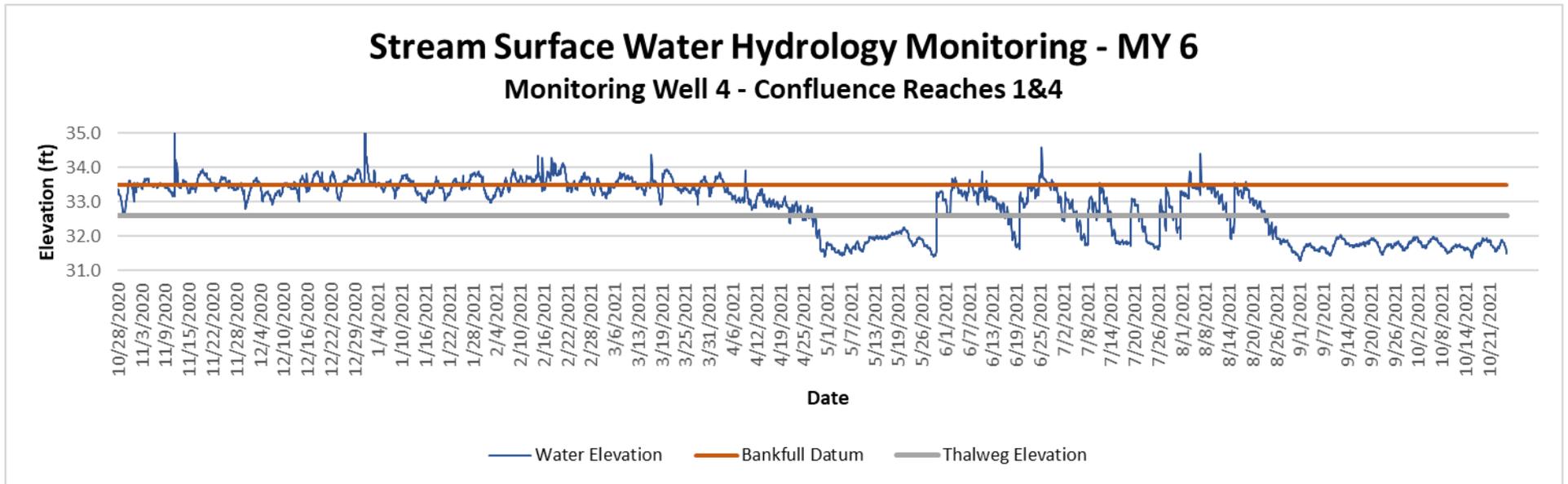


Figure 7

Monitoring Well 5 – Reach 1

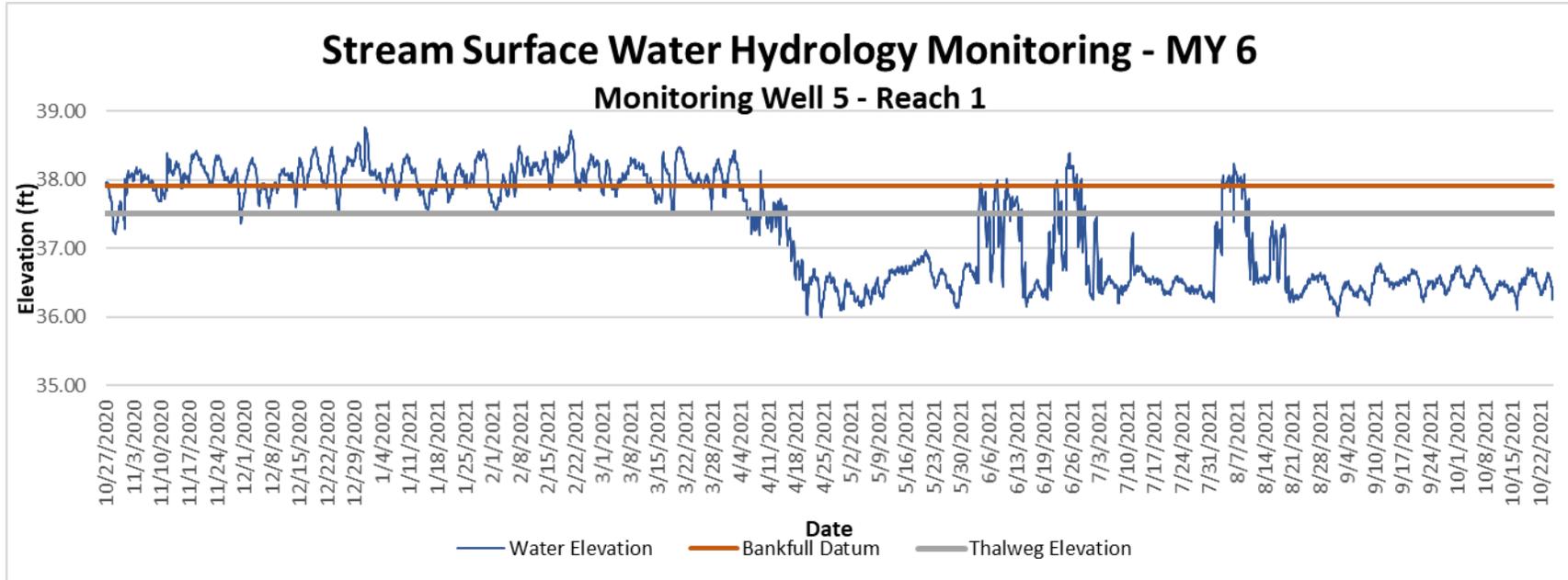


Figure 8
Monitoring Well 6 – Reach 1

Stream Surface Water Hydrology Monitoring - MY 6

Monitoring Well 6 - Reach 1

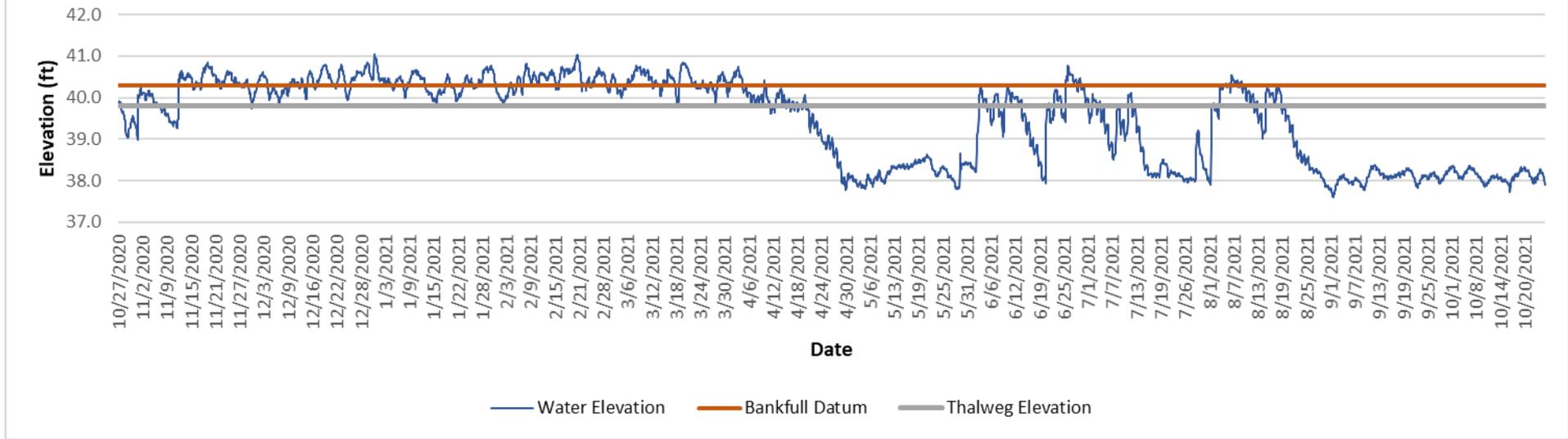


Figure 9

Monitoring Well 7 – Reach 2

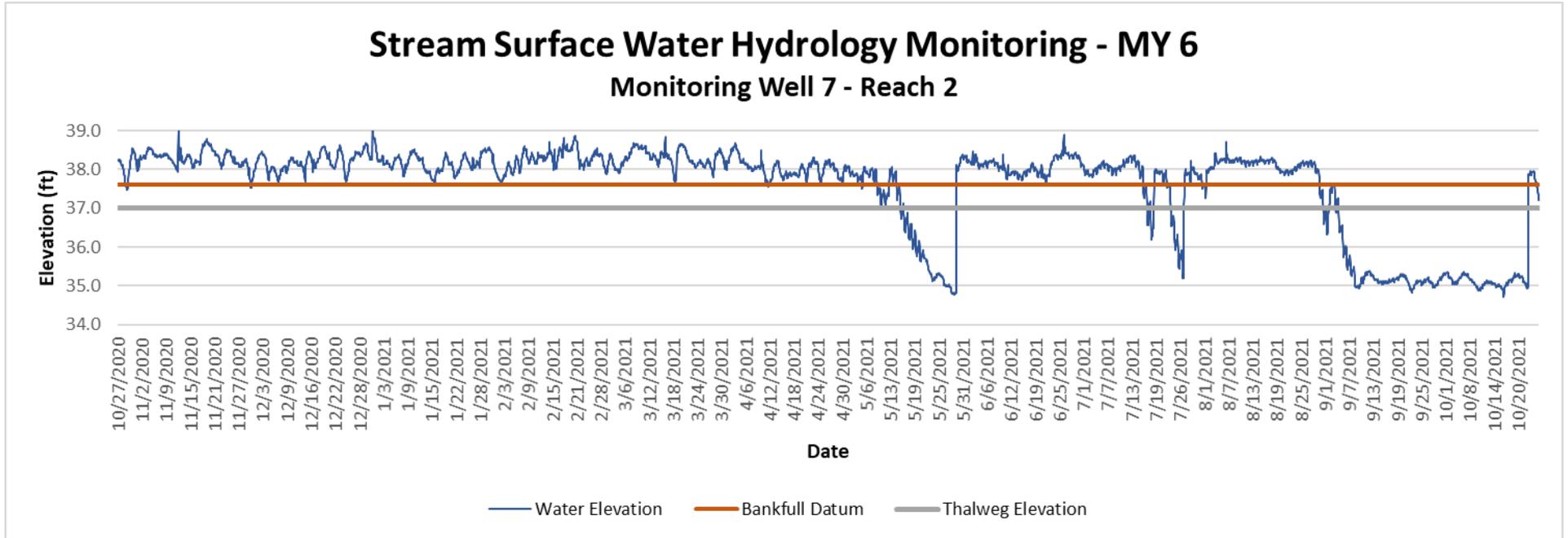


Figure 10
Monitoring Well 8 – Reach 5

Stream Surface Water Hydrology Monitoring - MY 6 Monitoring Well 8 - Reach 5

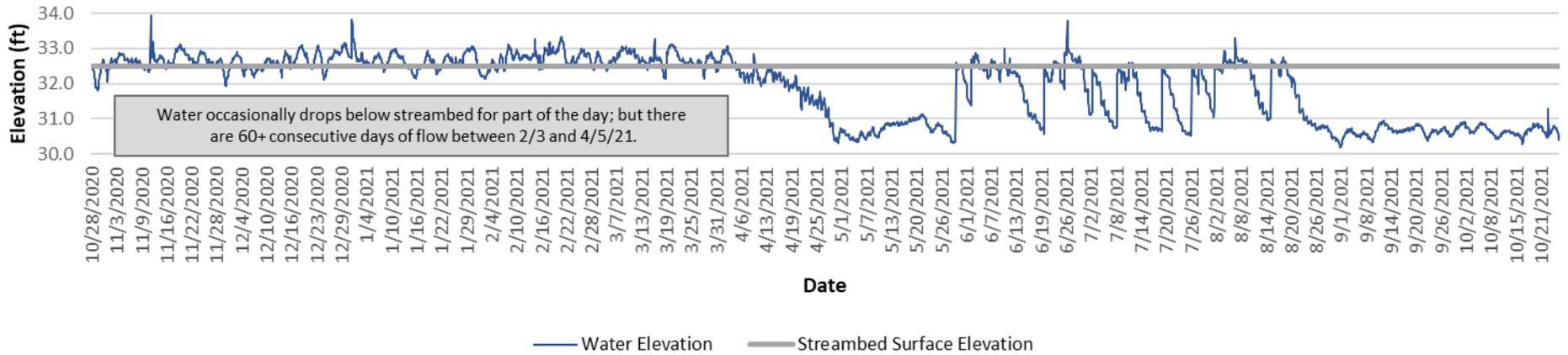


Figure 11
Monitoring Well 9 – Reach 5

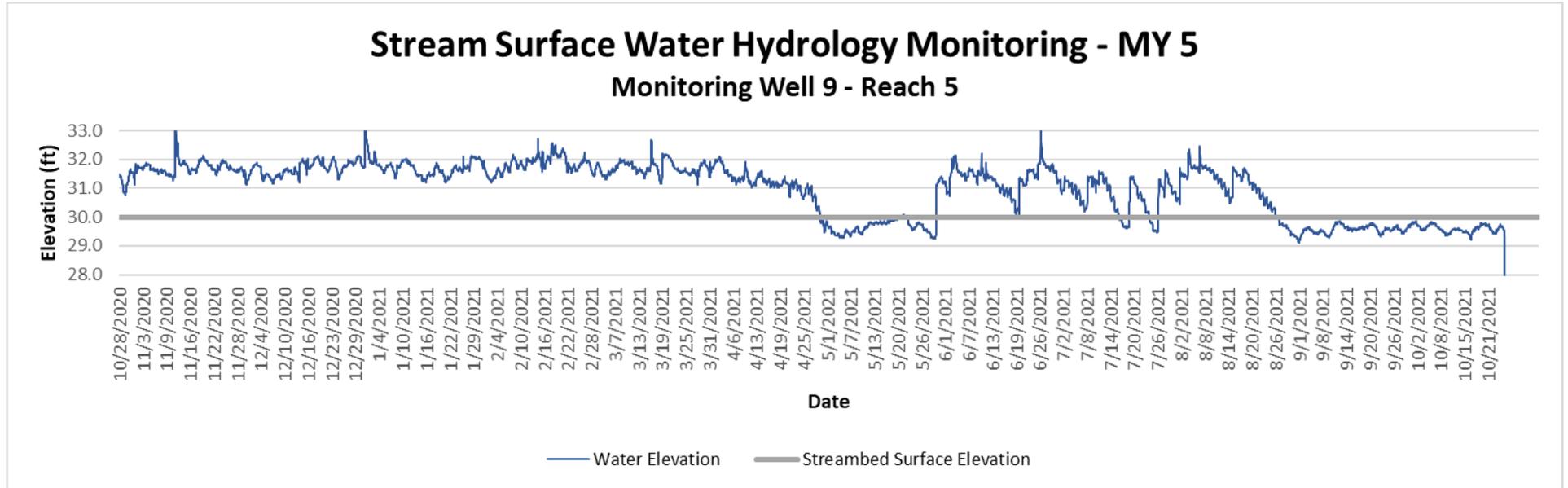


Figure 12
Monitoring Well 10 – Reach 5
Logger Malfunction; unable to download MY 6 data.

