Blair Creek Stream Mitigation Project
Year 1 (2022) Monitoring Report FINAL

Clay County, North Carolina
Hiwassee River Basin: 06020002
DMS Project ID No. 100047
DMS RFP #16-007278 (Issued: 6/21/17)
DEQ Contract No. 7415
USACE Action ID No. SAW-2018-00449
DWR# 2020-1094
Year 1 Collection Period: September - November 2022

Submitted to/Prepared for:
NC Department of Environmental Quality
Division of Mitigation Services (DMS)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Michael Baker
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Submission Date: February 2023

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February 28, 2023

Matt Reid, PM
NCDEQ, Division of Mitigation Services
Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

Subject:
Response to DMS Comments (January 19, 2023) for DRAFT Monitoring Year 1 Report.
Blair Creek Stream Mitigation Project, Clay County
Hiawassee River Basin: 06020002
DMS Project #100047 DEQ Contract #7415

Dear Mr. Reid,

Please find below our responses to the NC Division of Mitigation Services (DMS) review comments dated January 19, 2023, in reference to the Blair Creek Stream Mitigation Project's DRAFT Monitoring Year 1 Report. We have revised the Draft document in response to review comments as outlined below.

- In an effort to identify and resolve property issues early during the monitoring period, please verify that the conservation easement boundary has been walked, marking and signage is up to spec, fencing is intact, and no encroachments have been identified.
  RESPONSE: The easement boundary has been walked and signage is posted up to specifications. 4 encroachment areas were identified where the property owner mowed a narrow strip within the easement boundary when "bush-hogging" their field. Additional posts and signage were added along with 10' flagged PVC to make the Conservation Easement boundary highly visible during farm activities. These areas have been measured and added to Table 6 – Vegetation Conditions Assessment and are depicted on the CCPV in Appendix B. These areas will be monitored and reported on in Monitoring Year 2.

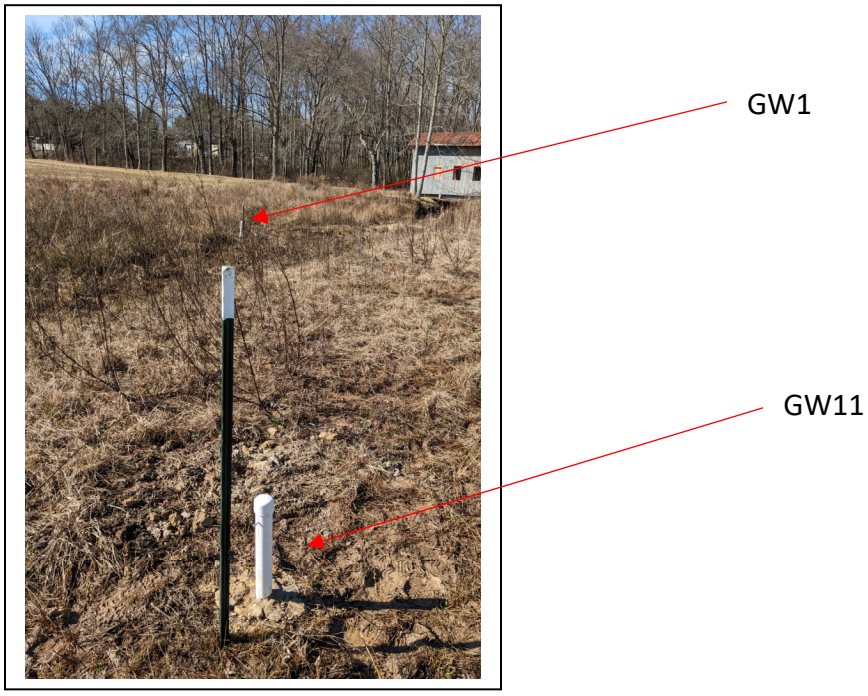
- Report indicates a supplemental planting will occur in the vicinity of vegetation plot 2. Please include supplemental planting information in the MY3 report regarding this effort. Include number, area, species, type (bare root, container, etc.) and include a polygon on the CCPV. If species are selected that are not from the approved mitigation planting list, the IRT will need to be notified in advance.
  RESPONSE: The requested information will be included in the MY2 report and CCPV. All planted species will be selected based on the approved mitigation planting list.

- CCPV: Please update color codes for vegetation plots, wetland gauges, and flow gauges for meeting/not meeting criteria.

797 Haywood Rd. Suite 201| Asheville, NC 28806
Office: 828-412-6101| Mobile: 828-380-0118

RESPONSE: Vegetation plots, wetland gauges, and flow gauges have been color coded for meeting/not meeting criteria. The color of FL-1 or Flow Gauge 1 has not changed as it met criteria and is the only flow gauge on site.

- It was noted in MY0 that GW-1 was installed in a non-representative area for the surrounding wetland reestablishment area. Baker committed to moving the gauge approximately 15-20' farther away from the channel. The gauge location shown on the CCPV appears to be the original location. Please verify that the gauge was moved and update the CCPV accordingly.
  RESPONSE: GW-1 was not moved; however, an additional well (GW11) was installed in a more representative location during MY1. The installation did not take place until late in the 2022 growing season, therefore data was not reported in MY1. All future monitoring years will include GW1 and GW11 data. The location of GW11 is shown on the CCPV. The photo below shows GW11 and GW1 is visible in the background.



- Two structures were identified in MY0 with scour behind the vane arms; Reach 1 log cross vane, sta: 24+75, and Reach 2 log J-hook vane, sta: 23+75. Baker indicated these structures were going to be repaired in MY1. The structure on Reach 2 was identified as Stream Problem Area #1; however, the structure on Reach 1 was not mentioned. Was the structure on Reach 1 repaired? Please update accordingly.

RESPONSE: The log vane structure on Reach 1 remains intact. The right bank scour shown in the MY0 Comment Letter has filled in with sediment and dense vegetation. At the time of data collection during MY1 the structure was functioning and not in need of repair. We will keep a close watch on this structure during MY2 and make repairs if needed. The grade control rock and log J-hook, SPA #1, on Reach 2 is currently scheduled to be repaired in February 2023 by a contractor. We will provide pictures of this repair once completed and a discussion will be included in the MY2 report. Some bank scour was also identified on a grade control rock and log j-hook on Reach 2. This area is identified as SPA #2 on the CCPV and will be repaired at the same time as SPA #1.

- Table 5 and 6: Please include assessment dates at the top of each table.
  RESPONSE: Assessment dates have been included as requested.

- Table 5 Reach 1: A 15' aggradation segment and 25' scoured/eroding segment is called out for this reach. These locations should be identified on the CCPV. Please update and include .shp files with digital submission as well.
  RESPONSE: The 15' aggradation segment has been added to the CCPV as requested. The 25' scour/eroding segment is located on Reach 2 and is represented on the CCPV as SPA-1. These shapefiles have been included with the digital submission as requested.

- Photo-points: In future reports, please include photos of stream problem areas and vegetation problem areas.
  RESPONSE: In future reports, photos of any stream or vegetation problem areas will be included.

- Table 7: Veg Plot 1 F is missing data in the "planted" column. Please update.
  RESPONSE: Missing data has been added to the "planted" column as requested.

- Cross-section Graphs: Several of the cross-section graphs do not provide confidence that surveys were conducted correctly. Surveys do not begin and end on cross section pins, elevations are different at end pins, and elevation/lateral errors appear to be present in several sections. Please review all cross-sections and specifically XS9-XS14.
  RESPONSE: Rebar pins are set at the existing ground elevation and are represented by the first (Left Pin) and last (Right Pin) point of the stationing. End pin stationing and elevation has been corrected and elevations have been reviewed and verified as requested.

- Table 9: Please review MY1 section data. Bankfull elevation – based on AB-Bankfull area should not be the same as MY0 data. Please verify other measurements and update calculations as necessary.
  RESPONSE: Data has been reviewed and updated as necessary as requested.

- Table 10: The draft report only contained a graph for Crest Gauge 3. Please include graphs for Crest Gauge 1 and 2. All crest gauge graphs should be included in each monitoring report. Please include the bankfull elevation line on each graph. Graph legend has an orange box indicating Manual. Please revise.
  RESPONSE: Graphs have been included and revisions made as requested.

Digital Deliverable Comments

- Wetland gauge data was not included with draft digital deliverables. Please include raw data and spreadsheets used to produce figures with final submittal.
  RESPONSE: Wetland gauge data has been included in the electronic submission files as requested.

As requested, Michael Baker has provided an electronic response letter addressing the DMS comments received and two (2) hardcopies of the FINAL report, and the updated e-submission digital files will be sent via secure ftp link. A full final electronic copy with electronic support files have been included on a USB drive. Please do not hesitate to contact me (Jason.york@mbakerintl.com 828-412-6101) should you have any questions regarding our response submittal.

Sincerely,

Jason York

Jason York
Environmental Scientist

Enclosure: Final MY3 Report Russell Gap Mitigation Project

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1.0 PROJECT SUMMARY

1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 4,293 linear feet of existing stream along both the North and South Forks of Blair Creek and below the confluence on Blair Creek itself and enhanced 177 linear feet of an unnamed tributary (UT) to the South Fork. Additionally, the project has restored-by-reestablishment, restored-by-rehabilitation, or enhanced approximately 6.095 total acres of riparian wetlands. The project is located in the Blue Ridge Physiographic Region, within the Broad Basins Level IV ecoregion. The project watershed drains into the Hiwassee River approximately 1.4 miles downstream, ultimately emptying into the Tennessee River. Blair Creek and its tributaries are classified by NCDWR as Class "WS-IV" waters (NCDWR, 2016).

The Blair Creek Mitigation Project (project) is located on five abutting parcels of an active farm in Clay County, North Carolina, approximately 1.5 miles south of the Town of Hayesville as shown on the Project Vicinity Map (Figure 1). Historic agricultural use on the project site has predominantly been for a dairy operation and is currently utilized for row crop and hay production. These activities have negatively impacted both water quality and streambank stability along the project streams. The resulting observed stressors include streambank erosion, sedimentation, excess nutrient input, channel modification, wetland drainage, and the loss of riparian buffers.
The project is being conducted as part of the NCDMS Full Delivery In-Lieu Fee Program and is anticipated to generate a total of 4,363.37 cold stream mitigation credits and 5.772 wetland mitigation credits and will be protected by a 10.02-acre permanent conservation easement (Appendix B).

1.2 Goals and Objectives

The goals of this project are identified below:

- Establishment of geomorphically stable conditions along all project reaches,
- Improvement of water quality by reducing nutrient and sediment inputs,
- Restoration of natural stream and floodplain interactions,
- Restoration and enhancement of riparian wetland functions,
- Restoration and protection of riparian buffer functions and corridor habitat,
- Improvement of in-stream aquatic habitat, and
- Establishment of a permanent conservation easement on the entire project.

To accomplish these goals, the following objectives were identified:

- To restore appropriate bankfull dimensions, remove spoil berms, and/or raise channel beds, by utilizing either a Priority I Restoration approach or an Enhancement Level I approach.
- To construct streams of appropriate dimensions, pattern, and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced streams and utilize bio-engineering to provide long-term stability.
- Construct the correct channel morphology along all stream channels, increasing the number and depth of pools utilizing structures including geo-lifts with brush toe, log vanes/weirs, root wads, and/or J-hooks.

- Raise ground water tables within the buffer through the implementation of Priority I restoration. Wetland vegetation will also be planted.
- Establish riparian buffers at a 30 foot minimum width along all stream reaches, planted with native tree and shrub species.
- Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.

1.3 Project Success Criteria

The success criteria and performance standards for the project will follow the NCDMS's templates As-Built Baseline Monitoring Report Format, Data Requirements, and Content Guidance (October 2020), and the Annual Monitoring Report Format, Data Requirements, and Content Guidance (October 2020), and as described in Section 7 of the approved Mitigation Plan. All specific monitoring activities will follow those outlined in detail in Section 8 of the approved Mitigation Plan and will be conducted for a period of 7 years unless otherwise noted.

1.4 Monitoring Results and Project Performance

The Year 1 monitoring survey data of the fifteen permanent cross-sections indicates that these stream sections are geomorphically stable and are within the lateral/vertical stability and in-stream structure performance categories. All reaches are stable and performing as designed despite one Stream Problem Area (SPA1) located at approximately Station 23+75 on Reach 2 where high flows eroded the left bank behind a J-hook structure prior to the establishment of year one vegetation (Table 5 in Appendix B). A second Stream Problem Area (SPA2) is located at approximately Station 24+75 where high flow caused lateral scour on the right bank behind the log vane. Michael Baker is currently working with a contractor to repair the eroded banks and to re-vegetate following completion of the repair in MY2. All planted species will be from the approved planting list. A discussion of these repairs will be included in the MY2 report.

During Year 1 monitoring, the planted acreage performance categories were functioning well overall. The planted stems endured flashy conditions in their first year, with rainfall well above the historic average in February, May, July, and August 2022; however, January, March, April, June, and September 2022 were well below the historic average (see Figure 7). The average density of total planted stems, based on data collected from the 6 permanent and 2 random monitoring plots for the Year 1 monitoring conducted in October and November 2022 was 424 stems per acre (Table 7 in Appendix C). Thus, the Year 1 vegetation data demonstrate that the Site is on track to meet the minimum success interim criteria of 320 trees per acre by the end of Year 3. No vegetation problem areas (VPAs) were identified as exceeding the reportable mapping threshold of 0.1 acres; however, small areas with high mortality will be supplementally planted during MY2 as needed. Vegetation Plot 2 failed to meet success criteria due to a dense infestation of cattails in the wetland area outside of the easement which moved into the plot area and smothered planted stems. Cattails will be manually removed and chemically treated during MY2 and areas impacted by cattails will be replanted with species from the approved planting list and will be discussed in the MY2 report.

During Year 1 monitoring, two separate post-construction bankfull events were observed (see Table 10 in Appendix E and the Overbank Photographs in Appendix B). These events occurred on 3/13/22 and 8/7/2022 as documented through spikes in water levels shown in the data from automated Crest Gauge 3 on R2 (see Table 10). Photographic evidence of debris jams was documented on the right floodplain of lower R1 and against the crest gauge located on the left floodplain of R2 (see Appendix B). Automated Crest Gauges 1 and 2 did not record a bankfull event.

As the observed monthly rainfall data for the project presented in Figure 6 in Appendix E demonstrates, the past 12 months have varied dramatically from month to month as compared to historic average precipitation. A total of 49.56 inches of rainfall was observed for the project, while the region averages 59.49 inches of annual rainfall, a deficit of 9.93 inches. All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database Legacy System. The rain gauge deployed on site suffered repeated malfunctions during MY1 therefore the data was not reliable. The rain gauge will be repaired and re-deployed during MY2.

During Year 1 monitoring, four of the ten automated groundwater monitoring wells met or exceeded the minimum hydroperiod performance criteria approved in the Mitigation Plan of 12% of the 211-day growing season (24 or more consecutive days); however, two of the ten wells failed to meet performance criteria by one day, one of ten failed to meet performance criteria by two days, and two of ten failed to meet criteria by three days (Table 11). Therefore, we expect these wells to meet performance criteria in future years. One automated flow gauge met or exceeded the minimum 30-day performance criteria during MY1 (Table 12). An additional well was added (MW11) on the left floodplain of R1 as requested by the Division of Mitigation Services. Installation of this additional well took place late in the MY1 growing season therefore MW11 data is not applicable to MY1. MW11 data will be included in the MY2 report.

The easement boundary has been walked and signage is posted up to specifications. Four encroachment areas were identified where the property owner mowed a narrow strip within the easement boundary when "bush-hogging" their field. Additional posts and signage were added along with 10' flagged PVC to make the Conservation Easement boundary highly visible during farm activities. These areas have been measured and included in Table 6 – Vegetation Conditions Assessment and are depicted on the CCPV in Appendix B. These areas will be monitored and reported on in Monitoring Year 2.

Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the DMS website. Any raw data supporting the tables and figures in the Appendices is available from DMS upon request.

This report documents the successful completion of the Year 1 monitoring activities for the post-construction monitoring period.

1.5 Technical and Methodological Descriptions

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using a Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey. The survey data from the permanent project cross-sections were collected and classified using the Rosgen Stream Classification System to confirm design stream type (Rosgen 1994).

The six vegetation-monitoring quadrants (plots) were installed across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the data collected from each was input into the DMS Veg Table Production Tool (2021).

Ten automated groundwater monitoring wells were installed in the floodplain following USACE protocols (USACE 2005). The gauges themselves, both flow and groundwater gauges, are all Van Essen brand Baro-Diver data loggers.

All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database Legacy System.

The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, and crest gauges, are shown on the CCPV map found in Appendix B.

1.6 References

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services. 2020. *Annual Monitoring Report Format, Data Requirements, and Content Guidance October 2020.* NC Department of Environmental Quality. Raleigh, NC.

North Carolina Interagency Review Team (NCIRT). 2020. Guidance document "*Wilmington District Stream and Wetland Compensatory Mitigation Update".* October 2020

Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

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

United States Army Corps of Engineers (USACE). 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

APPENDIX A

Background Tables and Figures

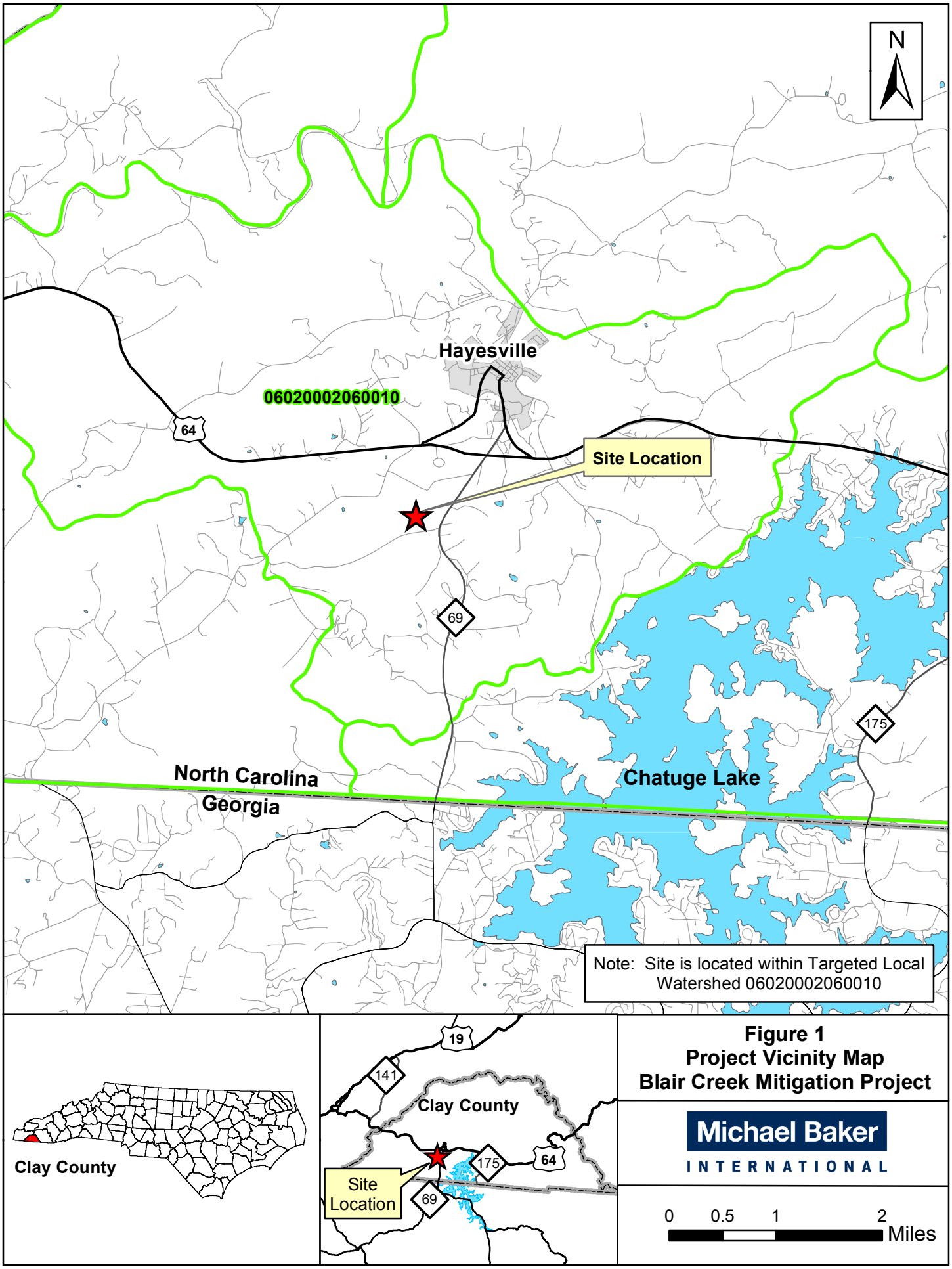

Figure 1
Project Vicinity Map
Blair Creek Mitigation Project

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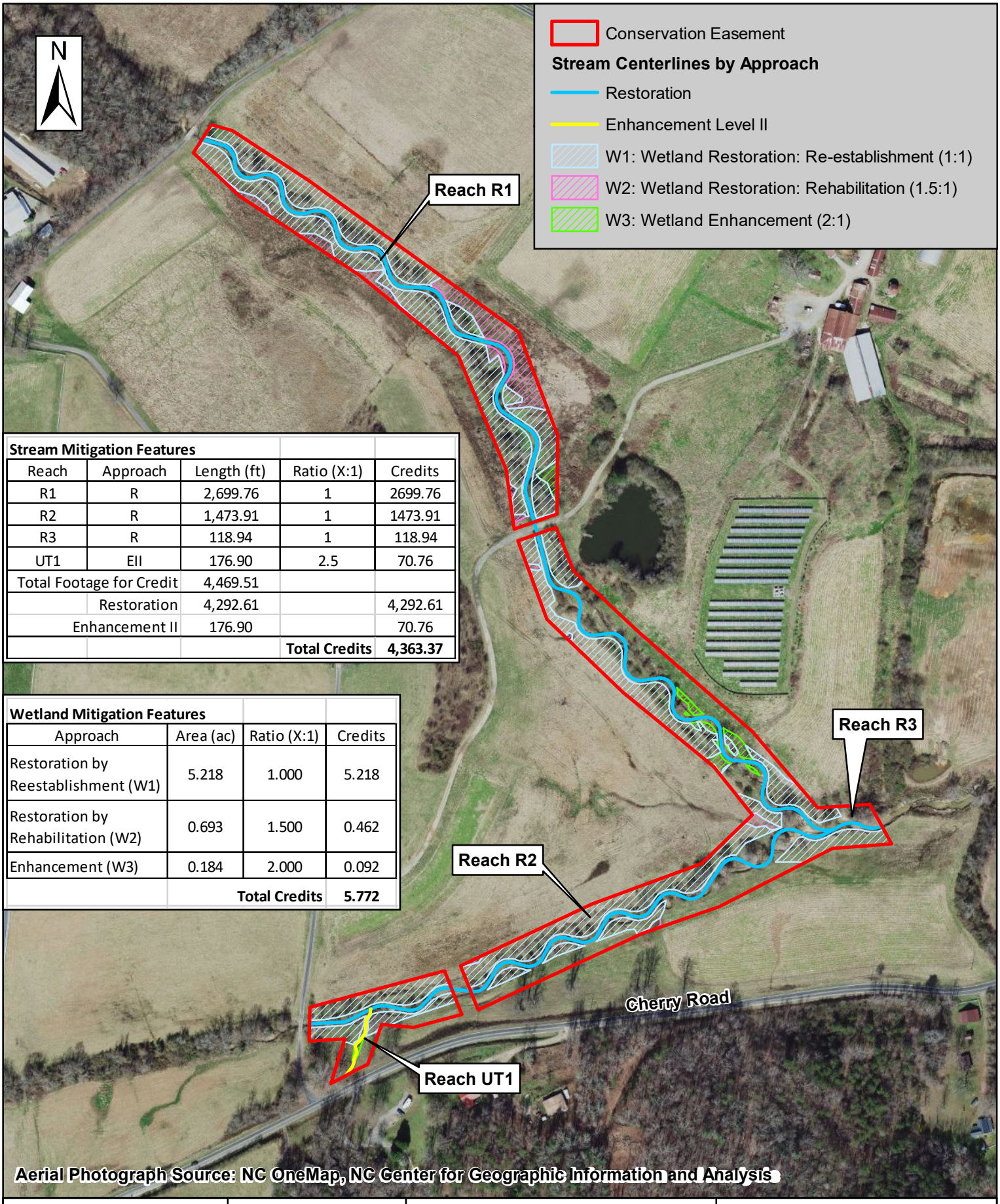

Stream Mitigation Features

Reach	Approach	Length (ft)	Ratio (X:1)	Credits
R1	R	2,699.76	1	2699.76
R2	R	1,473.91	1	1473.91
R3	R	118.94	1	118.94
UT1	EII	176.90	2.5	70.76
Total Footage for Credit		4,469.51		
	Restoration	4,292.61		4,292.61
	Enhancement II	176.90		70.76
			Total Credits	**4,363.37**

Wetland Mitigation Features

Approach	Area (ac)	Ratio (X:1)	Credits
Restoration by Reestablishment (W1)	5.218	1.000	5.218
Restoration by Rehabilitation (W2)	0.693	1.500	0.462
Enhancement (W3)	0.184	2.000	0.092
		Total Credits	**5.772**

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North Carolina Division of Mitigation Services
DMS Proj. No. 100047

0 125 250 500 Feet

Figure 2: Project Asset and Credit Map
Blair Creek Mitigation Project
Clay County, NC

Table 1.0 Project Components and Mitigation Credits
Blair Creek Mitigation Project - NCDMS Project No. 100047

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	As-Built Restored Footage[1]	Mitigation Plan Designed Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits [2]
Reach 1		2,399	10+00 - 2501.60, 2531.66 - 3771.92	2,699.76	2,741.86	R	P1	1.0	2,699.760
Reach 2		1,468	09+99.88 - 13+72.39, 14+20.16 - 2555.18	1,473.91	1,507.53	R	P1	1.0	1,473.910
Reach 3		185	25+55.18 - 26+88.82	118.94	133.64	R	P1	1.0	118.940
Reach UT1		195	10+14.97 - 11+88.00	176.9	173.03	EII	-	2.5	70.760
Wetland 1		5.218		5.218	5.217	R	Re-establishment	1.0	5.218
Wetland 2		0.693		0.693	0.691	R	Rehabilitation	1.5	0.462
Wetland 3		0.184		0.184	0.179	E	Enhancement	2.0	0.092

[1] All stream stationing and restored footage numbers reported here and shown in the as-built plan sheets use *thalweg* survey values and have had easement breaks removed.

[2] Credits reported here are derived from the design lengths as taken from the approved mitigation plan Table 11.1

Table 1.1
As-Built Centerline Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (ft^2)
		Riverine	Non-Riverine		
Restoration	4,383				
Enhancement I					
Enhancement II	173				
Re-establishment		5.217			
Rehabilitation		0.691			
Wetland Enhancement		0.179			
Creation					
Preservation					
High Quality Pres					

Table 1.2
Overall Assets Summary

Asset Category	Overall Credits
Stream (cool)	4,363.370
RP Wetland	5.772
NR Wetland	
Buffer	

Table 2. Project Activity and Reporting History
Blair Creek Mitigation Project - NCDMS Project No. 100047

Grading Completed in December 2021	
Elapsed Time Since grading complete:	**1 year**
All Planting Completed in February 2022	
Elapsed Time Since planting complete:	**10 months**
Number of Reporting Years[1]:	**1**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Institution date	N/A	Jan-22
404 permit date	N/A	Jan-21
Mitigation Plan	N/A	May-21
Final Design – Construction Plans	N/A	Dec-21
Construction Grading Completed	1/22/2022	Jan-22
As-Built Survey	Jan-22	Jan-22
Livestake and Bareroot Planting Completed	Feb-22	Feb-22
As-Built Stream Survey	Feb-22	Feb-22
As-Built Vegetation Monitoring	Mar-22	Apr-22
As-Built Baseline Monitoring Report (MY0)	Mar-22	May-22
Year 1 Stream Survey	Oct-22	N/A
Year 1 Vegetation Monitoring	Oct-22	N/A
Year 1 Monitoring	Nov-22	Dec-22
Year 2 Monitoring (anticipated)	Oct-23	Dec-23
Year 3 Monitoring (anticipated)	Oct-24	Dec-24
Year 4 Monitoring (anticipated)	Oct-25	Dec-25
Year 5 Monitoring (anticipated)	Oct-26	Dec-26
Year 6 Monitoring (anticipoated)	Oct-27	Dec-27
Year 7 Monitoring (anticipated)	Oct-28	Dec-28

[1] = The number of monitoring reports excluding the as-built/baseline report

Table 3. Project Contacts
Blair Creek Mitigation Project - NCDMS Project No. 100047

Designer	8000 Regency Parkway, Suite 600
Michael Baker Engineering, Inc.	Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-418-5703
Construction Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Survey Contractor	88 Central Avenue
Kee Mapping and Surveying	Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
Planting Contractor	
Ripple EcoSolutions	215 Moonridge Road Chapel Hill, NC 27516 Contact: George Morris, Tel. 919-818-3984
Seeding Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Seed Mix Sources	
Green Resources	5204 Highgreen Court, Colfax, NC 27235 Telephone: 336-855-6363
Nursery Stock Suppliers	825 Maude Etter Road, McMinnville, TN 37110
Dykes and Son Nursery	Telephone: 919-742-1200
Native Forest Nursery	11306 US-441, Chatswort, GA 30705 Telephone: 336-855-6363
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Michael Baker Engineering, Inc. Cary, NC 27518
Stream Monitoring POC	Jason York, Tel. 828-380-0118
Vegetation Monitoring POC	Jason York, Tel. 828-380-0119

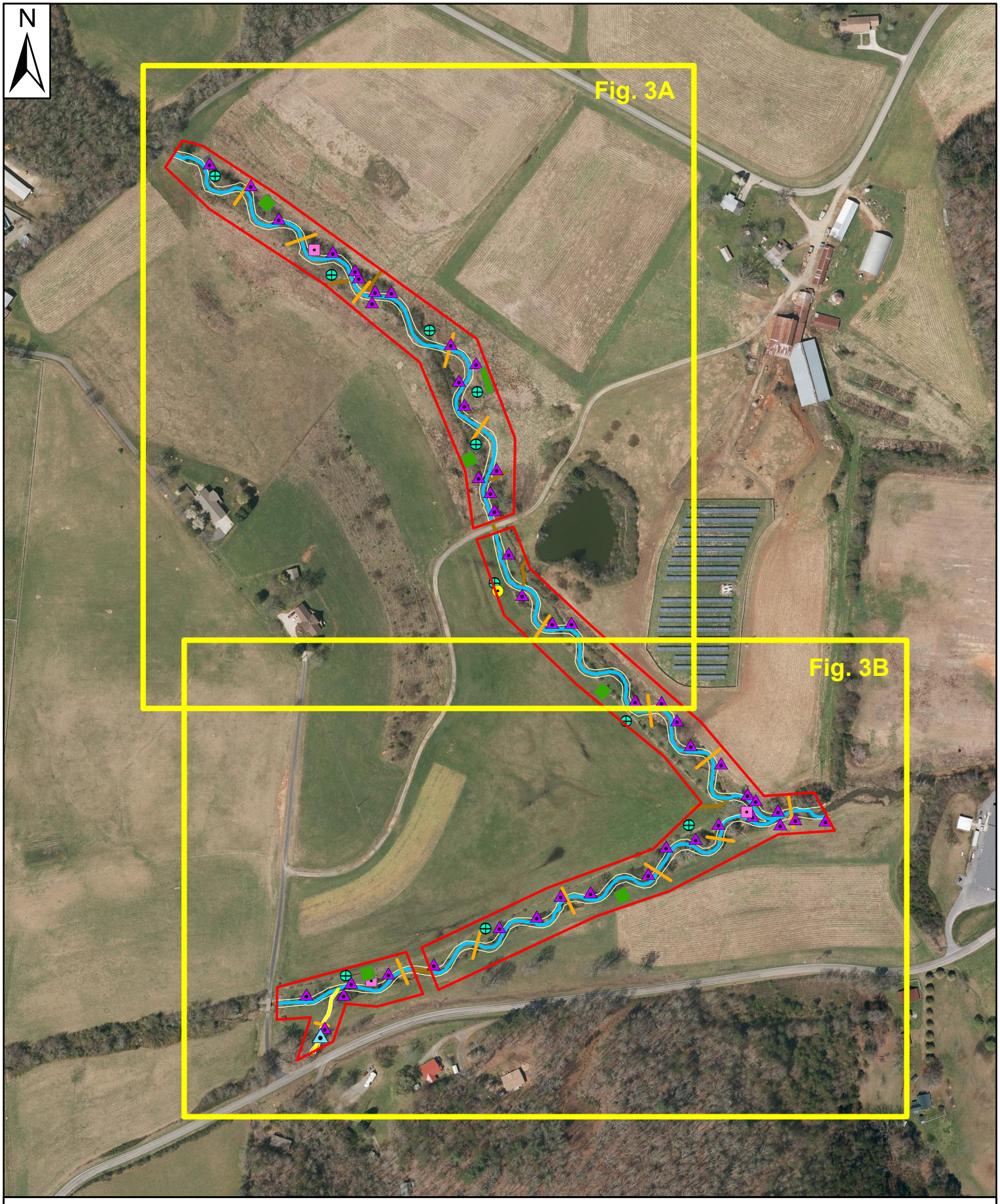
Table 4. Project Attributes for Existing Conditions

Blair Creek Mitigation Project – NCDMS Project No. 100047

Project Information				
Project Name	Blair Creek Stream Mitigation Project			
County	Clay			
Project Area (acres)	10.02			
Project Coordinates (lat. and long.)	35.026069 N, -83.831862 W			
Project Watershed Summary Information				
Physiographic Province	Level III Blue Ridge, Level IV; Broad Basins			
River Basin	Hiawassee			
USGS Hydrologic Unit 8-digit 6020002	USGS Hydrologic Unit 14-digit	06020002-060010		
DWR Sub-basin	04-05-01			
Project Drainage Area (acres)	1,862 arcres / 2.94 square miles (at confluence in Blair Creek)			
Stream Temperature Regime	cool			
Project Drainage Area Percentage of Impervious Area	1.7% impervious area			
USGS National Land Cover Database (NLCD) for 2011	12.6% developed (predominantly rural residential), 55.7% forested, 29.8% cultivated crops and pasture/hay, 1.2% shrub/scrub, and 0.7% herbaceous.			
Reach Summary Information				
Parameters	**Reach 1 (North Fork)**	**Reach 2 (South Fork)**	**Reach 3 (Blair Creek)**	**UT1**
Existing length of reach (linear feet)	2,399	1468	185	195
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Moderately Confined	Moderately Confined	Moderately Confined
Drainage area (acres)	983	880	1864	22
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Intermittent
NCDWR Water Quality Classification	WS-IV	WS-IV	WS-IV	N/A
Stream Classification (existing / proposed)	B-E4/C4	E4/C4	F4/C4	B/B
Evolutionary trend (Simon)	IV – Degradation and Widening	III – Degradation	IV – Aggradation and Widening	III – Degrading
FEMA classification	Zone X	Zone X	Zone AE	Zone X
Regulatory Considerations				
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**	
Water of the United States - Section 404	Yes	Yes	PCN	
Water of the United States - Section 401	Yes	Yes	PCN	
Endangered Species Act	Yes	Yes	Categorical Exclusion	
Historic Preservation Act	Yes	Yes	Categorical Exclusion	
Coastal Zone Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	N/A	
Essential Fisheries Habitat	No	N/A	N/A	

APPENDIX B

Visual Assessment Data



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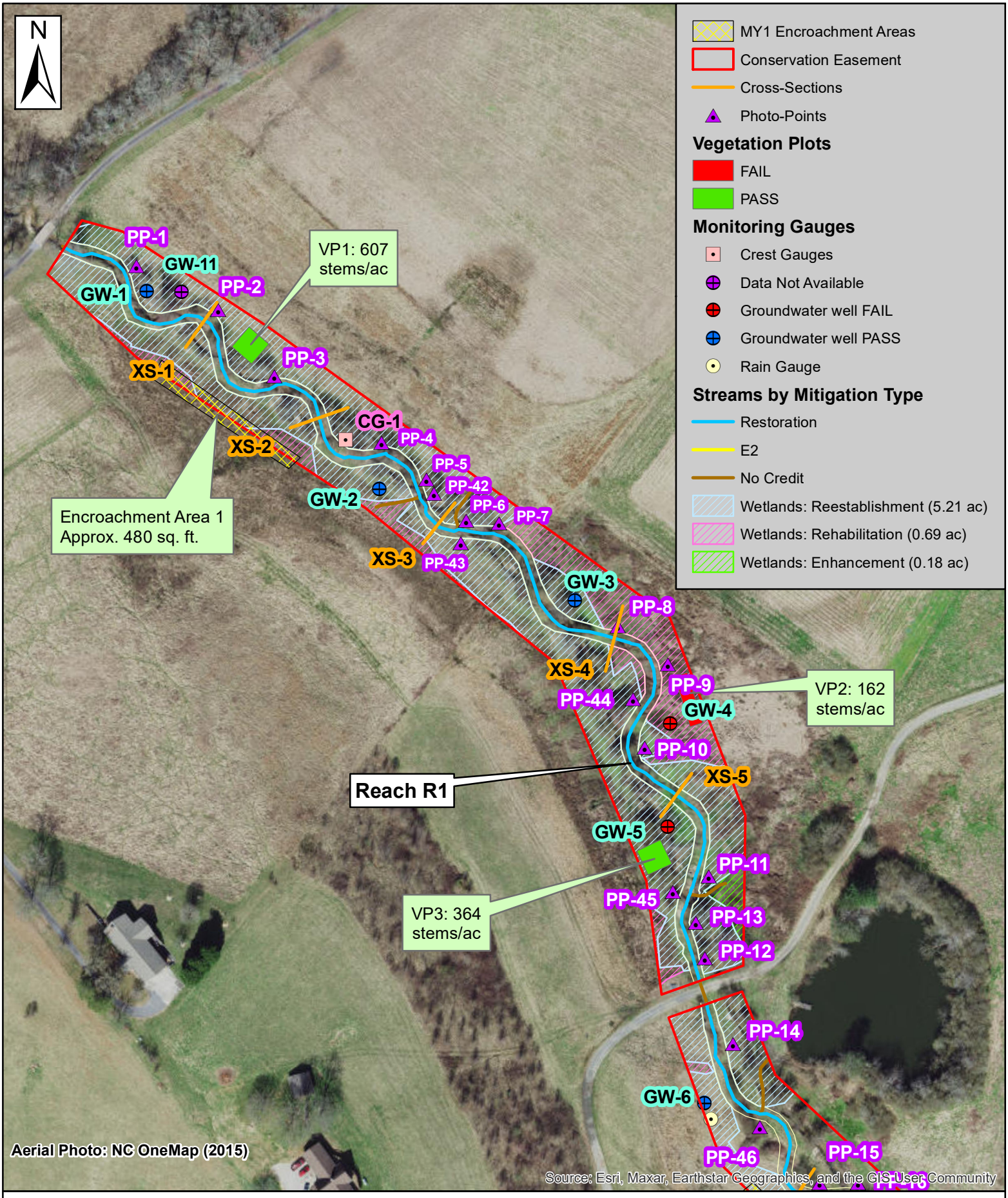
Overview Map: Current Condition Plan View (CCPV)
Blair Creek Mitigation Project
Clay County, NC

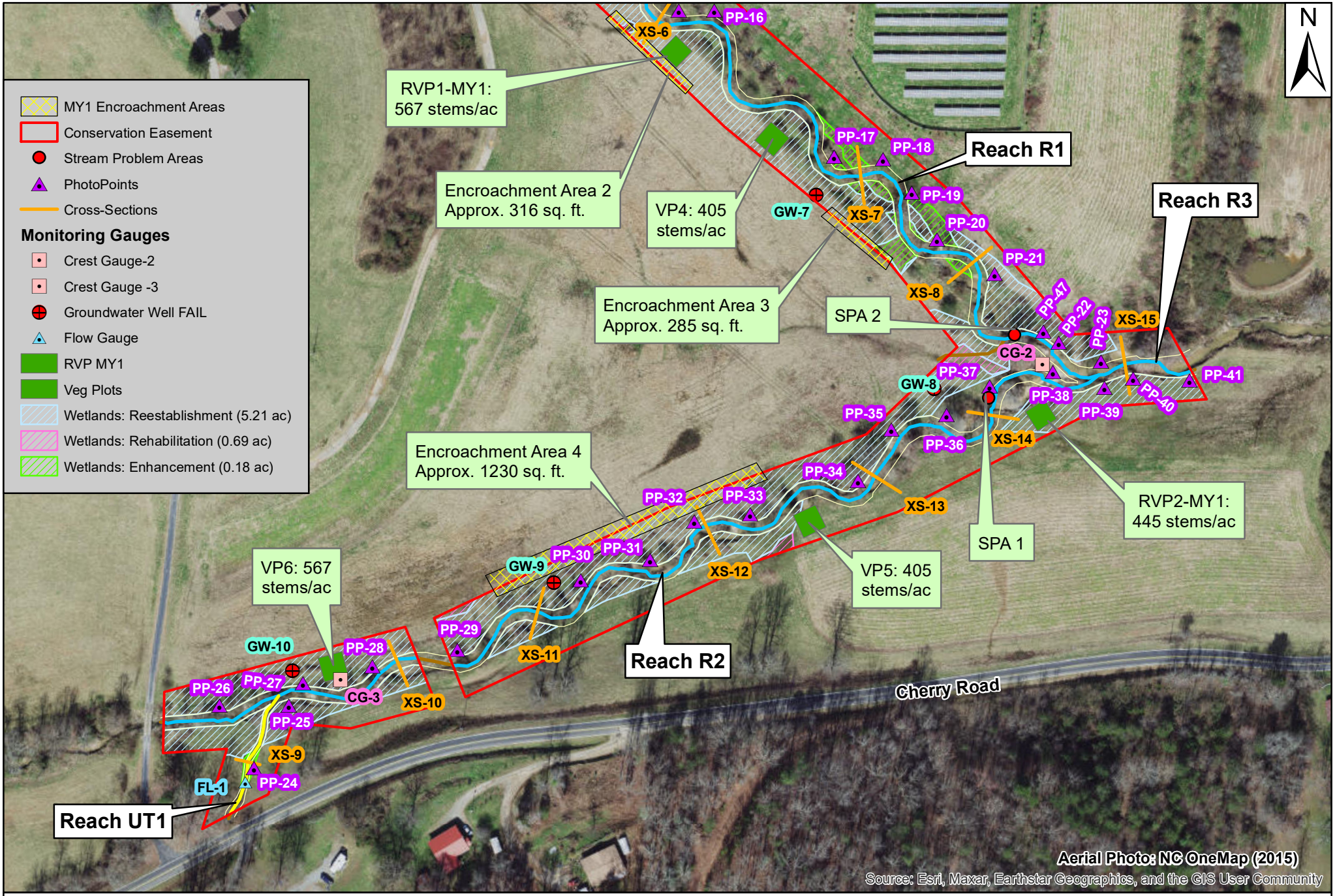


Michael Baker INTERNATIONAL

0 125 250 500 Feet

DMS Proj. No. 100047

Figure 3A. Current Condition Plan View (CCPV)
Blair Creek Mitigation Project
Clay County, NC



Michael Baker INTERNATIONAL

0 125 250 500 Feet

DMS Proj. No. 100047

Figure 3B. Current Condition Plan View (CCPV)
Blair Creek Mitigation Project
Clay County, NC

Table 5. Visual Stream Morphology Stability Assessment
Blair Creek Mitigation Project – NCDMS Project No. 100047 - All Reaches Assessed in November 2022

Reach ID: Reach 1							
Assessed Length (LF):	**2,741.86**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			1	15	99.5%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	36	36	**0.00**	**0.00**	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5)	36	36			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	27	27			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	27	27			100%
		2. Thalweg centering at downstream of meander bend (Glide)	27	27			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion		0	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse		0	0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	31	31			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	10	10			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	30	31			97%
	3. Bank Position	Bank erosion within the structures extent of influenc**does not** exceed 15%	30	31			97%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flow	14	14			100%

Table 5. Visual Stream Morphology Stability Assessment
Blair Creek Mitigation Project – NCDMS Project No. 100047

Reach ID: Reach 2							
Assessed Length (LF):	**1,507.53**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	24	24	**0.00**	**0.00**	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5)	26	26			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrea riffle)	26	26			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	26	26			100%
		2. Thalweg centering at downstream of meander bend (Glide)	26	26			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion		0	1	25	99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse		0	0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	21	21			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	7	7			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	20	21			95%
	3. Bank Position	Bank erosion within the structures extent of influenc**does not** exceed 15%	20	21			95%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flow	7	7			100%

Table 5. Visual Stream Morphology Stability Assessment
Blair Creek Mitigation Project – NCDMS Project No. 100047 - All Reaches Assessed in November 2022

Reach ID: Reach 3							
Assessed Length (LF):	**133.64**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2	**0.00**	**0.00**	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5)	3	3			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrea riffle)	3	3			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	3	3			100%
		2. Thalweg centering at downstream of meander bend (Glide)	3	3			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion		0	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse		0	0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	1	1			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%
	3. Bank Position	Bank erosion within the structures extent of influenc**does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flov	1	1			100%

Table 5. Visual Stream Morphology Stability Assessment
Blair Creek Mitigation Project – NCDMS Project No. 100047

Reach ID: Reach UT1							
Assessed Length (LF):	**173.03**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include poi bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	7	7	**0.00**	**0.00**	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth≥ 1.5) **Plunge Pools**	7	7			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstrea riffle)	7	7			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	N/A	N/A			100%
		2. Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion		0	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse		0	0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	7	7			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	7	7			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	7	7			100%
	3. Bank Position	Bank erosion within the structures extent of influenc**does not** exceed 15%	7	7			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio≥ 1.5. Rootwads/logs providing some cover at low flov	7	7			100%

Table 6. Vegetation Conditions Assessment

Blair Creek Mitigation Project - NCDMS Project No. 100047 - Vegetation Assessed in November 2022

Planted Acreage: 8.3						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas *	Very limited cover both woody and herbaceous material.	0.1 acres	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	N/A	0	0.00	0.0%
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total			
Easement Acreage: 8.3						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Points**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	Green Hatching	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	577 ft²	Yellow Polygon	4	0.05	0.7%

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-1: R1 Upstream, Station 10+75- Begin R1

PP-2: R1, Upstream, Station 12+25

PP-3: R1, Upstream, Station 13+50

PP-4: R1, Upstream, Station 15+50

PP-5: R1, Upstream, Station 16+00

PP-6: R1, Upstream, Station 17+00

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-7: R1 Upstream, Station 17+40

PP-8: R1, Upstream, Station 19+50

PP-9: R1, Upstream, Station 20+20

PP-10: R1, Upstream, Station 21+75

PP-11: R1, Upstream Station 23+75

PP-12: R1, Upstream, Station 24+60

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-13: R1, Downstream, Station 24+25- Culvert

PP-14: R1, Upstream, Station 25+60- Culvert

PP-15: R1, Upstream, Station 28+00

PP-16: R1, Upstream, Station 28+60

PP-17: R1, Upstream, Station 31+75

PP-18: R1, Upstream, Station 32+25

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-19: R1, Upstream, Station 32+75

PP-20: R1, Upstream, Station 33+75

PP-21: R1, Upstream, Station 34+65

PP-22: R1, Upstream, Station 36+75

PP-23: R1, Upstream, Station 37+00 – End R1

PP-24: UT1, Upstream, Station 10+60

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-25: UT1, Upstream, Station 11+85- Confluence with R2

PP-26: R2, Upstream, Station 10+50- Begin R2

PP-27: R2, Upstream, Station 11+60

PP-28: R2, Upstream, Station 13+51

PP-29: R2, Upstream, Station 12+25

PP-30: R2, Upstream, Station 16+50

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-31: R2, Upstream, Station 17+40

PP-32: R2, Upstream, Station 18+40

PP-33: R2, Upstream, Station 19+15

PP-34: R2, Upstream at Station 20+80

PP-35: R2, Upstream, Station 21+75

PP-36: R2, Upstream, Station 22+30

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-37: R2, Upstream, Station 23+50

PP-38: R2, Upstream, Station 24+60

PP-39: R2, Upstream, Station 25+20- Confluence with R1

PP-40: R3, Upstream, Station 25+50- Begin R3

PP-41: R3, view upstream at Station 10+80- End R3

PP-42: R1, Swale on Right Floodplain, Station 16+25

Blair Creek: Stream Station Photo-Points
NCDMS Project No. #100047 – MY 1 Photos taken November 22, 2022.

PP-43: R1, Swale on Left Floodplain, Station 17+00

PP-44: R1, Swale on Left Floodplain, Station 20+70

PP-45: R1, Swale on Left Floodplain, Station 24+00

PP-46: R1, Overflow Channel on Left Floodplain, Station 26+75

PP-47: R1, Swale on Right Floodplain, Station 36+40

Blair Creek: Vegetation Plot Photographs
NCDMS Project No. 100047

Vegetation Plot #1: Photo taken September 21, 2022

Vegetation Plot #2: Photo taken November 22, 2022

Vegetation Plot #3: Photo taken September 21, 2022

Vegetation Plot #4: Photo taken September 21, 2022

Vegetation Plot #5: Photo taken September 21, 2022

Vegetation Plot #6: Photo taken September 21, 2022

Blair Creek: Vegetation Plot Photographs
NCDMS Project No. 100047

Random Vegetation Plot #1: Photo taken November 22, 2022

Random Vegetation Plot #2: Photo taken November 22, 2022

Monitoring Gauges and Overbank Photographs

Monitoring Well 1. (Photo taken November 22, 2022)

Monitoring Well 2. (Photo taken November 22, 2022)

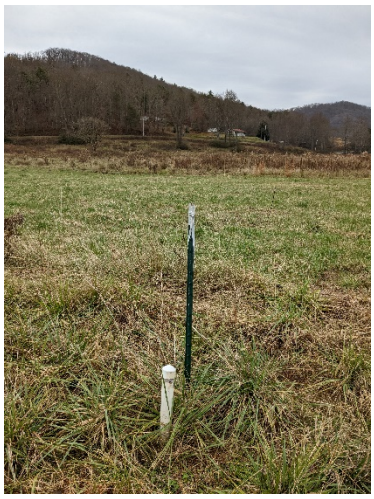
Monitoring Well 3. (Photo taken November 22, 2022)

Monitoring Well 4. (Photo taken November 22, 2022)

Monitoring Well 5. (Photo taken November 22, 2022)

Monitoring Well 6. (Photo taken November 22, 2022)

Monitoring Gauges and Overbank Photographs



Monitoring Well 7. (Photo taken November 22, 2022)

Monitoring Well 8. (Photo taken November 22, 2022)

Monitoring Well 9. (Photo taken November 22, 2022)

Monitoring Well 10. (Photo taken November 22, 2022)

Crest Gauge 1. Reach 1 (Photo taken November 22, 2022)

Crest Gauge 2. Confluence Reach 1&2 (Photo taken November 22, 2022)

Monitoring Gauges and Overbank Photographs

Crest Gauge 3. (Photo taken November 22, 2022)

Flow Gauge 1. UT1 (Photo taken November 22, 2022)

Overbank evidence. Debris in lower Reach 1 floodplain. (Photo taken July 1, 2022)

Overbank evidence. Debris in lower Reach 1 floodplain (Photo taken July 1, 2022)

Overbank evidence. Debris jam on Crest Gauge 3 Reach 2 Left floodplain. (Photo taken November 22, 2022)

APPENDIX C

Vegetation Plot Data

Table 7: Planted Stem Counts by Plot and Species

Planted Acreage	8.3
Date of Initial Plant	2022-02-10
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	2022-11-22
Date of Current Survey	2022-11-22
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 3 R	Veg Plot 4 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total
Species Included in Approved Mitigation Plan	Acer negundo	boxelder	Tree	FAC					1	1							4	
	Acer saccharinum	silver maple	Tree	FACW	1	1			3	3	1	1					1	
	Alnus serrulata	hazel alder	Tree	OBL					1	1					1	1		
	Aronia arbutifolia	red chokeberry	Shrub	FACW							1	1						
	Betula alleghaniensis	yellow birch	Tree	FAC									2	2				
	Betula lenta	sweet birch	Tree	FACU														2
	Betula nigra	river birch	Tree	FACW	2	2	1	1			3	3	2	2	3	3	2	2
	Carpinus caroliniana	American hornbeam	Tree	FAC	2	2			1	1			4	4			1	
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL			2	2									1	1
	Cornus amomum	silky dogwood	Shrub	FACW	4	4									2	2	2	
	Diospyros virginiana	common persimmon	Tree	FAC					1	1								
	Fraxinus pennsylvanica	green ash	Tree	FACW	1	1			1	1								
	Hamamelis virginiana	American witchhazel	Tree	FACU													1	
	Ilex verticillata	common winterberry	Tree	FACW											2	2		
	Lindera benzoin	northern spicebush	Tree	FAC											1	1		
	Liriodendron tulipifera	tuliptree	Tree	FACU											1	1		
	Nyssa sylvatica	blackgum	Tree	FAC													1	
	Platanus occidentalis	American sycamore	Tree	FACW	3	3					3	3			3	3	1	1
	Quercus falcata	southern red oak	Tree	FACU														1
	Quercus imbricaria	shingle oak	Tree	FAC	1	1	1	1	1	1	2	2	1	1				1
	Quercus phellos	willow oak	Tree	FAC									1	1				1
	Salix nigra	black willow	Tree	OBL														2
	Ulmus americana	American elm	Tree	FACW	1	1									1	1		
Sum	Performance Standard				0	15	4	4	9	9	10	10	10	10	14	14	14	11
Post Mitigation Plan Species	*Quercus lyrata*	*overcup oak*	*Tree*	*OBL*					*1*	*1*	*1*	*1*						
	Quercus michauxii	*swamp chestnut oak*	*Tree*	*FACW*		*1*			*2*	*2*	*1*	*1*						
Sum	Proposed Standard				15	15	4	4	9	9	10	10	10	10	14	14	14	11
Mitigation Plan Performance Standard	Current Year Stem Count					15		4		9		10		10		14	14	11
	Stems/Acre					607		162		364		405		405		567	567	445
	Species Count					8		3		7		5		5		8	9	8
	Dominant Species Composition (%)					25		50		25		25		40		21	29	18
	Average Plot Height (ft.)					1		3		1		1		1		1	2	2
	% Invasives					0		0		0		0		0		0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					15		4		9		10		10		14	14	11
	Stems/Acre					607		162		364		405		405		567	567	445
	Species Count					8		3		7		5		5		8	9	8
	Dominant Species Composition (%)					25		50		25		25		40		21	29	18
	Average Plot Height (ft.)					1		3		1		1		1		1	2	2
	% Invasives					0		0		0		0		0		0	0	0

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 7: Planted Stem Counts by Plot and Species

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems /Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	607		8	0	162		3	0	364		7	0
Monitoring Year 0	769		8	0	729		11	0	648		11	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems /Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	405		5	0	405		5	0	567		8	0
Monitoring Year 0	688		9	0	688		9	0	729		9	0
	Veg Plot Group 1 R				Veg Plot Group 2 R							
	Stems /Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives				
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	567		9	0	445		8	0				
Monitoring Year 0												

Project Stems per Acre = 424

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

APPENDIX D

Stream Geomorphology Data

Permanent Cross-Section 1

Year 1 Survey Data Collected: October 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	22.6	15.0	1.5	2.4	9.9	--	--	1848.21	1848.21

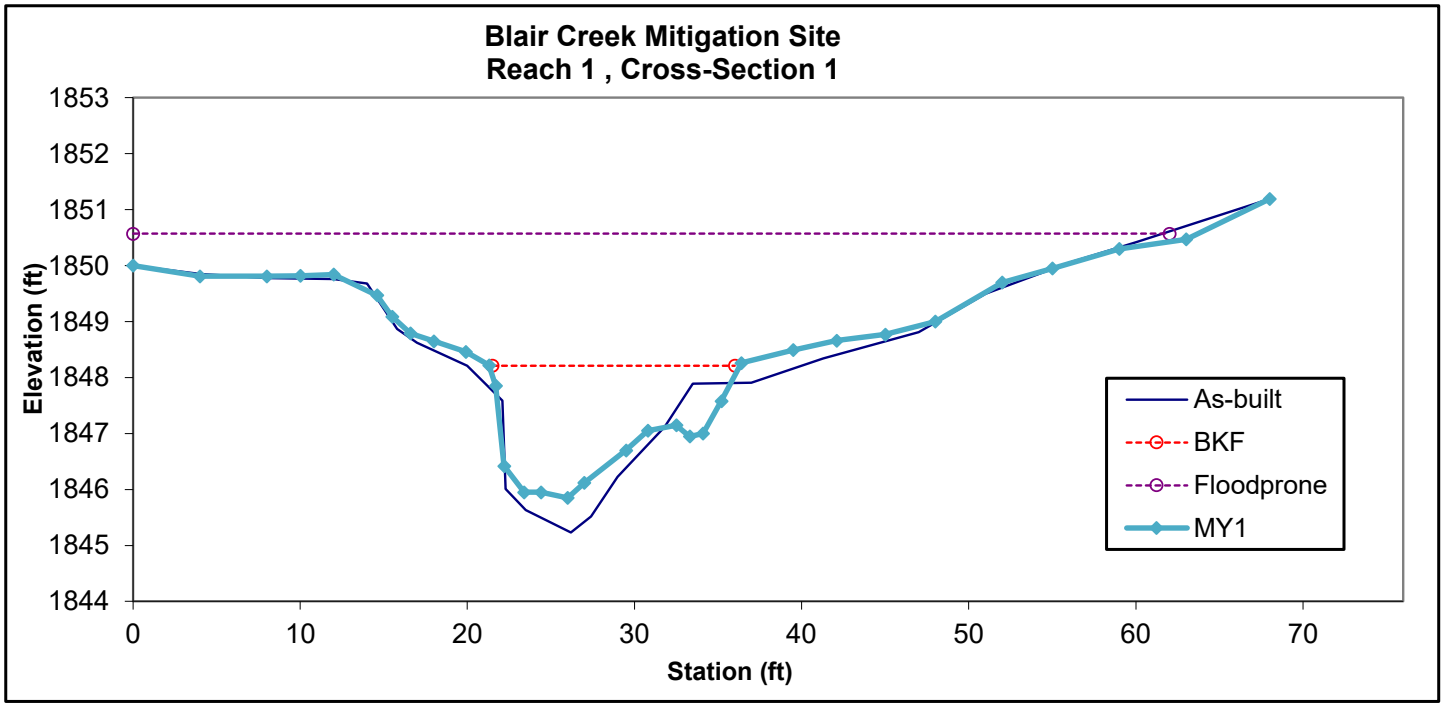


FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 2

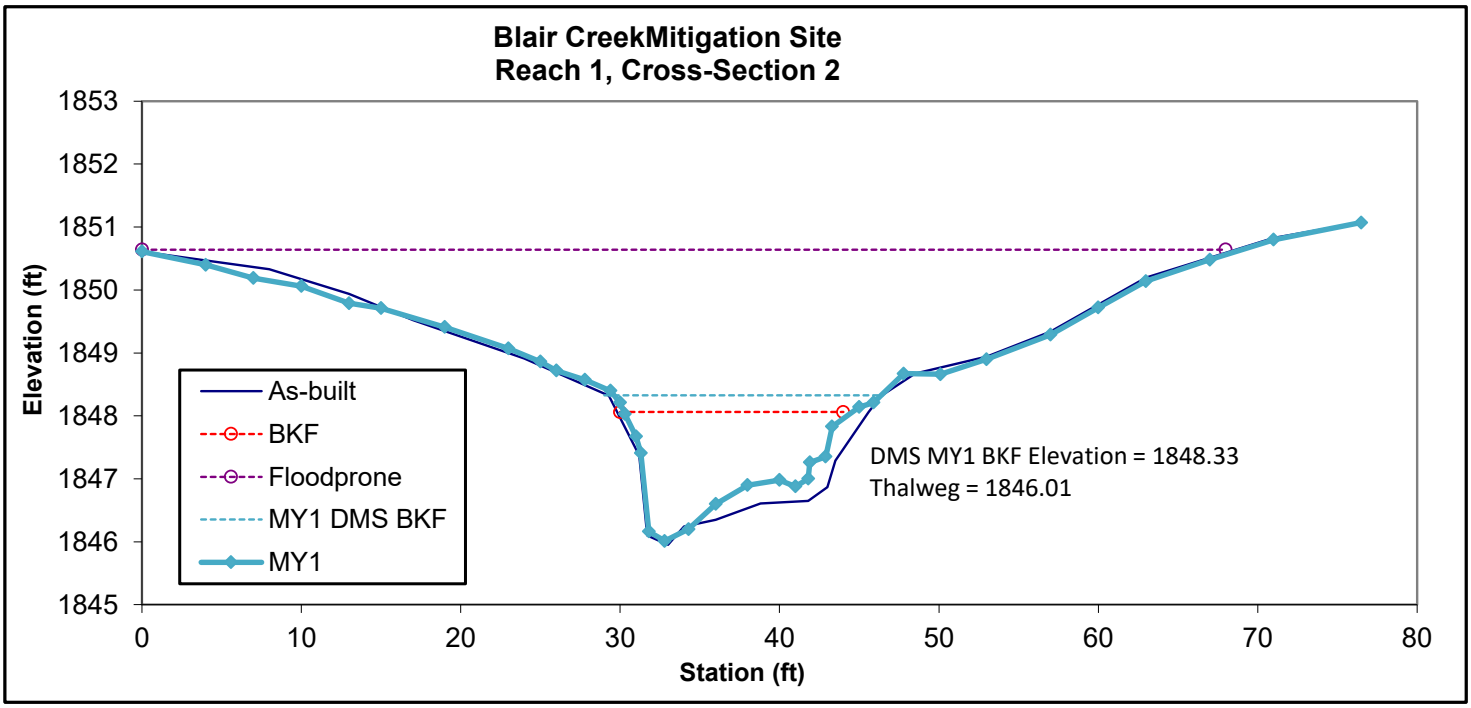
(Year 1 Survey Data Collected: October 2022)

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	16.70	14.30	1.20	2.00	12.20	1.0	4.5	1848.06	1848.14



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Permanent Cross-Section 3

Year 1 Survey Collected: October 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	--	34.27	13.53	2.53	4.25	5.4	--	--	1847.87	1847.88

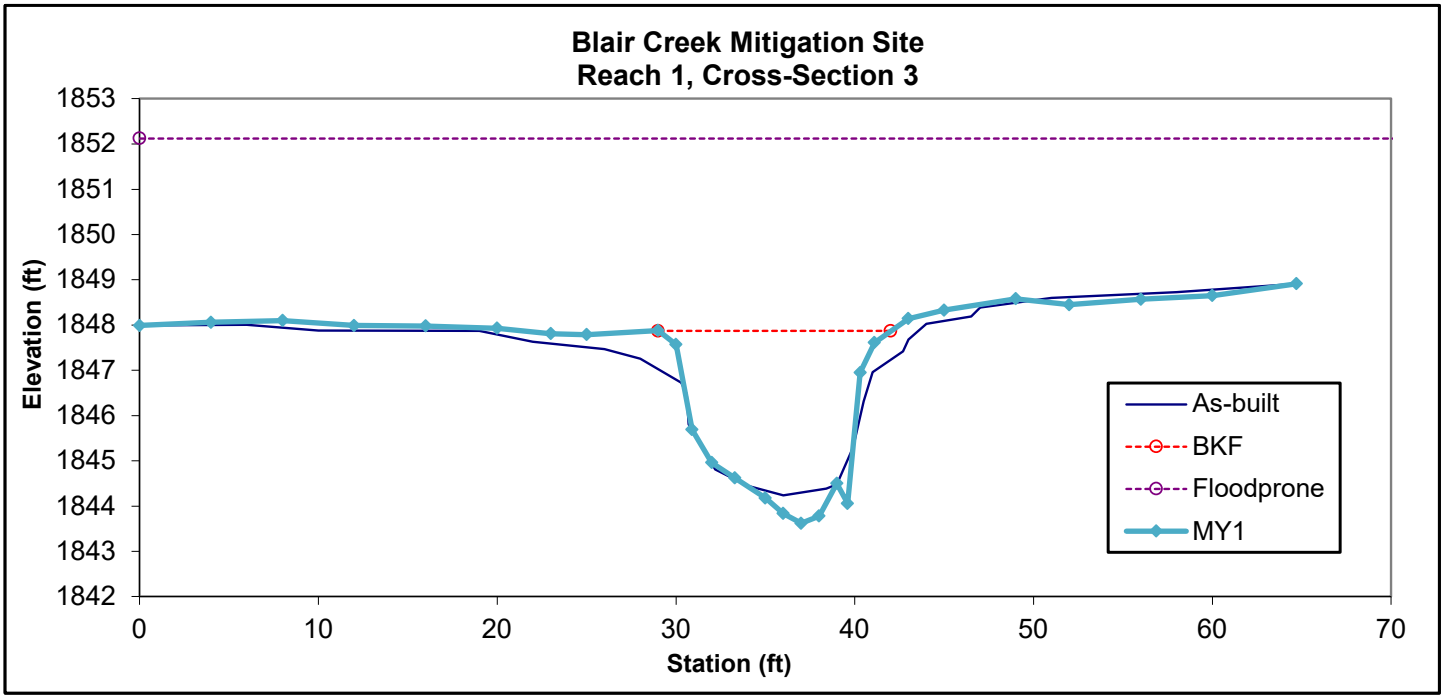


FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 4

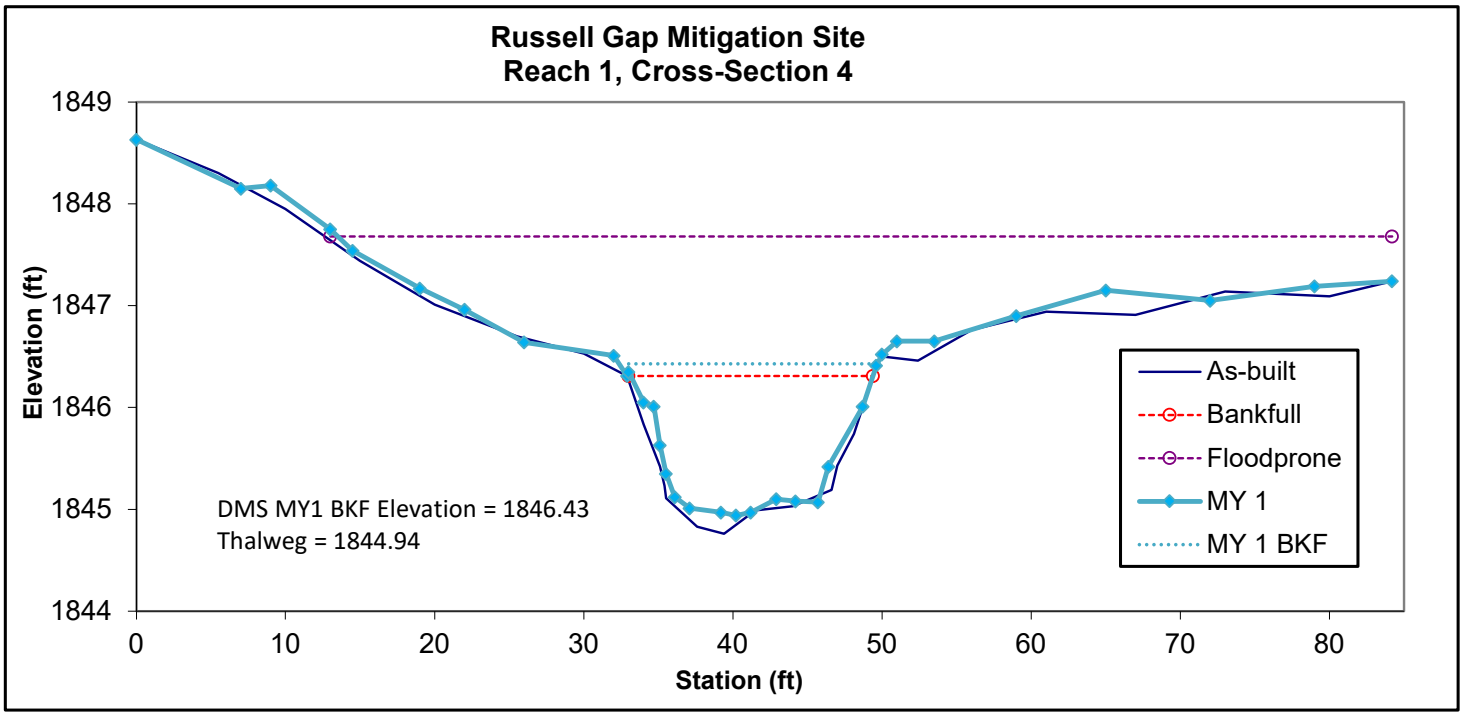
Year 1 Survey Collected: September 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	16	16.2	1	1.4	16.5	1.10	1.1	1846.31	1846.51



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

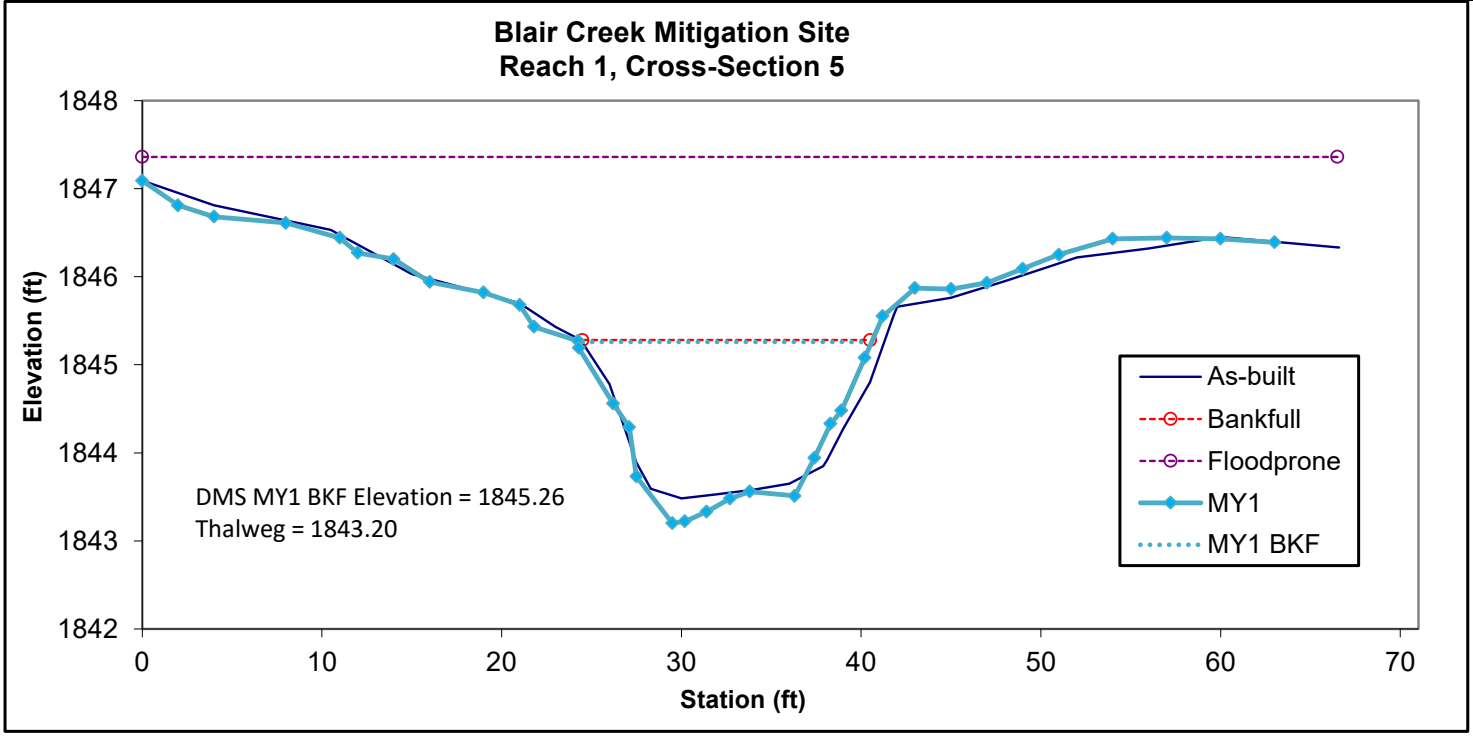
Permanent Cross-Section 5

Year 1 Survey Collected: September 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	22.2	16.50	1.30	2.1	12.3	1.0	4.1	1845.28	1845.25



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Permanent Cross-Section 6

Year 1 Survey Collected: October 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	--	36.2	20.1	1.8	3.4	11.2	--	--	1842.09	1842.09

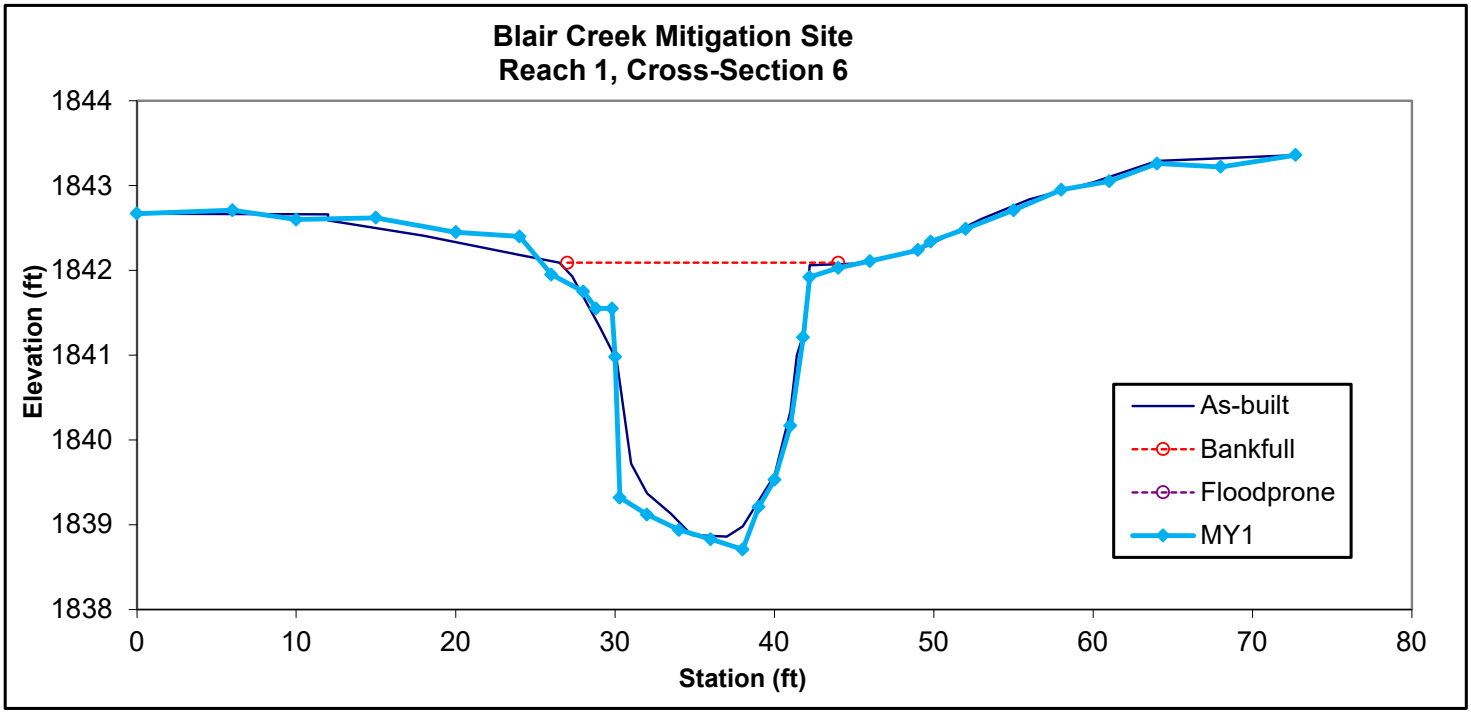


FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 7

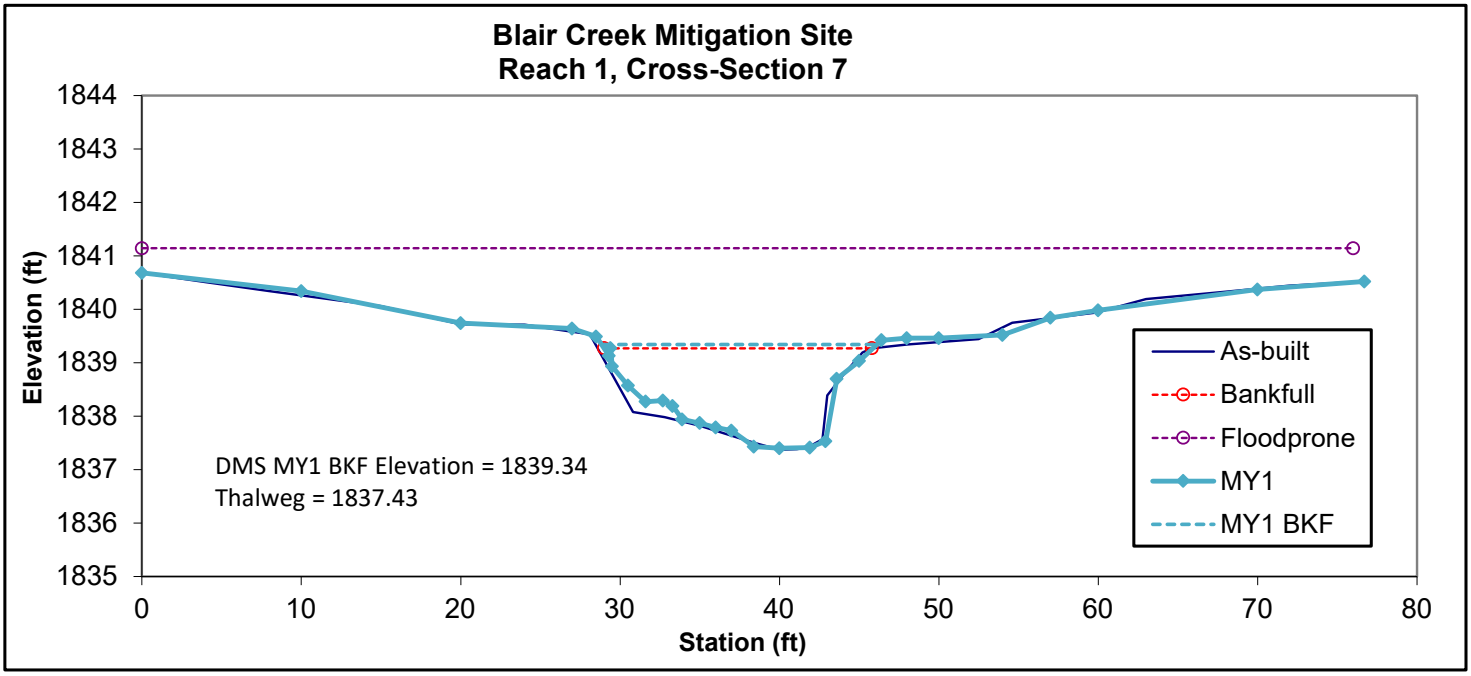
Year 1 Survey Collected: September 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	20.6	16.9	1.2	1.9	13.8	1.00	4.40	1839.27	1839.42



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

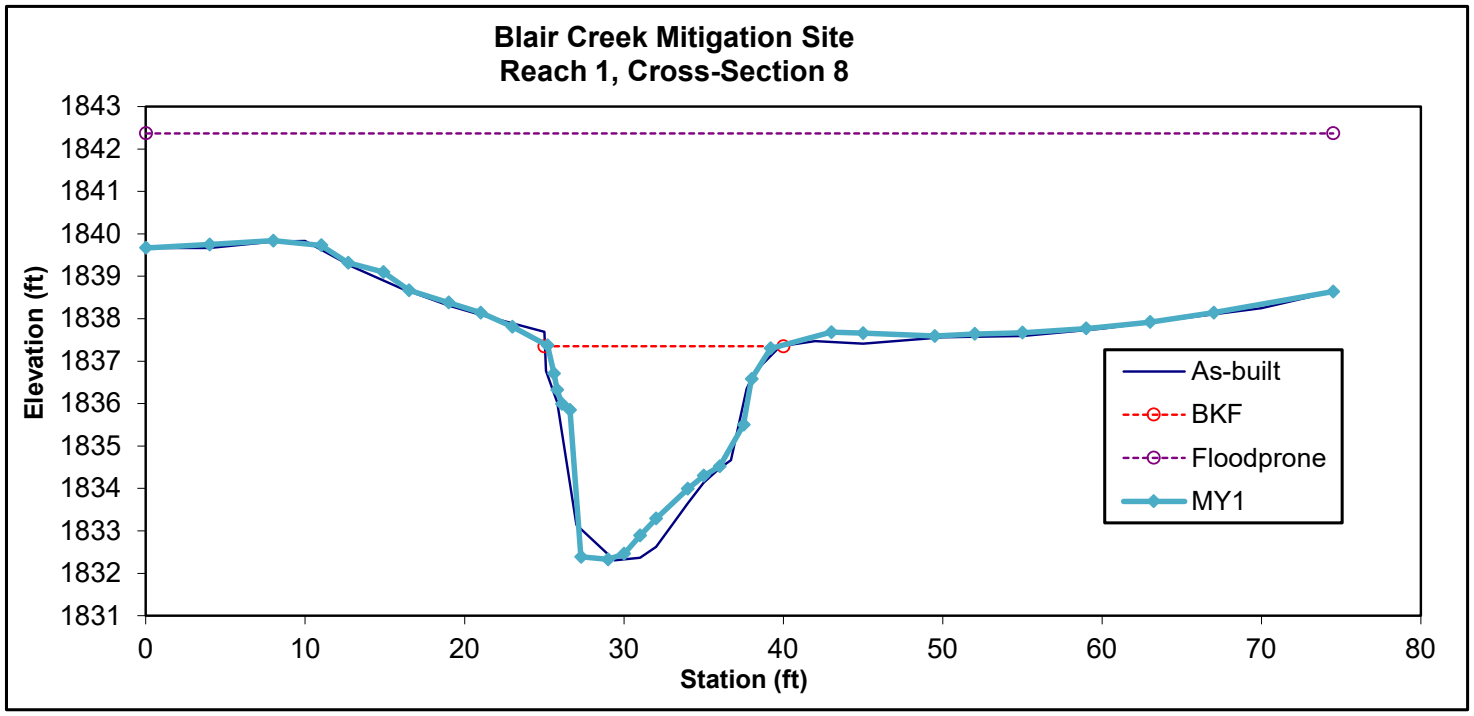
Permanent Cross-Section 8

Year 1 Survey Collected: October 2022

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	44.2	13.99	3.16	5.02	4.43	--	--	1837.35	1837.35



Permanent Cross-Section 9

Year 1 Survey Collected: September 2022

Enhancement 2

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	4.8	5.56	0.9	2.1	6.39	--	--	1845.99	1846.25

--

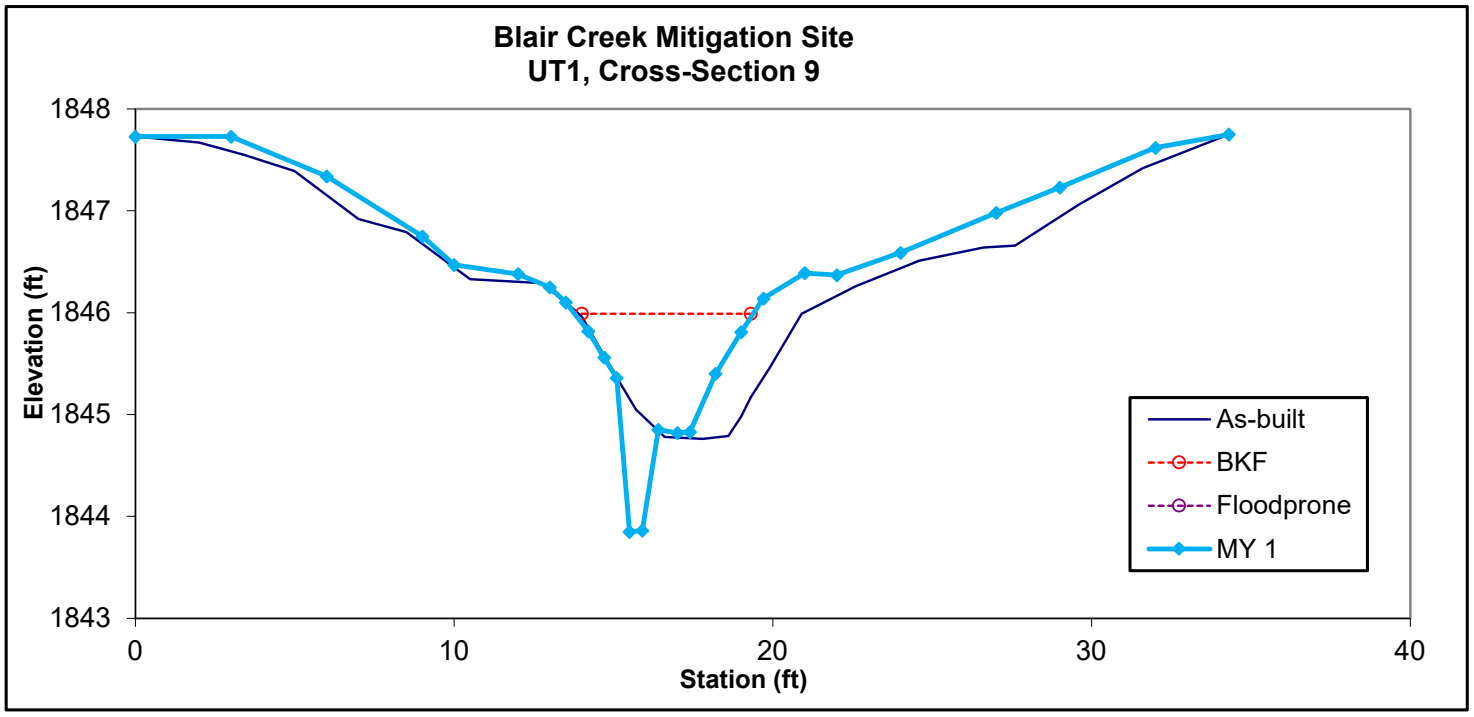


FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 10

Year 1 Survey Collected: November 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	--	33.46	24.10	1.39	3.66	17.34	--	--	1843.54	1843.54

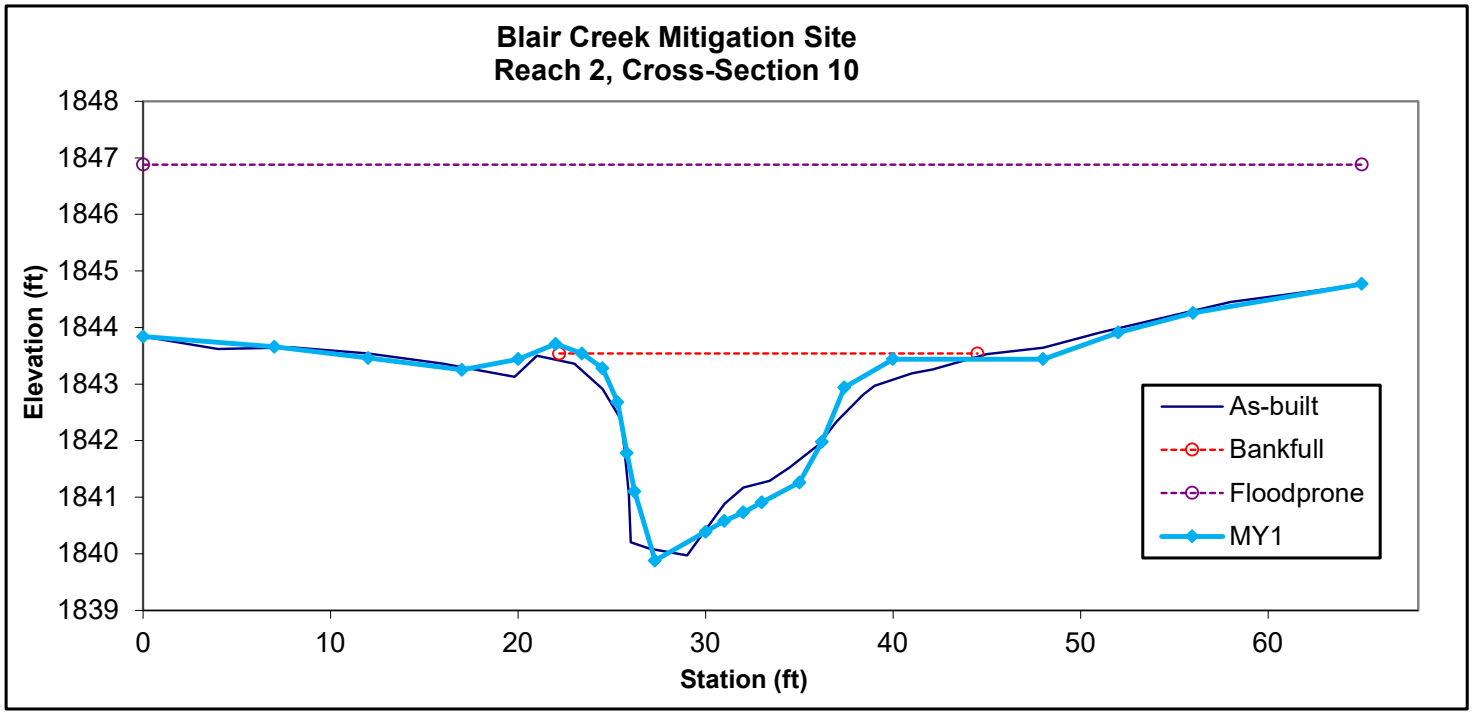


FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 11

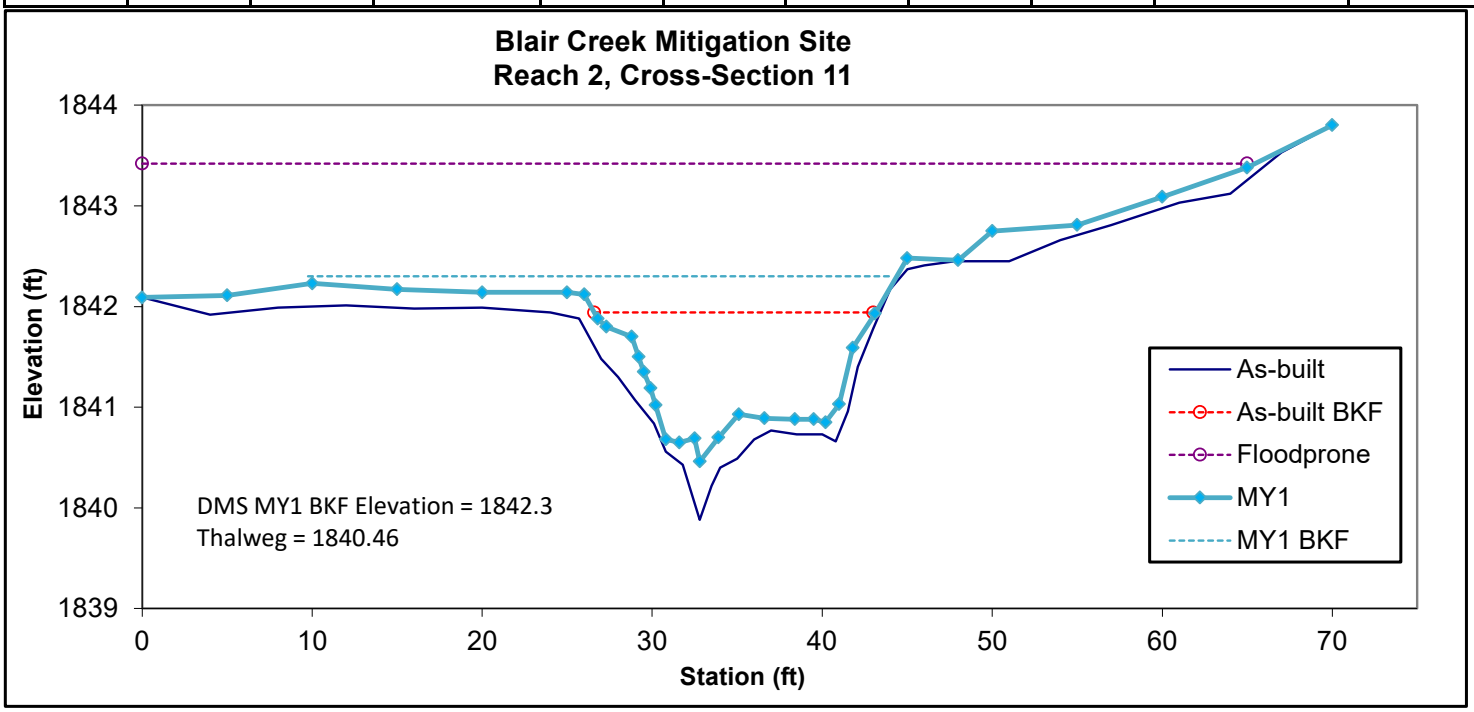
Year 1 Survey Collected: September 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	14.1	16.7	0.8	1.5	19.7	1.00	4.4	1841.94	1842.23



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Permanent Cross-Section 12

Year 1 Survey Collected: November 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool	--	27.28	20.54	1.33	3.13	15.44	--	--	1839.98	1839.98

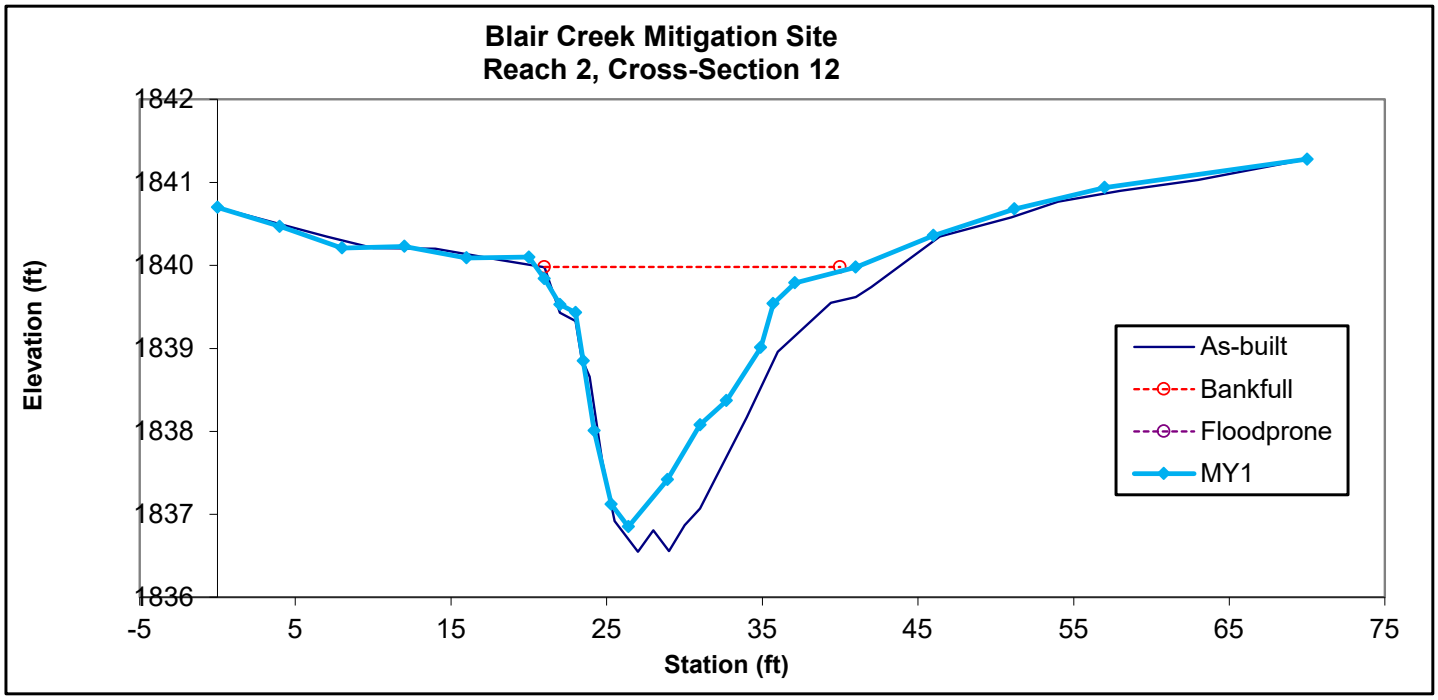


FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 13

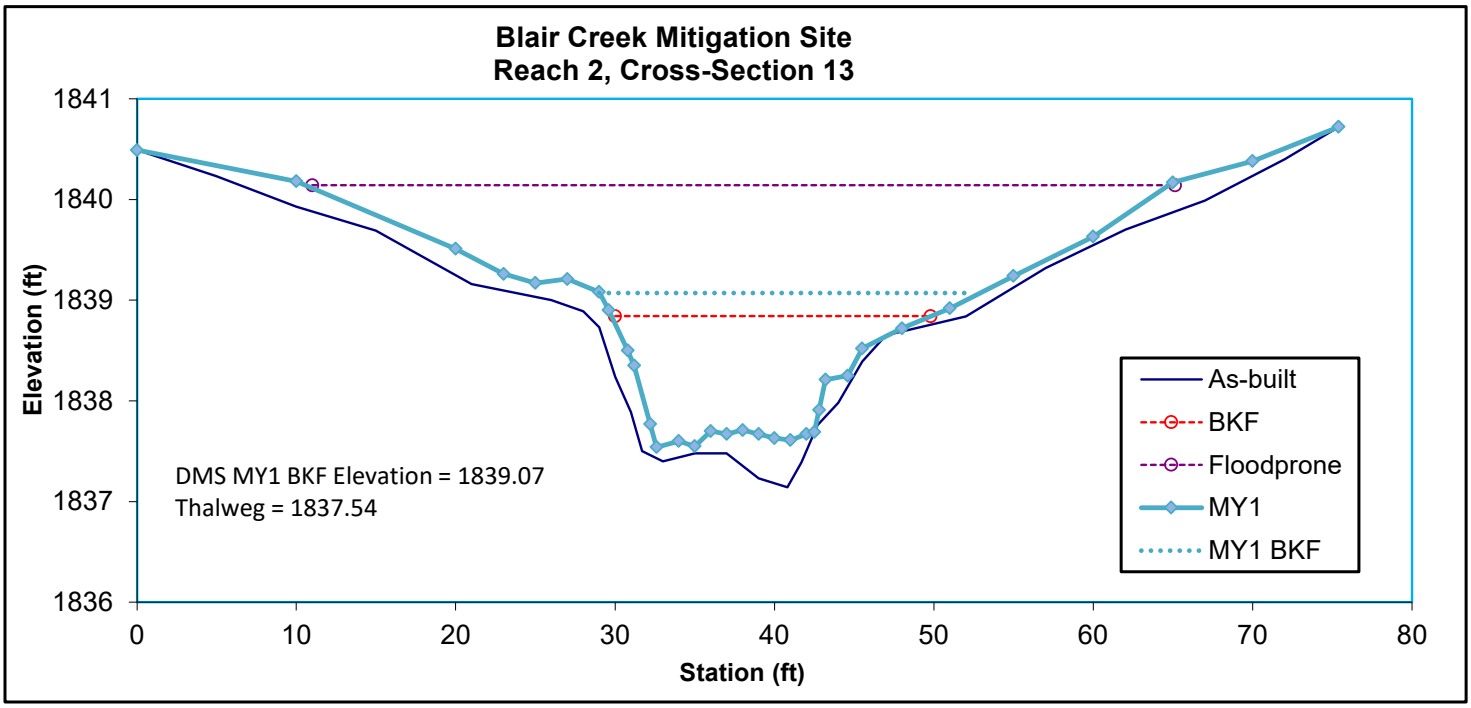
Year 1 Survey Collected: September 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	16.00	20.00	0.80	1.3	25.00	0.9	3.1	1838.84	1838.92



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Permanent Cross-Section 14

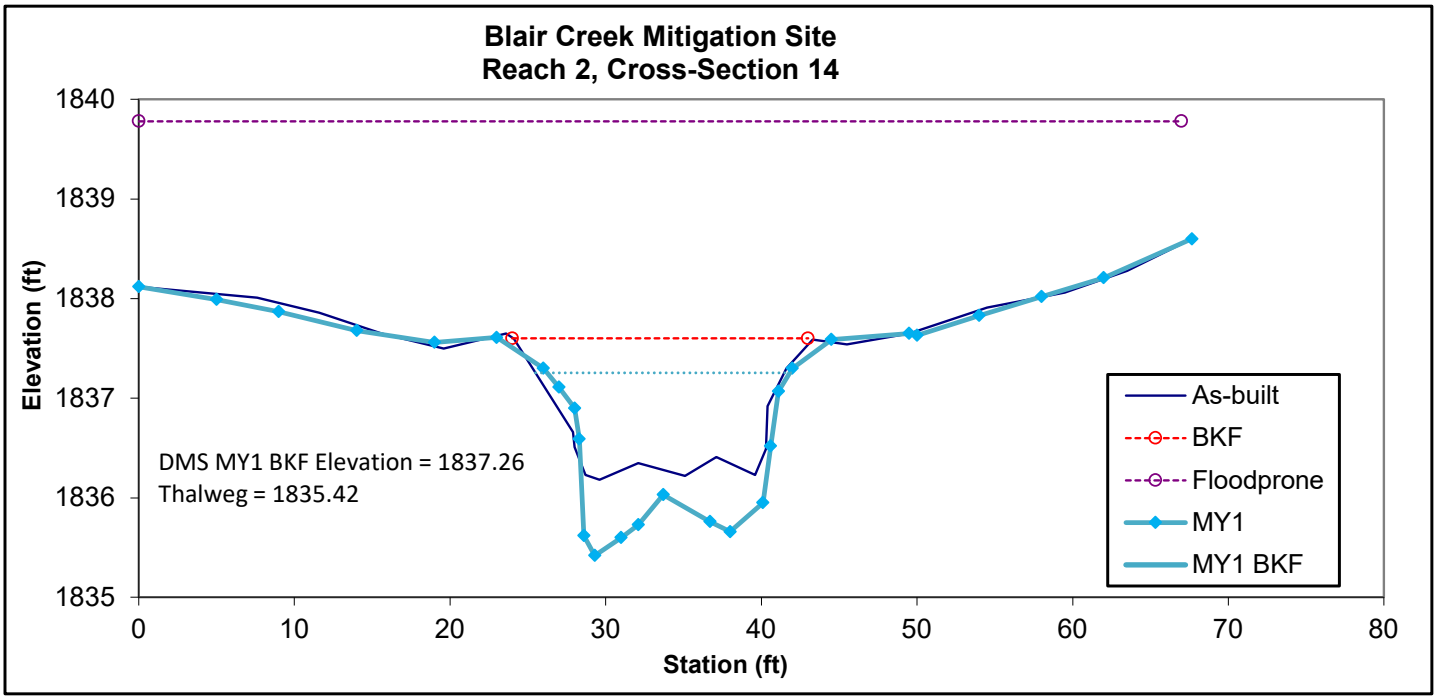
Year 1 Survey Collected: October 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	25.2	22.2	1.1	2.2	19.6	1.0	4.3	1837.60	1837.25



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

FIGURE 4. MY1 CROSS SECTIONS WITH ANNUAL OVERLAY

Permanent Cross-Section 15

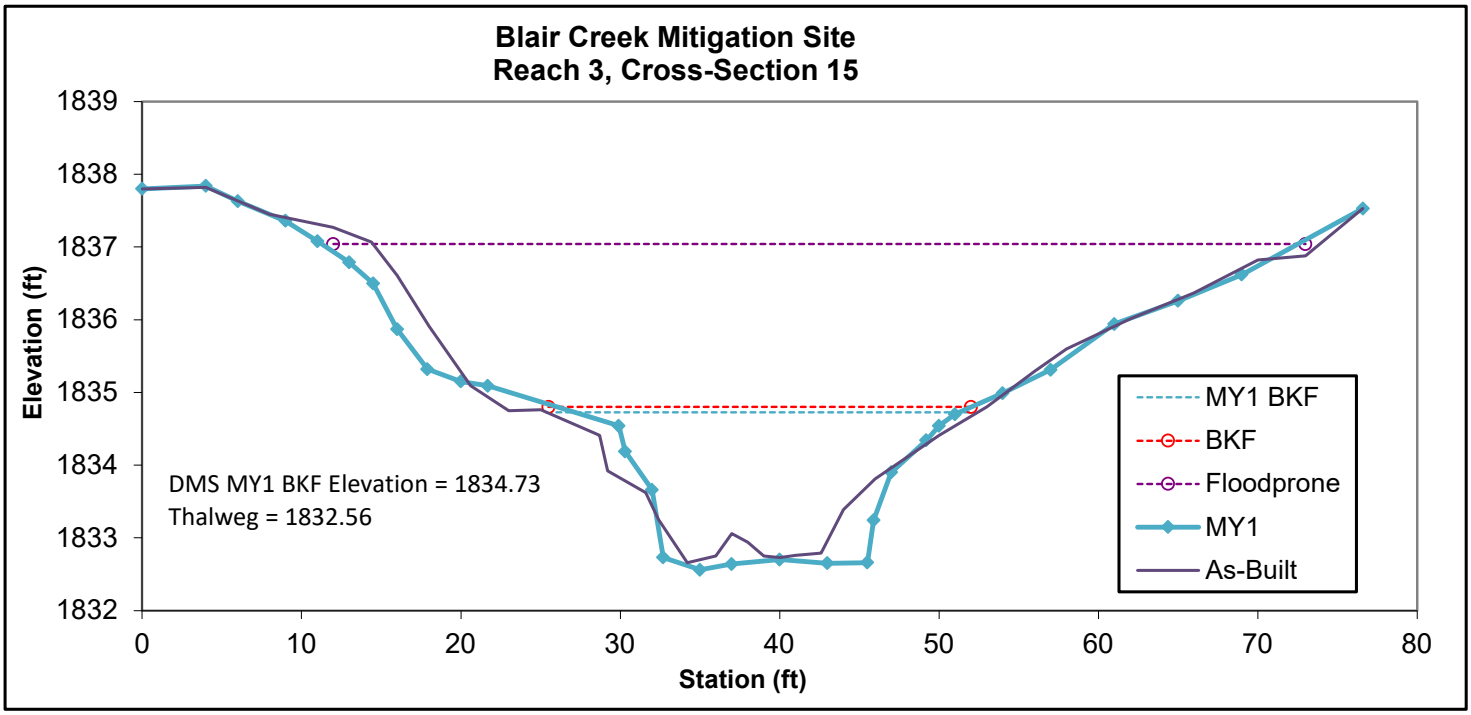
Year 1 Survey Collected: October 2022

Restoration

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	34.9	26.0	1.3	2.2	19.40	1	2.5	1834.8	1834.8



Note: Per DMS/IRT request, bank height ratio for MY1 has been calculated using the bankfull elevation as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Table 8. Baseline Stream Data Summary
Blair Creek Restoration Project: DMS Project No ID. 100047
Reach 1 (North Fork)

Parameter	Pre-Existing Condition			Reference Reach(es) Data			Design			As-built		
				Composite								
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	-----	8.57 - 8.59	-----	-----	-----	-----	-----	16.5 - 17.0	-----	16.48	16.60	17.2
Floodprone Width (ft)	-----	12.9 - 34.7	-----	-----	-----	-----	-----	60.00	-----	66.46	67.31	77
BF Mean Depth (ft)	-----	1.43 - 1.48	-----	-----	-----	-----	-----	1.1-1.2	-----	1.09	1.24	1.3
BF Max Depth (ft)	-----	2.77	-----	-----	-----	-----	-----	1.4 - 1.8	-----	1.55	1.84	2.1
BF Cross-sectional Area (ft^2)	-----	12.3 - 12.7	-----	-----	-----	-----	-----	18.2 - 20.4	-----	17.91	20.58	21.9
Width/Depth Ratio	-----	6.01 - 5.79	-----	10.00	12.50	15.00	-----	14.2 - 15	-----	11.95	12.58	15.1
Entrenchment Ratio	-----	1.5 - 4.05	-----	-----	-----	-----	-----	3.5-3.6	-----	3.93	4.04	4.5
Bank Height Ratio	-----	2.7 - 1.8	-----	1.00	1.05	1.10	-----	1.00	-----	1.00	1.00	1.0
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----
Pattern												
Channel Beltwidth (ft)	-----	N/A	-----	-----	----	-----	58-60	N/A	132-135	53	67	92.00
Radius of Curvature (ft)	-----	N/A	-----	-----	----	-----	33-34	N/A	50-51	33	45	61.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	2.00	2.5000	3.00	-----	2.0-3.0	-----	1.9	2.7	3.70
Meander Wavelength (ft)	-----	N/A	-----	-----	----	-----	115.00	N/A	235.00	134	163	229.00
Meander Width Ratio	-----	N/A	-----	3.50	5.7500	8.00	3.50	N/A	8.00	3.1	4.0	5.60
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.10	33.54	87.52
Riffle Slope (ft/ft)	0.0260	0.0345	0.0430	-----	-----	-----	0.006-0.007	0.0080	0.009-0.01	-0.018	0.011	0.09
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	11.00	42.00	70.00
Pool to Pool Spacing (ft)	35.00	57.50	80.00	-----	-----	-----	58	88.5	119	30.00	80.19	135.00
Pool Max Depth (ft)	1.14	1.9600	2.77	-----	-----	-----	1.8	3.0	4.2	0.00	0.00	5.04
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / Bo%	0% / 7% / 89% / 4% / 0%			-----	-----	-----	-----	-----	-----	0% / 1% / 83% / 16% / 0%		
d16 / d35 / d50 / d84 / d95	11 / 17 / 21 / 38 / 60			----	-----	-----	-----	-----	-----	16 / 28 / 37 / 64 / 127		
Additional Reach Parameters												
Drainage Area (SM)	-----	1.38 - 1.53	-----	-----	-----	-----	-----	1.38	---	-----	1.38	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Rosgen Classification	-----	B - E	-----	-----	C4	-----	-----	C4	-----	-----	C4	-----
BF Velocity (fps)	-----	3.15 - 3.20	-----	-----	5.0	5.0	-----	3.00	-----	-----	----	-----
BF Discharge (cfs)	-----	38.7 - 40.7	-----	-----	-----	-----	-----	61.85	-----	-----	----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2,280.00	-----
Channel Length (ft)	-----	2,399	-----	-----	-----	-----	-----	2,730	-----	-----	2,771.90	-----
Sinuosity	-----	1.06	-----	-----	-----	-----	-----	1.22	-----	-----	1.22	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Table 8. Baseline Stream Data Summary
Blair Creek Restoration Project: DMS Project No ID. 100047
Reach 2 (South Fork)

Parameter	Pre-Existing Condition			Reference Reach(es) Data			Design			As-built		
				Composite								
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	-----	9.82 - 11.26	-----	-----	-----	-----	-----	17.0	----	19.30	21.34	23.7
Floodprone Width (ft)	-----	25.66 - 26.55	-----	-----	-----	-----	-----	60	----	67.67	70.39	73.5
BF Mean Depth (ft)	-----	1.54 - 1.33	-----	-----	-----	-----	-----	1.2	----	0.89	0.94	1.0
BF Max Depth (ft)	-----	2.77	-----	-----	-----	-----	-----	1.4	----	1.42	1.73	2.1
BF Cross-sectional Area (ft^2)	-----	15.16 - 15.01	-----	-----	-----	-----	-----	20.4	----	18.86	19.76	21.1
Width/Depth Ratio	-----	6.38 - 8.47	-----	10.00	12.50	15.00	-----	14.2	----	19.69	23.05	26.6
Entrenchment Ratio	-----	2.61 - 2.36	-----	-----	-----	-----	-----	3.5	----	3.10	3.31	3.5
Bank Height Ratio	-----	1.96 - 1.54	-----	1.00	1.05	1.10	-----	1.1	----	1.00	1.00	1.0
d50 (mm)	-----	-----	----	-----	-----	-----	-----	-----	-----	-----		-----
Pattern												
Channel Beltwidth (ft)	-----	N/A	-----	-----	----	-----	65.00	-----	135	47.0	56	72.0
Radius of Curvature (ft)	-----	N/A	-----	-----	----	-----	34.00	-----	50	31.0	43	48.0
Rc/Bankfull width (ft/ft)	-----	N/A	-----	2.00	2.50	3.0	2.00	-----	2.9	1.8	3	2.8
Meander Wavelength (ft)	-----	N/A	-----	-----	----	-----	125.00	-----	235	129.0	149	174.0
Meander Width Ratio	-----	N/A	-----	3.50	5.75	8.0	3.80	-----	7.9	2.8	3	4.2
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.71	34.705	64.44
Riffle Slope (ft/ft)	0.026	0.035	0.043	-----	-----	-----	0.0075	0.0084	0.0093	-0.0460	0.0010	0.1070
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.00	37.00	70.00
Pool to Pool Spacing (ft)	35	58	80	-----	-----	-----	60.00	89.00	118.00	30.00	72.40	105.00
Pool Max Depth (ft)	1.1	2.0	2.8	----	-----	----	1.8000	3.00	4.2000	0.00	0.00	0.00
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / B%	0% / 1% / 91% / 8% / 0%			-----	-----	-----	-----	-----	-----	0% / 7% / 92% / 1% / 0%		
d16 / d35 / d50 / d84 / d95	13 / 18 / 23 / 42 / 131			-----	-----	-----	-----	-----	-----	7 / 13 / 18 / 40 / 55		
Additional Reach Parameters												
Drainage Area (SM)	-----	2.91	-----	-----	-----	-----	-----	1.53	-----	-----	----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Rosgen Classification	-----	F4	-----	-----	C4	-----	-----	C4	-----	-----	C4	-----
BF Velocity (fps)	-----	-----	-----	3.5	4.3	5.00	-----	3.00	-----	-----	----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	61.85	-----	-----	----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,310	-----
Channel Length (ft)	-----	185	-----	-----	-----	-----	-----	1,520	-----	-----	1,555	-----
Sinuosity	-----	1.07	-----	1.2	1.3	1.40	-----	1.14	-----	-----	1.1	-----
Water Surface Slope (Channel) (ft/ft)	-----		-----	-----	-----	-----	-----		-----	-----		-----

* The As-Built parameters shown here apply only to those surveyed sections of Reach UT4a where the channel was improved in its cross-section, profile, and in-stream structures.

Table 8. Baseline Stream Data Summary
Blair Creek Restoration Project: DMS Project No ID. 100047
Reach 3 Blair Creek, below confluence of North and South Fork.

Parameter	Pre-Existing Condition			Reference Reach(es) Data			Design			As-built		
				Composite								
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	-----	19.20	-----	-----	-----	-----	-----	22.50	----	-----	30.40	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	60.00	-----	-----	58.48	-----
BF Mean Depth (ft)	-----	1.33	-----	-----	-----	-----	-----		-----	-----	1.10	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	1.80	-----	-----	2.14	-----
BF Cross-sectional Area (ft²)	-----	25.6	-----	-----	-----	-----	-----	33.8	-----	-----	33.01	-----
Width/Depth Ratio	-----	14.44	-----	10.00	12.50	15.00	-----	15.00	-----	-----	27.80	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Bank Height Ratio	-----	2.00	-----	1.00	1.05	1.10	-----	-----	----	-----	----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pattern												
Channel Beltwidth (ft)	-----	N/A	-----	-----	----	-----	-----	N/A	-----	43.00	46.00	50.00
Radius of Curvature (ft)	-----	N/A	-----	-----	----	-----	-----	N/A	-----	33.00	40.00	46.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	2.00	2.50	3.00	-----	N/A	-----	1.40	1.60	1.90
Meander Wavelength (ft)	-----	N/A	-----	-----	----	-----	-----	N/A	-----	131.00	134.00	136.00
Meander Width Ratio	-----	N/A	-----	3.50	5.75	8.00	-----	N/A	-----	1.80	1.90	2.10
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pool Max Depth (ft)	-----	-----	-----	----	-----	----	2.2500	3.75	5.2500	-----	----	-----
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----				-----	-----	-----	-----	----	-----
Additional Reach Parameters												
Drainage Area (SM)	-----	2.91	-----	-----	-----	-----	-----	2.91	-----	-----	----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Rosgen Classification	-----	F4	-----	-----	C4	-----	-----	C4	-----	-----	C4	-----
BF Velocity (fps)	-----	-----	-----	3.50	4.25	5.00	-----	3.76	-----	-----	----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	128.00	-----	-----	----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Channel Length (ft)	-----	185	-----	-----	-----	-----	-----	185	-----	-----	133.6	-----
Sinuosity	-----	1.07	-----	1.20	1.30	1.40	-----	-----	-----	-----	1.09	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.02	-----

Table 8. Baseline Stream Data Summary
Blair Creek Restoration Project: DMS Project No ID. 100047
Reach UT1- *As Built data from pool XS

Parameter	Pre-Existing Condition			Reference Reach(es) Data Composite			Design			As-built		
Dimension and Substrate - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
BF Width (ft)	-----	-----	-----	-----	-----	-----	-----	7.25	----	-----	10.14	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	34.30	-----
BF Mean Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.81	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	1.00	-----	-----	1.53	-----
BF Cross-sectional Area (ft²)	-----	-----	-----	-----	-----	-----	-----	4.30	-----	-----	8.18	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	12.40	-----	-----	----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----		-----	-----	----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----		----	-----	----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pattern												
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	N/A	-----	15.00	17.00	18.00
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	N/A	-----	----	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	N/A	-----	3.20	3.50	3.80
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	N/A	-----	67.00	70.00	72.00
Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	N/A	-----	3.20	3.50	3.80
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pool to Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Pool Max Depth (ft)	-----	-----	-----	----	-----	----	-----	-----	-----	-----	----	-----
Substrate and Transport Parameters												
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----				-----	-----	-----	-----	----	-----
Additional Reach Parameters												
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Channel Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	173	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.02	-----

Table 9. Cross-Section Morphology Data Summary
Blair Creek Restoration Project: DMS Project No ID. 100047

Stream Reach	Reach 1																														
	Cross-section X-1 (Pool)							Cross-section X-2 (Riffle)							Cross-section X-3 (Pool)							Cross-section X-4 (Riffle)						
	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+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1848.21	1848.21						1848.06	1848.33						1847.87	1847.87						1846.31	1846.43					
Bank Height Ratio_Based on AB Bankfull[1] Area	--	--						1.00	1.00						--	--						1.00	1.10					
Thalweg Elevation	1845.23	1845.85						1845.95	1846.01						1844.24	1843.62						1844.76	1844.94					
LTOB[2] Elevation	1848.21	1848.21						1848.06	1848.14						1847.87	1847.88						1846.31	1846.51					
LTOB[2] Max Depth (ft)	2.98	2.40						2.11	2.00						3.63	4.25						1.60	1.40					
LTOB[2] Cross Sectional Area (ft^2)	25.48	22.60						20.85	16.70						38.37	34.27						17.90	16.00					

Stream Reach	Reach 1																														
	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (Riffle)							Cross-section X-8 (Pool)						
	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+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1845.28	1845.26						1842.09	1842.09						1839.27	1839.34						1837.35	1837.35					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						--	--						1.00	1.00						--	--					
Thalweg Elevation	1843.48	1843.20						1838.86	1838.71						1837.37	1837.43						1832.31	1832.33					
LTOB[2] Elevation	1845.28	1845.25						1842.09	1842.09						1839.27	1839.42						1837.35	1837.35					
LTOB[2] Max Depth (ft)	2.10	2.10						3.20	3.40						1.90	1.90						5.04	5.02					
LTOB[2] Cross Sectional Area (ft^2)	21.90	22.20						33.50	36.20						21.70	20.60						47.58	44.20					

Stream Reach	UT-1							Reach 2																							
	Cross-section X-9 (Pool)							Cross-section X-10 (Pool)							Cross-section X-11 (Riffle)							Cross-section X-12 (Pool)						
	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+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1845.99	1845.99						1843.54	1843.54						1841.94	1842.30						1839.98	1839.98					
Bank Height Ratio_Based on AB Bankfull[1] Area	--	--						--	--						1.00	1.00						--	--					
Thalweg Elevation	1844.76	1843.85						1839.97	1839.88						1839.88	1840.46						1836.55	1836.85					
LTOB[2] Elevation	1845.99	1846.25						1843.54	1843.54						1841.94	1842.23						1839.88	1839.98					
LTOB[2] Max Depth (ft)	1.20	2.10						3.57	3.66						2.06	1.50						3.43	3.13					
LTOB[2] Cross Sectional Area (ft^2)	5.60	4.80						36.81	33.46						23.70	14.10						36.69	27.28					

Stream Reach	Reach 2														Reach 3						
	Cross-section X-13 (Riffle)							Cross-section X-14 (Riffle)							Cross-section X-15 (Riffle)						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	1838.84	1839.07						1837.60	1837.26						1834.80	1834.73					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.90						1.00	1.00						1.00	1.00					
Thalweg Elevation	1837.14	1837.54						1836.18	1835.42						1832.66	1832.56					
LTOB[2] Elevation	1838.84	1838.92						1837.60	1837.25						1834.80	1834.80					
LTOB[2] Max Depth (ft)	1.70	1.30						1.40	2.20						2.14	2.20					
LTOB[2] Cross Sectional Area (ft^2)	21.13	16.00						18.90	25.20						33.01	34.90					

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 decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

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:

1 - **Bank Height Ratio (BHR)** takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.

2 - **LTOB Area and Max depth -** These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

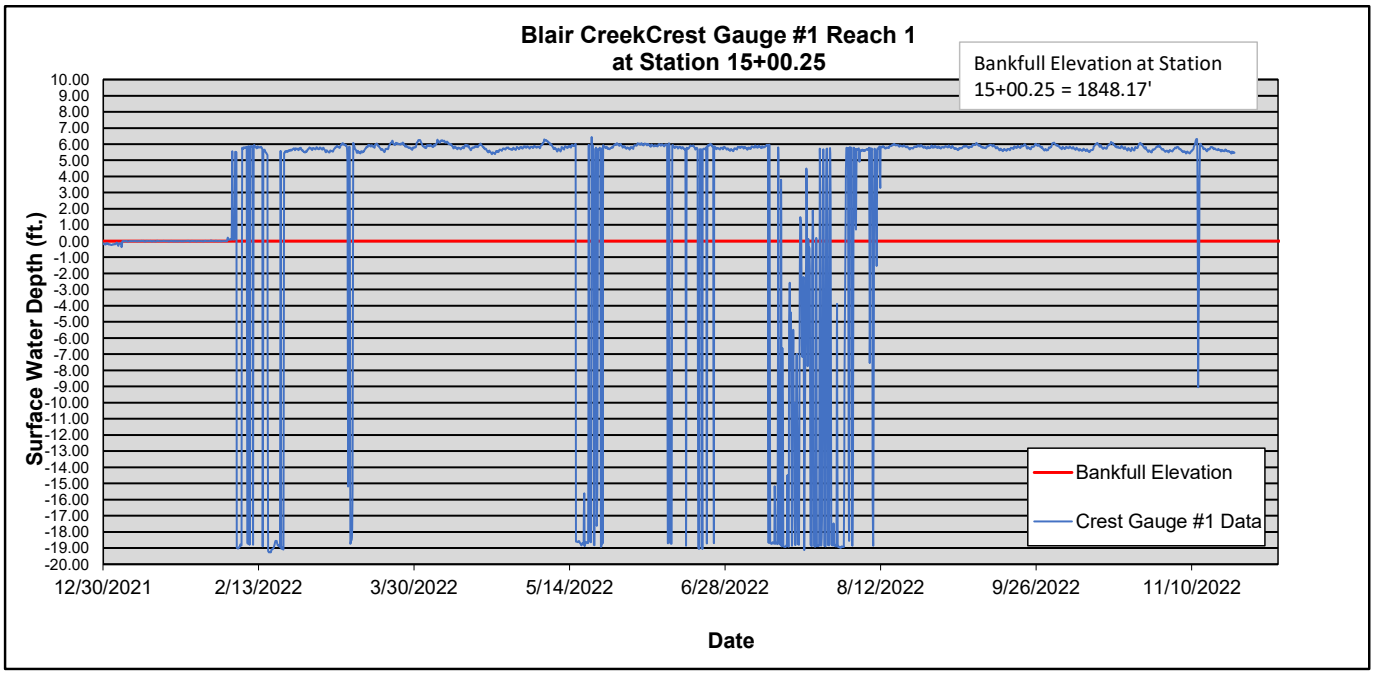
APPENDIX E

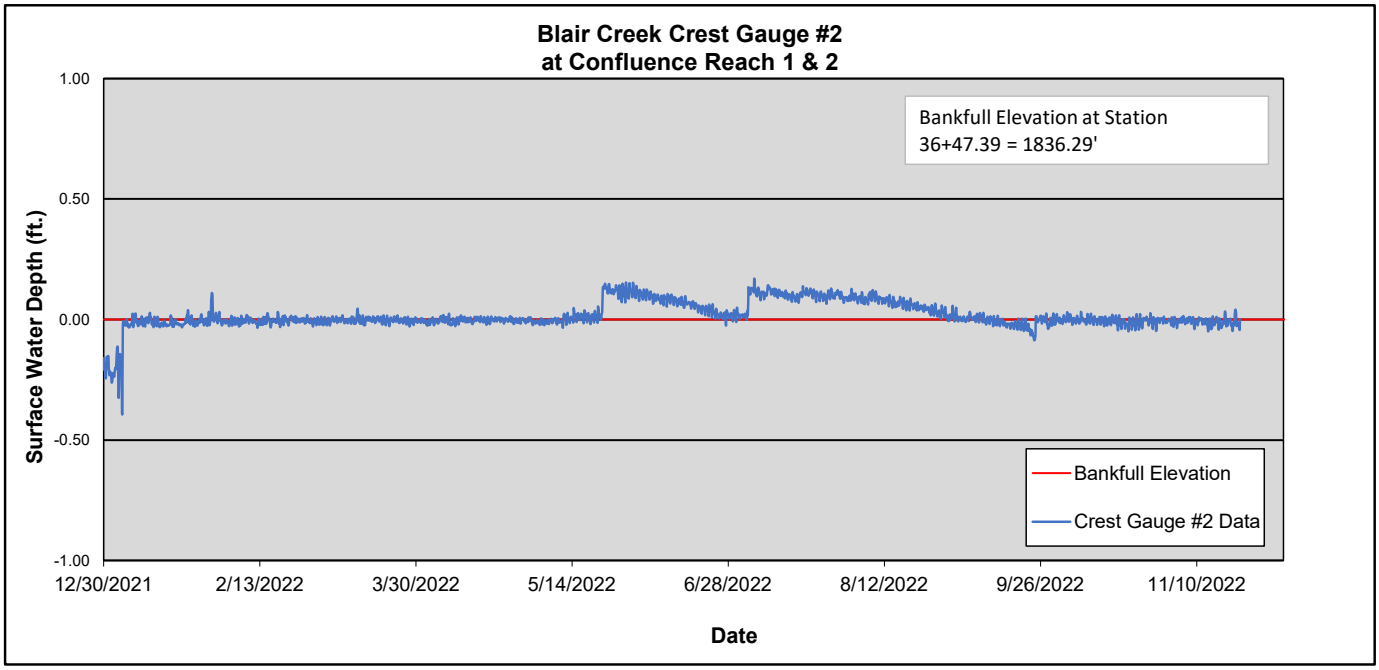
Hydrologic Data

Table 10. Verification of Bankfull Events
Blair Creek Mitigation Project - NCDMS Project No. 100047

Date of Data Collection	Reach 1 Lower Right Floodplain	Crest Gauge 3. Reach 2, Left Floodplain	Estimated Date of Bankfull Event Occurrence	Method of Data Collection
Year 1 Monitoring (2022)				
7/1/2022	Photographic Evidence on right floodplain of Lower R1 and Left floodplain of R2 at Crest Gauge 3.		3/13/2022	Photographic Evidence
11/22/2022		Photographic Evidence on floodplain and Continuous Logger Data	3/13/2022 & 8/7/2022	Photographic Evidence & Continuous Logger

Note: Crest gauge readings were corroborated with associated spikes in the automated Continuous Stage Recorder (see graph in Below) and/or with photographs (Appendix B).




Blair Creek Crest Gauge #2
at Confluence Reach 1 & 2
Bankfull Elevation at Station
36+47.39 = 1836.29'
Surface Water Depth (ft.)
1.00
0.50
0.00
-0.50
-1.00
12/30/2021
2/13/2022
3/30/2022
5/14/2022
6/28/2022
8/12/2022
9/26/2022
11/10/2022
Date
Bankfull Elevation
Crest Gauge #2 Data

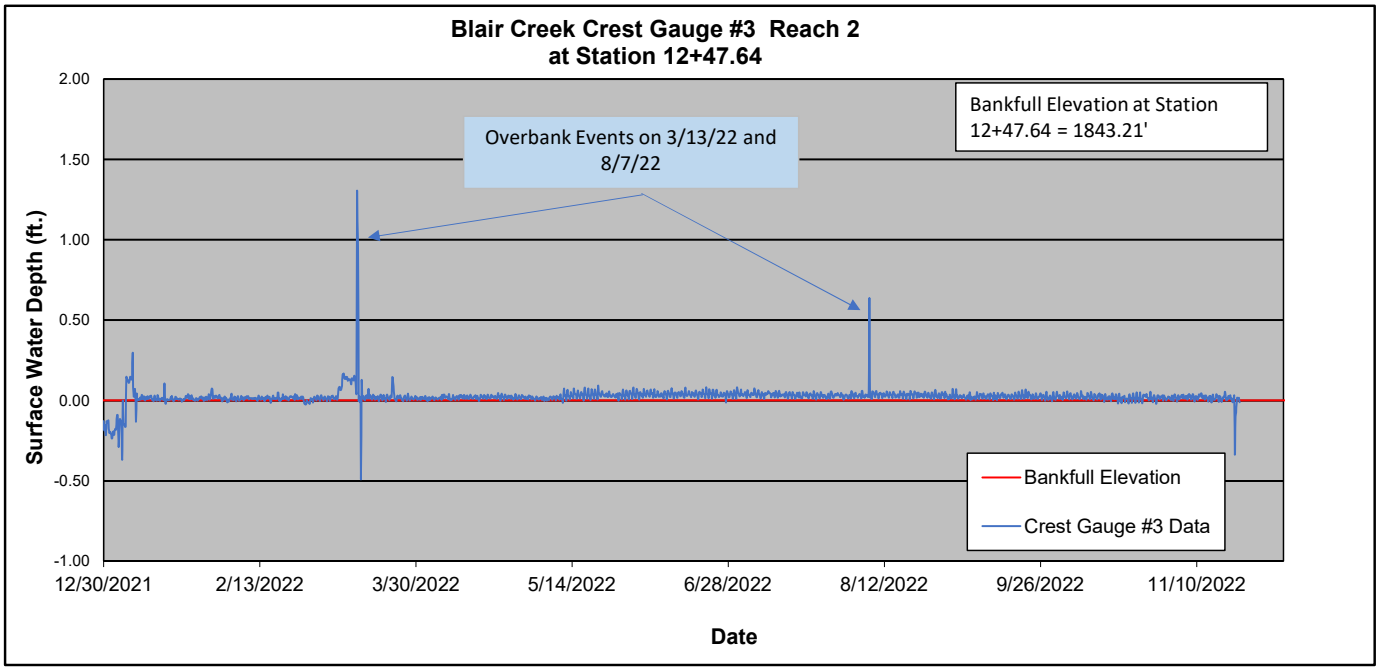

Blair Creek Crest Gauge #3 Reach 2
at Station 12+47.64
Bankfull Elevation at Station
12+47.64 = 1843.21'
Overbank Events on 3/13/22 and
8/7/22
Surface Water Depth (ft.)
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
12/30/2021
2/13/2022
3/30/2022
5/14/2022
6/28/2022
8/12/2022
9/26/2022
11/10/2022
Date
Bankfull Elevation
Crest Gauge #3 Data

Figure 5. Wetland Monitoring Well Graphs

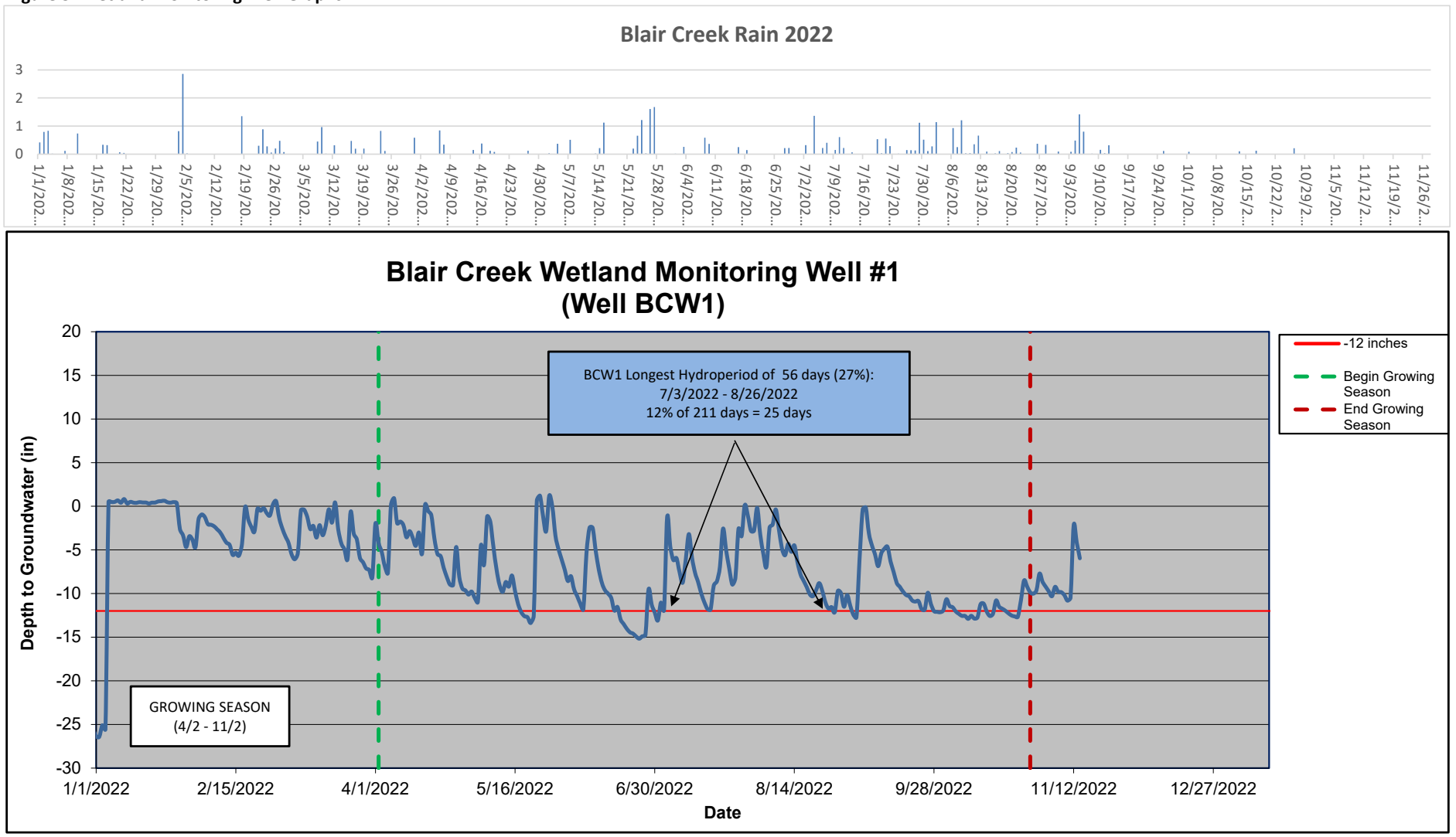


Figure 5. Wetland Monitoring Well Graphs

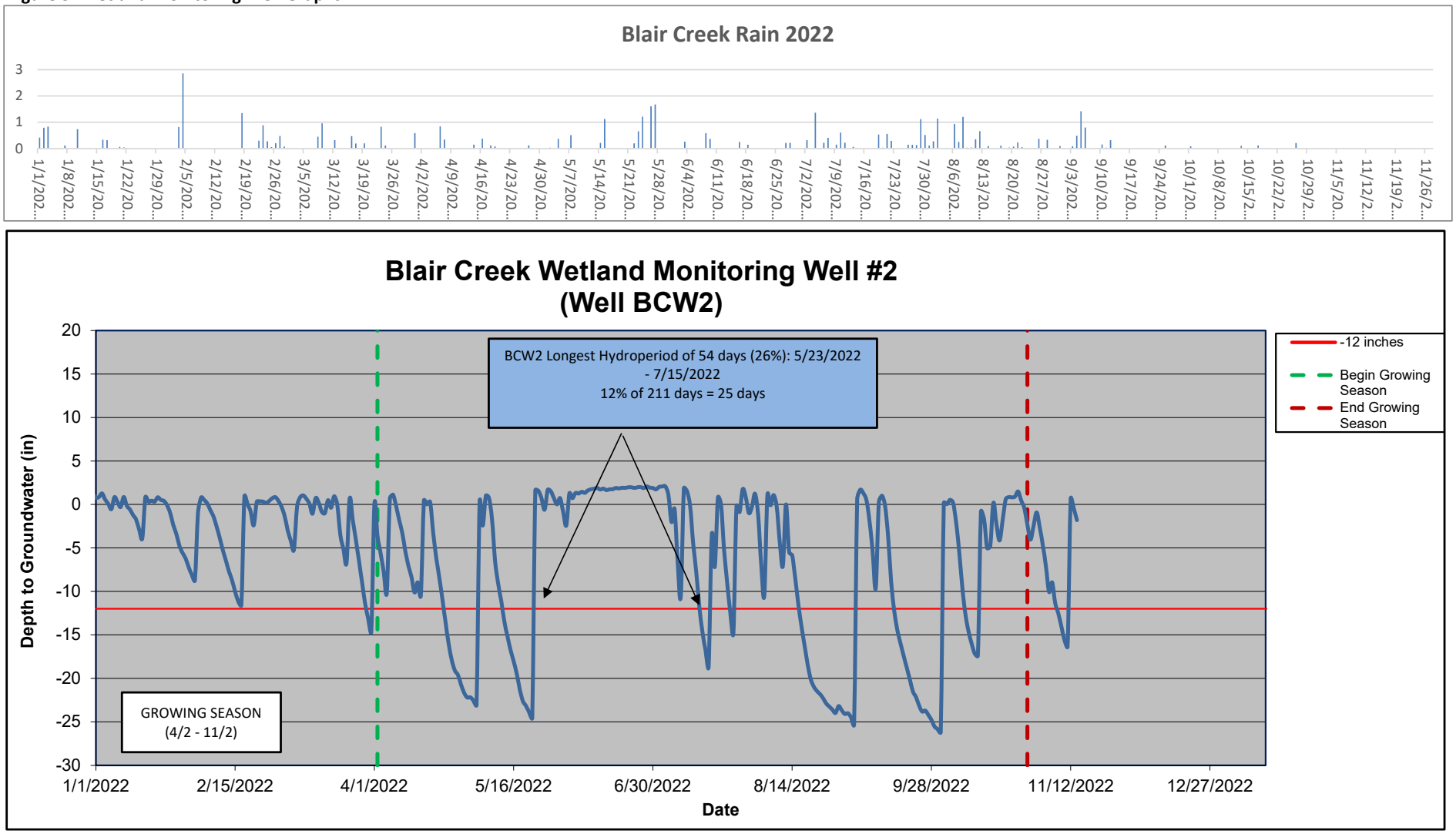


Figure 5. Wetland Monitoring Well Graphs

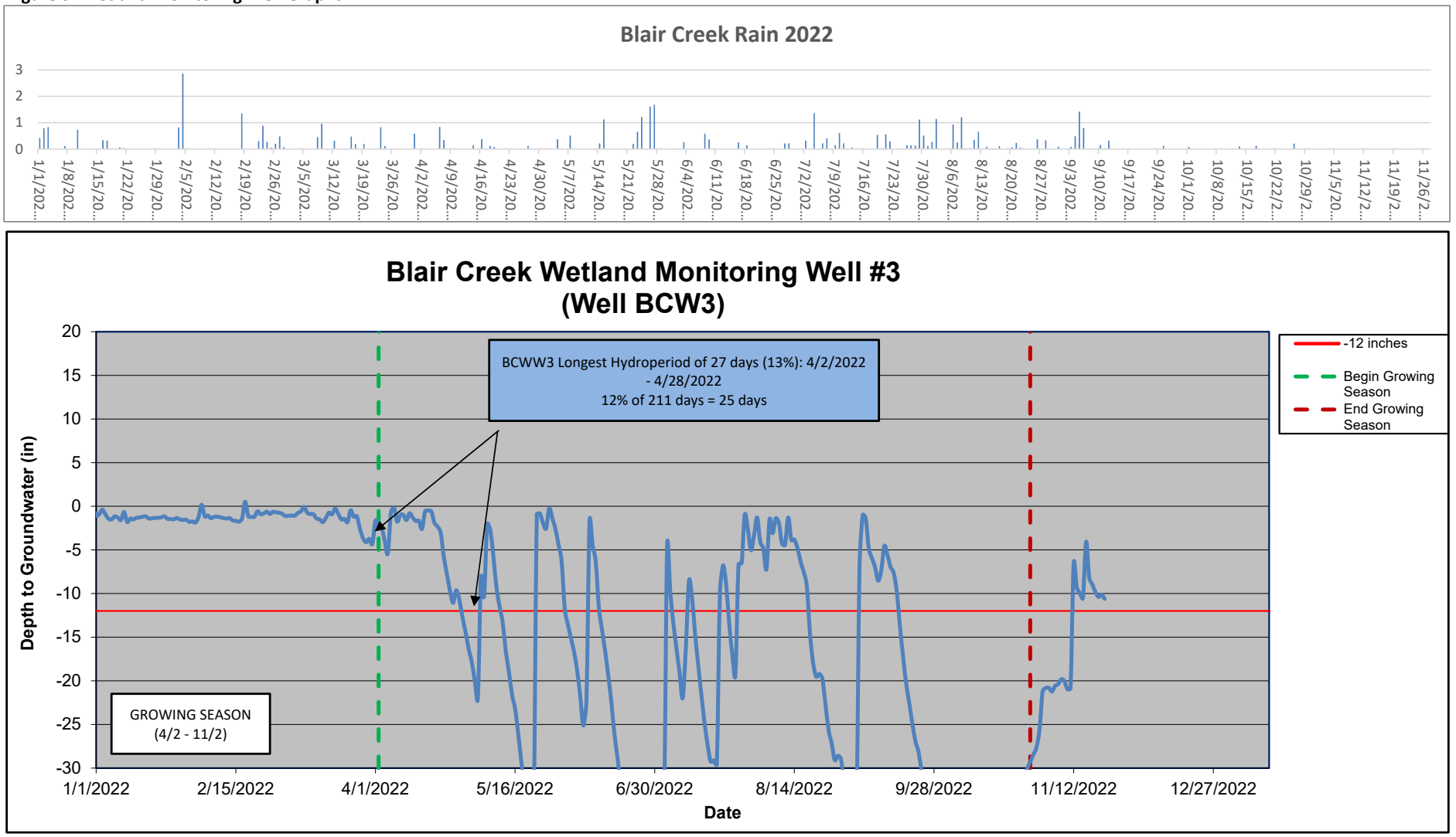
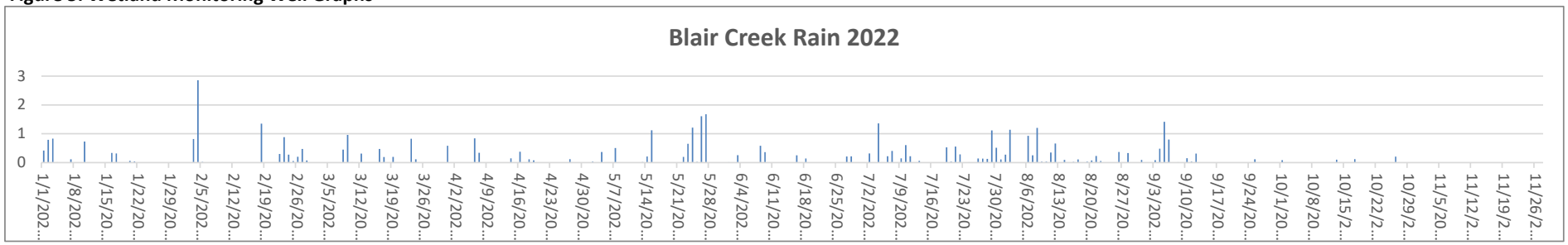


Figure 5. Wetland Monitoring Well Graphs



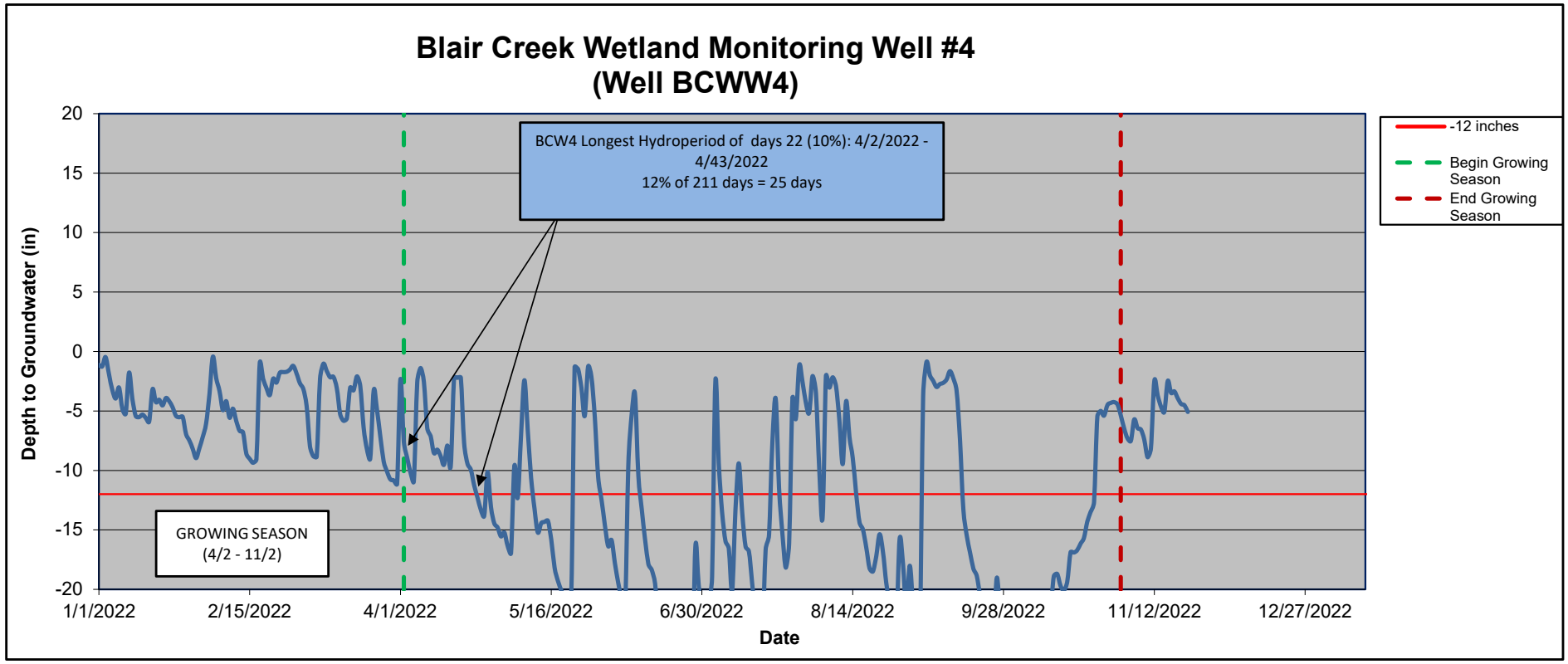


Figure 5. Wetland Monitoring Well Graphs

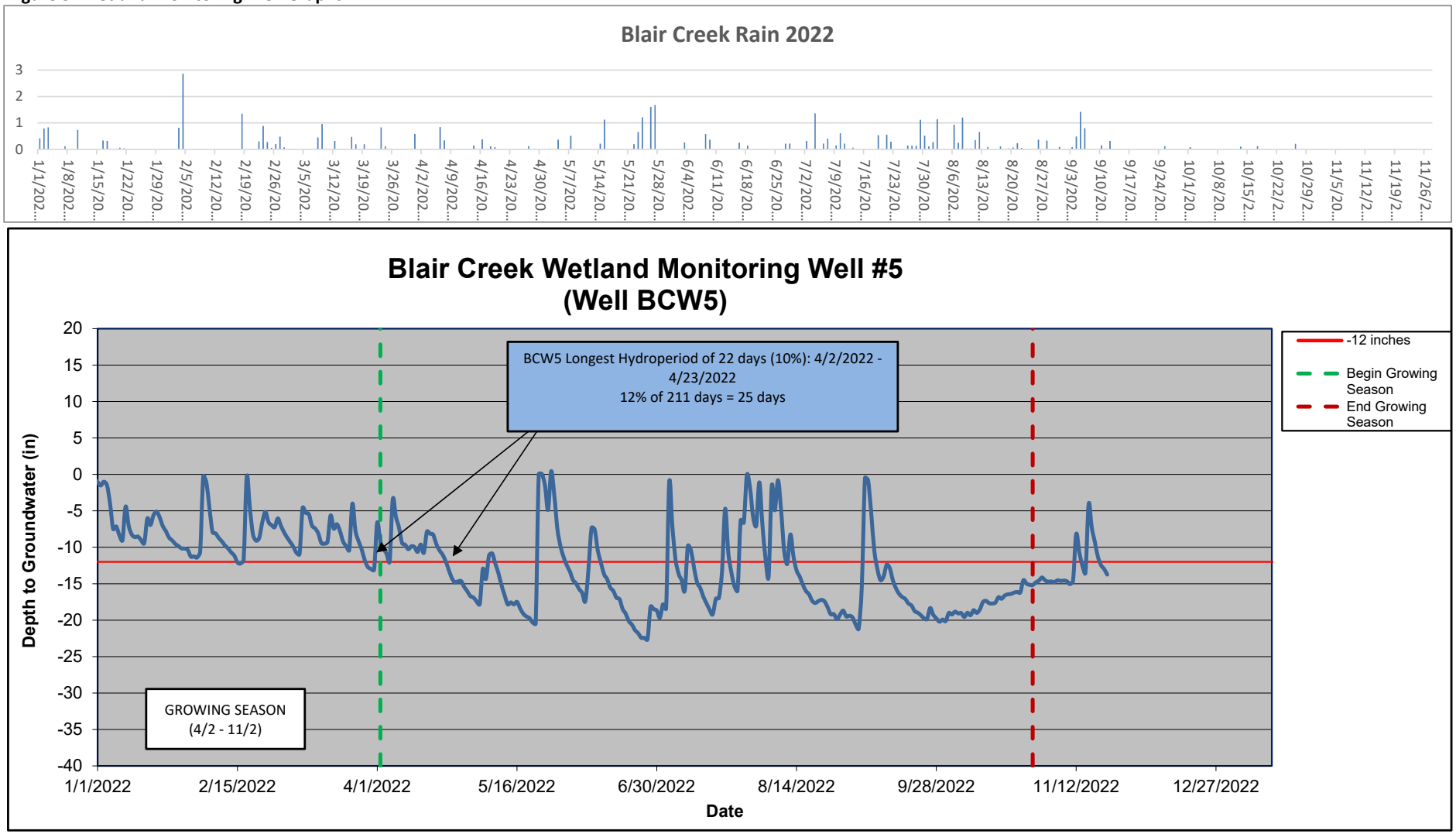


Figure 5. Wetland Monitoring Well Graphs

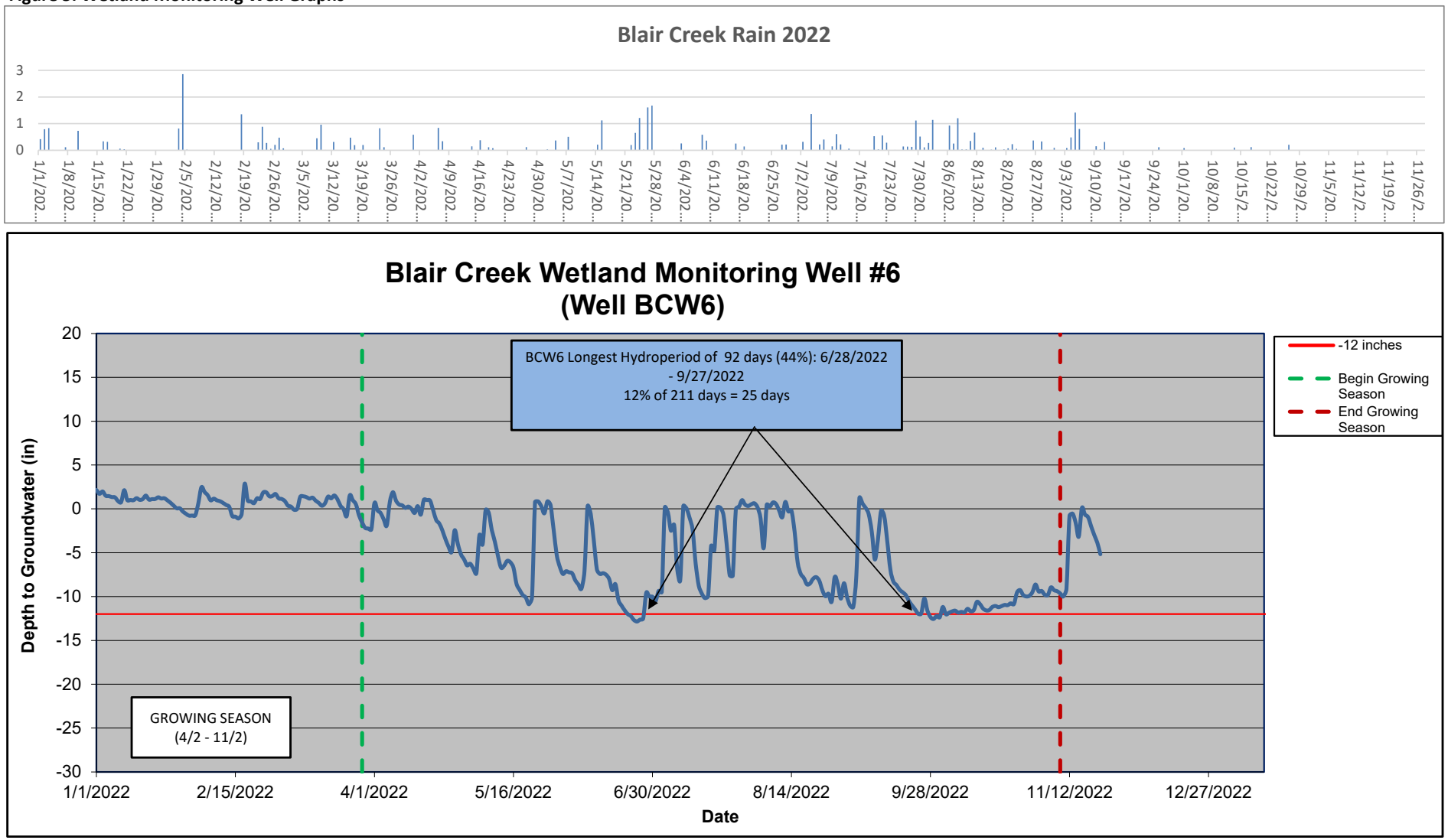


Figure 5. Wetland Monitoring Well Graphs

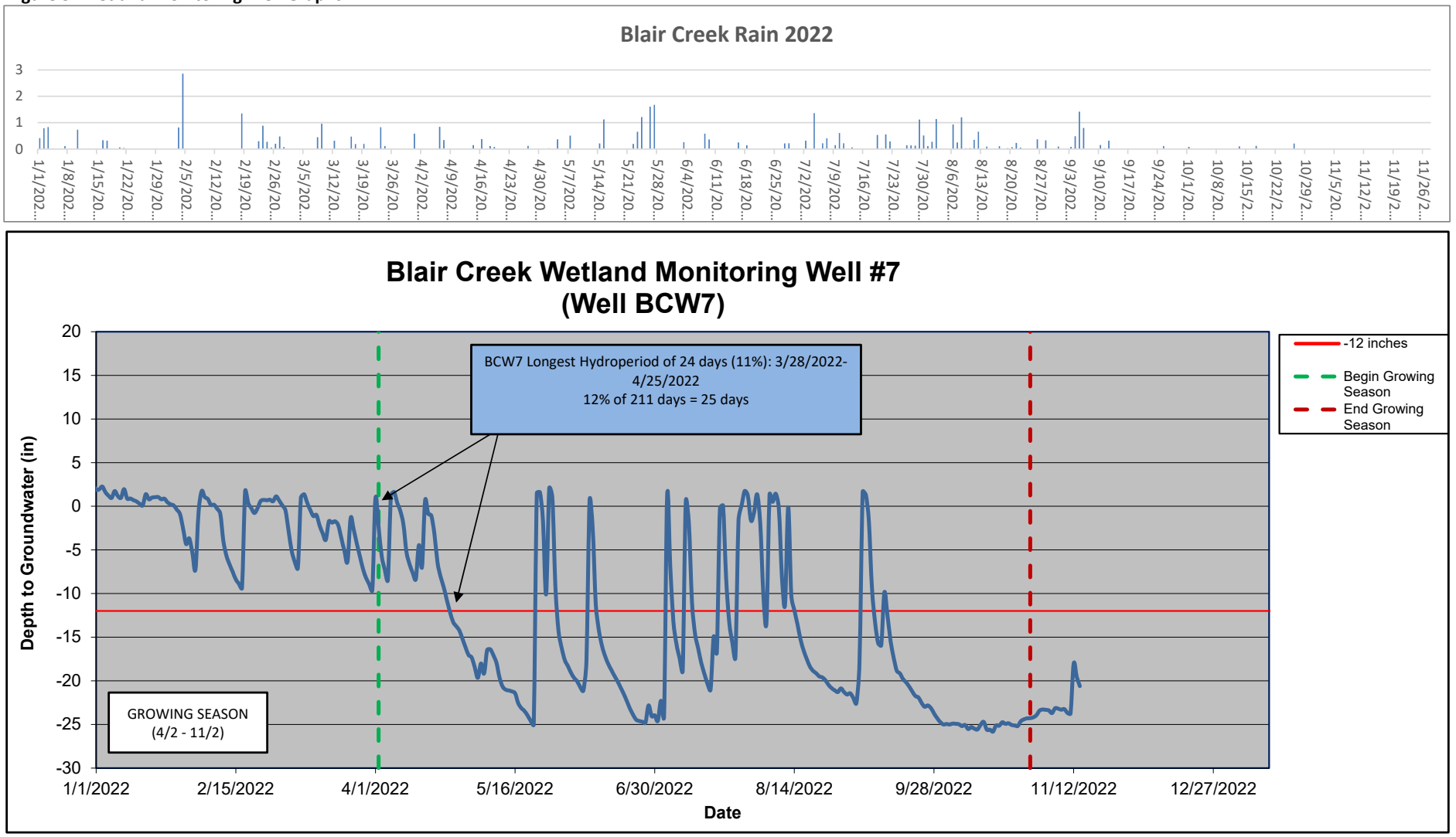


Figure 5. Wetland Monitoring Well Graphs

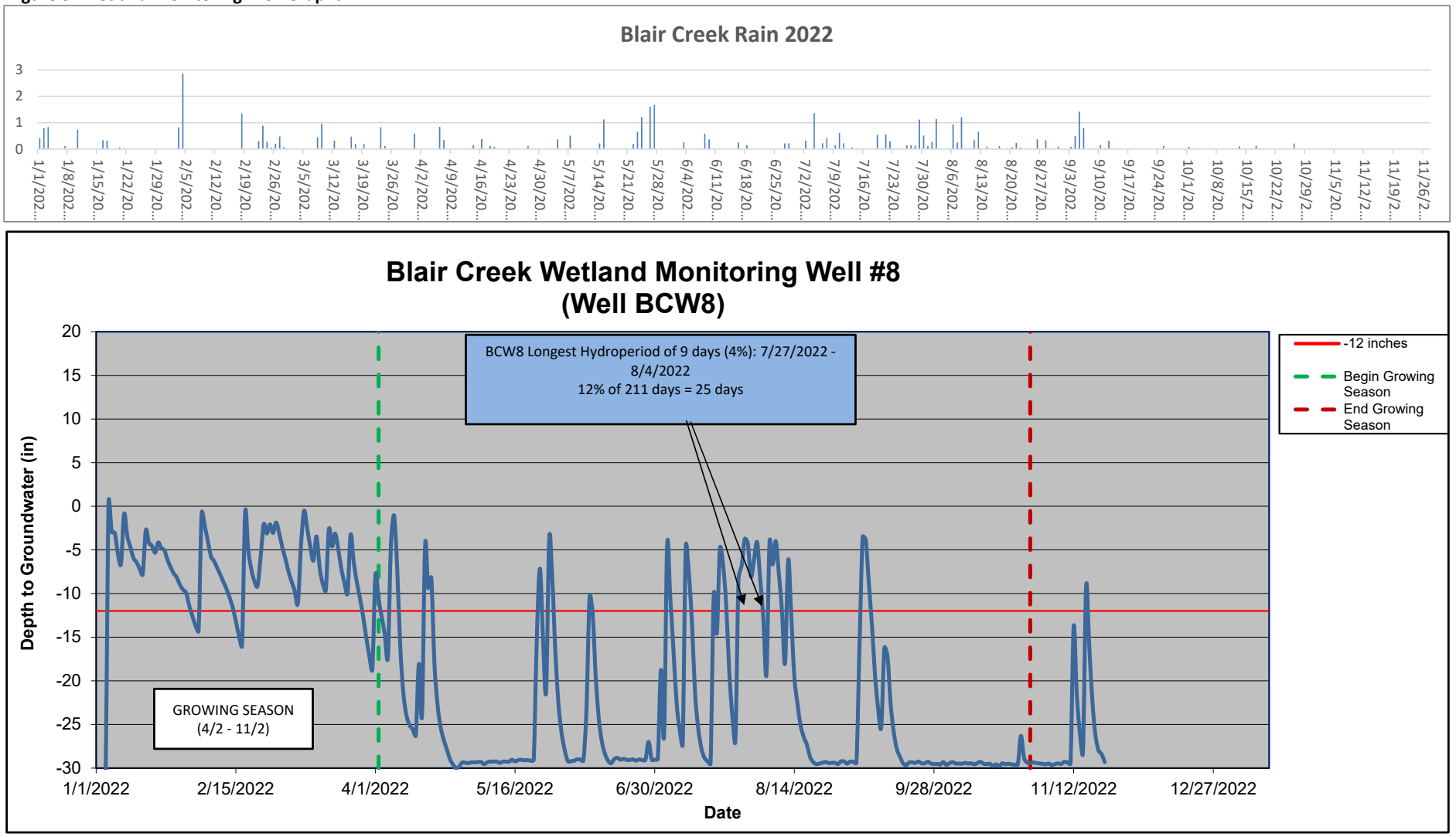


Figure 5. Wetland Monitoring Well Graphs

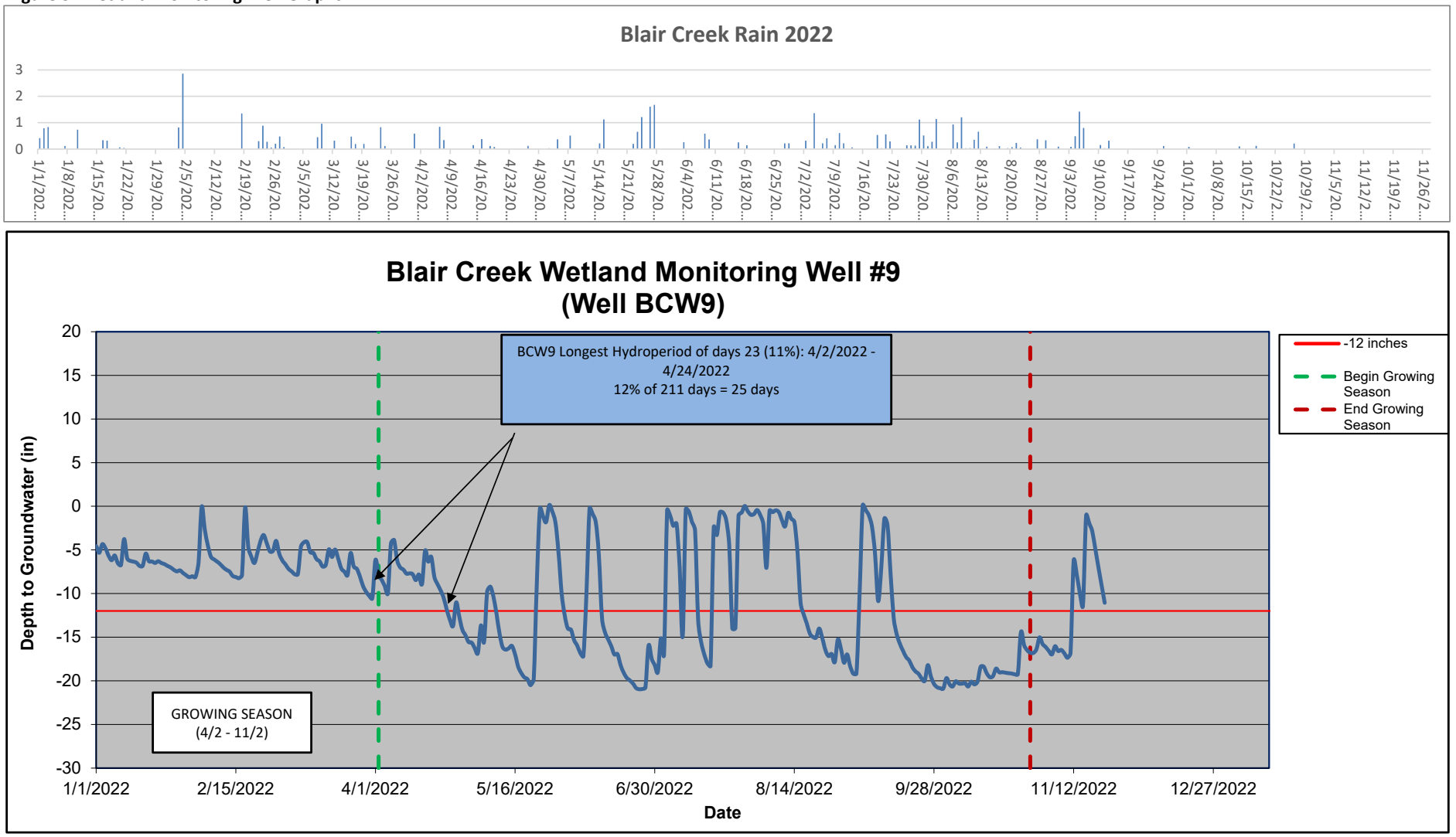


Figure 5. Wetland Monitoring Well Graphs

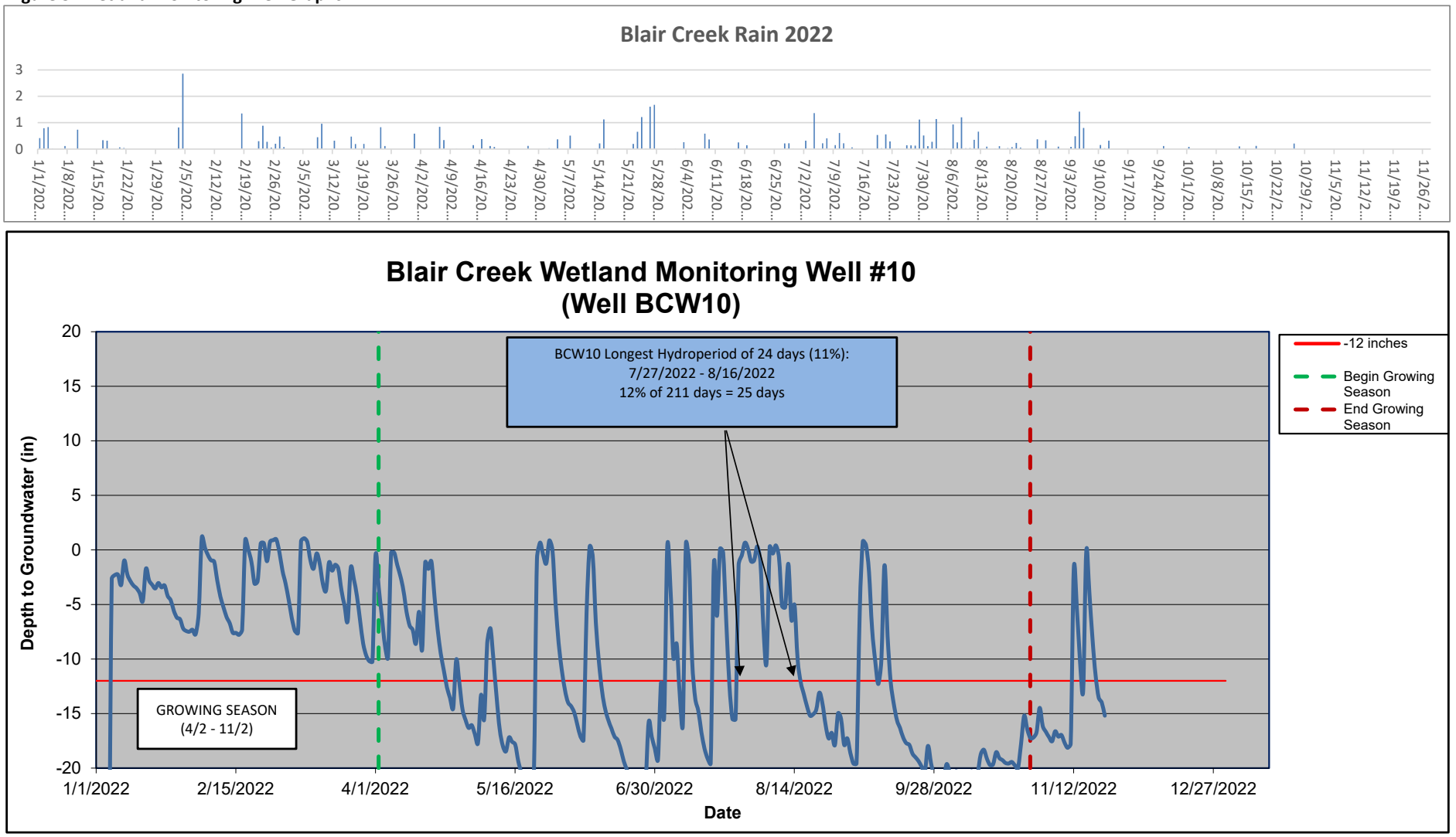
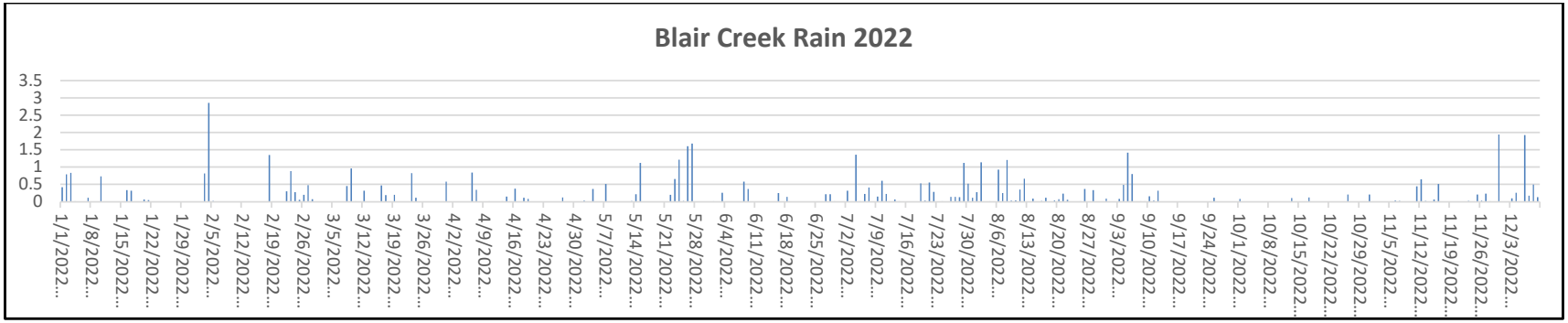


Table 11. Wetland Hydrology Summary Data
Blair Creek Stream Mitigation Project - NCDMS Project No. 100047

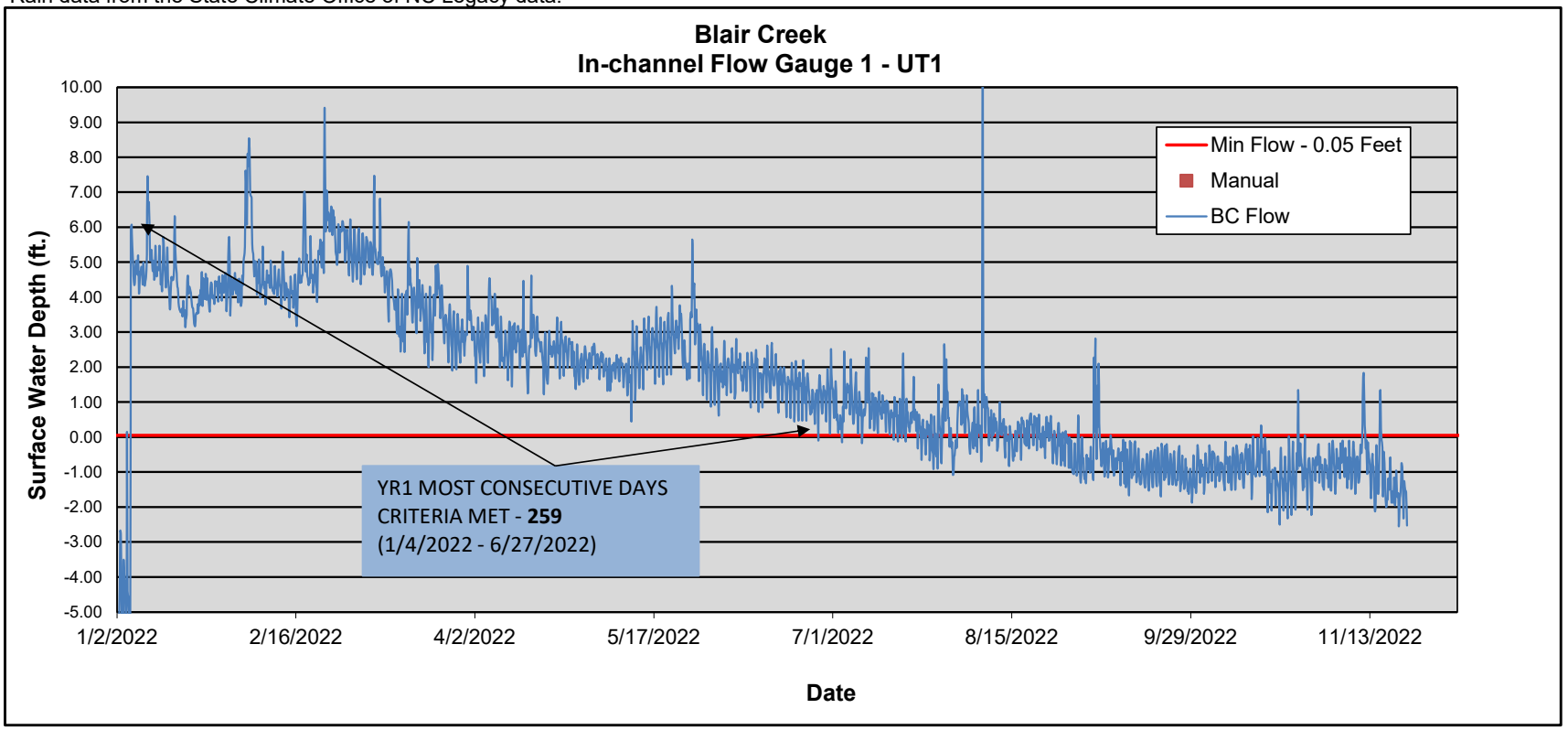
Well ID	Percentage of Consecutive Days <12 inches from Ground Surface[1]							Most Consecutive Days Meeting Criteria[2]							Percentage of Cumulative Days <12 inches from Ground Surface							Cumulative Days Meeting Criteria[3]						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 8 (2028)	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 8 (2028)	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 8 (2028)	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 8 (2028)
Wetland Monitoring Wells (Installed December 2021)																												
BCW1	27.0							56							82.0							172						
BCW2	26.0							54							68.0							144						
BCW3	13.0							27							43.0							90						
BCW4	10.0							22							38.0							80						
BCW5	10.0							22							30.0							63						
BCW6	44.0							92							47.0							199						
BCW7	11.0							24							30.0							63						
BCW8	4.0							9							17.0							35						
BCW9	11.0							23							41.0							87						
BCW10	11.0							24							38.0							81						

[1]Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
[2]Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surfa
[3]Indicates the total number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
Growing season for Clay County is from April 2 to October 29 and is **211** days long. 12% of the growing season is **25** days.

Figure 6: Flow Gauge Graphs



Rain data from the State Climate Office of NC Legacy data.



*Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Table 12. All Years Flow Gauge Success
Blair Creek Mitigation Project - NCDMS Project No. 100047

Flow Gauge ID	Most Consecutive Days Meeting Criteria[1]							Cumulative Days Meeting Criteria[2]						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
Flow Gauges (Installed January, 2022)														
BC Flow 1	259.0							315.0						

Notes:

[1]Indicates the number of consecutive days within the monitoring year where flow was measured.

[2]Indicates the number of cumulative days within the monitoring year where flow was measured.

Success criteria will include 30 days of consecutive baseflow for monitoring gauges during a normal rainfall year.

Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 7. Observed Rainfall vs. Historical Average