FINAL
MY2 (2023) MONITORING REPORT

PHANTOM MILL
Alamance County, North Carolina
Cape Fear River Basin
Cataloging Unit 03030002

DMS Project No. 100057
Full Delivery Contract No. 7526
DMS RFP No. 16-007330
USACE Action ID No. SAW-2018-01166
DWR Project No. 18-0796

Data Collection: January 2023-October 2023
Submission: January 2024

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
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Response to DMS Comments – MY 2 (2023) Report
Phantom Mill Mitigation Site – Alamance County
DMS Project No. 100057, Full Delivery Contract No. 7526, DMS RFP No. 16-007330
USACE Action ID No. SAW-2018-01166, DWR Project No. 18-0796

Comments Received (Black Text) & Responses (Blue Text)

Report Document:

1. Appendix A, Table 5 (visual assessment): Does RS believe 7.333 acres of the planted area are still low in stem density? Please review and update. If applicable, please provide a shapefile for any areas that are still low in stem density.
   Response: Based on MY2 (2023) data, RS does believe the upland areas of UT3 should be considered a "Low Stem Density Area." We have also included a portion of Cane Creek floodplain where herbaceous overtopping was observed during the dormant season of 2023/2024. Table 5 and the CCPV were updated, and a 2023 "Low Stem Density Area" shapefile was added to the digital submittal. The "Low Stem Density Area" is 2.746 Acres, down from the 7.333 acres stated in the MY1 (2022) Monitoring Report.

   Given the MY 2 (2023) vegetation survey data associated with UT3 (vegetation plots 7, 8, and 9) RS was able to plant ~245, 1 and 3-gallon containerized trees within the Low Stem Density Area of UT3. Species included River birch, Ironwood, Persimmon, Tulip poplar, Black gum, Sycamore, White oak, Water oak, Willow oak, and Red oak. The planting effort was completed on December 22, 2023, and no stems were planted within the vegetation plots. RS will conduct random vegetation transects along UT3 in the Spring of 2024 to better understand the extent of the Low Stem Density Area. A brief narrative, including a list of the planted stems, was added to the vegetation summary in Section 2.1 of the report.

2. Pg. 8, Section 2.1, Stream Summary: Is any supplemental planting (bare root or live-stake) proposed for areas disturbed by the stream repair on UT2? Please describe in the narrative.
   Response: ~5, 1 and 3-gallon containerized trees were planted within the footprint of the UT2 repair. Species included Water oak, Willow oak, Sycamore, and River birch.

   RS will also plant live stakes along the repaired portion of UT2, species will include Black willow and Silky dogwood. This work is scheduled for mid to late February 2024.

   This information was added to the stream summary narrative in Section 2.1.

3. Pg 9, Section 2.1, Vegetation Summary: A large portion of the site was replanted in early 2023, yet 3 vegetation plots around UT3 are not meeting success criteria. Is the low stem density of these plot indicative of the surrounding area? Please discuss causes for failure of these plots to meet criteria and any additional remedial actions.
   Response: Based on an in-field survey of the area post-MY2 data collection, CVS plots 7, 8, and 9 represented the surrounding area. Compacted/low nutrient-rich soils resulted in poor vigor of planted stems. On December 22, 2023, RS was able to plant ~245 mitigation plan-approved containerized species within the area surrounding UT3. RS will conduct random vegetation transects in this area during the Spring of 2024 to better understand the planted stem density of the area. If data indicates additional remedial actions are required, we will coordinate with DMS and the IRT.

4. Appendix B, Table 8: Please add a title to the tables and remove the mowing date. Shumard's oak, swamp chestnut oak, and southern arrowwood should be displayed in the Post Mitigation Plan Species section with regular font. These species were not in the approved mitigation plan but were approved in a previous monitoring year with a mitigation plan addendum. Please review and update.
   Response: Appendix B, Table 8 has been updated by adding a title, removing the mowing date, and moving the specified species to the "post mitigation plan species" row.

5. Appendix D, Surface Water Gauge Graphs: For clarity, please include a line on the graphs where bankfull is located.
   Response: Top of bank lines have been added to all surface water gauge graphs in Appendix D.

6. Appendix D, Figure D1 Rainfall: Please update rainfall data through November and December.
   Response: Appendix D, Figure D1 has been updated through November and December.

7. Appendix D, Evidence of Headwater Channel Formation: It's great that UT-2, UT-3, and UT-4 appear to have most of the channel forming indicators, but only photos were provided for flow. Please update with additional photos and/or provide photographs for each indicator in future reports.
   Response: The channel forming indicators were observed and noted in accordance with IRT guidance, however, we do not have individual photos for each channel forming indicator this year. In very small stream channels like these, it is difficult to photo-document channel forming factors individually. We will make our best effort to better document channel forming indicators in future reports.

8. Appendix F, Photo Log: Please include photos of the piping/headcut area on UT2 before maintenance was completed.
   Response: Unfortunately, RS does not have any high-quality photos of the piping/headcut area on UT2 given the dense herbaceous vegetation. Two photos taken August 3rd were added to the 2023(MY2) Photo Log.

Phantom Mill -- Year 2 (2023) Monitoring Summary

General Notes

- No encroachment was documented during Year 2.
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver, etc.) was observed.

Site Maintenance Report (2023)

Invasive Species Work	Maintenance work
05/15/2023 Russian Olive, Nodding Thistle, Microstegium, Multiflora rose 9/14/2023 Chinese Privet, Autumn Olive, Multiflora rose	01/20/2023 Supplemental planting of approximately 7.33 acres of the Site (Figure 1, Appendix A) 6/23/2023 Removed an old fence within the easement 10/24/2023 Small area of piping (~20 linear feet) on UT2 was stabilized using matting and onsite rock. Additional signs added to gas pipeline. 12/22/2023 250 1 and 3-gallon containerized trees within the Low Stem Density Area of UT3 and repair area of UT2. Species included River birch, Ironwood, Persimmon, Tulip poplar, Black gum, Sycamore, White oak, Water oak, Willow oak, and Red oak.

Streams

- All stream restoration reaches were stable and exhibited no signs of erosion, all structures were stable (Appendix C).
- One stream area of concern was observed within the Enhancement II reach of UT2 and repaired during Year 2 (2023) monitoring. At the bottom of UT2, approximately 11 linear feet of the stream was found to be unstable due to piping (Figure 1, Appendix A). To arrest head cut formation, the area was stabilized with matting and rock found onsite piled outside the easement. The IRT was notified of the maintenance work, which was performed on October 24, 2023. Email correspondence and photos of the repair are in Appendix F. This area will continue to be monitored closely in years 3-7.
- Two bankfull events were documented during the Year 2 (2023) monitoring period (Table 11, Appendix D).
- All Site tributaries showed evidence of channel formation during the Year 2 (2023) monitoring period (Tables 13A-C, Appendix D).

Vegetation

- Measurements of all 12 permanent plots and 3 temporary plots resulted in an average of 431 planted stems/acre, with an average of 5 species per plot. Additionally, 12 of the 15 individual plots met success criteria during Year 2 (Appendix B).
- Due to the high rate of planted stem mortality during year 1 (2022), RS conducted a supplemental replant within 7.33 acres of the Site's original 12.5 acres of bare-root planting on January 20, 2023. The supplemental planting plan is detailed in Section 2.1.

Wetlands

- All seven groundwater gauges met success criteria for the Year 2 (2023) monitoring period (Appendix D).

Summary of Monitoring Period/Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	12 Percent of Monitoring Period
2022 (Year 1)	March 1, 2022	March 1-October 22 (236 days)	28 days
2023 (Year 2)	March 1, 2023*	March 1-October 22 (236 days)	28 days

*Based on observed/documented bud burst on the Site on February 28, 2023, and soil temperature of 49.16 ºF documented March 1, 2023.

Summary of Monitoring Period/Hydrology Success Criteria by Year

Gauge	12% Hydroperiod Success Criteria Achieved Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
1	Yes 106 days (44.9%)	Yes 109 days (46.2%)					
2	Yes 117 days (49.6%)	Yes 144 days (61.0%)					
3	Yes 111 days (47.0%)	Yes 138 days (58.5%)					
4	Yes 115 days (48.7%)	Yes 142 days (60.2%)					
5	Yes 79 days (33.5%)	Yes 72 days (30.5%)					
6	Yes 93 days (39.4%)	Yes 143 days (60.6%)					
7	Yes 98 days (41.5%)	Yes 105 days (44.5%)					

Site Monitoring Activity and Reporting History

Project Milestones	Stream Monitoring Complete	Vegetation Monitoring Complete	Wetland Monitoring	Data Analysis Complete	Completion or Delivery
Construction Earthwork	--	--	--	--	June 2, 2021
Planting	--	--	--	--	December 22, 2021
As-Built Documentation	Dec. 9-10, 2021	January 5, 2022	--	February 2022	October 2022
Year 1 Monitoring	May 23-24, 2022	July 14, 2022	Feb. – Nov. 2022	November 2022	December 2022
Year 2 Monitoring	April 27, 2023	August 16, 2023	Jan. – Nov. 2023	November 2023	December 2023

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APPENDICES

1 PROJECT SUMMARY

Restoration Systems, LLC (RS) has established the North Carolina Division of Mitigation Services (NCDMS) Phantom Mill (Site). The Site is on two contiguous parcels along the warm water Cane Creek and unnamed tributaries to Cane Creek in the Carolina Slate Belt Ecoregion of North Carolina. Located in the Cape Fear River Basin, cataloging unit 03030002, the Site is in the Targeted Local Watershed (TLW) 03030002050050 and North Carolina Division of Water Resources (NCDWR) subbasin number 03-06-04. The Site is not located in a Local Watershed Plan (LWP), Regional Watershed Plan (RWP), or Targeted Resource Area (TRA). Site watersheds range from approximately 0.08 of a square mile (50 acres) on UT4 to 4.37 square miles (2,795 acres) at the Site's outfall.

1.1 Project Background, Components, and Structure

Located approximately 1 mile north of Pleasant Hill and 2 miles west of Snow Camp in southwest Alamance County, the Site encompasses 16.1 acres. Mitigation work within the Site included 1) stream restoration, 2) stream enhancement (Level I), 3) stream enhancement (Level II), 4) stream preservation, 5) wetland reestablishment, 6) wetland enhancement, and 7) vegetation planting. The Site is expected to provide 3632.153 warm water stream credits and 4.141 riparian wetland credits by closeout (Table 1, Page 2). A conservation easement was granted to the State of North Carolina and recorded at the Alamance County Register of Deeds on October 18, 2018.

Before construction, land use at the Site was characterized by disturbed forest and livestock pasture. Site design was completed in January 2020. Construction started on March 29, 2021, and ended with a final walkthrough on June 2, 2021. The Site was planted on December 22, 2021. Completed project activities, reporting history, completion dates, and project contacts are summarized in Tables 11-12 (Appendix E).

Additional activities that occurred at the Site included the following.

- Planting 12.5 acres of the Site with 14,300 stems (planted species are included in Table 6A [Appendix B]).
- Installing one shallow wetland marsh treatment area in the floodplain, with an outfall constructed of hydraulically stable rip rap
- Applying an herbaceous seed mix:
    - Upland areas received pollinator-friendly native and naturalized species, including forbs and grasses
    - Streamside zones and wetlands, including the Marsh Treatment Wetland areas, received a similarly designed mix with an additional component of FACW species (including *Elymus virginicus, Juncus effusus, and Carex* spp.).
- Fencing the entire conservation easement.

Table 1. Phantom Mill (ID-100057) Project Mitigation Quantities and Credits

Project Segment	Original Mitigation Plan Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits	Comments
Stream							
Cane Creek-R	1917	1943	Warm	R	1.00000	1,917.000	70 lf is located outside of the easement and therefore is not generating credit
Cane Creek-P	484	485	Warm	P	10.00000	48.400	
UT 1	198	198	Warm	No Credit	NA	0.000	Feature is non-jurisdictional
UT 2A-P	34	34	Warm	P	10.00000	3.400	
UT 2-EI	214	204	Warm	EI	1.50000	142.667	
UT 2-EII	203	193	Warm	EII	2.00000	101.500	
UT 2-EII	351	341	Warm	EII	2.50000	140.400	
UT 2-P	151	159	Warm	P	10.00000	15.100	
UT 3-EI	121	120	Warm	EI	1.50000	80.667	62 lf is located outside of the easement and therefore is not generating credit
UT 3-R	806	806	Warm	R	1.00000	806.000	
UT 4-EII	112	112	Warm	EII	2.50000	44.800	
UT 4-R	261	263	Warm	R	1.00000	261.000	
					Total:	**3,560.934**	
Wetland							
Wetland Reestablish	3.727	3.727	R	REE	1.00000	3.727	
Wetland Enhancement	0.828	0.794	E	E	2.00000	0.414	
Wetland Preservation							
					Total:	**4.141**	

Project Credits

	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	2,984.000			0.000	0.000	0.000
Re-establishment	0.000			3.727	0.000	0.000
Rehabilitation	0.000			0.000	0.000	0.000
Enhancement	0.000			0.414	0.000	0.000
Enhancement I	223.334	0.000	0.000			
Enhancement II	286.700	0.000	0.000			
Creation				0.000	0.000	0.000
Preservation	66.900	0.000	0.000	0.000	0.000	
Benthics 2%	71.219	0.000	0.000	0.000	0.000	
Totals	**3,632.153**	**0.000**	**0.000**	**4.141**	**0.000**	**0.000**

Total Stream Credit **3,632.153**
Total Wetland Credit **4.141**

Table 2. Summary: Goals, Performance, and Results

Targeted Functions	Goals	Objectives	Compatibility with Success Criteria
(1) HYDROLOGY			
(2) Flood Flow (4) Wooded Riparian Buffer (4) Microtopography	• Attenuate flood flow across the Site. • Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning wetland systems.	• Construct a new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Remove livestock • Deep rip floodplain soils to reduce compaction and increase soil surface roughness • Protect riparian buffers with a perpetual conservation easement	• BHR not to exceed 1.2 • Document four overbank events in separate monitoring years • Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
(3) Stream Stability (4) Sediment Transport (4) Stream Geomorphology	• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with the proper pattern, dimension, and longitudinal profile • Remove livestock • Construct stable channels with appropriate substrate • Plant woody riparian buffer • Stabilize stream banks	• Cross-section measurements indicate a stable channel with an appropriate substrate • Visual documentation of stable channels and structures • BHR not to exceed 1.2 • ER of 2.2 or greater • < 10% change in BHR and ER in any given year • Livestock excluded from the easement • Attain Vegetation Success Criteria
(1) WATER QUALITY			
(2) Streamside Area Vegetation (3) Upland Pollutant Filtration (2) Indicators of Stressors (2) Aquatic Life Tolerance Wetland Particulate Change Wetland Physical Change	• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Remove livestock and reduce agricultural land/inputs • Install marsh treatment areas • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams • Provide surface roughness and reduce compaction through deep ripping/plowing. • Restore overbank flooding by constructing channels at historic floodplain elevation.	• Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria

Table 2. Summary: Goals, Performance, and Results (Continued)

(1) HABITAT			
(2) In-stream Habitat	• Improve instream and streamside habitat.	• Construct stable channels with appropriate substrate • Plant woody riparian buffer to provide organic matter and shade • Construct a new channel at historic floodplain elevation to restore overbank flows • Plant woody riparian buffer • Protect riparian buffers with a perpetual conservation easement • Restore/enhance jurisdictional wetlands adjacent to Site streams • Stabilize stream banks • Install in-stream structures	• Cross-section measurement indicate a stable channel with appropriate substrate • Visual documentation of stable channels and in-stream structures. • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
(3) Substrate			
(3) In-Stream Habitat			
(2) Streamside Habitat			
(3) Streamside Habitat			
(3) Thermoregulation			
Wetland Physical Structure			
Wetland Landscape Patch Structure			

1.2 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM data collection. From a mitigation perspective, several goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. The following summarizes Site success criteria.

Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • A continuous surface flow must be documented each year for at least 30 consecutive days on the intermittent reach of UT3. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section during the monitoring period. • The entrenchment ratio (ER) must be no less than 2.2 at any measured riffle cross-section during the monitoring period. • BHR and ER at any measure riffle cross-section should not change by more than 10% from baseline condition during the monitoring period. • The stream project shall remain stable, and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.
Wetland Hydrology
• Saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season during average climatic conditions
Vegetation
• Within planted portions of the Site, a minimum of 320 stems per acre must be present at Year 3; a minimum of 260 stems per acre must be present at Year 4; and a minimum of 210 stems per acre must be present at Year 7. • Trees must average 7 feet in height at Year 5, and 10 feet in height at Year 7 in each plot. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the Site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis.

2 METHODS

Monitoring will be conducted by Axiom Environmental, Inc. Annual monitoring reports of the data collected will be submitted to the NCDMS by Restoration Systems no later than December 1 of each monitoring year data is collected. The monitoring schedule is summarized in the following table.

Monitoring Schedule

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams							
Wetlands							
Vegetation							
Macroinvertebrates							
Visual Assessment							
Report Submittal							

2.1 Monitoring

The monitoring parameters are summarized in the following table.

Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period	3 surface water gauges on UT 2, 3, and 4	Surface water data for each monitoring period
Bankfull Events	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period	3 surface water gauges on UT 2, 3, and 4	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through the monitoring period	1 trail camera on Cane Creek	Visual evidence, photo documentation, and/or rain data.
Benthic Macroinvertebrates	"Qual 4" method described in *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDWR 2016)	Pre-construction, Years 3, 5, and 7 during the "index period" referenced in *Small Streams Biocriteria Development* (NCDWQ 2009)	2 stations (on Cane Creek upstream and Cane Creek downstream); however, the exact locations will be determined at the time pre-construction benthics are collected	Results* will be presented on a site-by-site basis and will include a list of taxa collected, an enumeration of *Ephemeroptera, Plecoptera,* and *Tricopetera* taxa as well as Biotic Index values.
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	Years 1, 2, 3, 4, 5, 6, and 7 throughout the year, with the growing season defined as March 1-October 22	7 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period
Vegetation Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acre (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	12 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	3 plots; randomly selected each year	Species and height

*Benthic Macroinvertebrate sampling data will not be tied to success criteria; however, the data may be used as a tool to observe positive gains to in-stream habitat

Stream Summary

All streams are functioning as designed. Constructed channels exhibit characteristics of a stable piedmont stream with minimal changes in cross-sections when compared to the as-built stream measurement data. All in-stream structures are all functioning as designed. Grade control and bank protection structures are intact and performing as intended by controlling stream flow while preventing erosion. Stream morphology data is in Appendix C, and visual assessment data is in Tables 4A-D (Appendix A).

One stream area of concern was observed and repaired during Year 2 (2023) monitoring. At the bottom of the Enhancement II area of UT2, approximately 11 linear feet of the stream was found to be unstable due to piping (Figure 1, Appendix A). In an effort to arrest head cut formation, the area was stabilized with matting and rock found onsite piled outside the easement. The IRT was notified of the maintenance work, which was performed on October 24, 2023. Additionally, five 1- and 3-gallon containerized trees were planted within the footprint of the repair on December 22, 2023. Species included water oak, willow oak, sycamore, and river birch. Live staking of black willow and silky dogwood along the repaired reach is scheduled for mid to late February 2024. See Q4 2023/Q4 2024 Remedial Planting Plan in Vegetation Summary for details. Email correspondence and photos of the repair are in Appendix F. This area will continue to be monitored closely in years 3-7.

Wetland Summary

Summary of Monitoring Period/Hydrology Success Criteria by Year

Year	Soil Temperatures/Date Bud Burst Documented	Monitoring Period Used for Determining Success	12 Percent of Monitoring Period
2022 (Year 1)	March 1, 2022*	March 1-October 22 (236 days)	28 days
2023 (Year 2)	March 1, 2023**	March 1-October 22 (236 days)	28 days

*Based on observed/documented bud burst on the Site on February 28, 2022, and soil temperature of 49.16 oF documented March 1, 2023.

**Based on observed/documented bud burst on the Site on February 28, 2023 and soil temperature of 52.69 oF documented March 1, 2023

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All groundwater gauges met success criteria for the Year 2 (2023) monitoring period (Appendix D).

Summary of Monitoring Period/Hydrology Success Criteria by Year

Gauge	12% Hydroperiod Success Criteria Achieved Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
1	Yes 106 days (44.9%)	Yes 109 days (46.2%)					
2	Yes 117 days (49.6%)	Yes 144 days (61.0%)					
3	Yes 111 days (47.0%)	Yes 138 days (58.5%)					
4	Yes 115 days (48.7%)	Yes 142 days (60.2%)					
5	Yes 79 days (33.5%)	Yes 72 days (30.5%)					
6	Yes 93 days (39.4%)	Yes 143 days (60.6%)					
7	Yes 98 days (41.5%)	Yes 105 days (44.5%)					

Vegetation Summary

Year 2 (2023) vegetation measurements occurred on August 16, 2023. During quantitative vegetation sampling, 12 permanent plots (10-meter by 10-meter) were installed within the Site as per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.2 (Lee et al. 2008). Additionally, 3 random temporary plots were also measured in accordance with the Site monitoring plan. Measurements of all 15 plots resulted in an average of 431 planted stems/acre, with an average of 6 species per plot. Twelve of the 15 individual plots met success criteria during Year 2 (Tables 7-8, Appendix B).

Due to the high rate of planted stem mortality during Year 1 (2022), RS conducted a supplemental replant within 7.33 acres of the Site's original 12.5 acres of bare-root planting on January 20, 2023. The areas targeted for supplemental planting are depicted in Figure 1 (Appendix A). Vegetation mortality between MY0 and MY1 mainly occurred in areas of dense herbaceous growth. These were likely out-competing many of the smaller bare-root trees. In response, RS planted 3-4 feet tall bare roots hardwoods to reduce the overtopping of planted bare-root stems. Planting occurred in and around CVS Plots in an effort to represent area densities and replant mortality. Bare-root replanting efforts are summarized in the table below and photos of the replanting are located in Appendix F. In addition to the bare-root planting, a combination of Black willow, Silky dogwood, and Elderberry live-stakes were added along UT4. Three random vegetation transects were conducted in the replanted areas during MY2 (2023) monitoring, and the data is shown in Table 8 (Appendix B).

Phantom Mill - Q1 2023 Remedial Planting Plan
Vegetation Association: Piedmont/Low Mountain Alluvial Forest
Total Area = 7.33 Acres

		Planting Zones Appendix A, Figure 1				
		Zone 1		Zone 2		TOTAL
MY1 Average Stems/Acre =		108		188		
Acres =		3.03		4.30		7.33
Stems added/acre		+/-360		+/-280		
Species	**Wetland Indicator Status**	**# planted**	**% of total**	**# planted**	**% of total**	**# planted**
River birch (*Betula nigra*)	FACW	170	13%	150	13%	320
Sugarberry (*Celtis Laevigata)*	FACW	130	10%	120	10%	250
Silky dogwood (*Cornus amomum*)	FACW	130	10%	120	10%	250
Green ash (*Fraxinus pennsylvanica*)	FACW	80	6%	70	6%	150
Tulip poplar (*Liriodendron tulipifera*)	FAC	130	10%	120	10%	250
Sycamore (*Platanus occidentalis*)	FACW	180	14%	170	15%	350
Black gum (*Nyssa sylvatica*)	FAC	50	4%	50	3%	100
White oak (*Quercus alba*)	FACU	70	5%	60	5%	130
Water oak (*Quercus nigra*)	FAC	180	14%	170	14%	350
Willow oak (*Quercus phellos*)	FACW	180	14%	170	14%	350
TOTAL		**1,300**	**100%**	**1,200**	**100%**	**2,500**

Based on Year 2 (2023) data and visual assessment, and despite the January 2023 supplemental planting, two areas of low stem density remained. These include the upland areas of UT3, and a portion of the Cane Creek floodplain where herbaceous overtopping was observed during the dormant season of 2023/2024. In response, the upland areas of UT3 was planted on December 22, 2023, with approximately 245, 1- and 3-gallon containerized trees. Species are summarized below. No stems were planted within vegetation plots. RS will conduct random vegetation transects along UT3 in the Spring of 2024 to determine the success of the planting and to better understand the extent of the low stem density area. RS will continue to visually monitor overtop stems within the Cane Creek floodplain and will hand release stems in February 2024. These areas are depicted in Figure 1 and are quantified in Table 5 (Appendix A).

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Phantom Mill – Q4 2023/Q1 2024 Remedial Planting Plan
Vegetation Association: Piedmont/Low Mountain Alluvial Forest, Dry Mesic Oak-Hickory Forest
Total Area = 2.75 Acres

Species	Wetland Indicator Status	Type	# planted	% of total
River birch (*Betula nigra*)	FACW	1 gallon	15	6%
Ironwood (*Carpinus caroliniana)*	FAC	3 gallon	20	8%
Persimmon (*Diospyros virginiana*)	FAC	1 gallon	25	10%
Tulip poplar (*Liriodendron tulipifera*)	FAC	1 gallon	30	12%
Black gum (*Nyssa sylvatica*)	FAC	1 gallon	25	10%
Sycamore (*Platanus occidentalis*)	FACW	1 gallon	25	10%
White oak (*Quercus alba*)	FACU	1 gallon	25	10%
Water oak (*Quercus nigra*)	FAC	3 gallon	35	14%
Willow oak (*Quercus phellos*)	FACW	1 gallon	25	10%
Red oak (*Quercus rubra*)	FACU	1 gallon	25	10%
TOTAL			**250**	**100%**
Live Stakes (Stream-Side Assemblage)				
Black willow (*Salix nigra*)	OBL	Live Stake	15	43%
Silky dogwood (*Cornus amomum)*	FACW	Live Stake	20	57%
TOTAL			**35**	**100%**

Table 3. Project Attribute Table

Project Information	
Project Name	Phantom Mill
Project County	Alamance County, North Carolina
Project Area (acres)	16.1
Project Coordinates (latitude & latitude)	35.8924ºN, 79.4754ºW
Planted Area (acres)	12.5
Project Watershed Summary Information	
Physiographic Province	Piedmont
Project River Basin	Cape Fear
USGS HUC for Project (14-digit)	03030002050050
NCDWR Sub-basin for Project	03-06-04
Project Drainage Area (acres)	2795
Percentage of Project Drainage Area that is Impervious	<5%
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps

Table 3. Project Attribute Table (Continued)

Reach Summary Information				
Parameters	**Cane Creek**	**UT2**	**UT 3**	**UT4**
Pre-Project Length (linear feet)	2333	967	1037	225
Post-Project Length (linear feet)	2499	955	969	374
Valley Classification & Confinement	Alluvial, confined – moderately confined			
Drainage Area (acres)	2795	67	83	50
NCDWR Stream ID Score	--	34.5	32	34.5
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial/ Intermittent	Perennial
NCDWR Water Quality Classification	WS-V, NSW			
Existing Morphological Description (Rosgen 1996)	Eg5	Cg 3/4	F4	Eg4
Proposed Stream Classification (Rosgen 1996)	C/E 3/4	C/E 3/4	Cb 3/4	C/E 3/4
Existing Evolutionary Stage (Simon and Hupp 1986)	II/III	II/III	III/IV	II/III
Underlying Mapped Soils	Chewacla loam, Cullen clay loam, Riverview loam			
Drainage Class	Somewhat poorly drained, well-drained, well-drained, respectively			
Hydric Soil Status	Nonhydric (may contain hydric inclusions), nonhydric, nonhydric, respectively			
Valley Slope	0.0035	0.0225	0.0320	0.0237
FEMA Classification	Lower reaches AE floodway	NA	NA	NA
Native Vegetation Community	Piedmont Alluvial Forest/Dry-Mesic Oak-Hickory Forest			
Watershed Land Use/Land Cover (Site)	43% forest,55% agricultural land, <2% low density residential/impervious surface			
Watershed Land Use/Land Cover (Cedarock Reference Channel)	65% forest, 30% agricultural land, <5% low density residential/impervious surface			
Percent Composition of Exotic Invasive Vegetation	<5%			

Wetland Summary Information	
Parameters	**Wetlands**
Wetland acreage	4.377 acre drained & 0.923 acre degraded
Wetland Type	Riparian riverine
Mapped Soil Series	Worsham and Wehadkee
Drainage Class	Poorly drained
Hydric Soil Status	Hydric
Source of Hydrology	Groundwater, stream overbank
Hydrologic Impairment	Incised streams, compacted soils, livestock, ditches
Native Vegetation Community	Piedmont/Low Mountain Alluvial Forest
% Composition of Exotic Invasive Vegetation	<5%
Restoration Method	Hydrologic, vegetative, livestock
Enhancement Method	Vegetative, livestock

Table 3. Project Attribute Table (Continued)

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	Yes	JD Package (App D)
Waters of the United States-Section 404	Yes	Yes	JD Package (App D)
Endangered Species Act	Yes	Yes	CE Document (App E)
Historic Preservation Act	Yes	Yes	CE Document (App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	Yes	No	In Process (App F)
Essential Fisheries Habitat	No	--	NA

3 REFERENCES

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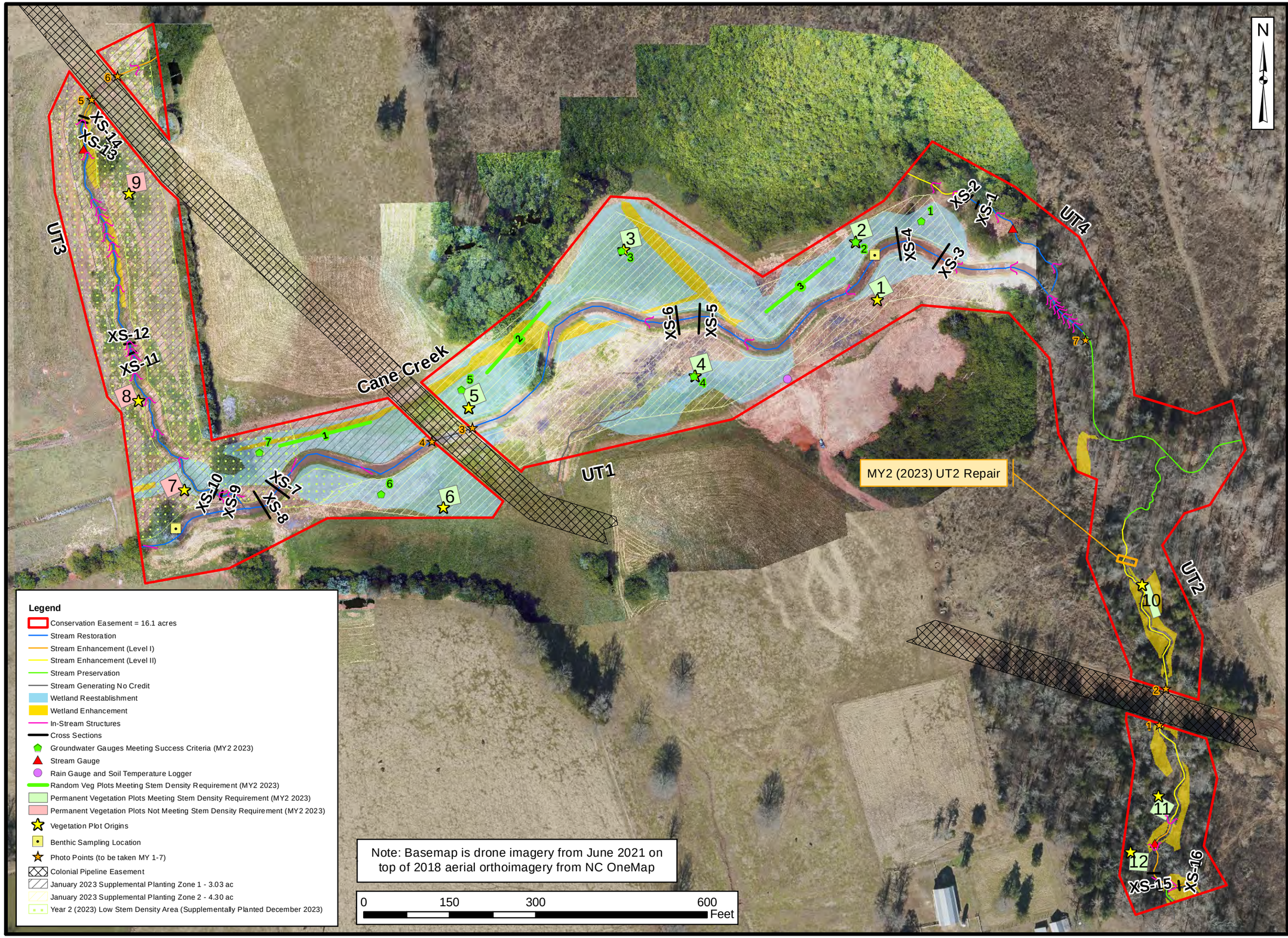
Appendix A: Visual Assessment Data

Figure 1. Current Conditions Plan View
Tables 4A-D. Stream Visual Stability Assessment
Table 5. Visual Vegetation Assessment
Vegetation Plot Photographs
Site Photo Log



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

PHANTOM MILL MITIGATION SITE

Alamance County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

Date: JAN 2024

Scale: 1:1900

Project No.: 18-012

FIGURE

1

Table 4A. Visual Stream Stability Assessment

Reach Cane Creek

Assessed Stream Length 1943

Assessed Bank Length 3886

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	10	10		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	10	10		100%

Table 4B. Visual Stream Stability Assessment

Reach	UT 2
Assessed Stream Length	738
Assessed Bank Length	1476

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	4	4		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	4	4		100%

Table 4C. Visual Stream Stability Assessment

Reach UT 3

Assessed Stream Length 926

Assessed Bank Length 1852

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	16	16		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	16	16		100%

Table 4D. Visual Stream Stability Assessment

Reach	UT 4
Assessed Stream Length	374
Assessed Bank Length	748

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	4	4		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	4	4		100%

Table 5. Visual Vegetation Assessment

Planted acreage **12.5**

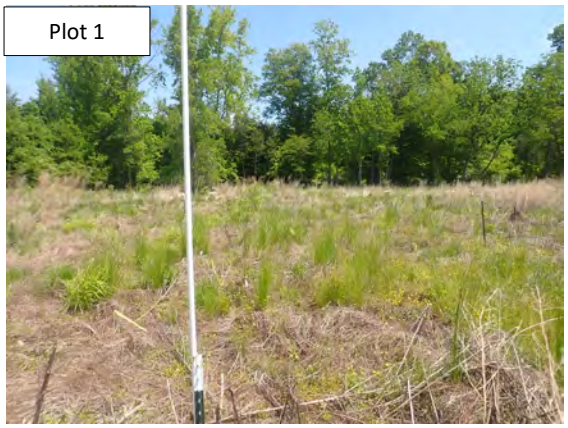
Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	2.746	22.0%
	Total		2.746	22.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
	Cumulative Total		2.746	22.0%

Easement Acreage **16.1**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.10 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	0 Encroachments noted	

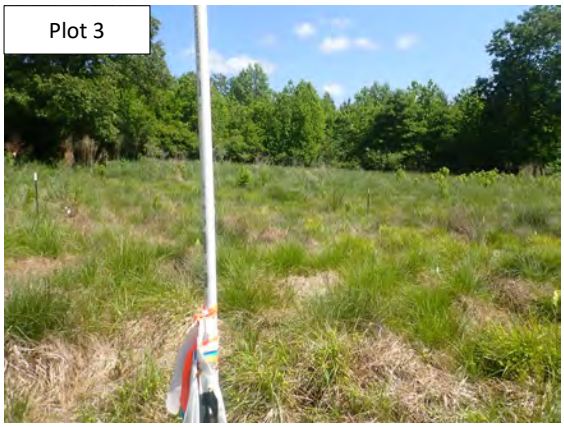
Phantom Mill Site
MY2 (2023) Vegetation Monitoring Photographs

Plot 1



Plot 2

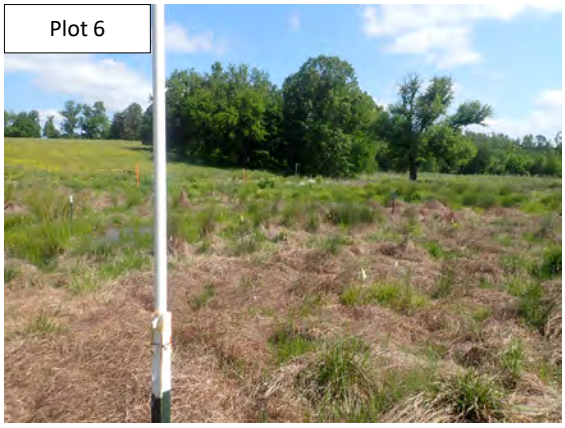
Plot 3



Plot 4

Plot 5

Plot 6



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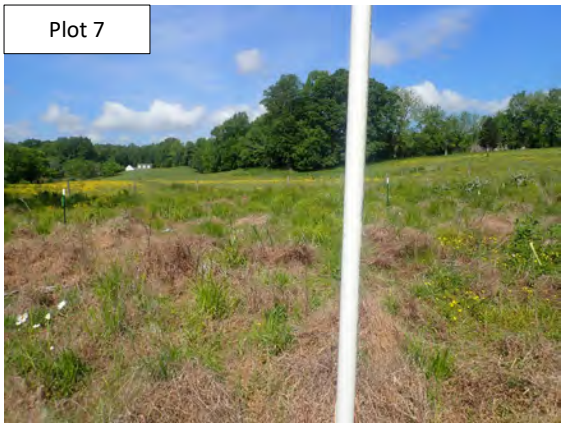


Plot 8

Phantom Mill Site
MY2 (2023) Vegetation Monitoring Photographs

Plot 9

Plot 10

Plot 11

Plot 12

Phantom Mill
MY-02 (2023) Photo Log

Photo 1: Photo Point 1- UT2 Colonial Pipeline Easement Break Upstream End, Facing Downstream

Photo 2: Photo Point 2- UT2 Colonial Pipeline Easement Break Downstream End, Facing Upstream

Phantom Mill
MY-02 (2023) Photo Log

Photo 3: Photo Point 3- Cane Creek Colonial Pipeline Easement Break Downstream End, Facing Upstream

Photo 4: Photo Point 4- Cane Creek Colonial Pipeline Easement Break Upstream End, Facing Downstream

Phantom Mill
MY-02 (2023) Photo Log

Photo 5: Photo Point 5- UT3 Colonial Pipeline Easement Break
Downstream End, Facing Upstream

Photo 6: Photo Point 6- UT3 Colonial Pipeline Easement Break
Upstream End, Facing Downstream

Phantom Mill
MY-02 (2023) Photo Log

Photo 7: Photo Point 7- Outer Bend at Cane Creek Restoration/Preservation Transition Below Drop Structure

Photo 8: State Champion Fraxinus pennsylvanica

Phantom Mill
MY-02 (2023) Photo Log

Photo 9: Cane Creek Drop Structure – April 2023

Photo 10: Easement Boundary Top of UT3

Phantom Mill
MY-02 (2023) Photo Log

Photo 11: Cane Creek aerial view, looking east

Photo 12: UT3 aerial view, looking north

Phantom Mill
MY-02 (2023) Photo Log

Photo 13: Cane Creek aerial view, easement fencing and vegetation

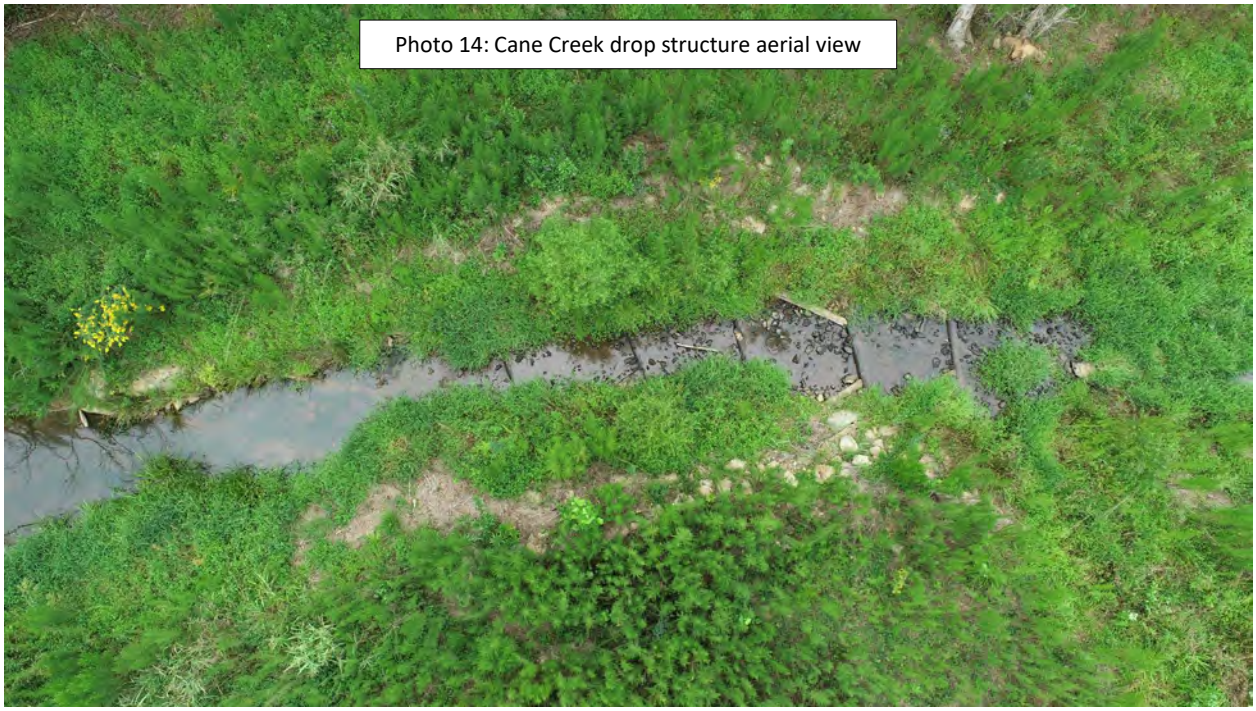


Photo 14: Cane Creek drop structure aerial view

Phantom Mill
MY-02 (2023) Photo Log

Photo 15: UT-3 Flow 1/20/2023

Photo 16: UT-3 Flow 4/8/2023

Phantom Mill
MY-02 (2023) Photo Log

Photo 17: Bud Burst of Carpinus caroliniana
Photo Taken 2/28/23

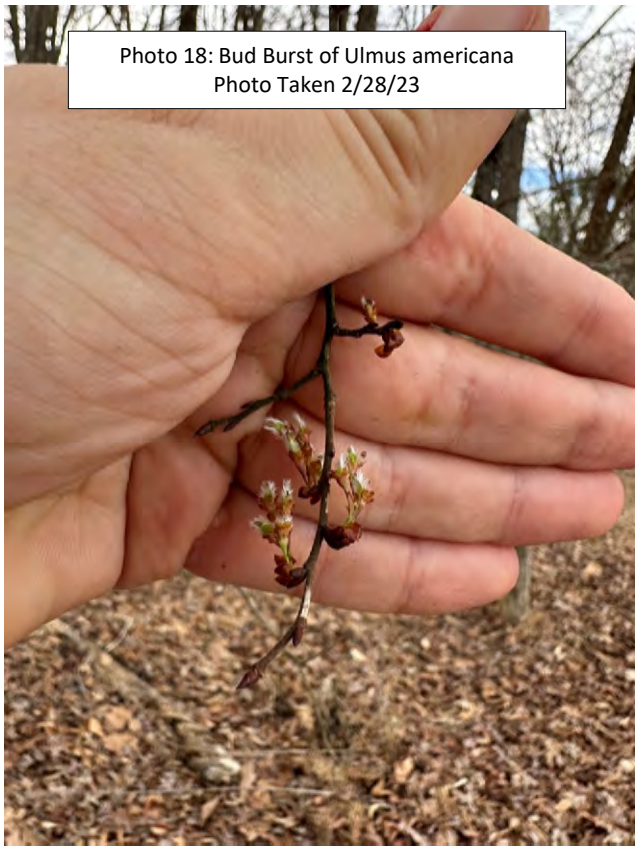


Photo 18: Bud Burst of Ulmus americana
Photo Taken 2/28/23

Phantom Mill
MY-02 (2023) Photo Log

Photo 19: Cane Creek Drop Structure – January 2024

Photo 20: UT2 Repair

Photo 21: UT2 Headcut – August 2023

Phantom Mill
MY-02 (2023) Photo Log

Photo 22: UT2 Headcut – August 2023

Appendix B: Vegetation Data

Table 6A. Planted Bare-Root Woody Vegetation
Table 6B. Permanent Seed Mix
Table 7. Vegetation Plot Counts and Densities
Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

Table 6A. Planted Bare Root Woody Vegetation
Phantom Mill

Species	Wetland Indicator	Total
Acres		**12.5**
Betula nigra	FACW	1,000
Celtis occidentalis	FACU	500
Cephalanthus occidentalis	OBL	300
Cercis canadensis	FACU	750
Cornus ammomum	FACW	2,000
Diospyros virginiana	FAC	500
Fraxinus pennsylvanica	FACW	700
Liriodendron tulipifera	FACU	1,000
Morus rubra	FACU	350
Nyssa sylvatica	FAC	500
Platanus occidentalis	FACW	1,500
Quercus alba	FACU	650
Quercus lyrata	OBL	600
Quercus nigra	FAC	1,250
Quercus phellos	FAC	1,250
Quercus rubra	FACU	600
Quercus shumardii	FAC	750
Viburnum dentatum	FAC	100
TOTALS		14,300
Average Stems/Acre		**1,144**

Table 6B. Permanent Seed Mix
Phantom Mill

Meadow Mix (50 lbs)					
Species	**Wetland Indicator**	**%**	**Species**	**Wetland Indicator**	**%**
Common Yarrow (*Achillea millefolium*)	FACU	1	Boneset (*Eupatorium perfoliatum*)	FACW	0.5
Redtop (*Agrostis gigantea*)	FACW	15	Perennial Gaillardia (Blanketflower) (*Gaillardia perennial*)	NI	2
Winter Bentgrass (*Agrostis hyemalis*)	FAC	5	Narrowleaf Sunflower (*Helianthus angustifolius*)	FACW	1
Creeping Bentgrass (*Agrostis stolonifera*)	FACW	2	Oxeye Sunflower (*Heliopsis helianthoides*)	FACU	1
Blue False Indigo (*Baptisia australis*)	FACU	2	Crimsoneyed Rosemallow (*Delmarva peninsula*)	OBL	0.5
Fox Sedge (*Carex vulpinoidea*)	OBL	1	Path Rush (*Juncus tenuis*)	FAC	0.5
Partridge Pea (*Chamaecrista fasciculata*)	FACU	1	Roundhead Lespedeza (*Lespedeza capitata*)	FACU	0.5
Sensitive Pea (*Chamaecrista nictitans*)	FACU	1	Marsh Blazing Star (*Liatris spicata*)	FAC	0.5
Oxeye Daisy (*Leucanthemum vulgare*)	UPL	4.5	Wild Bergamot (*Monarda fistulosa*)	UPL	0.5
Shasta Daisy (*Leucanthemum superbum*)	NI	3	Deertongue (*Dichanthelium clandestinum*)	FAC	5
Lanceleaf Coreopsis (*Coreopsis lanceolata*)	NI	4	Redtop Panicgrass (*Panicum rigidulum*)	FACW	0.5
Plains Coreopsis (*Coreopsis tinctoria*)	FAC	4	Tall White Beardtongue (*Penstemon digitalis*)	FAC	1
Cosmos (*Cosmos bipinnatus*)	FACU	1	Clasping Coneflower (*Dracopis amplexicaulis*)	FAC	1
Rocket Larkspur (*Consolida ajacis*)	NI	2	Blackeyed Susan (*Rudbeckia hirta*)	FACU	3
Showy Ticktrefoil (*Desmodium canadense*)	FAC	1	Little Bluestem (*Schizachyrium scoparium*)	FACU	5
Purple Coneflower (*Echinacea purpurea*)	NI	5	Wild Senna (*Senna hebecarpa*)	FAC	0.5
Virginia Wildrye (*Elymus virginicus*)	FACW	5	Purpletop (*Tridens flavus*)	FACU	18
Mistflower (*Conoclinium coelestinum*)	FAC	0.5	Blue Vervain (*Verbena hastata*)	FACW	1
			Total		**100%**
Wetland Mix (30 lbs)					
Bur-marigold (*Bidens aristosa*)	FACW	13.33	Leathery Rush (*Juncus coriaceus*)	FACW	1.67
Greenwhite Sedge (*Carex albolutescens*)	FACW	4.67	Soft Rush (*Juncus effusus*)	FACW	1.67
Hop Sedge (*Carex lupulina*)	OBL	1.67	Path Rush (*Juncus tenuis*)	FAC	1.67
Fox Sedge (*Carex vulpinoidea*)	OBL	0.67	Redtop Panicgrass (*Panicum rigidulum*)	FACW	22
Partridge Pea (*Chamaecrista fasciculata*)	FACU	1.67	Switchgrass (*Panicum virgatum*)	FAC	3.33
Large-flowered Tickseed (*Coreopsis grandiflora*)	NI	1.67	Black eyed Susan (*Rudbeckia hirta*)	FACU	3
Lance-leaved Coreopsis (*Coreopsis lanceolata*)	NI	3.33	Little Bluestem (*Schizachyrium scoparium*)	FACU	5
Plains Coreopsis (*Coreopsis tinctoria*)	FAC	1.67	Indiangrass (*Sorghastrum nutans*)	FACU	10
Virginia Wildrye (*Elymus virginicus*)	FACW	10.33	Purpletop (*Tridens flavus*)	FACU	1.67
Narrowleaf Sunflower (*Helianthus angustifolius*)	FACW	11	**Total**		**100%**

Table 7. Planted Vegetation Totals
Phantom Mill

Plot #	Planted Stems/Acre	Success Criteria Met?
1	486	Yes
2	607	Yes
3	445	Yes
4	324	Yes
5	567	Yes
6	526	Yes
7	283	No
8	202	No
9	121	No
10	648	Yes
11	445	Yes
12	364	Yes
T-1	445	Yes
T-2	526	Yes
T-3	486	Yes
Average Planted Stems/Acre	**431**	**Yes**

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool

Planted Acreage	12.5
Date of Initial Plant	2021-12-22
Date(s) of Supplemental Plant(s)	2023-01-04
Date(s) Mowing	NA
Date of Current Survey	2023-08-16
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 7 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	2	2							1	1	1	1	3	3
	Cercis canadensis	eastern redbud	Tree	FACU													1	1
	Cornus amomum	silky dogwood	Shrub	FACW	2	2	1	1	2	2	2	2	3	3	1	1		
	Fraxinus pennsylvanica	green ash	Tree	FACW	1	1							1	1			1	1
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1							1	1				
	Nyssa sylvatica	blackgum	Tree	FAC	1	1					2	2	1	1			1	1
	Platanus occidentalis	American sycamore	Tree	FACW	1	1	4	4	1	1	3	3	3	3	1	1		
	Quercus alba	white oak	Tree	FACU											1	1		
	Quercus nigra	water oak	Tree	FAC					2	2			2	2	3	3	1	1
	Quercus phellos	willow oak	Tree	FAC	2	2	4	4	1	1	1	1	1	1	5	5		
	Quercus sp.				2	2	3	3	3	3								
Sum	Performance Standard				12	12	12	12	9	9	8	8	13	13	12	12	7	7
Post Mitigation Plan Species	*Alnus serrulata*	*hazel alder*	*Tree*	*OBL*				*1*										
	Juglans nigra	*black walnut*	*Tree*	*FACU*														
	Liquidambar styraciflua	*sweetgum*	*Tree*	*FAC*				*1*										
	Quercus michauxii	swamp chestnut oak	Tree	FACW			2	2	1	1					1	1		
	Quercus shumardii	Shumard's oak	Tree	FAC					1	1								
	Salix nigra	*black willow*	*Tree*	*OBL*				*1*										
	Viburnum dentatum	southern arrowwood	Tree	FAC			1	1					1	1				
Sum	Proposed Standard				12	12	15	15	11	11	8	8	14	14	13	13	7	7
Mitigation Plan Performance Standard	Current Year Stem Count					12		12		9		8		13		12		7
	Stems/Acre					486		486		364		324		526		486		283
	Species Count					8		4		5		4		8		6		5
	Dominant Species Composition (%)					17		22		27		38		21		38		43
	Average Plot Height (ft.)					3		2		3		3		2		2		3
	% Invasives					0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					12		15		11		8		14		13		7
	Stems/Acre					486		607		445		324		567		526		283
	Species Count					8		6		7		4		9		7		5
	Dominant Species Composition (%)					17		22		27		38		21		38		43
	Average Plot Height (ft.)					3		3		3		3		2		2		3
	% Invasives					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 8. Vegetation Plot Data Table from Vegetation Data Entry Tool (continued)

Planted Acreage	12.5
Date of Initial Plant	2021-12-22
Date(s) of Supplemental Plant(s)	2023-01-04
Date(s) Mowing	NA
Date of Current Survey	2023-08-16
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F		Veg Plot 11 F		Veg Plot 12 F		Veg Plot 1 R	Veg Plot 2 R	Veg Plot 3 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW			1	1	1	1			1	1	1	2	1
	Cercis canadensis	eastern redbud	Tree	FACU	1	1											
	Cornus amomum	silky dogwood	Shrub	FACW					5	5	1	1	1	1		1	1
	Fraxinus pennsylvanica	green ash	Tree	FACW	2	2			5	5	2	2			3		2
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1	2	2					1	1	4		
	Nyssa sylvatica	blackgum	Tree	FAC	1	1									1		
	Platanus occidentalis	American sycamore	Tree	FACW							1	1	1	1		3	1
	Quercus alba	white oak	Tree	FACU					2	2	1	1					
	Quercus nigra	water oak	Tree	FAC							2	2				3	3
	Quercus phellos	willow oak	Tree	FAC					2	2	2	2	3	3		3	2
	Quercus sp.								1	1	2	2	2	2			
Sum	Performance Standard				5	5	3	3	16	16	11	11	9	9	9	12	10
Post Mitigation Plan Species	*Alnus serrulata*	*hazel alder*	*Tree*	*OBL*													
	Juglans nigra	*black walnut*	*Tree*	*FACU*				*1*									
	Liquidambar styraciflua	*sweetgum*	*Tree*	*FAC*													
	Quercus michauxii	swamp chestnut oak	Tree	FACW											2	1	2
	Quercus shumardii	Shumard's oak	Tree	FAC													
	Salix nigra	*black willow*	*Tree*	*OBL*													
	Viburnum dentatum	southern arrowwood	Tree	FAC													
Sum	Proposed Standard				5	5	3	3	16	16	11	11	9	9	11	13	12
Mitigation Plan Performance Standard	Current Year Stem Count					5		3		16		11		9	9	12	10
	Stems/Acre					202		121		648		445		364	364	486	405
	Species Count					4		2		6		7		6	4	5	6
	Dominant Species Composition (%)					40		50		31		18		33	36	23	25
	Average Plot Height (ft.)					3		3		2		2		1	3	3	3
	% Invasives					0		0		0		0		0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					5		3		16		11		9	11	13	12
	Stems/Acre					202		121		648		445		364	445	526	486
	Species Count					4		2		6		7		6	5	6	7
	Dominant Species Composition (%)					40		50		31		18		33	36	23	25
	Average Plot Height (ft.)					3		3		2		2		1	3	3	3
	% 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.

Appendix C: Stream Geomorphology Data

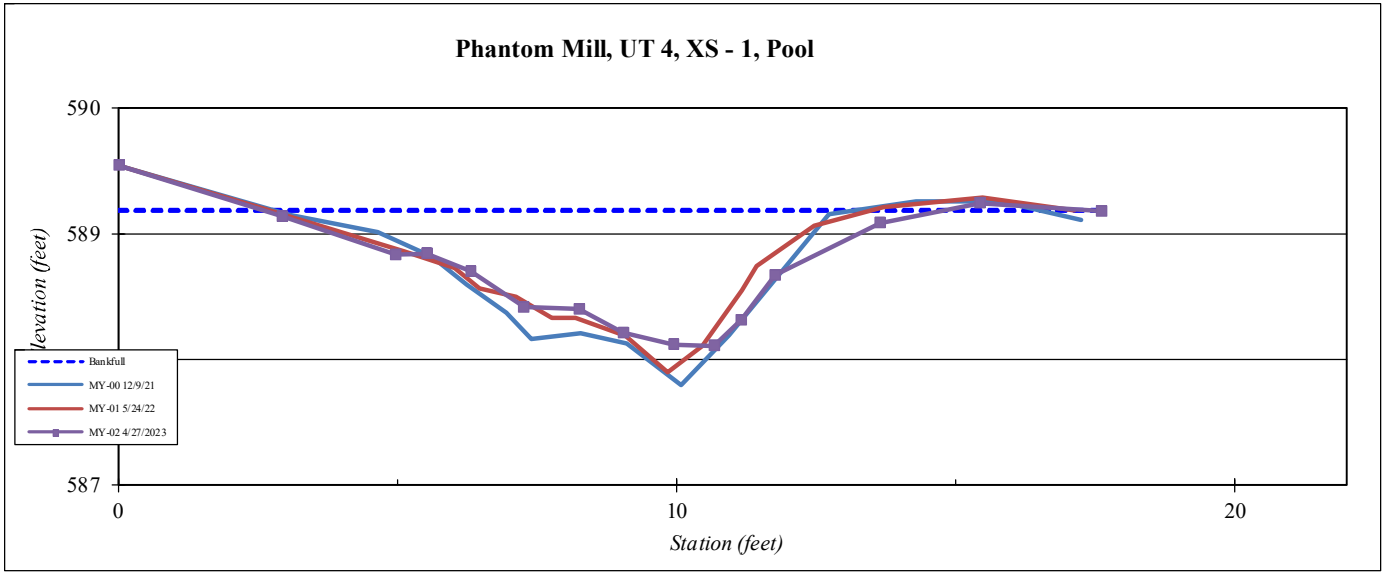
Cross-Sections with Annual Overlays
Table 9A-D. Baseline Stream Data Summary Tables
Table 10A-B. Cross-Section Morphology Monitoring Summary

Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 4, XS -1, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	589.5
2.9	589.1
5.0	588.8
5.5	588.8
6.3	588.7
7.3	588.4
8.2	588.4
9.0	588.2
10.0	588.1
10.7	588.1
11.2	588.3
11.8	588.7
13.6	589.1
15.4	589.2
17.6	589.2

SUMMARY DATA	
Bankfull Elevation:	589.2
Bank Height Ratio:	0.96
Thalweg Elevation:	588.1
LTOB Elevation:	589.1
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	5.7

Stream Type	E/C 5

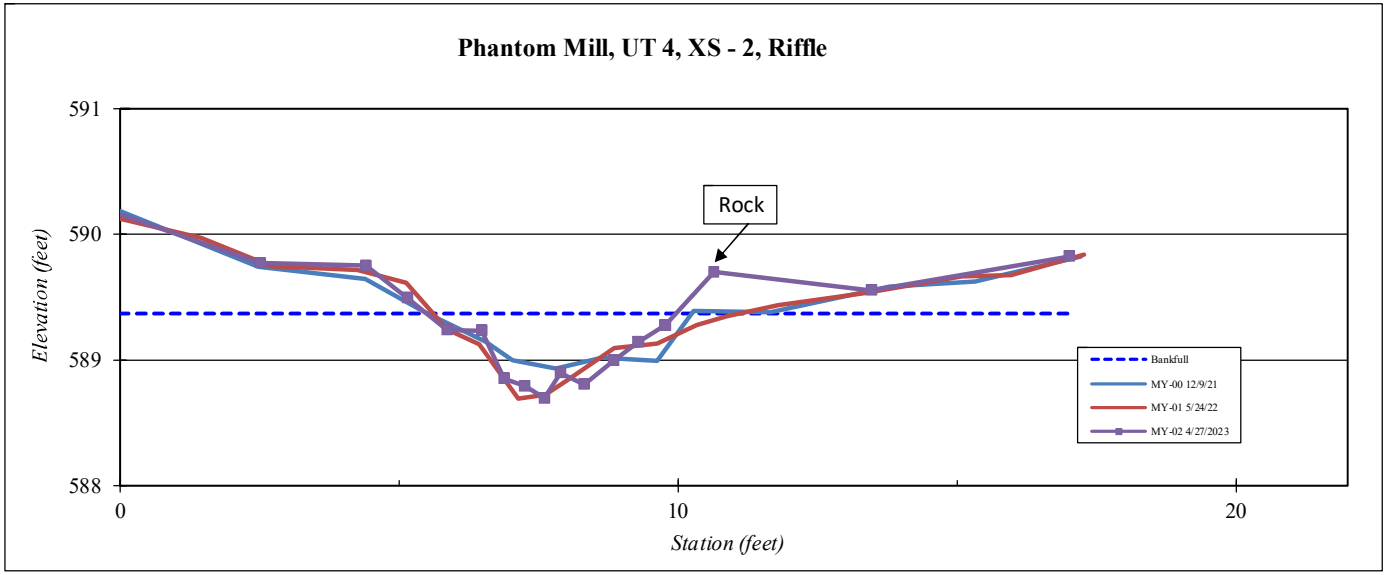


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 4, XS -2, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
-0.4	590.2
2.5	589.8
4.4	589.7
5.2	589.5
5.9	589.2
6.5	589.2
6.9	588.8
7.3	588.8
7.6	588.7
7.9	588.9
8.3	588.8
8.8	589.0
9.3	589.1
9.8	589.3
10.6	589.7
13.5	589.6
17.0	589.8

SUMMARY DATA	
Bankfull Elevation:	589.4
Bank Height Ratio:	0.86
Thalweg Elevation:	588.7
LTOB Elevation:	589.3
LTOB Max Depth:	0.6
LTOB Cross Sectional Area:	1.1

Stream Type	E/C 5



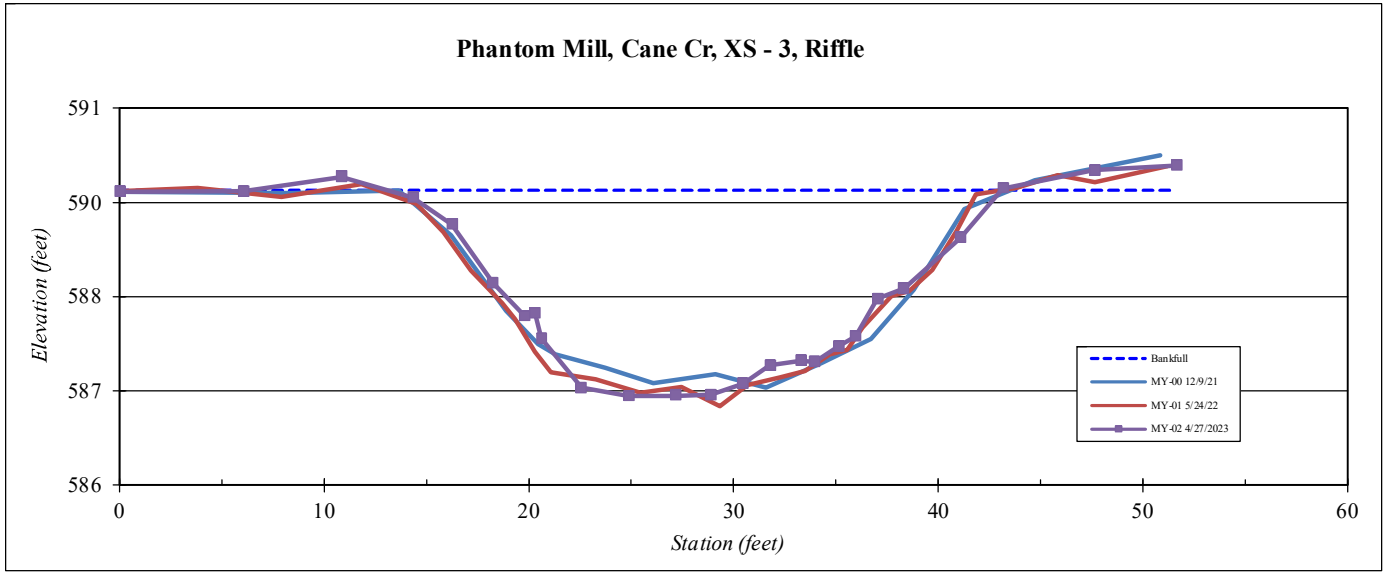
*Note: During MY-02 (2023) Monitoring, a rock was captured on the survey approximately where the LTOB was located in previous years. The Bank Height Ratio is slightly lower (0.84) as a result.

Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS -3, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	589.8
6.1	589.8
10.8	590.0
14.3	589.7
16.2	589.4
18.3	588.6
19.8	588.2
20.3	588.2
20.6	587.9
22.6	587.2
24.9	587.1
27.2	587.1
28.9	587.1
30.5	587.3
31.8	587.5
33.3	587.6
33.9	587.5
35.1	587.8
36.0	587.9
37.0	588.4
38.3	588.52
41.1	589.2
43.2	589.8
47.6	590.1
51.7	590.2

SUMMARY DATA	
Bankfull Elevation:	589.8
Bank Height Ratio:	0.97
Thalweg Elevation:	587.1
LTOB Elevation:	589.7
LTOB Max Depth:	2.6
LTOB Cross Sectional Area:	48.4

Stream Type	E/C 5

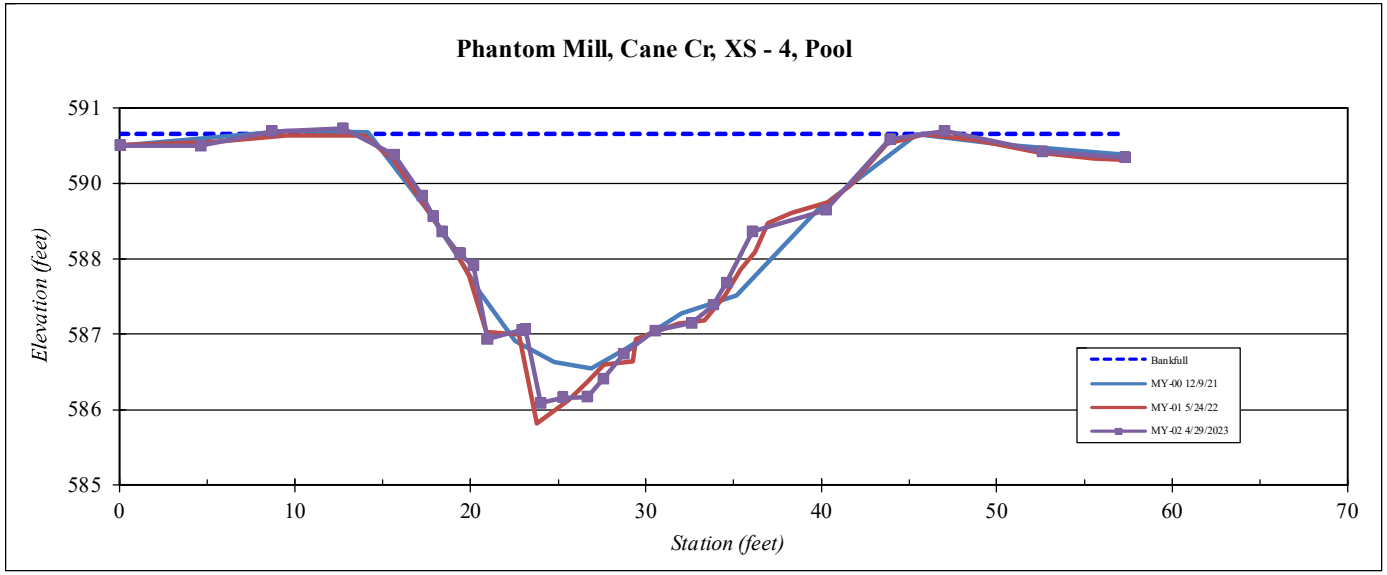


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS -4, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	590.3
4.6	590.3
8.7	590.5
12.7	590.6
15.7	590.1
17.3	589.5
17.9	589.1
18.4	588.9
19.4	588.5
20.2	588.3
21.0	587.1
22.9	587.2
23.1	587.2
24.0	586.0
25.3	586.1
26.7	586.1
27.6	586.4
28.7	586.8
30.5	587.2
32.6	587.3
33.8	587.64
34.6	588.0
36.1	588.9
40.2	589.2
43.9	590.4
47.0	590.5
52.6	590.2
57.3	590.1

SUMMARY DATA	
Bankfull Elevation:	590.5
Bank Height Ratio:	0.98
Thalweg Elevation:	586.0
LTOB Elevation:	590.4
LTOB Max Depth:	4.4
LTOB Cross Sectional Area:	66.6

Stream Type	E/C 5

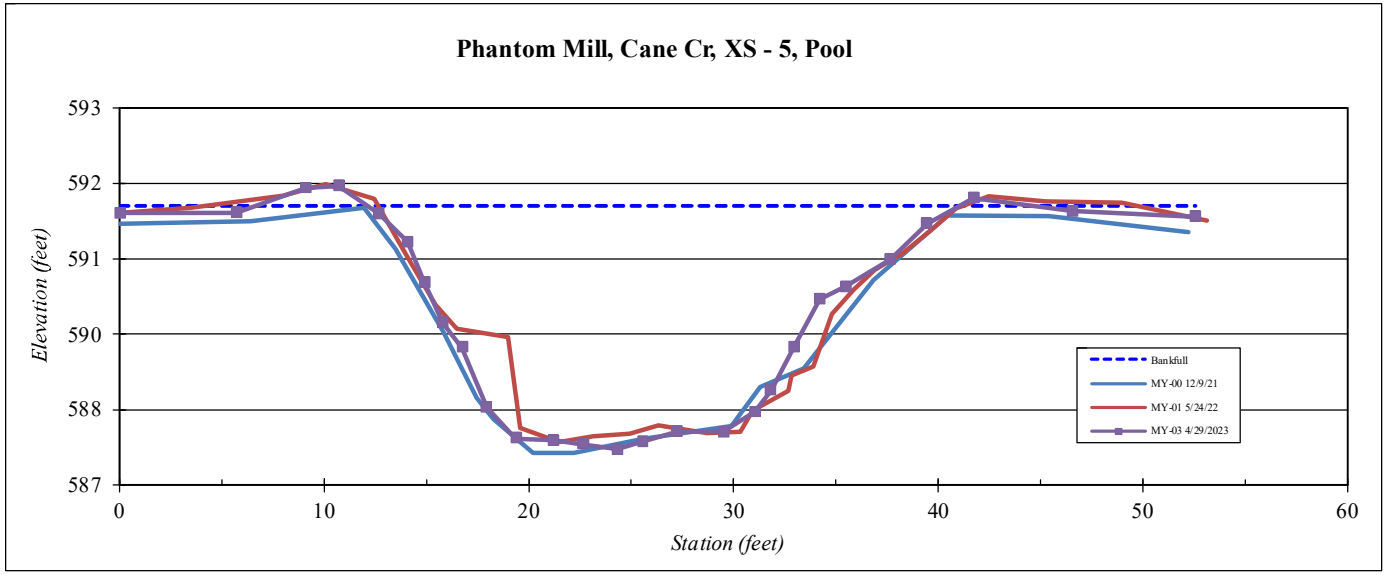


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS -5, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	591.7
5.7	591.7
9.1	592.1
10.7	592.1
12.7	591.7
14.1	591.2
14.9	590.5
15.8	589.9
16.7	589.4
17.9	588.5
19.4	587.9
21.2	587.9
22.6	587.8
24.3	587.8
25.6	587.9
27.2	588.0
29.5	588.0
31.0	588.4
31.8	588.7
33.0	589.5
34.2	590.25
35.5	590.5
37.6	590.9
39.4	591.5
41.7	591.9
46.5	591.7
52.5	591.6

SUMMARY DATA	
Bankfull Elevation:	591.8
Bank Height Ratio:	0.97
Thalweg Elevation:	587.8
LTOB Elevation:	591.7
LTOB Max Depth:	3.9
LTOB Cross Sectional Area:	68.3

Stream Type	E/C 5

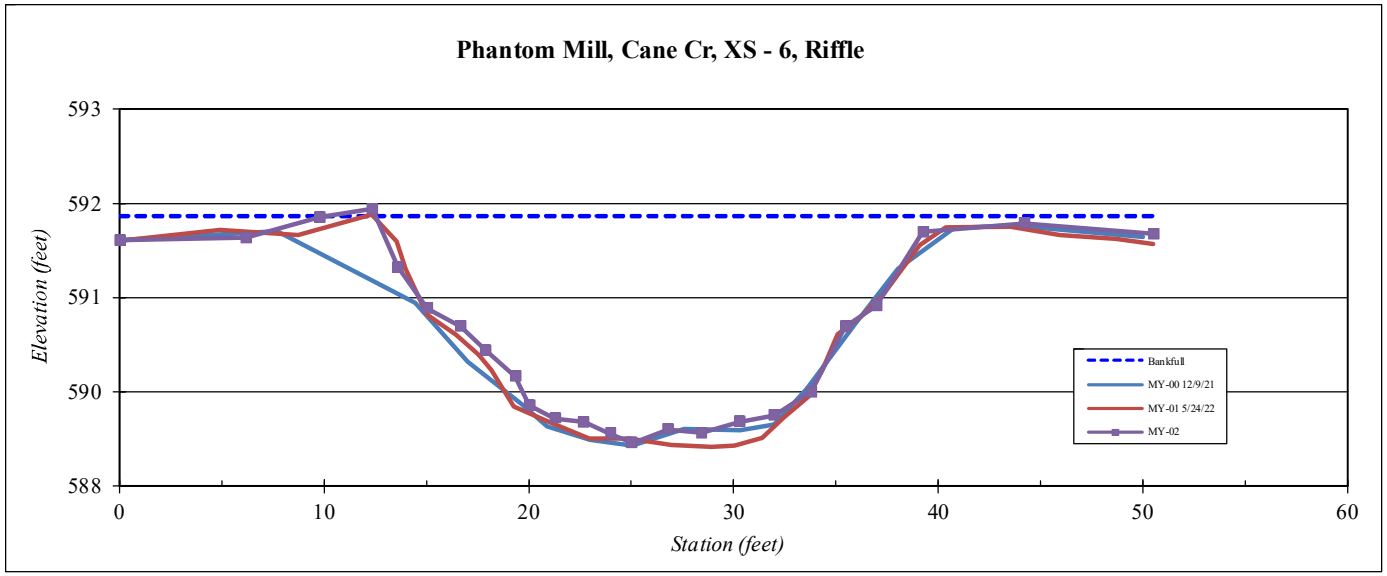


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS - 6, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	591.7
6.2	591.7
9.8	592.0
12.4	592.1
13.6	591.3
15.0	590.8
16.6	590.5
17.9	590.2
19.3	589.9
20.0	589.5
21.3	589.3
22.7	589.3
24.0	589.1
25.1	589.0
26.8	589.2
28.4	589.1
30.3	589.3
32.0	589.4
33.8	589.7
35.5	590.5
37.0	590.81
39.3	591.8
44.2	591.9
50.5	591.8

SUMMARY DATA	
Bankfull Elevation:	592.0
Bank Height Ratio:	0.93
Thalweg Elevation:	589.0
LTOB Elevation:	591.8
LTOB Max Depth:	2.8
LTOB Cross Sectional Area:	49.6

Stream Type	E/C 5

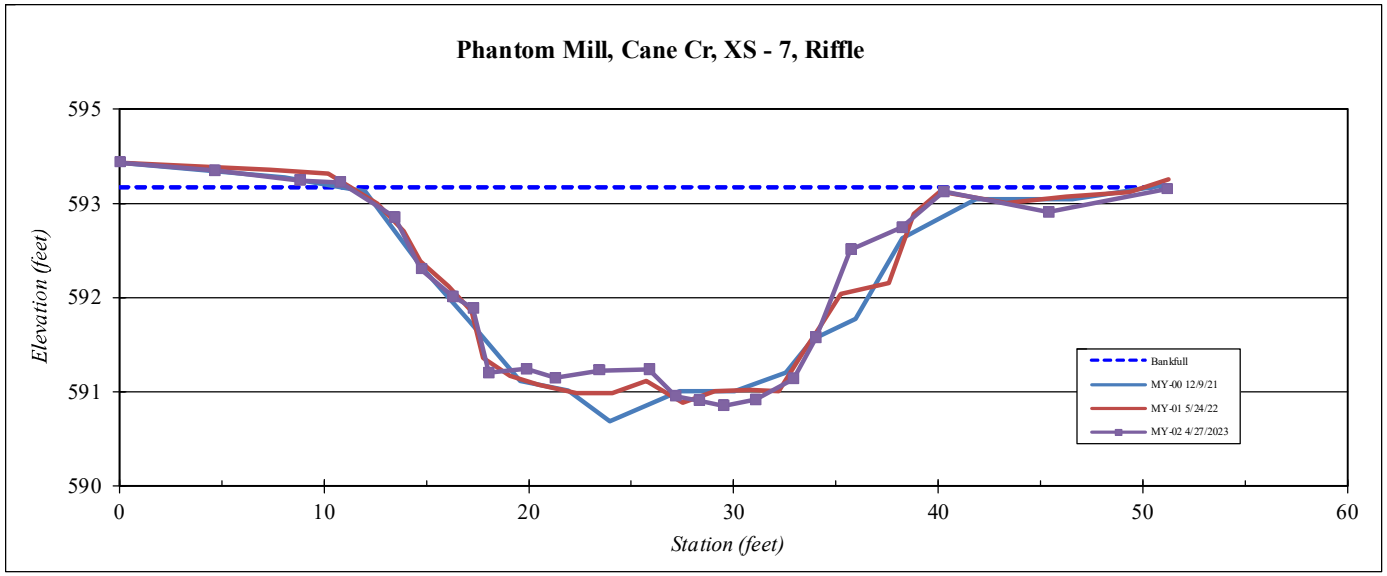


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS - 7, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	594.0
4.6	593.9
8.8	593.7
10.8	593.7
13.4	593.2
14.7	592.5
16.3	592.2
17.3	592.0
18.0	591.2
19.9	591.2
21.3	591.1
23.4	591.2
25.9	591.2
27.2	590.9
28.3	590.8
29.5	590.7
31.1	590.8
32.9	591.1
34.0	591.6
35.7	592.8
38.2	593.11
40.3	593.6
45.4	593.3
51.2	593.6

SUMMARY DATA	
Bankfull Elevation:	593.6
Bank Height Ratio:	0.98
Thalweg Elevation:	590.7
LTOB Elevation:	593.6
LTOB Max Depth:	2.9
LTOB Cross Sectional Area:	50.8

Stream Type	E/C 5

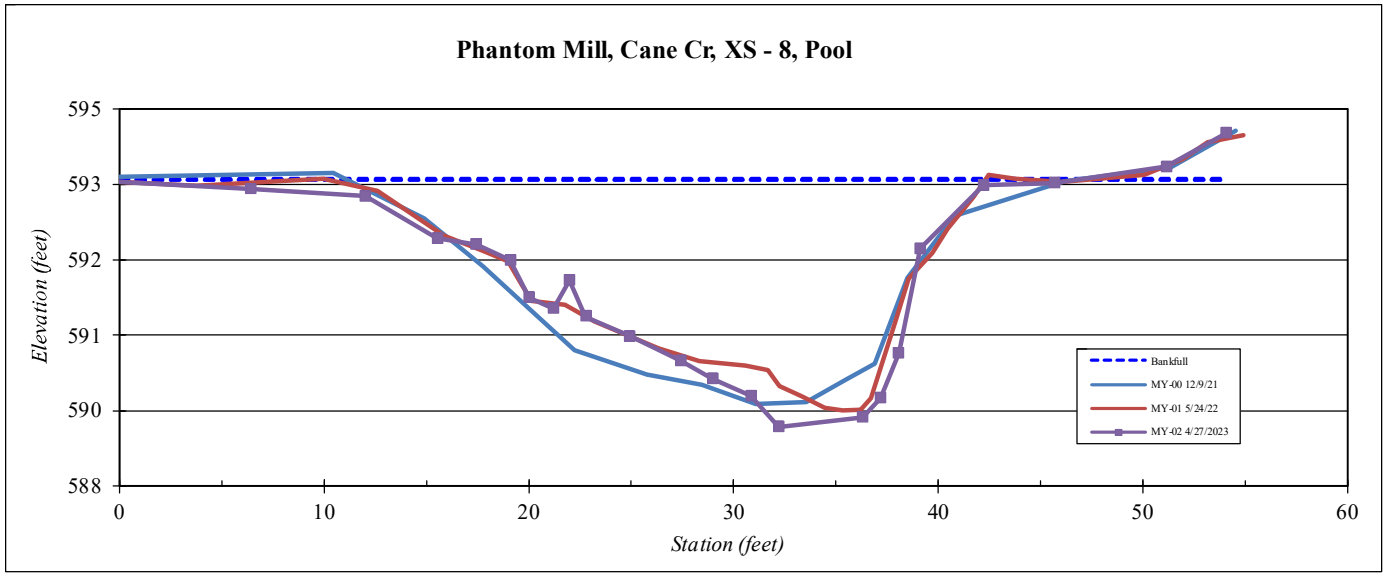


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS - 8, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
-0.6	593.5
6.4	593.3
12.0	593.2
15.5	592.5
17.4	592.4
19.1	592.2
20.0	591.5
21.2	591.4
22.0	591.8
22.8	591.2
24.9	590.9
27.4	590.5
29.0	590.2
30.8	589.9
32.2	589.4
36.3	589.6
37.2	589.9
38.1	590.6
39.1	592.4
42.2	593.4
45.7	593.5
51.1	593.7
54.1	594.3

SUMMARY DATA	
Bankfull Elevation:	593.5
Bank Height Ratio:	0.98
Thalweg Elevation:	589.4
LTOB Elevation:	593.4
LTOB Max Depth:	4.0
LTOB Cross Sectional Area:	66.9

Stream Type	E/C 5

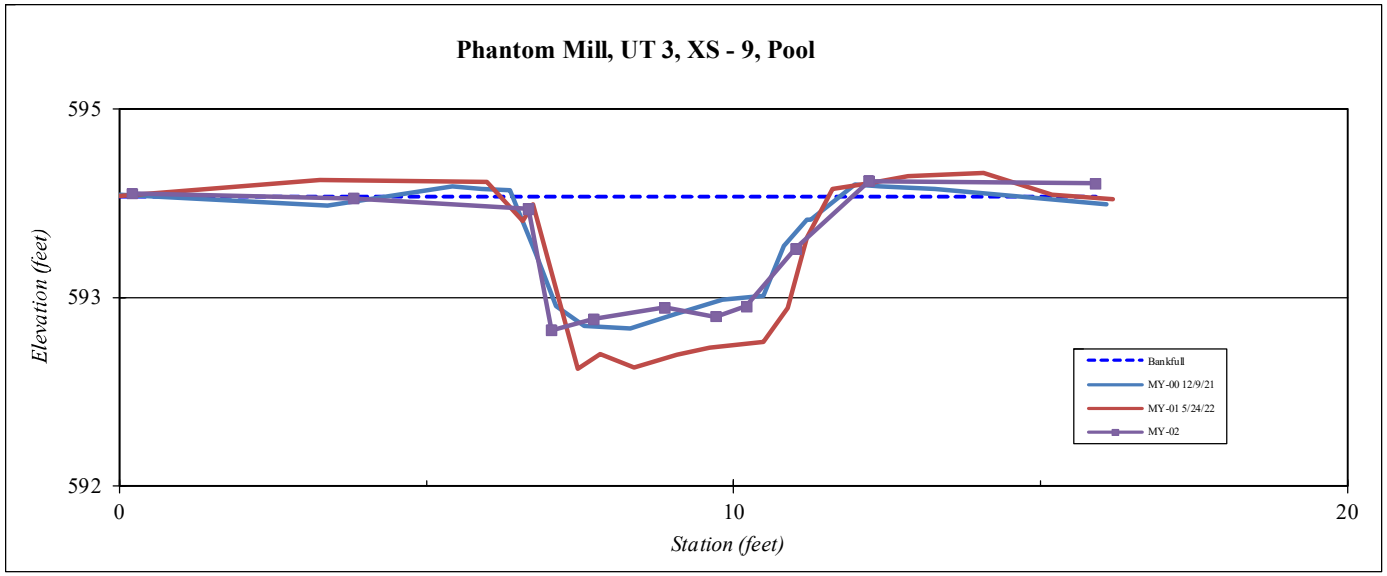


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 9, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.2	594.1
3.8	594.1
6.7	594.0
7.0	593.2
7.7	593.3
8.9	593.4
9.7	593.3
10.2	593.4
11.0	593.7
12.2	594.2
15.9	594.2

SUMMARY DATA	
Bankfull Elevation:	594.1
Bank Height Ratio:	0.98
Thalweg Elevation:	593.2
LTOB Elevation:	594.1
LTOB Max Depth:	0.9
LTOB Cross Sectional Area:	3.3

Stream Type	E/C 5

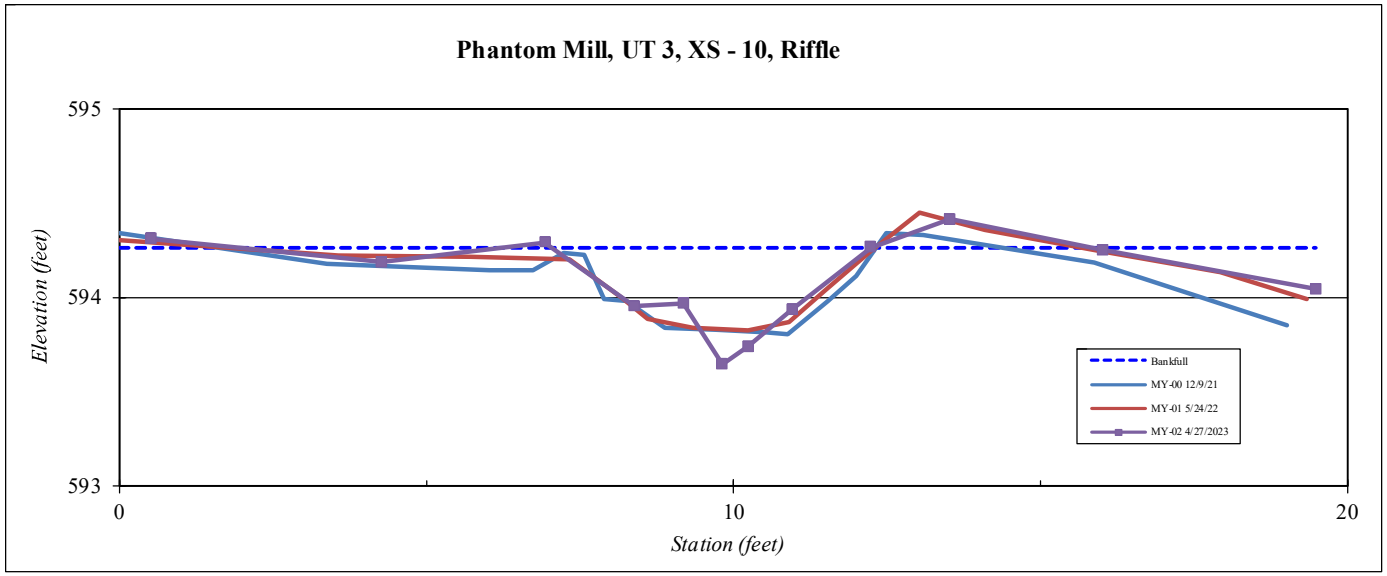


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 10, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.5	594.3
4.3	594.2
6.9	594.3
8.4	594.0
9.2	594.0
9.8	593.6
10.2	593.7
11.0	593.9
12.2	594.3
13.5	594.4
16.0	594.3
19.5	594.0

SUMMARY DATA	
Bankfull Elevation:	594.3
Bank Height Ratio:	1.00
Thalweg Elevation:	593.6
LTOB Elevation:	594.3
LTOB Max Depth:	0.6
LTOB Cross Sectional Area:	1.5

Stream Type	E/C 5

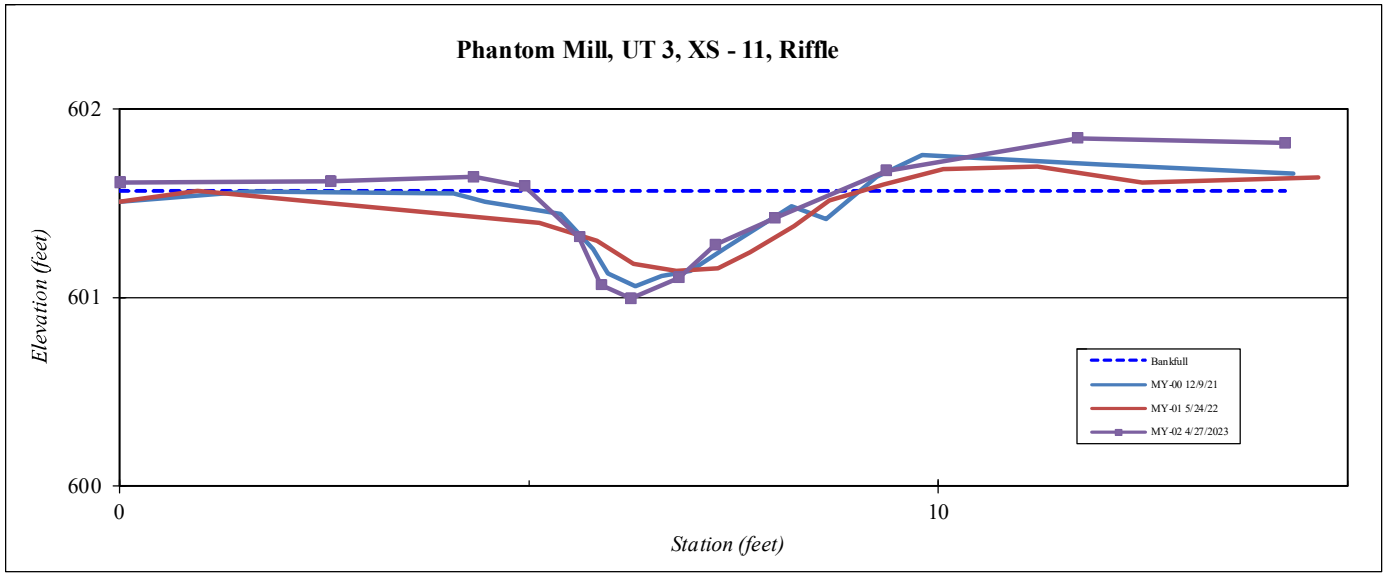


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 11, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	601.7
2.6	601.7
4.3	601.8
4.9	601.7
5.6	601.4
5.9	601.0
6.2	600.9
6.8	601.1
7.3	601.3
8.0	601.5
9.4	601.8
11.7	602.0
14.2	602.0

SUMMARY DATA	
Bankfull Elevation:	601.7
Bank Height Ratio:	1.13
Thalweg Elevation:	600.9
LTOB Elevation:	601.8
LTOB Max Depth:	0.8
LTOB Cross Sectional Area:	1.7

Stream Type	E/C 5

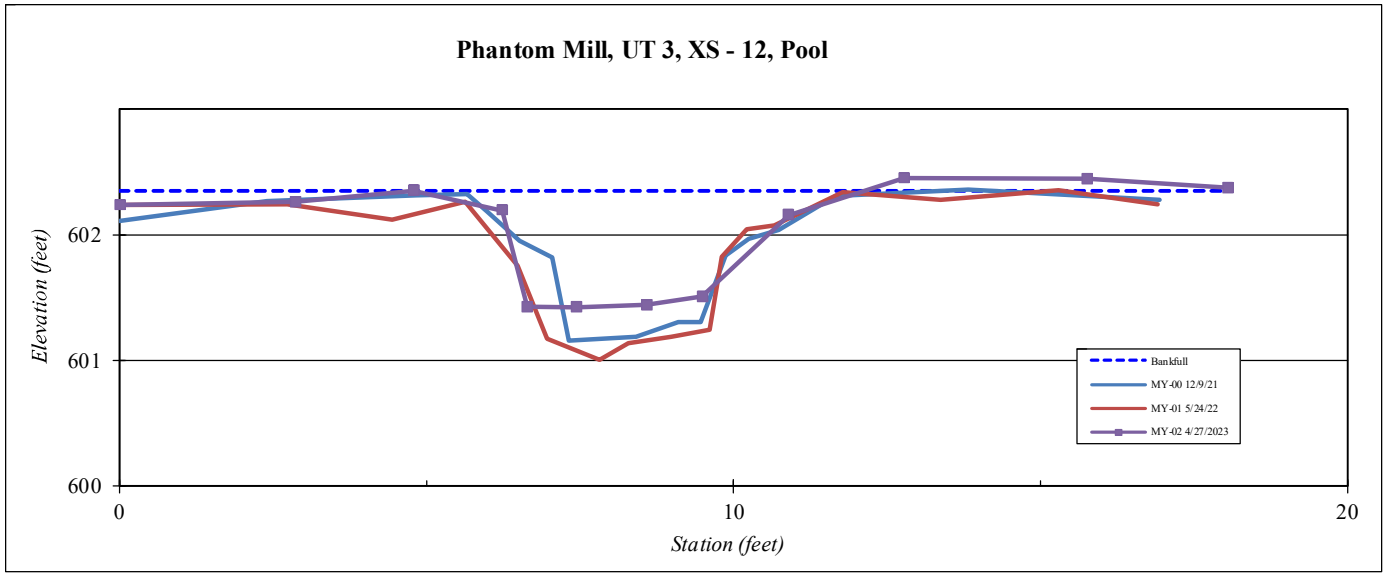


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 12, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	602.5
2.9	602.5
4.8	602.6
6.2	602.5
6.6	601.5
7.4	601.5
8.6	601.5
9.5	601.6
10.9	602.4
12.8	602.8
15.8	602.8
18.0	602.7

SUMMARY DATA	
Bankfull Elevation:	602.6
Bank Height Ratio:	1.00
Thalweg Elevation:	601.5
LTOB Elevation:	602.6
LTOB Max Depth:	1.2
LTOB Cross Sectional Area:	4.7

Stream Type	E/C 5

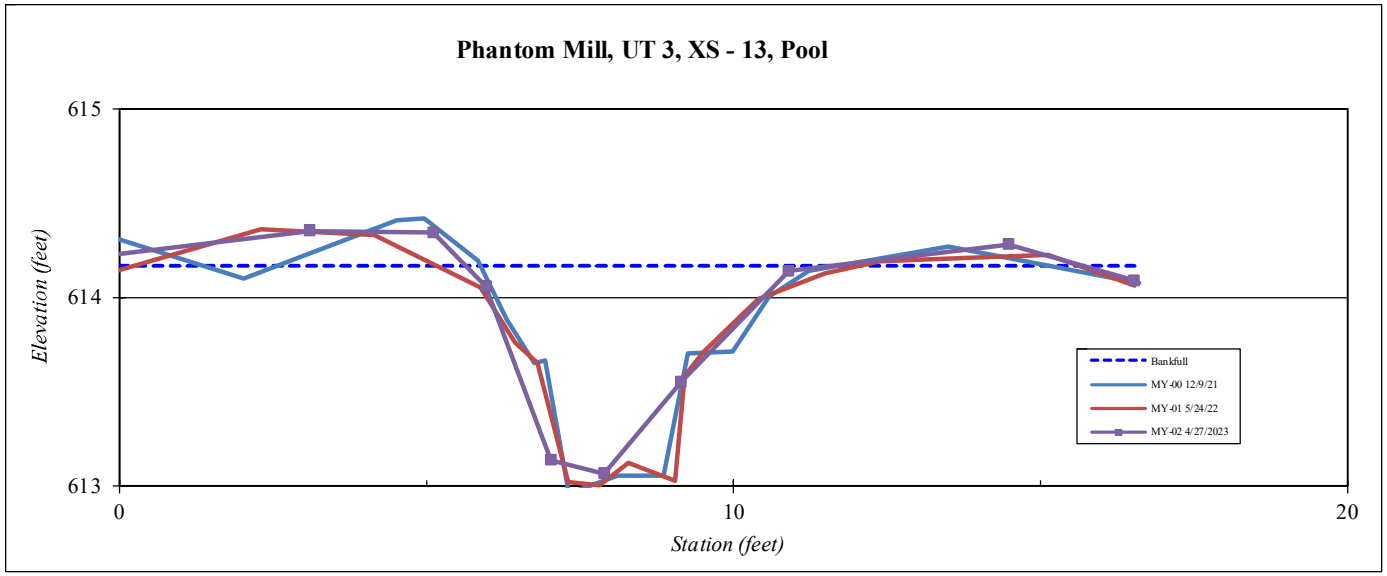


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 13, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
-0.3	614.2
3.1	614.4
5.1	614.3
6.0	614.1
7.0	613.1
7.9	613.1
9.1	613.6
10.9	614.1
14.5	614.3
16.5	614.1

SUMMARY DATA	
Bankfull Elevation:	614.2
Bank Height Ratio:	0.98
Thalweg Elevation:	613.1
LTOB Elevation:	614.1
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	3.0

Stream Type	E/C 5

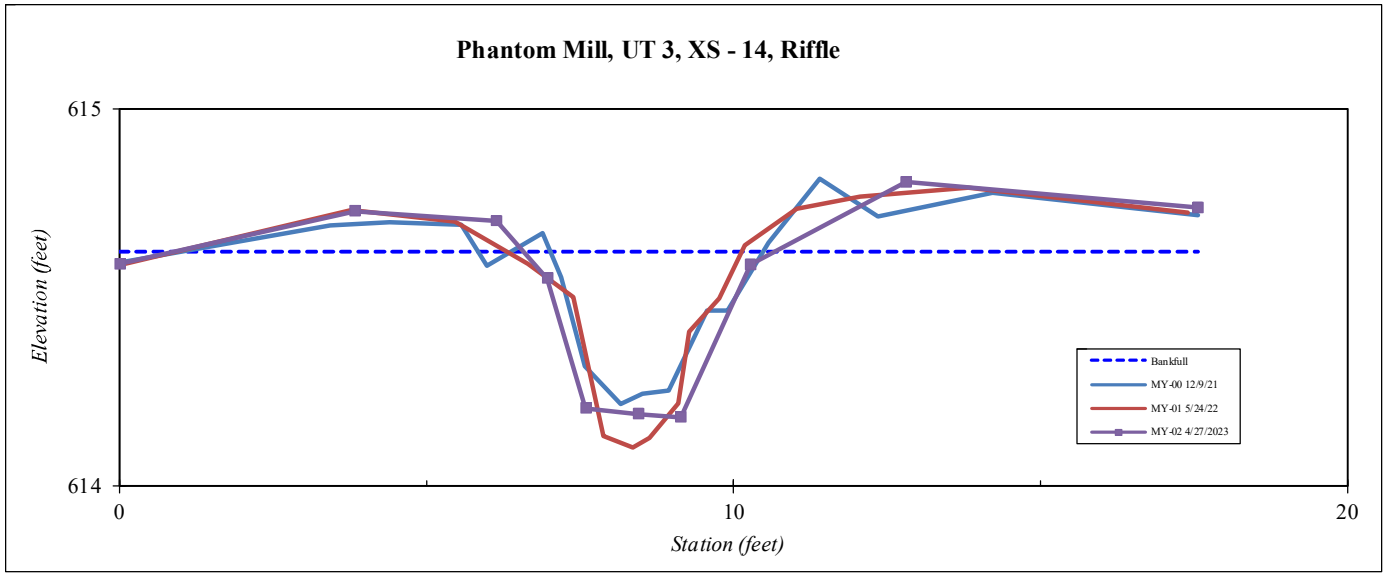


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 14, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	614.2
3.8	614.4
6.1	614.4
7.0	614.2
7.6	613.8
8.5	613.7
9.1	613.7
10.3	614.2
12.8	614.5
17.6	614.4

SUMMARY DATA	
Bankfull Elevation:	614.3
Bank Height Ratio:	0.84
Thalweg Elevation:	613.7
LTOB Elevation:	614.2
LTOB Max Depth:	0.5
LTOB Cross Sectional Area:	1.0

Stream Type	E/C 5

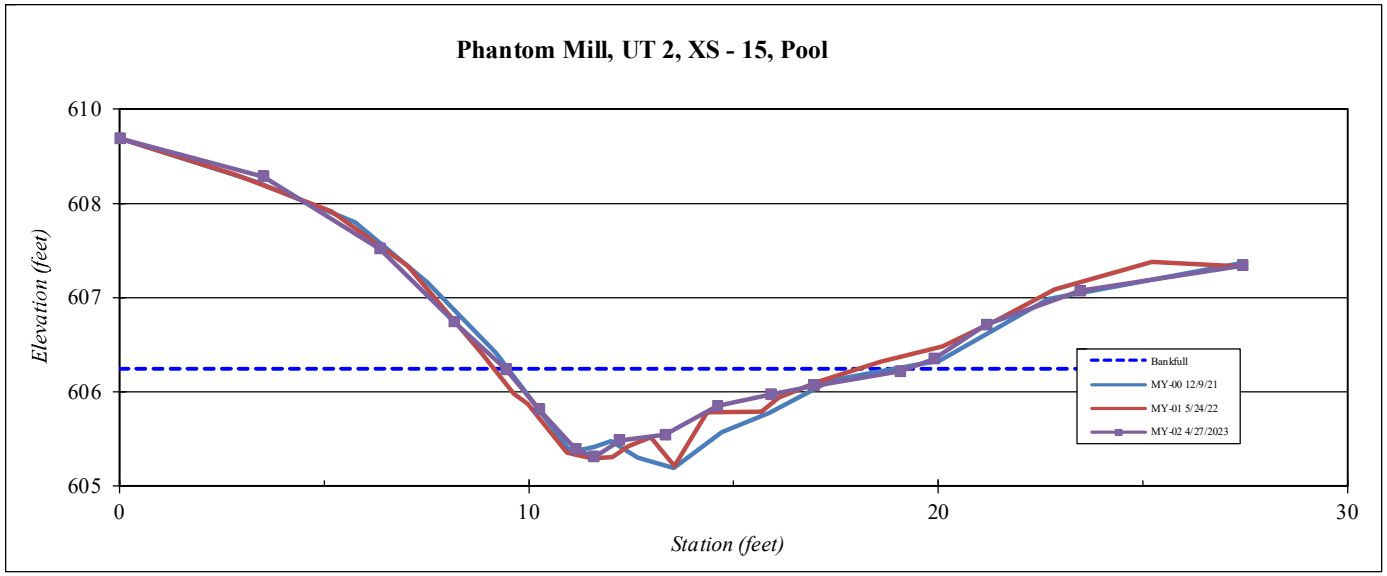


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 2, XS - 15, Pool
Feature	Pool
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	609.3
3.5	608.8
6.4	607.9
8.2	606.9
9.4	606.3
10.2	605.7
11.1	605.2
11.6	605.1
12.2	605.3
13.3	605.4
14.6	605.8
15.9	605.9
17.0	606.1
19.1	606.2
19.9	606.4
21.2	606.9
23.5	607.3
27.4	607.7

SUMMARY DATA	
Bankfull Elevation:	606.3
Bank Height Ratio:	0.99
Thalweg Elevation:	605.1
LTOB Elevation:	606.3
LTOB Max Depth:	1.2
LTOB Cross Sectional Area:	5.0

Stream Type	E/C 5



Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 2, XS - 16, Riffle
Feature	Riffle
Date:	4/27/2023
Field Crew:	Perkinson, Lance, Adams, Smith

Station	Elevation
0.0	607.7
3.1	607.7
5.3	607.4
6.6	607.2
7.3	607.2
8.1	606.9
8.6	606.8
8.7	606.8
9.2	606.7
9.5	606.7
10.2	606.8
10.7	606.8
11.1	606.8
11.8	606.6
12.5	606.7
12.8	606.8
13.8	607.1
14.7	607.4
16.5	607.6
19.7	607.8

SUMMARY DATA	
Bankfull Elevation:	607.4
Bank Height Ratio:	0.95
Thalweg Elevation:	606.6
LTOB Elevation:	607.4
LTOB Max Depth:	0.8
LTOB Cross Sectional Area:	4.1

Stream Type	E/C 5

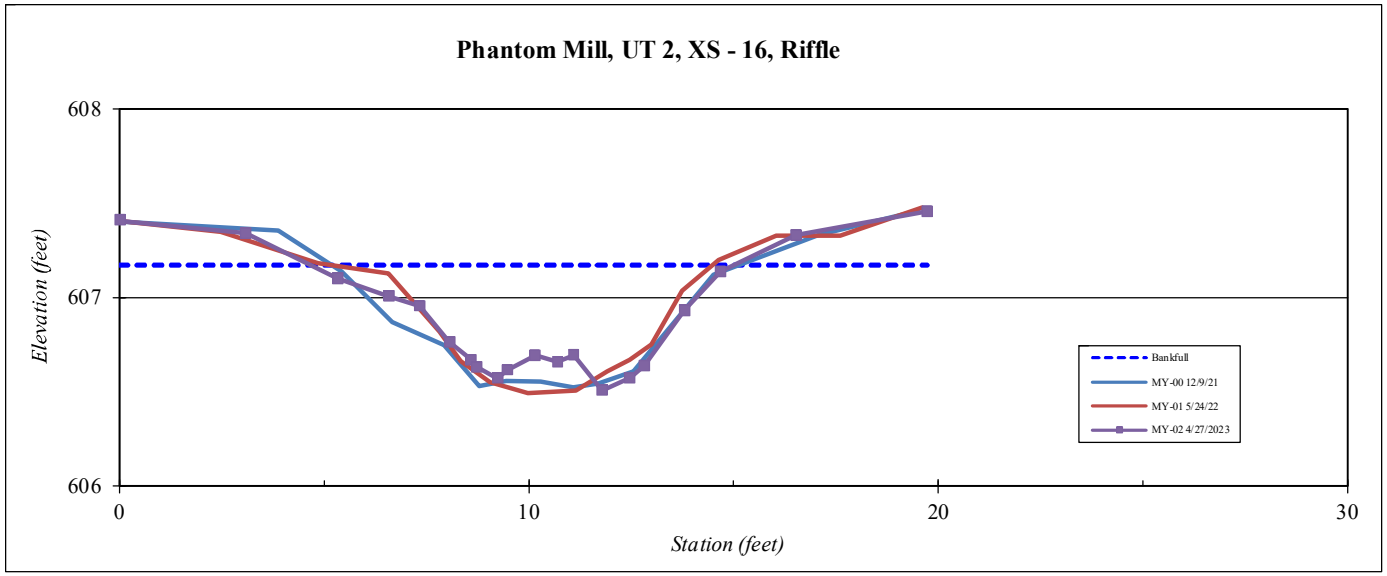


Table 9A. Baseline Stream Data Summary Phantom Mill - Cane Creek										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	18.6	23		43.5		25.1	28.9	29.5	32.9	3
Floodprone Width (ft)	50	100		100		100	150	100	100	3
Bankfull Mean Depth (ft)	1.2	2.3		2.8		1.8	2.1	1.7	1.8	3
Bankfull Max Depth (ft)	2	3.3		4.4		2.3	2.9	2.6	3.0	3
Bankfull Cross Sectional Area (ft^2)	52.3	52.3		52.3		52.3	52.3	50.9	55.3	3
Width/Depth Ratio	6.6	10		36.3		12	16	16.6	19.6	3
Entrenchment Ratio	1.6	4.3		5.4		3.7	5.5	3.0	3.4	3
Bank Height Ratio	**1.1**	**1.4**		**2**		**1**	**1.2**	**1.0**	**1.0**	3
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg 5					E/C 3/4		E/C 4		
Bankfull Discharge (cfs)	232.1					232.1		232.1		
Sinuosity (ft)	1.06					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0033					0.003		0.0026		
Other										

Table 9B. Baseline Stream Data Summary Phantom Mill - UT 2										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	7.8	11		17.2		7.2	8.3	9.0	9.0	1
Floodprone Width (ft)	20	50		100		30	90	50.0	50.0	1
Bankfull Mean Depth (ft)	0.2	0.4		0.6		0.5	0.6	0.5	0.5	1
Bankfull Max Depth (ft)	0.4	0.8		1.2		0.7	0.8	0.7	0.7	1
Bankfull Cross Sectional Area (ft^2)	4.3	4.3		4.3		4.3	4.3	4.5	4.5	1
Width/Depth Ratio	13	27.5		86		12	16	18.0	18.0	1
Entrenchment Ratio	1.2	3.6		12.8		3.9	11.6	5.6	5.6	1
Bank Height Ratio	**0.9**	**1.5**		**3.1**		**1**	**1.2**	**1.0**	**1.0**	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Cg 3/4					E/C 3/4		C 4		
Bankfull Discharge (cfs)	16.2					16.2		16.2		
Sinuosity (ft)	1.2					1.2		1.2		
Water Surface Slope (Channel) (ft/ft)	0.0188					0.0188		0.0169		
Other										

Table 9C. Baseline Stream Data Summary Phantom Mill - UT 3										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	4.1	7.9		11.7		4.4	5.1	3.8	4.8	3
Floodprone Width (ft)	8	12		25		30	90	50.0	50.0	3
Bankfull Mean Depth (ft)	0.1	0.2		0.3		0.3	0.4	0.3	0.3	3
Bankfull Max Depth (ft)	0.2	0.4		0.7		0.4	0.5	0.4	0.6	3
Bankfull Cross Sectional Area (ft^2)	1.6	1.6		1.6		1.6	1.6	1.2	1.5	3
Width/Depth Ratio	10.3	39.5		117		12	16	11.2	15.6	3
Entrenchment Ratio	1.1	1.4		4.8		6.3	19	10.5	13.0	3
Bank Height Ratio	**1.3**	**5**		**10**		**1**	**1.2**	**1.0**	**1.0**	3
Max part size (mm) mobilized at bankfull										
Rosgen Classification	F4					Cb 3/4		E/C 4		
Bankfull Discharge (cfs)	18.9					18.9		18.9		
Sinuosity (ft)	1.01					1.05		1.05		
Water Surface Slope (Channel) (ft/ft)	0.0317					0.0305		0.0263		
Other										

Table 9D. Baseline Stream Data Summary Phantom Mill - UT 4										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	5	6.4		7.4		6.5	7.5	4.9	4.9	1
Floodprone Width (ft)	8	10		100		30	90	15.0	15.0	1
Bankfull Mean Depth (ft)	0.5	0.6		0.7		0.5	0.5	0.3	0.3	1
Bankfull Max Depth (ft)	0.6	0.9		1		0.6	0.8	0.5	0.5	1
Bankfull Cross Sectional Area (ft^2)	3.5	3.5		3.5		3.5	3.5	1.5	1.5	1
Width/Depth Ratio	7.1	10.7		14.8		12	16	16.0	16.0	1
Entrenchment Ratio	1.1	1.8		20		4.3	12.9	3.1	3.1	1
Bank Height Ratio	**1.1**	**1.8**		**3.2**		**1**	**1.2**	**1.0**	**1.0**	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg 4					E/C 3/4		C 4		
Bankfull Discharge (cfs)	13.1					13.1		13.1		
Sinuosity (ft)	1.04					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0228					0.0206		0.0135		
Other										

Table 10A. Monitoring Data - Cross Section Morphology Monitoring Summary
(Phantom Mill / DMS:95017) Cane Creek

	Cane Creek - Cross Section 3 (Riffle)							Cane Creek - Cross Section 4 (Pool)							Cane Creek - Cross Section 5 (Pool)							Cane Creek - Cross Section 6 (Riffle)							Cane Cr - Cross Section 7 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	589.82	589.76	589.82					590.49	590.44	590.49					591.65	591.85	591.80					591.81	591.90	592.00					593.48	593.56	593.64				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00	0.97					1.00	1.00	0.98					1.00	1.02	0.97					1.00	0.99	0.93					1.00	0.95	0.98				
Thalweg Elevation	587.20	586.95	587.09					586.589	585.67	586.01					587.688	587.87	587.75					588.95	588.93	588.98					590.526	590.78	590.74				
LTOB[2] Elevation	589.82	589.77	589.73					590.488	590.46	590.40					591.65	591.92	591.67					591.81	591.86	591.79					593.477	593.43	593.59				
LTOB[2] Max Depth (ft)	2.62	2.82	2.65					3.90	4.79	4.39					3.96	4.05	3.92					2.85	2.93	2.81					2.95	2.65	2.85				
LTOB[2] Cross Sectional Area (ft[2])	50.9	51.27	48.42					69.4	70.18	66.64					71.9	73.80	68.33					55.2	54.22	49.60					52.4	48.89	50.85				

	Cane Creek - Cross Section 8 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	593.47	593.68	593.51				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.96	0.98				
Thalweg Elevation	589.77	589.67	589.40				
LTOB[2] Elevation	593.47	593.53	593.42				
LTOB[2] Max Depth (ft)	3.71	3.86	4.02				
LTOB[2] Cross Sectional Area (ft[2])	70.4	65.48	66.87				

Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area							
Bank Height Ratio_Based on AB Bankfull[1] Area							
Thalweg Elevation							
LTOB[2] Elevation							
LTOB[2] Max Depth (ft)							
LTOB[2] Cross Sectional Area (ft[2])							

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 bankfull 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.

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.

Table 10B. Monitoring Data - Cross Section Morphology Monitoring Summary
(Phantom Mill / DMS:95017) UT 2, 3, and 4

	UT 2 - Cross Section 15 (Pool)							UT 2 - Cross Section 16 (Riffle)							UT 3 - Cross Section 9 (Pool)							UT 3 - Cross Section 10 (Riffle)							UT 3 - Cross Section 11 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	606.13	606.19	606.28					607.38	607.45	607.44					594.14	593.94	594.10					594.24	594.26	594.26					601.65	601.60	601.66				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.93	0.99					1.00	1.00	0.95					1.00	1.10	0.98					1.00	0.87	1.00					1.00	1.00	1.13				
Thalweg Elevation	604.963	604.99	605.11					606.632	606.59	606.61					593.223	592.95	593.21					593.81	593.83	593.65					601.03	601.13	600.95				
LTOB[2] Elevation	606.13	606.11	606.27					607.38	607.45	607.40					594.14	594.05	594.08					594.24	594.20	594.27					601.651	601.60	601.76				
LTOB[2] Max Depth (ft)	1.17	1.12	1.16					0.75	0.86	0.79					0.92	1.09	0.87					0.43	0.38	0.62					0.62	0.47	0.81				
LTOB[2] Cross Sectional Area (ft[2])	5.1	4.48	5.03					4.5	4.56	4.11					3.4	3.90	3.30					1.5	1.21	1.50					1.3	1.33	1.71				

	UT 3 - Cross Section 12 (Pool)							UT 3 - Cross Section 13 (Pool)							UT 3 - Cross Section 14 (Riffle)							UT 4 - Cross Section 1 (Pool)							UT 4 - Cross Section 2 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	602.61	602.48	602.65					614.14	614.13	614.17					614.34	614.30	614.28					589.15	589.21	589.18					589.39	589.32	589.37				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.04	1.00					1.00	1.00	0.98					1.00	1.00	0.84					1.00	0.99	0.96					1.00	1.03	0.86				
Thalweg Elevation	601.15	600.96	601.49					612.961	613.00	613.07					613.78	613.63	613.73					587.792	587.89	588.11					588.932	588.68	588.70				
LTOB[2] Elevation	602.61	602.54	602.65					614.141	614.13	614.14					614.34	614.30	614.19					589.15	589.19	589.14					589.39	589.34	589.27				
LTOB[2] Max Depth (ft)	1.46	1.58	1.16					1.18	1.12	1.07					0.57	0.67	0.46					1.36	1.30	1.03					0.46	0.66	0.58				
LTOB[2] Cross Sectional Area (ft[2])	4.7	5.07	4.72					3.2	3.15	3.04					1.3	1.29	1.01					6.2	5.95	5.68					1.5	1.57	1.11				

Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area							
Bank Height Ratio_Based on AB Bankfull[1] Area							
Thalweg Elevation							
LTOB[2] Elevation							
LTOB[2] Max Depth (ft)							
LTOB[2] Cross Sectional Area (ft[2])							

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:

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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.

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.

Appendix D: Hydrologic Data

Table 11. Verification of Bankfull Events
Table 12. Groundwater Hydrology Data
Groundwater Gauge Graphs
Tables 13 A-C. Channel Evidence
Surface Water Gauge Graphs
Figure D1. 30/70 Percentile Graph for Rainfall
Soil Temperature Graph

Table 11. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
January 3, 2022	January 3, 2022	A bankfull event was documented on Cane Creek, UT-3, and UT-4 by trail camera and stream gauge evidence after 1.79 inches of rain were captured at an onsite rain gauge.	1, 2, 3
March 12, 2022	March 12, 2022	A bankfull event was documented on the UT-4 trail camera and UT-2, UT-3, and UT-4 stream gauges after 1.17 inches of rain were captured at an onsite rain gauge.	4
April 18, 2022	April 18, 2022	A bankfull event was documented on the UT-4 trail camera and UT-2, UT-3, and UT-4 stream gauges after 1.11 inches of rain were captured at an onsite rain gauge.	5
October 5, 2022	July 27, 2022	UT-2, UT-3, and UT-4 stream gauges documented a bankfull event after 2.75 inches of rain were captured at an onsite rain gauge.	--
February 12, 2023	February 12, 2023	A bankfull event was documented on the UT-3 trail camera and UT-2, UT-3, and UT-4 stream gauges after 2.14 inches of rain were captured at an onsite rain gauge.	6
April 7, 2023	April 7, 2023	A bankfull event was documented on the UT-3 trail camera and UT-2, UT-3, and UT-4 stream gauges after 2.88 inches of rain were captured at an onsite rain gauge.	7

Photo 1: Bankfull event documented on Cane Creek

Photo 2: Bankfull Event Documented on UT-3

Photo 3: Bankfull Event Documented on UT-4

Photo 4: Bankfull Event Documented on UT-4

Photo 5: UT-4 Receding after a Bankfull Event

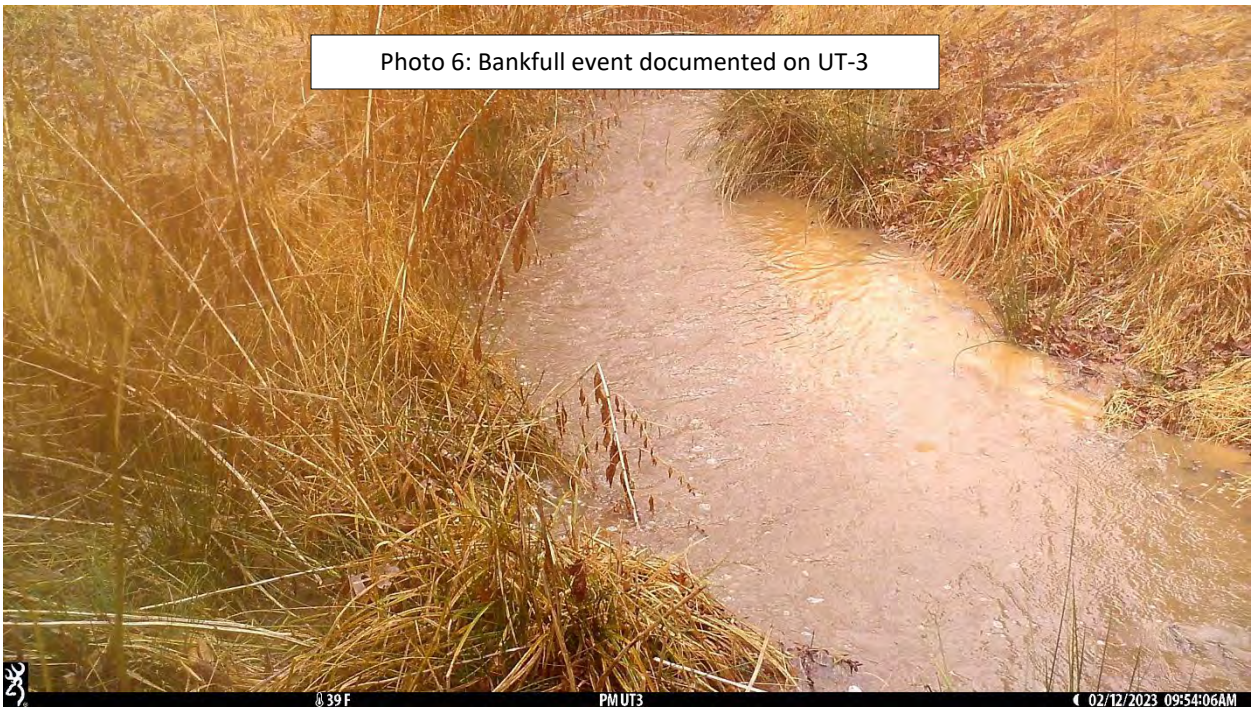
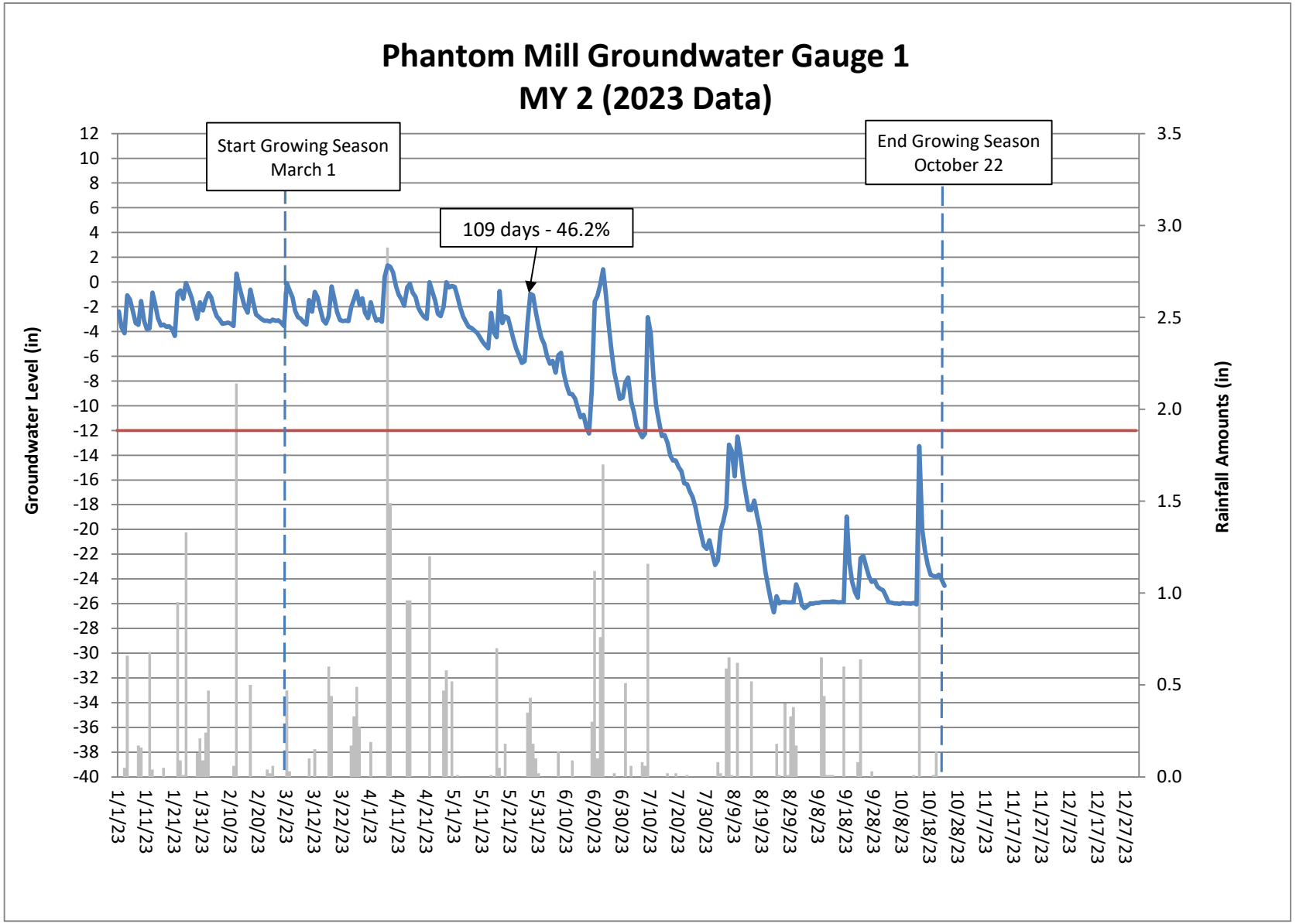


Photo 6: Bankfull event documented on UT-3

Photo 7: Bankfull event documented on UT-3

Table 12. Groundwater Hydrology Data
Summary of Monitoring Period/Hydrology Success Criteria by Year

Gauge	12% Hydroperiod Success Criteria Achieved - Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2022)	Year 2 (2023)	Year 3 (2024)	Year 4 (2025)	Year 5 (2026)	Year 6 (2027)	Year 7 (2028)
1	Yes 106 days (44.9%)	Yes 109 days (46.2%)					
2	Yes 117 days (49.6%)	Yes 144 days (61.0%)					
3	Yes 111 days (47.0%)	Yes 138 days (58.5%)					
4	Yes 115 days (48.7%)	Yes 142 days (60.2%)					
5	Yes 79 days (33.5%)	Yes 72 days (30.5%)					
6	Yes 93 days (39.4%)	Yes 108 days (45.8%)					
7	Yes 98 days (41.5%)	Yes 105 days (44.5%)					


Phantom Mill Groundwater Gauge 1
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
109 days - 46.2%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
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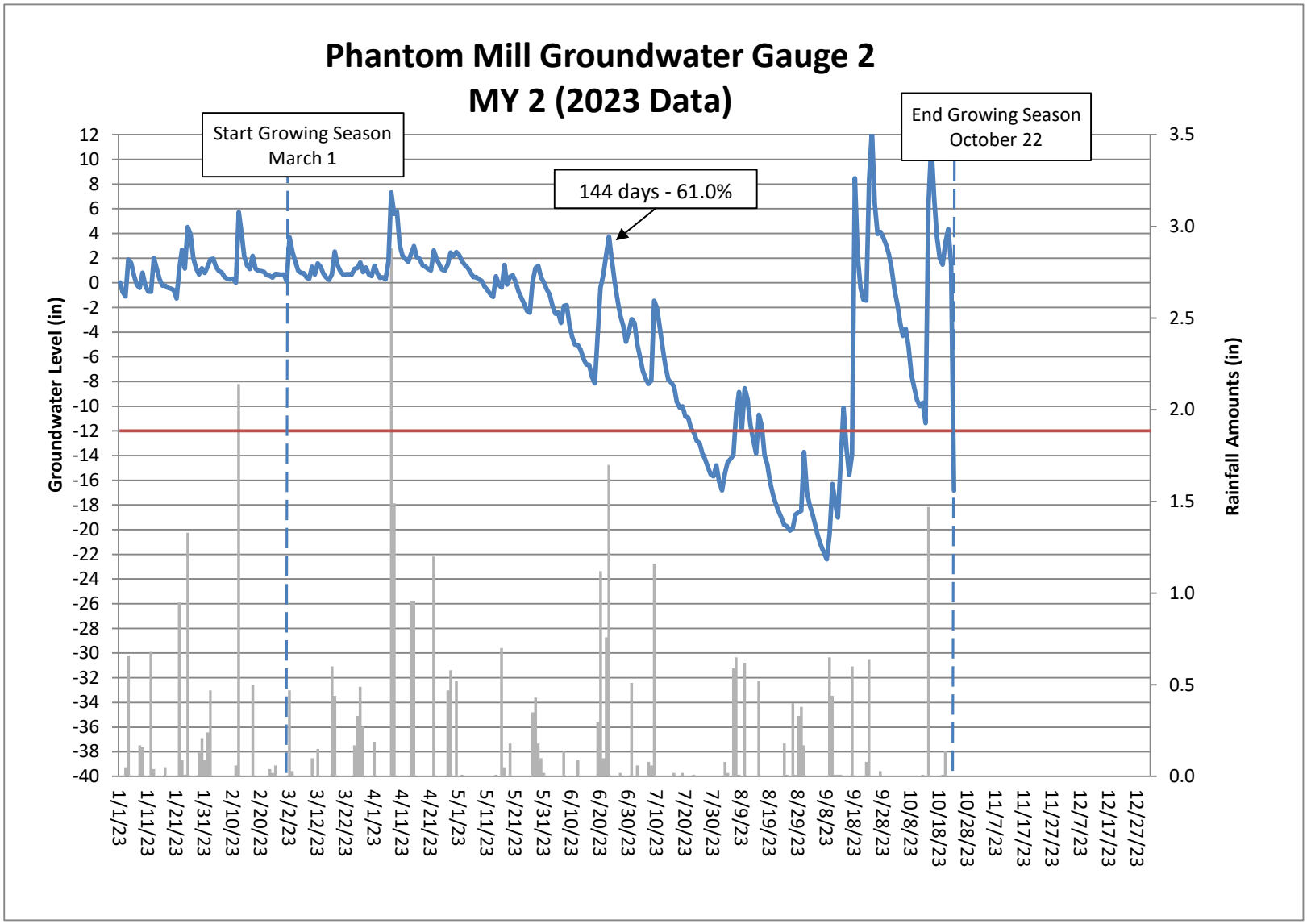
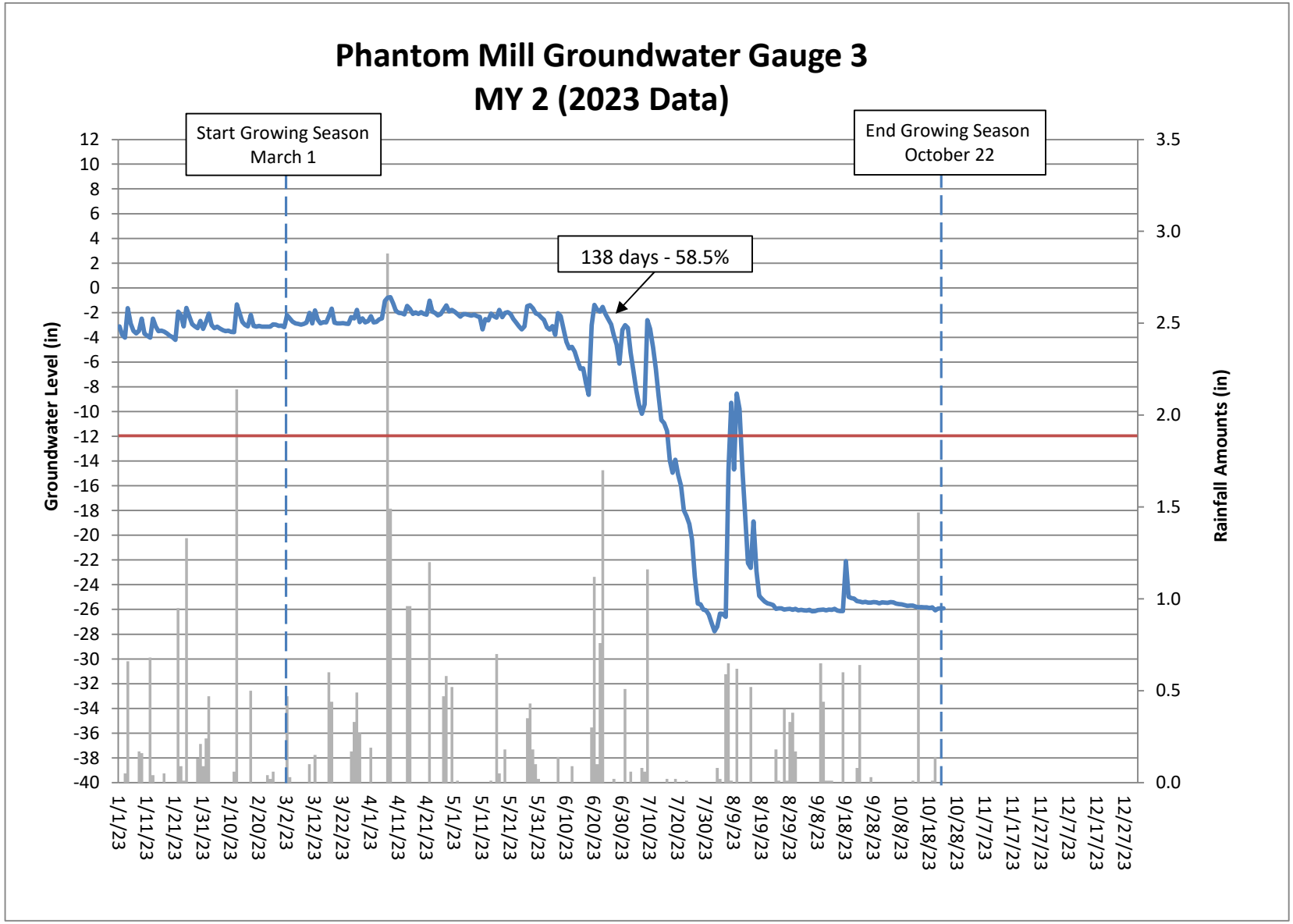
11/27/23
12/7/23
12/17/23
12/27/23


Phantom Mill Groundwater Gauge 2
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
144 days - 61.0%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23


Phantom Mill Groundwater Gauge 3
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
138 days - 58.5%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
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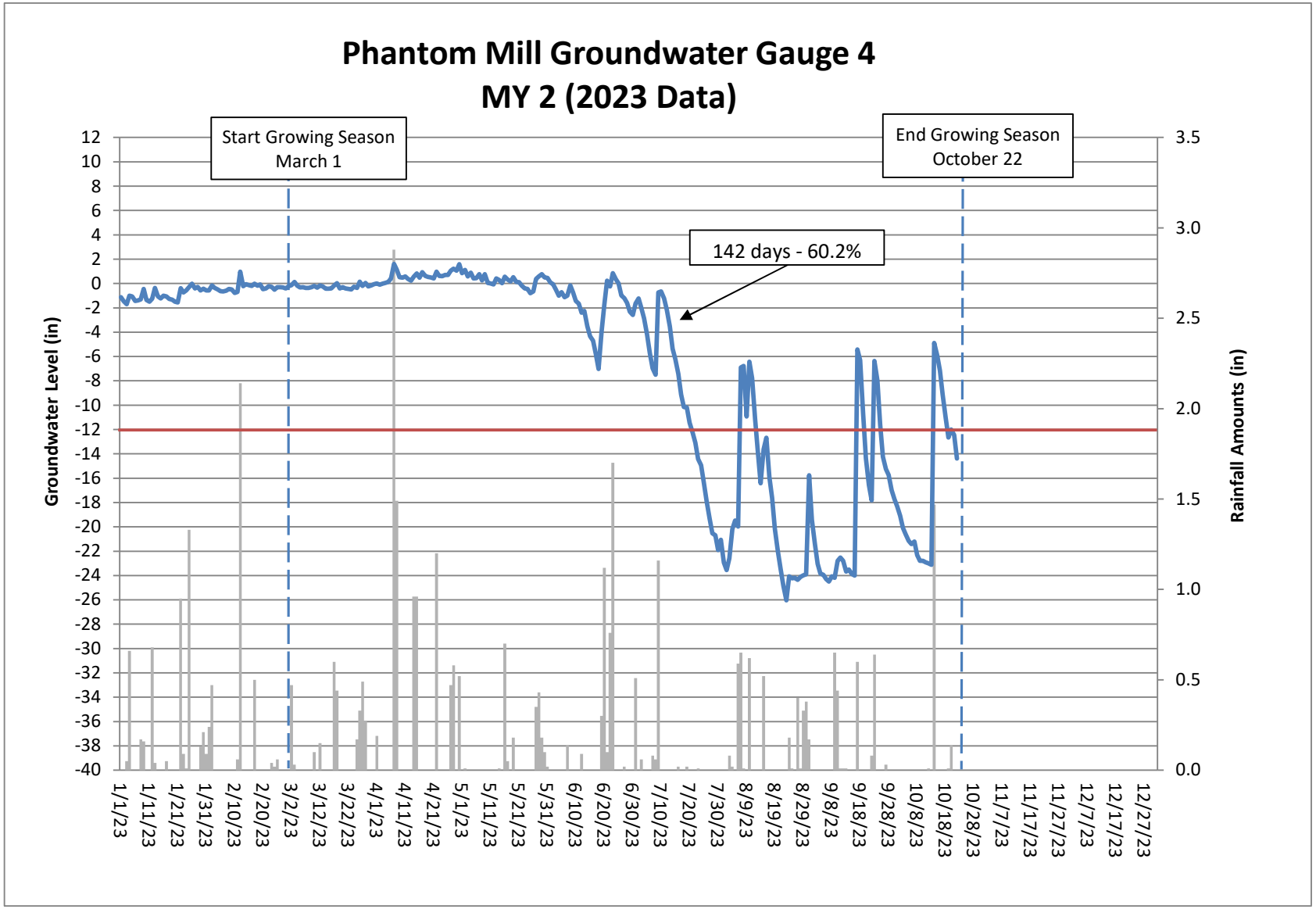
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23


Phantom Mill Groundwater Gauge 4
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
142 days - 60.2%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
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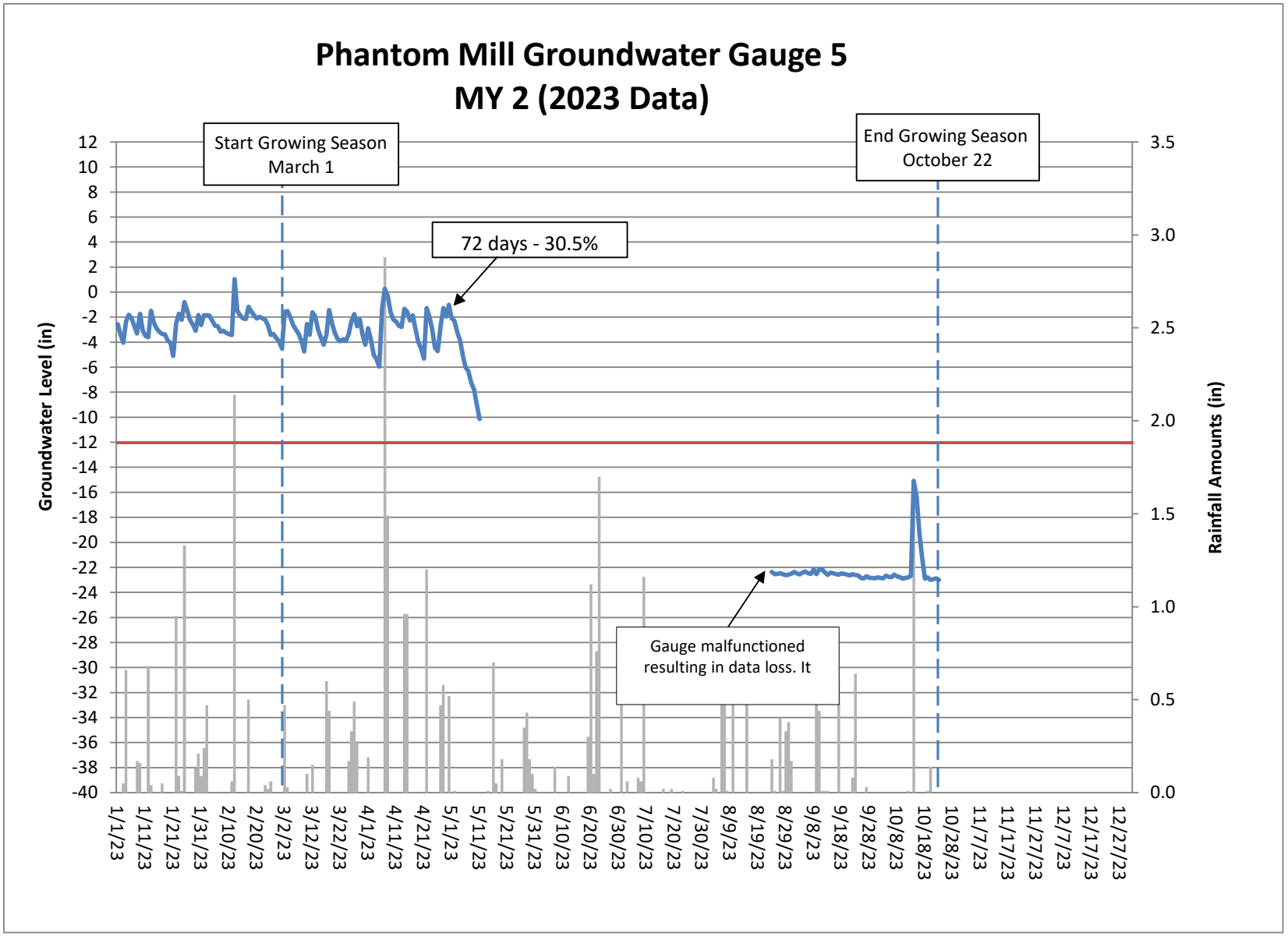
11/27/23
12/7/23
12/17/23
12/27/23


Phantom Mill Groundwater Gauge 5
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
72 days - 30.5%
Gauge malfunctioned
resulting in data loss. It
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
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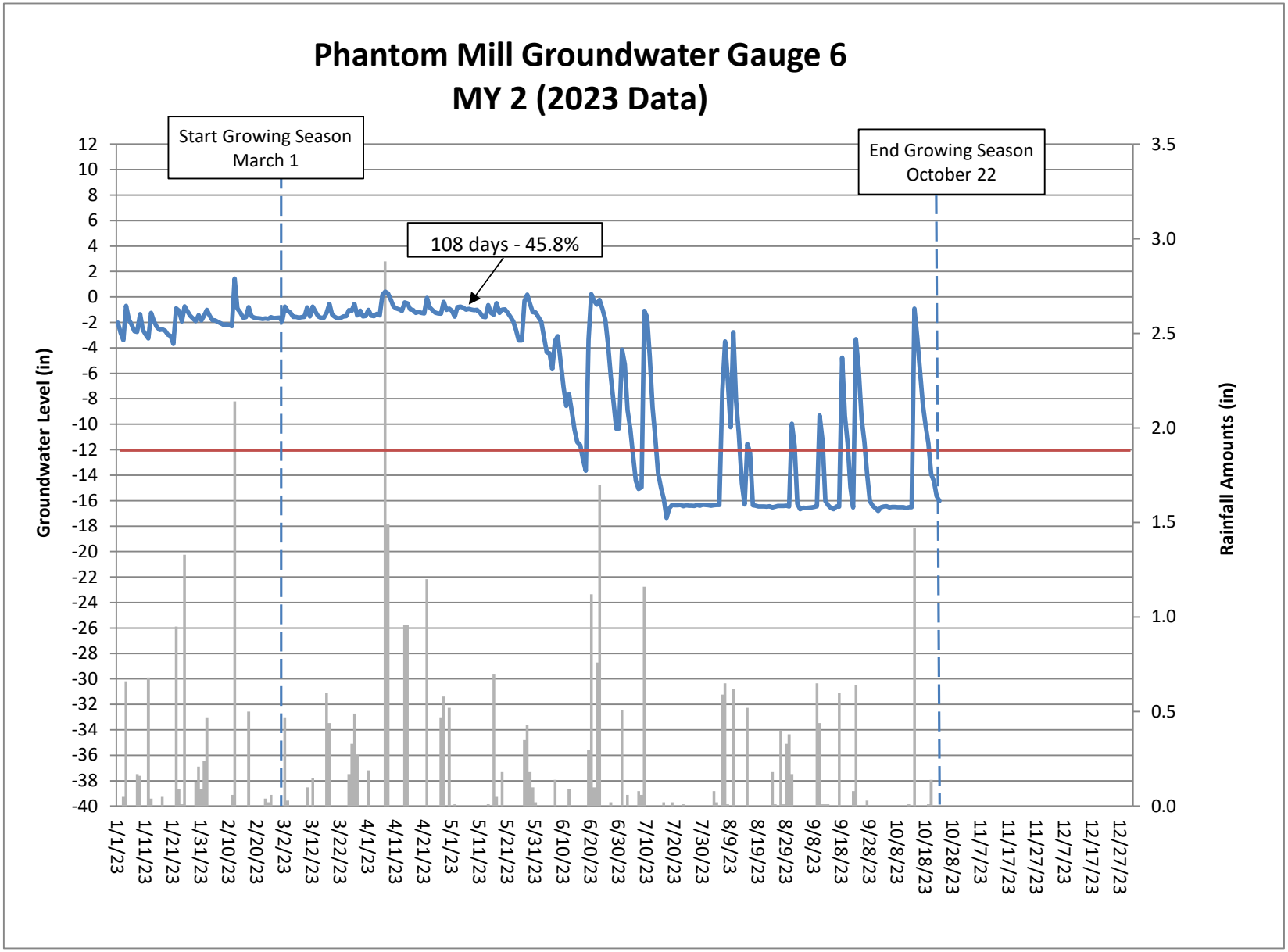
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23


Phantom Mill Groundwater Gauge 6
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
108 days - 45.8%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
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10/28/23
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11/17/23
11/27/23
12/7/23
12/17/23
12/27/23

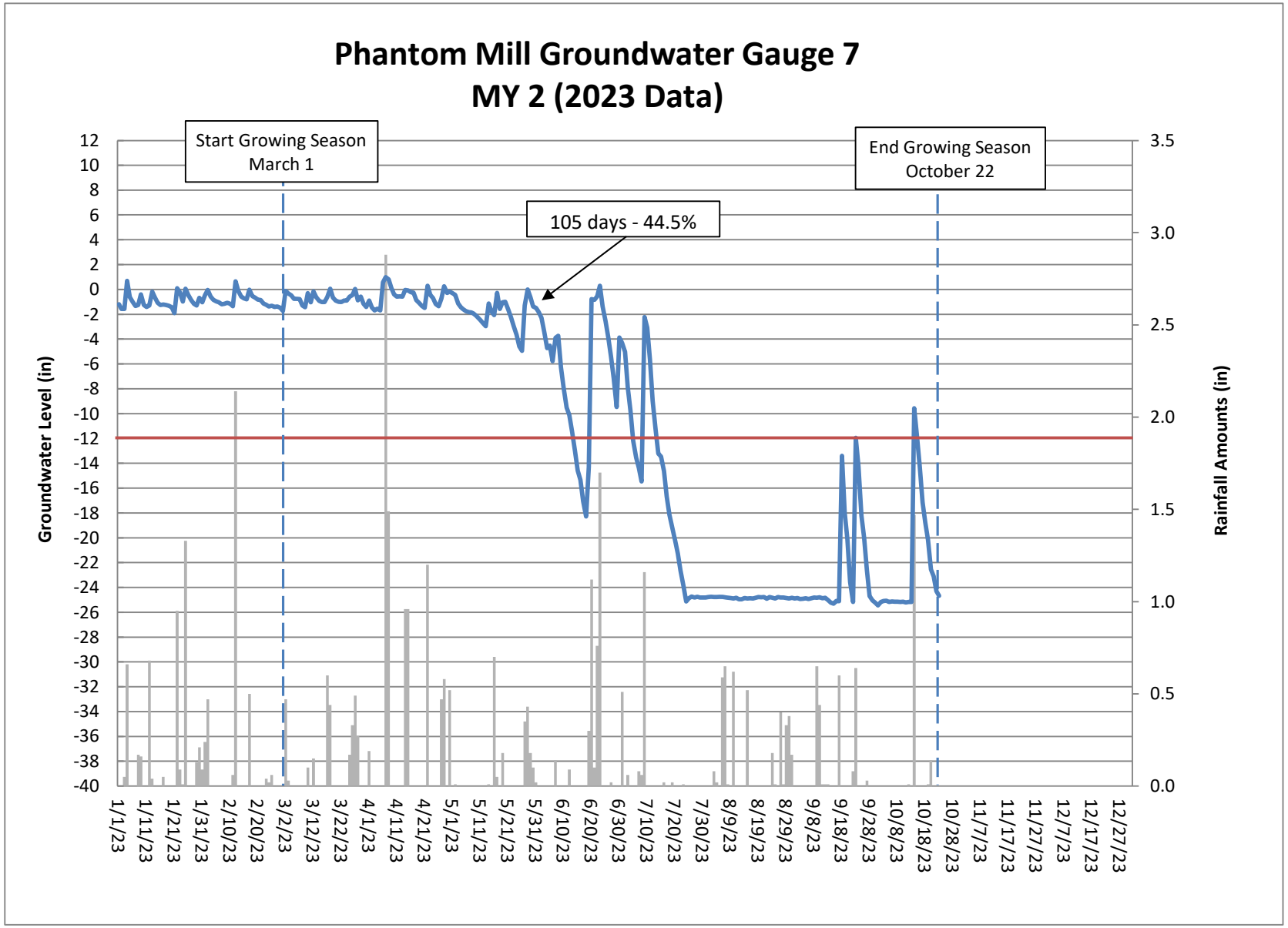

Phantom Mill Groundwater Gauge 7
MY 2 (2023 Data)
Start Growing Season
March 1
End Growing Season
October 22
105 days - 44.5%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23

Table 13A UT-2 Channel Evidence

UT-2 Upstream Channel Evidence	Year 1 (2022)	Year 2 (2023)
Max consecutive days channel flow	164	162
Total cumulative days channel flow*	-	191
Presence of litter and debris (wracking)	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes
Water staining due to continual presence of water	Yes	Yes
Formation of channel bed and banks	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No
Other:		

*New parameter as of MY-2 (2023), at the request of the IRT

Table 13B UT-3 Channel Evidence

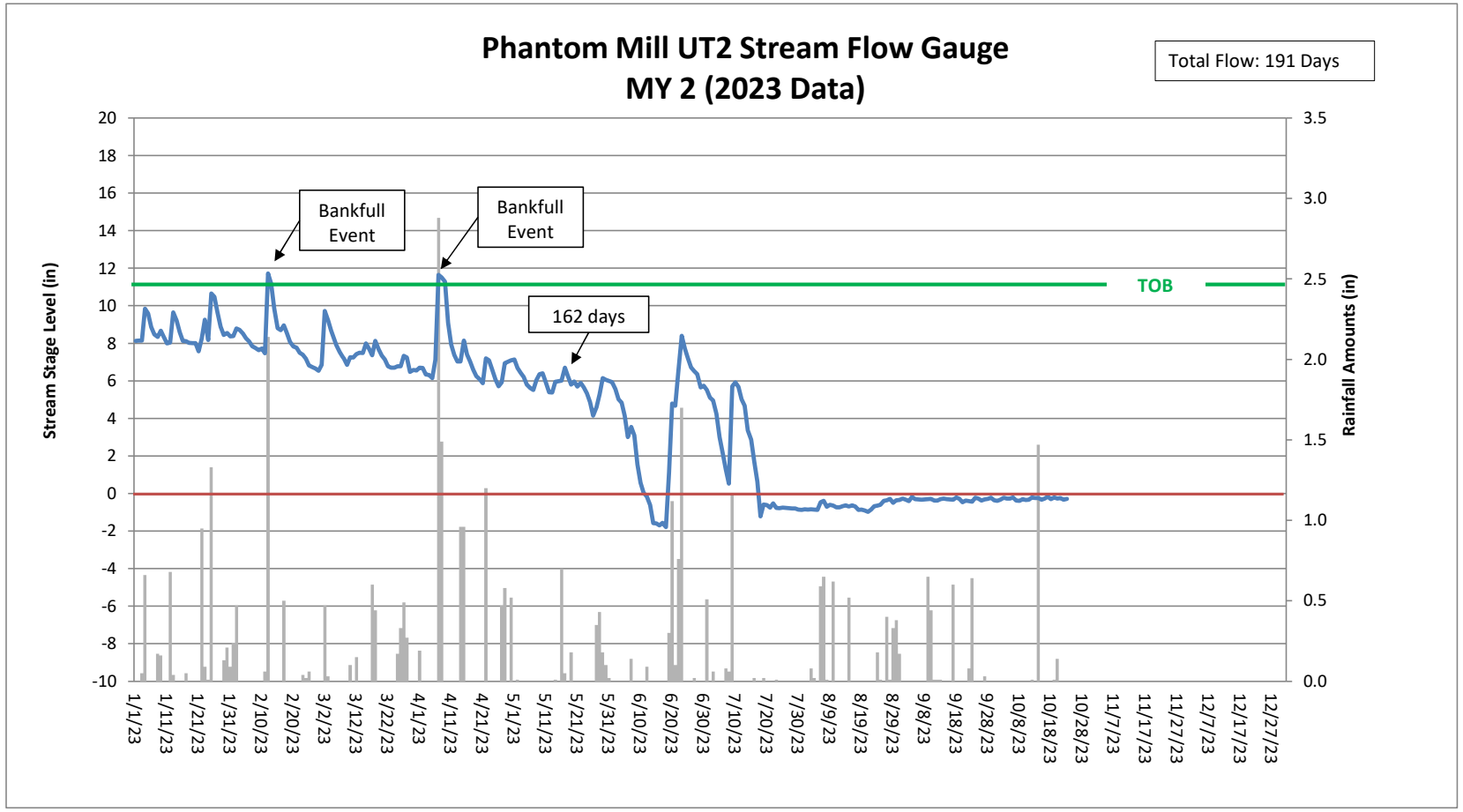
UT-3 Channel Evidence	Year 1 (2022)	Year 2 (2023)
Max consecutive days channel flow	278	296
Total cumulative days channel flow*	-	296
Presence of litter and debris (wracking)	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes
Water staining due to continual presence of water	Yes	Yes
Formation of channel bed and banks	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No
Other:		

*New parameter as of MY-2 (2023), at the request of the IRT

Table 13C UT-4 Channel Evidence

UT-4 Channel Evidence	Year 1 (2022)	Year 2 (2023)
Max consecutive days channel flow	266	213
Total cumulative days channel flow*	-	258
Presence of litter and debris (wracking)	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes
Water staining due to continual presence of water	Yes	Yes
Formation of channel bed and banks	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No
Other:		

*New parameter as of MY-2 (2023), at the request of the IRT


Phantom Mill UT2 Stream Flow Gauge
MY 2 (2023 Data)
Total Flow: 191 Days
Bankfull Event
Bankfull Event
162 days
TOB
Stream Stage Level (in)
Rainfall Amounts (in)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
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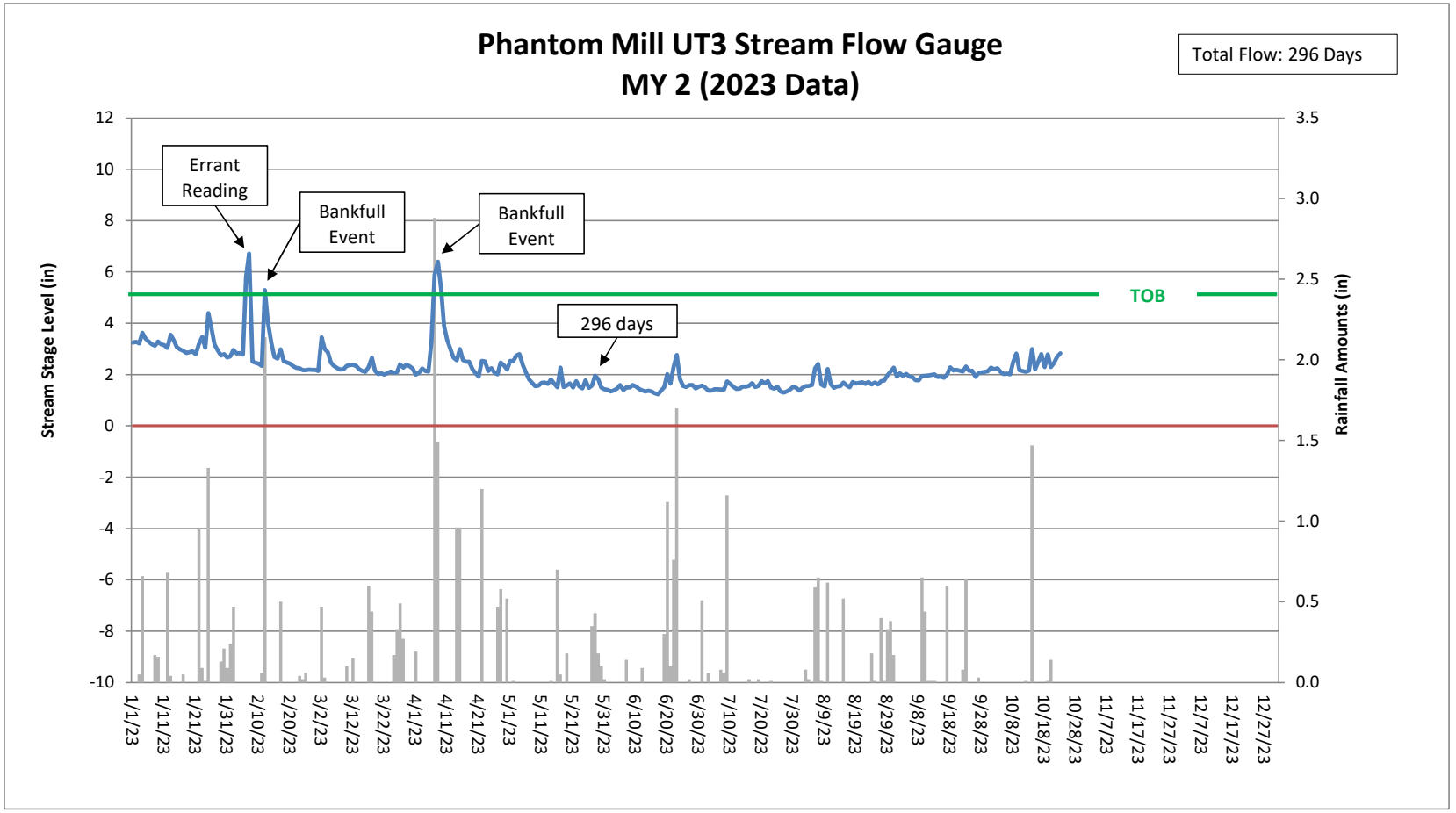
11/27/23
12/7/23
12/17/23
12/27/23


Phantom Mill UT3 Stream Flow Gauge
MY 2 (2023 Data)
Total Flow: 296 Days
Errant Reading
Bankfull Event
Bankfull Event
296 days
TOB
Stream Stage Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
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11/17/23
11/27/23
12/7/23
12/17/23
12/27/23

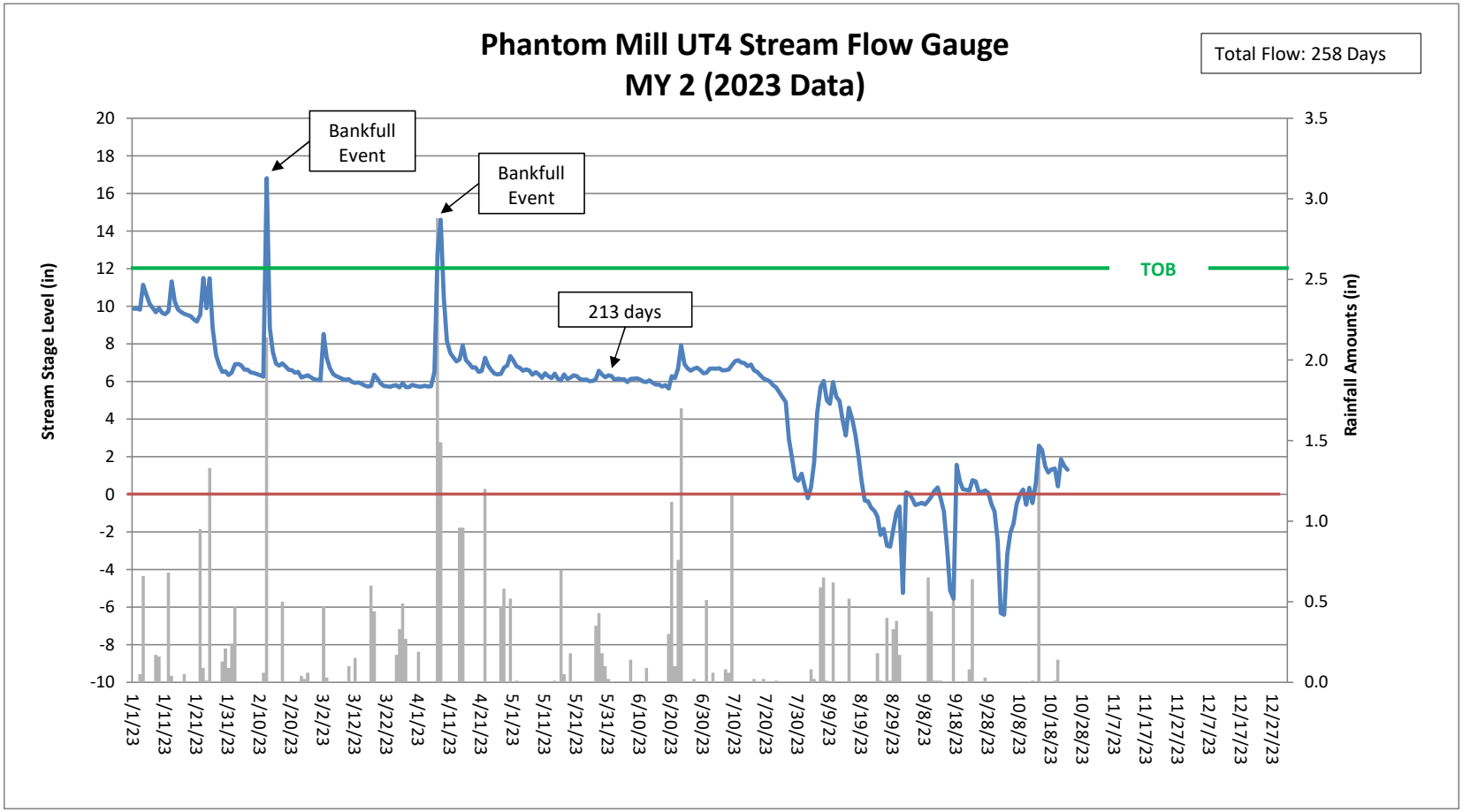
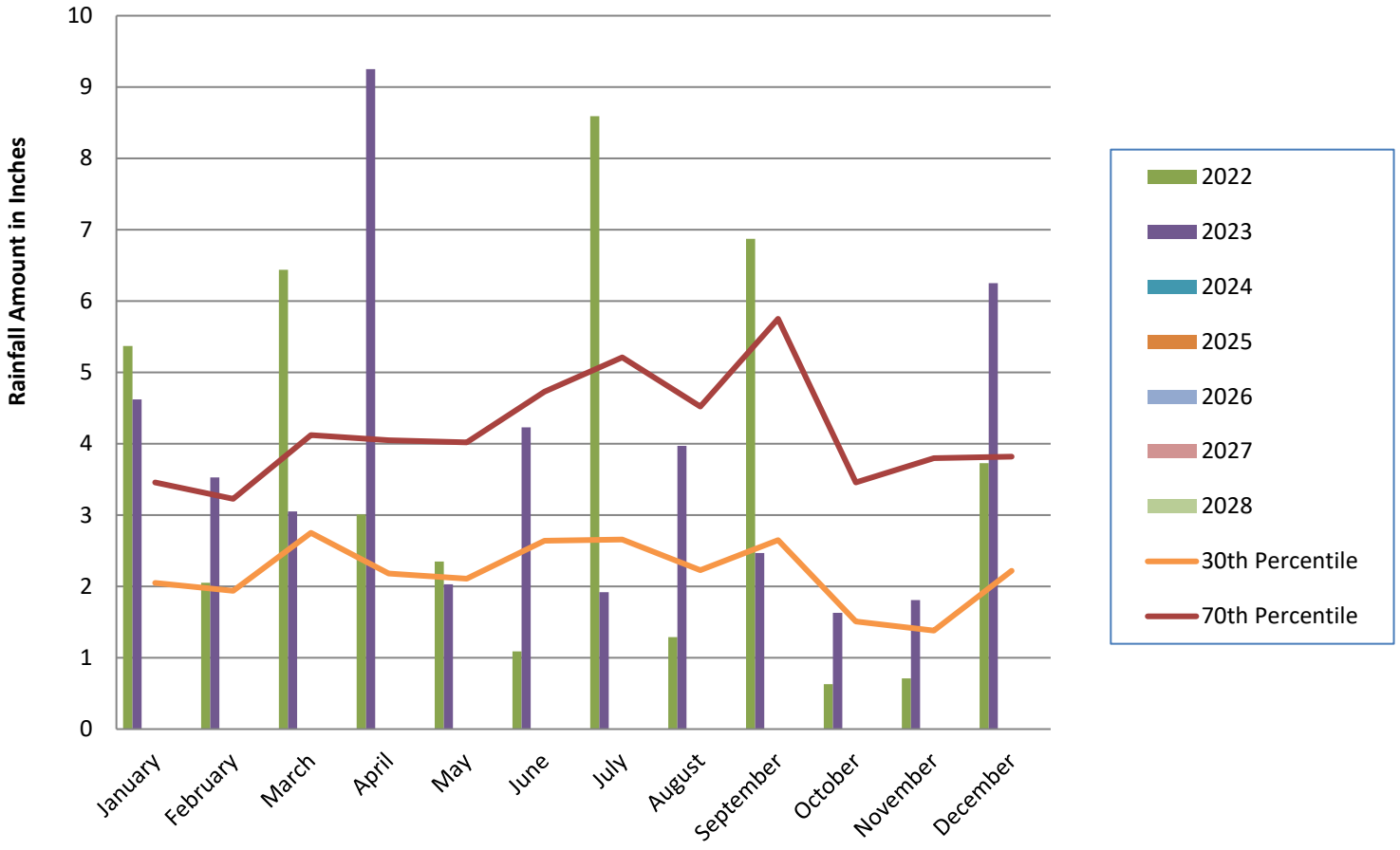
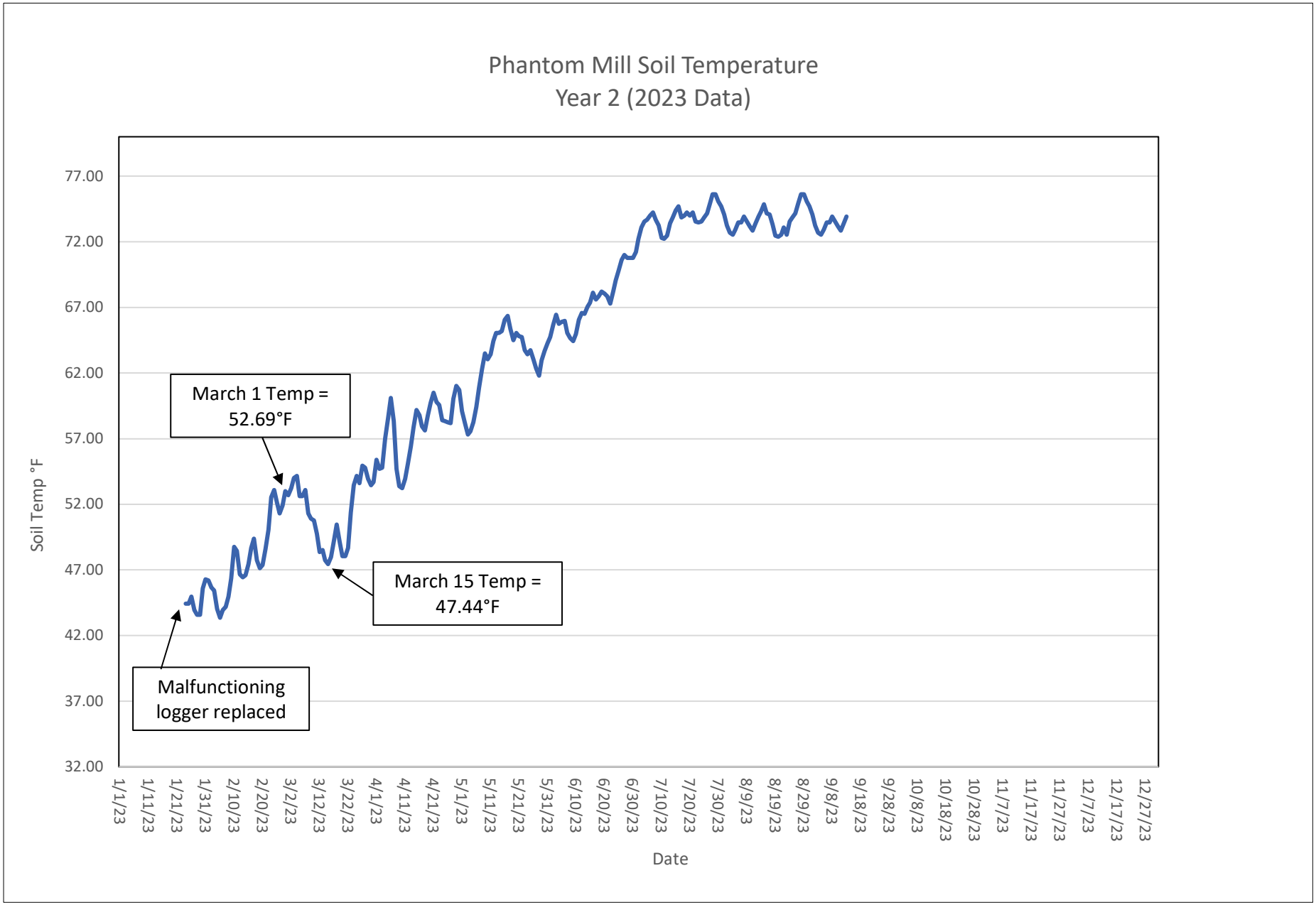

Phantom Mill UT4 Stream Flow Gauge
MY 2 (2023 Data)
Total Flow: 258 Days
Bankfull Event
Bankfull Event
213 days
TOB
Stream Stage Level (in)
Rainfall Amounts (in)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23

Figure D1: Phantom Mill
30-70 Percentile Graph for Rainfall
Current year data from onsite rain gauge
30-70th percentile data from WETS Station: Burlington Alamance Regional Airport, NC (1992-2022)




Phantom Mill Soil Temperature
Year 2 (2023 Data)
Soil Temp °F
77.00
72.00
67.00
62.00
57.00
52.00
47.00
42.00
37.00
32.00
March 1 Temp = 52.69°F
March 15 Temp = 47.44°F
Malfunctioning logger replaced
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23
Date

Appendix E: Project Timeline and Contact Info

Table 14. Project Timeline
Table 15. Project Contacts

Table 14. Project Timeline

Activity or Deliverable	Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted	--	19-Apr-18
Mitigation Plan Approved	7-Aug-19	Jan-20
Construction (Grading) Completed	NA	2-Jun-21
Planting Completed	NA	22-Dec-21
As-built Survey Completed	9-Dec-21	May-22
MY-0 Baseline Report	Dec-21	May-22
MY1 Monitoring Report	Nov-22	Dec-22
MY2 Monitioring Report	Nov-23	Jan-24
Remediation Items (e.g. beaver removal, supplements, repairs etc.)		
Encroachment		

Table 15. Project Contacts

Phantom Mill Site/95017	
Provider	Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, NC 27604
Mitigation Provider POC	Worth Creech 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Ave Raleigh, NC 27603
Primary project design POC	Grant Lewis 919-215-1693
Construction Contractor	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592
	Charles Hill 919-639-6132

Appendix F: IRT Communication

2023 Email correspondence with IRT – RE: UT2 Repair, Supplemental Planting
Photo Log – Maintenance 2023

From: Isenhour, Kimberly T CIV USARMY CESAW (USA)
To: Josh Merritt
Subject: RE: Phantom Mill Supplemental Replant Availability
Date: Wednesday, November 2, 2022 9:40:14 AM

Hi Josh,
We don't have any issues with the substitutions. Thanks for reaching out. From what I read, it seems like overcup or swamp chestnut are a better choice than white oak, which is FACU. Overcup can withstand significant flooding and poorly drained soils (OBL), whereas swamp chestnut (FACW) occurs in bottomlands and prefers well-drained soils. Interestingly, swamp chestnut is also alleopathic when mature, and it can be shade intolerant. Overcup is shade intolerant, and it can be slow growing. Swamp chestnut may be a better option, but you know the site best.
Thanks
Kim

Kim Isenhour
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers l 919.946.5107

-----Original Message-----
From: Josh Merritt <jmerritt@restorationsystems.com>
Sent: Monday, October 31, 2022 1:05 PM
To: Isenhour, Kimberly T CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Subject: [Non-DoD Source] Phantom Mill Supplemental Replant Availability

Kim,

It was good meeting you last week. I am making a planting list for a supplemental replant at Phantom Mill this upcoming planting season. RS plans to plant larger materials to help combat the dense herbaceous vegetation within the Piedmont/Low Mountain Alluvial Forest onsite. However, species availability is limited due to the late timing of ordering the stems. I am looking for approval to substitute Overcup Oak (Quercus lyrata) for White Oak (Quercus alba). Quercus lyrata is not on the approved mitigation plan but appears on the as-built document. Another alternative would be to substitute Swamp Chestnut Oak (Quercus michauxii) which is not on the approved mitigation plan or as-built document. Please let me know how you would like me to proceed on the matter.

Thanks,

Josh M.

Josh Merritt | Project Manager

Restoration Systems, LLC

1101 Haynes Street, Suite 211, Raleigh NC, 27604

910-840-3809 (M)

From:	Isenhour, Kimberly T CIV USARMY CESAW (USA)
To:	Harrell, Matthew
Subject:	RE: Phantom Mill- Maintenance for piping planned
Date:	Wednesday, September 20, 2023 9:23:13 AM

Thanks for letting me know Matthew. Please just call it out in the monitoring report for next year. Enjoy the cooler weather!

Regards,
Kim

From: Harrell, Matthew <Matthew.Harrell@davey.com>
Sent: Tuesday, September 19, 2023 2:06 PM
To: Isenhour, Kimberly T CIV USARMY CESAW (USA) <Kimberly.T.Isenhour@usace.army.mil>
Subject: [Non-DoD Source] Phantom Mill- Maintenance for piping planned

Hi Kim,

We have a small area (about 11 linear feet) of piping at Phantom Mill near STA 8 on UT2. This is at the bottom of our enhancement II area. We are planning use some matting and onsite rock that is piled just outside the easement there to correct the issue while it is still minor and arrest the headcut that is forming. We expect to complete the repair in the next 60-90 days.

At the moment it is below the reporting threshold but we just wanted to keep you in the loop. I'm happy to answer any questions.

-Matthew

Matthew Harrell | Project Manager
Davey Mitigation
P: 252-299-1655
E: matthew.harrell@davey.com

Phantom Mill
MY-02 (2023) Maintenance Activity Photo Log

Photo 1: Replanting efforts taken place on January 10, 2023

Photo 2: Replanting efforts taken place on January 10, 2023

Phantom Mill
MY-02 (2023) Maintenance Activity Photo Log

Photo 3: Replanting efforts taken place on January 10, 2023

Photo 4: Replanting efforts taken place on January 10, 2023

Phantom Mill
MY-02 (2023) Maintenance Activity Photo Log

Photo 5: UT2 maintenance work taken place on October 24, 2023

Photo 6: UT2 maintenance work taken place on October 24, 2023