MY1 (2022) 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 2022-October 2022
Submission: February 2023

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1652

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ENVIRONMENTAL QUALITY

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Response to DMS Comments – MY 1 (2022) 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. Thank you for referencing in the General Notes section, the October 2022 IRT site visit notes and comment response letter included in Appendix F.
   Response: Noted.

2. Table 5 (visual assessment): correct acreage typo of low stem density area to be 7.333 to match CCPV.
   Response: The low stem density area in Table 5 was corrected to 7.333 acres.

3. Table 11 Verification of Bankfull Events: Photographs of the bankfull flow were helpful in this section, thank you for including.
   Response: Noted.

4. Figure D1 Rainfall: For all future reports please provide a full year of rainfall data. Capturing data from the end of the previous monitoring year through the current monitoring year. Ex: Nov 2021-Oct 2022.
   Response: All rainfall data will be provided on Figure D1 for future reports, up to the point of submittal.

5. Conservation Easement Boundary Marking: DMS conducted a conservation easement boundary inspection during MY1, and supplemental boundary marking was installed in response. Please summarize this effort in the report and indicate that ongoing boundary inspection will be conducted to ensure compliance with the terms of the conservation easement.
   Response: The following was added to the Monitoring Summary:
   "In response to a DMS MY0 site visit on June 22, 2022, the boundary was marked per the RFP protocol with rebar and numbered caps, witness posts, and standard DMS signs at all corners. Additional signs were added at primary entry points and as needed between corners during the week of July 24, 2022. Boundary markers will be maintained throughout monitoring to ensure easement integrity and to allow easy recognition of boundaries at closeout. DMS Project Manager Kelly Phillips visited the Site during the marking, July 28, 2022, and confirmed the completion of the requested work. Regular monitoring of the site will include boundary checks to ensure easement compliance."

Digital Deliverable:

1. Please submit the wetland groundwater gauge summary table.
   Response: The groundwater gauge summary table has been updated in the digital submittal.

Phantom Mill -- Year 1 (2022) Monitoring Summary

General Notes

- No encroachment was documented during Year 1.
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver, etc.) observed.
- An MY0 (As-built Report) Site visit with the IRT was conducted on October 27, 2022. IRT Site Visit Notes, the MY0 IRT Comment Response Letter, and Mitigation Plan Amendment Request are included in Appendix F

Site Maintenance Report (2022)

Invasive Species Work	Maintenance work
08/02/2022 Japanese Privet, Multiflora rose, Tree-of-Heaven, Chinese Privet 09/13/2022 Multiflora rose, Privet, Tree-of-Heaven	In response to a DMS MY0 site visit on June 22, 2022, the boundary was marked per the RFP protocol with rebar and numbered caps, witness posts, and standard DMS signs at all corners. Additional signs were added at primary entry points and as needed between corners during the week of July 24, 2022. Boundary markers will be maintained throughout monitoring to ensure easement integrity and to allow easy recognition of boundaries at closeout. DMS Project Manager Kelly Phillips visited the Site during the marking, July 28, 2022, and confirmed the completion of the requested work. Regular monitoring of the site will include boundary checks to ensure easement compliance.

Streams

- All stream restoration reaches were stable and exhibited no signs of erosion, all structures were stable (Appendix C).
- Four bankfull events were documented during the year 1 (2022) monitoring period (Table 11, Appendix D).
- All Site tributaries showed evidence of channel formation during the year 1 (2022) monitoring period (Tables 13A-C, Appendix D).

Vegetation

- Measurements of all 12 permanent plots and 3 temporary plots resulted in an average of 254 planted stems/acre. Additionally, 4 of the 15 individual plots met success criteria during year 1 (Appendix B).
- As discussed during the MY0, October 27, 2022 IRT site visits, due to the high rate of planted stem mortality during year 1 (2022), RS will conduct a supplemental replant within 7.333 acres of the Site's original 12.5 acres of bare-root planting. The supplemental planting plan is detailed in Section 2.1.

Wetlands

- All seven groundwater gauges met success criteria for the year 1 (2022) 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

*Based on observed/documented bud burst on the Site on February 28, 2022, and soil temperature of 46.05 ^{o}F documented March 1, 2022.

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%)						
2	Yes - 117 days (49.6%)						
3	Yes - 111 days (47.0%)						
4	Yes - 115 days (48.7%)						
5	Yes - 79 days (33.5%)						
6	Yes - 93 days (39.4%)						
7	Yes - 98 days (41.5%)						

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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 and,
    - 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, and no stream areas of concern were observed during year 1 (2022) monitoring. The constructed channel exhibits 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 available in Appendix C. Visual assessment data is available in Appendix A, Tables 4A-D.

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

*Based on observed/documented bud burst on the Site on February 28, 2022, and soil temperature of 46.05 ºF documented March 1, 2022.

All groundwater gauges met success criteria for the year 1 (2022) 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%)						
2	Yes - 117 days (49.6%)						
3	Yes - 111 days (47.0%)						
4	Yes - 115 days (48.7%)						
5	Yes - 79 days (33.5%)						
6	Yes - 93 days (39.4%)						
7	Yes - 98 days (41.5%)						

Vegetation Summary

Year 1 (2022) vegetation measurements occurred on July 14, 2022. 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. Measurements of all 15 plots resulted in an average of 254 planted stems/acre, excluding livestakes. Four of the 15 individual plots met success criteria during year 1 (Tables 7-8, Appendix B).

2022/2023 Replant

As discussed during the MY0, October 27, 2022 IRT site visits, due to the high rate of planted stem mortality during year 1 (2022), RS will conduct a supplemental replant within 7.333 acres of the Site's original 12.5 acres of bare-root planting. The areas of low stem density to be replanted are depicted in Figure 1 and quantified in Table 5 of Appendix A. Figure 2, Appendix A shows the proposed replanting.

Vegetation mortality between MY0 and MY1 mainly occurred in areas of dense herbaceous growth. These are likely out-competing many of the smaller bare-root trees. Though herbaceous growth across the Site is strong, RS does not feel it is warranted to chemically treat the herbaceous layer. Bare-root planting will occur with larger stock and stems at least 36 inches tall. In addition, RS staff will mechanically mow/cut the herbaceous layer ahead of replating to reduce the overtopping of planted bare-root stems. It is believed the larger bare roots and mowing of the herbaceous layer will help reduce mortality.

Proposed bare-root replanting efforts are summarized in the table below. In addition to the bare-root planting, a combination of Black willow, Silky dogwood, and Elderberry live-stakes will be added along UT4.

As part of this effort, RS will replant permanent vegetation monitoring plots 1-9. RS will conduct five random vegetation transects within the replanted areas in the Spring of 2023 and repeat the same transects in the Fall of 2023. Transect data will be presented in the MY2 (2023) Monitoring Report.

Phantom Mill - Q1 2023 Remedial Planting Plan
Vegetation Association: Piedmont/Low Mountain Alluvial Forest
Total Area = 7.333 Acres

		Planting Zones Appendix A, Figure 2				
		Zone 1		**Zone 2**		
MY1 Average Stems/Acre =		108		188		
Acres =		3.034		4.299		
Stems added/acre		+/-360		+/-280		
Species	**Wetland Indicator Status**	**# planted**	**% of total**	**# planted**	**% of total**	**# planted**
River birch (*Betula nigra*)	FACW	170	13%	175	15%	345
Northern Red Oak (*Quercus rubra)*	FACU	25	2%	0	0%	25
Silky dogwood (*Cornus amomum*)	FACW	145	11%	130	11%	275
Green ash (*Fraxinus pennsylvanica*)	FACW	70	5%	60	5%	130
Tulip poplar (*Liriodendron tulipifera*)	FAC	145	11%	130	11%	275
Sycamore (*Platanus occidentalis*)	FACW	180	14%	195	16%	375
Black gum (*Nyssa sylvatica*)	FAC	75	6%	80	7%	155
White oak (*Quercus alba*)	FACU	100	8%	70	6%	170
Water oak (*Quercus nigra*)	FAC	195	15%	180	15%	375
Willow oak (*Quercus phellos*)	FACW	195	15%	180	15%	375
TOTAL		**1,300**	**100%**	**1,200**	**100%**	**2,500**

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			
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%			

Table 3. Project Attribute Table (Continued)

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		
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

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

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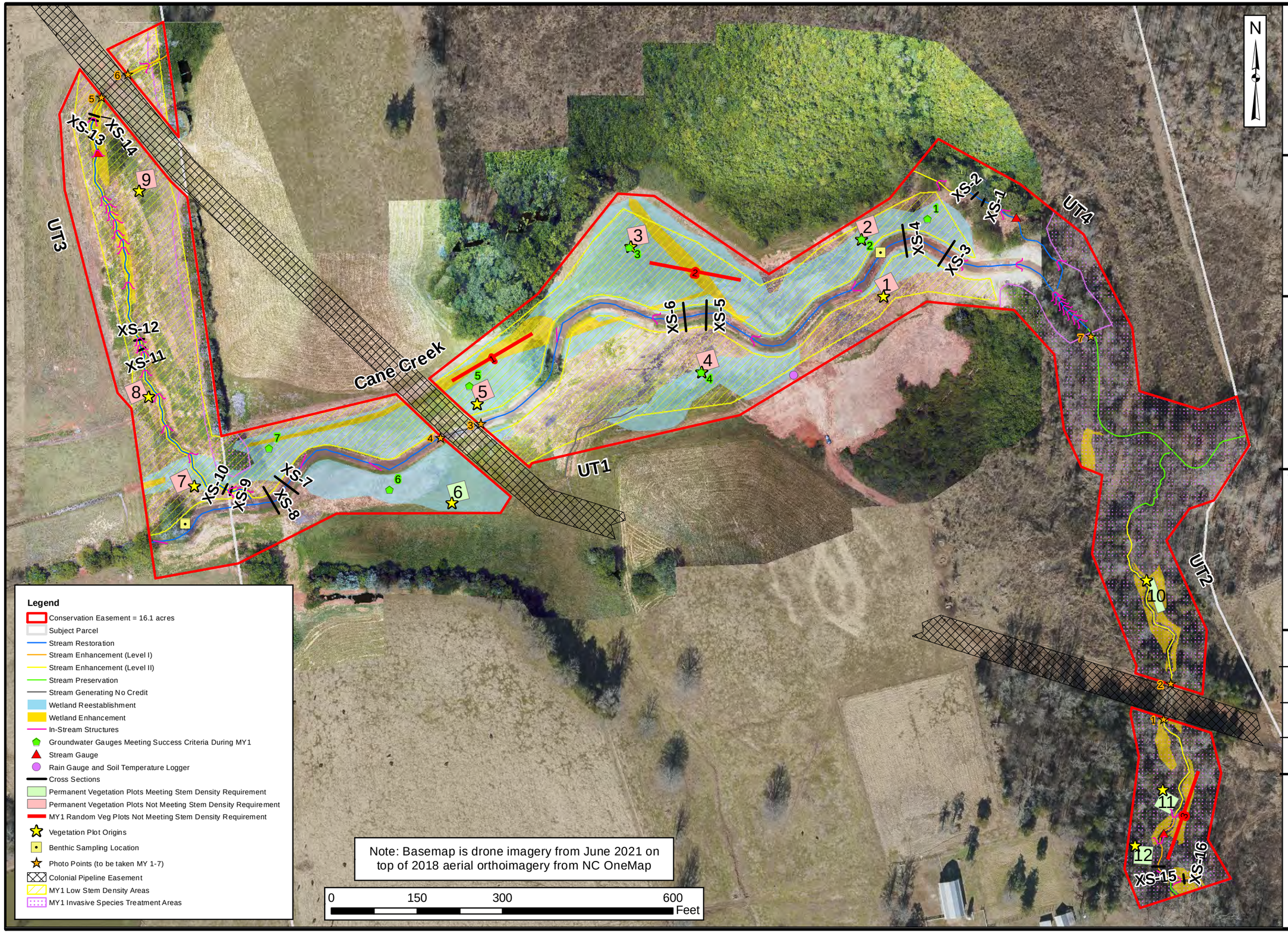
Appendix A: Visual Assessment Data

Figure 1. Current Conditions Plan View
Figure 2. 2023 Replant
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

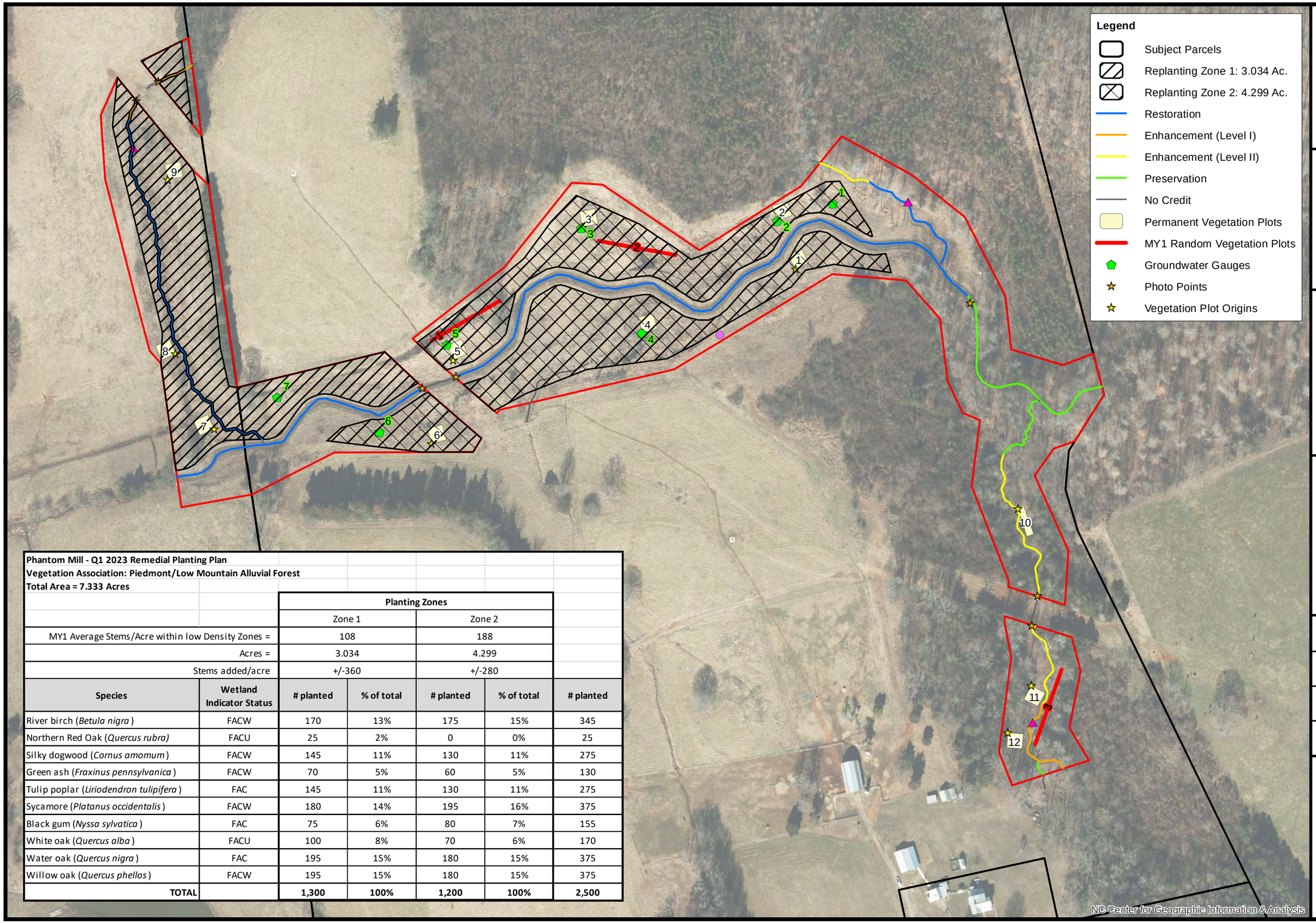
Date: NOV 2022

Scale: 1:1900

Project No.: 18-012

FIGURE

1



Phantom Mill - Q1 2023 Remedial Planting Plan
Vegetation Association: Piedmont/Low Mountain Alluvial Forest
Total Area = 7.333 Acres

		Planting Zones				
		Zone 1		Zone 2		
MY1 Average Stems/Acre within low Density Zones =		108		188		
Acres =		3.034		4.299		
Stems added/acre		+/-360		+/-280		
Species	**Wetland Indicator Status**	**# planted**	**% of total**	**# planted**	**% of total**	**# planted**
River birch (*Betula nigra*)	FACW	170	13%	175	15%	345
Northern Red Oak (*Quercus rubra)*	FACU	25	2%	0	0%	25
Silky dogwood (*Cornus amomum*)	FACW	145	11%	130	11%	275
Green ash (*Fraxinus pennsylvanica*)	FACW	70	5%	60	5%	130
Tulip poplar (*Liriodendron tulipifera*)	FAC	145	11%	130	11%	275
Sycamore (*Platanus occidentalis*)	FACW	180	14%	195	16%	375
Black gum (*Nyssa sylvatica*)	FAC	75	6%	80	7%	155
White oak (*Quercus alba*)	FACU	100	8%	70	6%	170
Water oak (*Quercus nigra*)	FAC	195	15%	180	15%	375
Willow oak (*Quercus phellos*)	FACW	195	15%	180	15%	375
TOTAL		**1,300**	**100%**	**1,200**	**100%**	**2,500**

RESTORATION SYSTEMS | LLC

Prepared for:

NC DEQ
Division of Enviromental Quality

Division of Mitigation Services

Project:

PHANTOM MILL MITIGATION SITE

Alamance County, NC

Title:

2022/2023 RE-PLANTING PLAN

2018 NC One Map Imagery

Drawn by: RJH

Date: DEC. 2022

Scale: 1:2,200

Project No.: DMS ID: 100057

FIGURE

2

N

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	7.333	58.7%
		Total	7.333	58.7%
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	7.333	58.7%

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
MY1 (2022) Vegetation Monitoring Photographs (taken July 14, 2022)

Plot 1

Plot 2

Plot 3

Plot 4

Plot 5

Plot 6

Plot 7

Plot 8

Phantom Mill Site
MY1 (2022) Vegetation Monitoring Photographs (taken July 14, 2022)

Plot 9

Plot 10

Plot 11

Plot 12

Phantom Mill
MY-01 (2022) Photo Log

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

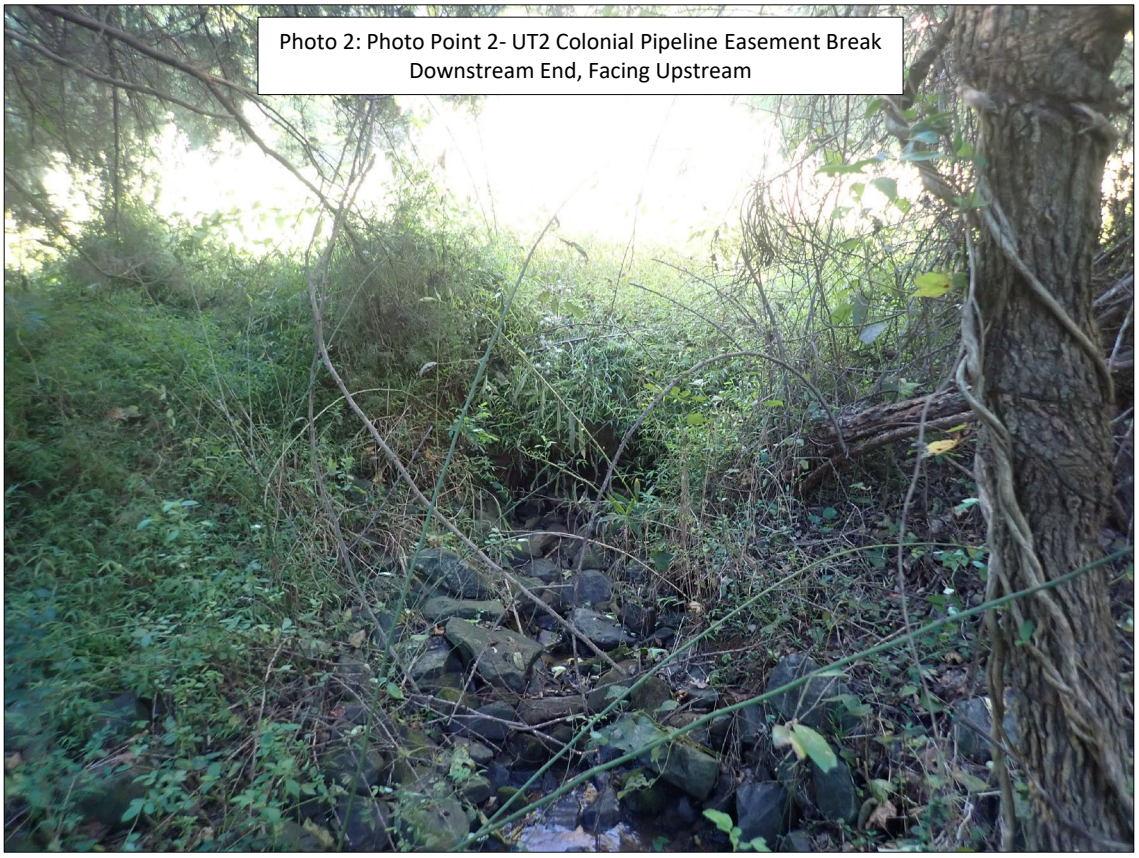


Photo 2: Photo Point 2- UT2 Colonial Pipeline Easement Break Downstream End, Facing Upstream

Phantom Mill
MY-01 (2022) 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-01 (2022) Photo Log

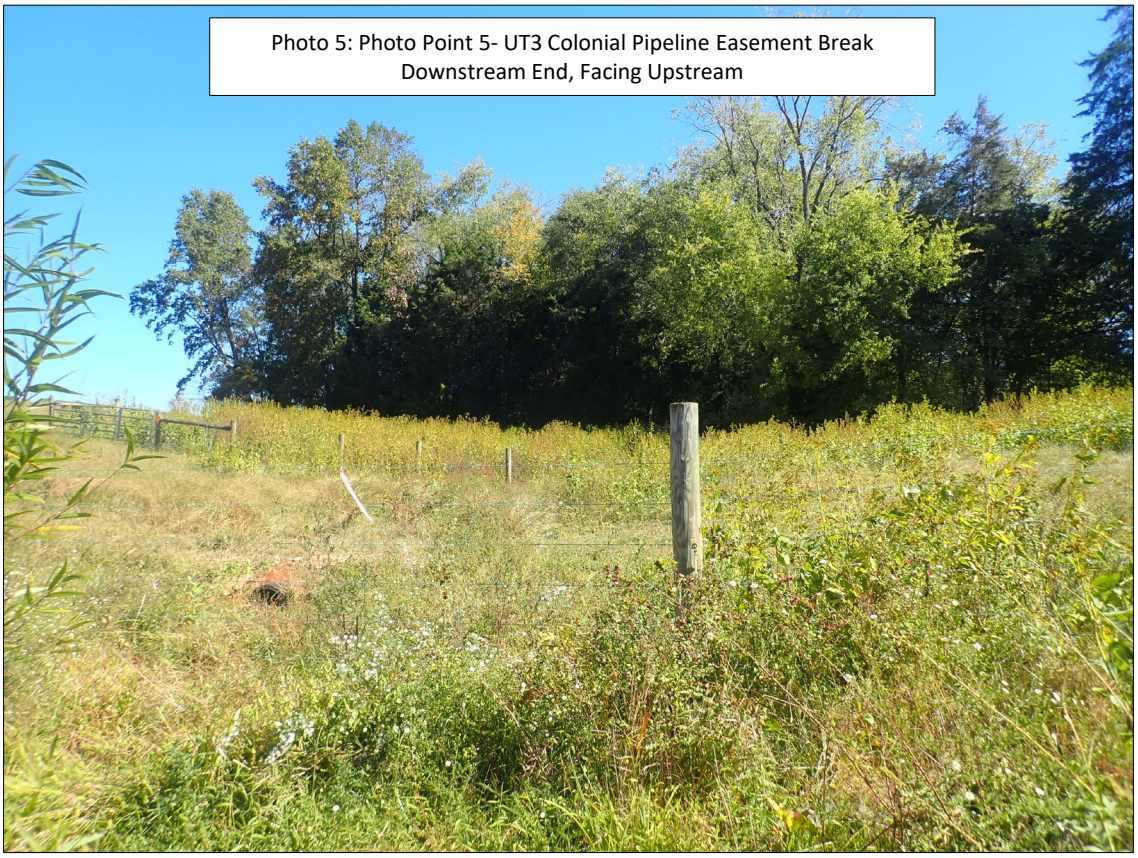


Photo 5: Photo Point 5- UT3 Colonial Pipeline Easement Break
Downstream End, Facing Upstream

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

Phantom Mill
MY-01 (2022) 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-01 (2022) Photo Log

Photo 9: Cane Creek Drop Structure

Photo 10: Enhancement (Level I) on UT2

Phantom Mill
MY-01 (2022) Photo Log

Photo 11: Bud Burst of Carya sp.
Photo Taken 2/28/22

Photo 12: Bud Burst of Ulmus americana
Photo Taken 2/28/22

Phantom Mill
MY-01 (2022) Photo Log

Photo 13: UT-2 Flow 1/14/22

Photo 14: UT-2 Flow 3/3/22

Phantom Mill
MY-01 (2022) Photo Log

Photo 15: UT-3 Flow 1/17/22

Photo 16: UT-3 Flow 3/3/22

Phantom Mill
MY-01 (2022) Photo Log

Photo 17: UT-4 Flow 1/15/22

Photo 18: UT-4 Flow 4/25/22

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	243	No
2	283	No
3	243	No
4	121	No
5	202	No
6	324	Yes
7	81	No
8	162	No
9	81	No
10	729	Yes
11	567	Yes
12	405	Yes
T-1	202	No
T-2	81	No
T-3	202	No
Average Planted Stems/Acre	**254**	**No**

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)	NA
Date(s) Mowing	NA
Date of Current Survey	2022-07-20
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	1	1									1	1	1	1
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL														
	Cercis canadensis	eastern redbud	Tree	FACU													1	1
	Cornus amomum	silky dogwood	Shrub	FACW									3	3				
	Diospyros virginiana	common persimmon	Tree	FAC					1	1								
	Fraxinus pennsylvanica	green ash	Tree	FACW	1	1												
	Liriodendron tulipifera	tuliptree	Tree	FACU											1	1		
	Nyssa sylvatica	blackgum	Tree	FAC	1	1					3	3						
	other				1	1												
	Platanus occidentalis	American sycamore	Tree	FACW											1	1		
	Quercus alba	white oak	Tree	FACU														
	Quercus nigra	water oak	Tree	FAC			1	1							1	1		
	Quercus pagoda	cherrybark oak	Tree	FACW					1	1								
	Quercus phellos	willow oak	Tree	FAC											4	4		
	Quercus sp.				2	2	6	6	4	4			1	1				
Sum	Performance Standard				6	6	7	7	6	6	3	3	4	4	8	8	2	2
Post Mitigation Plan Species	*Carya glabra*	*pignut hickory*	*Tree*	*FACU*														
	Carya sp.																	
	Juniperus virginiana	*eastern redcedar*	*Tree*	*FACU*														
	Ulmus americana	*American elm*	*Tree*	*FACW*														
	Viburnum dentatum	**southern arrowwood**	**Tree**	**FAC**									**1**	**1**				
Sum	Proposed Standard				6	6	7	7	6	6	3	3	5	5	8	8	2	2
Mitigation Plan Performance Standard	Current Year Stem Count					6		7		6		3		4		8		2
	Stems/Acre					243		283		243		121		162		324		81
	Species Count					5		2		3		1		2		5		2
	Dominant Species Composition (%)					33		86		67		100		75		50		50
	Average Plot Height (ft.)					2		1		2		2		1		1		1
	% Invasives					0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					6		7		6		3		5		8		2
	Stems/Acre					243		283		243		40		202		324		81
	Species Count					5		2		3		1		3		5		2
	Dominant Species Composition (%)					33		86		67		100		75		50		50
	Average Plot Height (ft.)					2		1		2		2		1		1		1
	% 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)	NA
Date(s) Mowing	NA
Date of Current Survey	2022-07-20
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									2	2			
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL											2		
	Cercis canadensis	eastern redbud	Tree	FACU													
	Cornus amomum	silky dogwood	Shrub	FACW					5	5	3	3	1	1			
	Diospyros virginiana	common persimmon	Tree	FAC													
	Fraxinus pennsylvanica	green ash	Tree	FACW			1	1	3	3	2	2	2	2		1	
	Liriodendron tulipifera	tuliptree	Tree	FACU	1	1											1
	Nyssa sylvatica	blackgum	Tree	FAC	3	3	1	1									
	other								2	2							
	Platanus occidentalis	American sycamore	Tree	FACW							1	1	1	1	2		4
	Quercus alba	white oak	Tree	FACU					1	1							
	Quercus nigra	water oak	Tree	FAC												1	
	Quercus pagoda	cherrybark oak	Tree	FACW											1		
	Quercus phellos	willow oak	Tree	FAC	1	1											
	Quercus sp.								7	7	8	8	4	4			
Sum	Performance Standard				5	5	2	2	18	18	14	14	10	10	5	2	5
Post Mitigation Plan Species	*Carya glabra*	*pignut hickory*	*Tree*	*FACU*													*1*
	Carya sp.																*1*
	Juniperus virginiana	*eastern redcedar*	*Tree*	*FACU*													*4*
	Ulmus americana	*American elm*	*Tree*	*FACW*													*4*
	Viburnum dentatum	**southern arrowwood**	**Tree**	**FAC**													
Sum	Proposed Standard				5	5	2	2	18	18	14	14	10	10	5	2	5
Mitigation Plan Performance Standard	Current Year Stem Count					5		2		18		14		10	5	2	5
	Stems/Acre					162		81		729		567		405	202	81	202
	Species Count					3		2		5		4		5	3	2	2
	Dominant Species Composition (%)					60		50		39		57		40	40	50	27
	Average Plot Height (ft.)					1		3		2		2		1	3	3	7
	% Invasives					0		0		0		0		0	0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count					5		2		18		14		10	5	2	5
	Stems/Acre					162		81		729		526		405	202	81	202
	Species Count					3		2		5		4		5	3	2	2
	Dominant Species Composition (%)					60		50		39		57		40	40	50	27
	Average Plot Height (ft.)					1		3		2		2		1	3	3	7
	% 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

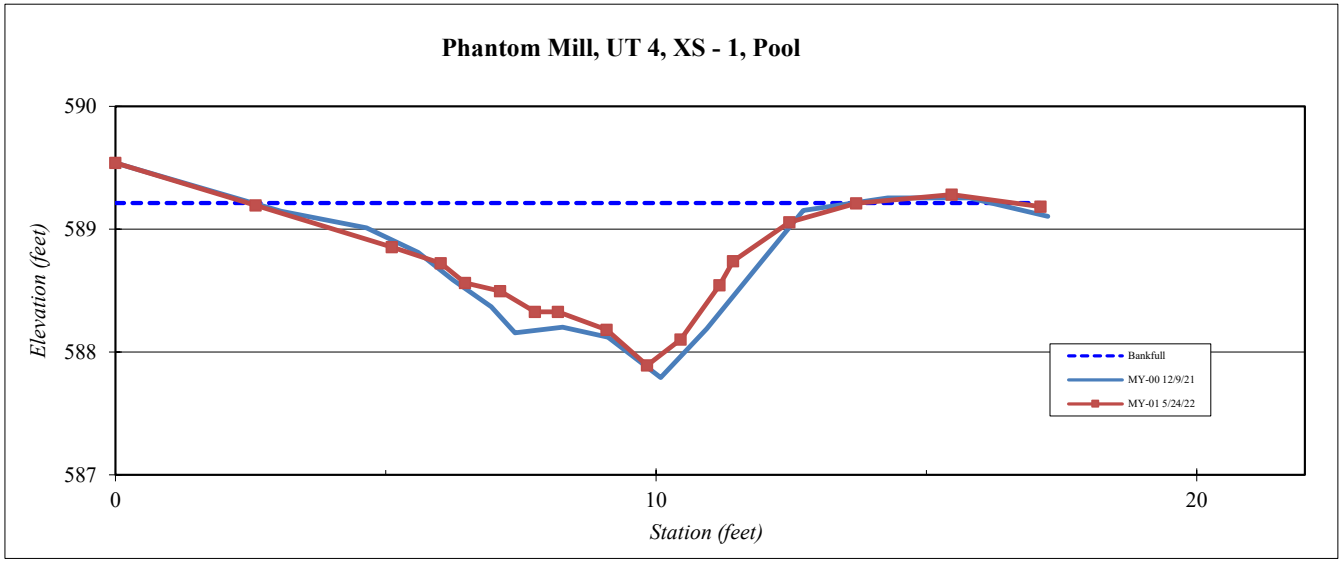
Cross-Sections with Annual Overlays
Table 9A-D. Baseline Stream Data Summary Tables
Table 10A-B. Cross-Section Morphology Monitoring Summary

Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 4, XS -1, Pool
Feature	Pool
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	589.5
2.6	589.2
5.1	588.9
6.0	588.7
6.5	588.6
7.1	588.5
7.8	588.3
8.2	588.3
9.1	588.2
9.8	587.9
10.5	588.1
11.2	588.5
11.4	588.7
12.5	589.1
13.7	589.2
15.5	589.3
17.1	589.2

SUMMARY DATA	
Bankfull Elevation:	589.2
Bank Hieght Ratio:	1.0
Thalweg Elevation:	587.9
LTOB Elevation:	589.2
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	5.9

Stream Type	E/C 5

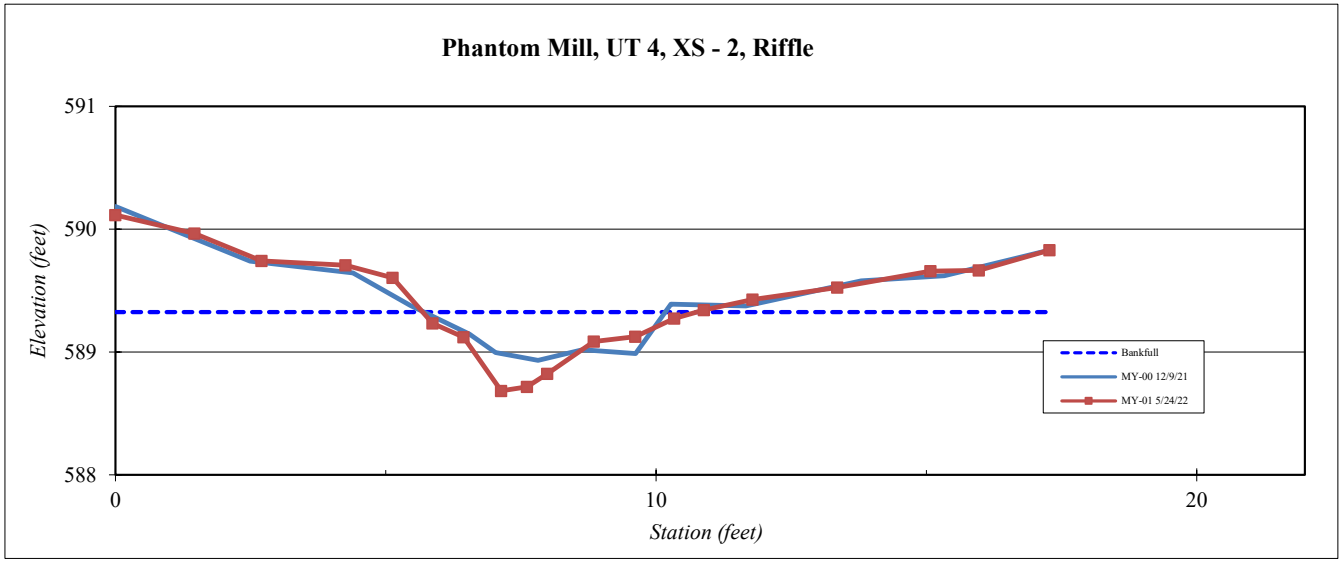


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 4, XS -2, Riffle
Feature	Riffle
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	590.1
1.5	590.0
2.7	589.7
4.3	589.7
5.1	589.6
5.9	589.2
6.4	589.1
7.1	588.7
7.6	588.7
8.0	588.8
8.9	589.1
9.6	589.1
10.3	589.3
10.9	589.3
11.8	589.4
13.4	589.5
15.1	589.7
16.0	589.7
17.3	589.8

SUMMARY DATA	
Bankfull Elevation:	589.3
Bank Hieght Ratio:	1.0
Thalweg Elevation:	588.7
LTOB Elevation:	589.3
LTOB Max Depth:	0.7
LTOB Cross Sectional Area:	1.6

Stream Type	E/C 5

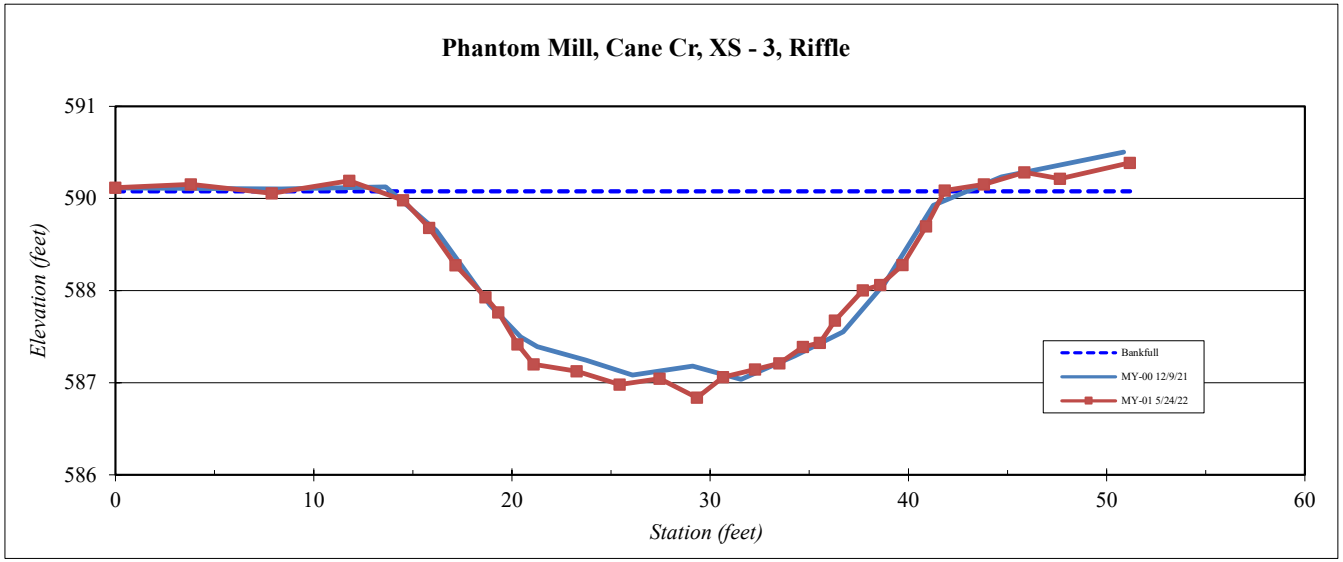


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS -3, Riffle
Feature	Riffle
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	589.8
3.8	589.9
7.9	589.7
11.8	589.9
14.5	589.6
15.8	589.3
17.2	588.8
18.7	588.3
19.3	588.1
20.3	587.7
21.1	587.4
23.3	587.3
25.4	587.1
27.4	587.2
29.3	587.0
30.7	587.2
32.3	587.3
33.5	587.4
34.7	587.6
35.5	587.7
36.3	588.00
37.7	588.4
38.6	588.5
39.7	588.8
40.9	589.3
41.8	589.8
43.8	589.9
45.9	590.0
47.6	589.9
51.2	590.2

SUMMARY DATA	
Bankfull Elevation:	589.8
Bank Hieght Ratio:	1.0
Thalweg Elevation:	587.0
LTOB Elevation:	589.8
LTOB Max Depth:	2.8
LTOB Cross Sectional Area:	51.3

Stream Type	E/C 5

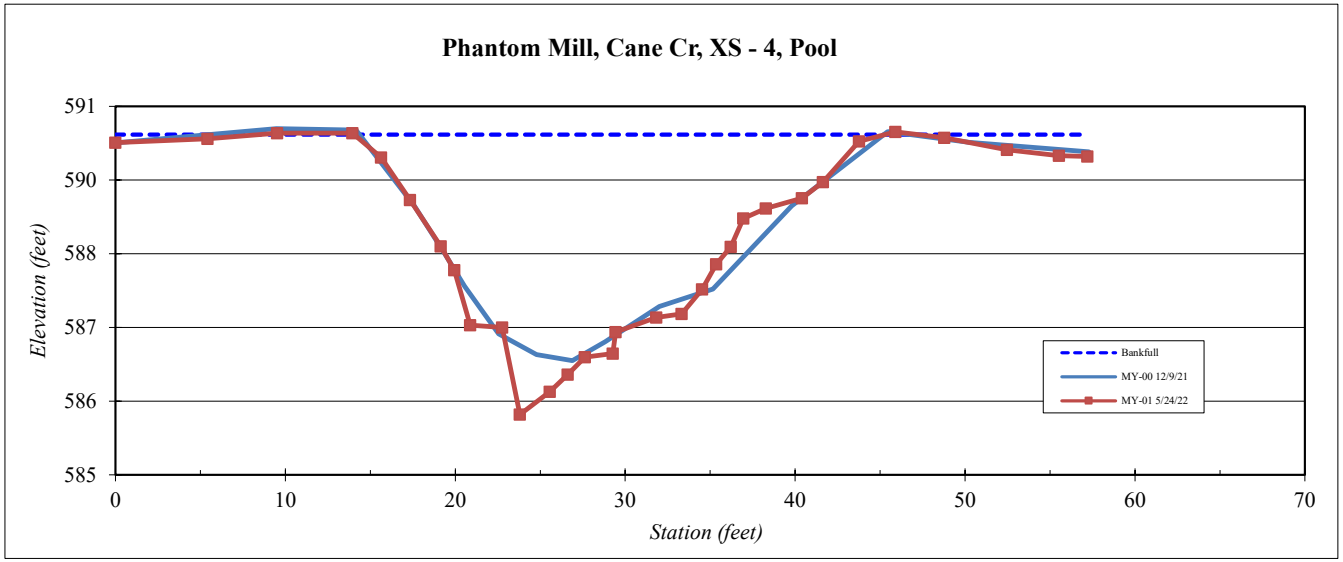


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS -4, Pool
Feature	Pool
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	590.3
5.4	590.4
9.5	590.5
13.9	590.5
15.6	590.0
17.3	589.3
19.1	588.5
19.9	588.1
20.9	587.2
22.8	587.2
23.8	585.7
25.6	586.1
26.6	586.4
27.6	586.7
29.3	586.7
29.4	587.1
31.8	587.3
33.3	587.4
34.5	587.8
35.4	588.2
36.2	588.53
37.0	589.0
38.3	589.2
40.4	589.4
41.6	589.6
43.8	590.3
45.9	590.5
48.8	590.4
52.5	590.2
55.5	590.1
57.2	590.1

SUMMARY DATA	
Bankfull Elevation:	590.4
Bank Hieght Ratio:	1.0
Thalweg Elevation:	585.7
LTOB Elevation:	590.5
LTOB Max Depth:	4.8
LTOB Cross Sectional Area:	70.2

Stream Type	E/C 5

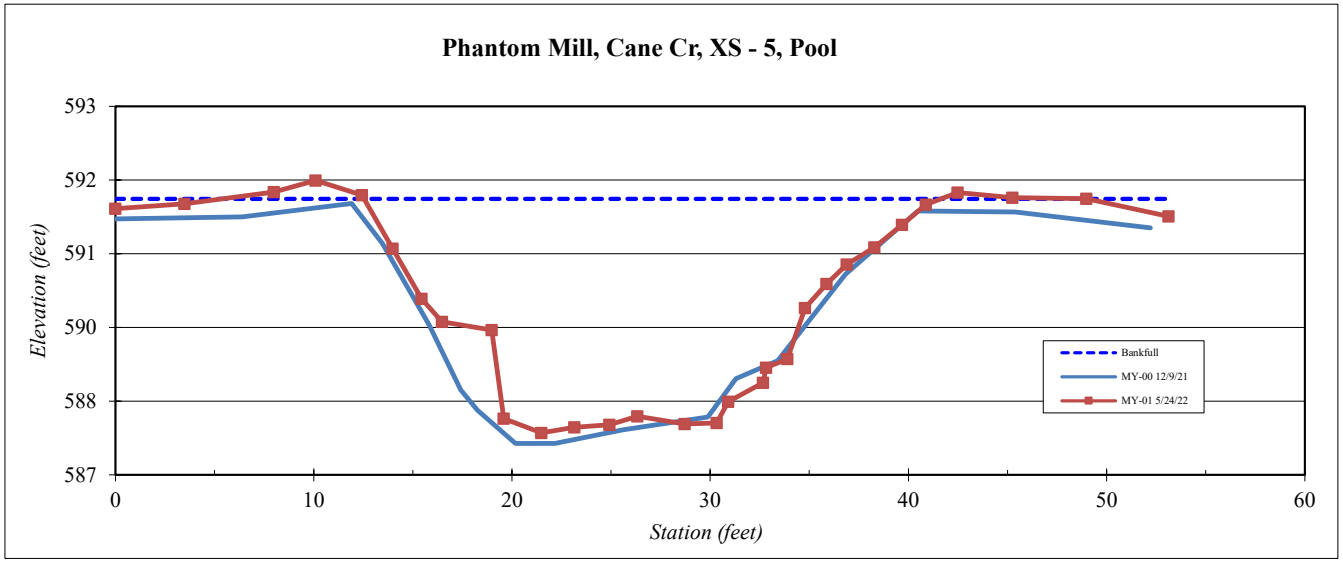


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS -5, Pool
Feature	Pool
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	591.7
3.5	591.8
8.0	592.0
10.1	592.2
12.4	591.9
14.0	591.0
15.4	590.2
16.5	589.8
19.0	589.6
19.6	588.1
21.5	587.9
23.1	588.0
24.9	588.0
26.3	588.2
28.7	588.0
30.3	588.0
30.9	588.4
32.7	588.7
32.8	589.0
33.9	589.1
34.8	590.00
35.9	590.4
36.9	590.7
38.3	591.0
39.7	591.4
40.9	591.8
42.5	592.0
45.3	591.9
49.0	591.9
53.1	591.6

SUMMARY DATA	
Bankfull Elevation:	591.9
Bank Hieght Ratio:	1.0
Thalweg Elevation:	587.9
LTOB Elevation:	591.9
LTOB Max Depth:	4.0
LTOB Cross Sectional Area:	73.8

Stream Type	E/C 5

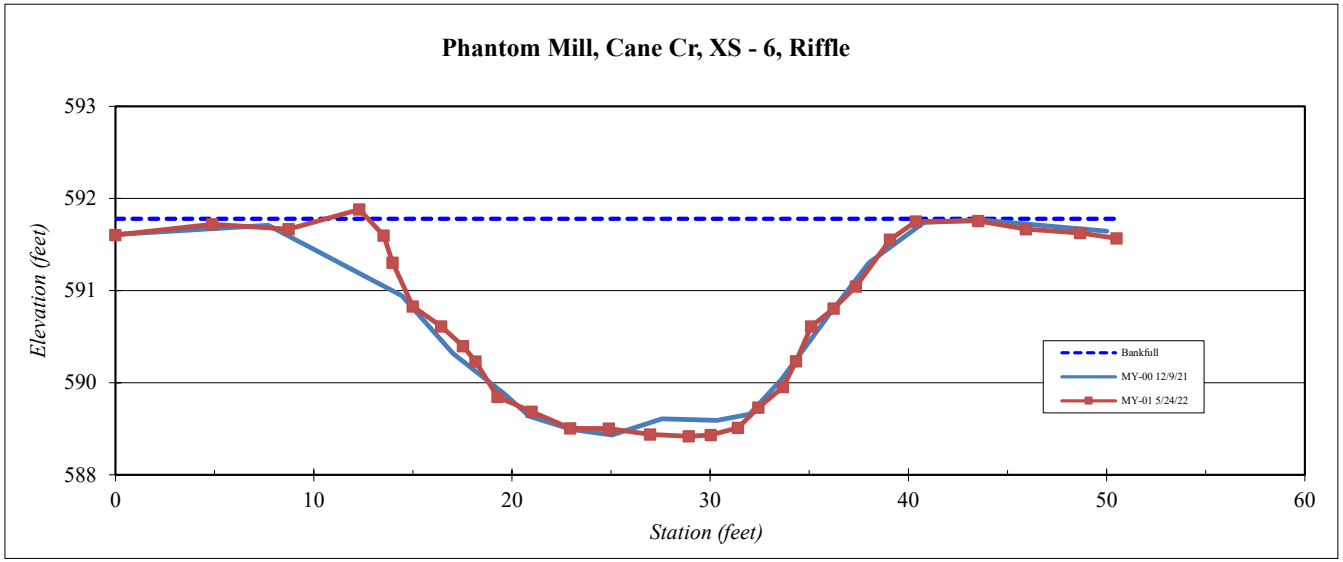


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS - 6, Riffle
Feature	Riffle
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	591.7
4.9	591.8
8.7	591.8
12.3	592.0
13.5	591.7
14.0	591.3
15.0	590.7
16.4	590.4
17.5	590.2
18.2	590.0
19.3	589.5
21.0	589.3
22.9	589.0
24.9	589.0
27.0	589.0
28.9	588.9
30.0	589.0
31.4	589.1
32.4	589.3
33.7	589.6
34.3	589.96
35.1	590.4
36.2	590.7
37.4	591.0
39.1	591.6
40.4	591.9
43.5	591.9
45.9	591.8
48.7	591.7
50.5	591.6

SUMMARY DATA	
Bankfull Elevation:	591.9
Bank Hieght Ratio:	1.0
Thalweg Elevation:	588.9
LTOB Elevation:	591.9
LTOB Max Depth:	2.9
LTOB Cross Sectional Area:	54.2

Stream Type	E/C 5

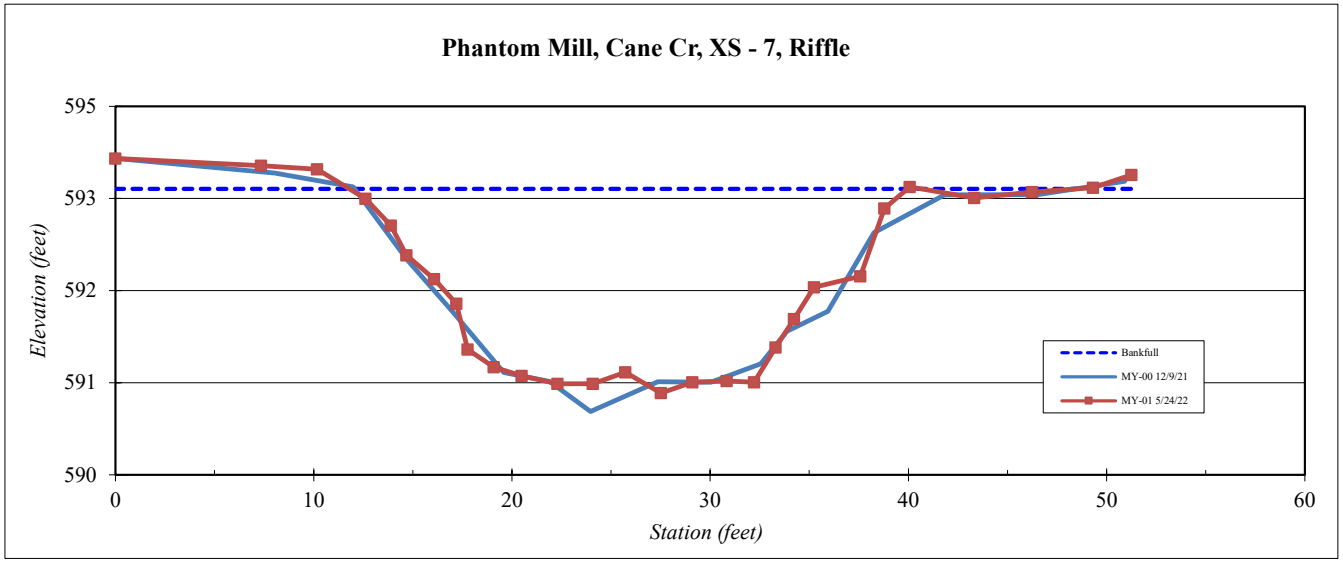


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS - 7, Riffle
Feature	Riffle
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	594.0
7.3	593.9
10.2	593.8
12.6	593.4
13.9	593.1
14.7	592.7
16.1	592.3
17.2	592.0
17.8	591.4
19.1	591.1
20.5	591.0
22.3	590.9
24.1	590.9
25.7	591.1
27.5	590.8
29.1	590.9
30.8	590.9
32.2	590.9
33.3	591.4
34.2	591.8
35.2	592.22
37.6	592.4
38.8	593.3
40.1	593.6
43.3	593.4
46.2	593.5
49.3	593.6
51.3	593.7

SUMMARY DATA	
Bankfull Elevation:	593.6
Bank Hieght Ratio:	1.0
Thalweg Elevation:	590.8
LTOB Elevation:	593.4
LTOB Max Depth:	2.6
LTOB Cross Sectional Area:	48.9

Stream Type	E/C 5

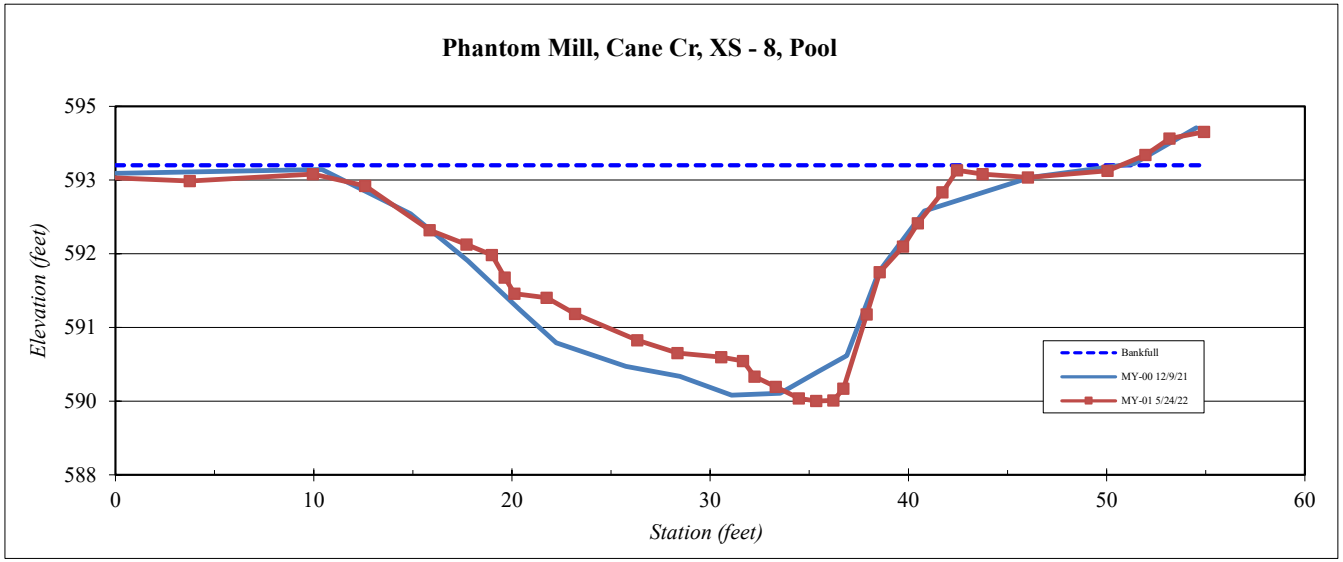


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	Cane Cr, XS - 8, Pool
Feature	Pool
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
-0.6	593.5
-0.6	593.5
3.8	593.4
10.0	593.5
12.6	593.3
15.9	592.6
17.7	592.3
19.0	592.2
19.6	591.8
20.1	591.5
21.8	591.4
23.2	591.2
26.3	590.7
28.4	590.5
30.6	590.4
31.7	590.3
32.2	590.1
33.3	589.9
34.5	589.7
35.4	589.7
36.2	589.7
36.7	589.9
37.9	591.1
38.6	591.9
39.7	592.3
40.5	592.7
41.7	593.2
42.5	593.6
43.7	593.5
46.0	593.5
50.1	593.6
52.0	593.9
53.2	594.1
54.9	594.2

SUMMARY DATA	
Bankfull Elevation:	593.7
Bank Hieght Ratio:	1.0
Thalweg Elevation:	589.7
LTOB Elevation:	593.5
LTOB Max Depth:	3.9
LTOB Cross Sectional Area:	65.5

Stream Type	E/C 5

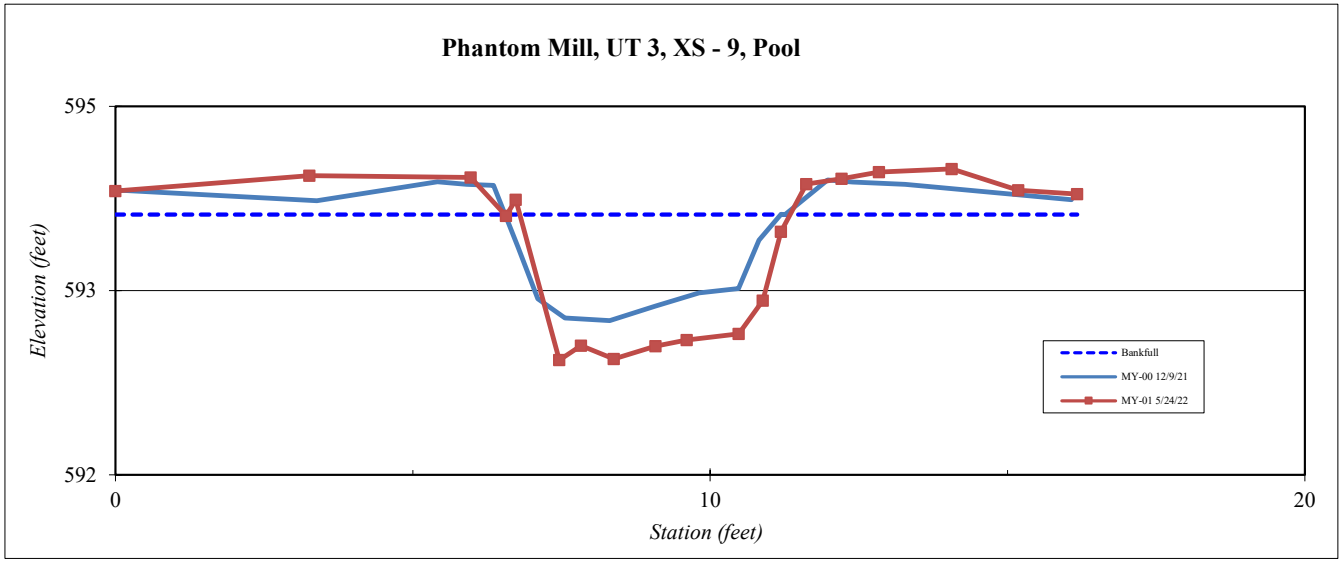


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 9, Pool
Feature	Pool
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	594.1
3.3	594.2
6.0	594.2
6.6	593.9
6.7	594.0
7.5	593.0
7.8	593.1
8.4	593.0
9.1	593.0
9.6	593.1
10.5	593.1
10.9	593.4
11.2	593.8
11.6	594.2
12.2	594.2
12.8	594.2
14.1	594.3
15.2	594.1
16.2	594.1

SUMMARY DATA	
Bankfull Elevation:	593.9
Bank Hieght Ratio:	1.10
Thalweg Elevation:	593.0
LTOB Elevation:	594.0
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	3.9

Stream Type	E/C 5

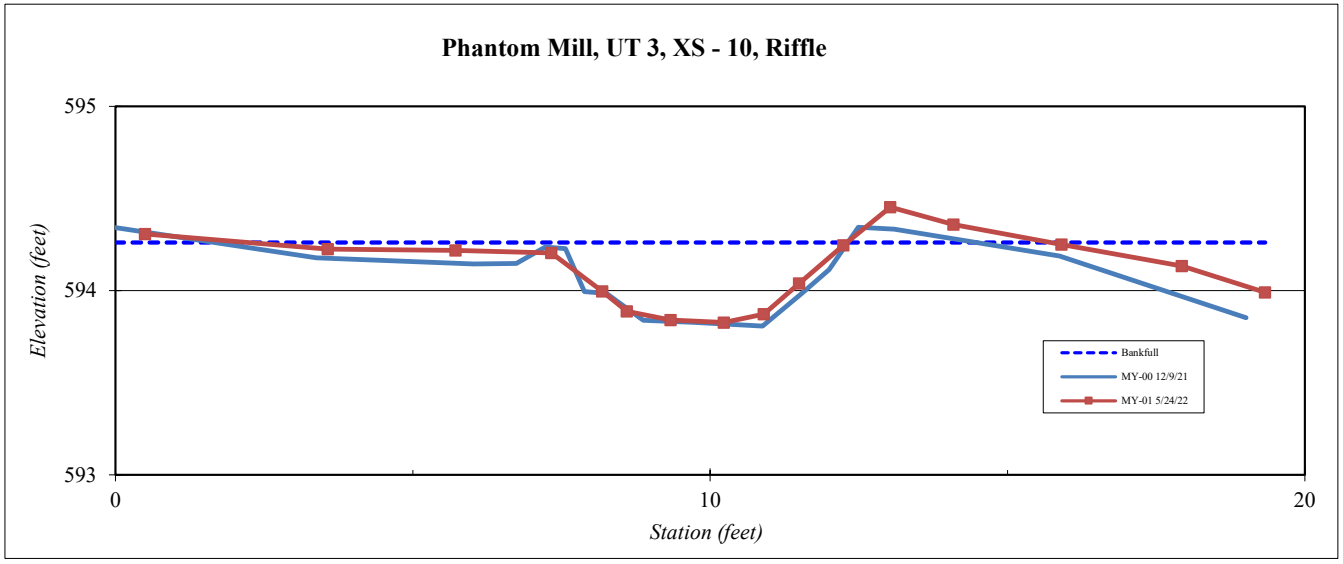


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 10, Riffle
Feature	Riffle
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.5	594.3
3.6	594.2
5.7	594.2
7.3	594.2
8.2	594.0
8.6	593.9
9.3	593.8
10.2	593.8
10.9	593.9
11.5	594.0
12.2	594.2
13.0	594.5
14.1	594.4
15.9	594.3
17.9	594.1
19.3	594.0

SUMMARY DATA	
Bankfull Elevation:	594.3
Bank Hieght Ratio:	0.87
Thalweg Elevation:	593.8
LTOB Elevation:	594.2
LTOB Max Depth:	0.4
LTOB Cross Sectional Area:	1.2

Stream Type	E/C 5

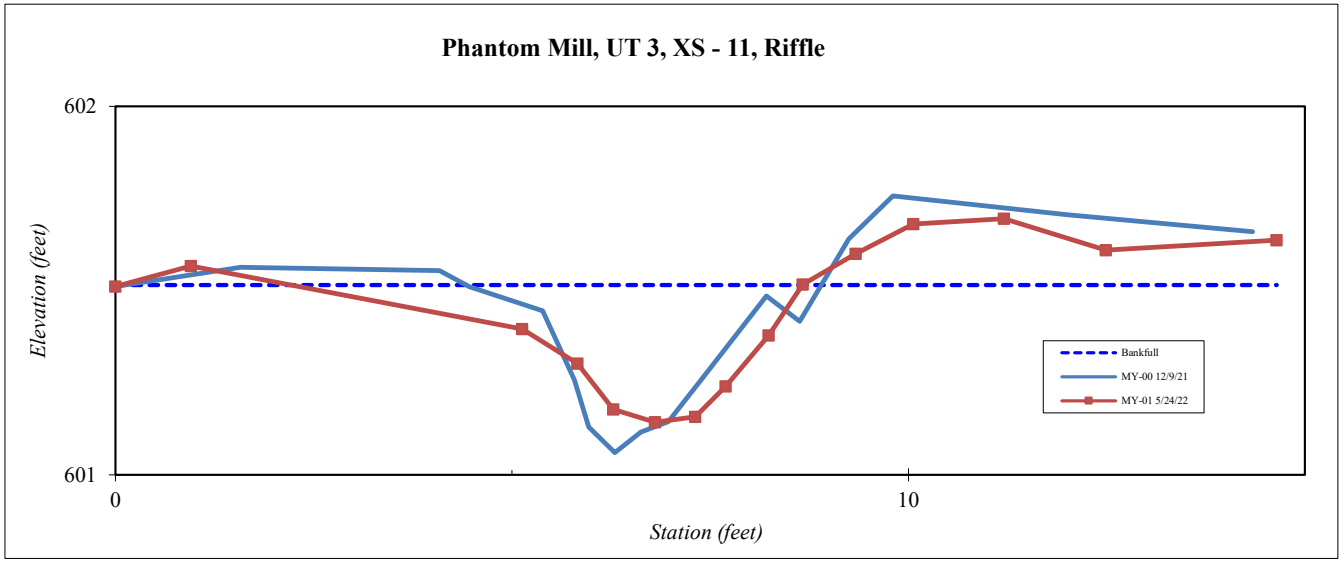


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 11, Riffle
Feature	Riffle
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	601.6
1.0	601.7
5.1	601.5
5.8	601.3
6.3	601.2
6.8	601.1
7.3	601.2
7.7	601.3
8.2	601.4
8.7	601.6
9.3	601.7
10.1	601.8
11.2	601.8
12.5	601.7
14.6	601.8

SUMMARY DATA	
Bankfull Elevation:	601.6
Bank Hieght Ratio:	1.0
Thalweg Elevation:	601.1
LTOB Elevation:	601.6
LTOB Max Depth:	0.5
LTOB Cross Sectional Area:	1.3

Stream Type	E/C 5

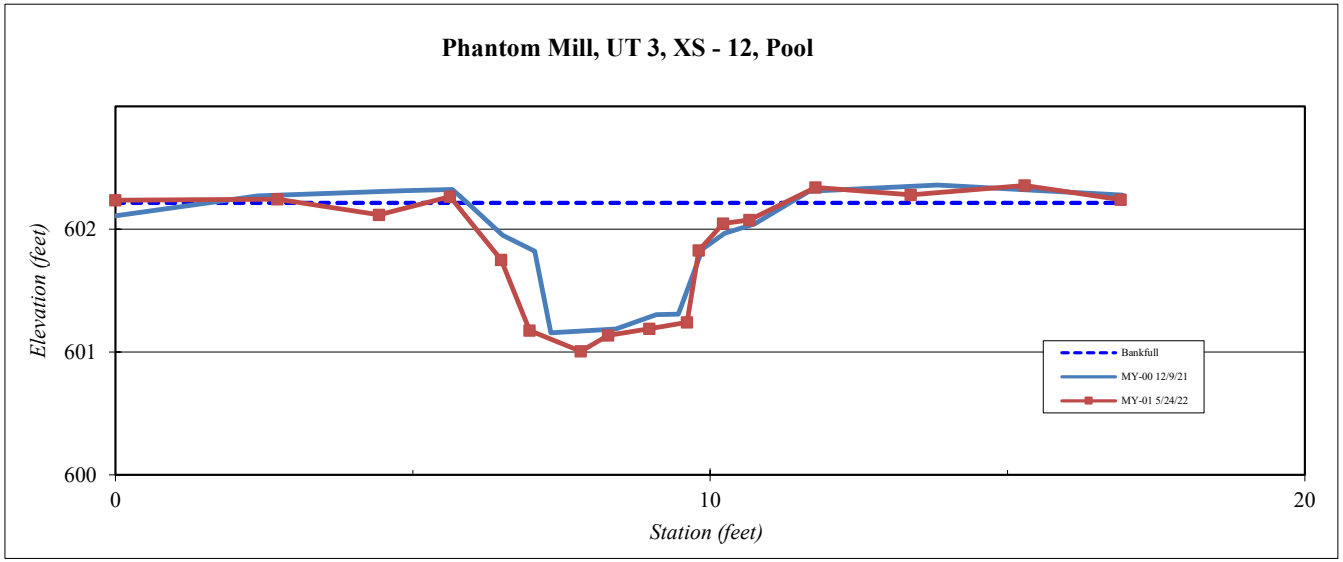


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 12, Pool
Feature	Pool
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	602.5
2.7	602.5
4.4	602.4
5.6	602.5
6.5	601.9
7.0	601.2
7.8	601.0
8.3	601.1
9.0	601.2
9.6	601.3
9.8	602.0
10.2	602.3
10.7	602.3
11.8	602.6
13.4	602.6
15.3	602.7
16.9	602.5

SUMMARY DATA	
Bankfull Elevation:	602.5
Bank Hieght Ratio:	1.0
Thalweg Elevation:	601.0
LTOB Elevation:	602.5
LTOB Max Depth:	1.6
LTOB Cross Sectional Area:	5.1

Stream Type	E/C 5

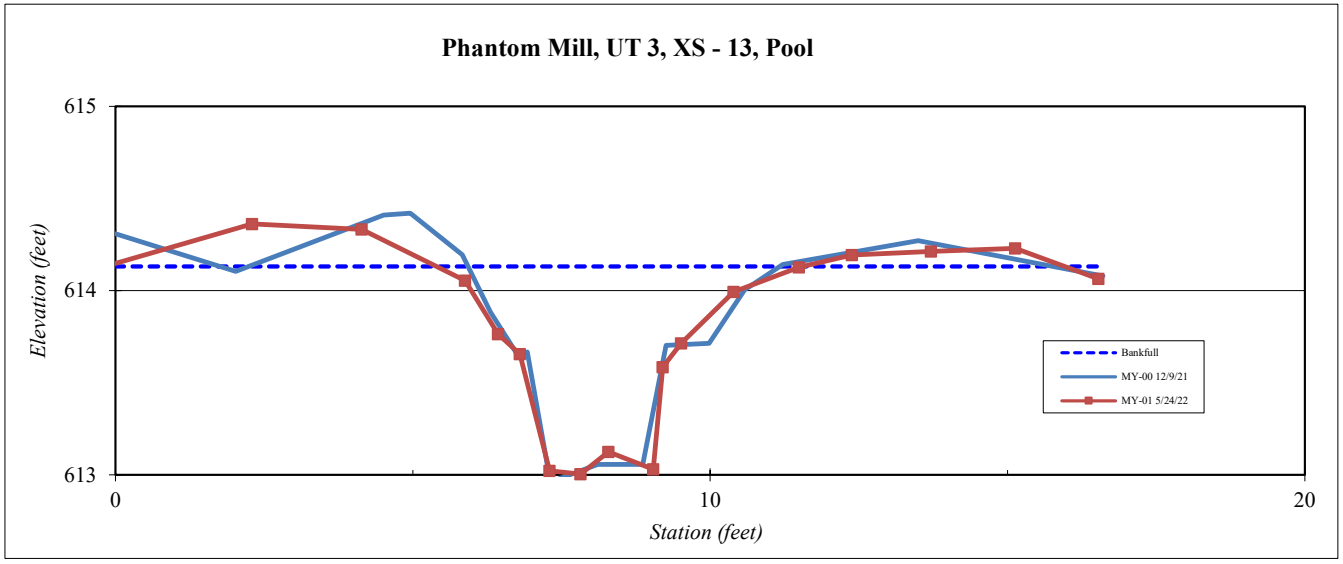


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 13, Pool
Feature	Pool
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
-0.3	614.1
2.3	614.4
4.1	614.3
5.9	614.1
6.4	613.8
6.8	613.7
7.3	613.0
7.8	613.0
8.3	613.1
9.0	613.0
9.2	613.6
9.5	613.7
10.4	614.0
11.5	614.1
12.4	614.2
13.7	614.2
15.1	614.2
16.5	614.1

SUMMARY DATA	
Bankfull Elevation:	614.1
Bank Hieght Ratio:	1.0
Thalweg Elevation:	613.0
LTOB Elevation:	614.1
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	3.1

Stream Type	E/C 5

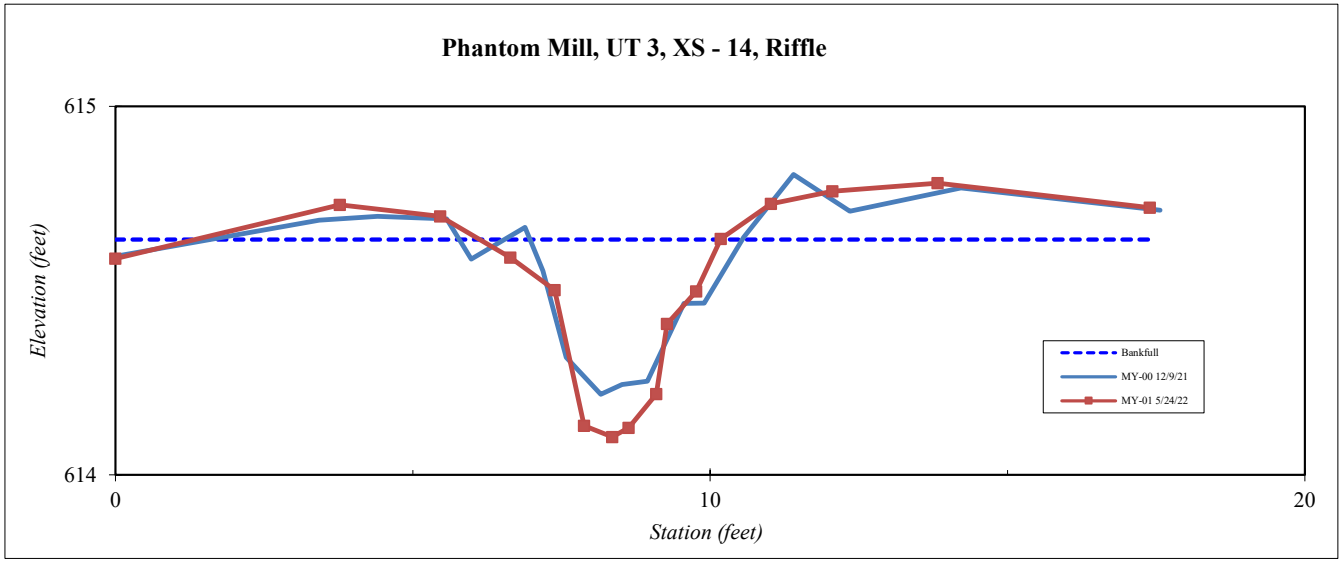


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 3, XS - 14, Riffle
Feature	Riffle
Date:	5/24/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	614.2
3.8	614.4
5.5	614.4
6.6	614.2
7.4	614.1
7.9	613.7
8.4	613.6
8.6	613.7
9.1	613.8
9.3	614.0
9.8	614.1
10.2	614.3
11.0	614.4
12.1	614.5
13.8	614.5
17.4	614.4

SUMMARY DATA	
Bankfull Elevation:	614.3
Bank Hieght Ratio:	1.0
Thalweg Elevation:	613.6
LTOB Elevation:	614.3
LTOB Max Depth:	0.7
LTOB Cross Sectional Area:	1.3

Stream Type	E/C 5

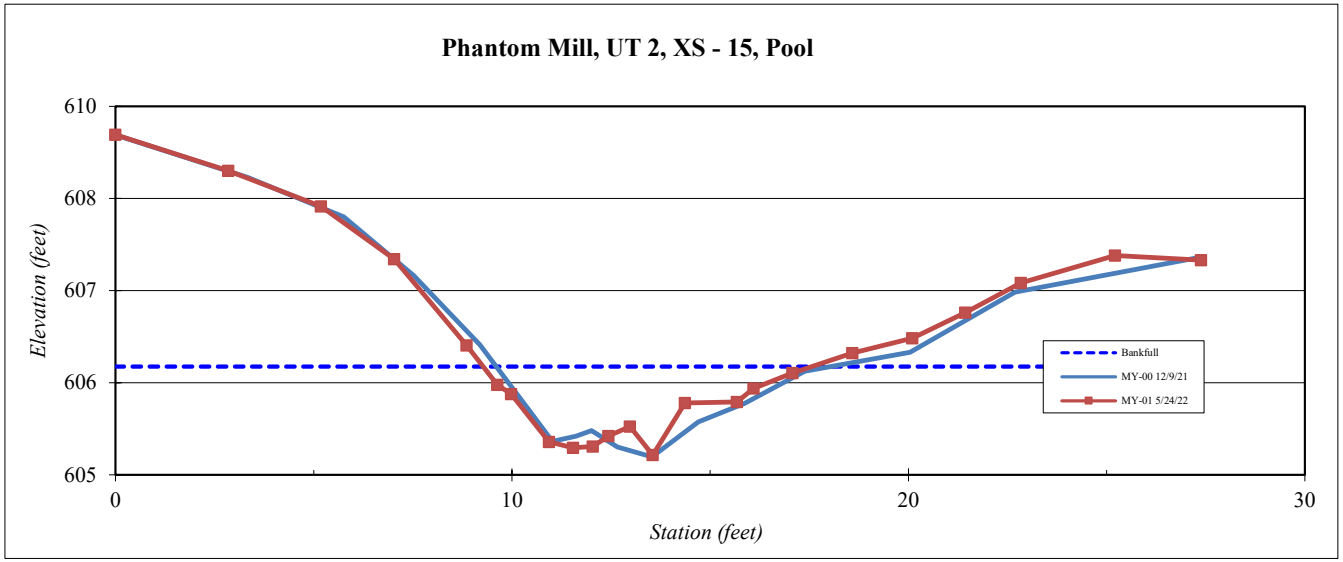


Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 2, XS - 15, Pool
Feature	Pool
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	609.4
2.8	608.9
5.2	608.4
7.0	607.7
8.9	606.5
9.6	605.9
10.0	605.8
10.9	605.2
11.5	605.1
12.0	605.1
12.4	605.2
13.0	605.4
13.6	605.0
14.4	605.7
15.7	605.7
16.1	605.9
17.1	606.1
18.6	606.4
20.1	606.6
21.4	606.9
22.8	607.33
25.2	607.7
27.4	607.6

SUMMARY DATA	
Bankfull Elevation:	606.2
Bank Hieght Ratio:	0.93
Thalweg Elevation:	605.0
LTOB Elevation:	606.1
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	4.5

Stream Type	E/C 5



Site	Phantom Mill
Watershed:	Cape Fear River Basin, 03030002
XS ID	UT 2, XS - 16, Riffle
Feature	Riffle
Date:	5/23/2022
Field Crew:	Perkinson, D. Lewis

Station	Elevation
0.0	607.7
2.5	607.7
4.8	607.5
6.6	607.4
7.8	607.0
8.3	606.8
9.1	606.7
10.0	606.6
11.1	606.6
11.9	606.7
12.5	606.8
13.0	606.9
13.7	607.3
14.6	607.5
16.0	607.6
17.6	607.6
19.6	607.8

SUMMARY DATA	
Bankfull Elevation:	607.5
Bank Hieght Ratio:	1.0
Thalweg Elevation:	606.6
LTOB Elevation:	607.5
LTOB Max Depth:	0.9
LTOB Cross Sectional Area:	4.6

Stream Type	E/C 5

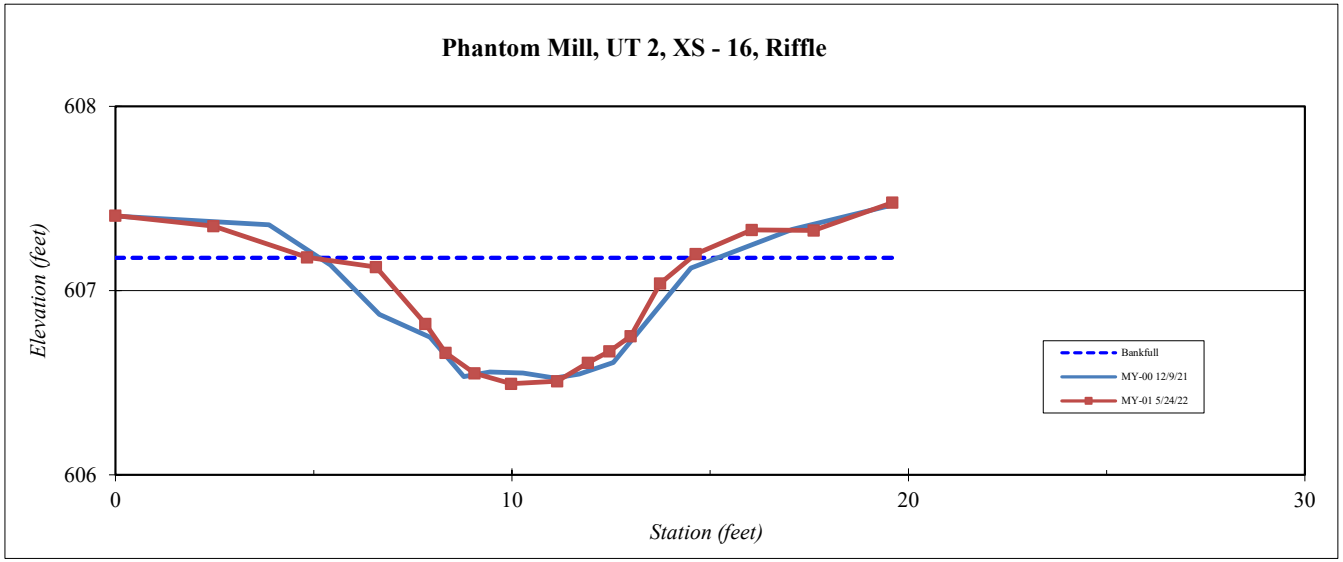


Table 9A. Baseline Stream Data Summary Phantom Mill - Cane Creek										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline (MY0)**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	18.6	23		43.5		25.1	28.9	29.5	32.9	3
Floodprone Width (ft)	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						590.49	590.44						591.65	591.85						591.81	591.90						593.48	593.56					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.00						1.00	1.00						1.00	1.02						1.00	0.99						1.00	0.95					
Thalweg Elevation	587.20	586.95						586.589	585.67						587.688	587.87						588.95	588.93						590.526	590.78					
LTOB[2] Elevation	589.82	589.77						590.488	590.46						591.65	591.92						591.81	591.86						593.477	593.43					
LTOB[2] Max Depth (ft)	2.62	2.82						3.90	4.79						3.96	4.05						2.85	2.93						2.95	2.65					
LTOB[2] Cross Sectional Area (ft^2)	50.9	51.27						69.4	70.18						71.9	73.80						55.2	54.22						52.4	48.89					

	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					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.96					
Thalweg Elevation	589.77	589.67					
LTOB[2] Elevation	593.47	593.53					
LTOB[2] Max Depth (ft)	3.71	3.86					
LTOB[2] Cross Sectional Area (ft^2)	70.4	65.48					

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

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

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						607.38	607.45						594.14	593.94						594.24	594.26						601.65	601.60					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.93						1.00	1.00						1.00	1.10						1.00	0.87						1.00	1.00					
Thalweg Elevation	604.963	604.99						606.632	606.59						593.223	592.95						593.81	593.83						601.03	601.13					
LTOB[2] Elevation	606.13	606.11						607.38	607.45						594.14	594.05						594.24	594.20						601.651	601.60					
LTOB[2] Max Depth (ft)	1.17	1.12						0.75	0.86						0.92	1.09						0.43	0.38						0.62	0.47					
LTOB[2] Cross Sectional Area (ft^2)	5.1	4.48						4.5	4.56						3.4	3.90						1.5	1.21						1.3	1.33					

	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						614.14	614.13						614.34	614.30						589.15	589.21						589.39	589.32					
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.04						1.00	1.00						1.00	1.00						1.00	0.99						1.00	1.03					
Thalweg Elevation	601.15	600.96						612.961	613.00						613.78	613.63						587.792	587.89						588.932	588.68					
LTOB[2] Elevation	602.61	602.54						614.141	614.13						614.34	614.30						589.15	589.19						589.39	589.34					
LTOB[2] Max Depth (ft)	1.46	1.58						1.18	1.12						0.57	0.67						1.36	1.30						0.46	0.66					
LTOB[2] Cross Sectional Area (ft^2)	4.7	5.07						3.2	3.15						1.3	1.29						6.2	5.95						1.5	1.57					

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.	--

Photo 1: Bankfull event documented on Cane Creek

Photo 2: Bankfull Event Documented on UT-3

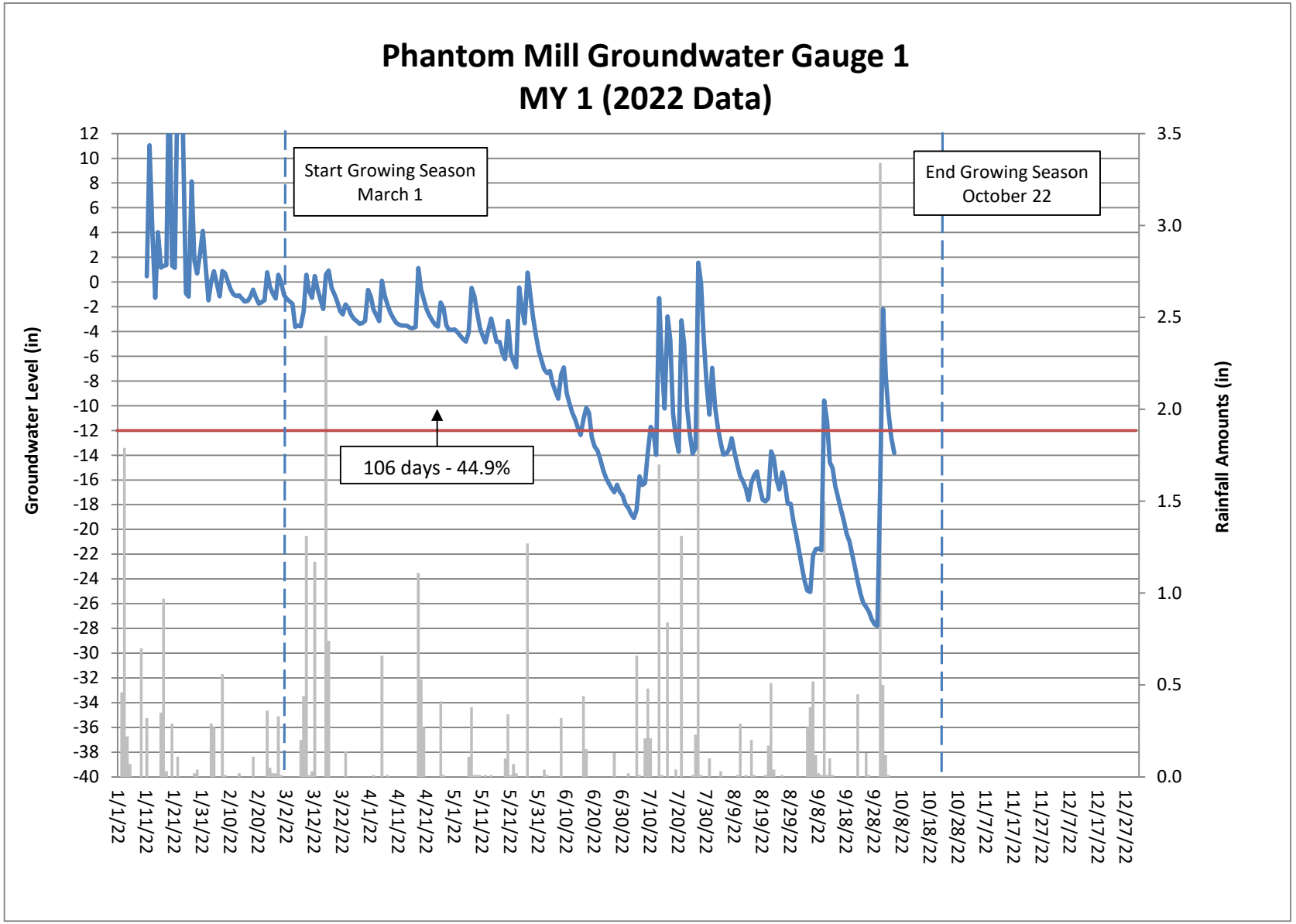
Photo 3: Bankfull Event Documented on UT-4

Photo 4: Bankfull Event Documented on UT-4

Photo 5: UT-4 Receding after a Bankfull Event

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%)						
2	Yes - 117 days (49.6%)						
3	Yes - 111 days (47.0%)						
4	Yes - 115 days (48.7%)						
5	Yes - 79 days (33.5%)						
6	Yes - 93 days (39.4%)						
7	Yes - 98 days (41.5%)						


Phantom Mill Groundwater Gauge 1
MY 1 (2022 Data)
Groundwater Level (in)
Rainfall Amounts (in)
Start Growing Season
March 1
End Growing Season
October 22
106 days - 44.9%
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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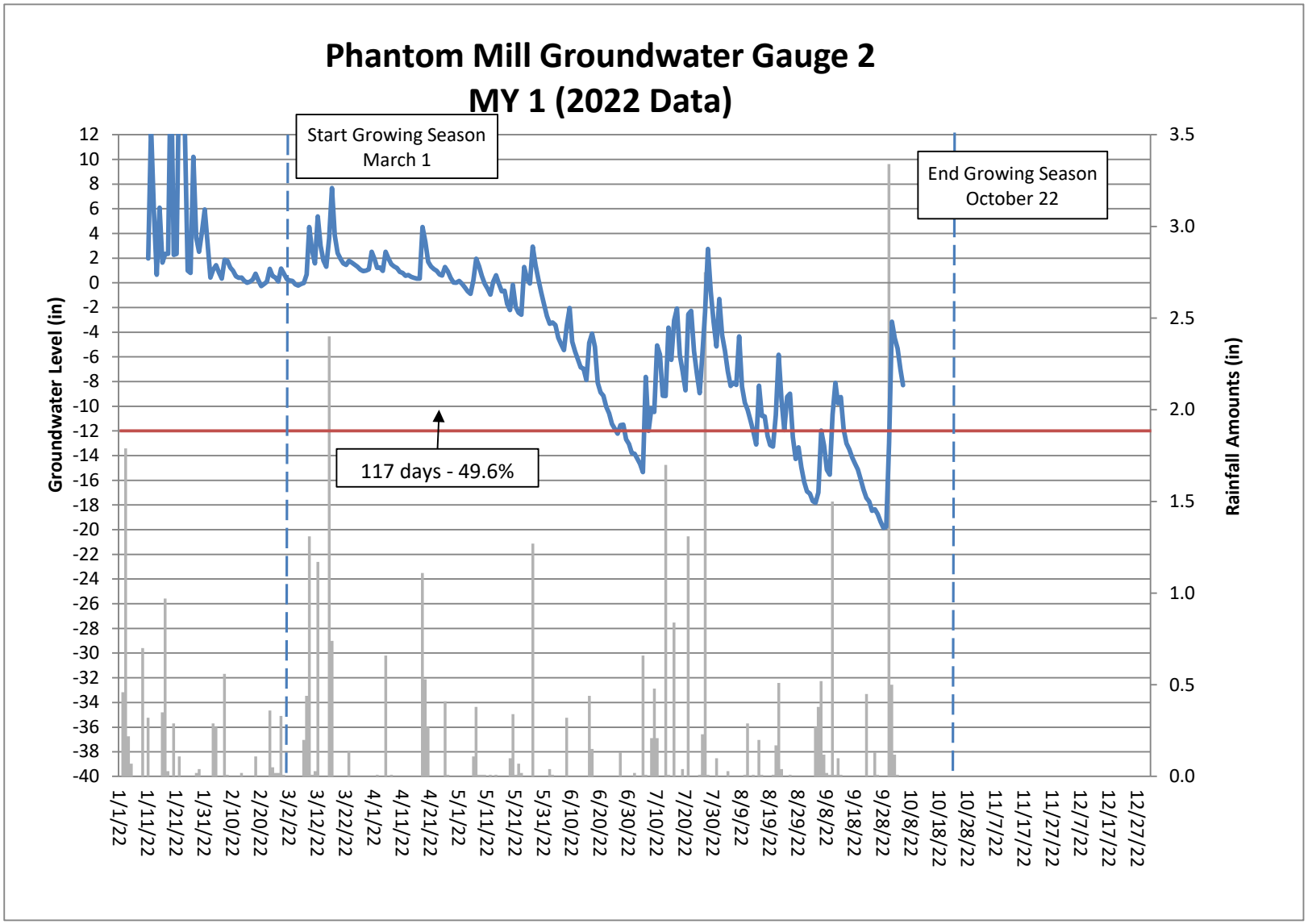
11/27/22
12/7/22
12/17/22
12/27/22


Phantom Mill Groundwater Gauge 2
MY 1 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
117 days - 49.6%
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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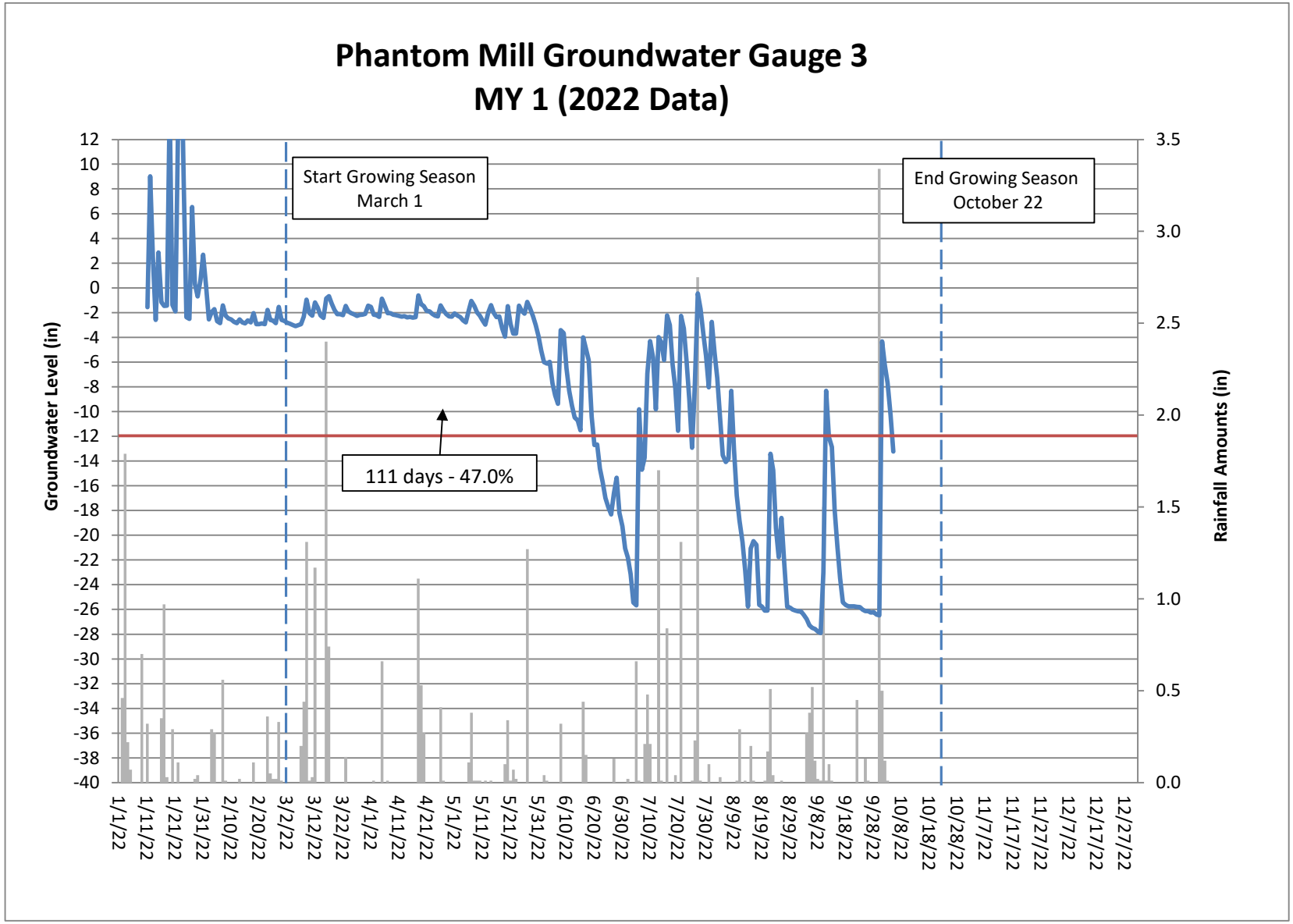
11/27/22
12/7/22
12/17/22
12/27/22


Phantom Mill Groundwater Gauge 3
MY 1 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
111 days - 47.0%
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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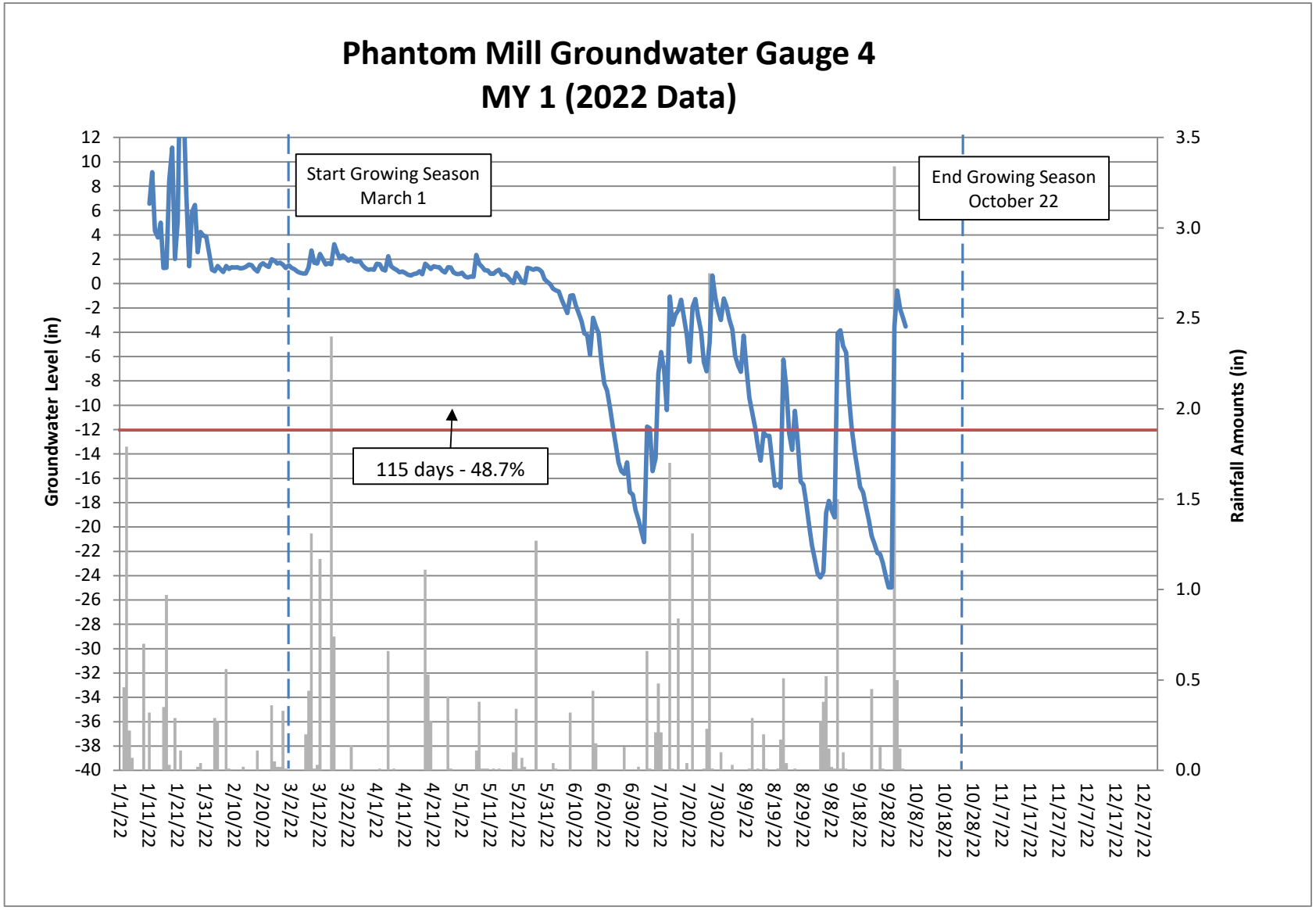
11/27/22
12/7/22
12/17/22
12/27/22


Phantom Mill Groundwater Gauge 4
MY 1 (2022 Data)
Groundwater Level (in)
Rainfall Amounts (in)
Start Growing Season
March 1
End Growing Season
October 22
115 days - 48.7%
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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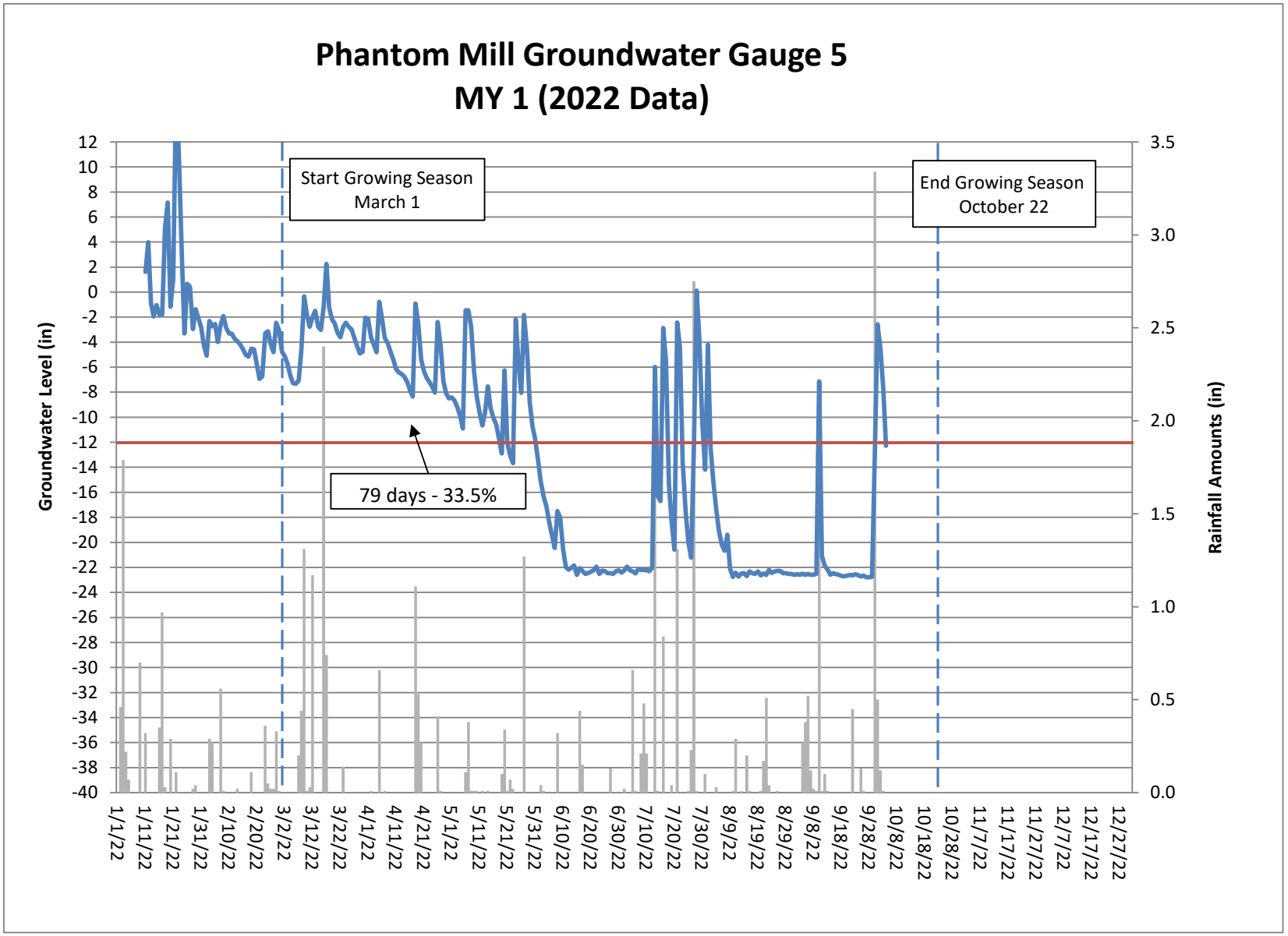
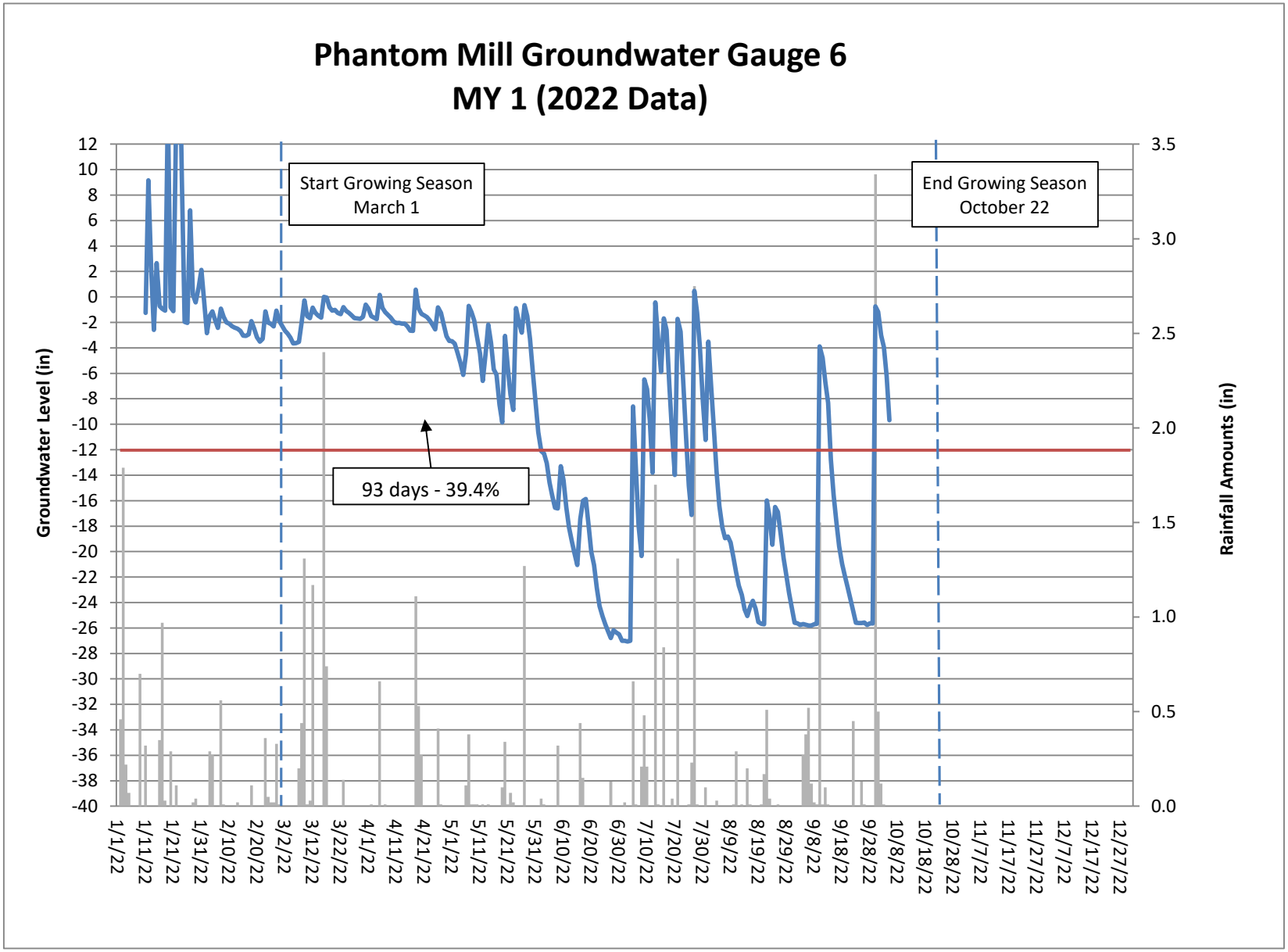
11/27/22
12/7/22
12/17/22
12/27/22


Phantom Mill Groundwater Gauge 5
MY 1 (2022 Data)
Groundwater Level (in)
Rainfall Amounts (in)
Start Growing Season
March 1
End Growing Season
October 22
79 days - 33.5%
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22


Phantom Mill Groundwater Gauge 6
MY 1 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
93 days - 39.4%
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

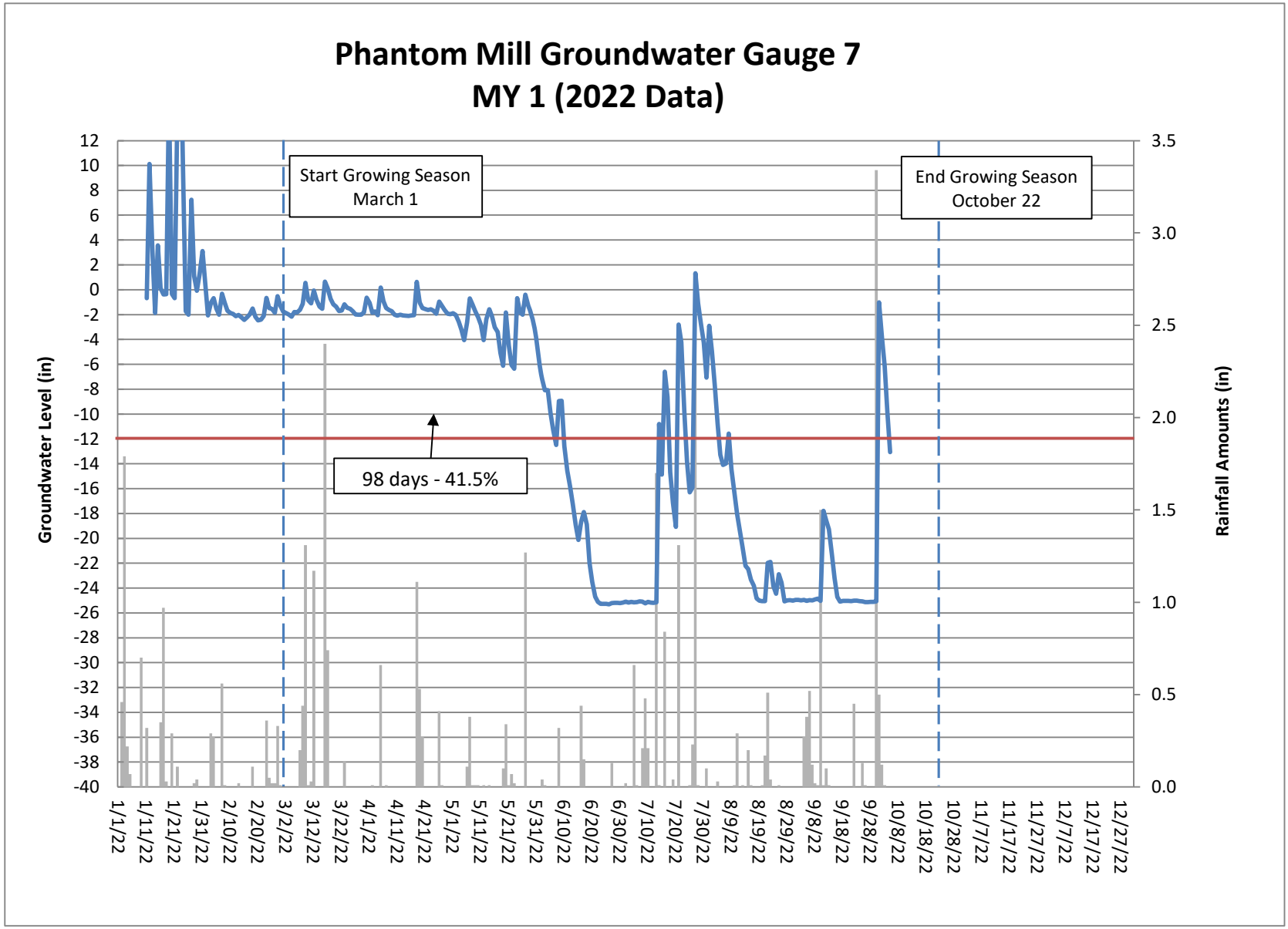

Phantom Mill Groundwater Gauge 7
MY 1 (2022 Data)
Start Growing Season
March 1
End Growing Season
October 22
98 days - 41.5%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

Table 13A UT-2 Channel Evidence

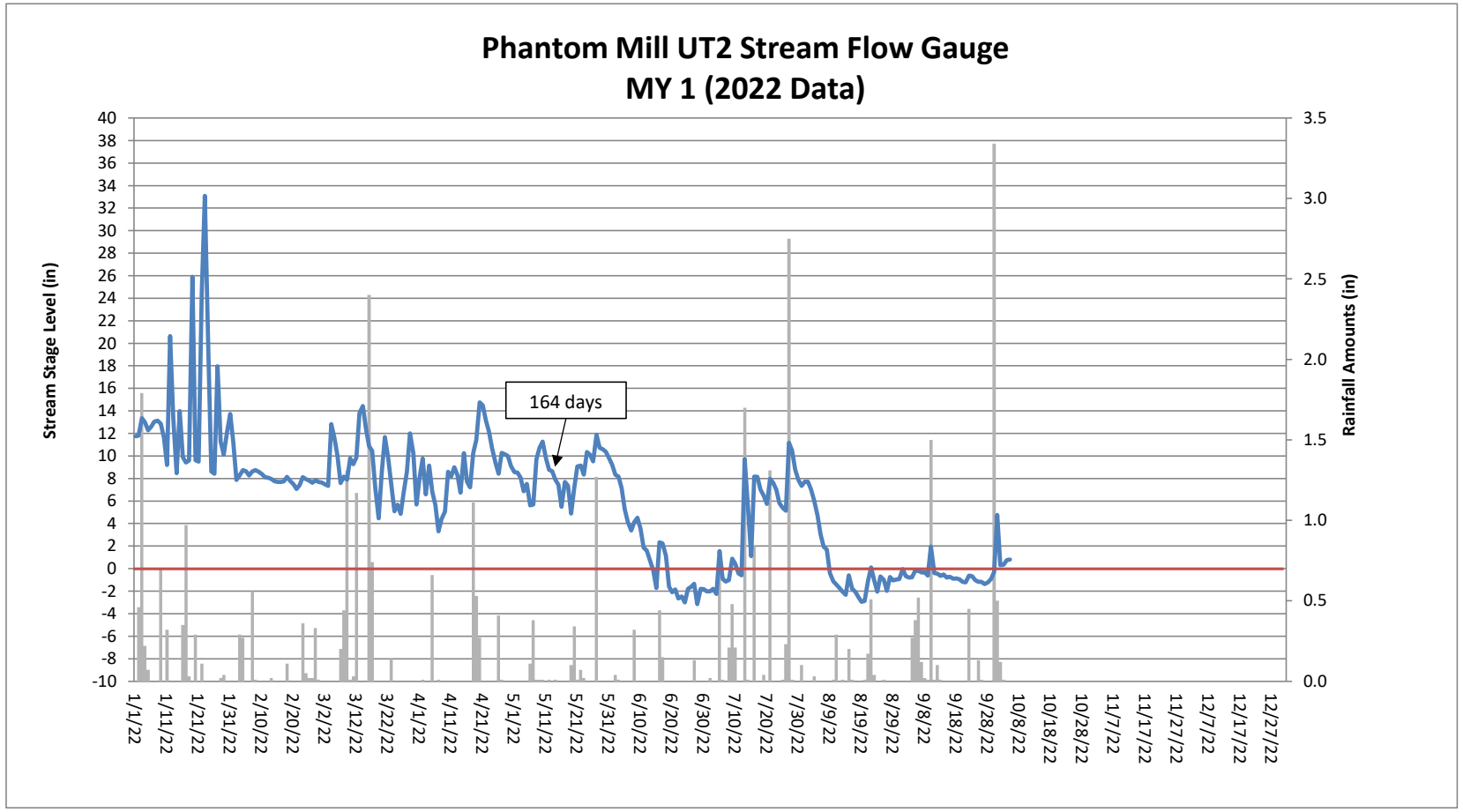
UT-1 Upstream Channel Evidence	Year 1 (2022)
Max consecutive days channel flow	164
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	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
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	

Table 13B UT-3 Channel Evidence

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

Table 13C UT-4 Channel Evidence

UT-2 Channel Evidence	Year 1 (2022)
Max consecutive days channel flow	266
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	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
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	


Phantom Mill UT2 Stream Flow Gauge
MY 1 (2022 Data)
Stream Stage Level (in)
Rainfall Amounts (in)
164 days
40
38
36
34
32
30
28
26
24
22
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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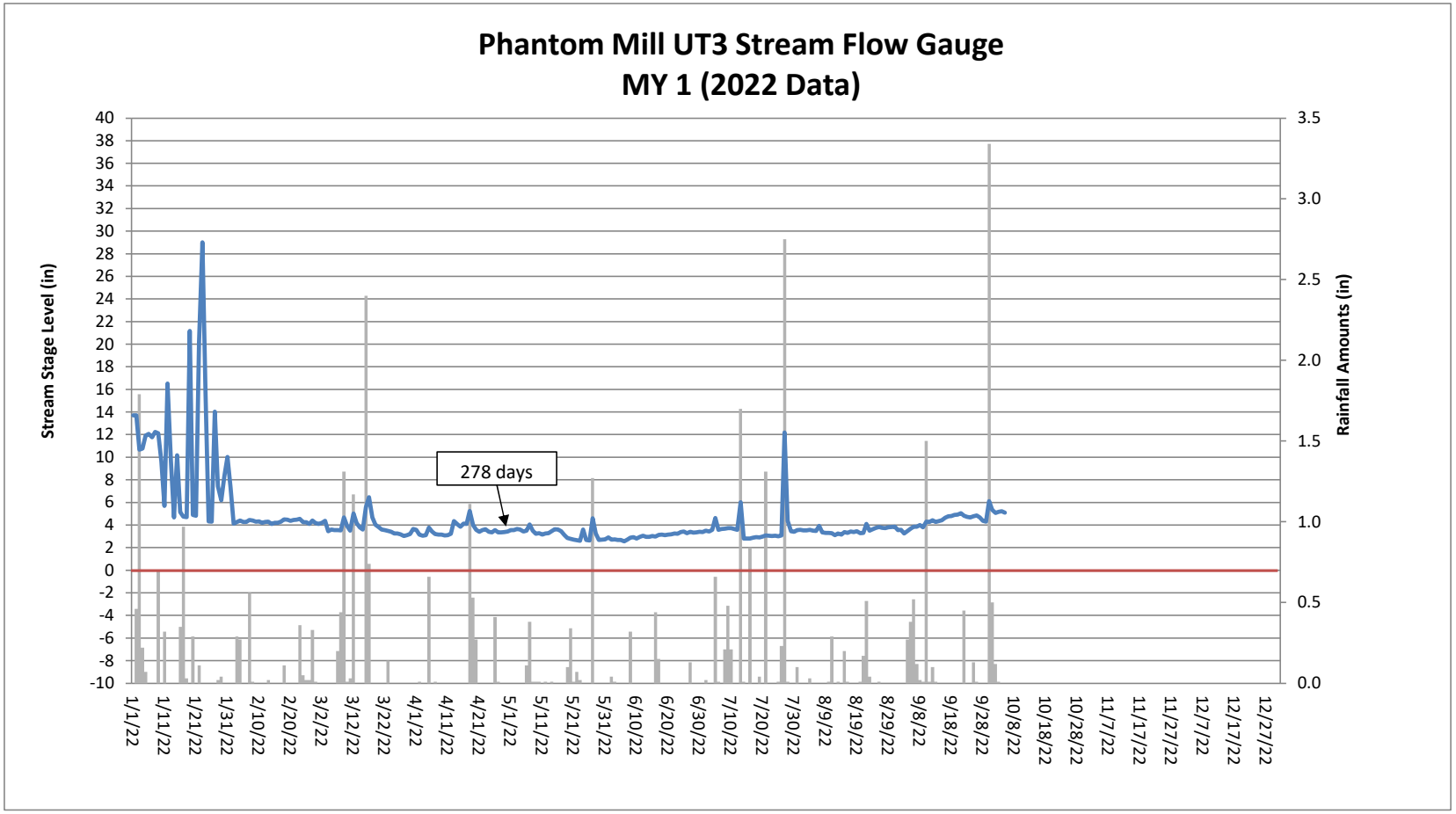
11/27/22
12/7/22
12/17/22
12/27/22


Phantom Mill UT3 Stream Flow Gauge
MY 1 (2022 Data)
Stream Stage Level (in)
Rainfall Amounts (in)
278 days
40
38
36
34
32
30
28
26
24
22
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
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
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3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
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8/29/22
9/8/22
9/18/22
9/28/22
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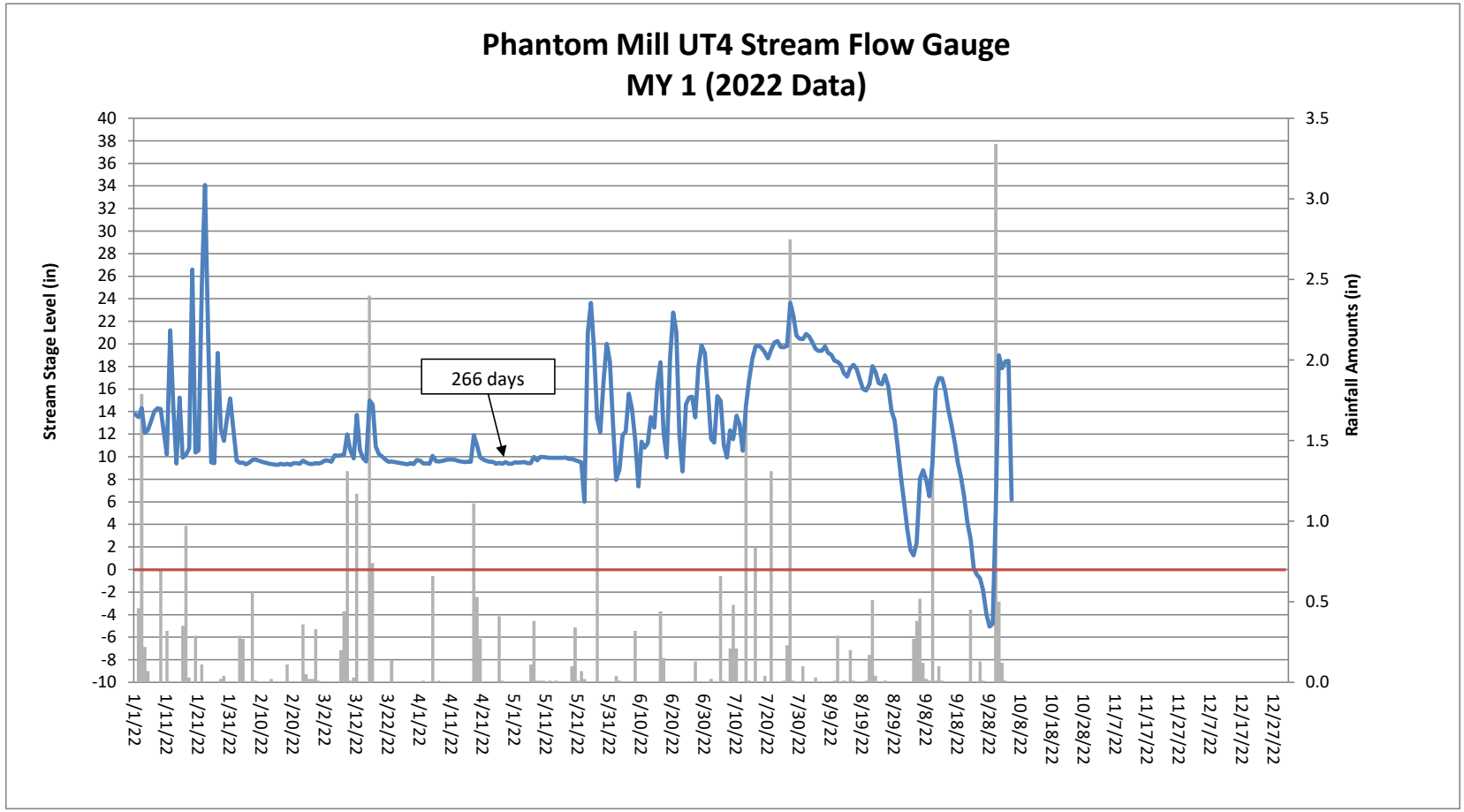
12/17/22
12/27/22


Phantom Mill UT4 Stream Flow Gauge
MY 1 (2022 Data)
Stream Stage Level (in)
Rainfall Amounts (in)
266 days
40
38
36
34
32
30
28
26
24
22
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
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1/1/22
1/11/22
1/21/22
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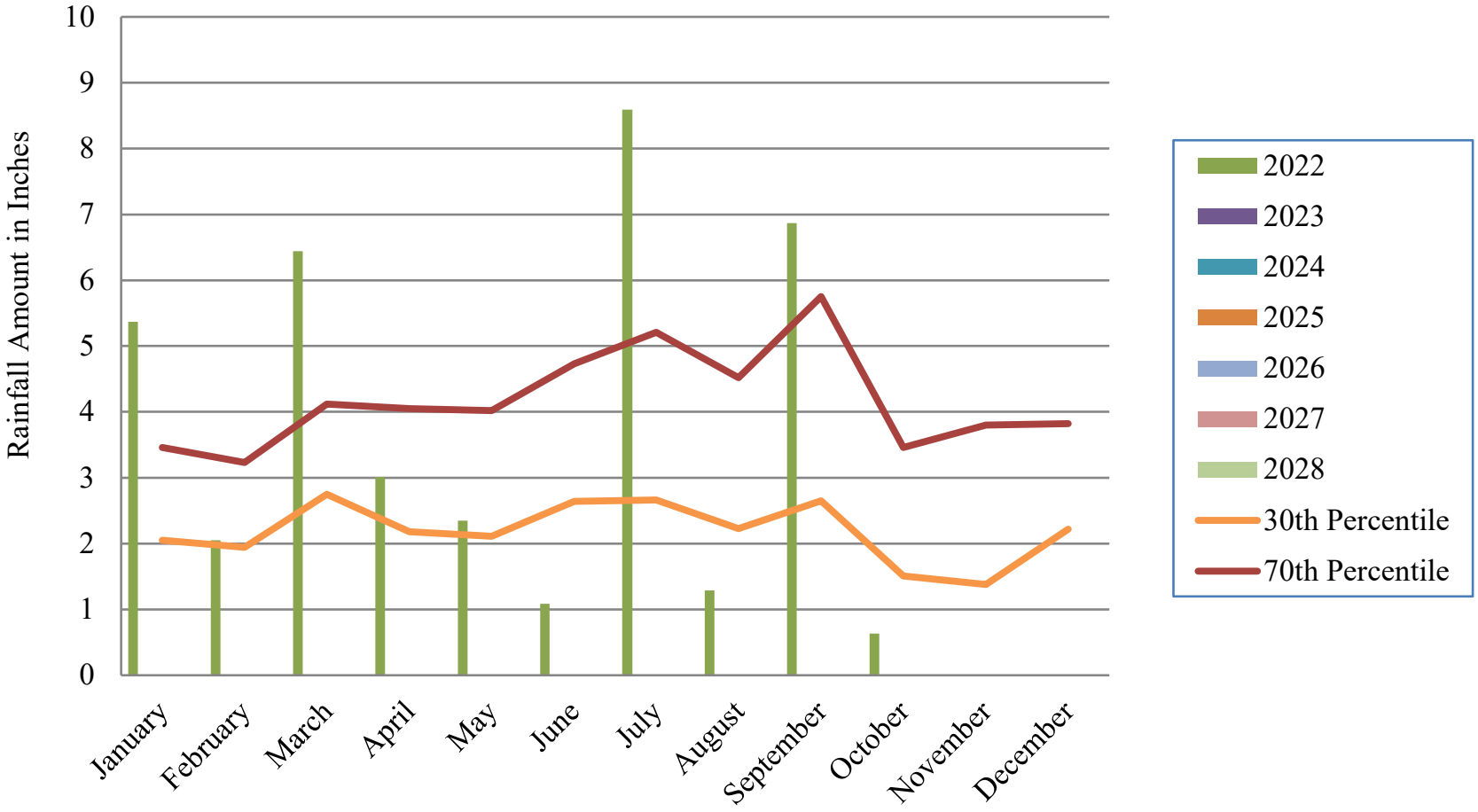
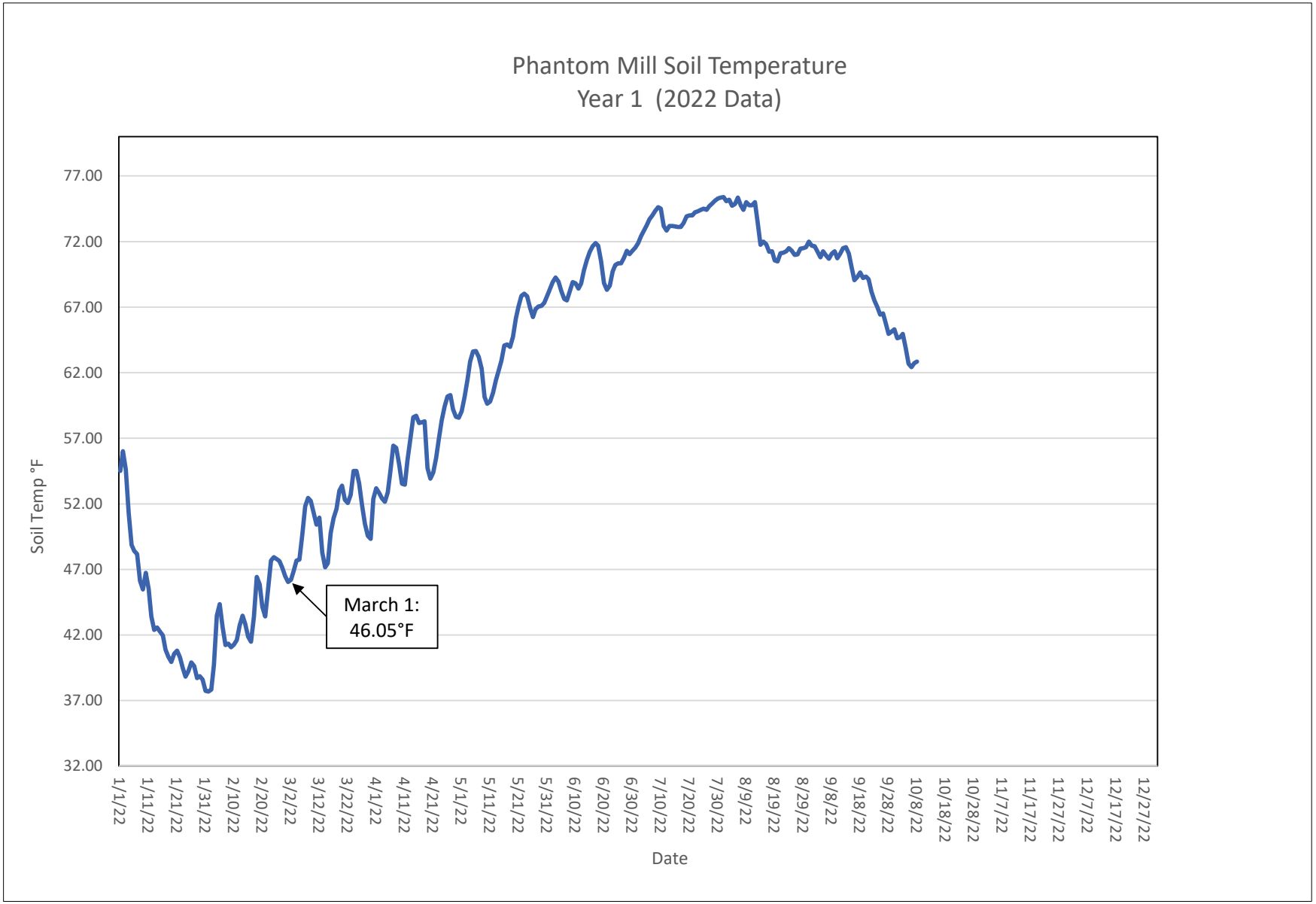
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

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 1 (2022 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:
46.05°F
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22
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
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

IRT Site Visit Notes - October 25, 2022
MY0 IRT Comment Response Letter
Mitigation Plan Amendment Request

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

October 27, 2022

Kelly Philips
NC DEQ – Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Subject: **MY 0 (2022) IRT Site Visit**
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

IRT Site Visit Notes:
On October 25, 2022, Restoration Systems (RS) held an on-site meeting with regulatory agencies to review the Phantom Mill Mitigation Site (Site) post construction (MY0). Below is a list of attendees and general site visit notes.

Attendees:

USACE:
- Kim Isenhour
- Casey Haywood

NC DWR:
- Erin Davis

Restoration Systems:
- Worth Creech
- Josh Merritt

Division of Mitigation Services:
- Kelly Philips

NC Wildlife Resource Commission:
- Olivia Munzer

Axiom Environmental:
- Grant Lewis
- Kenan Jernigan

Site Visit Notes:

- The IRT requested that any variation from the planting plan proposed in the mitigation plan be approved by IRT members prior to Site planting activities. In this instance, all replaced species will be approved for planting and success, but it is imperative to request approval for substitutions prior to planting in the future.

- The IRT acknowledged that some vegetation plot locations moved from the locations originally proposed in the mitigation plan due to post-construction field conditions and limitations. The IRT requested 3 temporary vegetation plots to capture wetland enhancement areas during MY1 monitoring. Existing permanent plots will not be moved or removed.

- Based on preliminary MY1 vegetation data, the IRT agreed that supplemental planting will be necessary during the 2022/2023 dormant season. RS acknowledged that a supplemental planting of more than 20% of the Site would typically require an adaptive management plan, however, the IRT agreed that the discussion held at this Site visit is sufficient and that an adaptive management plan will not be required in this case. The plan will be detailed in the MY1 monitoring report. It will include planted species, proposed planted stem density, and proposed treatment to mitigate competition with dense herbaceous vegetation.

- The IRT would like to see additional temporary vegetation plots during MY2 monitoring to sufficiently capture the success of the supplemental planting effort.

- The IRT requested that RS consider willow-staking UT-4 as part of the supplemental planting plan in an effort to shade the channel and reduce the amount of herbaceous vegetation. Additionally, the upper reach of UT-4 should be visually monitored for channel formation. A photo point will be added to this reach during MY2 monitoring.

- The IRT requested that RS/DMS consider some additional, highly visible easement signage along the gas easement to avoid accidental encroachment by maintenance activities.

- The IRT would like RS to closely monitor the amount of vegetation in the stream. There are also concerns about fescue from surrounding pastures encroaching into the upland portions of the Site. RS agrees to monitor these areas closely during forthcoming monitoring years.

In summary, the IRT was satisfied with site construction, stream and wetland conditions, and MY0 monitoring efforts. Planted stem mortality and shading along UT-4 will be addressed with supplemental planting during the 2022/2023 dormant season. Additional easement signage will be added along the gas line easement. Dense herbaceous vegetation in the channel and throughout the easement will be monitored closely, and management will be considered if problems are observed.

Thank you,
Worth Creech
Restoration Systems

Attachments
- Final MY0 Comment Responses
- Mitigation Plan Amendment Request
- July 2022 CCPV
- Revised MY0 Table 8 Vegetation Plot Data Table from Vegetation Data Entry Tool
- Revised As-built/Recorded Drawings

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

Response to IRT Comments – MY 0, Baseline 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)

Kim Isenhour, USACE:

1. During monitoring, please make visual observations of the large tree on the bank on Cane Creek STA 0+35. I'd like to know how tree survival is affected after construction.
   Response: The tree will be visually observed throughout the monitoring period.

2. In future monitoring reports, please note any issues that arise on UT-2 and UT-3 where rock riffles and log cross vanes were not installed per Colonial Pipeline regulations.
   Response: Reaches crossing the colonial pipeline easement will be monitored closely during the monitoring period.

3. Please confirm that the shallow wetland marsh treatment area that was constructed in the floodplain was not constructed in a jurisdictional wetland. I'm unclear where it's located. I'd like to see this area during the site visit. The IRT has had concerns with the amount of rip rap armoring of constructed outfalls.
   Response: During construction, it was determined that the marsh treatment areas were not necessary, so no marsh treatment areas were constructed. The UT1 channel was turned and dissipates into a large, restored wetland area. And the swale on the adjacent upstream property was turned into the channel prior to entering the easement. The as-built plan sheets have been updated to show that the marsh treatment areas were not constructed.

4. It would be helpful to show the location of the pipeline, and any other utilities on Figure 1.
   Response: The pipeline easement will be added to Figure 1. No other utilities exist onsite.

5. Table 5: What is the total acreage of invasives on site? Was this not listed on Table 5 because it was below the mapping threshold?
   Response: Invasive species occurrences observed onsite were sporadic and below the mapping threshold; however, spot treatment of privet and multiflora rose has occurred since as-built measurements. Treatment areas will be depicted on Figure 1 in the MY1 report.

6. Concur with DWR's comment #6 and EPA's comment #1.
   Response: See response to DWR comment #6.

7. While I appreciate the diversity in the seed mixes, please note the wetland indicator status for each species. For example, I believe Indiangrass is UPL, but it's listed in the wetland seed mix.
   Response: RS applied several long-term seed mixes to this site. The lower elevation areas including the streamside zones and wetland areas received a wetland specific mix. The entire site (except preservation areas) received a general mix of regionally appropriate native and naturalized species. This mix includes species likely to thrive on the upland margins of the site, some of which have a FACU or UPL indicator status. The mix is intended to provide early soil stabilization, facilitate tree establishment and survival, and support diverse wildlife including pollinators. In our experience it is more effective to broadly apply a diverse seed mix than to restrict species to narrowly delineated zones, and the planting on this site followed that philosophy. Additionally, wetland indicator status will be added to the seed mix table in the MY1 monitoring document.

8. Do you plan to add additional stems to vegetation plot 8, since it's currently not meeting interim success criteria? Is this an old road bed?
   Response: Based on preliminary MY1 vegetation monitoring data, the Site will require significant supplemental planting. The planting will occur during the 2022/2023 dormant season and will be detailed in the MY1 monitoring report.

9. Concur with DWR's comment #5. Please capture the wetland enhancement areas in random veg plots throughout monitoring.
   Response: Vegetation in wetland enhancement areas will be captured with random vegetation plots throughout the monitoring period.

Erin Davis, NCDWR:

1. DWR appreciated and agrees with DMS' site visit comments on invasives treatment and easement boundary markers.
   Response: As stated in our comment response to DMS, the boundary has been marked and invasives have been treated and will continue to be treated with documentation in yearly Monitoring Reports.

2. Please pay particular attention to stream areas where structures were omitted for any instability or downcutting during monitoring. DWR is concerned with the three structures removed from the meander bend transition point from restoration to preservation on Cane Creek, particularly if any bank grading could've affected the root zone of trees left along the bank. A photo point would be helpful at this location.
   Response: Areas where structures were omitted will be monitored closely for instability and downcutting. A photo point of the omitted log vanes on Cane Creek at the transition from restoration to preservation will be included during monitoring.

3. What was the stream condition along UT1 that initially warranted the proposed structure installation? DWR understands that this is a non-credit reach, but what is the risk of stream instability and/or potential sediment source to the downstream wetland if the current stream condition is not addressed through an alternative treatment or structure?
   Response: UT 1 is not a stream, and there is no risk of stream instability. During design, a structure was proposed based on the slope of the feature; however, during construction it was determined that the slope did not require a structure and there was no risk of incision along UT 1. The feature is a swale that drains into a large swath of reestablished wetland which will naturally treat pollutants and sediment entering the site. This area will be monitored for excessive sediment deposition, but this is not expected to be an issue.

4. DWR appreciated all of the photos, including planting and drone footage. Could a photo of the BMP please be included in the MY1 report?
   Response: The BMPs were not constructed. See response to USACE comment #3.

5. As noted in the report, many of the permanent veg plots have shifted compared to locations in the approved final mitigation plan monitoring plan figure. DWR questions whether the new locations provide representative coverage to demonstrate performance standard success for all proposed credit areas. DWR requires either veg plot 11 or 12 and veg plot 3 or 5 be relocated to at least partially overlap a nearby wetland enhancement credit area. DWR would prefer that veg plots 2 and 4 be located completely within wetland reestablishment areas.
   Response: Vegetation in wetland enhancement/reestablishment areas will be captured with random vegetation plots throughout the monitoring period.

6. DWR is very concerned that six species appear to have been planted that were not on the approved mitigation plan plant list (Viburnum dentatum, Quercus shumardii, Q. rubra, Q. lyrate, Morus rubra, Celtis occidentalis). These changes were not mentioned in the MY0 report. Please provide wetland indicator statuses for all planted species requiring IRT approval and identify which planting zone each species was installed in. DWR would like to review this information before approving species to be able to count toward vegetative performance success.

The species were included in the planting list based on nursery availability and observation in nearby forest communities. RS has proposed a modification to the mitigation plan where the additional species are proposed for inclusion to meet performance standards. The additional species counted in MY0 monitoring have been marked as "Proposed" and appear as "Post Mitigation Plan Species" in the vegetation plot data table. See revised MY0 vegetation table and the proposed modification to the mitigation plan. If the IRT approves the modification to the planting plan, these species will be marked "Approved Post Mit Plan" during MY1 monitoring.

Todd Bowers, USEPA:

1. Overall, the Site looks good, appears to be performing as intended, and is on track to meet stream, vegetation and wetland hydrology success criteria.
   Response: Noted

2. Table 6a/Page 34 and 97: Recommend adding the wetland indicator status here and updating the table to show deviations from proposed planting plan in final mitigation plan.
   Response: Wetland indicator status will be added to the planting table in the MY1 document. Deviations from the proposed planting plan are described in detail in the proposed modification to the mitigation plan.

3. Modifications made during construction and red line deviations in site plans noted with no issues.
   Response: Noted

4. While overall, vegetation stem counts are performing as expected, several plots have dominant species (>50%) and/or less than 4 species. Recommend keeping a close eye on the areas with these plots (fixed plots 3, 8, 9, 11 and 12).
   Response: Species diversity will be closely monitored throughout the monitoring period.

5. Overall, I am very satisfied with the report and the work that RS has completed at the site. Having not been able to visit this location, I really appreciated the detailed ground-level wetland, vegetation and stream feature photos to illustrate the grading, planting and features implemented.
   Response: Noted, thank you.

October 18, 2022

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

Kimberly Isenhour
Mitigation Project Manager, Regulatory Division
U.S. Army Corps of Engineers

Subject: Phantom Mill Mitigation Site - request to count replacement tree species towards site success criteria
DMS Project ID No. 100057
Full Delivery Contract No. 7526
RFP No. 16-007330
USACE Action ID No. SAW-2018-01166
DWR Project No. 18-0796

Mrs. Isenhour,

Restoration Systems, LLC (RS), Sponsor of the Phantom Mill Mitigation Site (Site), is requesting a modification of the Site's Mitigation Plan to include planted tree/shrub species that were not included in the Site's approved Mitigation Plan. A lack of availability from nurseries of approved Mitigation Plan tree/shrub species required RS to adjust the number of stems planted for some approved species and include five additional species not included in the approved Mitigation Plan. Table A below is a list of tree/shrub species detailed in the approved Mitigation Plan that were not planted at the Site.

Table A. Non-planted Species Specified in the Mitigation Plan

Species (Mitigation Plan)	Wetland Indicator Status	Mit. Plan Stems
Tag Alder (*Alnus serrulata*)	OBL	400
Ironwood *(Carpinus caroliniana*)	FAC	300
Sugarberry (*Celtis laevigata*)	FACW	1,000
Sweet Pepperbush (*Clethra alnifolia*)	FAC	25
White Ash (*Fraxinus americana*)	FACU	100
Elderberry (*Sambucus canadensis*)	FACW	25
Possumhaw (*Viburmum nudum*)	OBL	25
	TOTAL	1,875

Species summarized in Table A, as with others in the approved Mitigation Plan, were selected based on Reference Forest Ecosystem (RFE) data, on-site observations, and community descriptions from Classification of the Natural Communities of North Carolina (Schafale and Weakley 1990 and 2012) – Piedmont Alluvial and Dry-Mesic Oak-Hickory Forests.

To replace the 1,875 stems detailed in Table A, 2,300 were supplemented by five species not included in the approved Mitigation Plan: hackberry, red mulberry, overcup oak, Shumard oak, and southern arrowwood. RS selected these species based on their availability and that they were observed in nearby forest communities. The additional 12,000 stems needed to complete the targeted planting density were comprised of Mitigation Plan approved species. Table B summarizes planted species and their individual quantity.

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Table B. As-Built Planted Species and Stems

Replacement Species & Final Planting Numbers (As-built)	Wetland Indicator Status	Mit. Plan Stems	Planted Stems	Percentage of Total
Hackberry (*Celtis occidentalis*) *	FACU	--	500	3.50%
Red mulberry *(Morus rubra)* *	FACU	--	350	2.45%
Overcup oak *(Quercus lyrata)* *	OBL	--	600	4.20%
Shumard oak *(Quercus shumardii)* *	FAC	--	750	5.24%
Southern arrowwood *(Viburnum dentatum)* *	FAC	--	100	0.70%
River birch (*Betula nigra*)	FACW	1,400	1,000	6.99%
Buttonbush (*Cephalanthus occidentalis*)	OBL	25	300	2.10%
Eastern redbud (*Cercis canadensis*)	FACU	100	750	5.24%
Silky dogwood (*Cornus amomum*)	FACW	2,000	2,000	13.99%
Persimmon (*Diospyros virginiana*)	FAC	200	500	3.50%
Green ash (*Fraxinus pennsylvanica*)	FACW	1,000	700	4.90%
Tulip poplar (*Liriodendron tulipifera*)	FACU	600	1,000	6.99%
Black gum (*Nyssa sylvatica*)	FAC	300	500	3.50%
Sycamore (*Platanus occidentalis*)	FACW	2,600	1,500	10.49%
White oak (*Quercus alba*)	FACU	500	650	4.55%
Water oak (*Quercus nigra*)	FAC	1,500	1,250	8.74%
Willow oak (*Quercus phellos*)	FAC	1,400	1,250	8.74%
Red oak (*Quercus rubra*)	FACU	100	600	4.20%
	TOTALS	11,725	14,300	100%

*Replacement species not included in the approved Mitigation Plan

RS included all planted species in the data collection for the MY0 Monitoring Report. Table 8 within the MY0 Monitoring Report, the DMS vegetation tool, requires providers to select from five options regarding the species status for inclusion in meeting performance standards, "Performance Standard Approval" column:

1. Approved Mit Plan
2. Approved Post Mit Plan
3. Proposed
4. Not Approved – Not Invasive or Exotic
5. Not Approved – Invasive or Exotic

The five additional species detailed in Table B are included in the MY 0 Report as "Proposed" species for inclusion in meeting performance standards – Vegetation Plot Data Table from Vegetation Data Entry Tool, MY 0 Report Table 8, Appendix B. If the IRT concurs that these species may be included to count toward the Site's performance standards, RS will update the four species as "Approved Post Mit Plan" in the MY1 (2022) report.

Please let me know if you have any questions or if I can provide any additional information.

Sincerely,

Raymond Holz
Operations Manager
Restoration Systems, LLC