FINAL
MY3 (2023) MONITORING REPORT

SHAW'S RUN MITIGATION SITE
Columbus County, North Carolina
Lumber River Basin
Cataloging Unit 03040203

DMS Project No. 100055
Full Delivery Contract No. 7515
DMS RFP No. 16-007337
USACE Action ID No. SAW-2018-01169
DWR Project No. 2018-0866

Data Collection: January – November 2023
Submission: January 2024

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
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Response to Monitoring Year 3 (2023) DMS Comments
Shaw's Run Mitigation Site
Lumber River Basin – CU# 03040203– Columbus County
DMS Project ID No. 100055, Contract # 7515

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

Report:

1. Pg. 8, Section 2.1: Invertebrate sampling was attempted on June 18, 2023, but was not completed due to dry stream conditions. Were other attempts made during the sampling window (spring/summer) when conditions could have been more favorable? Though sampling was not completed, please add the benthic sampling locations to the CCPV and provide the shapefile.
   Since benthic sampling is not tied to success criteria and the monitoring scope does not allow for additional site visits, additional sampling attempts were not made. Habitat forms were completed on the June 18 site visit and are included in Appendix F. Benthic sampling locations were added to the CCPV and shapefiles were added to the digital submittal.

2. Appendix B: Please provide a table with the species and number of supplementally planted stems.
   Appendix B has been updated to include a table with the information for the supplementally planted stems.

3. Appendix D, Surface Water Gauge Graphs: For clarity, please include a line on the graphs where bankfull is located for each gauge.
   The surface water gauge graphs have been updated with the bankfull elevation.

4. Appendix D, Figure D1 Rainfall: Please update rainfall data through December.
   Figure D1 Rainfall has been updated to reflect rainfall through December. An additional site visit was not made in December, so data came from the closest Weather Underground station to the Site. December rainfall will be updated with onsite gauge data in MY4 when the rainfall gauge is downloaded.

5. Appendix D, Evidence of Headwater Channel Formation: It's great that UT1 and UT2 appear to have most of the channel forming indicators, but only photos were provided for flow and wrack lines. Please update with additional photos and/or provide photographs for each indicator in future reports.
   The channel forming indicators were observed and noted in accordance with IRT guidance, however, we do not have individual photos for each channel forming indicator this year. In very small stream channels like these, it is difficult to photo-document channel forming factors individually. We will make our best effort to better document channel forming indicators in future reports.

Digital Deliverables:

1. The submission is missing the hydrology data and summary tables (groundwater and surface water gauge tables, graphs, and data); please submit the missing components.
   These items have been added to the digital submittal.

Shaw's Run -- Year 3 (2023) Monitoring Summary

General Notes

- Three small areas of encroachment totaling 0.06 acres were observed from farm scalloping. These areas have been replanted with 3-gallong containerized species from the approved Site Mitigation Plan. RS also installed additional wooden posts and PVC pipe with signage and horse tape along the easement boundary to improve visibility. On-site conversations with the farmer also took place to ensure encroachment ceases.
- Additional signs were added to ensure signs are in place every 200-feet along the easement.
- For tree mounted signs, steel screws were replaced with aluminum nails.
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver, etc.) observed.

Streams

- All stream restoration reaches were stable and exhibited no signs of erosion, all structures were stable (Appendix C).
- Three bankfull events were documented with stream loggers across all site streams (Table 12, Appendix D).
- Streams continue to maintain distinct flow paths and maintain flow for well more than 30 consecutive days (Tables 14A-C, Appendix D).
- In accordance with the monitoring schedule, year 3 (2023) benthic macroinvertebrate sampling was attempted on June 18, 2023. All stream channels were dry at the time of the site visit, and no benthics were collected. See the table in Section 2.1 for a summary of benthic macroinvertebrate results to date. Year 3 (2023) habitat forms are in Appendix F.
- A permanent monumented cross section (XS 11) was added on the upper reach of UT2.

Vegetation

- Measurements of all 7 permanent plots resulted in an average of 497 planted stems/acre with an average of 5 species per plot. Additionally, all individual plots met success criteria (Appendix B).
- A random transect (25m x 4m) was conducted in year 3 (2023). The transect was short four stems from meeting the success criteria of 320 stems per acre (Appendix B).
- Invasive vegetation treatments have been effective in reducing populations and currently areas of invasive vegetation are below the mapping threshold. These areas will continue to be monitored and treated as needed.

Wetlands

- All groundwater gauges met success criteria for the year 3 (2023) monitoring period except Gauges 1 and 9 (Appendix D). Gauge 1 was installed outside of the credit generating area to confirm the drainage influence from the Greene Swamp. It had a similar hydroperiod during Years 1 and 2 (2021 and 2022). Gauge 9 read within 12 inches of the surface for 24 consecutive days (9.4%) during the growing season before it dropped below for just 3 days. The gauge read within the top 12 inches for 11 of the 15 days immediately following the drop. Additionally, Gauge 9 was damaged late in the year and was replaced at the end of the monitoring period. Groundwater gauge data is in 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 (2021)	Year 2 (2022)	Year 3 (2023)	Year 4 (2024)	Year 5 (2025)	Year 6 (2026)	Year 7 (2027)
1*	No - 5 days (1.9%)	No – 4 days (1.6%)	No – 5 days (1.9%)				
2	No - 15 days (5.8%)^	Yes – 53 days (20.6%)	Yes – 63 Days (24.5%)				
3	Yes - 44 days (17.1%)	Yes – 57 days (22.2%)	Yes – 51 Days (19.8%)				
4	Yes - 38 days (14.8%)	Yes – 58 days (22.6%)	Yes – 70 Days (27.2%)				
5	Yes - 34 days (13.2%)	Yes – 58 days (22.6%)	Yes – 68 Days (26.5%				
6	Yes - 52 days (20.2%)	Yes – 59 days (23.0%)	Yes – 71 Days (27.6%)				
7	Yes - 36 days (14.0%)	No – 11 days (4.3%)	Yes – 50 Days (19.5%)				
8	Yes - 38 days (14.8%)	Yes – 54 days (21.0%)	Yes – 50 Days (19.5%)				
9	Yes - 37 days (14.4%)	Yes – 53 days (20.6%)	No – 24 Days (9.4%)				

* Gauge 1 is not located in a credit generating area.

^ Gauge 2 likely would have met success criteria, however, logger failure occurred at the start of the growing season.

Site Maintenance Report (2023)

Invasive Species Work	Maintenance work
5/18/2023: Chinese Privet, Autumn Olive, Nodding Thistle, Multiflora Rose 10/12/23: Chinese Privet, Mimosa, Chinese Tallow, Chinaberry	9/30/2023: Easement Encroachment Area (added horse tape) 12/11/2023: Easement Encroachment Area (3-gallon container planting) 12/14/2023: Easement Encroachment Area (added additional signage, added wooden posts, added PVC pipe, added horse tape); Replaced steel screws with aluminum nails

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APPENDICES

1.0 PROJECT SUMMARY

Restoration Systems, LLC has established the North Carolina Division of Mitigation Services (NCDMS) Shaw's Run Mitigation Site.

1.1 Project Background, Components, and Structure

The Shaw's Run Mitigation Site (hereafter referred to as the "Site") encompasses 9.44 acres of disturbed forest and agricultural fields along warm water, unnamed tributaries to Greene Branch. The Site is located approximately 2 miles west of Chadbourn, NC, south of NC Highway 76 in Columbus County.

Before construction, Site land use consisted of agricultural row crops and disturbed forest. Row crop production extended to, and abutted, ditched stream margins. Herbaceous vegetation and a few shrubby species grew within the ditches, which were regularly maintained by bush hogging and herbicide application. As the ditch descended the valley towards Greene Branch, soils changed from the Goldsboro and Lynchburg soil series (moderately well and somewhat poorly drained) to the Muckalee soil series (poorly drained), and disturbed forest vegetation became more prevalent along stream margins and floodplains. Stream channels were cleared, dredged and straightened, plowed annually for row crops, eroded vertically and laterally, and received extensive sediment and nutrient inputs from agriculture chemicals and sediment. The entire stream channel was ditched and cleared of vegetation which contributed to sediment export from the Site. In addition, stream-side wetlands were cleared and drained by channel downcutting, drain tile installation, and adjacent land uses. Preconstruction Site conditions resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities restored riffle-pool morphology, aided in energy dissipation, increased aquatic habitat, stabilized channel banks, and greatly reduced sediment loss from channel banks.

Proposed Site restoration activities generated 2285.000 Stream Mitigation Units (SMUs) and 5.862 Riparian Wetland Mitigation Units (WMUs) as described in Table 1.

Additional activities that occurred at the Site included the following.

- Planting 7.7 acres of the Site with 8300 stems (planted species are included in Table 6, Appendix B).

Deviations from the construction plans included the following.

- The easement was updated from the construction plans. Construction plans had an older easement that was not the proper (recorded) easement boundary.
- Woody material was placed in the channel riffles.
- Several log cross vanes were not installed due to Site conditions, including low slope causing the vanes to not be necessary. Log vanes removed from the project include stations 0+30, 7+20, 7+85, and 9+10 along UT1, and stations 0+30, 0+80, 1+10, 1+75, 2+05, 2+40, and 4+05 along UT2.

Table 1. Shaw's Run (ID-100055) 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								
UT1	1919	1912	Warm	R	1.00000	1,919.000		
UT2	366	366	Warm	R	1.00000	366.000		
					Total:	**2,285.000**		
Wetland								
Wetland R	5.852	5.852	R	REE	1.00000	5.852		
Wetland E	0.103	0.103	R	P	10.00000	0.010		
					Total:	**5.862**		

Project Credits

	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	2,285.000	0.000	0.000	0.000	0.000	0.000
Re-establishment				5.852	0.000	0.000
Rehabilitation				0.000	0.000	0.000
Enhancement				0.000	0.000	0.000
Enhancement I	0.000	0.000	0.000			
Enhancement II	0.000	0.000	0.000			
Creation				0.000	0.000	0.000
Preservation	0.000	0.000	0.000	0.010	0.000	
Totals	**2,285.000**	**0.000**	**0.000**	**5.862**	**0.000**	**0.000**

Total Stream Credit	**2,285.000**
Total Wetland Credit	**5.862**

Site design was completed in March 2019. Construction started on March 13, 2020, and ended within a final walkthrough on June 25, 2020. The Site was planted on December 20, 2020. Completed project activities, reporting history, completion dates, project contacts are summarized in Tables 15-16 (Appendix E).

1.2 Project Goals and Objectives

Project goals were based on the *Lumber River Basin Restoration Priorities* (RBRP) report (NCEEP 2008) and on-site preconstruction data collection of channel morphology and function observed during field investigations. The Site is located within **Targeted Local Watershed (TLW) 03040203191010** and subbasin 03-07-51. The project is not located within a Local Watershed Planning area. Project goals identified in the RBRP include the following.

1. Improve water quality through increased riparian buffer area (Project will restore approximately 7.7 acres of riparian buffer).
2. Reduce impacts from agricultural practices (Project will remove agricultural row crops from the Site).
3. Reduce impacts from impervious surfaces (Project will incorporate one marsh treatment area to treat ditches that receive roadside runoff).
4. Protection of existing resources (Project will be protected with a permanent conservation easement).

In addition to the defined Cataloging Unit (CU) goals for the Lumber River, additional goals for the area generally revolve around reducing stressors to water quality. Stressors and how each will be addressed by project activities are as follows.

1. Sedimentation - (reduction of 15.8 tons/year after mitigation is complete).
2. Nutrients – (direct reduction of 89 pounds of nitrogen and 156 pounds of phosphorus per year by removing agricultural row crops; eliminate fertilizer application; and installing a marsh treatment area).
3. Land Use Impacts (imperviousness) – (incorporation of one marsh treatment area to treat ditches that receive roadside runoff).
4. Stormwater – (reduction of bank height ratio, restoration of wetlands, reforestation, and installation of a marsh treatment area will reduce stormwater pulses).
5. Lack of Riparian Buffer – (restoration of 7.7 acres of riparian buffer).

Site-specific mitigation goals and objectives were developed through the use of North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) analyses of preconstruction and reference stream systems at the Site (NC SFAT 2015 and NC WFAT 2010) (see Table 2 below).

Table 2. Summary: Goals, Performance, and Results

Targeted Functions	Goals	Objectives	Success Criteria
(1) HYDROLOGY			
(2) Flood Flow (Floodplain Access) (3) Streamside Area Attenuation (4) Floodplain Access (4) Wooded Riparian Buffer (4) Microtopography Wetland – Surface and Sub-Surface Storage and Retention	• Attenuate flood flow across the Site. • Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning and degraded wetland systems.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Cease row crop production within the easement • 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 • Remove agricultural row crops from the easement • Monitoring wells will be successful if the water table is within 12 inches of the soil surface for 12% of the growing season • Vegetation plots will be successful if the plant density is 210 stems per acre with an average plant height of 10 feet at 7 years following planting • Conservation Easement recorded
(3) Stream Stability (4) Stream Geomorphology	• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with proper pattern, dimension, and longitudinal profile • Cease row crop production within the easement • Construct stable channels with grade control structures. • Plant woody riparian buffer	• Cross-section measurements indicate a stable channel • 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 • Remove agricultural row crops from the easement • Vegetation plots will be successful if the plant density is 210 stems per acre with an average plant height of 10 feet at 7 years following planting
(1) WATER QUALITY			

(2) Streamside Area Vegetation
(3) Upland Pollutant Filtration
(3) Thermoregulation
(2) Aquatic Life Tolerance
Wetland - Pathogen, Particulate, Soluble, and Physical Change
	• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Reduce agricultural land/inputs
		• Install marsh treatment areas
		• Plant woody riparian buffer
		• Restore jurisdictional wetlands adjacent to Site streams
		  o Remove drain tile
		  o Promote overbank flooding by P1 stream restoration.
			• Remove agricultural row crops from the easement
			• Monitoring wells will be successful if the water table is within 12 inches of the soil surface for 12% of the growing season
			• Vegetation plots will be successful if the plant density is 210 stems per acre with an average plant height of 10 feet at 7 years following planting

(1) HABITAT			
(2) In-stream Habitat (3) Substrate (2) Stream-side Habitat (3) Stream-side Habitat (3) Thermoregulation Wetland - Physical Structure, Landscape Patch Structure, and Vegetation Composition	• Improve instream and stream-side habitat.	• Construct stable channels • Plant woody riparian buffer to provide organic matter and shade • Construct new channel at historic floodplain elevation to restore overbank flows and plant woody riparian buffer • Protect riparian buffers with a perpetual conservation easement • Restore jurisdictional wetlands adjacent to Site streams	• Cross-section measurements indicate a stable channel • Visual documentation of stable channels and in-stream structures. • Monitoring wells will be successful if the water table is within 12 inches of the soil surface for 12% of the growing season • Vegetation plots will be successful if the plant density is 210 stems per acre with an average plant height of 10 feet at 7 years following planting • Conservation Easement recorded

1.3 Success Criteria

Project success criteria have been established per the October 24, 2016, NC Interagency Review Team *Wilmington District Stream and Wetland Compensatory Mitigation Update*. Monitoring and success criteria relate to project goals and objectives. From a mitigation perspective, several of the 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 table summarizes Site success criteria.

Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow must be documented each year for at least 30 consecutive days. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. • Entrenchment ratio (ER) must be no less than 2.2 at any measured riffle cross-section. • BHR and ER at any measure riffle cross-section should not change by more than 10% from baseline condition during any given 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 5; 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.
Visual Assessment
• Photographs at vegetation plots and cross-sections should illustrate the Site's vegetative and morphological stability on an annual basis, including no excessive erosion or degradation on the channel banks, no mid-channel bars, or vertical incision. In addition, grade control structures should remain stable.

Note: BHR will be calculated using procedures outlined in the latest approved guidance from NCDMS.

2.0 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	X	X	X		X		X
Wetlands	X	X	X	X	X	X	X
Vegetation	X	X	X		X		X
Macroinvertebrates			X		X		X
Visual Assessment	X	X	X	X	X	X	X
Report Submittal	X	X	X	X	X	X	X

*Visual Assessment will be complemented by permanent photographic points located at each permanent cross-section and vegetation plot.

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 10 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 surface water gauges and/or trail camera	Continuous recording through monitoring period	Surface water gauges on UT 1 and UT2	Surface water data for each monitoring period
Bankfull Events	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Surface water gauges on UT 1 and UT2	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through monitoring period	All restored stream channels	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)	Preconstruction, Years 3, 5, and 7 during the "index period" referenced in *Small Streams Biocriteria Development* (NCDWQ 2009)	2 stations (one at the lower end of UT 1 and one at the lower end of UT 2); however, the exact locations will be determined at the time preconstruction 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 Reestablishment	Groundwater gauges	Years 1, 2, 3, 4, 5, 6, and 7 throughout the year with the growing season defined as March 1-November 12	9 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season (no earlier than March 1), 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	7 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre

*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 3 (2023) monitoring. The constructed channel exhibits characteristics of a stable coastal plain 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. At the request of the IRT, an additional cross-section, cross-section 11, was added in the upper reach of UT2 to monitor aggradation in this reach. None was observed during Year 3 (2023). Stream morphology data is available in Appendix C. Visual assessment data is available in Appendix A, Tables 4A-B.

In accordance with the monitoring schedule, year 3 (2023) benthic macroinvertebrate sampling was attempted on June 18, 2023. All stream channels were dry at the time of the site visit, and no benthics were collected. See the table below for a summary of benthic macroinvertebrate results to date. Year 3 (2023) habitat forms are in Appendix F.

Summary of Benthic Macroinvertebrate Data by Year

Sampling Station	Preconstruction			Year 3 (2023)*			Year 5 (2025)			Year 7 (2027)		
	# EPT Taxa	Biotic Index	Habitat Score	# EPT Taxa	Biotic Index	Habitat Score	# EPT Taxa	Biotic Index	Habitat Score	# EPT Taxa	Biotic Index	Habitat Score
UT-1	0	9.24	33	NA	NA	81						
UT-2	0	8.78	48	NA	NA	78						

*All reaches were dry at time of benthic collection. No samples were collected.

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
2021 (Year 1)	March 1, 2021	March 1-November 12 (257 days)	31 days
2022 (Year 2)	March 1, 2022*	March 1-November 12 (257 days)	31 days
2023 (Year 3)	March 1, 2023^	March 1-November 12 (257 days)	31 days

*Based on observed/documented bud burst on the Site on March 1, 2022, and soil temperature of 53.9°F.
^ Based on observed/documented bud burst on the Site on March 1, 2023, and soil temperature of 60.03°F.

All groundwater gauges met success criteria for the Year 3 (2023) monitoring period except Gauges 1 and 9 (Appendix D). Gauge 1 was installed outside of the credit generating area to confirm the drainage influence from the Greene Swamp. It had a similar hydroperiod during Years 1 and 2 (2021 and 2022). Gauge 9 read within 12 inches of the surface for 24 consecutive days (9.4%) during the growing season before it dropped below for just 3 days. The gauge read within the top 12 inches for 11 of the 15 days immediately following the drop. Additionally, Gauge 9 was damaged late in the year and was replaced at the end of the monitoring period. Groundwater gauge data is in Appendix D.

Vegetation Summary

Year 3 (2023) vegetation measurements occurred on August 23, 2023, with another visit to collect additional visual and transect data in November. During quantitative vegetation sampling, 7 sample plots (10-meter by 10-meter) were monitored within the Site as per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.2 (Lee et al. 2008). Measurements of all 7 plots resulted in an average of 497 planted stems/acre, 5.1 species per plot, and an average height of 4.7 feet. All individual plots met success criteria (Tables 7-8, Appendix B). In Plot 3, the dominant species composition exceeded 50% for bald cypress (*Taxodium distichum*). In reference forests, it is very common to have dense stands of cypress and its density in this plot is an outlier. Sitewide vegetation is excellent and representative of the targeted forest type.

At the request of the IRT, a transect was completed in the vicinity of the onsite rain gauge. This area is dominated by very dense southern dewberry (*Rubus trivialis*), and just downslope towards the floodplain vegetation is comprised of dense herbaceous obligate wetland species. The transect that was completed indicated an average stem density of 162 stem/acre with an average height of 5.1 feet. The trees were vigorous and are unlikely to be affected by the dense population of dewberry. This area will continue to be monitored and the next evaluation will occur in the spring while the dewberry is dormant to determine if additional trees are present. Containerized trees may be added if deemed necessary. Species composition throughout the site will continue to be monitored during subsequent Site visits and visual surveys will be conducted to ensure species diversity is maintained. Visual assessment data is available in Appendix A, Table 5.

Table 3. Project Attribute Table			
Project Name	Shaw's Run		
County	Columbus County, North Carolina		
Project Area (acres)	9.44		
Project Coordinates (latitude and longitude decimal degrees)	34.3193ºN, 78.8666 ºW		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	Lumber		
USGS Hydrologic Unit 8-digit	03040203		
DWR Sub-basin	03-07-51		
Project Drainage Area (acres)	106		
Project Drainage Area Percentage of Impervious Area	<2%		
Land Use Classification	Cultivated & Other Broadleaf Deciduous Forest		
Reach Summary Information			
Parameters	**UT 1**	**UT 2**	**Reach 3**
Pre-project length (feet)	1474	283	
Post-project (feet)	1912	366	
Valley confinement (Confined, moderately confined, unconfined)	Alluvial, moderately confined to unconfined		
Drainage area (acres)	106.5	24.6	
Perennial, Intermittent, Ephemeral	Perennial/Intermitternt	Intermittent	
NCDWR Water Quality Classification	C, Sw		
Dominant Stream Classification (existing)	G5/6	F5/6	
Dominant Stream Classification (proposed)	E/C5	E/C5	
Dominant Evolutionary class (Simon) if applicable	III/IV	III/IV	
Wetland Summary Information			
Parameters	**Wetland R**	**Wetland E**	**Wetland 3**
Pre-project (acres)	0	0.103	
Post-project (acres)	5.852	0.103	
Wetland Type (non-riparian, riparian)	Riparian riverine		
Mapped Soil Series	Muckalee		
Soil Hydric Status	Hydric		
Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	JD Package (App D)
Water of the United States - Section 401	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 (CZMA or CAMA)	No	--	NA
Essential Fisheries Habitat	No	--	NA

3.0 REFERENCES

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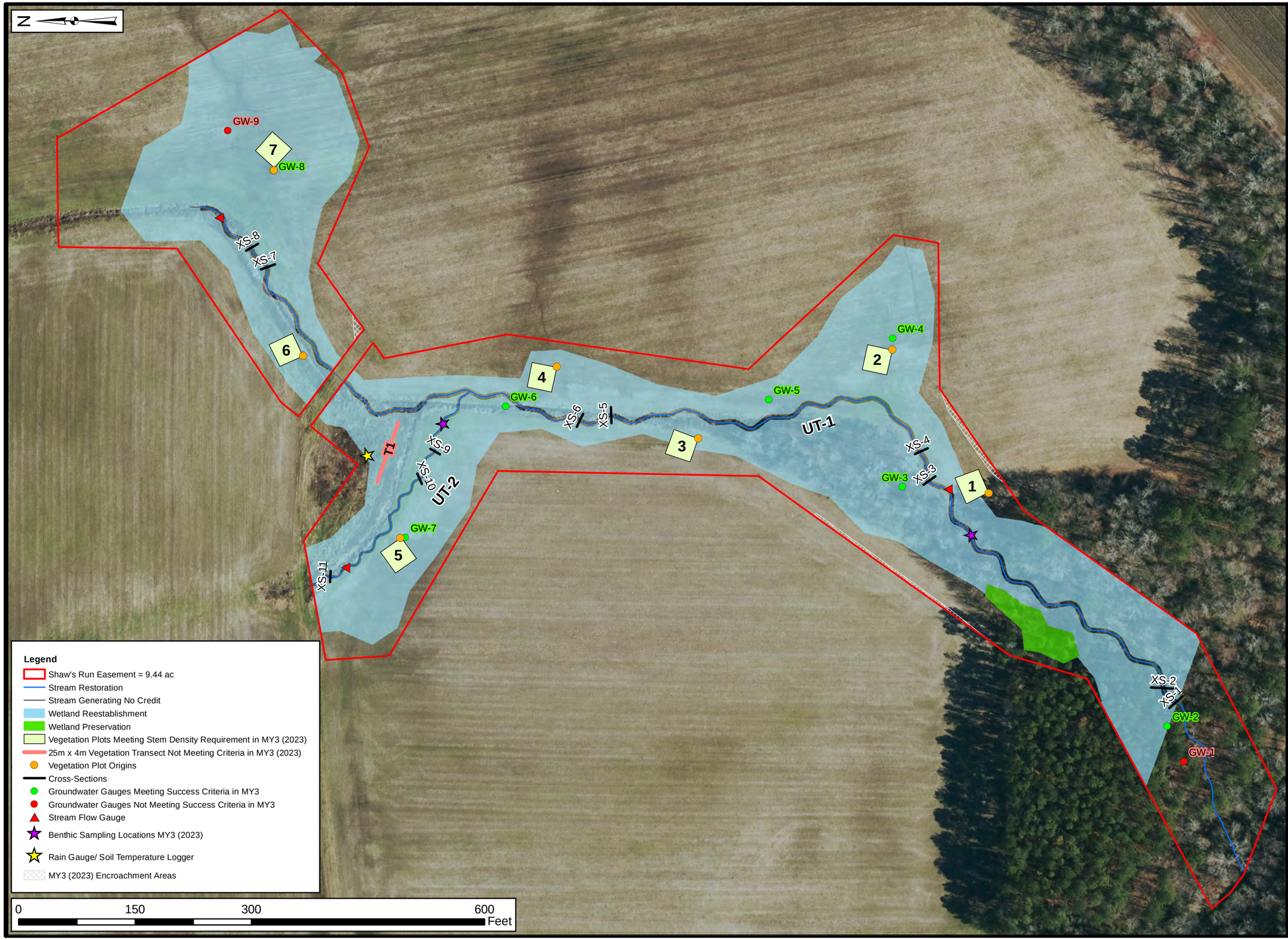
Appendix A
Visual Assessment Data

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



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SHAW'S RUN STREAM AND WETLAND MITIGATION SITE

Columbus County, NC

Title:

Current Conditions Plan View

Drawn by: MLA

Date: Dec 2023

Scale: 1:1400

Project No.: 18-014

FIGURE

1

Table 4A. Visual Stream Stability Assessment

Reach UT 1
Assessed Stream Length 1912
Assessed Bank Length 3824

Survey Date: August 23, 2023

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.	36	36		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)	36	36		100%

Table 4B. Visual Stream Stability Assessment

Reach UT 2
Assessed Stream Length 366
Assessed Bank Length 732

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.	9	9		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)	9	9		100%

Table 5. Visual Vegetation Assessment

Planted acreage **7.7** **Survey Date:August 23, 2023**

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	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
		Cumulative Total	0.00	0.0%

Easement Acreage **9.44**

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	

Shaw's Run Mitigation Site
MY-03 (2023) Vegetation Monitoring Photographs

Plot 1

Plot 2

Plot 3

Plot 4

Plot 5

Plot 6

Plot 7

Appendix B
Vegetation Data

Table 6A. Planted Bare-Root Woody Vegetation
Table 6B. Planted Bare Root Woody Vegetation – December 2023 Supplemental Planting
Table 7A. Vegetation Plot Counts and Densities
Table 7B. Temporary Vegetation Plot
Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool
Table 9. Vegetation Performance Standards Summary Table

Table 6A. Planted Bare Root Woody Vegetation
Shaw's Run Mitigation Site

Species	Total*
Acres	**7.7**
Betula nigra	800
Celtis laevigata	100
Cephalanthus occidentalis	800
Cornus amomum	700
Diospyros virginiana	300
Fraxinus pennsylvanica	300
Liriodendron tulipifera	500
Nyssa sylvatica	1000
Platanus occidentalis	1000
Quercus laurifolia	400
Quercus lyrata	400
Quercus nigra	300
Quercus pagoda	400
Quercus phellos	300
Taxodium distichum	1000
TOTALS	8300
Average Stems/Acre	**1078**

Table 6B. Planted Woody Vegetation – December 2023 Supplemental Planting
Shaw's Run Mitigation Site

Species	Total (Count/%)	
Acres	**0.06**	**Size**
Liriodendron tulipifera	5 (20%)	1 gallon
	1 (4%)	3 gallon
Platanus occidentalis	7 (28%)	3 gallon
Quercus nigra	6 (24%)	3 gallon
Quercus phellos	6 (24%)	3 gallon
TOTALS	**25 (100%)**	
Average Stems/Acre	**417**	

Table 7A. Planted Vegetation Totals
Shaw's Run Mitigation Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	486	Yes
2	445	Yes
3	607	Yes
4	405	Yes
5	445	Yes
6	607	Yes
7	486	Yes
Average Planted Stems/Acre	497	**Yes**

Table 7B. Temporary Vegetation Plots
Shaw's Run Mitigation Site

Species	25m x 4m Temporary Plots
	T-1
Fraxinus pennsylvanica	1
Quercus phellos	2
Quercus sp.	1
Total Stems	**4**
Total Stems/Acre	**162**

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

Planted Acreage	7.7
Date of Initial Plant	2020-12-21
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2023-08-23
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													4	4
	Celtis laevigata	sugarberry	Tree	FACW							2	2	1	1	1	1		
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL											1	1		
	Cornus amomum	silky dogwood	Shrub	FACW											2	2		
	Diospyros virginiana	common persimmon	Tree	FAC							1	1	1	1				
	Fraxinus pennsylvanica	green ash	Tree	FACW			3	3										
	Liriodendron tulipifera	tuliptree	Tree	FACU	3	3												
	Nyssa sylvatica	blackgum	Tree	FAC	2	2							2	2			4	4
	Platanus occidentalis	American sycamore	Tree	FACW	2	2					1	1	1	1	7	7		
	Quercus lyrata	overcup oak	Tree	OBL			1	1					1	1				
	Quercus nigra	water oak	Tree	FAC					5	5			2	2			1	1
	Quercus pagoda	cherrybark oak	Tree	FACW							1	1						
	Quercus phellos	willow oak	Tree	FACW	4	4			2	2	1	1						
	Quercus sp.				1	1	2	2			4	4	1	1	1	1	3	3
	Taxodium distichum	bald cypress	Tree	OBL			5	5	10	10			2	2	3	3		
Sum	Performance Standard				12	12	11	11	17	17	10	10	11	11	15	15	12	12
Mitigation Plan Performance Standard	Current Year Stem Count					12		11		17		10		11		15		12
	Stems/Acre					486		445		607		405		445		607		486
	Species Count					5		4		3		6		8		6		4
	Dominant Species Composition (%)					33		45		59		40		18		47		33
	Average Plot Height (ft.)					4		5		3		5		5		6		5
	% Invasives					0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					12		11		17		10		11		15		12
	Stems/Acre					486		445		607		405		445		607		486
	Species Count					5		4		3		6		8		6		4
	Dominant Species Composition (%)					33		45		59		40		18		47		33
	Average Plot Height (ft.)					4		5		3		5		5		6		5
	% 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 9. Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	486	4	5	0	445	5	4	0	607	3	3	0
Monitoring Year 2	567	2	6	0	607	3	5	0	607	3	3	0
Monitoring Year 1	648	2	6	0	607	2	5	0	607	2	3	0
Monitoring Year 0	729	1	6	0	810	1	6	0	607	1	3	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	405	5	6	0	445	5	8	0	607	6	6	0
Monitoring Year 2	486	3	7	0	526	4	9	0	567	4	5	0
Monitoring Year 1	486	2	7	0	567	2	9	0	648	2	6	0
Monitoring Year 0	567	2	8	0	648	2	9	0	810	1	7	0
	Veg Plot 7 F											
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives								
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3	486	5	4	0								
Monitoring Year 2	445	4	4	0								
Monitoring Year 1	445	2	4	0								
Monitoring Year 0	526	1	5	0								

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

Appendix C
Stream Geomorphology Data

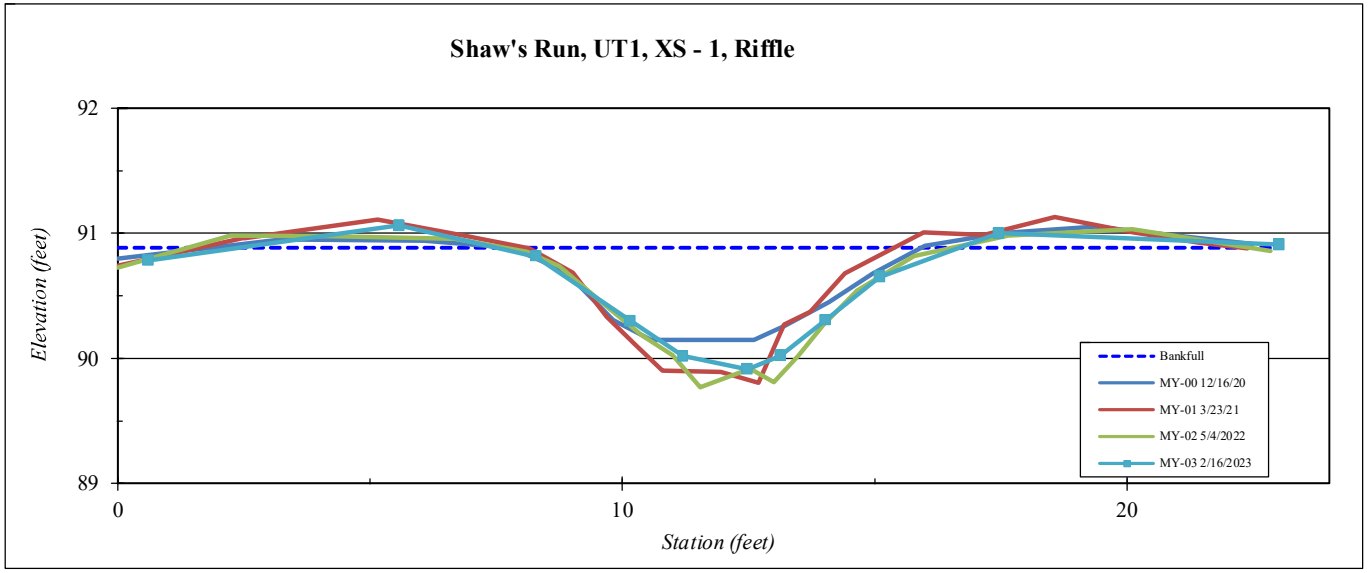
Cross-Sections with Annual Overlays
Table 10A-B. Baseline Stream Data Summary Tables
Table 11. Cross-Section Morphology Monitoring Summary

Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 1, Riffle
Feature	Riffle
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.6	90.8
5.6	91.1
8.3	90.8
10.2	90.3
11.2	90.0
12.5	89.9
13.1	90.0
14.0	90.3
15.1	90.6
17.5	91.0
23.0	90.9

SUMMARY DATA	
Bankfull Elevation:	90.8
Bank Height Ratio:	1.01
Thalweg Elevation:	89.9
LTOB Elevation:	90.8
LTOB Max Depth:	0.9
LTOB Cross Sectional Area:	3.8

Stream Type	E/C 5

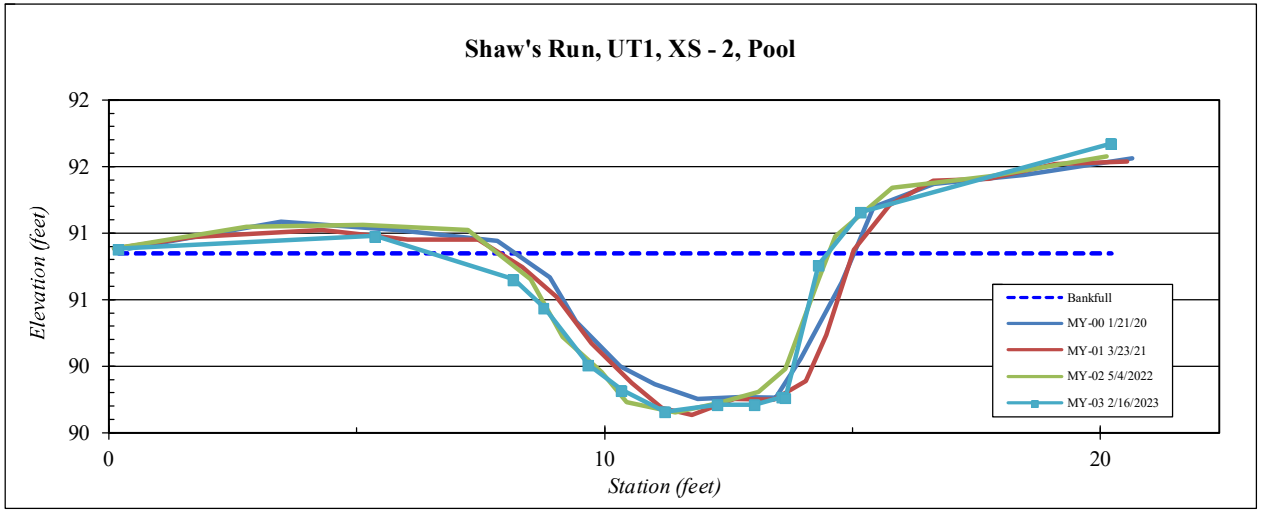


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 2, Pool
Feature	Pool
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
-0.2	90.9
5.0	91.0
7.8	90.6
8.4	90.4
9.3	90.0
10.0	89.8
10.8	89.7
11.9	89.7
12.6	89.7
13.2	89.8
13.2	89.8
13.9	90.8
14.8	91.2
19.8	91.7

SUMMARY DATA	
Bankfull Elevation:	90.8
Bank Height Ratio:	1.11
Thalweg Elevation:	89.7
LTOB Elevation:	91.0
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	6.8

Stream Type	E/C 5

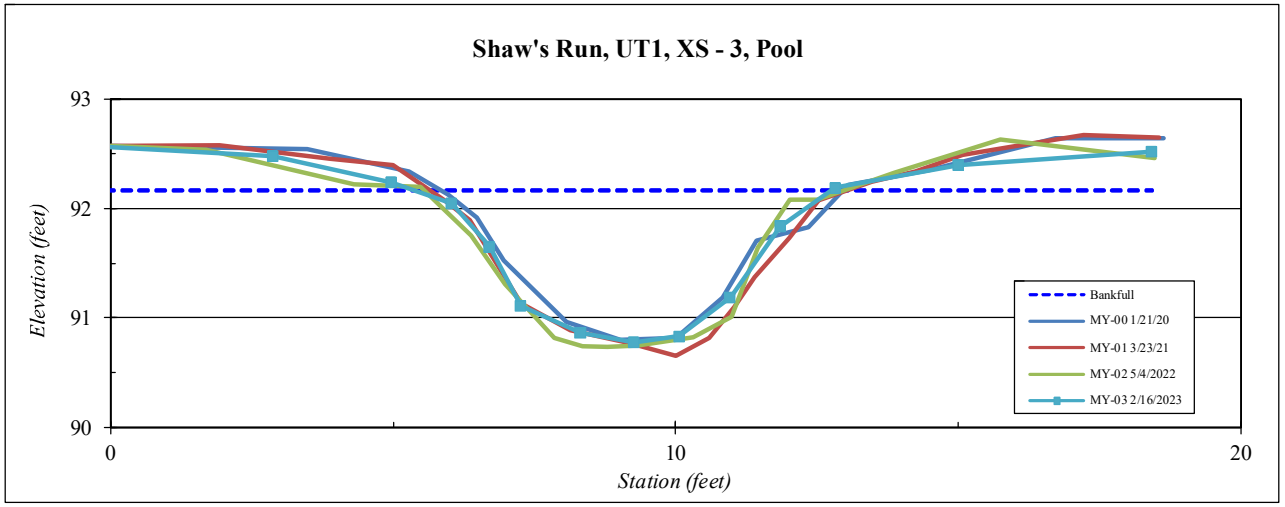


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 3, Pool
Feature	Pool
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
-0.4	92.6
2.9	92.5
5.0	92.2
6.0	92.0
6.7	91.7
7.3	91.1
8.3	90.9
9.3	90.8
10.1	90.8
11.0	91.2
11.8	91.8
12.8	92.2
15.0	92.4
18.4	92.5

SUMMARY DATA	
Bankfull Elevation:	92.2
Bank Height Ratio:	1.02
Thalweg Elevation:	90.8
LTOB Elevation:	92.2
LTOB Max Depth:	1.4
LTOB Cross Sectional Area:	6.2

Stream Type	E/C 5

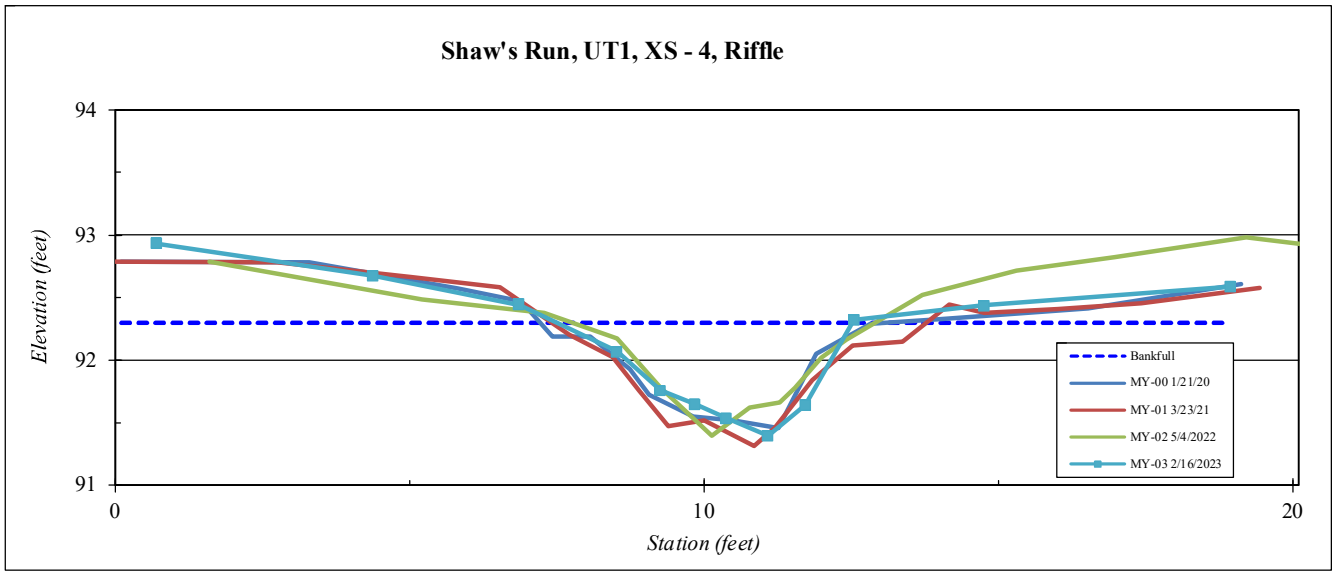


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 4, Riffle
Feature	Riffle
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.6	92.9
4.3	92.7
6.8	92.4
8.4	92.1
9.2	91.8
9.8	91.6
10.3	91.5
11.0	91.4
11.6	91.6
12.5	92.3
14.7	92.4
18.8	92.6

SUMMARY DATA	
Bankfull Elevation:	92.3
Bank Height Ratio:	1.03
Thalweg Elevation:	91.4
LTOB Elevation:	92.3
LTOB Max Depth:	0.9
LTOB Cross Sectional Area:	2.6

Stream Type	E/C 5

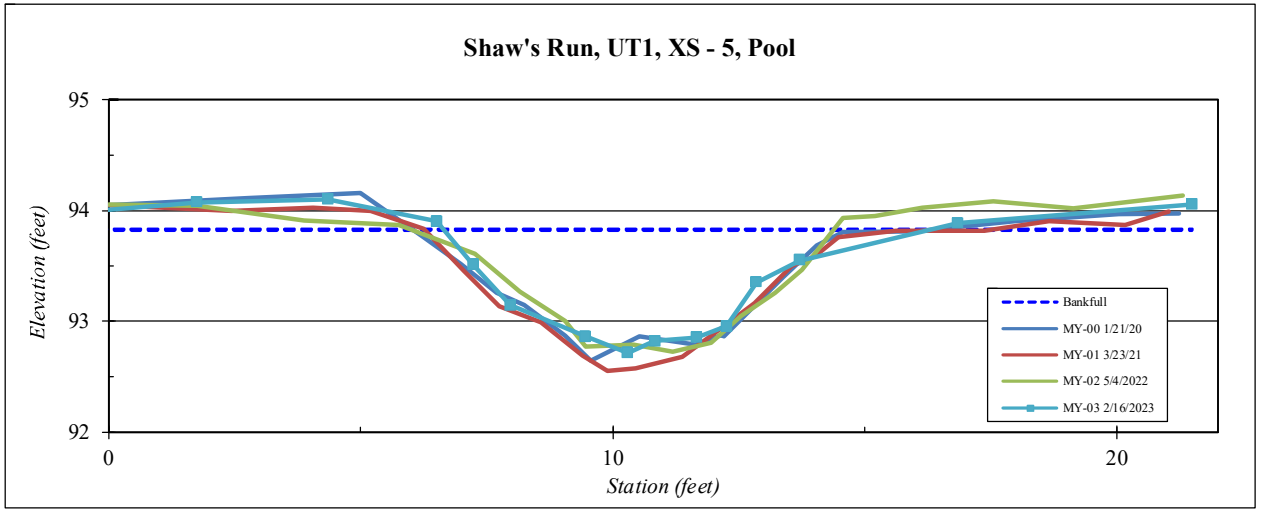


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 5, Pool
Feature	Pool
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
-0.9	94.0
1.7	94.1
4.4	94.1
6.5	93.9
7.2	93.5
8.0	93.1
9.5	92.9
10.3	92.7
10.8	92.8
11.7	92.9
12.3	93.0
12.8	93.4
13.7	93.5
16.8	93.9
21.5	94.1

SUMMARY DATA	
Bankfull Elevation:	93.8
Bank Height Ratio:	1.05
Thalweg Elevation:	92.7
LTOB Elevation:	93.9
LTOB Max Depth:	1.2
LTOB Cross Sectional Area:	6.2

Stream Type	E/C 5

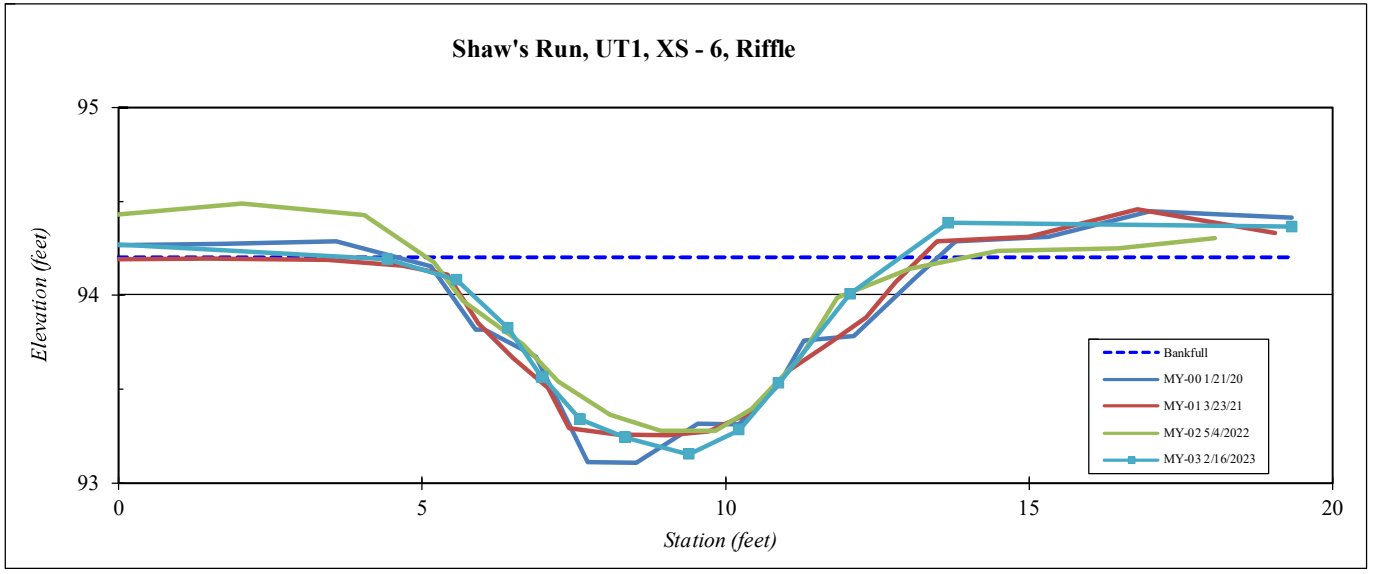


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 6, Riffle
Feature	Riffle
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
-0.2	94.3
4.4	94.2
5.6	94.1
6.4	93.8
7.0	93.6
7.0	93.6
7.6	93.3
8.4	93.2
9.4	93.2
10.2	93.3
10.9	93.5
12.1	94.0
13.7	94.4
19.3	94.4

SUMMARY DATA	
Bankfull Elevation:	94.2
Bank Height Ratio:	0.99
Thalweg Elevation:	93.2
LTOB Elevation:	94.2
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	4.6

Stream Type	E/C 5

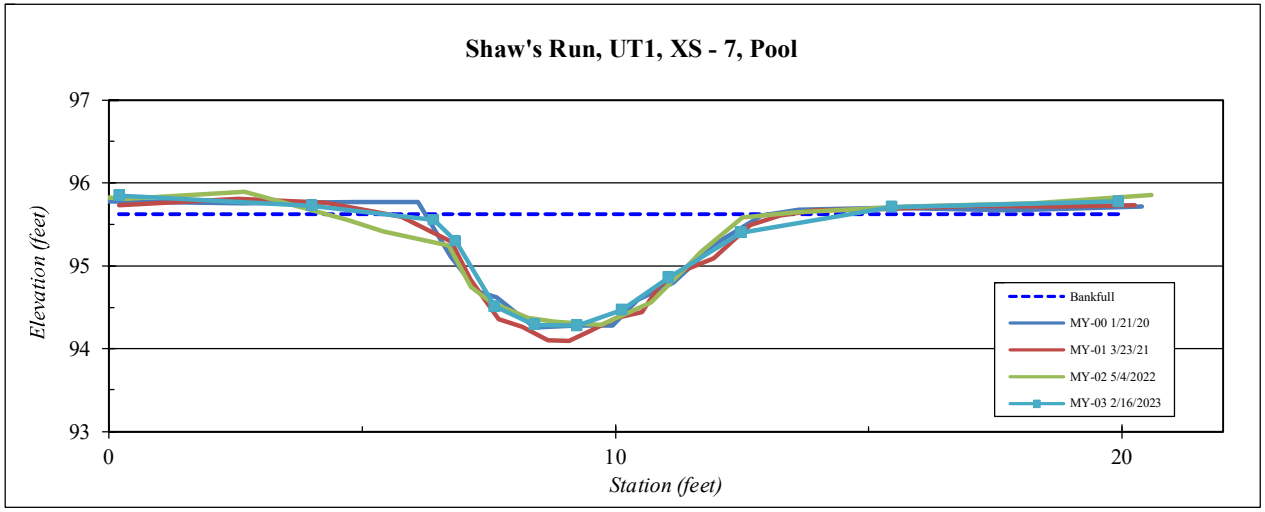


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 7, Pool
Feature	Pool
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.2	95.8
4.0	95.7
6.4	95.6
6.8	95.3
7.6	94.5
8.4	94.3
9.2	94.3
10.1	94.5
11.1	94.9
12.5	95.4
15.5	95.7
19.9	95.8

SUMMARY DATA	
Bankfull Elevation:	95.6
Bank Height Ratio:	0.95
Thalweg Elevation:	94.3
LTOB Elevation:	95.6
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	5.1

Stream Type	E/C 5

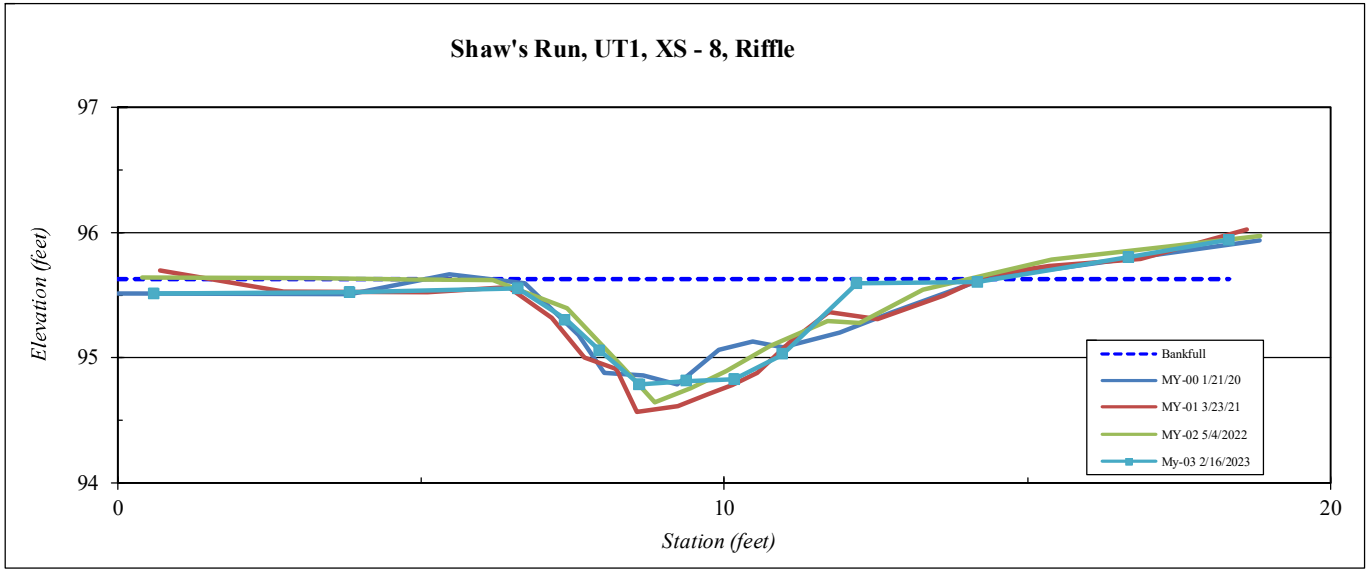


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 8, Riffle
Feature	Riffle
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.6	95.5
3.8	95.5
6.6	95.6
7.4	95.3
7.9	95.1
8.6	94.8
9.4	94.8
10.2	94.8
11.0	95.0
12.2	95.6
14.2	95.6
16.7	95.8
18.3	95.9

SUMMARY DATA	
Bankfull Elevation:	95.6
Bank Height Ratio:	0.97
Thalweg Elevation:	94.8
LTOB Elevation:	95.6
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	3.0

Stream Type	E/C 5

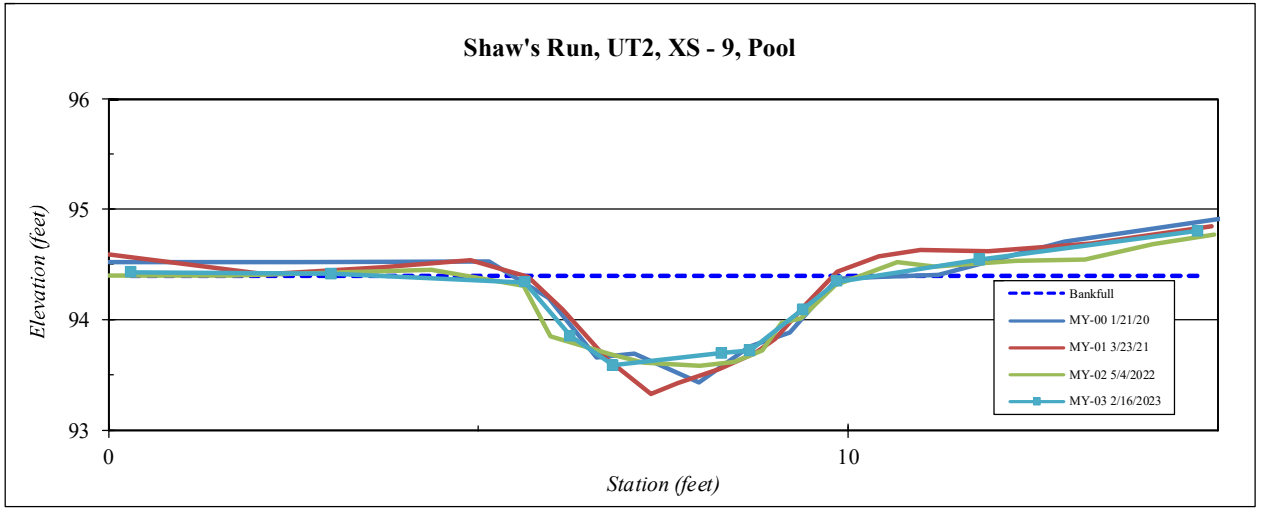


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT2, XS - 9, Pool
Feature	Pool
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.3	94.4
3.0	94.4
5.6	94.3
6.3	93.9
6.8	93.6
8.3	93.7
8.7	93.7
9.4	94.1
9.9	94.4
11.8	94.6
14.7	94.8

SUMMARY DATA	
Bankfull Elevation:	94.4
Bank Height Ratio:	0.93
Thalweg Elevation:	93.6
LTOB Elevation:	94.3
LTOB Max Depth:	0.8
LTOB Cross Sectional Area:	2.1

Stream Type	E/C 5

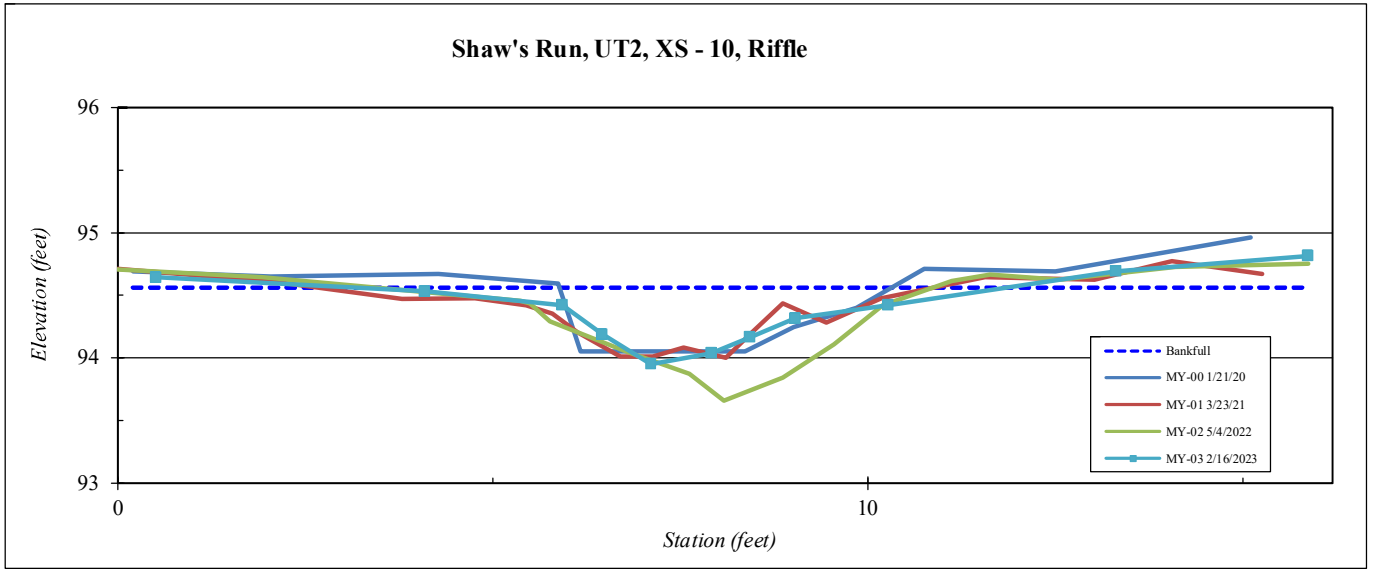


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT2, XS - 10, Riffle
Feature	Riffle
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.3	94.6
3.9	94.5
5.7	94.4
6.3	94.2
6.9	94.0
7.7	94.0
8.2	94.2
8.8	94.3
10.1	94.4
13.1	94.7
15.7	94.8

SUMMARY DATA	
Bankfull Elevation:	94.6
Bank Height Ratio:	0.95
Thalweg Elevation:	94.0
LTOB Elevation:	94.5
LTOB Max Depth:	0.6
LTOB Cross Sectional Area:	1.6

Stream Type	E/C 5

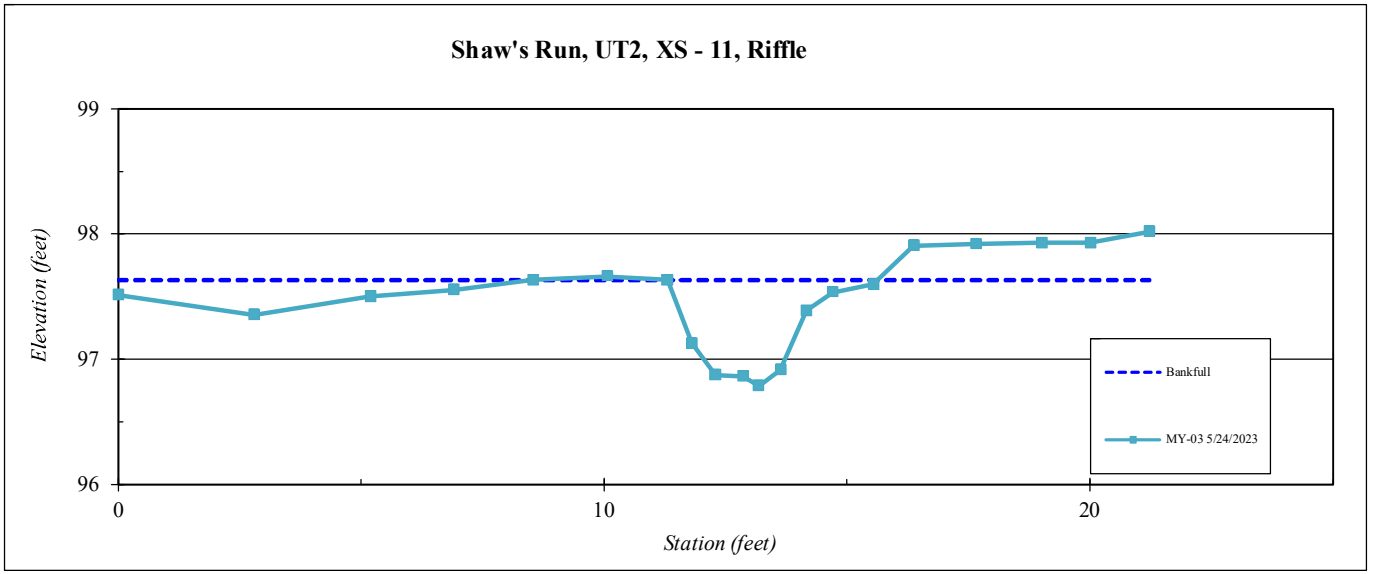


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT2, XS - 11, Riffle
Feature	Riffle
Date:	5/24/2023
Field Crew:	Smith

Station	Elevation
0.0	97.5
2.8	97.4
5.2	97.5
6.9	97.6
8.5	97.6
10.1	97.7
11.3	97.6
11.8	97.1
12.3	96.9
12.9	96.9
13.2	96.8
13.6	96.9
14.2	97.4
14.7	97.5
15.5	97.6
16.4	97.9
17.7	97.9
19.0	97.9
20.0	97.9
21.2	98.0

SUMMARY DATA	
Bankfull Elevation:	97.6
Bank Height Ratio:	1.00
Thalweg Elevation:	96.8
LTOB Elevation:	97.6
LTOB Max Depth:	0.8
LTOB Cross Sectional Area:	1.9

Stream Type	E/C 5



***Note: UT-2 XS-11 was added for the first time in MY-03 (2023) at the request of the IRT.

Table 10A. Baseline Stream Data Summary Shaw's Run - UT 1										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	4.1	5.9		6.9		6.1	7	5.6	8.2	4
Floodprone Width (ft)	5.4	7		9.4		30	70	100	100	4
Bankfull Mean Depth (ft)	0.5	0.5		0.8		0.4	0.5	0.4	0.6	4
Bankfull Max Depth (ft)	0.6	0.8		1.2		0.6	0.8	0.7	1.0	4
Bankfull Cross Sectional Area (ft^2)	3.1	3.1		3.1		3.1	3.1	2.5	4.8	4
Width/Depth Ratio	5.3	10.9		14.9		12	16	12.7	17.7	4
Entrenchment Ratio	4.6	7.6		10.6		4.6	10.6	12.2	17.9	4
Bank Height Ratio	**2.8**	**3.4**		**4.7**		**1**	**1.2**	**1.0**	**1.0**	4
Max part size (mm) mobilized at bankfull										
Rosgen Classification	G 5/6					E/C 5		C 5		
Bankfull Discharge (cfs)	2.8					2.8		2.8		
Sinuosity (ft)	1					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.0033					0.0029		0.004		
Other										

Table 10B. Baseline Stream Data Summary Shaw's Run - UT 2										
Parameter	**Pre-Existing Condition (applicaple)**					**Design**		**Monitoring Baseline**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	5.2	7.9		8.3		3.6	4.2	4.5	4.5	1
Floodprone Width (ft)	7	9		12		30	70	100	100	1
Bankfull Mean Depth (ft)	0.1	0.1		0.2		0.3	0.3	0.4	0.4	1
Bankfull Max Depth (ft)	0.2	0.3		0.3		0.3	0.5	0.5	0.5	1
Bankfull Cross Sectional Area (ft^2)	1.1	1.1		1.1		1.1	1.1	1.8	1.8	1
Width/Depth Ratio	24.6	56.9		62.6		12	16	11.2	11.2	1
Entrenchment Ratio	1	1.2		1.6		7.6	17.8	22.0	22.0	1
Bank Height Ratio	**6**	**6.8**		**9.5**		**1**	**1.2**	**1.0**	**1.0**	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	F 5/6					E/C 5		E/C 5		
Bankfull Discharge (cfs)	0.9					0.9		0.9		
Sinuosity (ft)	1					1.15		1.15		
Water Surface Slope (Channel) (ft/ft)	0.01					0.0087		0.0028		
Other										

Table 11. Monitoring Data - Cross Section Morphology Monitoring Summary

(Shaw's Run/ DMS:100055) UT 1 and UT 2

	UT 1 - Cross Section 1 (Riffle)							UT 1 - Cross Section 2 (Pool)							UT 1 - Cross Section 3 (Pool)							UT 1 - Cross Section 4 (Riffle)							UT 1 - Cross Section 5 (Pool)						
	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	90.88	90.81	90.76	90.80																		92.29	92.21	92.35	92.16										
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.99	1.06	1.01																		1.00	0.99	1.03	1.02										
Thalweg Elevation	90.15	89.80	89.77	89.92				89.75	89.63	89.65	89.65				90.80	90.66	90.74					91.46	91.31	91.40	90.78				92.65	92.56	92.73	92.72			
LTOB[2] Elevation	90.88	90.80	90.82	90.81				90.94	90.87	90.97	90.97				92.21	92.07	92.19					92.29	92.20	92.38	92.19				93.81	93.76	93.87	93.89			
LTOB[2] Max Depth (ft)	0.74	1.00	1.05	0.90				1.19	1.24	1.32	1.32				1.41	1.42	1.46					0.83	0.89	0.98	1.41				1.16	1.21	1.14	1.17			
LTOB[2] Cross Sectional Area (ft^2)	3.72	3.72	4.17	3.82				5.71	5.71	6.24	6.81				6.06	6.06	6.63					2.47	2.47	2.64	6.25				5.57	5.57	5.82	6.15			

	UT 1 - Cross Section 6 (Riffle)							UT 1 - Cross Section 7 (Pool)							UT 1 - Cross Section 8 (Riffle)							UT 2 - Cross Section 9 (Pool)							UT 2 - Cross Section 10 (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	94.16	94.18	94.24	94.20											95.60	95.52	95.60	95.63												94.60	94.55	94.41	94.56			
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.01	1.01	0.99											1.00	1.05	1.02	0.97												1.00	1.11	1.03	0.95			
Thalweg Elevation	93.11	93.25	93.28	93.15				94.26	94.09	94.28	94.28				94.79	94.57	94.64	94.79				93.44	93.33	93.59	93.59				94.05	94.00	93.66	93.95			
LTOB[2] Elevation	94.16	94.19	94.25	94.19				95.61	95.59	95.58	95.55				95.60	95.56	95.62	95.60				94.37	94.39	94.32	94.34				94.60	94.61	94.44	94.53			
LTOB[2] Max Depth (ft)	1.05	0.93	0.97	1.04				1.35	1.50	1.30	1.27				0.81	1.00	0.98	0.95				0.93	1.06	0.73	0.75				0.54	0.61	0.78	0.58			
LTOB[2] Cross Sectional Area (ft^2)	4.78	4.78	4.90	4.60				5.65	5.65	5.70	5.13				3.16	3.16	3.29	2.97				2.37	2.37	2.23	2.13				1.84	1.84	1.96	1.62			

	UT 2 - Cross Section 11 (Riffle)						
	MY0	MY1	MY2	MY3			
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	-	-	-	97.63			
Bank Height Ratio_Based on AB Bankfull[1] Area	-	-	-	1.00			
Thalweg Elevation	-	-	-	96.79			
LTOB[2] Elevation	-	-	-	97.63			
LTOB[2] Max Depth (ft)	-	-	-	0.84			
LTOB[2] Cross Sectional Area (ft^2)	-	-	-	1.87			

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.

Appendix D
Hydrologic Data

Table 12. Verification of Bankfull Events
Table 13. Groundwater Hydrology Data
Groundwater Gauge Graphs
Tables 14 A-C. Channel Evidence
Surface Water Gauge Graphs
Figure D1. 30/70 Percentile Graph for Rainfall
Soil Temperature Graph

Table 12. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
February 18, 2021 and March 1, 2021	February 18, 2021	A bankfull event was documented on UT1 by trail camera and stream gauge evidence after 3.02 inches of rain were captured at an onsite rain gauge. Additionally, wrack and laid-back vegetation were observed on the TOB of UT2 during a site visit on March 1, 2021.	1-2
March 12, 2022	March 12, 2022	A bankfull event was documented on UT1 downstream by trail camera and stream gauge evidence after 1.20 inches of rain were captured at an onsite rain gauge.	3
September 30, 2022	September 30, 2022	Stream gauge data indicate a bankfull event occurred on UT1 and UT2 after of 3.39 inches of rain was documented on September 30, 2022 at an onsite rain gauge.	--
March 26-27, 2023	March 27, 2023	A bankfull event was documented on UT1 upstream by stream gauge evidence and by trail camera on March 27, 2023 after 1.88 inches of rain fell on March 26, 2023.	4
June 18-22, 2023	June 22, 2023	A bankfull event was documented on UT1 and UT2 by stream gauge evidence after the onsite rain gauge captured 2.69 inches of rain in the 5 total prior days.	-
August 25-31, 2023	August 31, 2023	Stream gauge data shows a bankfull event occurred on August 31, 2023 after the onsite rain gauge captured 8.48 inches of rain in the 2 days prior to the event.	5

Photo 1: Bankfull event documented on UT 1 downstream after 3.02” of rain fell on February 18, 2021

Photo 2: Wrack and laid-back vegetation were observed on the TOB of UT 2 after 3.02” of rain fell on February 18, 2021.

Photo 3: UT 1 swelling to bankfull during a 1.20” rainstorm on March 12, 2022

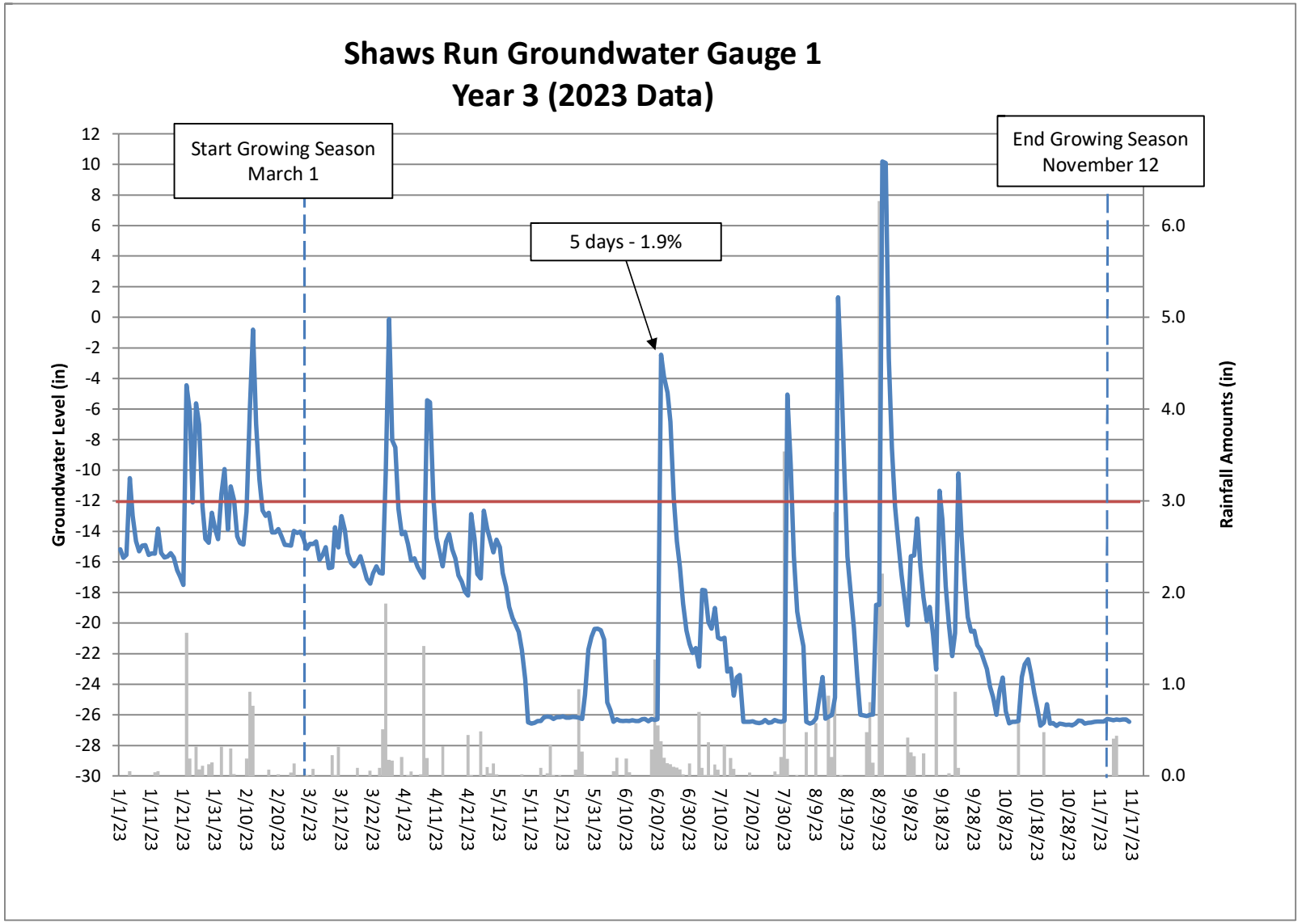
Photo 4: Bankfull event on UT-1 upstream on March 27, 2023 following a 1.88" rainstorm on March 26, 2023

Photo 5: Wrack and laid-back vegetation were observed on the TOB of UT 1 after 8.48" of rain fell between August 30-31, 2023.

Table 13. 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 (2021)	Year 2 (2022)	Year 3 (2023)	Year 4 (2024)	Year 5 (2025)	Year 6 (2026)	Year 7 (2027)
1*	No - 5 days (1.9%)	No – 4 days (1.6%)	No – 5 days (1.9%)				
2	No - 15 days (5.8%)^	Yes – 53 days (20.6%)	Yes – 63 Days (24.5%)				
3	Yes - 44 days (17.1%)	Yes – 57 days (22.2%)	Yes – 51 Days (19.8%)				
4	Yes - 38 days (14.8%)	Yes – 58 days (22.6%)	Yes – 70 Days (27.2%)				
5	Yes - 34 days (13.2%)	Yes – 58 days (22.6%)	Yes – 68 Days (26.5%				
6	Yes - 52 days (20.2%)	Yes – 59 days (23.0%)	Yes – 71 Days (27.6%)				
7	Yes - 36 days (14.0%)	No – 11 days (4.3%)	Yes – 50 Days (19.5%)				
8	Yes - 38 days (14.8%)	Yes – 45 days (17.5%)	Yes – 50 Days (19.5%)				
9	Yes - 37 days (14.4%)	Yes – 45 days (17.5%)	No – 24 Days (9.4%)				

* Gauge 1 is not located in a credit generating area.
^ Gauge 2 likely would have met success criteria, however, logger failure occurred at the start of the growing season.


Shaws Run Groundwater Gauge 1
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
5 days - 1.9%
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
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
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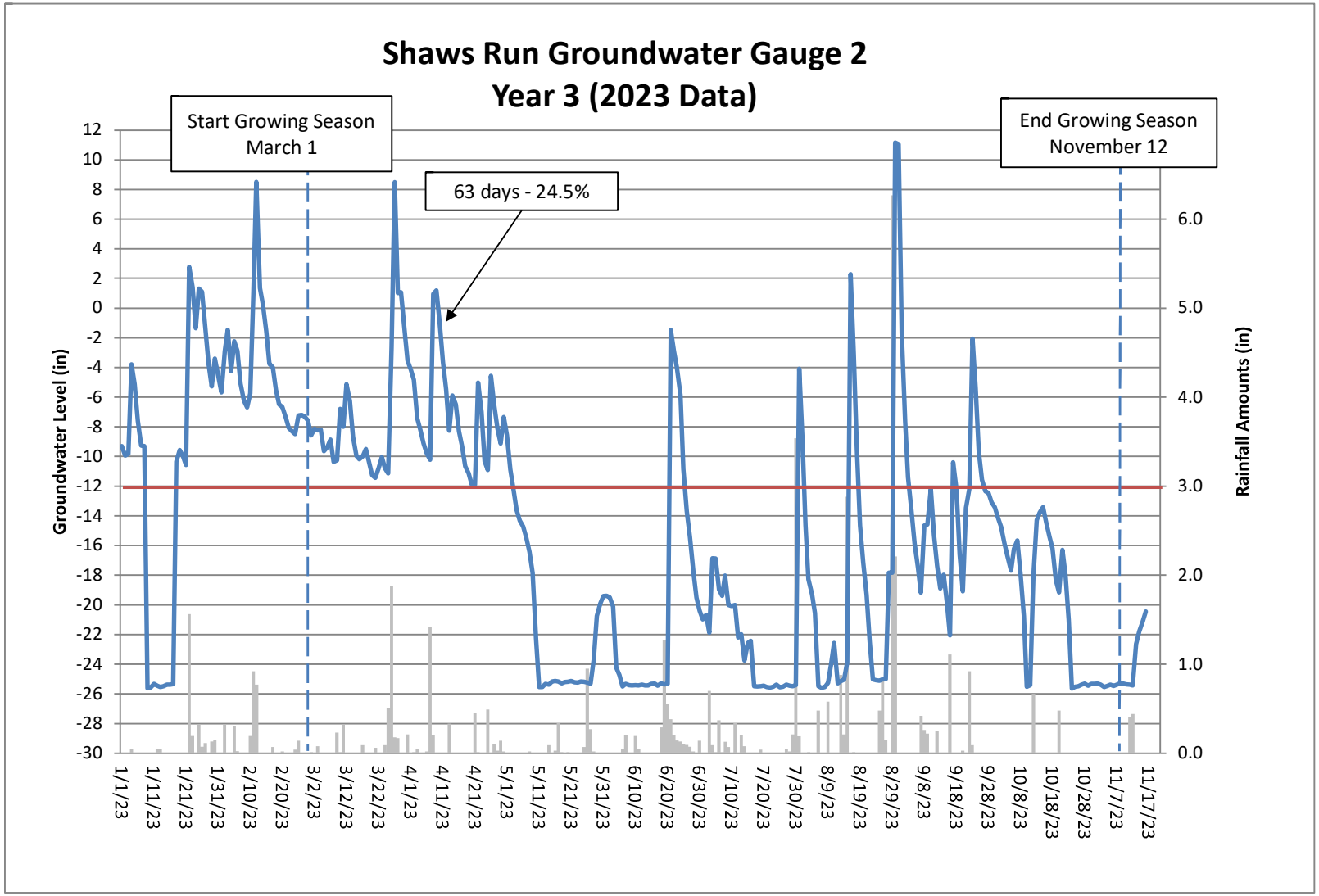
10/18/23
10/28/23
11/7/23
11/17/23


Shaws Run Groundwater Gauge 2
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
63 days - 24.5%
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
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
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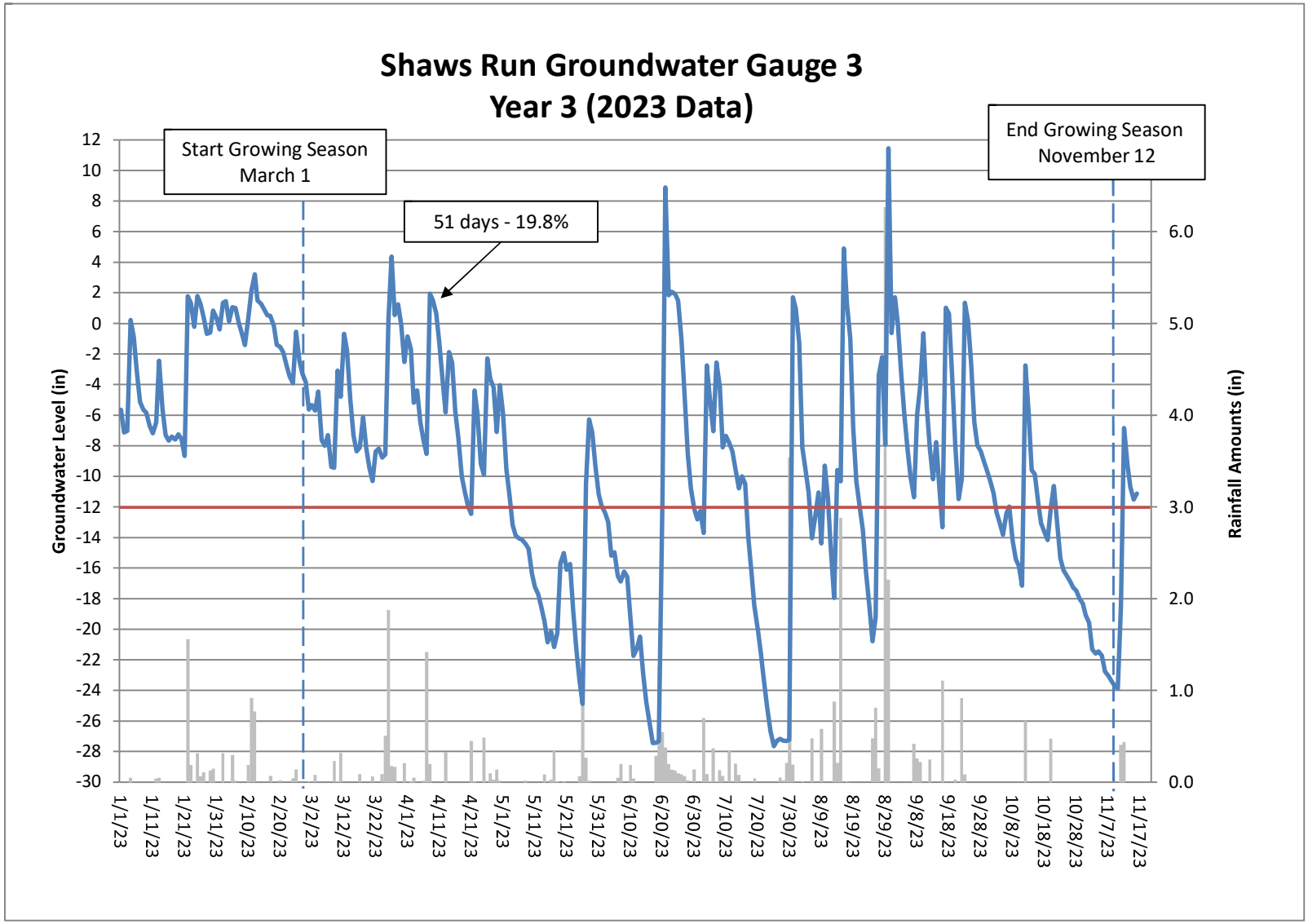
10/18/23
10/28/23
11/7/23
11/17/23


Shaws Run Groundwater Gauge 3
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
51 days - 19.8%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
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7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
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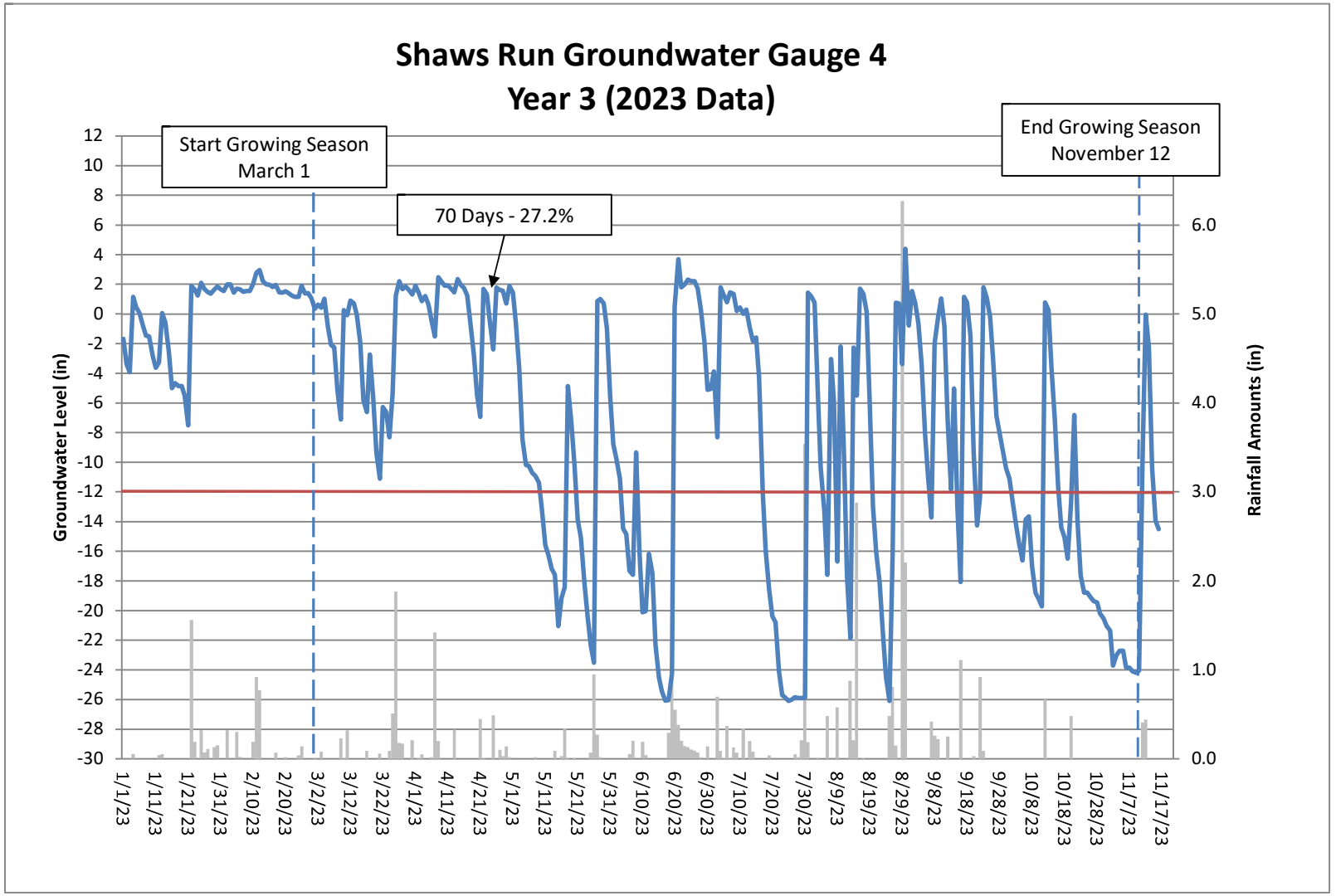
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23


Shaws Run Groundwater Gauge 4
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
70 Days - 27.2%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
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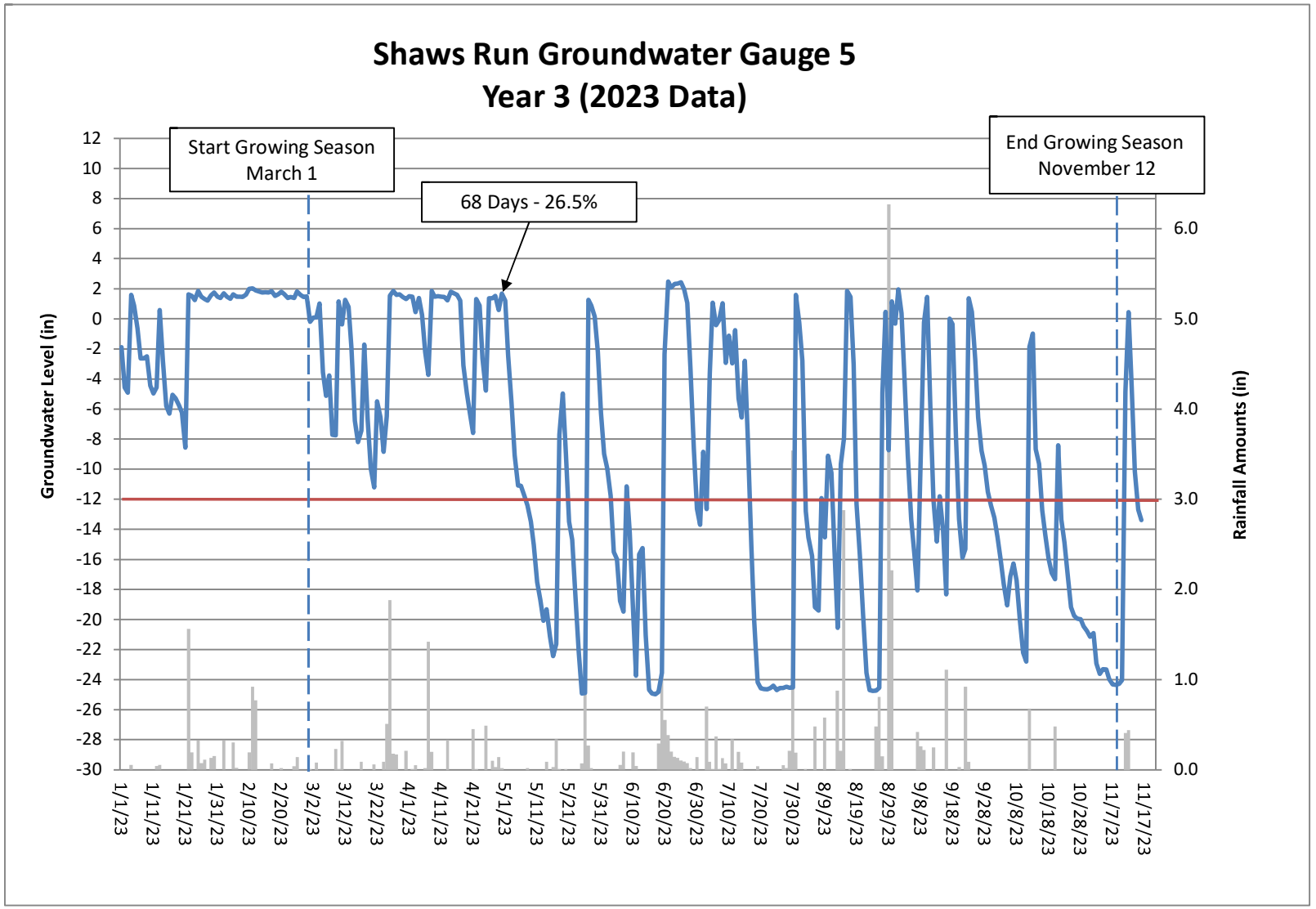
10/18/23
10/28/23
11/7/23
11/17/23


Shaws Run Groundwater Gauge 5
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
68 Days - 26.5%
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
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
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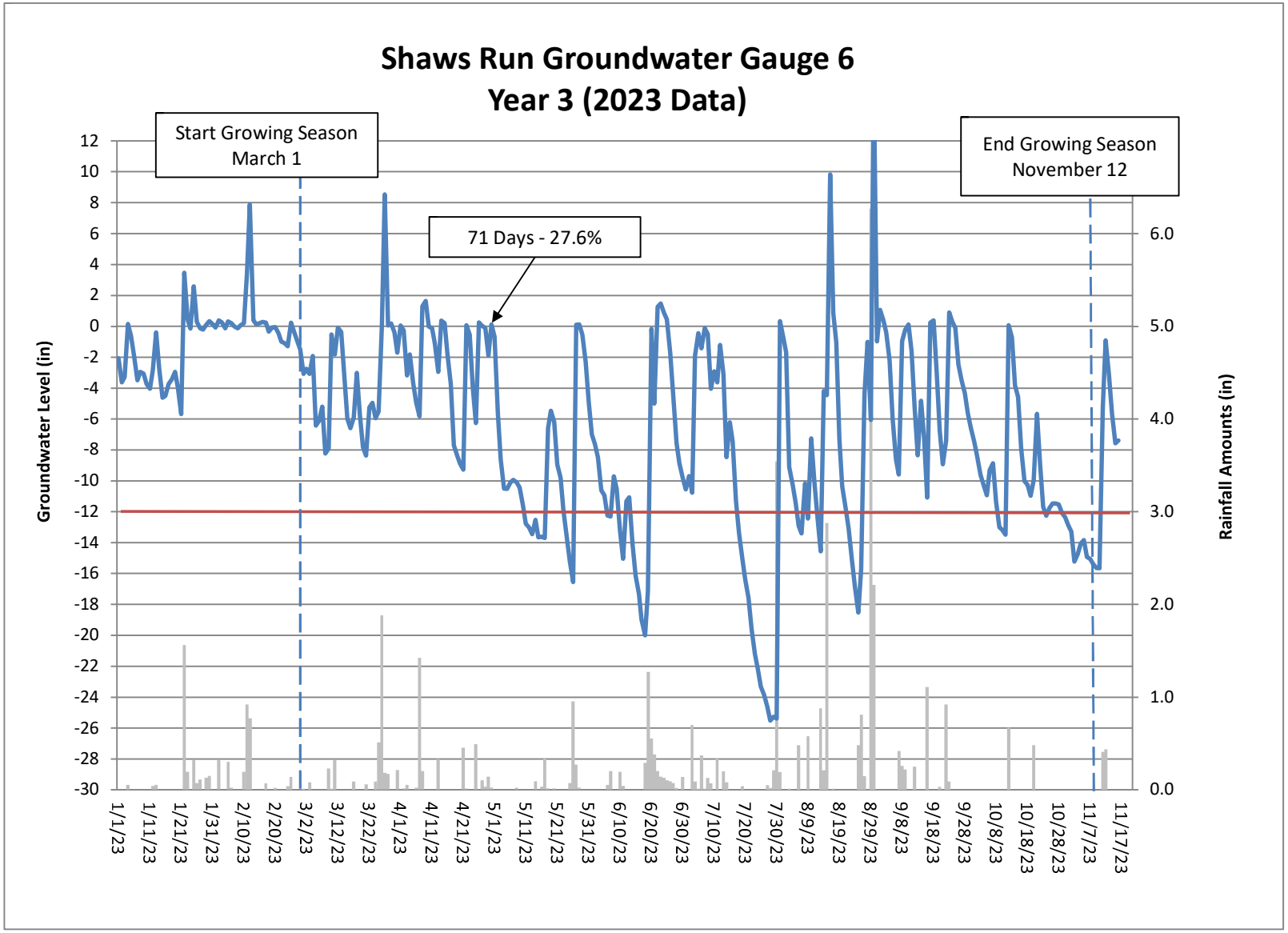
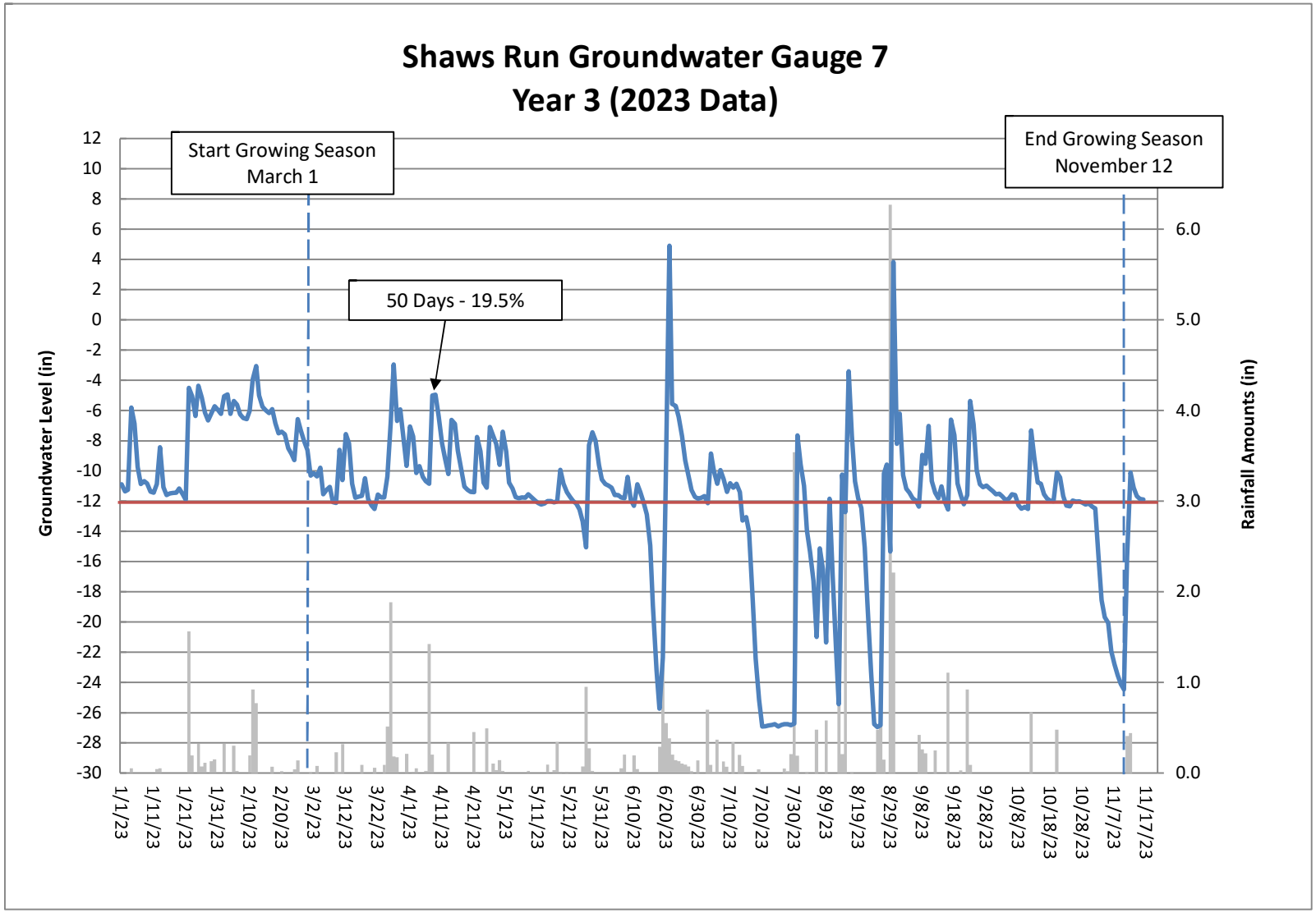
11/17/23


Shaws Run Groundwater Gauge 6
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
71 Days - 27.6%
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
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23


Shaws Run Groundwater Gauge 7
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
50 Days - 19.5%
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
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
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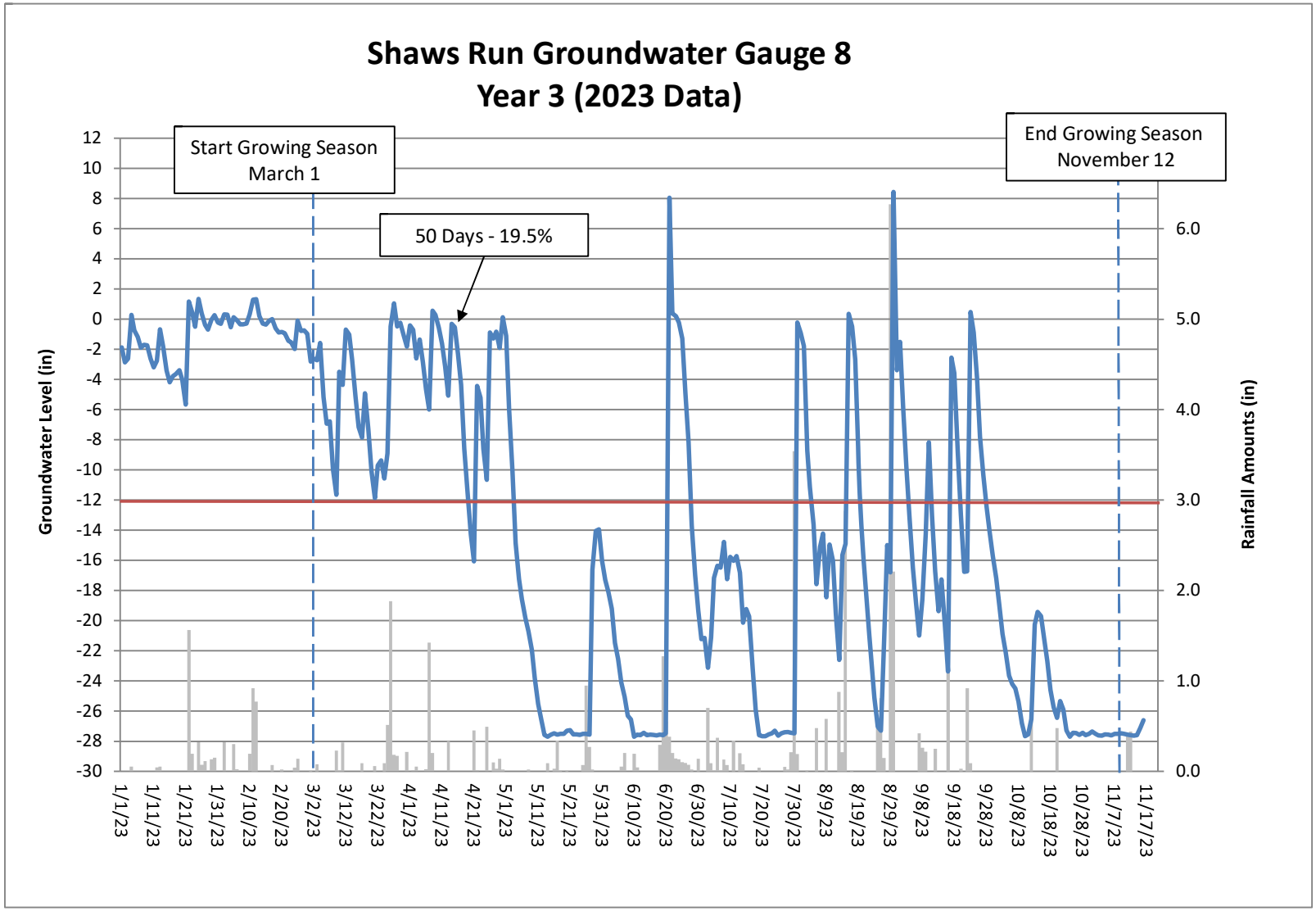
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23


Shaws Run Groundwater Gauge 8
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
50 Days - 19.5%
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
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
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10/8/23
10/18/23
10/28/23
11/7/23
11/17/23

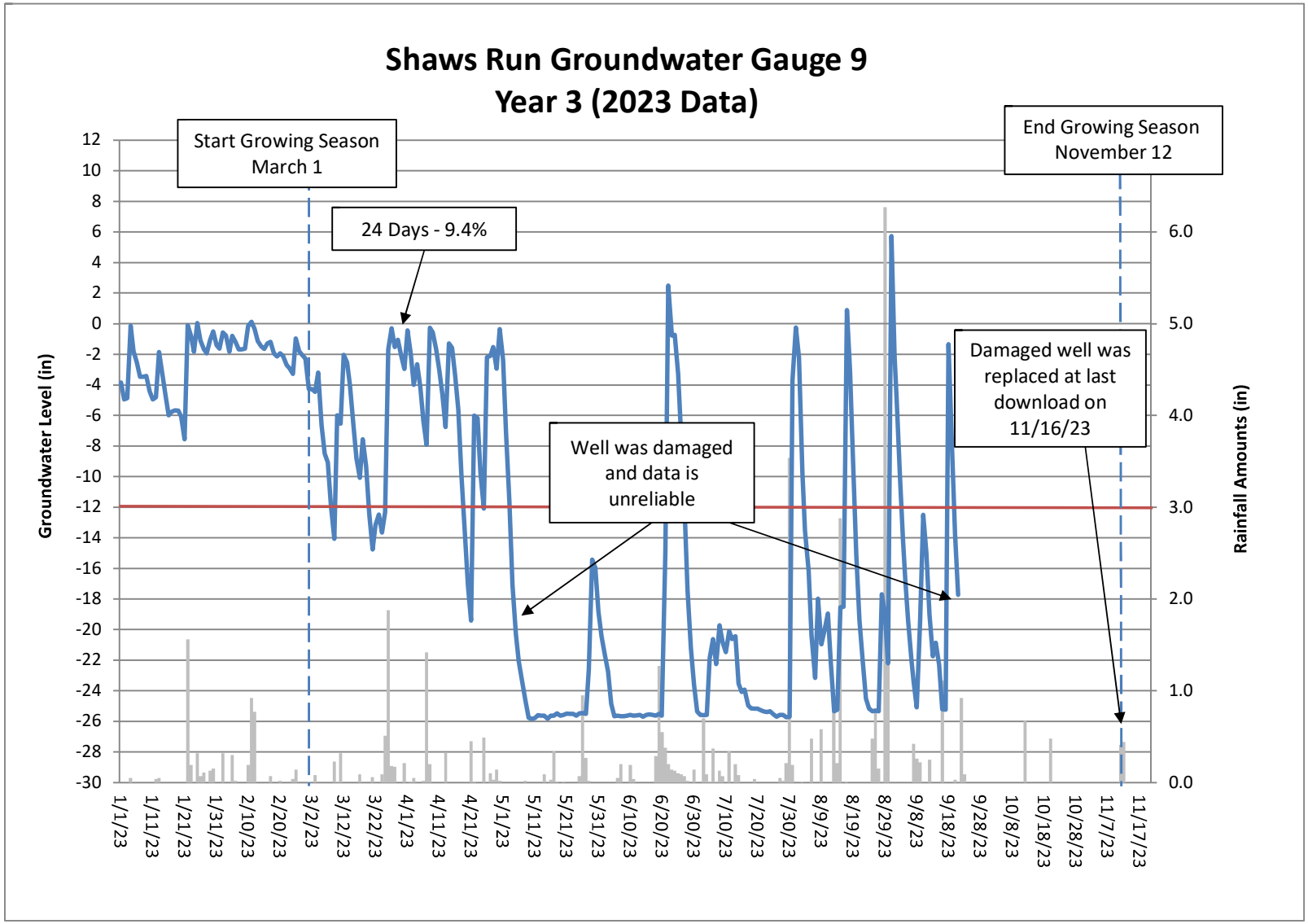

Shaws Run Groundwater Gauge 9
Year 3 (2023 Data)
Start Growing Season
March 1
End Growing Season
November 12
24 Days - 9.4%
Well was damaged
and data is
unreliable
Damaged well was
replaced at last
download on
11/16/23
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23

Table 14A. UT-1 Upstream Channel Evidence

UT-1 Upstream Channel Evidence	Year 1 (2021)	Year 2 (2022)	Year 3 (2023)
Max consecutive days channel flow	107	107	67
Total cumulative days channel flow*	-	-	186
Presence of litter and debris (wracking)	Yes	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes	Yes
Water staining due to continual presence of water	Yes	Yes	Yes
Formation of channel bed and banks	Yes	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No	No
Other:			

*New parameter as of MY-3 (2023), at the request of the IRT

Table 14B. UT-1 Downstream Channel Evidence

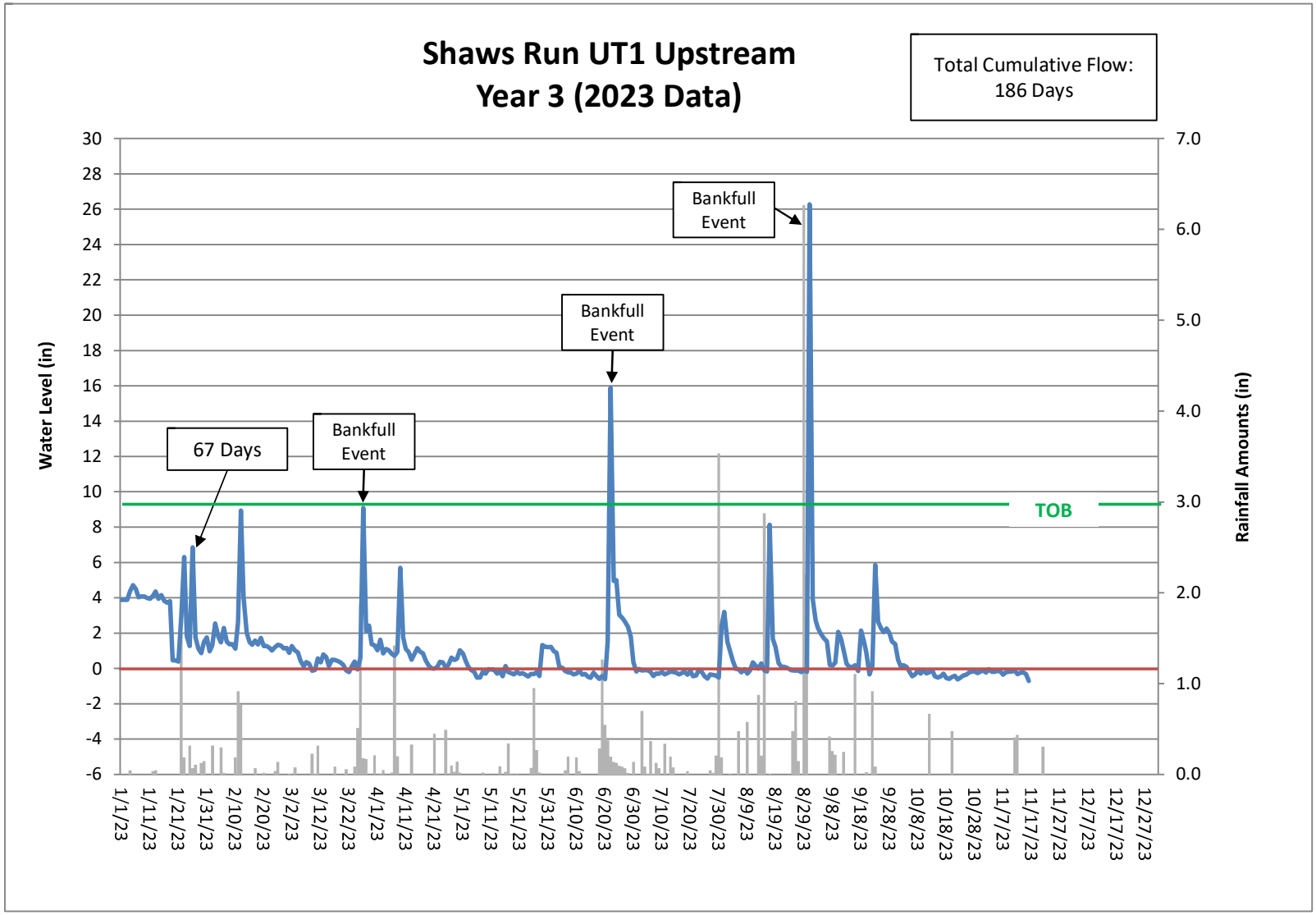
UT-1 Downstream Channel Evidence	Year 1 (2021)	Year 2 (2022)	Year 3 (2023)
Max consecutive days channel flow	109	113	133
Total cumulative days channel flow*	-	-	271
Presence of litter and debris (wracking)	Yes	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes	Yes
Water staining due to continual presence of water	Yes	Yes	Yes
Formation of channel bed and banks	Yes	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No	No
Other:			

*New parameter as of MY-3 (2023), at the request of the IRT

Table 14C. UT-2 Channel Evidence

UT-2 Channel Evidence	Year 1 (2021)	Year 2 (2022)	Year 3 (2023)
Max consecutive days channel flow	70	124	167
Total cumulative days channel flow*	-	-	290
Presence of litter and debris (wracking)	Yes	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes	Yes
Sediment deposition and/or scour indicating sediment transport	Yes	Yes	Yes
Water staining due to continual presence of water	Yes	Yes	Yes
Formation of channel bed and banks	Yes	Yes	Yes
Sediment sorting within the primary path of flow	Yes	Yes	Yes
Sediment shelving or a natural line impressed on the banks	Yes	Yes	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes	Yes	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes	Yes	Yes
Exposure of woody plant roots within the primary path of flow	No	No	No
Other:			

*New parameter as of MY-3 (2023), at the request of the IRT


Shaws Run UT1 Upstream
Year 3 (2023 Data)
Total Cumulative Flow:
186 Days
Water Level (in)
Rainfall Amounts (in)
67 Days
Bankfull Event
Bankfull Event
Bankfull Event
TOB
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
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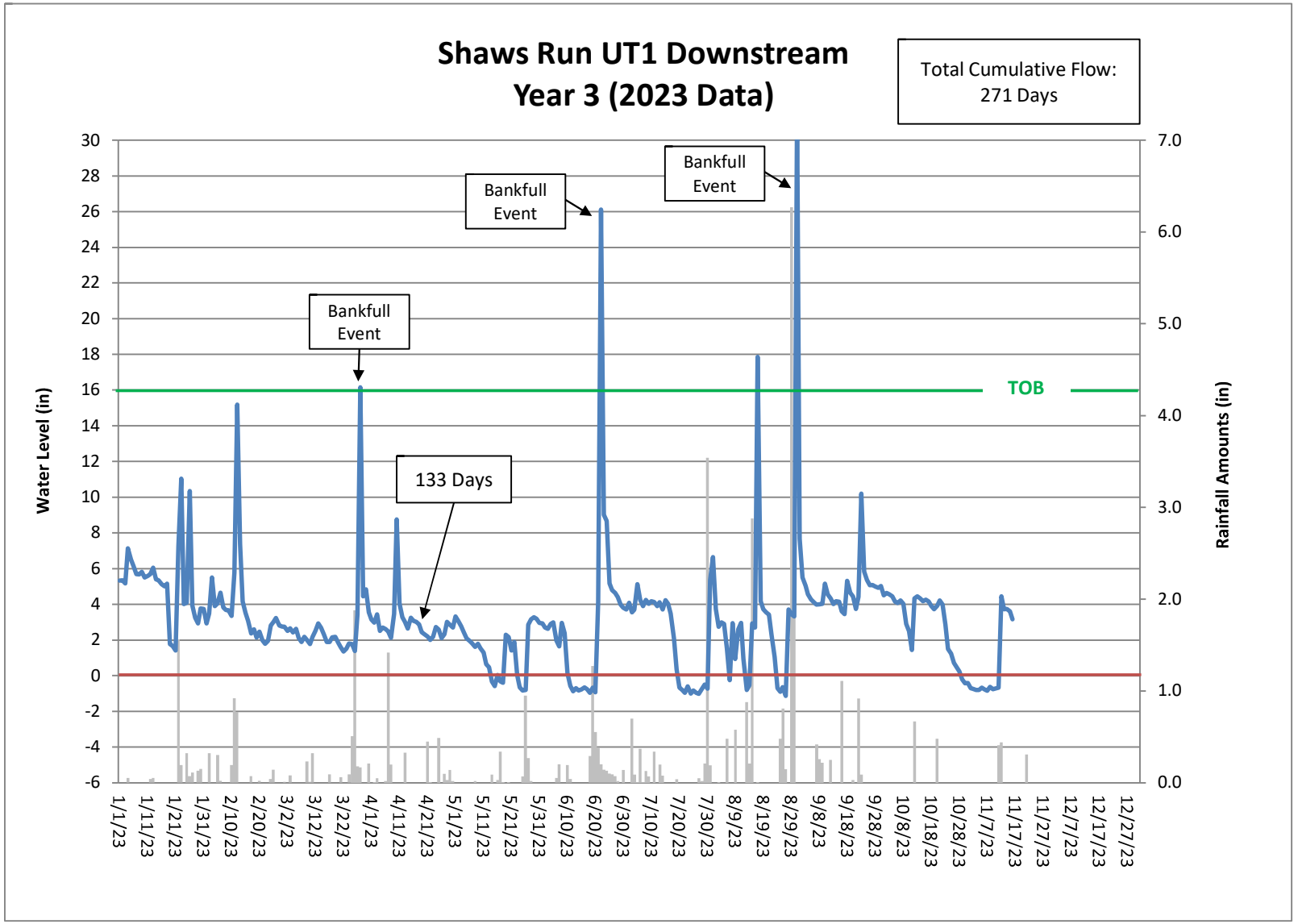
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23


Shaws Run UT1 Downstream
Year 3 (2023 Data)
Total Cumulative Flow:
271 Days
Bankfull Event
Bankfull Event
Bankfull Event
TOB
133 Days
Water Level (in)
Rainfall Amounts (in)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
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10/28/23
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23

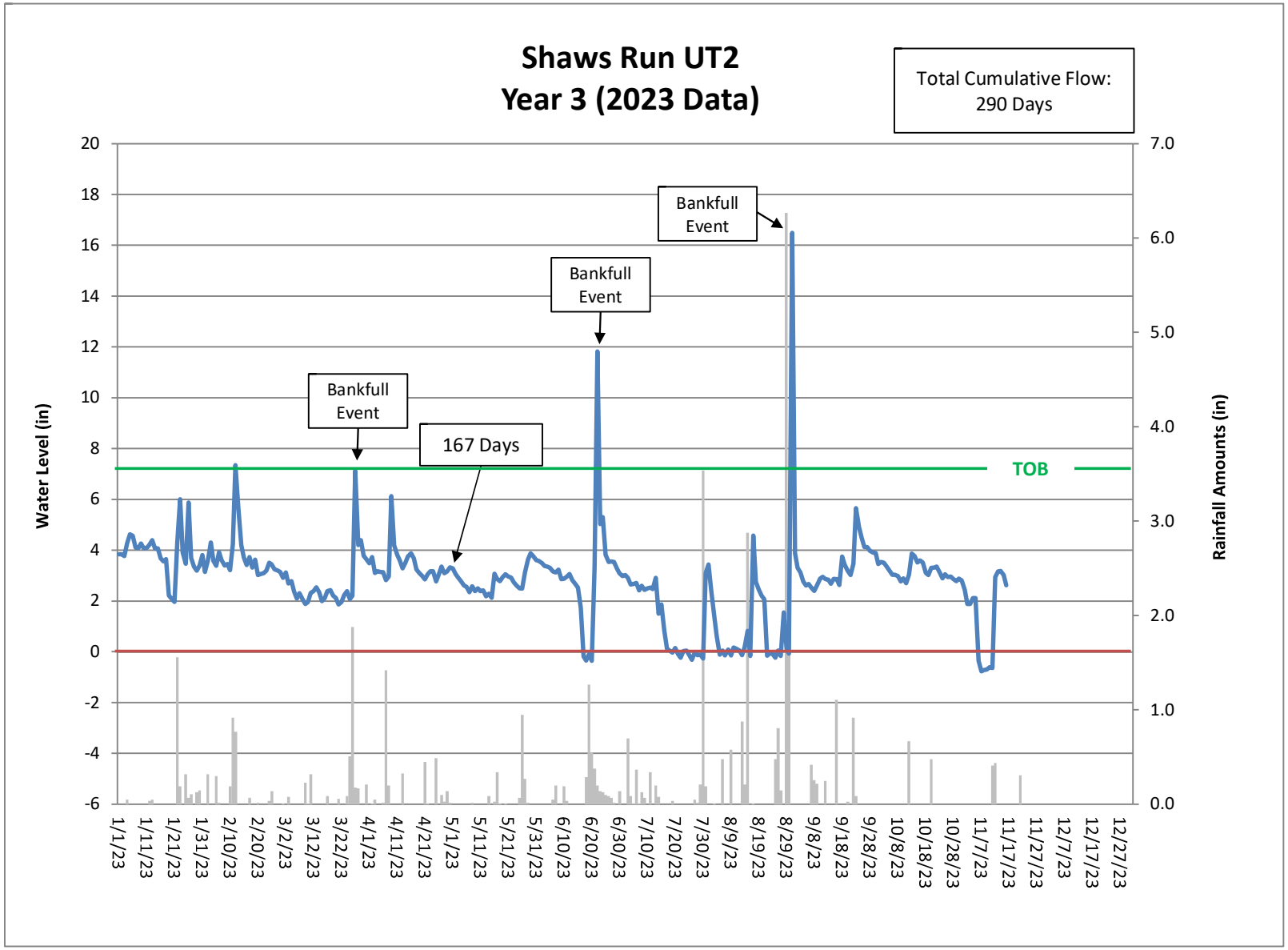
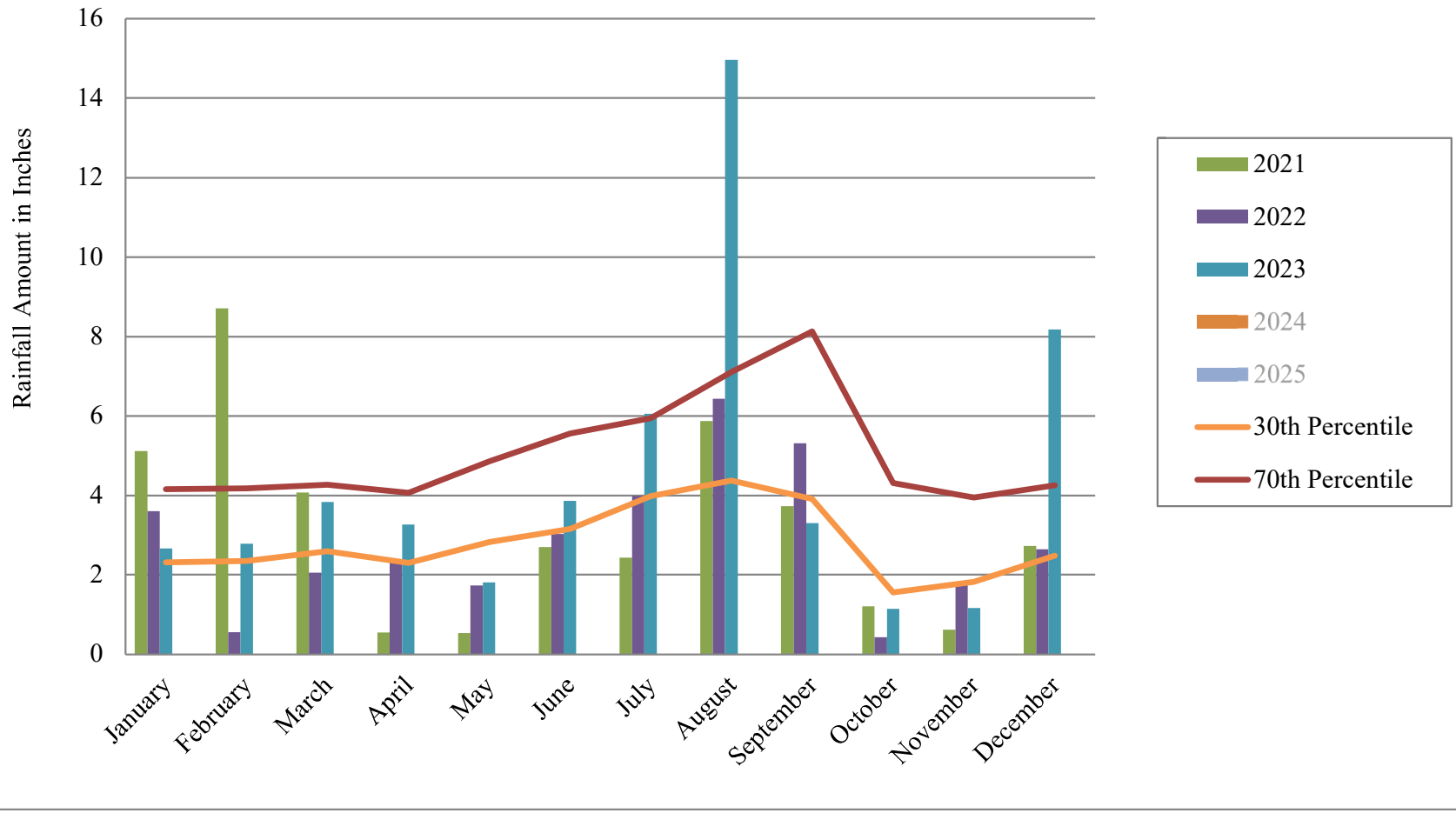
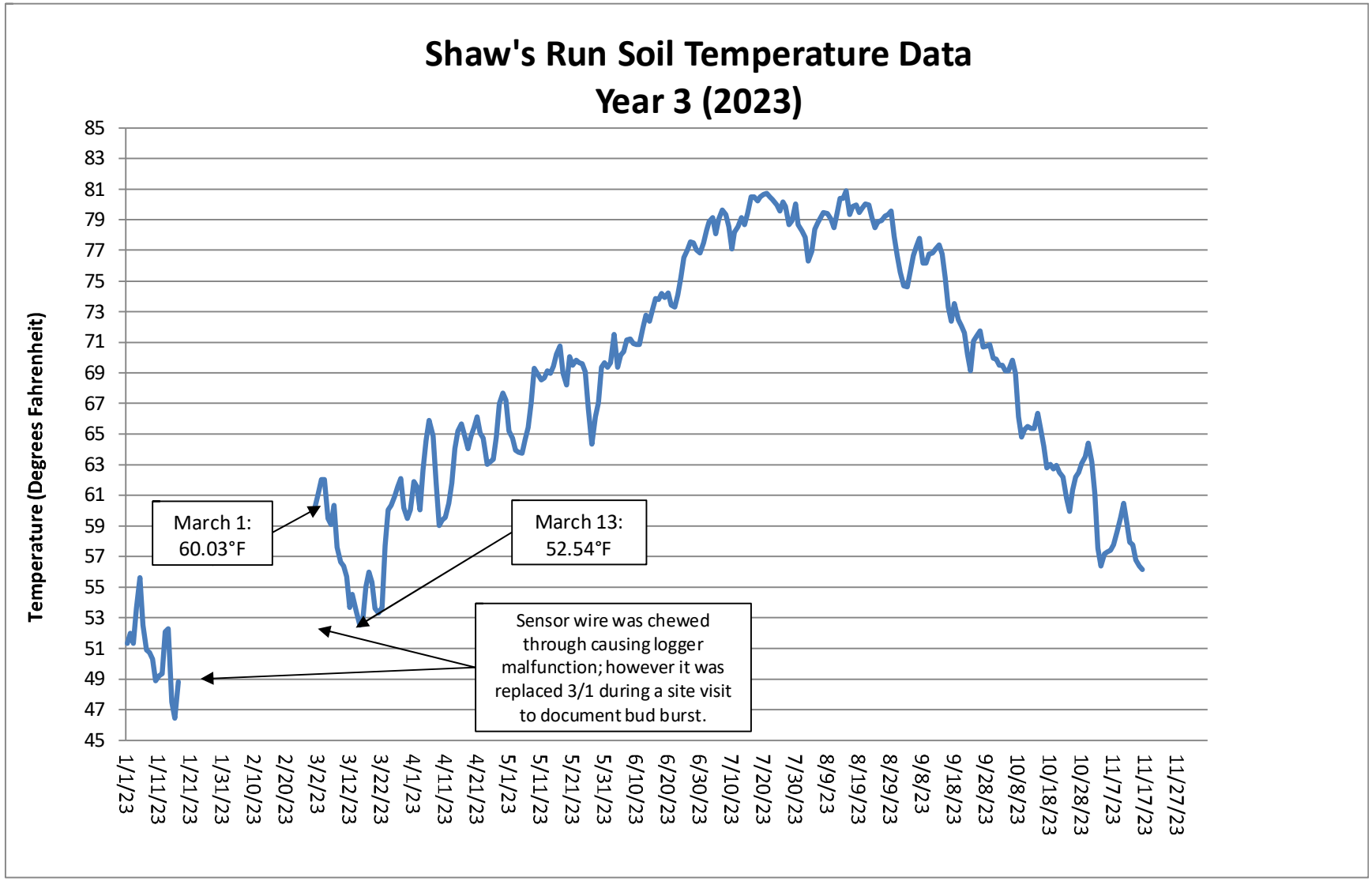

Shaws Run UT2
Year 3 (2023 Data)
Total Cumulative Flow:
290 Days
Bankfull Event
Bankfull Event
Bankfull Event
167 Days
TOB
Water Level (in)
Rainfall Amounts (in)
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23
11/27/23
12/7/23
12/17/23
12/27/23

Figure D1: Shaw's Run
30-70 Percentile Graph for Rainfall
Current year data from onsite rain gauge
30-70th percentile data from WETS Station: Whiteville, NC




Shaw's Run Soil Temperature Data
Year 3 (2023)
Temperature (Degrees Fahrenheit)
85
83
81
79
77
75
73
71
69
67
65
63
61
59
57
55
53
51
49
47
45
1/1/23
1/11/23
1/21/23
1/31/23
2/10/23
2/20/23
3/2/23
3/12/23
3/22/23
4/1/23
4/11/23
4/21/23
5/1/23
5/11/23
5/21/23
5/31/23
6/10/23
6/20/23
6/30/23
7/10/23
7/20/23
7/30/23
8/9/23
8/19/23
8/29/23
9/8/23
9/18/23
9/28/23
10/8/23
10/18/23
10/28/23
11/7/23
11/17/23
11/27/23
March 1: 60.03°F
March 13: 52.54°F
Sensor wire was chewed through causing logger malfunction; however it was replaced 3/1 during a site visit to document bud burst.

Appendix E
Project Timeline and Contact Info

Table 15. Project Timeline
Table 16. Project Contacts

Table 15. Project Timeline
Shaw's Run Stream and Wetland Mitigation Site/100055

Activity or Deliverable	Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted	NA	20-Apr-18
Mitigation Plan Approved	NA	02-Dec-19
Construction (Grading) Completed	NA	25-Jun-20
Planting Completed	NA	20-Dec-20
As-built Survey Completed	Jan-21	Jan-21
MY-0 Baseline Report	Jan-21	Mar-21
MY-1 Monitoring Report	Oct-21	Dec-21
MY-2 Monitoring Report	Nov-22	Dec-22
MY-3 Monitoring Report	Nov-23	Jan-24

Table 16. Project Contacts
Shaw's Run Stream and Wetland Mitigation Site/100055

Provider Mitigation Provider POC	Restoration Systems 1101 Haynes Street, #211 Raleigh, NC 27604 Raymond Holz 919-755-9490
Designer Primary project design POC	Axiom Environmental 218 Snow Ave Raleigh, NC 27603 Grant Lewis 919-215-1693
Construction Contractor	Land Mechanics 126 Circle G Lane Willow Spring, NC 27592 Loyde Glover 919-639-6132

Appendix F
Benthic Data

Benthic Habitat Forms

3/06 Revision 7

Habitat Assessment Field Data Sheet
Coastal Plain Streams

TOTAL SCORE 79

Biological Assessment Unit, DWQ
Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT-2 Location/road: Hwy 74 (Road Name) County Columbus

Date 23 **CC#** 03040203 Basin Lumber Subbasin 03-07-50

Observer(s) Type of Study: ☐ Fish ☑ Benthos ☐ Basinwide ☐ Special Study (Describe)

Latitude 34.319606 Longitude 78.866604 Ecoregion: ☐ CA ☐ SWP ☐ Sandhills ☐ CB

Water Quality: Temperature — °C DO — mg/l Conductivity (corr.) — µS/cm pH —

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location. Check off what you observe driving thru the watershed in watershed land use.

Visible Land Use: 20* %Forest ____%Residential ____%Active Pasture 80 % Active Crops
____%Fallow Fields ____% Commercial ____%Industrial ____%Other - Describe:

Watershed land use ☐ Forest ☑ Agriculture ☐ Urban ☐ Animal operations upstream

Width: (meters) Stream .5 Channel (at top of bank) 1 **Stream Depth:** (m) Avg .1 Max .2
☐ **Width variable** ☐ **Braided channel** ☐ **Large river >25m wide**
Bank Height (from deepest part of channel to top of bank): (m) .2

Flow conditions : ☐ High ☐ Normal ☐ ~~Low~~ Dry
Channel Flow Status
Useful especially under abnormal or low flow conditions.

A. Water reaches base of both banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☑

Turbidity: ☐ Clear ☐ Slightly Turbid ☐ Turbid ☐ Tannic ☐ Milky ☐ Colored (from dyes) ☐ Green tinge reach not
Good potential for Wetlands Restoration Project?? ☑ **YES** ☐ **NO**
Details
Tree XO stream/wetland mitigation project

☐ Channelized ditch
☐ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☐ Channel filled in with sediment
☐ Recent overbank deposits ☐ Bar development ☐ Sewage smell
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth

Manmade Stabilization: ☐ N ☑ Y: ☐ Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐ Berm/levee
Weather Conditions: **Photos:** ☑ N ☐ Y ☐ Digital ☐ 35mm

Remarks: XO mitigation site
TYPICAL STREAM CROSS SECTION DIAGRAM ON BACK

I. Channel Modification

	Score
A. Natural channel-minimal dredging.....	(15)
B. Some channelization near bridge, or historic (>20 year old), and/or bends beginning to reappear..	10
C. Extensive channelization, straight as far as can see, channelized ditch.....	5
D. Banks shored with hard structure, >80% of reach disrupted, instream habitat gone.....	0

Remarks _____ Subtotal 15

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >50% of the reach is snags, and 1 type is present, circle the score of 16. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

__/__ **Sticks** ____ **Snags/logs** ____ **Undercut banks or root mats** ____ **Macrophytes** __/__ **Leafpacks**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>50% Score	30-50% Score	10-30% Score	<10% Score
4 or 5 types present.....	20	15	10	5
3 types present.....	18	13	8	4
2 types present.....	17	12	7	3
1 type present.....	16	(11)	6	2
No substrate for benthos colonization and no fish cover.....				0

☐ No woody vegetation in riparian zone Remarks _____ Subtotal 11

III. Bottom Substrate (silt, clay, sand, detritus, gravel) look at entire reach for substrate scoring.

	Score
A. Substrate types mixed	
1. gravel dominant.....	15
2. sand dominant.....	13
3. detritus dominant.....	7
4. silt/clay/muck dominant.....	(4)
B. Substrate homogeneous	
1. nearly all gravel.....	12
2. nearly all sand	7
3. nearly all detritus.....	4
4. nearly all silt/clay/muck.....	(1)

Remarks _____ Subtotal 5

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow.

	Score
A. Pools present	
1. Pools Frequent (>30% of 100m length surveyed)	
a. variety of pool sizes.....	(10)
b. pools about the same size (indicates pools filling in).....	8
2. Pools Infrequent (<30% of the 100m length surveyed)	
a. variety of pool sizes.....	6
b. pools about the same size.....	4
B. Pools absent	
1. Deep water/run habitat present.....	4
2. Deep water/run habitat absent.....	0

Subtotal 16

Remarks _____ Page Total 41

V. Bank Stability and Vegetation

	Score	Score
A. Banks stable or no banks, just flood plain		
1. little or no evidence of erosion or bank failure, little potential for erosion	(10)	(10)
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	9	9
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	7	7
3. sparse vegetation; plant types and conditions suggest poorer soil binding.....	4	4
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....0	0	

Total 20

Remarks_____

VI. Light Penetration (Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead).

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	(7)
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Subtotal 7

Remarks_____

VII. Riparian Vegetative Zone Width

Definition: A break in the riparian zone is any area which allows sediment to enter the stream. Breaks refer to the near-stream portion of the riparian zone (banks); places where pollutants can directly enter the stream.

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. zone width > 18 meters.....	(5)	(5)
2. zone width 12-18 meters.....	4	4
3. zone width 6-12 meters.....	3	3
4. zone width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. zone width > 18 meters.....	4	4
b. zone width 12-18 meters.....	3	3
c. zone width 6-12 meters.....	2	2
d. zone width < 6 meters.....	1	1
2. breaks common		
a. zone width > 18 meters.....	3	3
b. zone width 12-18 meters.....	2	2
c. zone width 6-12 meters.....	1	1
d. zone width < 6 meters.....	0	0

Total 10

Remarks_____

Page Total 37

TOTAL SCORE 78

Swamp Run

3/06 Revision 7

Habitat Assessment Field Data Sheet
Coastal Plain Streams

TOTAL SCORE 81

Biological Assessment Unit, DWQ

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT 1 Location/road: Chadbourn (Road Name Braswell) County Columbus

Date 23 CC# 03040203 Basin Lumber Subbasin 03-07-50

Observer(s)_____ Type of Study: ☐ Fish ☑ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 34.317735 Longitude 78.86707 Ecoregion: ☐ CA ☐ SWP ☐ Sandhills ☐ CB

Water Quality: Temperature_____°C DO _____mg/l Conductivity (corr.) _____µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location. Check off what you observe driving thru the watershed in watershed land use.

Visible Land Use: 50 %Forest _____%Residential 1 %Active Pasture 50 % Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe:_____

Watershed land use ☐ Forest ☑ Agriculture ☐ Urban ☐ Animal operations upstream

Width: (meters) Stream .5 Channel (at top of bank) 1 **Stream Depth:** (m) Avg .1 Max .5
☐ **Width variable** ☐ **Braided channel** ☐ **Large river >25m wide**
Bank Height (from deepest part of channel to top of bank): (m)_____

Flow conditions : ☐High ☐Normal ☐Low

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☑

Turbidity: ☐Clear ☐ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes) ☐Green tinge
Good potential for Wetlands Restoration Project?? ☑ **YES** ☐ **NO**
Details_____
N-F

☐Channelized ditch
☐Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐Recent overbank deposits ☐Bar development ☐Sewage smell
☐Excessive periphyton growth ☐Heavy filamentous algae growth

Manmade Stabilization: ☐N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Weather Conditions:_____ **Photos:** ☐N ☐Y ☐Digital ☐35mm

Remarks: 3 yo stream restoration
TYPICAL STREAM CROSS SECTION DIAGRAM ON BACK

I. Channel Modification

	Score
A. Natural channel-minimal dredging.....	(15)
B. Some channelization near bridge, or historic (>20 year old), and/or bends beginning to reappear..	10
C. Extensive channelization, straight as far as can see, channelized ditch.....	5
D. Banks shored with hard structure, >80% of reach disrupted, instream habitat gone.....	0

Remarks _____ Subtotal 15

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >50% of the reach is snags, and 1 type is present, circle the score of 16. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

__/__Sticks ____Snags/logs ____Undercut banks or root mats __(__Macrophytes __/__Leafpacks

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>50% Score	30-50% Score	10-30% Score	<10% Score
4 or 5 types present.....	20	15	10	5
3 types present.....	18	(13)	8	4
2 types present.....	17	12	7	3
1 type present.....	16	11	6	2
No substrate for benthos colonization and no fish cover.....				0

☐ No woody vegetation in riparian zone Remarks _____ Subtotal 13

III. Bottom Substrate (silt, clay, sand, detritus, gravel) look at entire reach for substrate scoring.

	Score
A. Substrate types mixed	
1. gravel dominant.....	15
2. sand dominant.....	13
3. detritus dominant.....	7
4. silt/clay/muck dominant.....	(4)
B. Substrate homogeneous	
1. nearly all gravel.....	12
2. nearly all sand	7
3. nearly all detritus.....	4
4. nearly all silt/clay/muck.....	(1)

Remarks _____ Subtotal 5

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow.

	Score
A. Pools present	
1. Pools Frequent (>30% of 100m length surveyed)	
a. variety of pool sizes.....	(10)
b. pools about the same size (indicates pools filling in).....	8
2. Pools Infrequent (<30% of the 100m length surveyed)	
a. variety of pool sizes.....	6
b. pools about the same size.....	4
B. Pools absent	
1. Deep water/run habitat present.....	4
2. Deep water/run habitat absent.....	0

Subtotal 10

Remarks _____ Page Total 43

V. Bank Stability and Vegetation

	Score	Score
A. Banks stable or no banks, just flood plain		
1. little or no evidence of erosion or bank failure, little potential for erosion	(10)	(10)
B. Erosion areas present		
1. diverse trees, shrubs, grass; plants healthy with good root systems.....	9	9
2. few trees or small trees and shrubs; vegetation appears generally healthy.....	7	7
3. sparse vegetation; plant types and conditions suggest poorer soil binding.....	4	4
4. mostly grasses, few if any trees and shrubs, high erosion and failure potential at high flow	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....0	0	

Total 20

Remarks_____

VI. Light Penetration (Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead).

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	(8)
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Subtotal 8

Remarks_____

VII. Riparian Vegetative Zone Width

Definition: A break in the riparian zone is any area which allows sediment to enter the stream. Breaks refer to the near-stream portion of the riparian zone (banks); places where pollutants can directly enter the stream.

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. zone width > 18 meters.....	(5)	(5)
2. zone width 12-18 meters.....	4	4
3. zone width 6-12 meters.....	3	3
4. zone width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. zone width > 18 meters.....	4	4
b. zone width 12-18 meters.....	3	3
c. zone width 6-12 meters.....	2	2
d. zone width < 6 meters.....	1	1
2. breaks common		
a. zone width > 18 meters.....	3	3
b. zone width 12-18 meters.....	2	2
c. zone width 6-12 meters.....	1	1
d. zone width < 6 meters.....	0	0

Total 10

Remarks_____

Page Total 36

TOTAL SCORE 61

Appendix G
Site Photo Log

Shaw's Run
MY-03 (2023) Photo Log

Photo 1: Full site aerial view, facing south

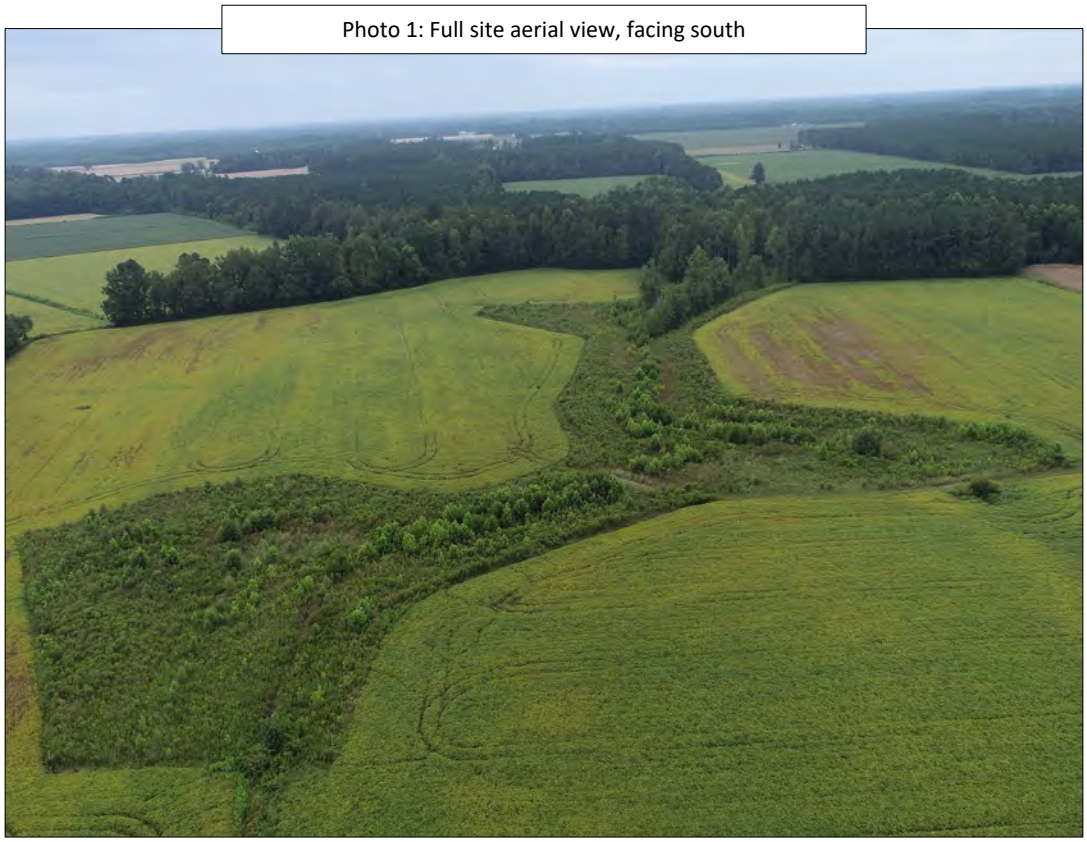
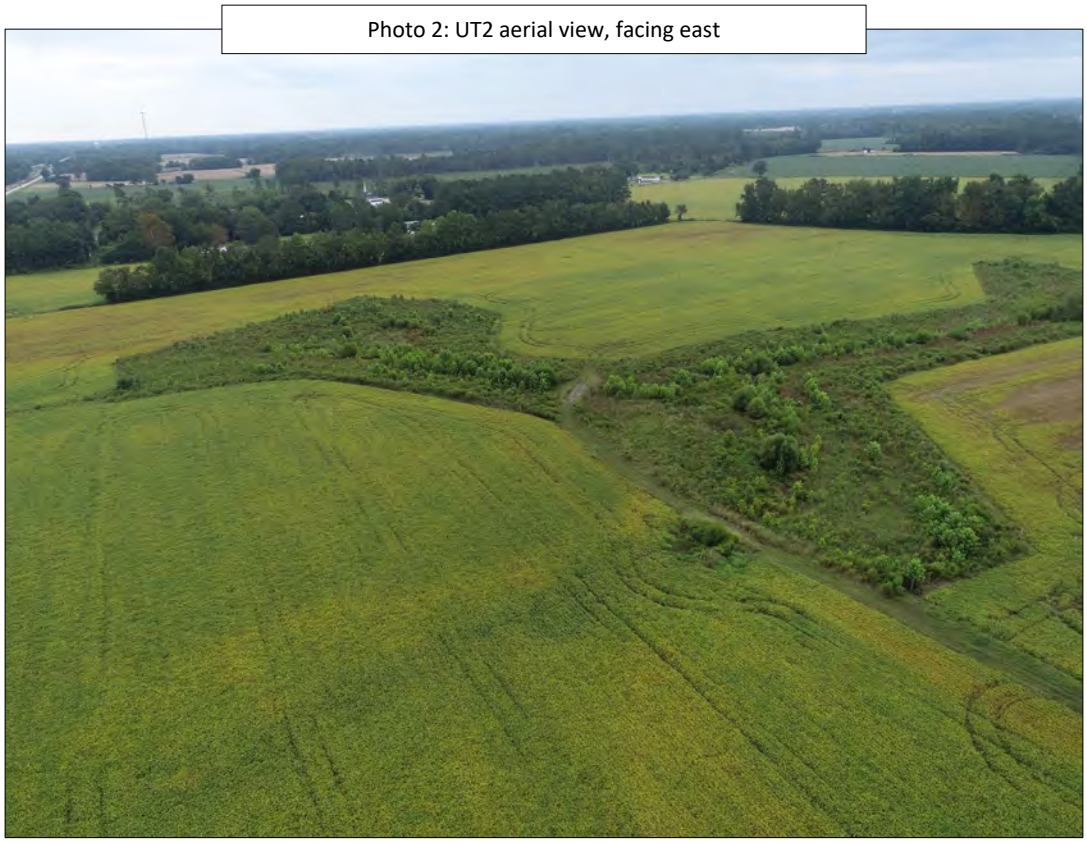


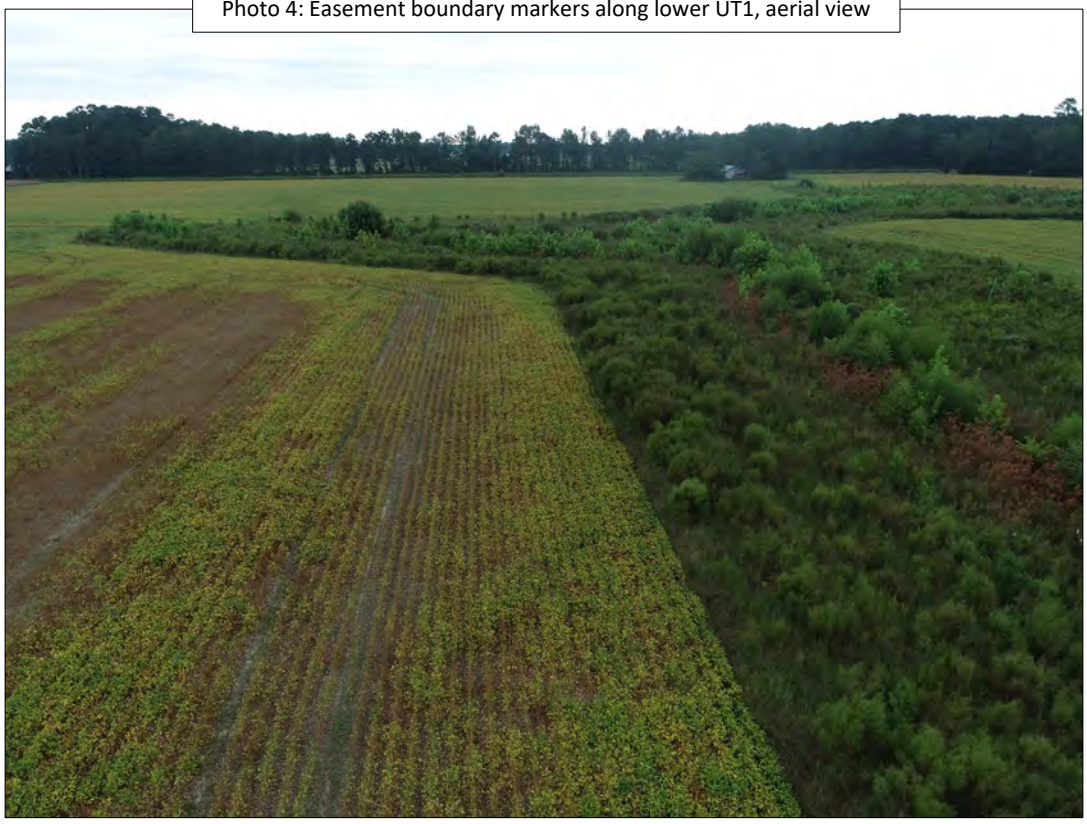
Photo 2: UT2 aerial view, facing east



Shaw's Run
MY-03 (2023) Photo Log

Photo 3: Easement Boundary markers near upper UT1, aerial view

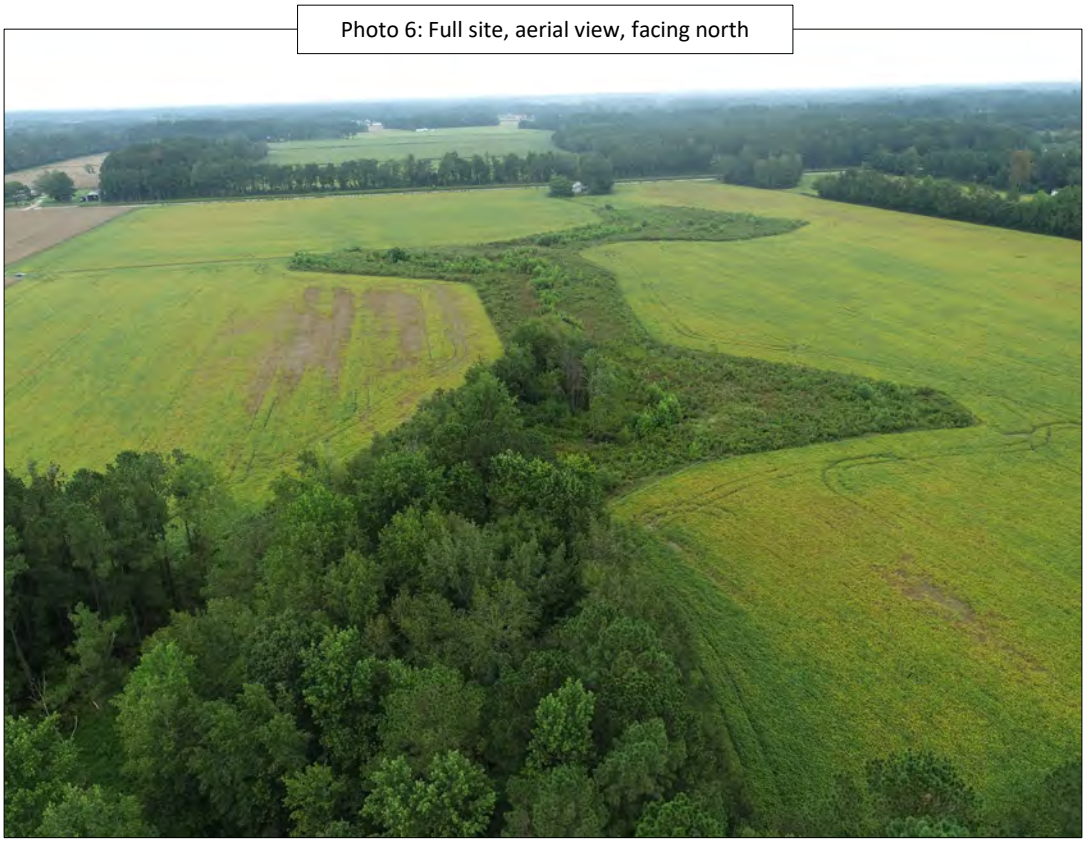
Photo 4: Easement boundary markers along lower UT1, aerial view



Shaw's Run
MY-03 (2023) Photo Log

Photo 5: UT1 lower reach, aerial view

Photo 6: Full site, aerial view, facing north



Shaw's Run
MY-03 (2023) Photo Log

Photo 7: Vegetation along UT1

Photo 8: Easement markers at UT1 crossing

Shaw's Run
MY-03 (2023) Photo Log

Photo 9: UT-2 Upstream flow gauge

Photo 10: UT-1 Upstream flow gauge

Shaw's Run
MY-03 (2023) Photo Log

Photo 11: UT-1 Piped Crossing– Upstream End

Photo 12: UT-1 Piped Crossing– Downstream End

Shaw's Run
MY-03 (2023) Photo Log

Photo 13: UT-2 Piped Crossing– Upstream End

Photo 14: UT-2 Piped Crossing– Downstream End

Shaw's Run
MY-03 (2023) Photo Log

Photo 15: UT1 upper flow

Photo 16: Groundwater gauge 9 replacement

Shaw's Run
MY-03 (2023) Photo Log

Photo 17: Bud burst on *Betula nigra*
Photo taken 3/1/23

Photo 18: *Betula nigra* full leaf-out
Photo taken 3/1/23

Shaw's Run
MY-03 (2023) Photo Log

Photo 19: Bud burst on *Taxodium distichum*
Photo taken 3/1/23

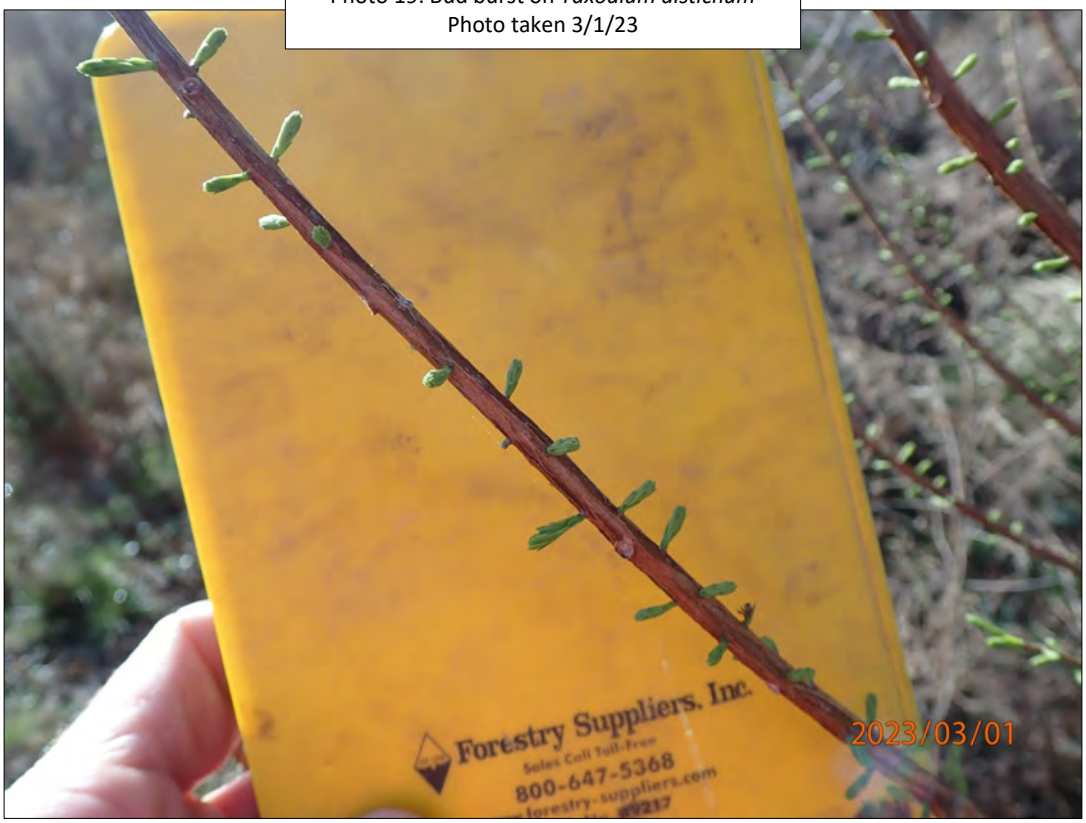


Photo 20: Steel screws replaced with aluminum nails.

Shaw's Run
MY-03 (2023) Photo Log

Photo 21: Container planting and horse tape in easement encroachment area.

Photo 22: Container planting and horse tape in easement encroachment area.

Shaw's Run
MY-03 (2023) Photo Log

Photo 23: Container planting and horse tape with wood post and PVC pipe in easement encroachment area.

Photo 24: Container planting and additional signage in easement encroachment area.

Shaw's Run
MY-03 (2023) Photo Log

Photo 25: Additional signage in easement encroachment area.

Appendix H
Project Notes

IRT Site Visit Notes Nov. 7, 2023
DMS Boundary Inspection Report Nov. 8, 2023

Task 1 a.) Inter-Agency Monitoring Year Three Site Visit: Site Visit Notes

Attendees:

USACE:
- Todd Tugwell
- Erin Davis

Restoration Systems:
- JD Hamby

NC DWR:
- Maria Polizzi

Axiom Environmental
- Grant Lewis

NC DMS:
- Emily Dunnigan

NC WRC:
- Travis Wilson

Notes:

- Jeff Horton of DMS was inspecting the project boundary during the IRT visit and issues dealing with encroachment and easement markings will be communicated to RS after the visit.

- Gauge #9 was determined to be faulty and removed. Axiom will replace the gauge and note on the report that it malfunctioned. Soil conditions were determined to show evidence of successful hydrology inundation.

- A small area below the crossing, between UT-1 and UT-2 was lacking in vigorous growth of planted stems upon visual inspection. Erin requested a random transect and additional planting in the area with larger material if deemed necessary.

- Erin also noted that RS should add larger trees (one to three-gallon pots based on availability) in the areas of scalping along the easement edge.

- Todd requested adding a permanent monumented cross section on the upper reaches of UT2 to ensure the stream is not aggrading and will remain a single thread channel.

- IRT requested some additional data be included in the monitoring report.
  - Cumulative flow days.
  - Consecutive flow days.
  - A summary table that shows this information with each monitoring year shown.
  - Add call outs noting bankfull events to the flow graphs.

ROY COOPER
Governor
ELIZABETH S. BISER
Secretary
MARC RECKTENWALD
Director

NORTH CAROLINA
Environmental Quality

November 8, 2023

Emily Dunnigan
Project Manger
Division of Mitigation Services
Green Square Office
217 West Jones Street
Raleigh, NC 27603

Subject: Boundary Inspection Report – MY3 Site
Shaw's Run, Columbus County, NC; DMS ID No. 100055

Emily,

The MY3 boundary inspection was conducted by DMS on November 8, 2023. The inspection was conducted in accordance with the DMS Property Checklist which included an office review and a site visit to document site conditions. I offer my observations on what requires follow up to uphold the easement integrity. This report summarizes those inspection results along with a KML file for reference.

Office Review: No items noted.

Field Inspection:

- The easement corners we checked met the RFP and recorded survey plat standards.
- Witness posts were consistent, with signs, and located near the CE corner.
- Scalloping was noted for specific areas ref. KML.
- Online signs were missing and needed to be located every 200 feet. See KML for areas that require signs.
- When trees were used to mark the line, steel screws were used. These pose a hazard to the landowner and to any worker who may one day use a chain saw to cut these trees.

Action Items:

- Work with the landowner to cease farming and scalloping immediately within the conservation easement.
  - Speak with the landowners to re-enforce the terms of the easement.
  - Where there is active farming or scalloping, consult with the landowner, and then add 10 ft tall PVC or conduit with flagging or reflective coating to the t-posts. If the landowner has a better idea that seems acceptable, try that.
  - Document the conversations and resolution to the DMS project manager.
- Remove steel screws and replace them with 16d aluminum nails. Call for specification or DMS can provide a minimum amount to complete this task.
- Add signs where needed to ensure at least one sign every 200 feet. Ref. KMl for example locations. Where signs are missing add them.
- There were two locations where previous scalloping entered the CE area. Add t-post or wooden bollard and 10 foot conduit to help the equipment operator know where the CE line exists.

.

Let me know if you have any questions or need additional information.

Sincerely,
Jeffrey Horton
Project Specialist
NCDEQ-DMS

cc: R:\EEP PROJECT LIBRARY FILES\PROJECT DELIVERABLES(REPORTS)\FD PROJECTS\Shaw's Run 007515 (#100055)\4_T2_Cons_Ease\100055_Boundary Inspection_2023