MY2 (2022) 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 2022
Submission: February 2023

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
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Response to Monitoring Year 2 (2022) 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. Site Maintenance Report: Invasive species have been treated this year but is not mentioned in the report. Please discuss the work that's been completed in the narrative of section 2.1 and add to CCPV/Table 5 if greater than 0.1 acres.
   Response: Invasive species treated are sporadic in nature and do not pose a threat to young woody stems in the short-term, nor are they suppressing the viability, density, or growth of planted woody stems, and thus do not meet the criteria of "high concern" nor "low/moderate concern" as denoted by footnote 4 of Table 6 (Vegetation Conditions Assessment), which states:

   "The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems."

   As such – we feel the location and detail of the invasive species work completed are appropriate within the yearly monitoring report. In general, RS uses Section 2.1 to provide a written narrative regarding the annual monitoring tasks/outcomes – as defined within the Monitoring Summary table of Section 2.1. Vegetate management conducted during the monitoring period is detailed in the Monitoring Summary section of the report.

2. 2.1 Monitoring Stream Summary: In the wetland summary section there's a reference to abnormal rainfall conditions as a contributing factor for the failure of gauge 7. Please discuss the abnormal conditions and provide supplemental rainfall/drought data if necessary.
   Response: additional drought related data was added to the report.

3. Please include dates on all photographs for future reports.
   Response: Understood and will do.

Site Visit

1. As discussed in the field there are multiple farming encroachments. Within the report, please detail the remedial actions for the encroachments (timeline, marking, planting, landowner coordination, etc.) and include all encroachment areas on the CCPV/Table 5 and as a shapefile. Photo documentation of completed work must be included in the MY3 report.
   Response: A narrative regarding the small farming encroachments around the Site (0.057 acres total) was added to the Monitoring Summary portion of the report which includes corrective actions. The encroachment areas were also added to the CCPV and Table 5.

Shaw's Run -- Year 2 (2022) Monitoring Summary

General Notes

- Six (6) small areas of encroachment were observed after the harvest of row crops adjacent to the Site totaling 0.057 acres. A corrective action plan is provided on page two of the Monitoring Summary.
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver, etc.) was observed.

Streams

- All stream restoration reaches were stable and exhibited no signs of erosion, all structures were stable (Appendix C).

Vegetation

- Measurements of all 7 permanent plots resulted in an average of 503 planted stems/acre. Additionally, all individual plots met the success criteria (Appendix B).

Wetlands

- All groundwater gauges met success criteria for the year 2 (2022) monitoring period except Gauges 1 and 7 (Appendix D). Gauge 1 was installed outside the credit-generating area to confirm the drainage influence from the Greene Swamp Canal. It had a similar hydroperiod during year 1 (2021). The gauge would likely have met success criteria under normal rainfall conditions, especially early in the growing season (Figure D1, Appendix D). Gauge 7 read within 12 inches of the surface for just 11 consecutive days (4.3%); however, readings hovered between 12 and 15 inches from the surface for the first 80 days of the growing season. 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%)					
2	No - 15 days (5.8%)^	Yes – 53 days (20.6%)					
3	Yes - 44 days (17.1%)	Yes – 57 days (22.2%)					
4	Yes - 38 days (14.8%)	Yes – 58 days (22.6%)					
5	Yes - 34 days (13.2%)	Yes – 58 days (22.6%)					
6	Yes - 52 days (20.2%)	Yes – 59 days (23.0%)					
7	Yes - 36 days (14.0%)	No – 11 days (4.3%)					
8	Yes - 38 days (14.8%)	Yes – 54 days (21.0%)					
9	Yes - 37 days (14.4%)	Yes – 53 days (20.6%)					

* 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 (2022)

Invasive Species Work	Maintenance work
06/03/2022 Privet, Multiflora rose, Chinese Tallow, Chinaberry, Cattail, Sweetgum 09/08/2022 Multiflora rose, Privet, China Berry, Chinese tallow, Sweetgum	None

2023 Corrective Action Plan for Agricultural Encroachment

- Six areas of encroachment were observed in 2022 post-crop harvest (Appendix A, Figure 1. Current Conditions Plan View). The total area equaled 0.057 acres (2,483 sq. ft.).

Corrective Action Plan

Step Number	Action Item	Completed / Planned Date
#1	Meet with Landowner to review areas of encroachment	Completed 02/03/2023
#2	Add additional easement posts (4-inch treated) along encroachment lines as needed +/- every 50-100 feet, and add additional signage	March 2023
#3	Meet with tenant farmer ahead of 2023 field preparation for crops	March/April 2023
#4	Site check for encroachment from 2023 ag. planting, and review planted vegetation along areas of 2022 encroachment to determine if larger caliber trees need to be planted. A current review of the encroachment areas indicates no planting is necessary.	April/May 2023
#5	Ahead of harvest, confirm boundary marking is adequately visible, and remind tenant farmer of the easement.	September 2023

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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 unnamed warm water 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.

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

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**

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 - Remove drain tile - 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

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

Targeted Functions	Goals	Objectives	Success Criteria
(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

Success Criteria (Continued)

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 2 (2022) 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. Stream morphology data is available in Appendix C. Visual assessment data is available in Appendix A, Tables 4A-B.

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 (257days)	31 days

*Based on observed/documented bud burst on the Site on March 1, 2022, and soil temperature of 53.9oF.

All groundwater gauges met success criteria for the year 2 (2022) monitoring period except Gauges 1 and 7 (Appendix D). Gauge 1 was installed outside of the credit generating area in order to confirm the drainage influence from the Greene Swamp. It had a similar hydroperiod during year 1 (2021). Gauge 7 read within 12 inches of the surface for just 11 consecutive days (4.3%), however, readings hovered between 12 and 15 inches from the surface for the first 80 days of the growing season. The gauge likely would have met success criteria under normal rainfall conditions, especially early in the growing season (Figure D1, Appendix D). Groundwater gauge data is in Appendix D.

Vegetation Summary

Year 2 (2022) vegetation measurements occurred on September 12, 2022. 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 503 planted stems/acre, excluding livestakes. All individual plots met success criteria (Tables 7-8, Appendix B). In plots 2 and 3, the dominant species composition exceeded 50% for bald cypress (*Taxodium distichum*). In monitoring year 1, Plot 2 experienced high mortality for sugarberry (*Celtis laevigata*) trees that were planted at as-built, which resulted in bald cypress composing 55% of woody stems in the plot. Plot 3 had a higher number of bald cypress trees planted at as-built when compared to other plots, however, the species composition is localized and there is no evidence to suggest an onsite trend. Species composition will continue to be monitored in 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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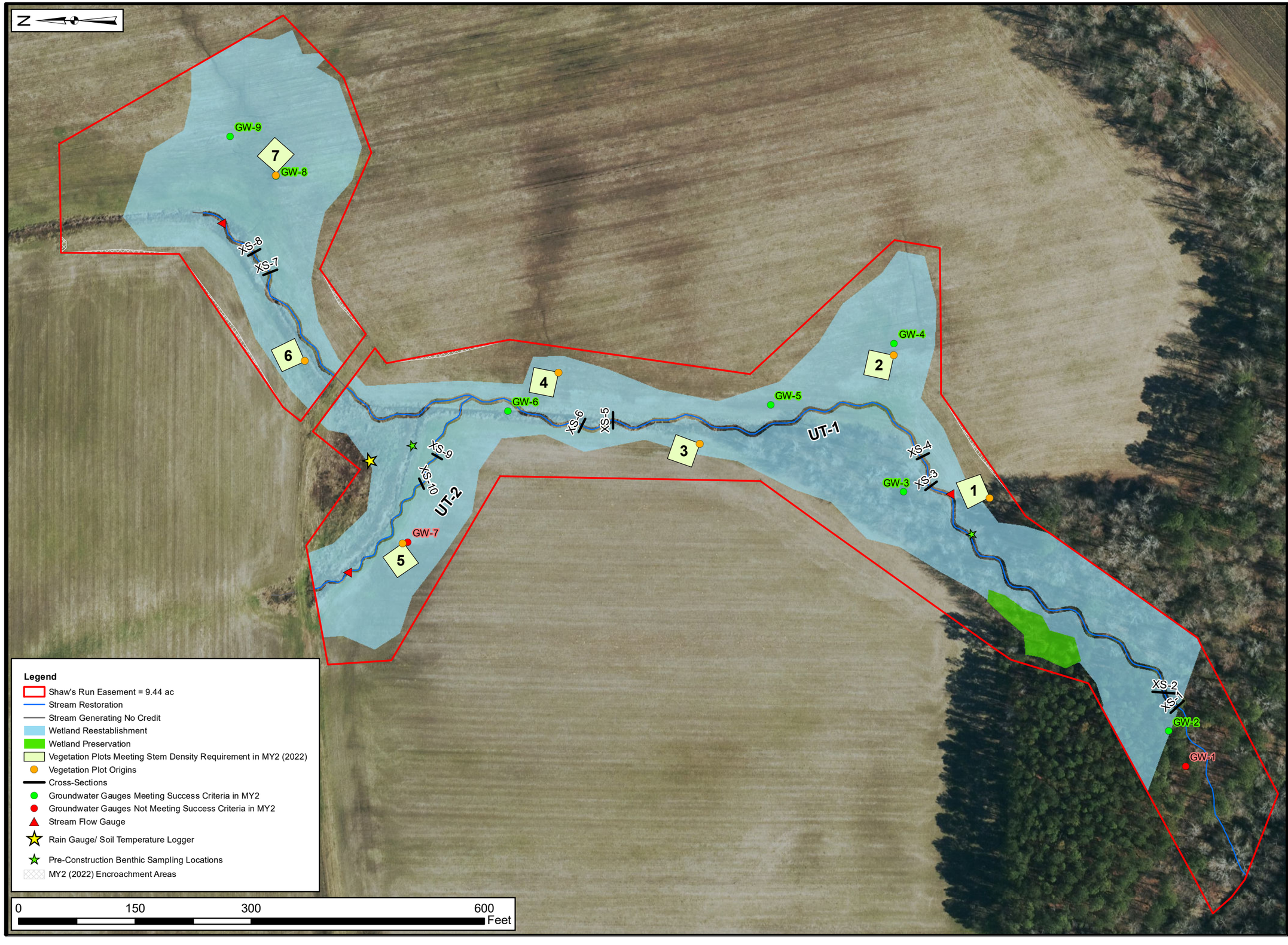
United States Department of Agriculture (USDA). 2022. Natural Resources Conservation Service National Weather and Climate Center. AgACIS Climate Data. Whiteville 7 NW WETS Station (online). Available: http://agacis.rcc-acis.org

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: KRJ

Date: Feb 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: November 16, 2022

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: September 24, 2021**

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%

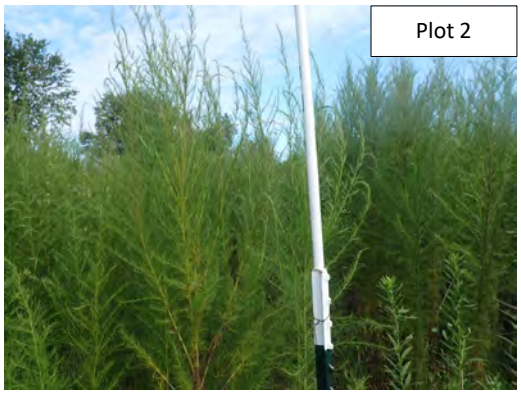
Easement Acreage **9.44**

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	6 Encroachments noted (0.057 ac)	

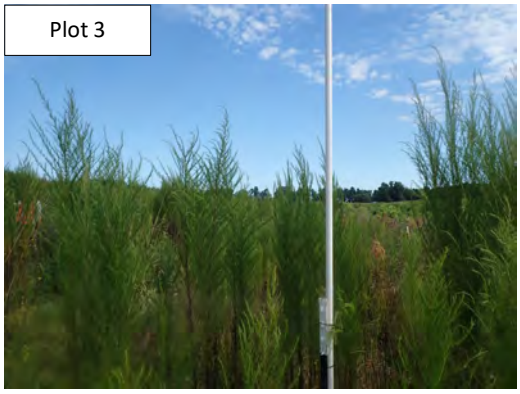
Shaw's Run Mitigation Site
MY-02 (2022) Vegetation Monitoring Photographs (Taken September 2022)

Plot 1

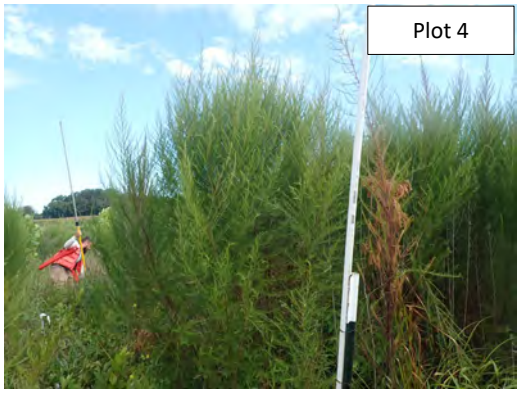
Plot 2



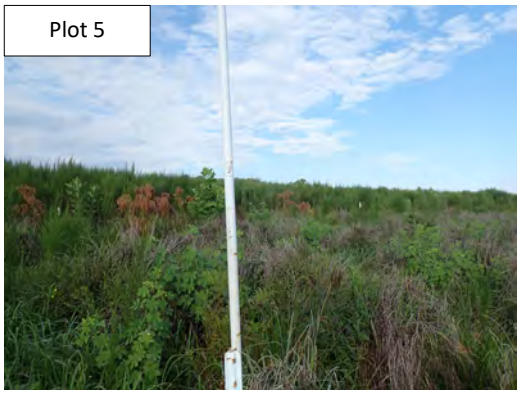
Plot 3



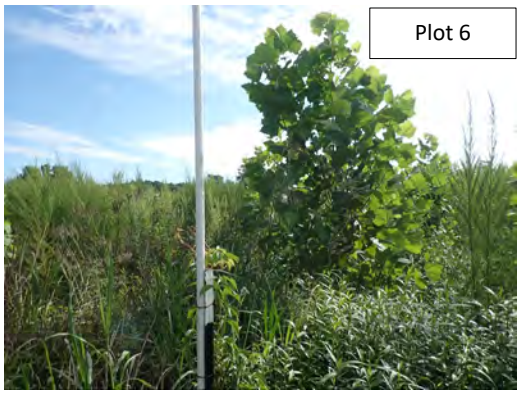
Plot 4



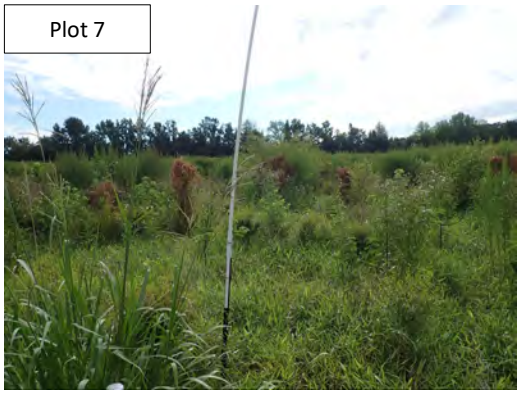
Plot 5



Plot 6



Plot 7



Appendix B – Vegetation Data

Table 6. 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 7. Planted Vegetation Totals
Shaw's Run Mitigation Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	526	Yes
2	405	Yes
3	567	Yes
4	486	Yes
5	486	Yes
6	607	Yes
7	445	Yes
Average Planted Stems/Acre	**503**	**Yes**

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

Planted Acreage	7.7
Date of Initial Plant	2020-12-01
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2022-09-12
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 7 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW							1	1					4	4
	Celtis laevigata	sugarberry	Tree	FACW							2	2	1	1			1	1
	Celtis occidentalis	common hackberry	Tree	FACU											1	1		
	Cephalanthus occidentalis	common buttonbush	Shrub	OBL														
	Cornus amomum	silky dogwood	Shrub	FACW	1	1									2	2		
	Diospyros virginiana	common persimmon	Tree	FAC							1	1						
	Fraxinus pennsylvanica	green ash	Tree	FACW			2	2										
	Liriodendron tulipifera	tuliptree	Tree	FACU	2	2												
	Nyssa sylvatica	blackgum	Tree	FAC	3	3							2	2	1	1	2	2
	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			1	1	4	4			2	2			1	1
	Quercus pagoda	cherrybark oak	Tree	FACW							1	1	1	1				
	Quercus phellos	willow oak	Tree	FACW	3	3			2	2	1	1						
	Quercus sp.				2	2	1	1			5	5	2	2	1	1	3	3
	Taxodium distichum	bald cypress	Tree	OBL			6	6	9	9			2	2	3	3		
Sum	Performance Standard				13	13	11	11	15	15	12	12	12	12	15	15	11	11
Mitigation Plan Performance Standard	Current Year Stem Count					13		11		15		12		12		15		11
	Stems/Acre					526		405		526		486		486		607		445
	Species Count					6		5		3		7		8		6		5
	Dominant Species Composition (%)					23		55		60		42		17		47		36
	Average Plot Height					3		4		3		3		4		4		4
	% Invasives					0		0		0		0		0		0		0
Post Mitigation Plan Performance Standard	Current Year Stem Count					13		11		15		12		12		15		11
	Stems/Acre					526		405		526		486		486		607		445
	Species Count					6		5		3		7		8		6		5
	Dominant Species Composition (%)					23		55		60		42		17		47		36
	Average Plot Height					3		4		3		3		4		4		4
	% 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												
Monitoring Year 2	526	3	6	0	405	4	5	0	526	3	3	0
Monitoring Year 1	607	2	6	0	405	2	5	0	567	2	3	0
Monitoring Year 0	688	2	6	0	607	2	6	0	567	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												
Monitoring Year 2	486	3	7	0	486	4	8	0	607	4	6	0
Monitoring Year 1	486	2	7	0	526	2	8	0	688	2	7	0
Monitoring Year 0	567	2	8	0	607	2	8	0	810	1	8	0

	Veg Plot 7 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7				
Monitoring Year 5				
Monitoring Year 3				
Monitoring Year 2	445	4	5	0
Monitoring Year 1	445	2	5	0
Monitoring Year 0	567	1	6	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

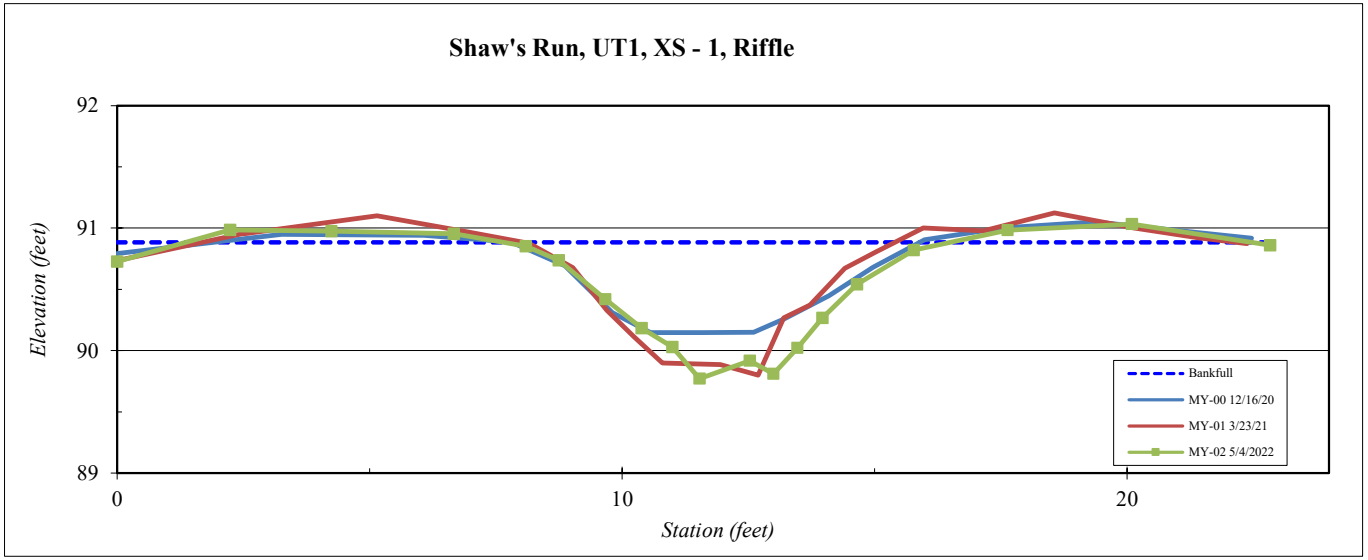
Cross-Sections with Annual Overlays
Table 10A-B. Baseline Stream Data Summary Tables
Table 11. Cross-Section Morphology Monitoring Summary

Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 1, Riffle
Feature	Riffle
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
0.0	90.7
2.2	91.0
4.2	91.0
6.7	91.0
8.1	90.9
8.7	90.7
9.7	90.4
10.4	90.2
11.0	90.0
11.5	89.8
12.5	89.9
13.0	89.8
13.5	90.0
14.0	90.3
14.7	90.5
15.8	90.8
17.6	91.0
20.1	91.0
22.8	90.9

SUMMARY DATA	
Bankfull Elevation:	90.8
Bank Height Ratio:	1.1
Thalweg Elevation:	89.8
LTOB Elevation:	90.8
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	4.2

Stream Type	E/C 5

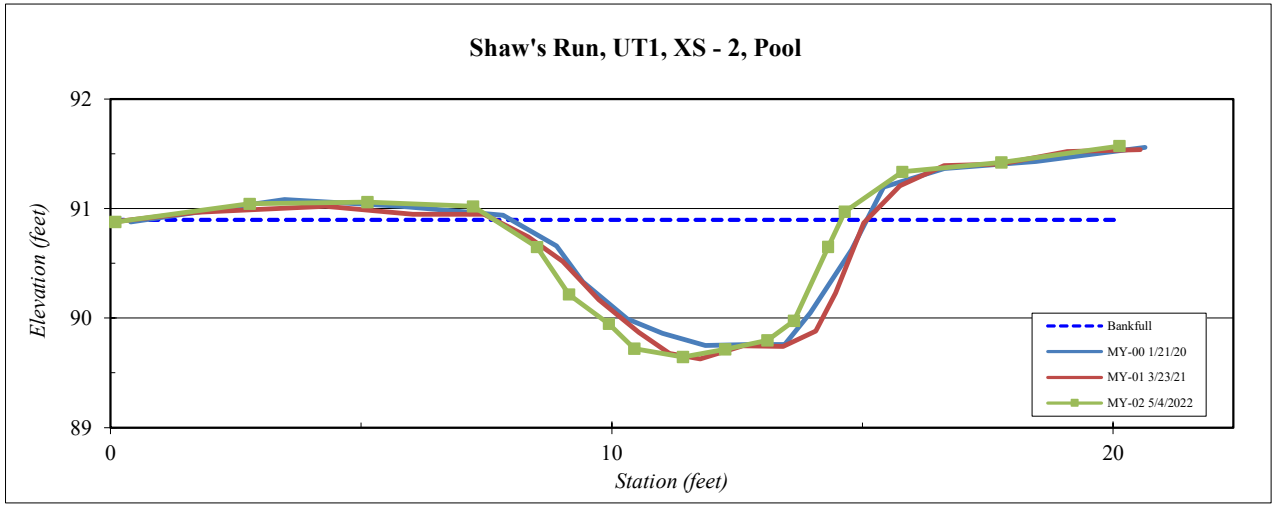


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 2, Pool
Feature	Pool
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
-0.3	90.9
2.4	91.0
4.7	91.1
6.8	91.0
8.1	90.6
8.7	90.2
9.5	89.9
10.0	89.7
11.0	89.6
11.9	89.7
12.7	89.8
13.2	90.0
13.9	90.7
14.2	91.0
15.4	91.3
17.4	91.4
19.7	91.6

SUMMARY DATA	
Bankfull Elevation:	90.9
Bank Height Ratio:	1.1
Thalweg Elevation:	89.6
LTOB Elevation:	91.0
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	6.2

Stream Type	E/C 5

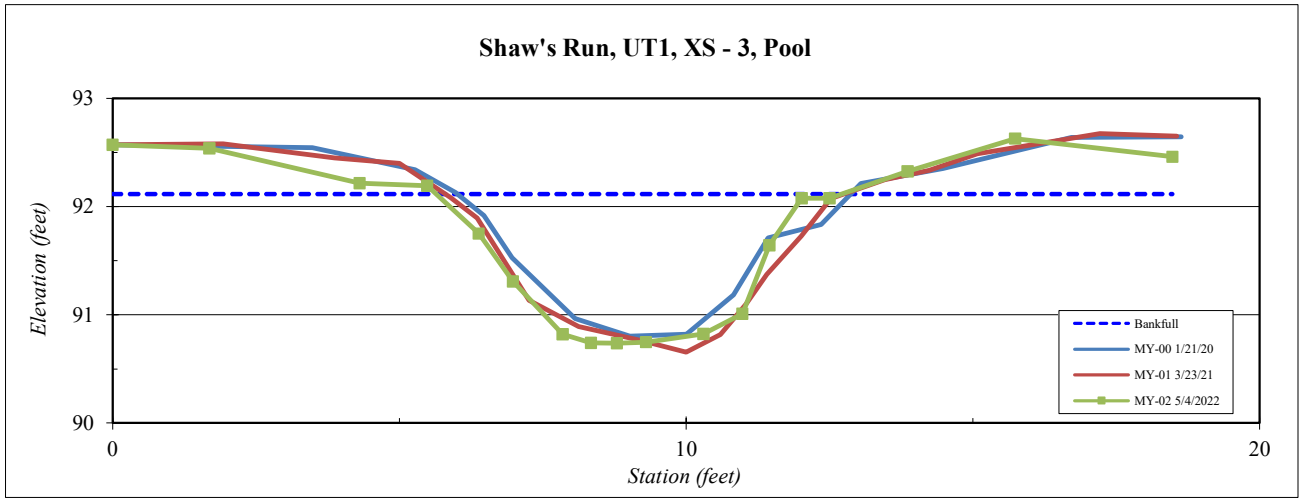


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 3, Pool
Feature	Pool
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
0.0	92.6
1.7	92.5
4.3	92.2
5.5	92.2
6.4	91.7
7.0	91.3
7.8	90.8
8.3	90.7
8.8	90.7
9.3	90.7
10.3	90.8
11.0	91.0
11.5	91.6
12.0	92.1
12.5	92.1
13.9	92.3
15.7	92.6
18.5	92.5

SUMMARY DATA	
Bankfull Elevation:	92.1
Bank Height Ratio:	1.1
Thalweg Elevation:	90.7
LTOB Elevation:	92.2
LTOB Max Depth:	1.5
LTOB Cross Sectional Area:	6.6

Stream Type	E/C 5

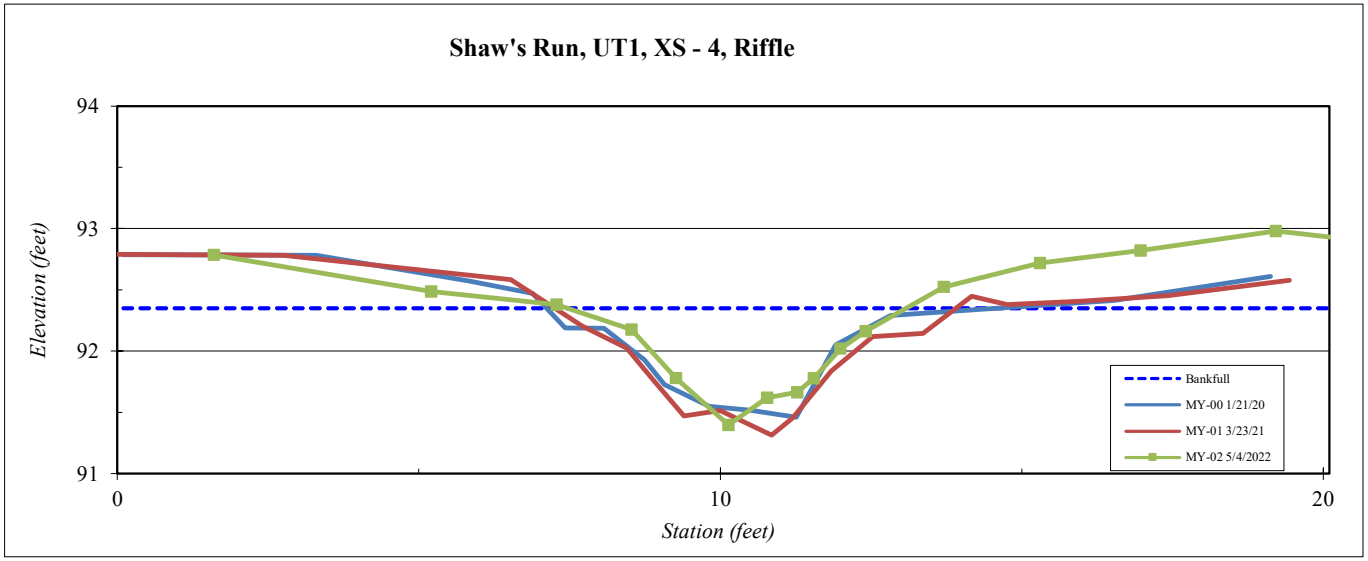


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 4, Riffle
Feature	Riffle
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
1.5	92.8
5.1	92.5
7.2	92.4
8.4	92.2
9.2	91.8
10.0	91.4
10.7	91.6
11.2	91.7
11.4	91.8
11.9	92.0
12.3	92.2
13.6	92.5
15.2	92.7
16.9	92.8
19.1	93.0
20.6	92.9

SUMMARY DATA	
Bankfull Elevation:	92.4
Bank Height Ratio:	1.0
Thalweg Elevation:	91.4
LTOB Elevation:	92.4
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	2.6

Stream Type	E/C 5

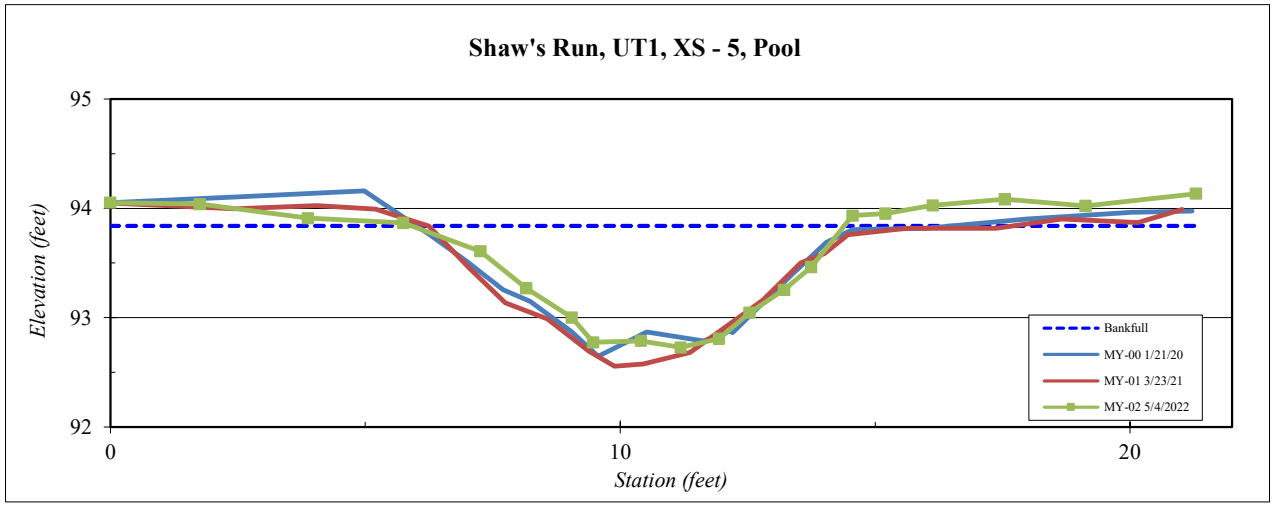


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 5, Pool
Feature	Pool
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
0.0	94.1
1.8	94.0
3.9	93.9
5.7	93.9
7.3	93.6
8.2	93.3
9.1	93.0
9.5	92.8
10.4	92.8
11.2	92.7
11.9	92.8
12.5	93.0
13.2	93.3
13.7	93.5
14.6	93.9
15.2	94.0
16.1	94.0
17.5	94.1
19.1	94.0
21.3	94.1

SUMMARY DATA	
Bankfull Elevation:	93.8
Bank Height Ratio:	1.0
Thalweg Elevation:	92.7
LTOB Elevation:	93.9
LTOB Max Depth:	1.1
LTOB Cross Sectional Area:	5.8

Stream Type	E/C 5

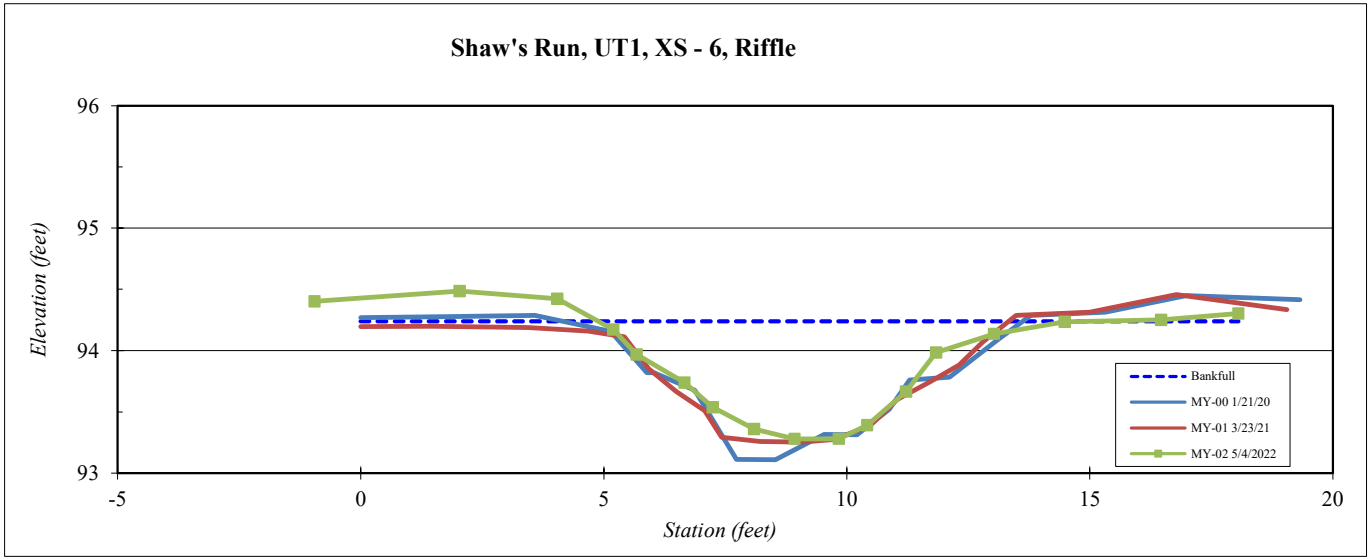


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 6, Riffle
Feature	Riffle
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
-1.0	94.4
2.0	94.5
4.0	94.4
5.2	94.2
5.7	94.0
6.7	93.7
7.2	93.5
8.1	93.4
8.9	93.3
9.8	93.3
10.4	93.4
11.2	93.7
11.8	94.0
13.0	94.1
14.5	94.2
16.5	94.3
18.1	94.3

SUMMARY DATA	
Bankfull Elevation:	94.2
Bank Height Ratio:	1.0
Thalweg Elevation:	93.3
LTOB Elevation:	94.3
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	4.9

Stream Type	E/C 5

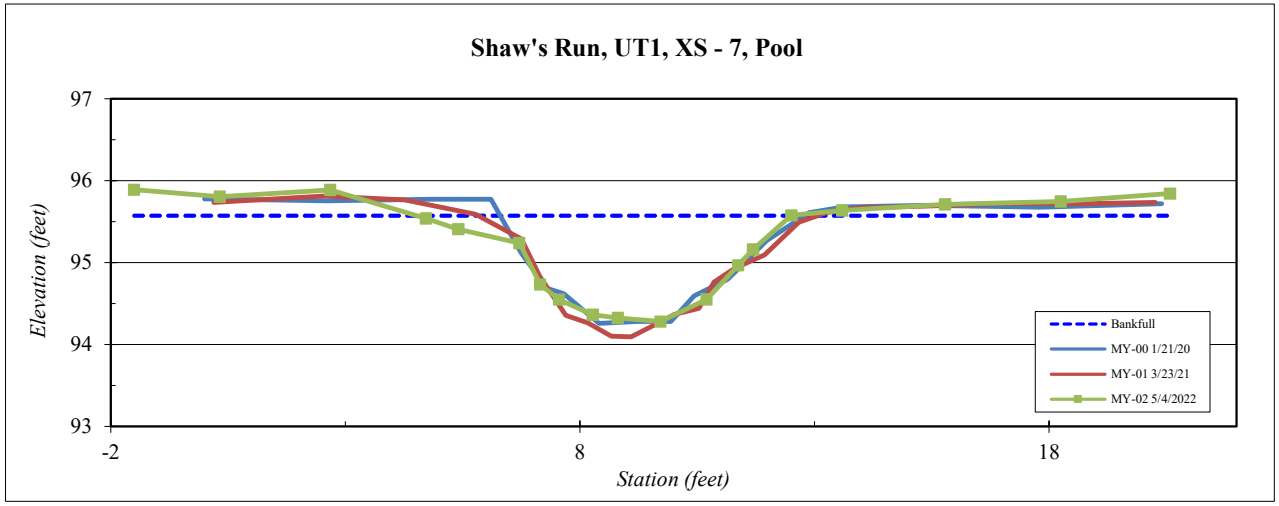


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 7, Pool
Feature	Pool
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
-1.5	95.9
0.3	95.8
2.7	95.9
4.7	95.5
5.4	95.4
6.7	95.2
7.2	94.7
7.6	94.5
8.3	94.4
8.8	94.3
9.7	94.3
10.7	94.5
11.4	95.0
11.7	95.2
12.5	95.6
13.6	95.6
15.8	95.7
18.3	95.7
20.6	95.8

SUMMARY DATA	
Bankfull Elevation:	95.6
Bank Height Ratio:	1.0
Thalweg Elevation:	94.3
LTOB Elevation:	95.6
LTOB Max Depth:	1.3
LTOB Cross Sectional Area:	5.7

Stream Type	E/C 5

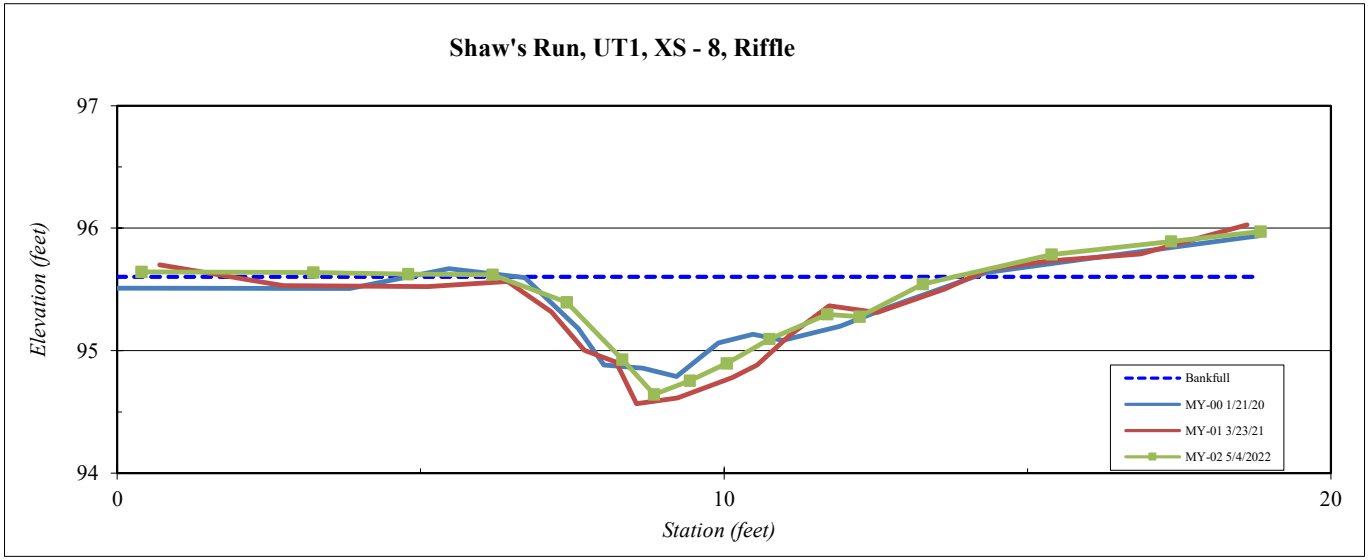


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT1, XS - 8, Riffle
Feature	Riffle
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
0.4	95.6
3.2	95.6
4.8	95.6
6.2	95.6
7.4	95.4
8.3	94.9
8.8	94.6
9.4	94.8
10.0	94.9
10.7	95.1
11.7	95.3
12.2	95.3
13.3	95.5
15.4	95.8
17.4	95.9
18.8	96.0

SUMMARY DATA	
Bankfull Elevation:	95.6
Bank Height Ratio:	1.0
Thalweg Elevation:	94.6
LTOB Elevation:	95.6
LTOB Max Depth:	1.0
LTOB Cross Sectional Area:	3.3

Stream Type	E/C 5

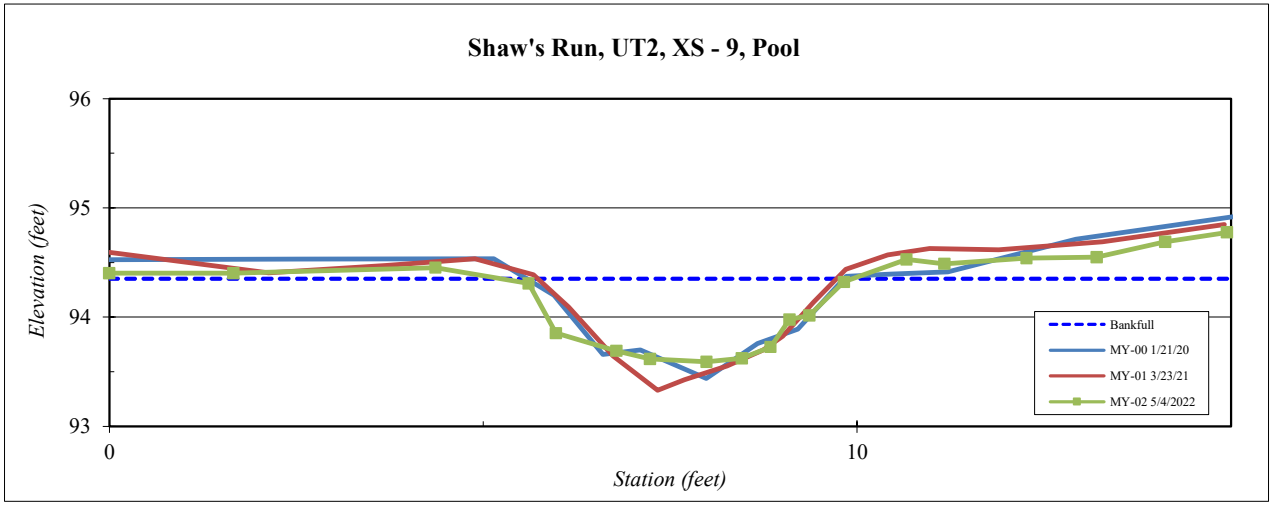


Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT2, XS - 9, Pool
Feature	Pool
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
0.0	94.4
1.7	94.4
4.4	94.5
5.6	94.3
6.0	93.9
6.8	93.7
7.2	93.6
8.0	93.6
8.5	93.6
8.8	93.7
9.1	94.0
9.4	94.0
9.8	94.3
10.7	94.5
11.2	94.5
12.3	94.5
13.2	94.5
14.1	94.7
14.9	94.8

SUMMARY DATA	
Bankfull Elevation:	94.4
Bank Height Ratio:	1.0
Thalweg Elevation:	93.6
LTOB Elevation:	94.3
LTOB Max Depth:	0.7
LTOB Cross Sectional Area:	2.2

Stream Type	E/C 5



Site	Shaw's Run
Watershed:	Lumber River Basin, 03040203
XS ID	UT2, XS - 10, Riffle
Feature	Riffle
Date:	5/4/2022
Field Crew:	Perkinson

Station	Elevation
-0.2	94.7
1.7	94.6
5.2	94.5
5.3	94.4
5.6	94.3
6.6	94.1
7.4	93.9
7.9	93.7
8.7	93.8
9.4	94.1
10.0	94.4
10.9	94.6
11.4	94.7
12.4	94.6
13.9	94.7
15.7	94.8

SUMMARY DATA	
Bankfull Elevation:	94.4
Bank Height Ratio:	1.0
Thalweg Elevation:	93.7
LTOB Elevation:	94.4
LTOB Max Depth:	0.8
LTOB Cross Sectional Area:	2.0

Stream Type	E/C 5

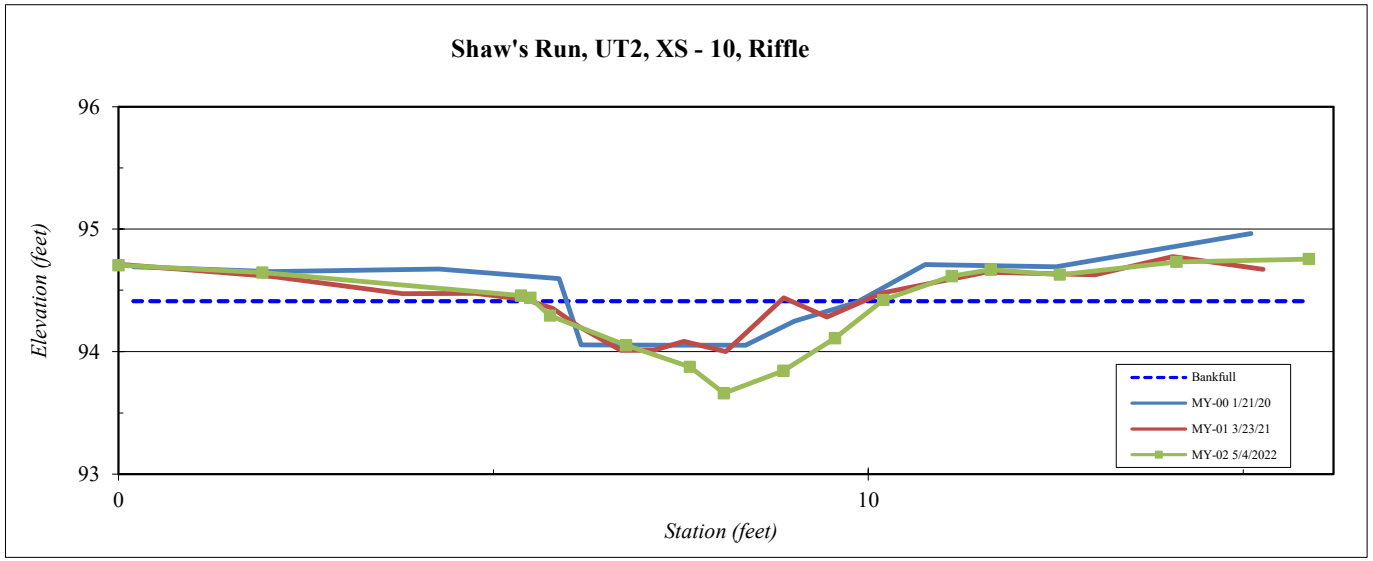


Table 10A. Baseline Stream Data Summary Shaw's Run - UT 1										
Parameter	**Pre-Existing Condition (applicable)**					**Design**		**Monitoring Baseline**		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)	4.1	5.9		6.9		6.1	7	5.6	8.2	4
Floodprone Width (ft)	5.4	7		9.4		30	70	100	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 (applicable)**					**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																			92.29	92.21	92.35											
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.99	1.06																			1.00	0.99	1.03											
Thalweg Elevation	90.15	89.80	89.77					89.75	89.63	89.65					90.80	90.66	90.74					91.46	91.31	91.40					92.65	92.56	92.73				
LTOB[2] Elevation	90.88	90.80	90.82					90.94	90.87	90.97					92.21	92.07	92.19					92.29	92.20	92.38					93.81	93.76	93.87				
LTOB[2] Max Depth (ft)	0.74	1.00	1.05					1.19	1.24	1.32					1.41	1.42	1.46					0.83	0.89	0.98					1.16	1.21	1.14				
LTOB[2] Cross Sectional Area (ft^2)	3.72	3.72	4.17					5.71	5.71	6.24					6.06	6.06	6.63					2.47	2.47	2.64					5.57	5.57	5.82				

	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												95.60	95.52	95.60												94.60	94.55	94.41				
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	1.01	1.01												1.00	1.05	1.02												1.00	1.11	1.03				
Thalweg Elevation	93.11	93.25	93.28					94.26	94.09	94.28					94.79	94.57	94.64					93.44	93.33	93.59					94.05	94.00	93.66				
LTOB[2] Elevation	94.16	94.19	94.25					95.61	95.59	95.58					95.60	95.56	95.62					94.37	94.39	94.32					94.60	94.61	94.44				
LTOB[2] Max Depth (ft)	1.05	0.93	0.97					1.35	1.50	1.30					0.81	1.00	0.98					0.93	1.06	0.73					0.54	0.61	0.78				
LTOB[2] Cross Sectional Area (ft^2)	4.78	4.78	4.90					5.65	5.65	5.70					3.16	3.16	3.29					2.37	2.37	2.23					1.84	1.84	1.96				

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

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

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

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

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

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
Drought.Gov Data
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.	--

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

Photo 2: Wrack and laid-back vegetation were observed on the TOB of UT2 after 3.02” inches of rain fell on February 18, 2021.

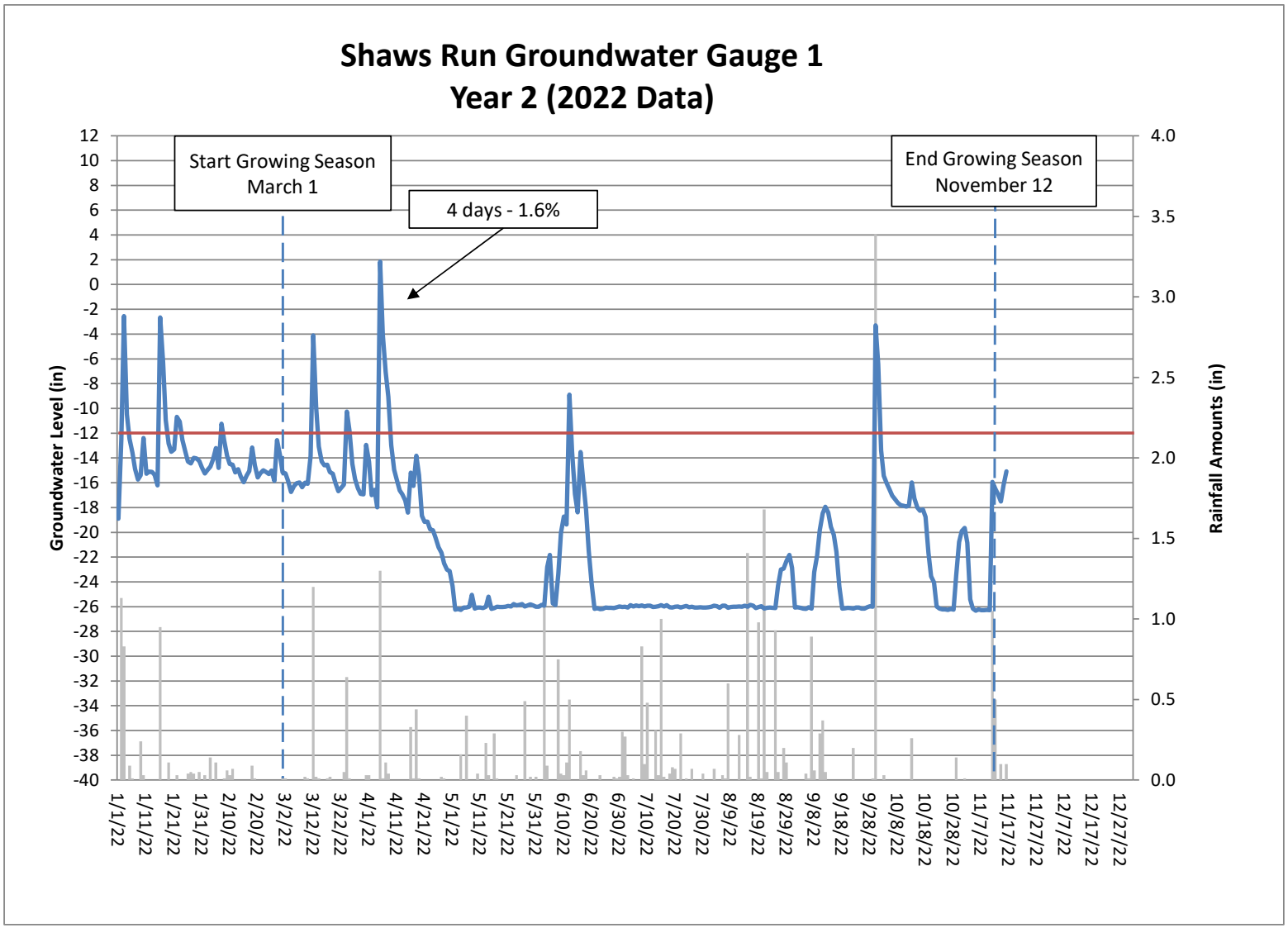
Photo 3: UT 1 swelling to bankfull during a 1.20” rainstorm on March 12, 2022

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%)					
2	No - 15 days (5.8%)^	Yes – 53 days (20.6%)					
3	Yes - 44 days (17.1%)	Yes – 57 days (22.2%)					
4	Yes - 38 days (14.8%)	Yes – 58 days (22.6%)					
5	Yes - 34 days (13.2%)	Yes – 58 days (22.6%)					
6	Yes - 52 days (20.2%)	Yes – 59 days (23.0%)					
7	Yes - 36 days (14.0%)	No – 11 days (4.3%)					
8	Yes - 38 days (14.8%)	Yes – 45 days (17.5%)					
9	Yes - 37 days (14.4%)	Yes – 45 days (17.5%)					

* 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 2 (2022 Data)
Start Growing Season
March 1
End Growing Season
November 12
4 days - 1.6%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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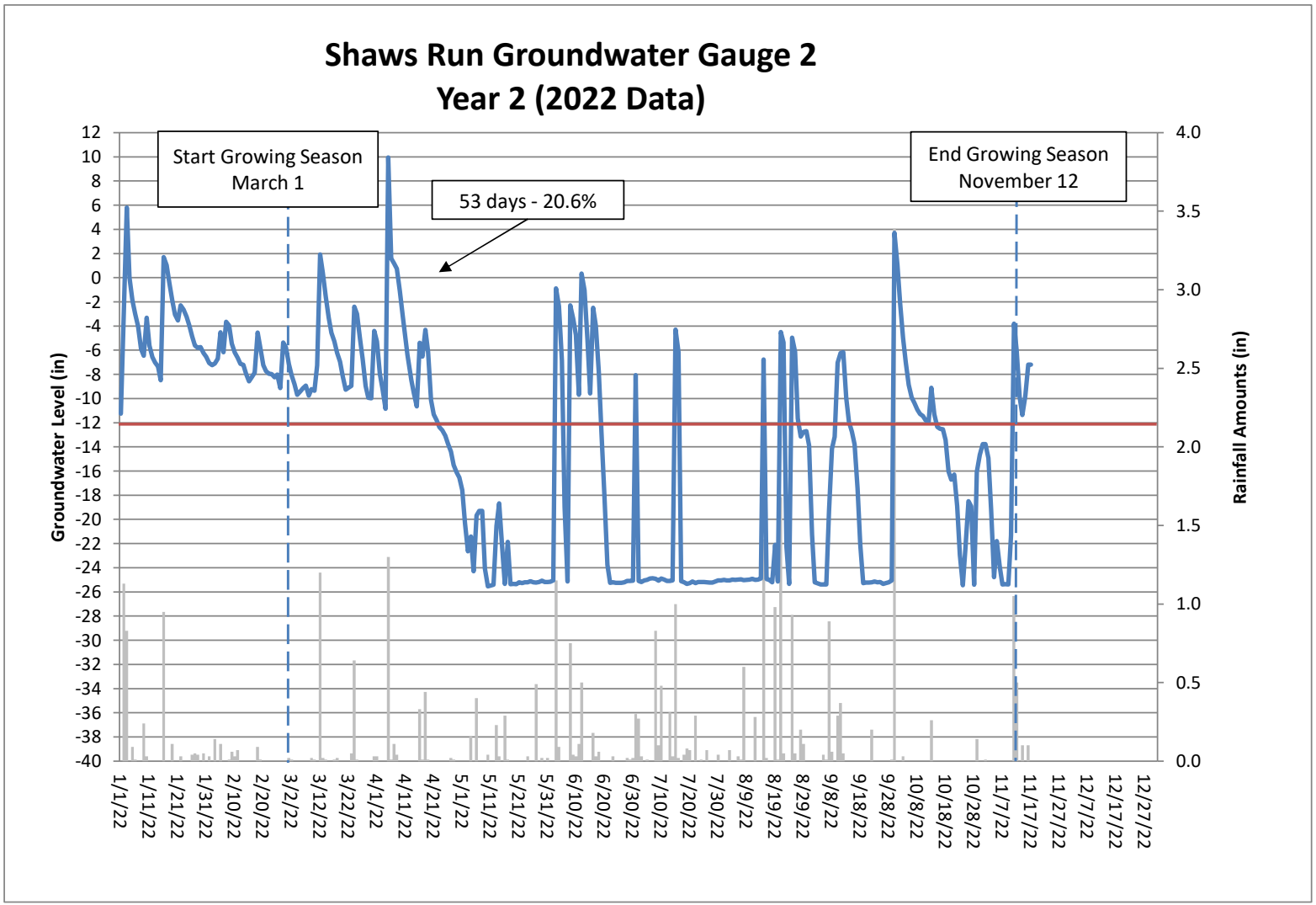
11/27/22
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 2
Year 2 (2022 Data)
Start Growing Season
March 1
53 days - 20.6%
End Growing Season
November 12
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
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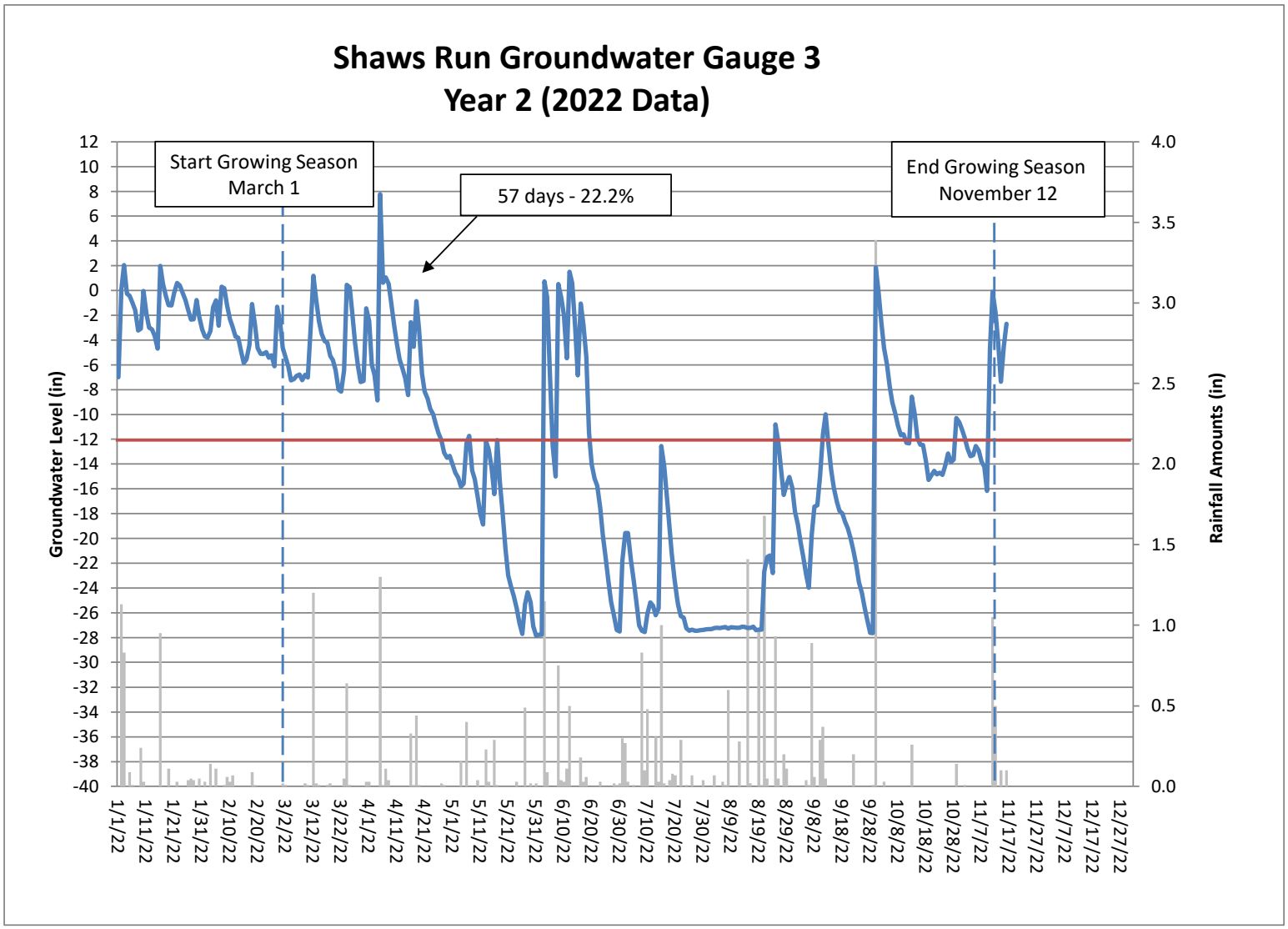
11/27/22
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 3
Year 2 (2022 Data)
Start Growing Season
March 1
57 days - 22.2%
End Growing Season
November 12
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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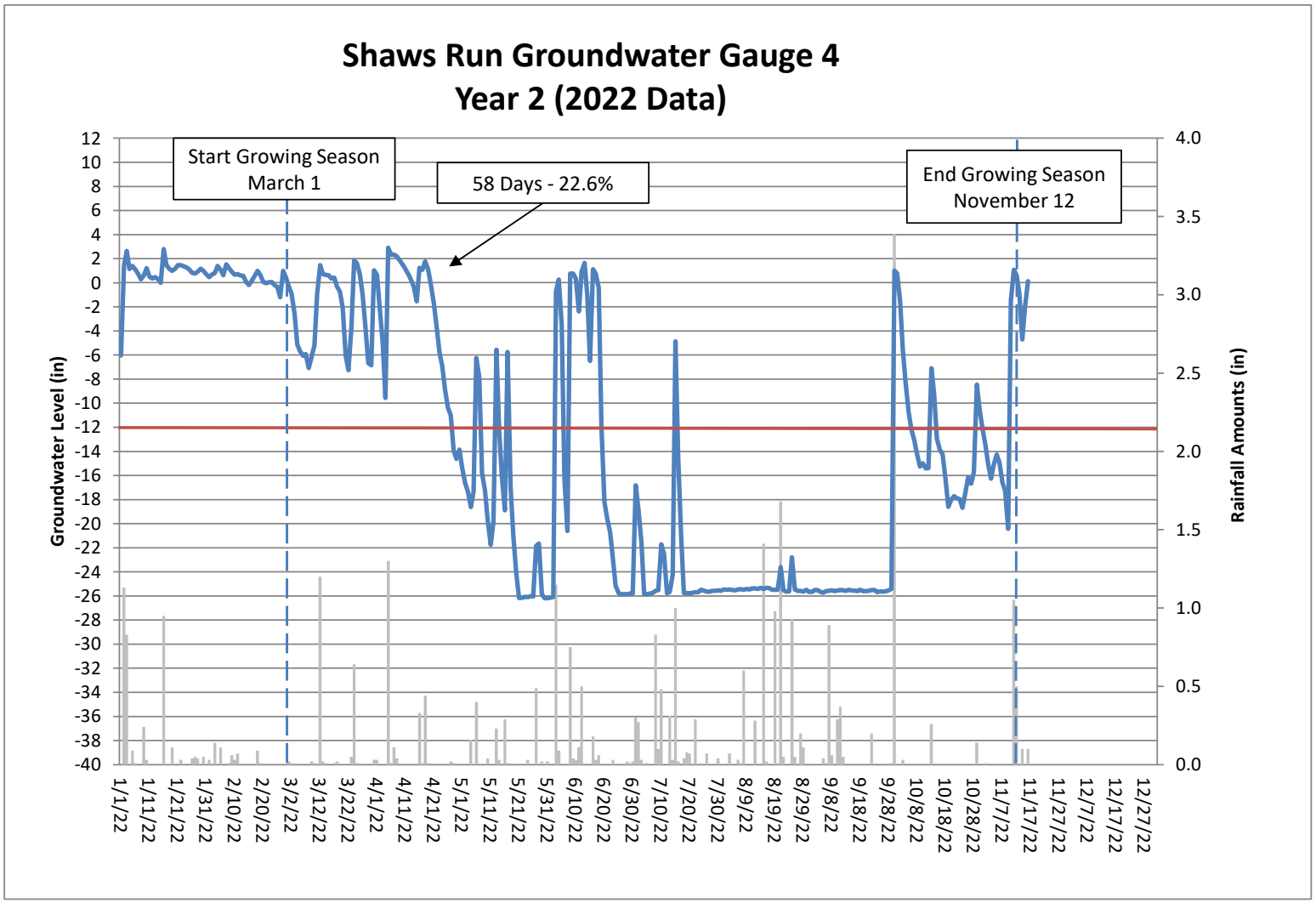
11/27/22
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 4
Year 2 (2022 Data)
Start Growing Season
March 1
58 Days - 22.6%
End Growing Season
November 12
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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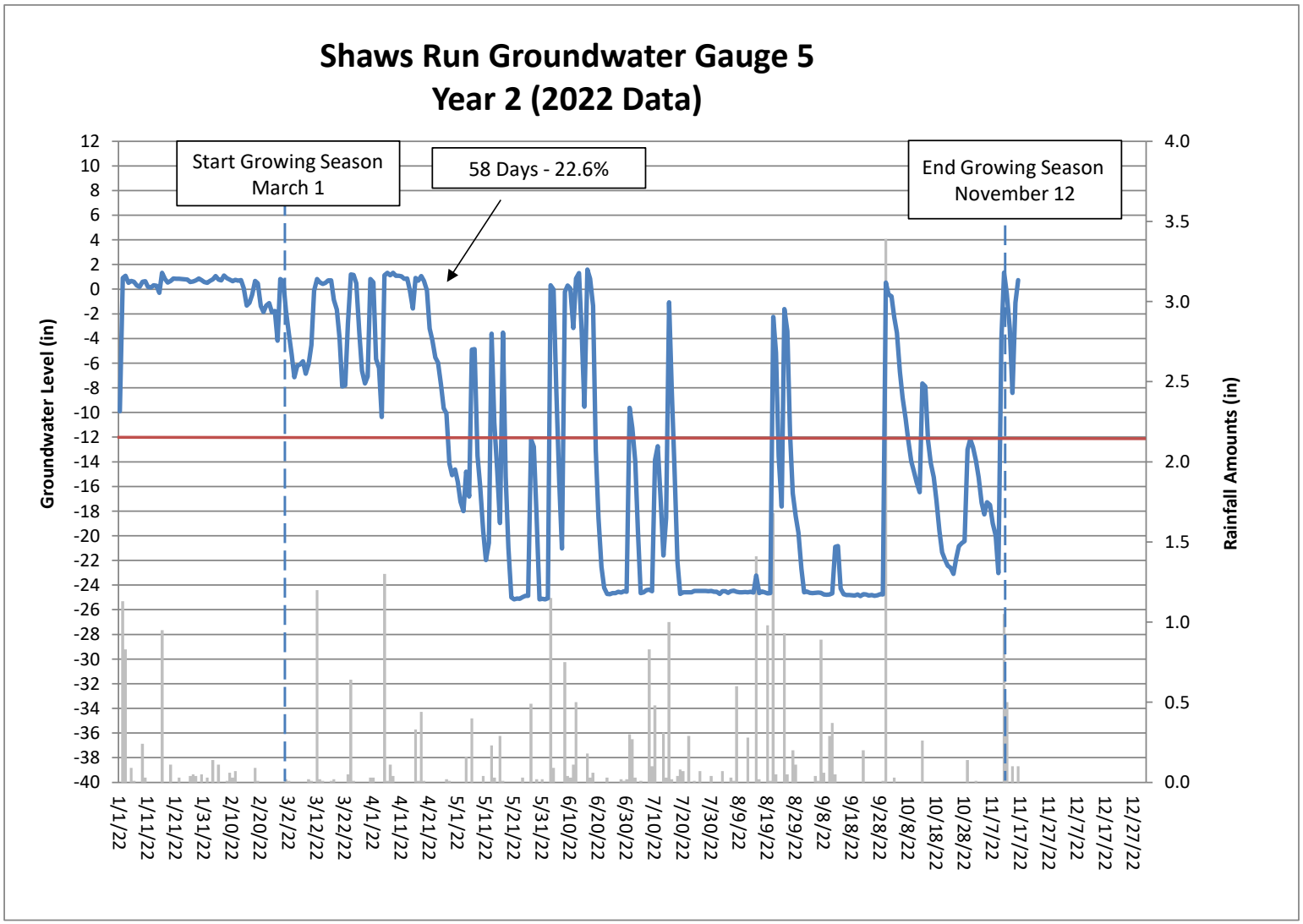
11/27/22
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 5
Year 2 (2022 Data)
Start Growing Season
March 1
58 Days - 22.6%
End Growing Season
November 12
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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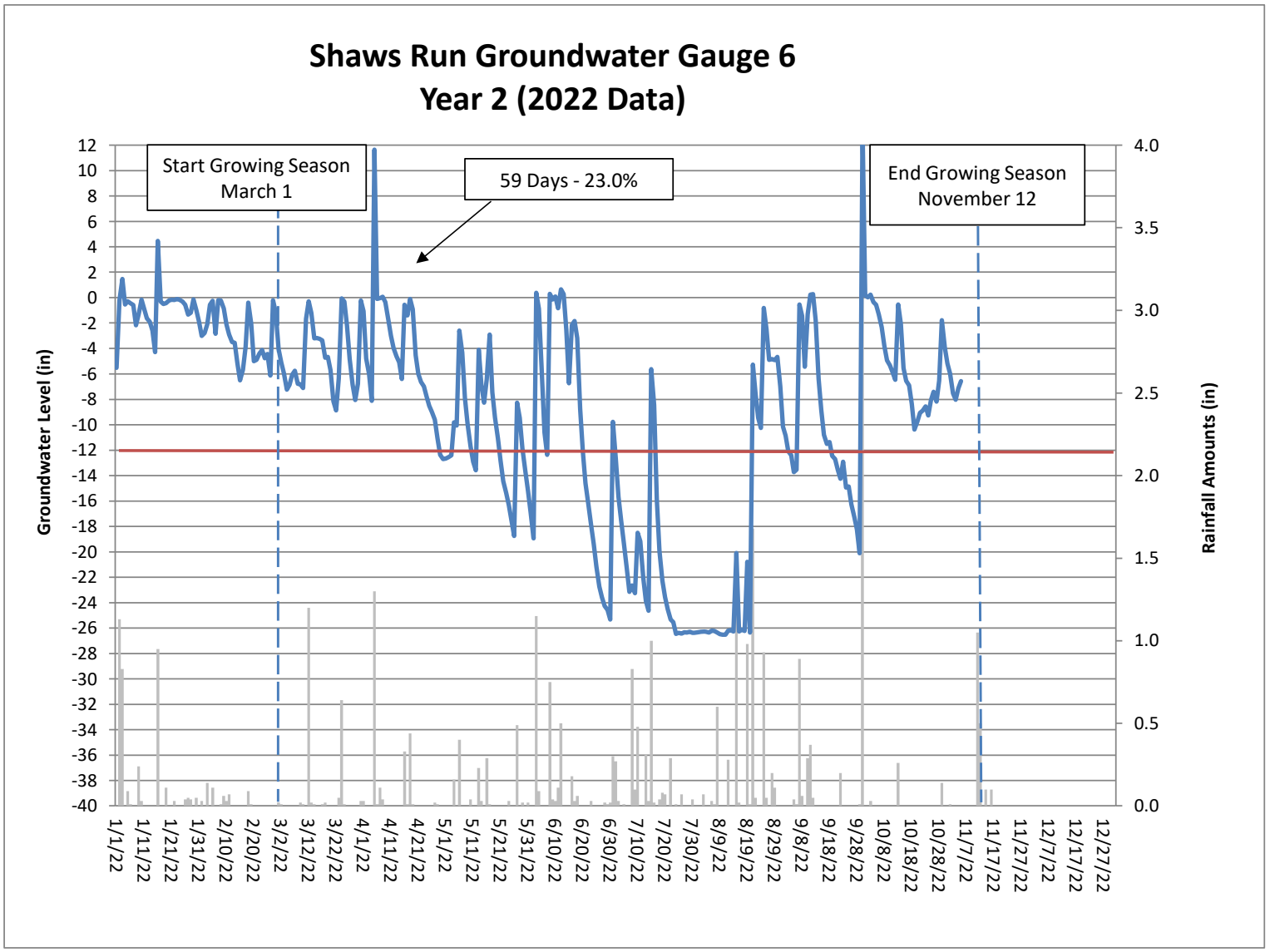
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 6
Year 2 (2022 Data)
Start Growing Season
March 1
59 Days - 23.0%
End Growing Season
November 12
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
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6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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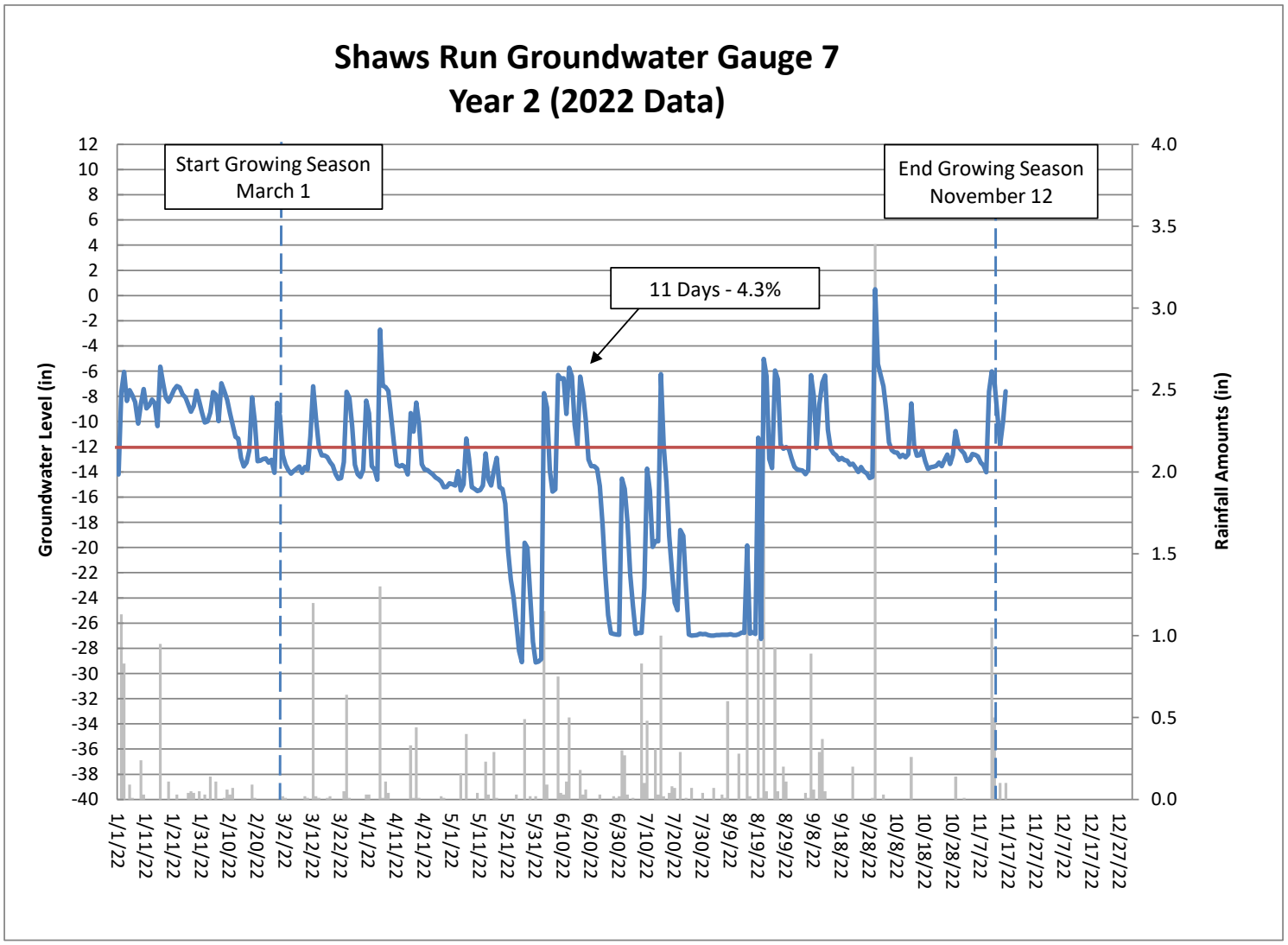
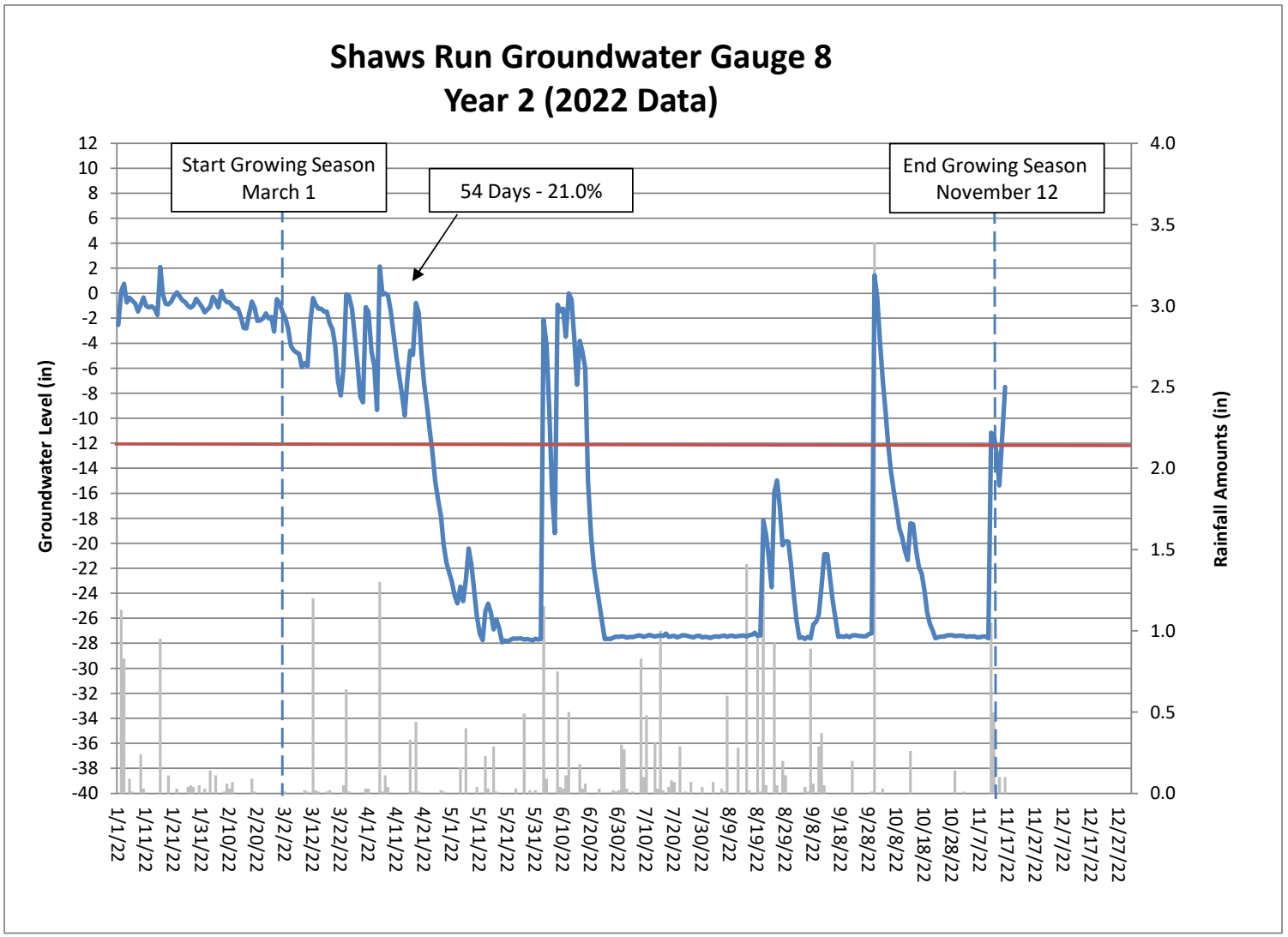
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 7
Year 2 (2022 Data)
Start Growing Season
March 1
End Growing Season
November 12
11 Days - 4.3%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22


Shaws Run Groundwater Gauge 8
Year 2 (2022 Data)
Start Growing Season
March 1
54 Days - 21.0%
End Growing Season
November 12
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
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11/27/22
12/7/22
12/17/22
12/27/22

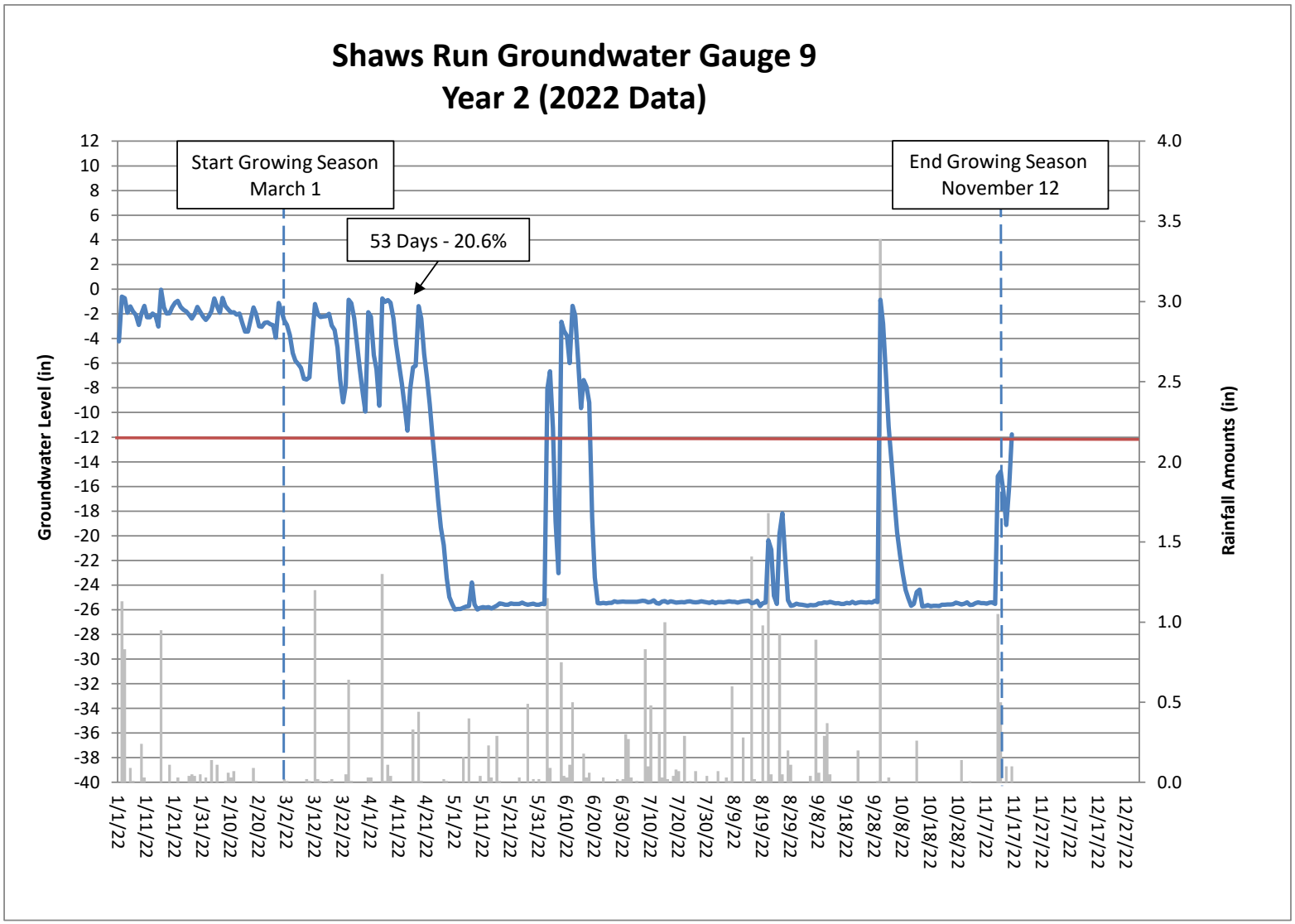

Shaws Run Groundwater Gauge 9
Year 2 (2022 Data)
Start Growing Season
March 1
End Growing Season
November 12
53 Days - 20.6%
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

Table 14A. UT-1 Upstream Channel Evidence

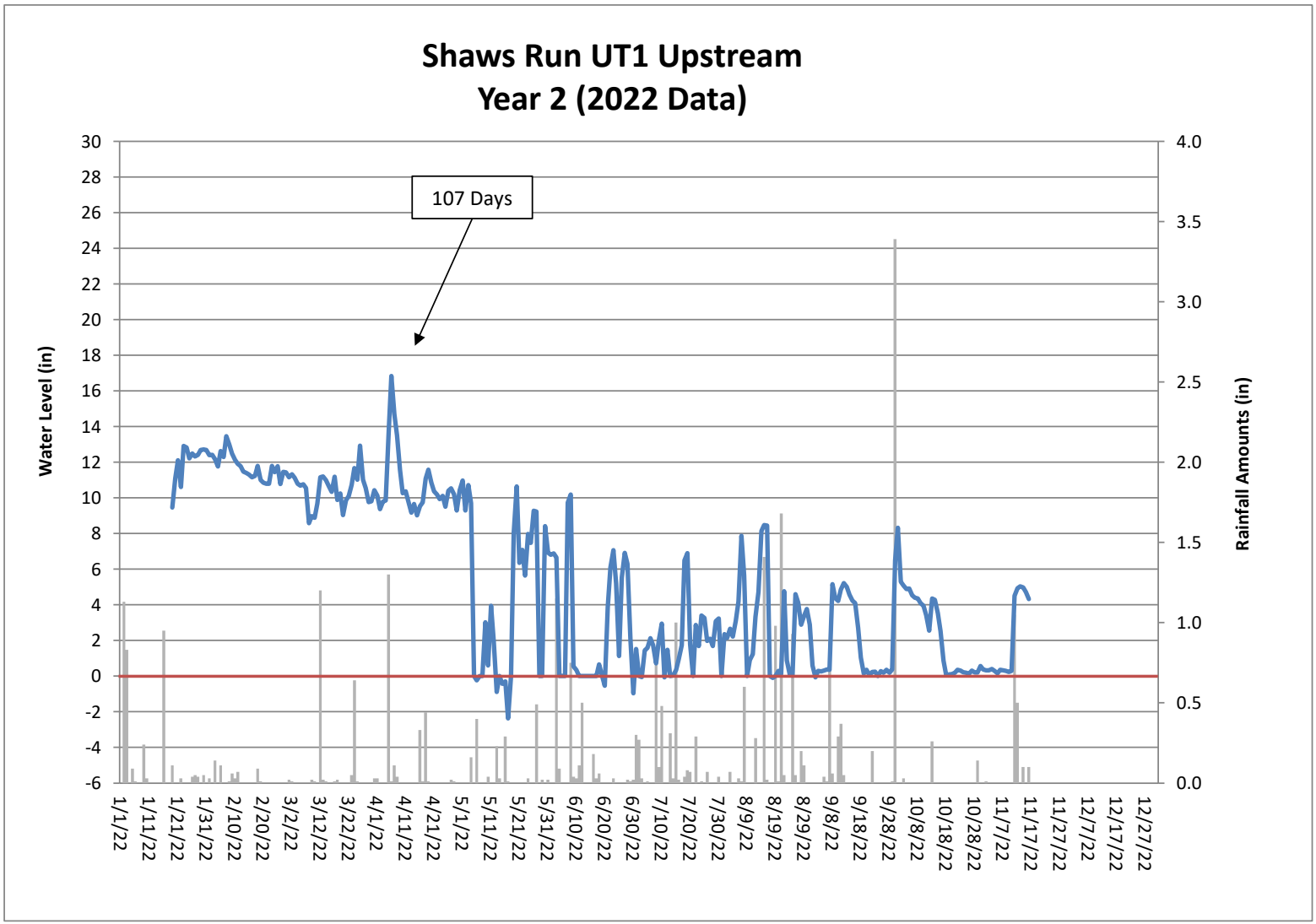
UT-1 Upstream Channel Evidence	Year 1 (2021)	Year 2 (2022)
Max consecutive days channel flow	107	107
Presence of litter and debris (wracking)	Yes	Yes
Leaf litter disturbed or washed away	Yes	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes	Yes
Sediment deposition and/or scour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

Table 14B. UT-1 Downstream Channel Evidence

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

Table 14C. UT-2 Channel Evidence

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


Shaws Run UT1 Upstream
Year 2 (2022 Data)
107 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
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
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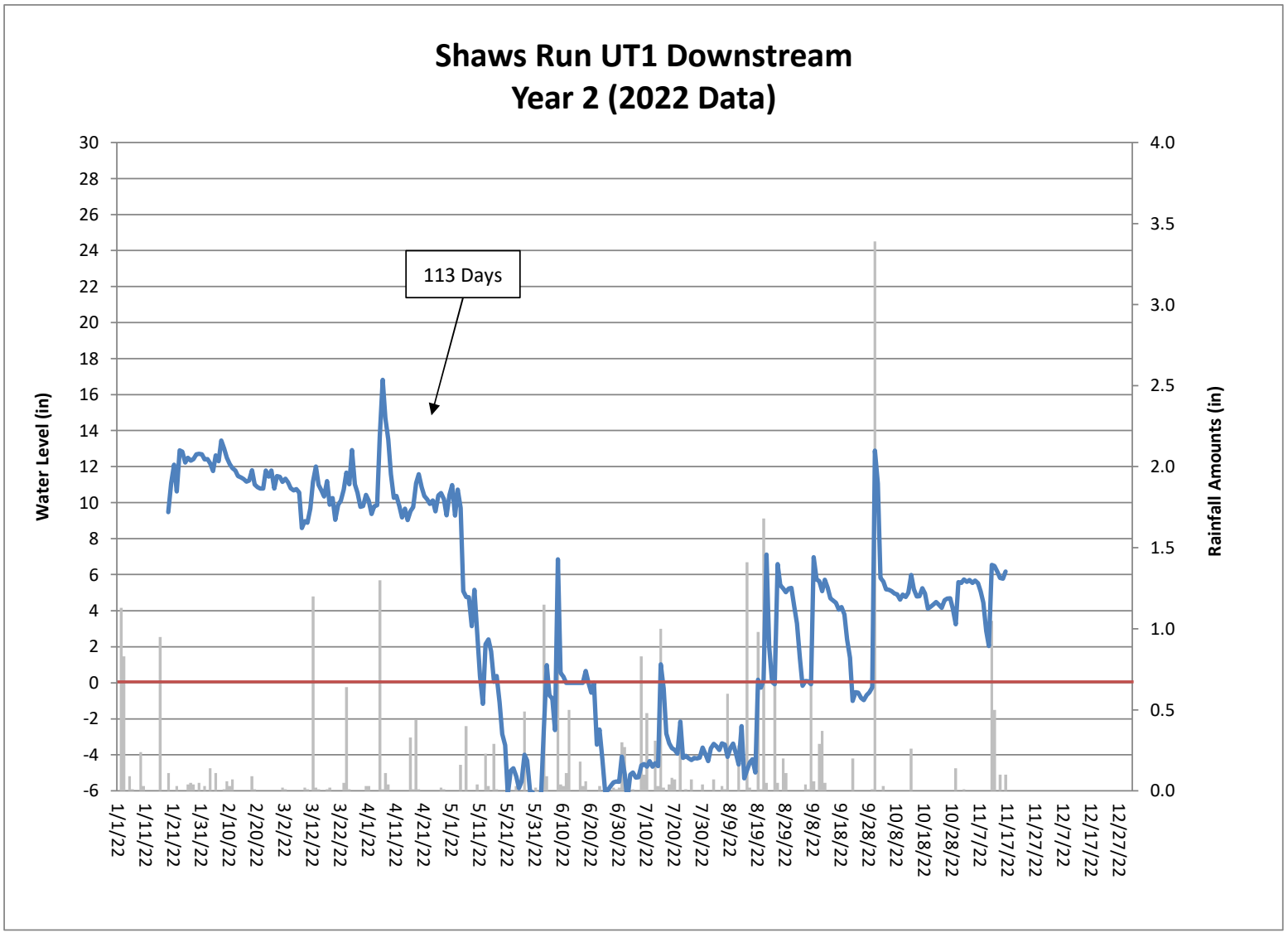
11/27/22
12/7/22
12/17/22
12/27/22


Shaws Run UT1 Downstream
Year 2 (2022 Data)
113 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
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
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11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

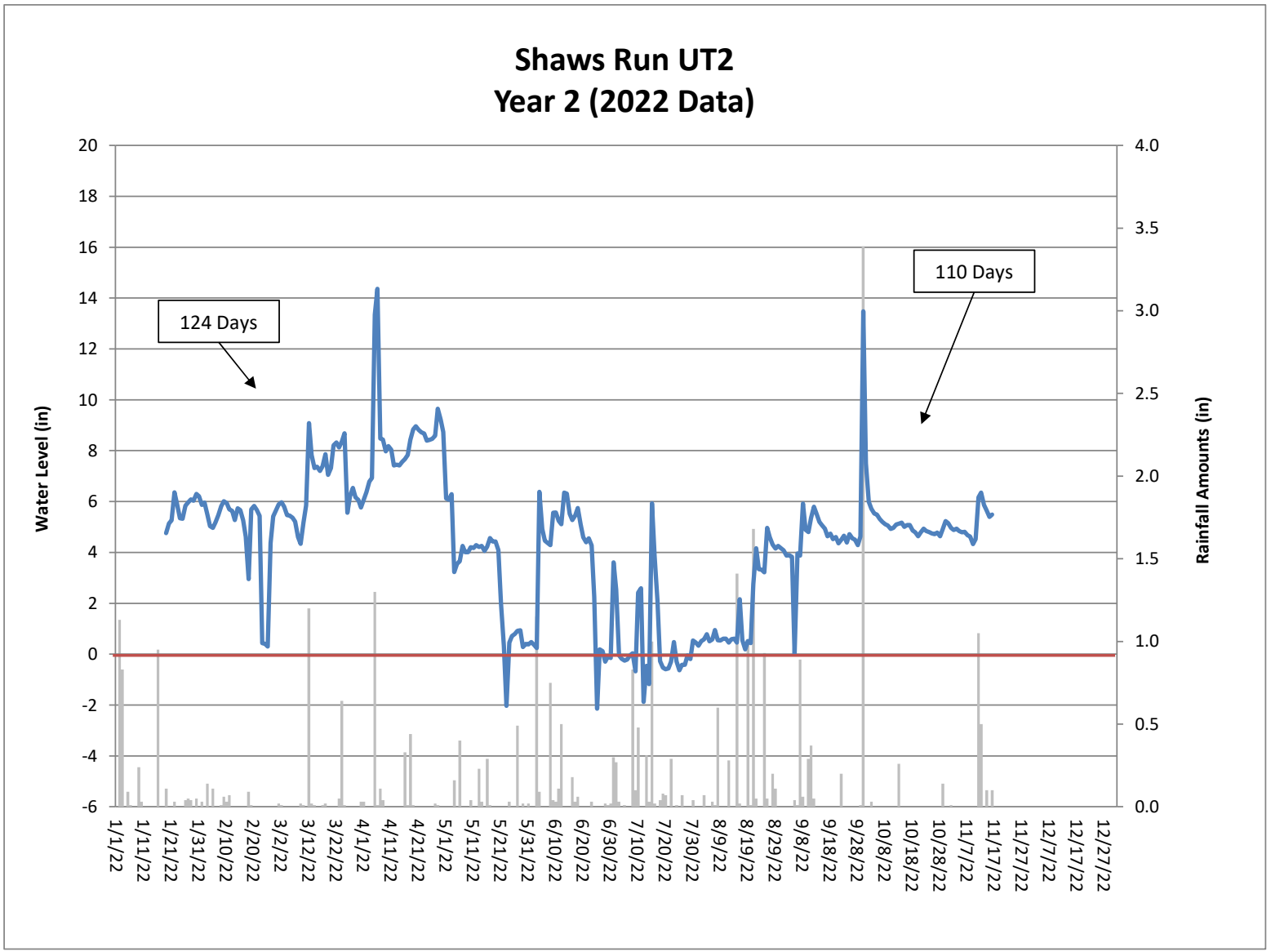
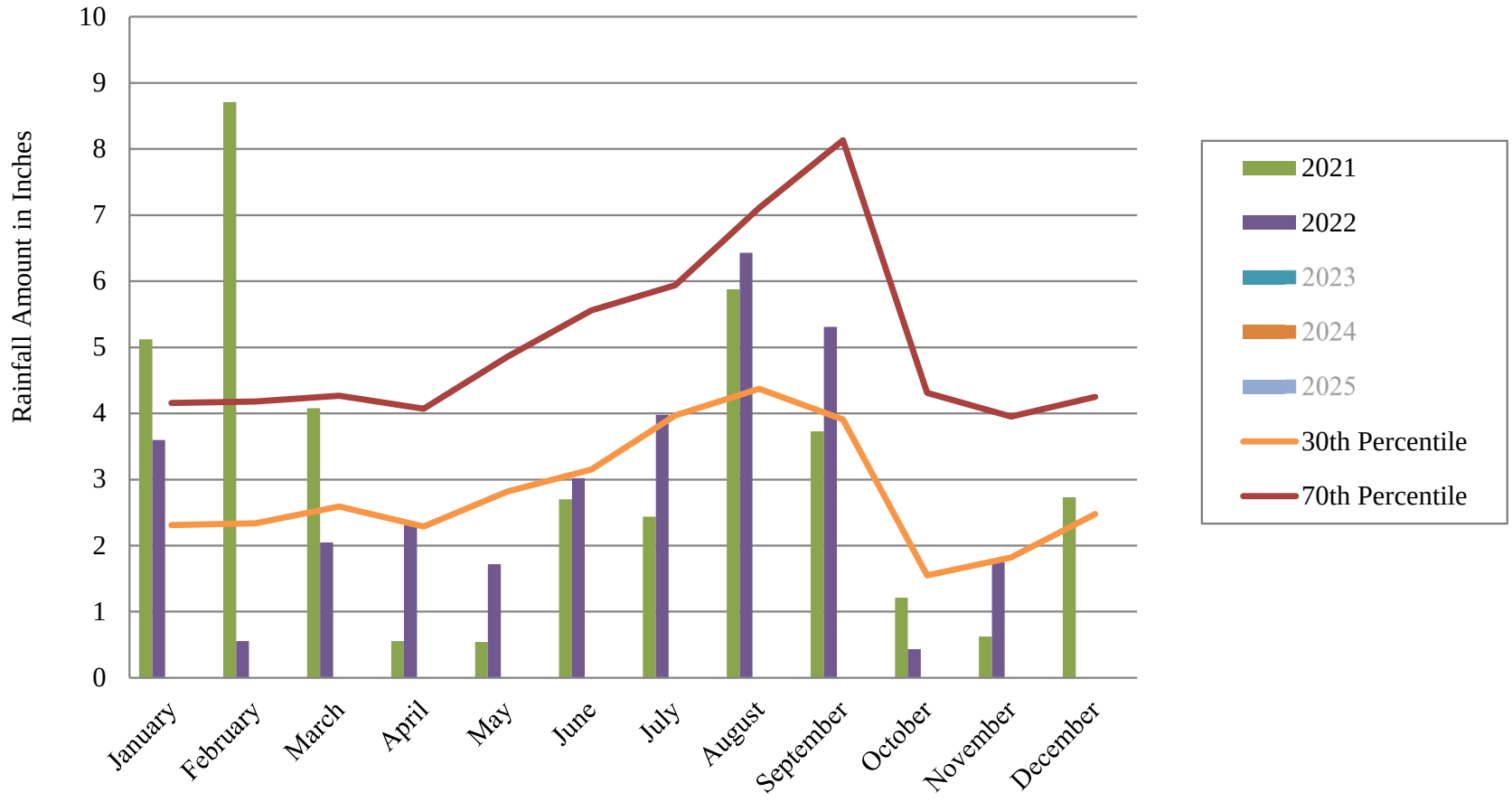
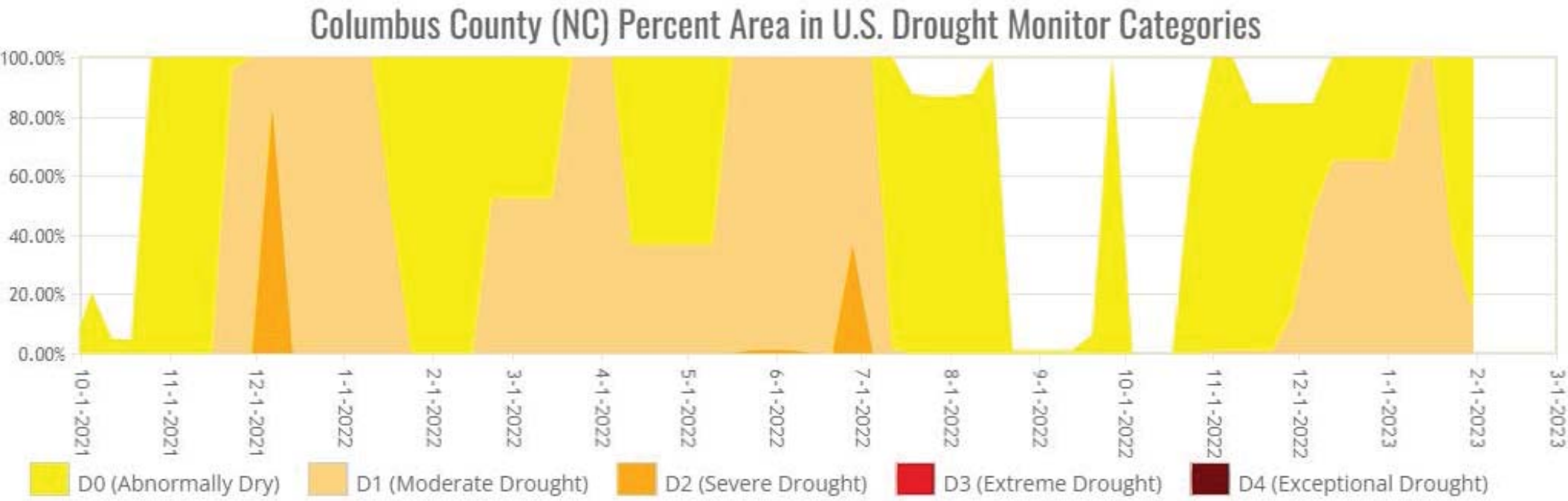
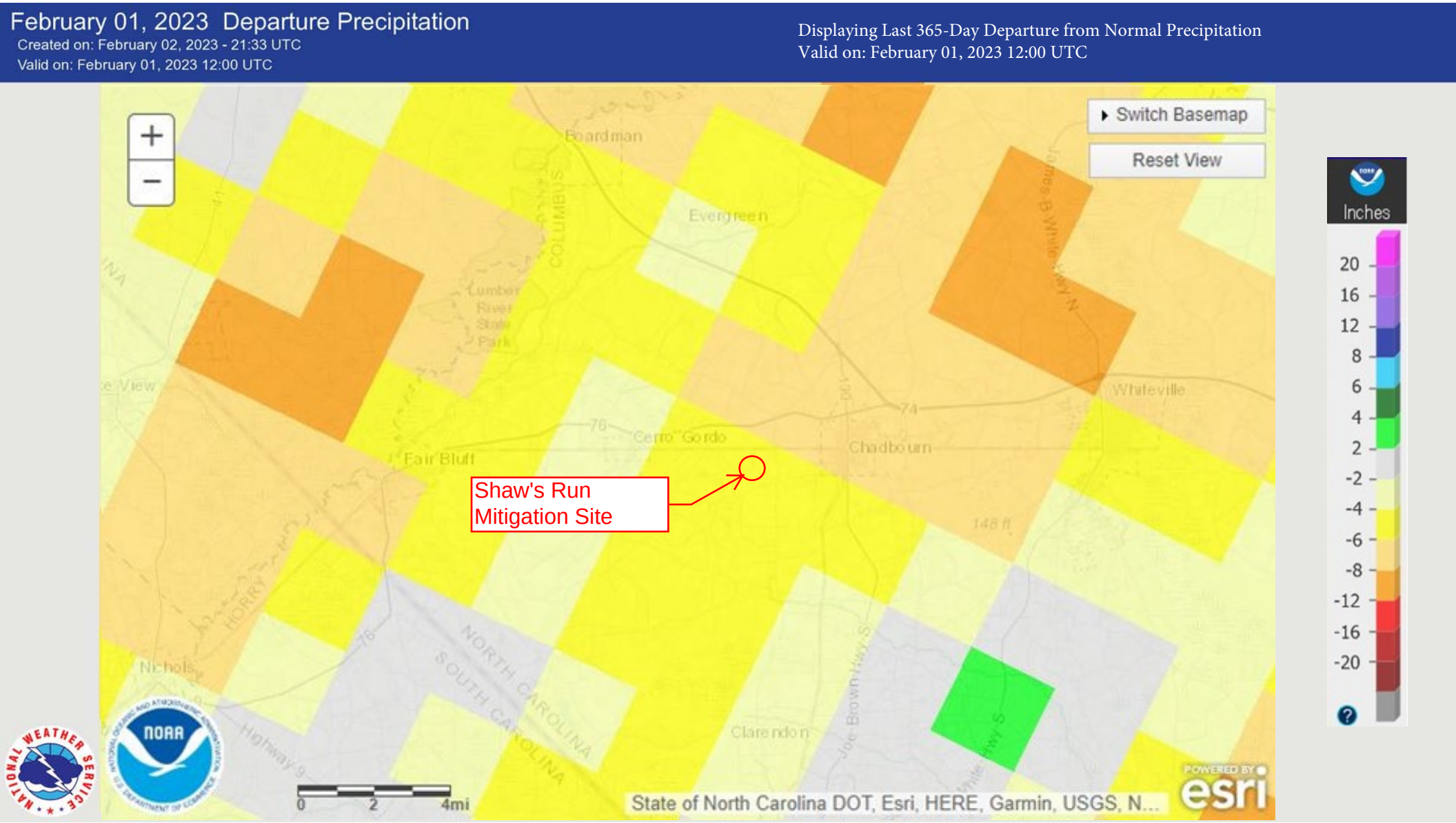

Shaws Run UT2
Year 2 (2022 Data)
Water Level (in)
Rainfall Amounts (in)
124 Days
110 Days
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22

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

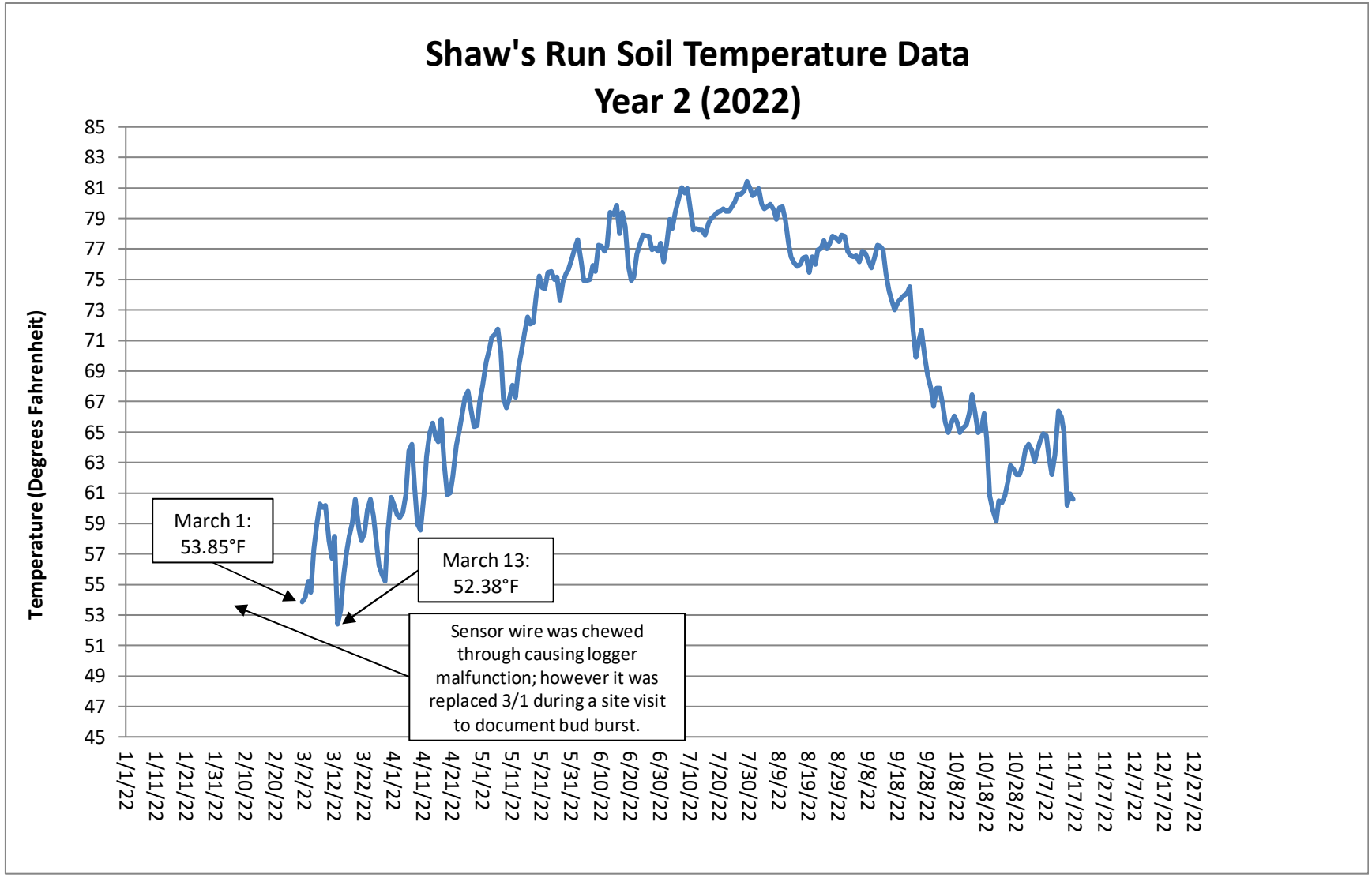




US Drought Monitor, https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx (accessed Feb. 2, 2023)



US Dept of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
1325 East West Highway
Silver Spring, MD 20910
https://water.weather.gov/precip/index.php (accessed Feb. 2, 2023)


Shaw's Run Soil Temperature Data
Year 2 (2022)
Temperature (Degrees Fahrenheit)
85
83
81
79
77
75
73
71
69
67
65
63
61
59
57
55
53
51
49
47
45
1/1/22
1/11/22
1/21/22
1/31/22
2/10/22
2/20/22
3/2/22
3/12/22
3/22/22
4/1/22
4/11/22
4/21/22
5/1/22
5/11/22
5/21/22
5/31/22
6/10/22
6/20/22
6/30/22
7/10/22
7/20/22
7/30/22
8/9/22
8/19/22
8/29/22
9/8/22
9/18/22
9/28/22
10/8/22
10/18/22
10/28/22
11/7/22
11/17/22
11/27/22
12/7/22
12/17/22
12/27/22
March 1: 53.85°F
March 13: 52.38°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

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 – Site Photo Log

Shaw's Run
MY-02 (2022) Photo Log

Photo 1: View Eastward at UT-2

Photo 2: Outfall structure at bottom of site south of GW-1

Shaw's Run
MY-02 (2022) Photo Log

Photo 3: UT-2 Upstream flow gauge

Photo 4: Upper UT-2 flow

Shaw's Run
MY-02 (2022) Photo Log

Photo 5: UT-1 Flow

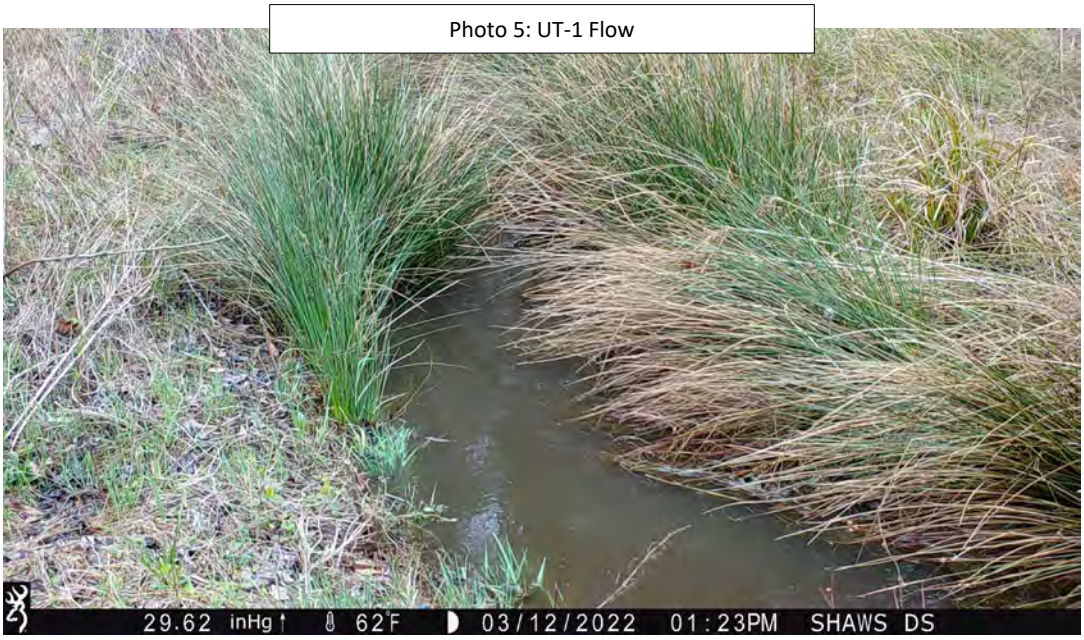


Photo 6: UT-1 Piped Crossing – Upstream End

Shaw's Run
MY-02 (2022) Photo Log

Photo 7: UT-2 Piped Crossing– Upstream End

Photo 8: UT-2 Piped Crossing– Downstream End

Shaw's Run
MY-02 (2022) Photo Log

Photo 9: UT-1 Road Crossing Piped Crossing – Upstream End

Photo 10: UT-1 Road Crossing Piped Crossing – Downstream End

Shaw's Run
MY-02 (2022) Photo Log

Photo 11: Row of *Platanus occidentalis* and *Betula nigra*

Photo 12: UT-2 flow moving detritus downstream

Shaw's Run
MY-02 (2022) Photo Log

Photo 13: UT-1 adjacent to plot 3

Photo 14: Snags along right bank of UT1 near vegetation plot 3

Shaw's Run
MY-02 (2022) Photo Log

Photo 15: UT-1 & UT-2 confluence

Photo 16: Chinese privet budding
Photo taken 3/1/22

Shaw's Run
MY-02 (2022) Photo Log

Photo 17: Bud burst on *Platanus occidentalis*
Photo taken 3/1/22

Photo 18: *Prunus serotina* buds and blooms
Photo taken 3/1/22

Shaw's Run
MY-02 (2022) Photo Log

Photo 19: *Gelsemium sempervirens* blooms
Photo taken 3/1/22

Photo 20: Southward view from UT-1 & UT-2 confluence