

MY1 MONITORING REPORT

CRANE STREAM AND WETLAND MITIGATION SITE

Lee County, North Carolina
Cape Fear River Basin
Cataloging Unit 03030002

DMS Project No. 100165
Full Delivery Contract No. 0302-01
DMS RFP No. 16-20190302 (issued 12/20/2019)
USACE Action ID No. SAW-2020-01401
DWR Project No. 20201292

Data Collection: January 2023-November 2023
Submission: February 2024



Prepared for:

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



Crane Year 1, 2023 Monitoring Summary

General Notes

- No encroachment was identified in Year 1 (2023).
- No evidence of nuisance animal activity (i.e., heavy deer browsing, beaver activated, etc.) was observed.

Site Maintenance Report (2023)

Invasive Species Work	Maintenance work
None	None

Streams

- Streams remained stable with little to no deviations from MY0 (Appendix C).
- All engineered structures were stable and functioning within design parameters; no stream areas of concern were documented.
- One bankfull event was documented during MY1 (2023) (Table 11, Appendix D).

Vegetation

- Measurements of the 23 vegetation plots resulted in an average of 503 approved stems/acre. Additionally, sixteen of the seventeen permanent vegetation plots and five out of six temporary transects met the interim success criteria. Plot 9 and Transect 4, were each 1 stem shy of the required stem density.
- In addition to Site vegetation monitoring as laid out in the detailed mitigation plan, the IRT requested 2 additional random vegetation transects (transects 7 and 8) to be measured during MY1. Transect 7 was requested in a wooded wetland enhancement area that was not proposed for planting and transect 8 was requested in an area characterized by dense herbaceous vegetation. Both transects were found to contain no approved/planted stems. Visual observations indicate that the low stem density near transect 8 is extremely localized (<0.1 acre) and is not considered an area of concern at this time.

Wetlands

- Seven of the fifteen groundwater gauges met success criteria during MY1 (2023). Gauges 1, 4, 8, 9, 12, 13, and 14 did not meet success criteria with hydroperiods of 1.8%, 1.8%, 4.4%, 9.8%, 1.3%, 2.7%, and 6.2%, respectively. (Appendix D).
- When compared with 30-year 30-70th percentile rainfall, on-site rainfall amounts were low during February and March (Figure D1, Appendix D), with only 3.49 inches recorded during the nearly-2-month period between February 12 and April 6. Four of the seven gauges that did not meet success criteria dipped below 12 inches from the surface during this period before rising again with each precipitation event. Gauges 8, 9, and 14 dropped below 12 inches around April 18 for 4, 2, and 3 days respectively; otherwise, they would have exceeded the 12% hydroperiod required for wetland success. It is expected that with normal rainfall early in the growing season, the groundwater would be sufficiently recharged at the start of the growing season, and all gauges would have met hydrology success criteria.

Yr. 1 (2023) Groundwater Hydrology Data

Gauge	12% Hydroperiod Success Criteria Achieved - Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2023)	Year 2 (2024)	Year 3 (2025)	Year 4 (2026)	Year 5 (2027)	Year 6 (2028)	Year 7 (2029)
1	No – 4 Days (1.8%)						
2	Yes – 42 Days (18.7%)						
3	Yes – 45 Days (20.0%)						
4	No – 4 Days (1.8%)						
5	Yes – 27 Days (12.0%)						
6	Yes – 29 Days (12.9%)						
7	Yes – 57 Days (25.3%)						
8	No – 10 Days (4.4%)						
9	No – 22 Days (9.8%)						
10	Yes – 81 Days (36.0%)						
11	Yes – 73 Days (32.4%)						
12	No – 3 Days (1.3%)						
13	No – 6 Days (2.7%)						
14	No – 14 Days (6.2%)						
15	Yes – 32 Days (14.2%)						

Site Monitoring Activity and Reporting History

Project Milestones	Stream Monitoring Complete	Vegetation Monitoring Complete	Wetland Monitoring	Data Analysis Complete	Completion or Delivery
Construction Earthwork	--	--	--	--	July 2022
Planting	--	--	--	--	February 3, 2023
As-Built Documentation	January 26, 2023	February 8, 2023	--	February 2023	April 2023
Year 1 Monitoring	August 8, 2023	August 25, 2023	Feb. – Nov. 2023	November 2023	December 2023

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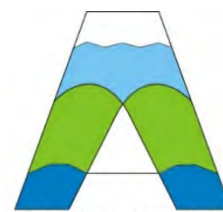


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1 PROJECT SUMMARY

Restoration Systems, LLC has established the North Carolina Division of Mitigation Services (NCDMS) Crane Stream and Wetland Mitigation Site (Site). The Site is on three land parcels along unnamed tributaries to Little Crane Creek in the Sandhills Ecoregion of North Carolina. Located in the Cape Fear River Basin, cataloging unit 03030002, the Site is in the Targeted Local Watershed (TLW) 03030004070010 and North Carolina Division of Water Resources (NCDWR) subbasin number 03-06-14. The Site is located within a Local Watershed Plan (LWP), Hydrology Targeted Resource Area (TRA), and Water Quality TRA due to modifications/stressors in the watershed. Site hydrology drains to unnamed tributaries and into Little Crane Creek (Stream Index Number 18-23-16-4), assigned a Best Usage Classification of WS-III (NCDWR 2021). Little Crane Creek is not listed on the NCDENR draft 2018 or final 2016 303(d) lists (NCDEQ 2018a, NCDEQ 2018b). Site watershed sizes range from approximately 0.02 square miles (12.2 acres) on UT3 to 0.15 square miles (97.5 acres) on UT 1 at the outfall.

1.1 Project Background, Components, and Structure

Located approximately 2 miles southwest of Lemon Springs, 8 miles southwest of Sanford, NC, and west of Rocky Fork Church Road (SR 1179) in Lee County, the Site encompasses 27.7 acres. Mitigation work within the Site included 1) stream restoration, 2) stream enhancement (Level II), 3) wetland reestablishment, 4) wetland rehabilitation, 5) wetland enhancement, and 6) vegetation planting. The Site is expected to provide 3,533 Stream Mitigation Units (SMUs) and 14.593 Riparian Wetland Mitigation Units (WMUs) by closeout (Table 1, Page 2). A conservation easement was granted to the State of North Carolina and recorded at the Lee County Register of Deeds on June 22, 2021.

Before construction, land use at the Site was characterized by livestock pasture and disturbed forest. Site design was completed in February 2022. Construction started on June 6, 2022 and ended within a final walkthrough on July 15, 2022. The Site was planted on February 3, 2023. Completed project activities, reporting history, completion dates, and project contacts are summarized in Tables 11-12 (Appendix E).

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Table 1. Crane Mitigation Site (ID-100165) 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							
UT 1, Reach 1	694	694	Warm	EII	2.5	237.600	Straight-line valley length used for credit calculation at request of IRT 60 foot easement break for crossing
UT 1, Reach 2 (above crossing)	1335	1330	Warm	R	1.0	1335.000	
UT 1, Reach 2 (below crossing)	267	265	Warm	R	1.0	267.000	
UT 1, Reach 3	232	233	Warm	EII	2.5	93.200	
UT 2, Reach 1	437	425	Warm	R	1.0	437.000	
UT 2, Reach 2	88	88	Warm	EII	2.5	35.200	
UT 3	463	451	Warm	R	1.0	463.000	
UT 4	422	414	Warm	R	1.0	422.000	
UT 5	243	241	Warm	R	1.0	243.000	
					Total:	3533.000	
Wetland							
Wetland Reestablishment	8.815	8.815	R	REE	1.00000	8.815	
Wetland Rehabilitation	0.683	0.683	R	RH	1.50000	0.455	
Wetland Enhancement	10.646	10.646	R	E	2.00000	5.323	
					Total:	14.593	

Project Credits

Restoration Level	Stream			Riparian	Non-Rip	Coastal
	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	3167.000	0.000	0.000	0.000	0.000	0.000
Re-establishment				8.815	0.000	0.000
Rehabilitation				0.455	0.000	0.000
Enhancement				5.323	0.000	0.000
Enhancement I	0.000	0.000	0.000			
Enhancement II	366.000	0.000	0.000			
Creation				0.000	0.000	0.000
Preservation	0.000	0.000	0.000	0.000	0.000	
Totals	3,533.000	0.000	0.000	14.593	0.000	0.000

Total Stream Credit 3,533.000

Total Wetland Credit 14.593

Wetland Mitigation Category

CM Coastal Marsh
R Riparian
NR Non-Riparian

Restoration Level

P Preservation
E Wetland Enhancement
EII Stream Enhancement II
EI Stream Enhancement I
C Wetland Creation
RH Wetland Rehabilitation
REE Wetland Re-establishment
R Restoration

Table 2: Summary: Goals, Performance and Results

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain. Remove overburden to reconnect with adjacent wetlands.	Dispersion of high flows on the floodplain, an increase in biogeochemical cycling within the system, and recharging of riparian wetlands.	<ul style="list-style-type: none"> The stream 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. 	2 crest gauges (pressure transducers) on UT1 and UT2, and documentation of visual/physical evidence of bankfull events	To be determined
Improve stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	<ul style="list-style-type: none"> All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period. Intermittent streams will demonstrate at least 30-days consecutive flow annually. 	Total of 16 cross-sections on restored channels and surface flow gauges on UT2, UT3, UT4, and UT5.	Site streams are stable, functioning as designed, and stream measurements are within design parameters.
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams, increased	<ul style="list-style-type: none"> 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. Natural recruits can only be counted toward success after they have been in the ground for 2 years. Areas of herbaceous vegetation establishment will have a minimum of four species present. 	17 permanent vegetation plots, 6 random vegetation plots, and 3 random herbaceous plots spread across the Site	All plots meeting performance criteria during MY0. Herbaceous plots will be surveyed beginning MY1 to allow time for herbaceous vegetation to establish.
Restore and enhance groundwater hydrology to drained or impacted hydric soil areas.	Reduce channel depth in incised stream reaches, fill drainage ditches, and alleviate soil compaction from agriculture activities.	Particulate and pollution conversion, groundwater storage and reduced downstream flooding, habitat diversification, and vegetative composition conversion.	<ul style="list-style-type: none"> Annual 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. 	15 groundwater gauges spread throughout restored wetlands	To be determined

Note: Onsite rain data will be collected throughout each monitoring period.

Table 3. Project Attribute Table					
Project Name	Crane Mitigation Site				
County	Lee County, North Carolina				
Project Area (acres)	27.66				
Project Coordinates (latitude and longitude decimal degrees)	35.367351°N, 79.222369°W				
Project Watershed Summary Information					
Physiographic Province	Sand Hills				
River Basin	Cape Fear				
USGS Hydrologic Unit 14-digit	3030004070010				
NCDWR Sub-basin	03-06-14				
Project Drainage Area (acres)	120.1				
Project Drainage Area Percentage of Impervious Area	<2%				
Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps				
Reach Summary Information					
Parameters	UT 1	UT 2	UT 3	UT4	UT5
Pre-project length of reach (linear feet)	2170	489	345	373	319
Post-project length of reach (linear feet)	2429	525	463	421	243
Valley Classification & Confinement	Rosgen Type VIII and III	Rosgen Type VIII and III	Rosgen Type VIII	Rosgen Type VIII	Rosgen Type VIII
Drainage Area (acres)	97.5	22.6	12.2	13.2	47.4
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Intermittent	Intermittent	Intermittent/Perennial
NCDWR Water Quality Classification	WS III				
Existing Morphological Description (Rosgen 1996)	Eg 5	G 5	Eg 5	Eg 5	Ge 5
Proposed Morphological Description (Rosgen 1996)	Ce 5	Ce 5	Ce 5	Ce 5	Ce 5
Existing Evolutionary Stage (Simon and Hupp 1986)	III/IV	IV	IV	II/III	IV
Wetland Summary Information					
Parameters	Wetlands				
Pre-project (acres)	11.330				
Post-project (acres)	20.146				
Wetland Type (non-riparian, riparian)	Riparian riverine				
Mapped Soil Series	Wehadkee				
Hydric Soil Status	Hydric				
Regulatory Considerations					
Parameters	Applicable?	Resolved?		Supporting Docs?	
Water of the United States - Section 401	Yes	Yes		Section 401 Certification	
Water of the United States - Section 404	Yes	Yes		Section 404 Permit	
Endangered Species Act	Yes	Yes		CE Document	
Historic Preservation Act	Yes	Yes		CE Document	
Coastal Zone Management Act (CZMA or CAMA)	No	--		NA	
FEMA Floodplain Compliance	Yes	Yes		FEMA Mapping	
Essential Fisheries Habitat	No	--		NA	

1.2 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site North Carolina Stream Assessment Method (NC SAM) data collection (NC SFAT 2015). 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 summarizes Site success criteria.

Table A. Success Criteria

Streams
<ul style="list-style-type: none"> All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. BHR 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 individual years, during the monitoring years 1-7. Intermittent streams will demonstrate at least 30-days consecutive flow.
Wetland Hydrology
<ul style="list-style-type: none"> Annual 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
<ul style="list-style-type: none"> 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. Natural recruits can only be counted toward success after they have been in the ground for 2 years. Herbaceous vegetation plots must have a minimum of four species present.

2 METHODS

Monitoring will be conducted in accordance with 2016 North Carolina Interagency Review Team (NCIRT) Guidelines. Monitoring will be conducted by Axiom Environmental, Inc based on the schedule in the following table. A monitoring summary is outlined in the table on page 6. Annual monitoring reports will be submitted to the NCDMS by Restoration Systems no later than December 31 of each monitoring year data is collected.

Table B. 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

Table C. Monitoring Summary

Stream Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photographs
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period	6 surface water gauges; 1 on UT 1, 2 on UT 2, 1 on UT 3, 1 on UT 4, and 1 on UT 5	Surface water data for each monitoring period
Bankfull Events	Continuous monitoring of surface water gauges and/or trail camera	Continuous recording through the monitoring period		Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through the monitoring period	All restored stream channels	Visual evidence, photo documentation, and/or rain data.
Wetland Parameters				
Parameter	Method	Schedule/Frequency	Number/Extent	Data Collected/Reported
Wetland Restoration	Groundwater gauges	Years 1- 7 throughout the year with the growing season defined as March 29-November 8* downloaded quarterly	15 gauges spread throughout restored wetlands	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; <i>CVS-EEP Protocol for Recording Vegetation, Version 4.2</i> (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	17 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	6 Random transects spread across the Site	Species and height
	Annual random herbaceous vegetation plots, 0.000247 acre (1 square meter) in size	Years 1, 2, 3, 5, and 7	3 plots located in herbaceous dominated vegetation areas	Number of species in plot and percent cover

* In accordance with IRT request after submittal of the MY0 report, the growing season for this site will be based on the latest 30-year WETS data (Station Sanford 8 NE, NC, 1991-2021) and is defined as March 29 to November 8 (225 days). Soil temperature and bud burst documentation will not be required to verify growing season start dates.

3 MONITORING YEAR 1 – DATA ASSESSMENT

Annual monitoring and site visits were conducted between February 2023 and November 2023 to assess the condition of the project. Stream, wetland, and vegetation criteria for the Site follow the approved success criteria presented in the Mitigation Plan and summarized in Section 1.2; monitoring methods are detailed in Section 3.0.

3.1 Stream Assessment

Morphological surveys for MY1 were conducted on August 8, 2023. All streams within the Site are stable and functioning as designed. Site streams continue to maintain an ordinary high-water mark, and no cross-sections have bank height ratios greater than 1.2. Additionally, UT2, UT3, UT4, and UT5 each maintained flow for well over 30 consecutive days during MY1 with 213, 214, 274, and 181 days, respectively. Refer to Appendix A for the visual stream morphology stability assessment (Tables 4A-E) and stream photographs, Appendix C for stream geomorphology data, and Appendix D for stream flow data. No stream areas of concern were identified during MY1.

3.2 Hydrology Assessment

Seven of the fifteen groundwater gauges met success criteria during MY1 (2023). Gauges 1, 4, 8, 9, 12, 13, and 14 did not meet success criteria with hydroperiods of 1.8%, 1.8%, 4.4%, 9.8%, 1.3%, 2.7%, and 6.2%, respectively. (Appendix D).

When compared with 30-year 30-70th percentile rainfall, on-site rainfall amounts were low during February and March (Figure D1, Appendix D), with only 3.49 inches recorded during the nearly-2-month period between February 12 and April 6. Four of the seven gauges that did not meet success criteria dipped below 12 inches from the surface during this period before rising again with each precipitation event. Gauges 8, 9, and 14 dropped below 12 inches around April 18 for 4, 2, and 3 days respectively; otherwise, they would have exceeded the 12% hydroperiod required for wetland success. It is expected that with normal rainfall early in the growing season, the groundwater would be sufficiently recharged at the start of the growing season, and all gauges would have met hydrology success criteria.

3.3 Vegetative Assessment

The MY1 vegetative survey was completed on August 25, 2023. Vegetation monitoring resulted in a sitewide stem density average of 503 planted stems per acre, above the interim requirement of 320 stems per acre required at MY3. Additionally, sixteen of the seventeen permanent vegetation plots and five out of six temporary transects met the interim success criteria. Plot 9 and Transect 4, were each 1 stem shy of the required stem density.

In addition to Site vegetation monitoring as laid out in the detailed mitigation plan, the IRT requested 2 additional random vegetation transects (transects 7 and 8) to be measured during MY1. Transect 7 was requested in a wooded wetland enhancement area that was not proposed for planting, and transect 8 was requested in an area characterized by dense herbaceous vegetation. Both transects were found to contain no approved/planted stems. Visual observations indicate that the low stem density near transect 8 is extremely localized (<0.1 acre) and is not considered an area of concern at this time.. Please refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table, and Appendix B for Vegetation Plot Data. No vegetation areas of concern were identified during MY1.

3.4 Monitoring Year 1 Summary

Overall, the Site looks good, is performing as intended, and is on track to meet success criteria. Site vegetation is track to exceed the MY3 interim requirement of 320 planted stems per acre, wetland development is evident, and all streams within the Site are stable and are meeting project goals.

4 REFERENCES

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

North Carolina Department of Environmental Quality (NCDEQ). 2018a. Final 2016 Category 5 Assessments -303(d) List (online). Available: https://files.nc.gov/ncdeq/Water%20Quality/Planning/TMDL/303d/2016/2016_NC_Category_5_303d_list.pdf (February 4, 2019).

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North Carolina Division of Mitigation Services (NCDMS). 2014. Stream and Wetland Mitigation Monitoring Guidelines. North Carolina Department of Environmental Quality, Raleigh, North Carolina.

North Carolina Interagency Review Team (NCIRT). 2016. Wilmington District Stream and Wetland Compensatory Mitigation Update. October 24, 2016.

Appendix A: Visual Assessment Data

Figure 1. Current Conditions Plan View

Table 4A-E. Visual Stream Morphology Stability Assessment Table

Table 5. Vegetation Condition Assessment Table

Vegetation Plot Photographs

Photo Log



Prepared for:



Project:

CRANE MITIGATION SITE

Lee County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by:

KRJ

Date:

DEC 2023

Scale:

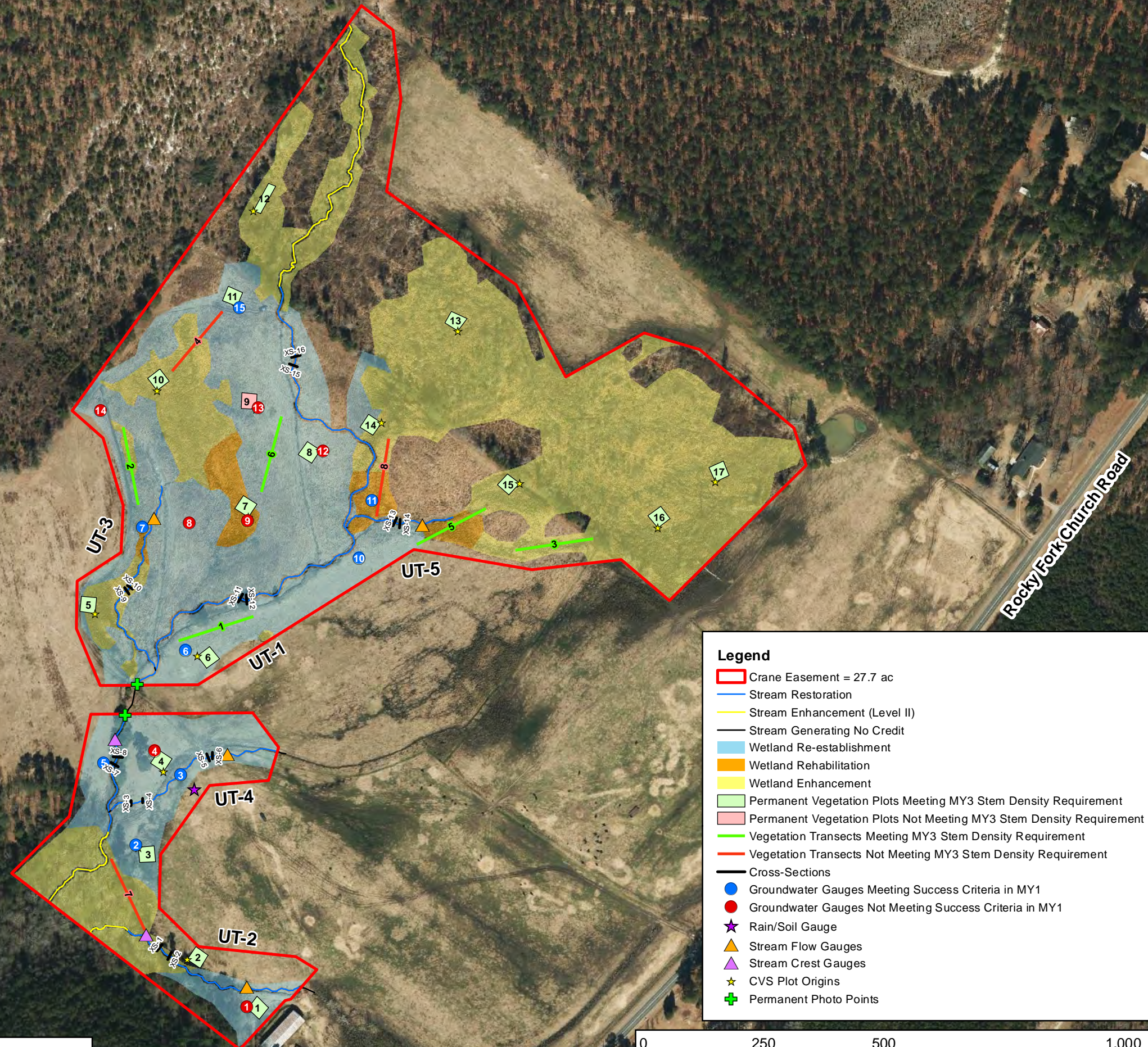
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Project No.:

20-032

FIGURE

1



- Legend**
- Crane Easement = 27.7 ac
 - Stream Restoration
 - Stream Enhancement (Level II)
 - Stream Generating No Credit
 - Wetland Re-establishment
 - Wetland Rehabilitation
 - Wetland Enhancement
 - Permanent Vegetation Plots Meeting MY3 Stem Density Requirement
 - Permanent Vegetation Plots Not Meeting MY3 Stem Density Requirement
 - Vegetation Transects Meeting MY3 Stem Density Requirement
 - Vegetation Transects Not Meeting MY3 Stem Density Requirement
 - Cross-Sections
 - Groundwater Gauges Meeting Success Criteria in MY1
 - Groundwater Gauges Not Meeting Success Criteria in MY1
 - ★ Rain/Soil Gauge
 - ▲ Stream Flow Gauges
 - ▲ Stream Crest Gauges
 - ★ CVS Plot Origins
 - + Permanent Photo Points

Note: Basemap is aerial orthoimagery from 2021 NC OneMap.

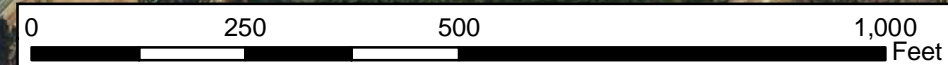


Table 4A. Visual Stream Stability Assessment

Reach UT 1, Reach 2
 Assessed Stream Length 1602
 Assessed Bank Length 3204

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 <u>NOT</u> 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.	35	35		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	35	35		100%

Table 4B. Visual Stream Stability Assessment

Reach UT 2, Reach 1
 Assessed Stream Length 437
 Assessed Bank Length 874

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 <u>NOT</u> 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.	19	19		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	19	19		100%

Table 4C. Visual Stream Stability Assessment

Reach UT 3
 Assessed Stream Length 480
 Assessed Bank Length 960

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 <u>NOT</u> 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.	22	22		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	22	22		100%

Table 4D. Visual Stream Stability Assessment

Reach UT 4
 Assessed Stream Length 427
 Assessed Bank Length 854

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 <u>NOT</u> 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.	14	14		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	14	14		100%

Table 4E. Visual Stream Stability Assessment

Reach UT 5
 Assessed Stream Length 248
 Assessed Bank Length 496

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 <u>NOT</u> 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.	8	8		100%
	Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in DMS monitoring guidance document)	8	8		100%

Table 5. Visual Vegetation Assessment

Planted acreage

26.2

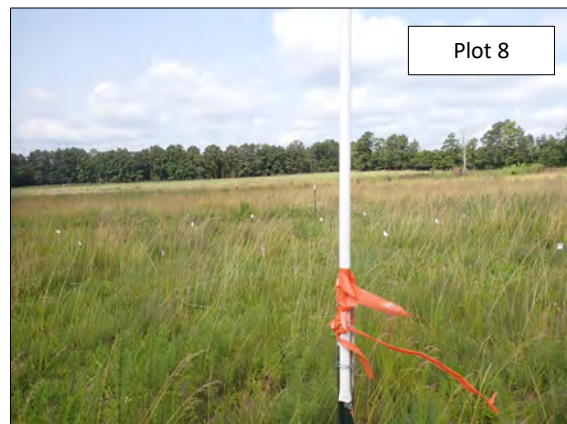
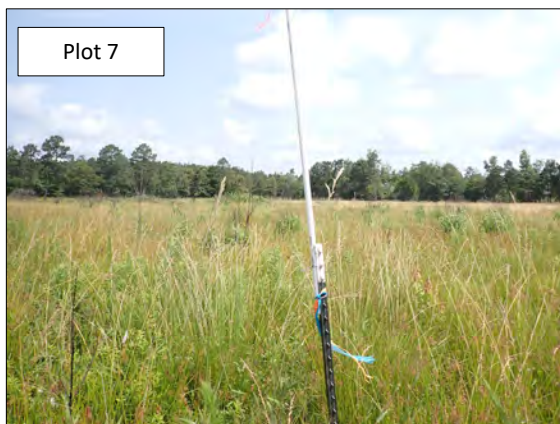
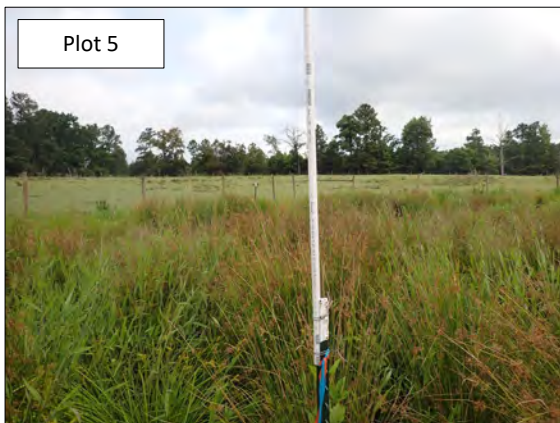
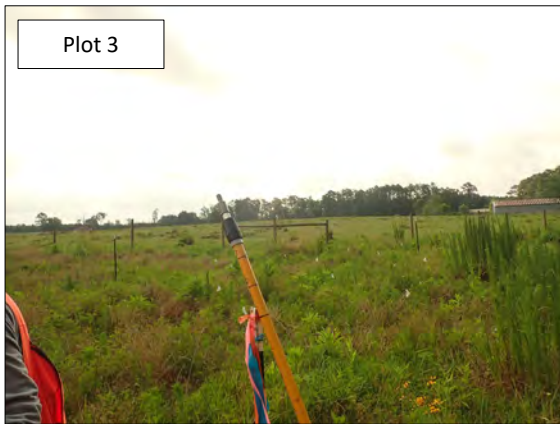
Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10 acres	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

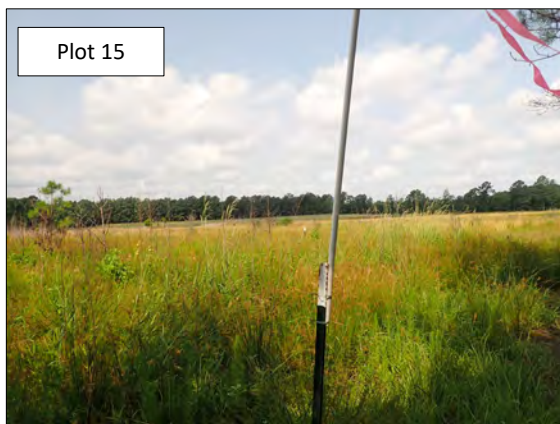
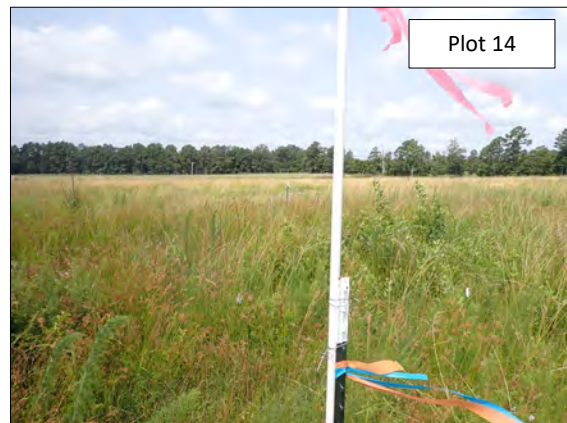
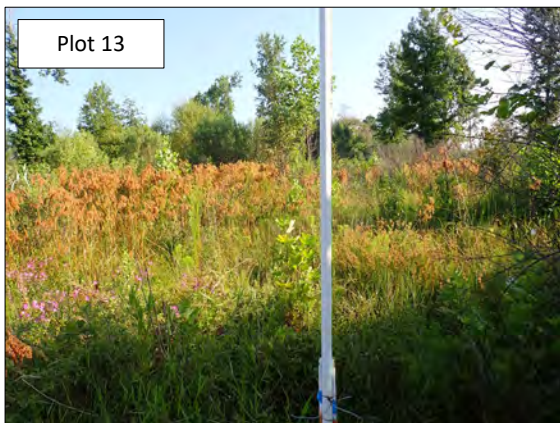
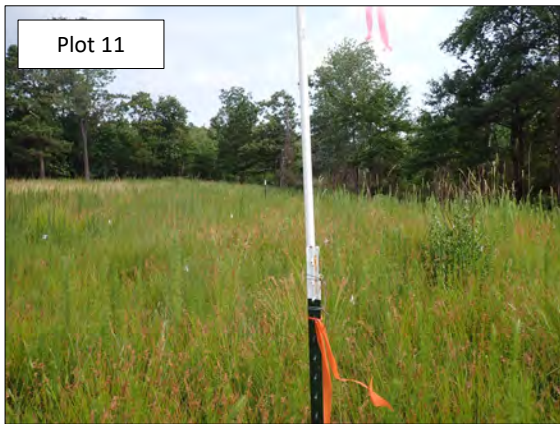
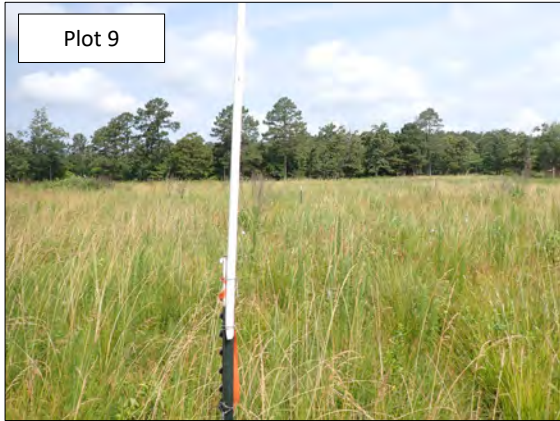
27.66

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	

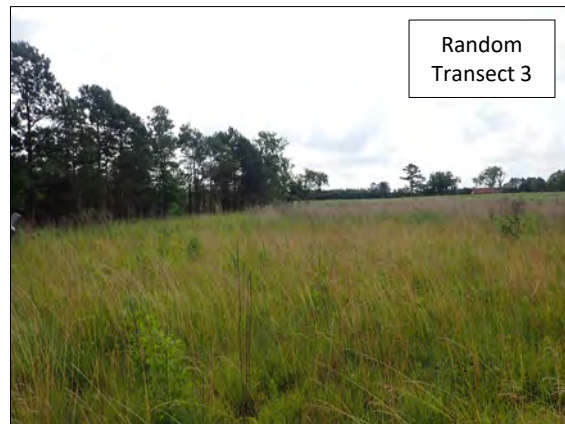
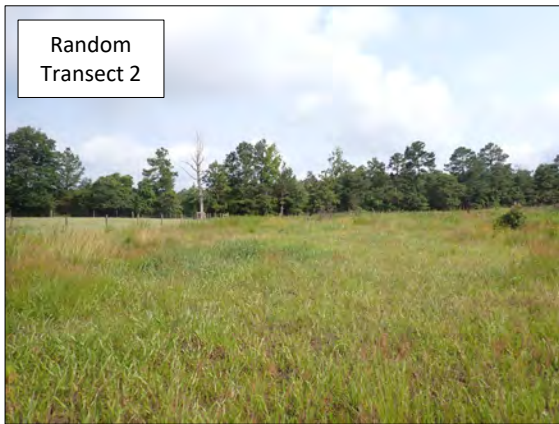
Crane Mitigation Site
MY1 (2023) Vegetation Monitoring Photographs (taken August 25, 2023)



Crane Mitigation Site
MY1 (2023) Vegetation Monitoring Photographs (taken August 25, 2023)



Crane Mitigation Site
MY1 (2023) Vegetation Monitoring Photographs (taken August 25, 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

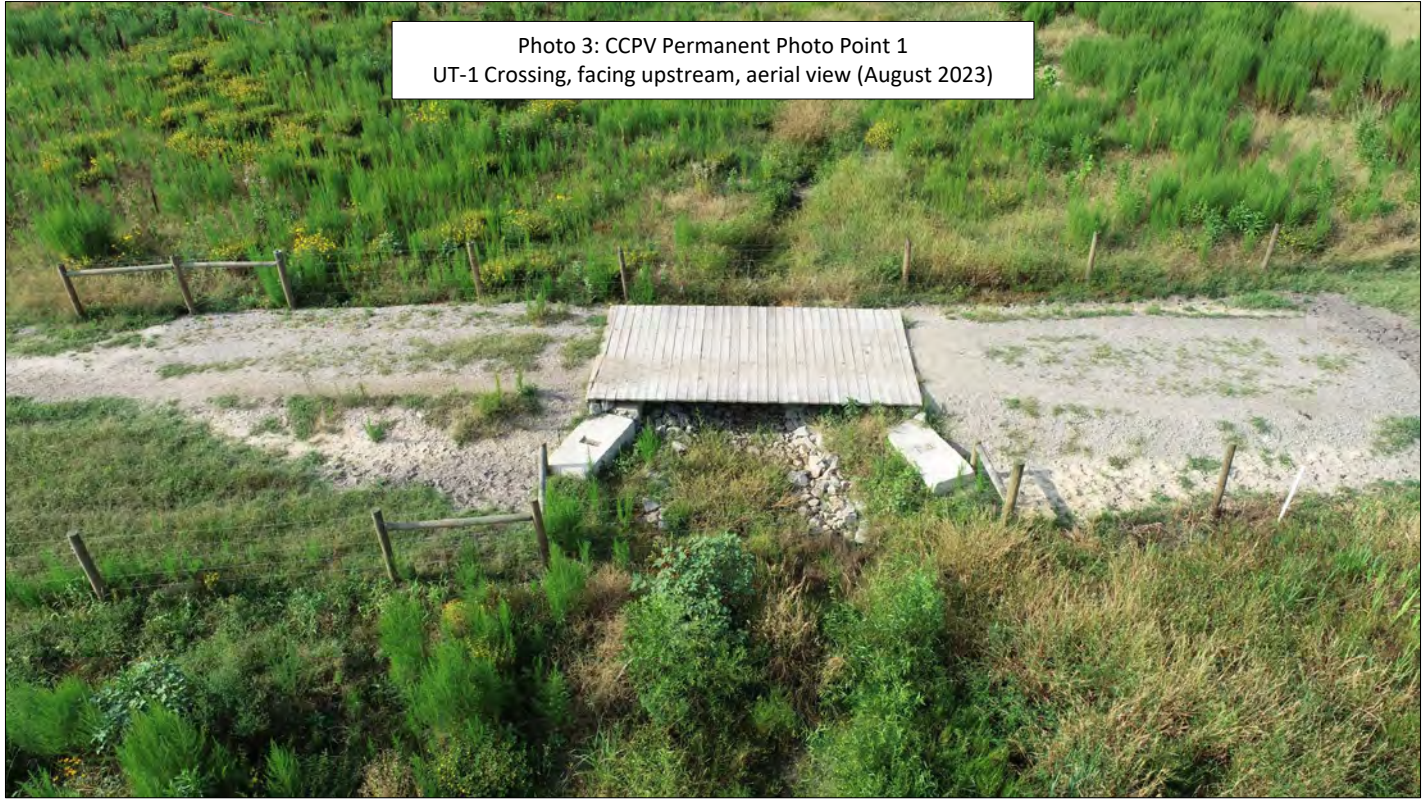


Photo 3: CCPV Permanent Photo Point 1
UT-1 Crossing, facing upstream, aerial view (August 2023)

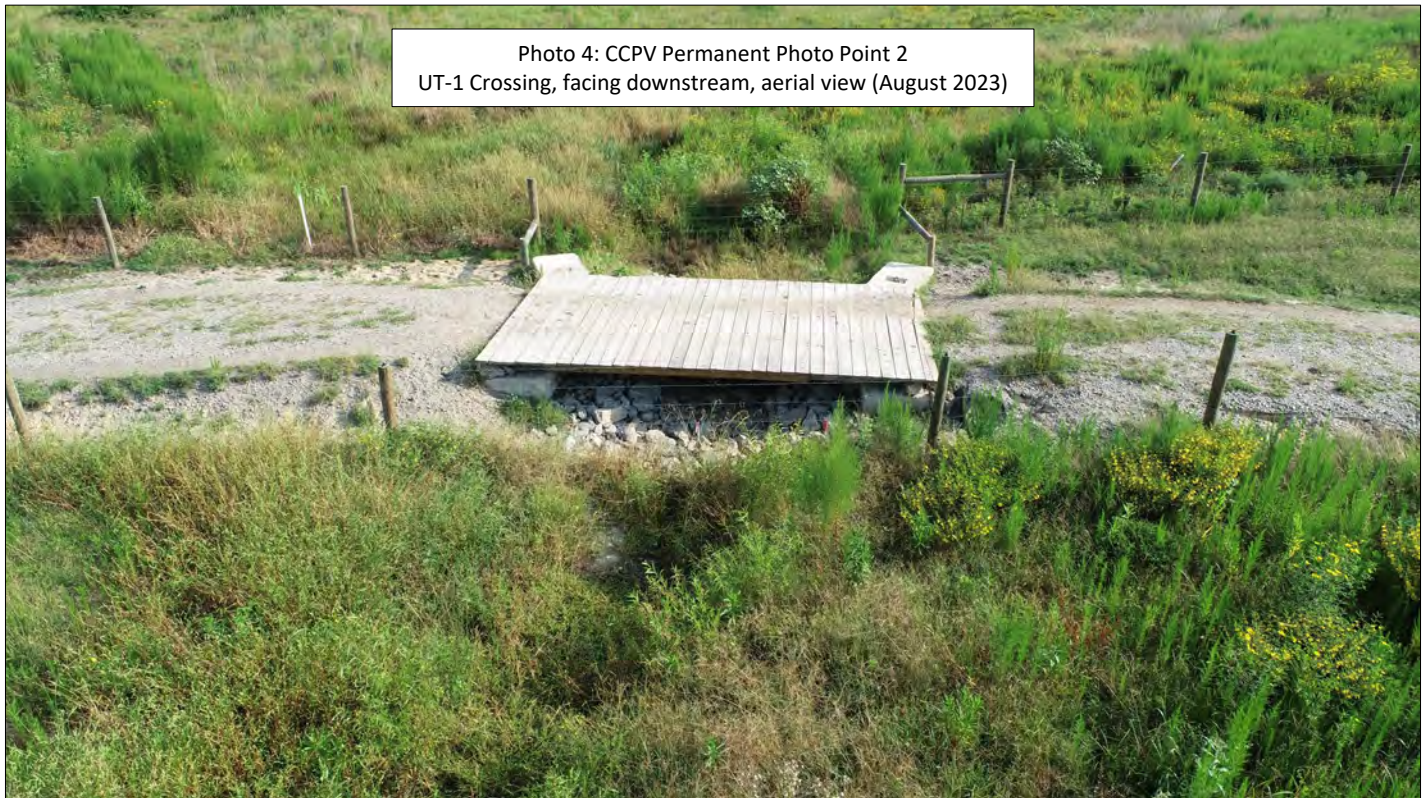


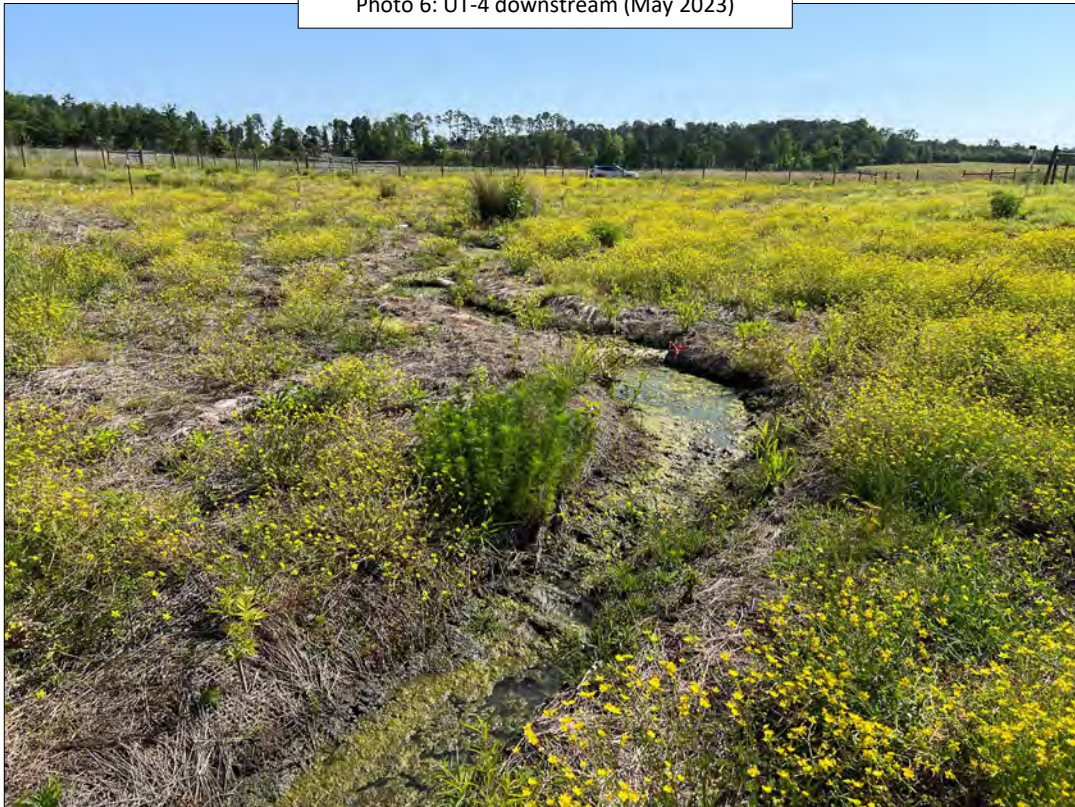
Photo 4: CCPV Permanent Photo Point 2
UT-1 Crossing, facing downstream, aerial view (August 2023)

**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 5: UT-4 upstream (May 2023)



Photo 6: UT-4 downstream (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 7: UT-1 & UT-4 confluence (May 2023)

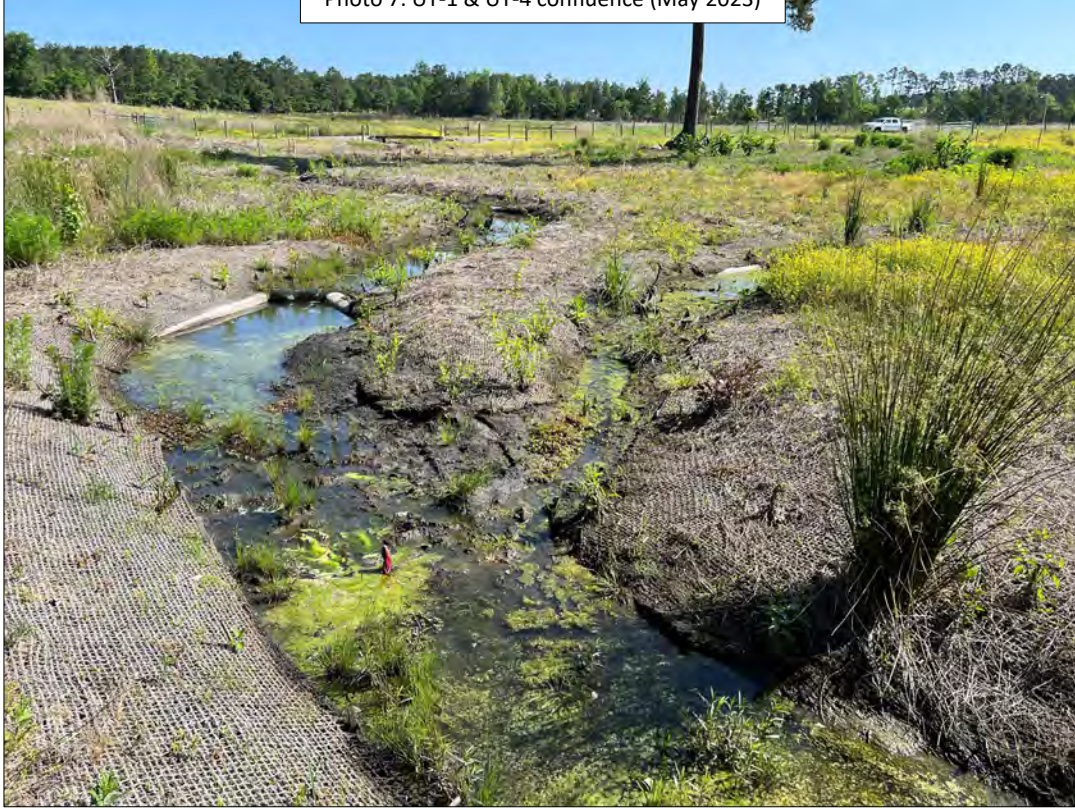


Photo 8: UT-1 crest gauge



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 9: UT-1 from bridge; downstream
(May 2023)



Photo 10: UT-1 from bridge;
upstream (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 11: UT-1 origin (May 2023)

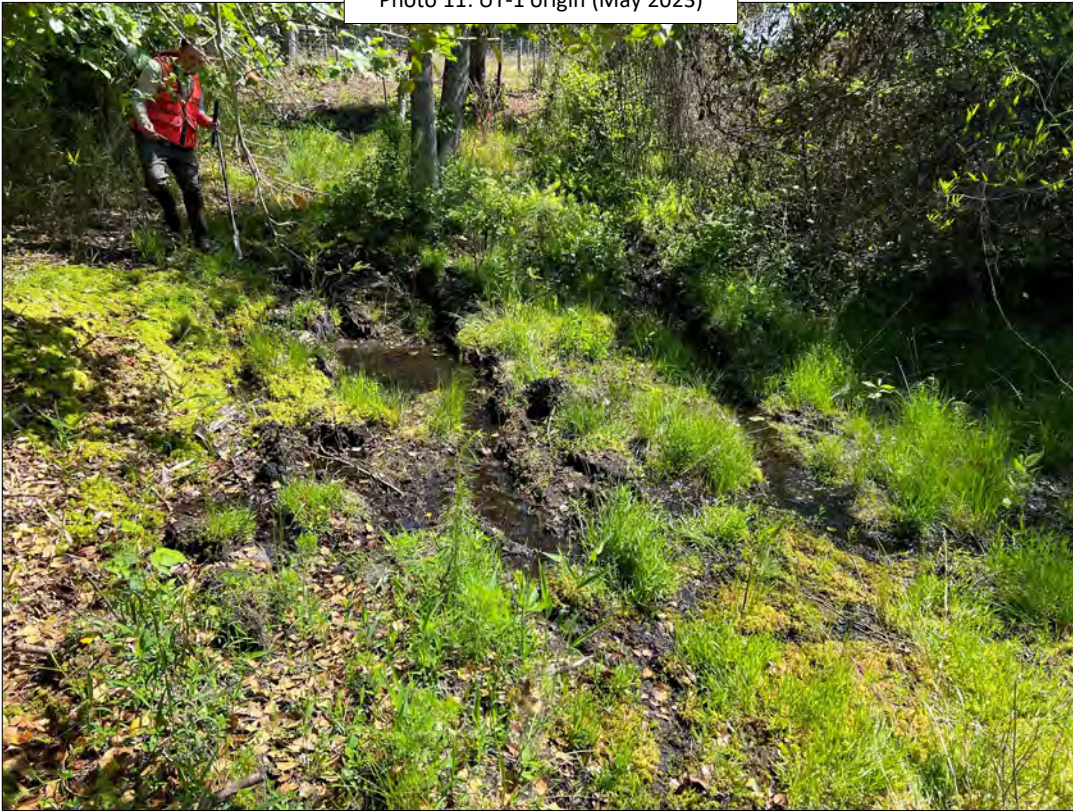


Photo 12: UT-1 origin (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 13: UT-1 upper at
Enhancement II tie-in (May 2023)



Photo 14: UT-2 downstream (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 15: UT-2 downstream (May 2023)



Photo 16: UT-2 upstream at tie-in (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 17: UT-2 Enhancement II (May 2023)



Photo 18: UT-2 crossing above tie-in (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 19: UT-3 upstream end (May 2023)



Photo 20: UT-3 stream gauge (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 21: UT-5 downstream (May 2023)



Photo 22: UT-5 origin (May 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

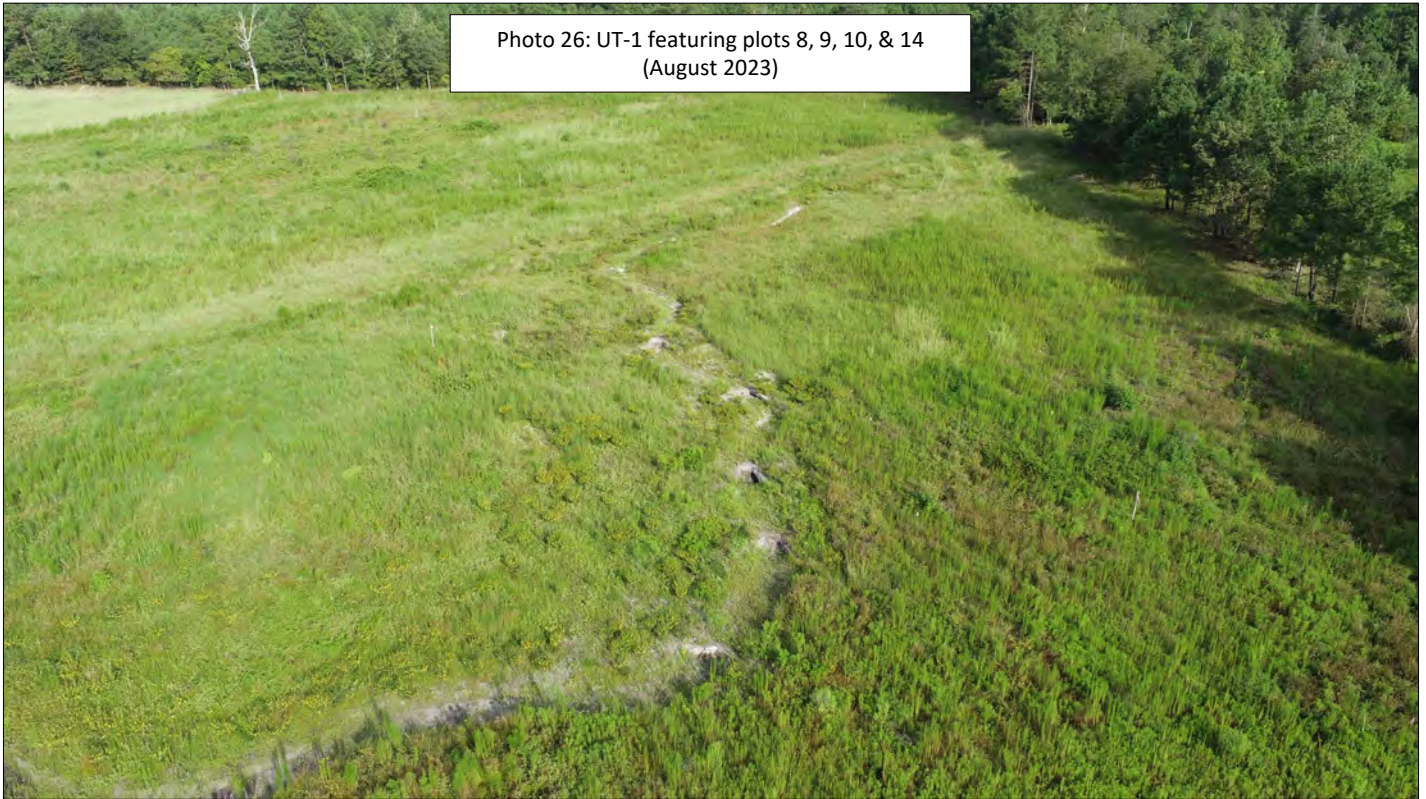
Photo 23: Easement signage (August 2023)



Photo 24: UT-1 & UT-5 confluence (August 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**



Photo 27: Aerial of bridge crossing over UT-1
(August 2023)



Photo 28: Aerial of bridge crossing over UT-1
(August 2023)

**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**

Photo 29: North section of easement
(August 2023)



Photo 30: North section of easement
(August 2023)



**Crane Stream and Wetland Mitigation Site
MY-01 (2023) Photo Log**



Photo 31: South section of easement
(August 2023)



Photo 32: South section of easement from UT4 origin
(August 2023)

Appendix B: Vegetation Data

Table 6A. Planted Bare-Root Woody Vegetation

Table 6B. Permanent Seed Mix

Table 7A. Vegetation Plot Counts and Densities

Table 7B. Herbaceous Vegetation Plots

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

**Table 6A. Planted Bare-Root Woody Vegetation
Crane Stream and Wetland Mitigation Site**

Vegetation Association		Coastal Plain Bottomland Hardwood Forest*		Coastal Plain Small Stream Swamp*		Stream-side Assemblage**		TOTAL
Area (acres)		8		15.4		2.8		26.2
Species	Indicator Status	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Swamp black gum (<i>Nyssa biflora</i>)	OBL	0	0.0%	1000	9.5%	0	0.0%	1000
Bald cypress (<i>Taxodium distichum</i>)	OBL	500	9.2%	1000	9.5%	0	0.0%	1500
Tupelo gum (<i>Nyssa aquatica</i>)	OBL	0	0.0%	1000	9.5%	0	0.0%	1000
Black gum (<i>Nyssa sylvatica</i>)	FAC	500	9.2%	1000	9.5%	700	9.2%	2200
Silky dogwood (<i>Cornus amomum</i>)	FACW	0	0.0%	0	0.0%	1500	19.7%	1500
Sweetbay (<i>Magnolia virginiana</i>)	FACW	0	0.0%	1000	9.5%	0	0.0%	1000
Red bay (<i>Persea borbonia</i>)	FAC	250	4.6%	500	4.8%	0	0.0%	750
River birch (<i>Betula nigra</i>)	FACW	500	9.2%	500	4.8%	1500	19.7%	2500
Hackberry (<i>Celtis occidentalis</i>)	FACW	300	5.5%	500	4.8%	400	5.3%	1200
American elm (<i>Ulmus americana</i>)	FACW	300	5.5%	500	4.8%	800	10.5%	1600
Tulip poplar (<i>Liriodendron tulipifera</i>)	FAC	300	5.5%	500	4.8%	800	10.5%	1600
Sycamore (<i>Platanus occidentalis</i>)	FACW	300	5.5%	500	4.8%	800	10.5%	1600
Swamp chestnut oak (<i>Quercus michauxii</i>)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Water oak (<i>Quercus nigra</i>)	FAC	500	9.2%	300	2.9%	400	5.3%	1200
Laurel oak (<i>Quercus larifolia</i>)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Cherrybark oak (<i>Quercus pagoda</i>)	FAC	200	3.7%	0	0.0%	400	5.3%	600
Willow oak (<i>Quercus phellos</i>)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Shumard oak (<i>Quercus shumardii</i>)	FACW	300	5.5%	500	4.8%	0	0.0%	800
Shagbark hickory (<i>Carya ovata</i>)	FACU	300	5.5%	0	0.0%	0	0.0%	300
Bitternut hickory (<i>Carya cordiformis</i>)	FAC	300	5.5%	200	1.9%	300	3.9%	800
TOTAL		5450		10500		7600		23550

* Planted at a density of 680 stems/acre.

** Planted at a density of 2720 stems/acre.

**Table 6B. Permanent Seed Mix
Crane Stream and Wetland Mitigation Site**

Temporary Seed (Erosion and Sediment Control)			
Species	Application Rate	Application Date	Notes
<i>Urochloa 1amose</i> (Brown Top Millet)	40 lbs. per acre	May – September	All disturbed soil
Permanent Seed- Sitewide @ 2lbs /acre			
Scientific Name	Common Name	Indicator	%
<i>Agrostis hyemalis</i>	Winter bentgrass	FAC	3
<i>Bidens aristosa</i>	Bur-marigold	FACW	0.6
<i>Carex albolutescens</i>	Greenwhite Sedge	FACW	2
<i>Carex lupulina</i>	Hop Sedge	OBL	2
<i>Chamaecrista fasciculata</i>	Partridge Pea	FACU	6
<i>Chamaecrista nictitans</i>	Sensitive Pea	FACU	3
<i>Coreopsis lanceolata</i>	Lance-leaved Coreopsis	NI	5
<i>Coreopsis tinctoria</i>	Plains Coreopsis	FAC	5
<i>Desmodium canadense</i>	Showy ticktrefoil	FAC	5
<i>Echinacea purpurea</i>	Coneflower	NI	5
<i>Elymus virginicus</i>	Virginia Wildrye	FACW	7
<i>Eupatorium fistulosum</i>	Joe Pye Weed	FACW	0.1
<i>Helianthus angustifolius</i>	Narrowleaved Sunflower	FACW	2
<i>Heliopsis helianthoides</i>	Oxeye sunflower	UPL	5
<i>Hibiscus moscheutos</i>	Crimsoneyed rosemallow	OBL	0.1
<i>Liatris spicata</i>	Marsh Blazing Star	FAC	0.1
<i>Monarda fistulosa</i>	Wild Bergamot	FACU	1
<i>Panicum anceps</i>	Beaked panicgrass	FAC	5
<i>Panicum clandestinum</i>	Deertongue	FAC	10
<i>Panicum dichotomiflorum</i>	Smooth panicgrass	FACW	8
<i>Panicum rigidulum</i>	Redtop Panicgrass	FACW	2
<i>Pycnanthemum tenuifolium</i>	Narrowleaf mountainmint	FACW	0.1
<i>Rudbeckia hirta</i>	Black eyed Susan	FACU	5
<i>Senna hebecarpa</i>	Wild Senna	FAC	2
<i>Tridens flavus</i>	Purpletop	FACU	10
<i>Verbena hastata</i>	Blue vervain	FACW	6

**Table 7A. Planted Vegetation Totals
Crane Stream and Wetland Mitigation Site**

Plot #	Planted Stems/Acre	Success Criteria Met?
1	526	Yes
2	607	Yes
3	688	Yes
4	526	Yes
5	486	Yes
6	567	Yes
7	364	Yes
8	526	Yes
9	243	No
10	486	Yes
11	607	Yes
12	688	Yes
13	445	Yes
14	526	Yes
15	526	Yes
16	567	Yes
17	486	Yes
R-1	729	Yes
R-2	486	Yes
R-3	526	Yes
R-4	283	No
R-5	405	Yes
R-6	283	Yes
Average Planted Stems/Acre	503	Yes

**Table 7B. Herbaceous Vegetation Plots
Crane Stream and Wetland Mitigation Site**

Plot #	Species Count	Success Criteria Met?	Taxa Identified
H1	6	Yes	<i>Juncus effusus</i> <i>Eupatorium capillifolium</i> <i>Cyperus sp.</i> <i>Carex sp.</i> <i>Bidens ferulifolia</i> <i>Veronia noveboracensis</i>
H2	5	Yes	<i>Carex sp.</i> <i>Juncus effusus</i> <i>Pycnanthemum sp.</i> <i>Eupatorium capillifolium</i> <i>Bidens ferulifolia</i>
H3	5	Yes	<i>Carex sp.</i> <i>Eupatorium capillifolium</i> <i>Juncus effusus</i> <i>Peltandra virginica</i> <i>Pycnanthemum sp.</i>
Average	5.3	Yes	

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

Planted Acreage	26.2
Date of Initial Plant	2023-02-03
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2023-08-25
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	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		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	<i>Betula nigra</i>	river birch	Tree	FACW			1	1									1	1	2	2				
	<i>Carya cordiformis</i>	bitternut hickory	Tree	FACU			1	1																
	<i>Celtis occidentalis</i>	common hackberry	Tree	FACU																				
	<i>Cornus amomum</i>	silky dogwood	Shrub	FACW																1	1			
	<i>Liriodendron tulipifera</i>	tuliptree	Tree	FACU					1	1	4	4					1	1	3	3				
	<i>Magnolia virginiana</i>	sweetbay	Tree	FACW					1	1	1	1							2	2				
	<i>Nyssa aquatica</i>	water tupelo	Tree	OBL		1	4	4							1	1			1	1	1	1	2	2
	<i>Nyssa sylvatica</i>	blackgum	Tree	FAC		1	1	1	2	2	2	2			2	2	2	2	1	1	1	1	4	4
	<i>Persea borbonia</i>	redbay	Tree	FACW					7	7														
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW		2	2	2	2	2	3	3	2	2	3	3	1	1						
	<i>Quercus laurifolia</i>	laurel oak	Tree	FACW		2	2						2	2	4	4								
	<i>Quercus michauxii</i>	swamp chestnut oak	Tree	FACW		2	2	2	2				3	3	1	1	2	2			1	1	1	1
	<i>Quercus nigra</i>	water oak	Tree	FAC		2	2	1	1														1	1
	<i>Quercus pagoda</i>	cherrybark oak	Tree	FACW		3	3		1	1	1	1	4	4	1	1	1	1	2	2			2	2
	<i>Quercus phellos</i>	willow oak	Tree	FAC							2	2												
<i>Quercus shumardii</i>	Shumard's oak	Tree	FAC			2	2					1	1	1	1			1	1					
<i>Quercus sp.</i>														1	1									
<i>Taxodium distichum</i>	bald cypress	Tree	OBL			1	1	3	3							1	1			4	4	2	2	
Sum	Performance Standard				13	13	15	15	17	17	13	13	12	12	14	14	9	9	13	13	7	7	12	12
Post Mitigation Plan Species	<i>Fraxinus pennsylvanica</i>	green ash	Tree	FACW																				
Sum	Proposed Standard				13	13	15	15	17	17	13	13	12	12	14	14	9	9	13	13	7	7	12	12
Mitigation Plan Performance Standard	Current Year Stem Count				13		15		17		13		12		14		9		13		7		12	
	Stems/Acre				526		607		688		526		486		567		364		526		243		486	
	Species Count				7		9		7		6		5		8		7		8		4		6	
	Dominant Species Composition (%)				23		27		41		31		33		29		22		23		57		33	
	Average Plot Height (ft.)				2		1		1		2		2		2		2		1		2		2	
% Invasives				0		0		0		0		0		0		0		0		0		0		
Post Mitigation Plan Performance Standard	Current Year Stem Count				13		15		17		13		12		14		9		13		7		12	
	Stems/Acre				526		607		688		526		486		567		364		526		243		486	
	Species Count				7		9		7		6		5		8		7		8		4		6	
	Dominant Species Composition (%)				23		27		41		31		33		29		22		23		57		33	
	Average Plot Height (ft.)				2		1		1		2		2		2		2		1		2		2	
% Invasives				0		0		0		0		0		0		0		0		0		0		

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

Table 8. Vegetation Plot Data Table from Vegetation Data Entry Tool (continued)

Planted Acreage	26.2
Date of Initial Plant	2023-02-03
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	NA
Date of Current Survey	2023-08-25
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/S hrub	Indicator Status	Veg Plot 11 F		Veg Plot 12 F		Veg Plot 13 F		Veg Plot 14 F		Veg Plot 15 F		Veg Plot 16 F		Veg Plot 17 F		Veg Plot 1 R	Veg Plot 2 R	Veg Plot 3 R	Veg Plot 4 R	Veg Plot 5 R	Veg Plot 6 R	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	<i>Betula nigra</i>	river birch	Tree	FACW			1	1											2	1					
	<i>Carya cordiformis</i>	bitternut hickory	Tree	FACU									1	1											
	<i>Celtis occidentalis</i>	common hackberry	Tree	FACU	1	1																			
	<i>Cornus amomum</i>	silky dogwood	Shrub	FACW															2					1	
	<i>Liriodendron tulipifera</i>	tuliptree	Tree	FACU				3		2					1	1					2			1	2
	<i>Magnolia virginiana</i>	sweetbay	Tree	FACW	1	1	2	2			2	2													1
	<i>Nyssa aquatica</i>	water tupelo	Tree	OBL	1	1			1	1															
	<i>Nyssa sylvatica</i>	blackgum	Tree	FAC	2	2	2	2	1	1	1	1	2	2					3	1					
	<i>Persea borbonia</i>	redbay	Tree	FACW																					
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW	1	1	1	1	3	3	1	1	1	1						1	1	3	1	1	1
	<i>Quercus laurifolia</i>	laurel oak	Tree	FACW							3	3			4	4	5	5							
	<i>Quercus michauxii</i>	swamp chestnut oak	Tree	FACW	1	1	2	2	4	4	1	1	3	3	2	2	2	2	4		4	1	1		
	<i>Quercus nigra</i>	water oak	Tree	FAC	1	1							1	1	5	5	2	2			3				
	<i>Quercus pagoda</i>	cherrybark oak	Tree	FACW	1	1	1	2			3	3	1	1	2	2				2		1	1	1	1
	<i>Quercus phellos</i>	willow oak	Tree	FAC	3	3					1	1								3		1		1	1
<i>Quercus shumardii</i>	Shumard's oak	Tree	FAC	2	2	1	2					3	3	2	2	2	2			1					
<i>Quercus sp.</i>																									
<i>Taxodium distichum</i>	bald cypress	Tree	OBL	1	1	2	2			1	1	1	1			1	1	7	2	2	1	8			
Sum	Performance Standard				15	15	12	17	9	11	13	13	13	13	14	14	12	12	18	12	13	7	12	7	
Post Mitigation Plan Species	<i>Fraxinus pennsylvanica</i>	green ash	Tree	FACW																				1	
Sum	Proposed Standard				15	15	12	17	9	11	13	13	13	13	14	14	12	12	18	12	13	7	12	7	
Mitigation Plan Performance Standard	Current Year Stem Count				15		17		11		13		13		14		12	18	12	13	7	12	7		
	Stems/Acre				607		688		445		526		526		567		486	729	486	526	283	405	283		
	Species Count				11		9		5		8		8		5		5	5	7	6	5	5	6		
	Dominant Species Composition (%)				20		18		36		23		23		36		42	39	25	31	43	67	25		
	Average Plot Height (ft.)				1		2		2		2		2		2		1	2	2	2	2	2	2	1	
% Invasives				0		0		0		0		0		0		0	0	0	0	0	0	0	0		
Post Mitigation Plan Performance Standard	Current Year Stem Count				15		17		11		13		13		14		12	18	12	13	7	12	7		
	Stems/Acre				607		688		445		526		526		567		486	729	486	526	283	405	283		
	Species Count				11		9		5		8		8		5		5	5	7	6	5	5	6		
	Dominant Species Composition (%)				20		18		36		23		23		36		42	39	25	31	43	67	25		
	Average Plot Height (ft.)				1		2		2		2		2		2		1	2	2	2	2	2	2	1	
% Invasives				0		0		0		0		0		0		0	0	0	0	0	0	0	0		

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

Appendix C: Stream Geomorphology Data

Cross-Sections with Annual Overlays

Table 9A-E. Baseline Stream Data Summary Tables

Table 10A-B. Cross-Section Morphology Monitoring Summary

Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT2, XS -1
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

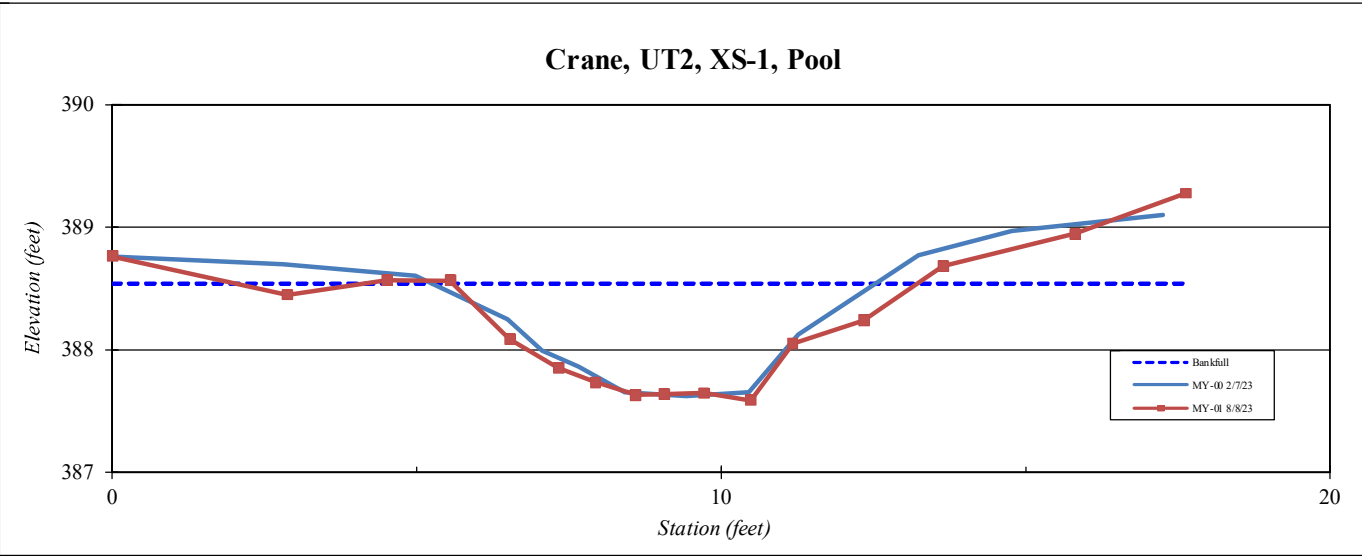
Station	Elevation
0.0	388.7
2.9	388.3
4.5	388.4
5.5	388.4
6.5	387.9
7.3	387.6
7.9	387.5
8.6	387.4
9.1	387.4
9.7	387.4
10.5	387.3
11.2	387.9
12.3	388.1
13.6	388.6
15.8	388.9
17.6	389.2

SUMMARY DATA	
Bankfull Elevation:	388.41
Bank Hieght Ratio:	NA
Thalweg Elevation:	387.33
LTOB Elevation:	388.44
LTOB Max Depth:	1.11
LTOB Cross Sectional Area:	5.3



Stream Type

Crane, UT2, XS-1, Pool



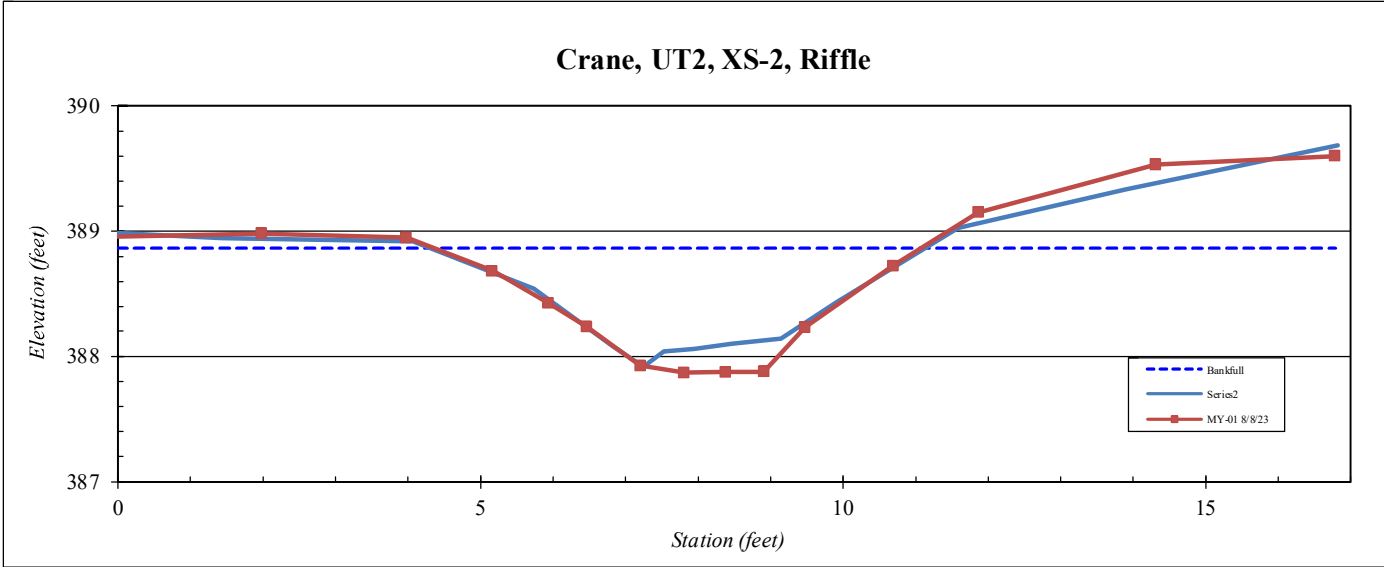
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT2, XS-2
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis



Station	Elevation
-0.2	389.0
2.0	389.0
4.0	389.0
5.2	388.7
5.9	388.4
6.5	388.2
7.2	387.9
7.8	387.9
8.4	387.9
8.9	387.9
9.5	388.2
10.7	388.7
11.9	389.2
14.3	389.5
16.8	389.6

SUMMARY DATA	
Bankfull Elevation:	388.86
Bank Hieght Ratio:	1.09
Thalweg Elevation:	387.87
LTOB Elevation:	388.95
LTOB Max Depth:	1.08
LTOB Cross Sectional Area:	4.4

Stream Type



Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT4, XS-3
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

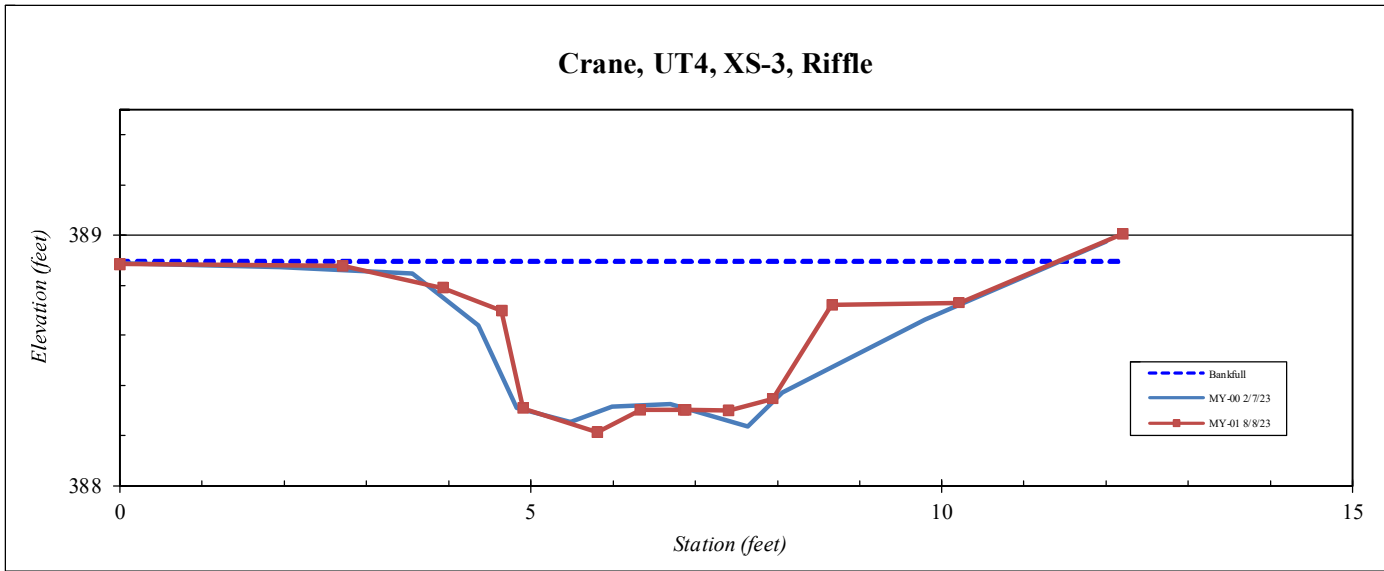


Station	Elevation
0.0	388.9
2.7	388.9
3.9	388.8
4.6	388.7
4.9	388.3
5.8	388.2
6.3	388.3
6.9	388.3
6.9	388.3
7.4	388.3
7.9	388.3
8.7	388.7
10.2	388.7
12.2	389.0

SUMMARY DATA	
Bankfull Elevation:	388.89
Bank Height Ratio:	0.98
Thalweg Elevation:	388.22
LTOB Elevation:	388.88
LTOB Max Depth:	0.66
LTOB Cross Sectional Area:	2.6

Stream Type

Crane, UT4, XS-3, Riffle



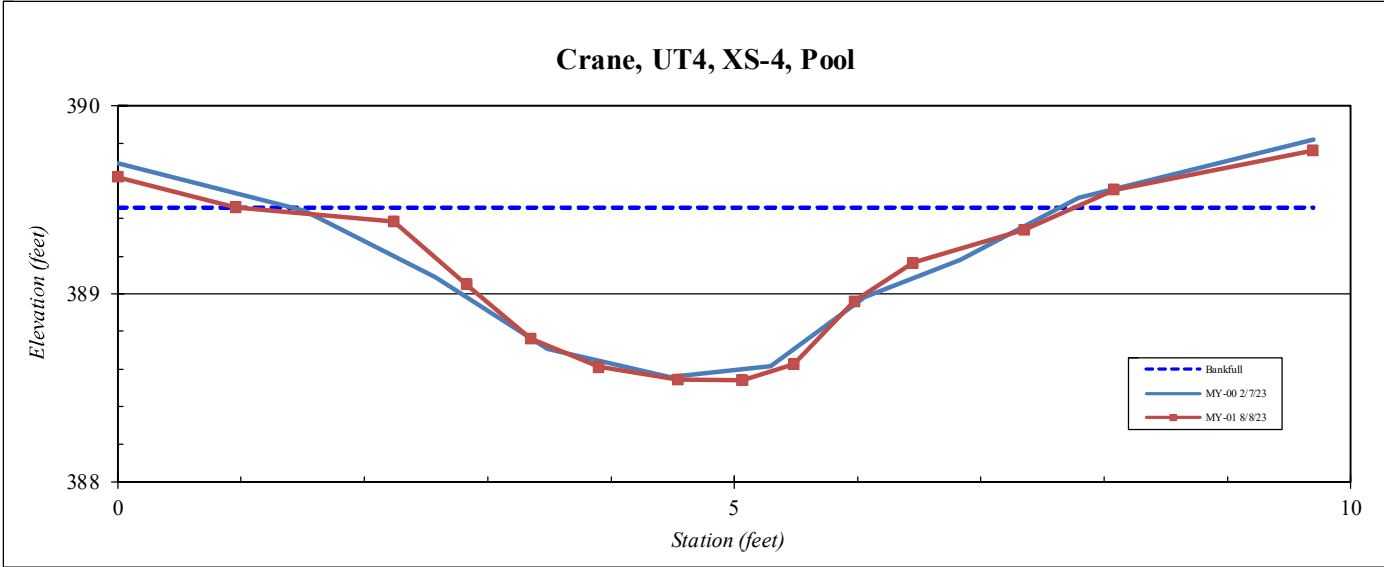
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT4, XS-4
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.0	389.1
1.0	389.0
2.2	388.9
2.8	388.6
3.3	388.3
3.9	388.1
4.5	388.0
5.1	388.0
5.5	388.1
6.0	388.5
6.5	388.7
7.3	388.8
8.1	389.1
9.7	389.3

SUMMARY DATA	
Bankfull Elevation:	388.96
Bank Height Ratio:	NA
Thalweg Elevation:	388.04
LTOB Elevation:	388.96
LTOB Max Depth:	0.92
LTOB Cross Sectional Area:	3.0



Stream Type



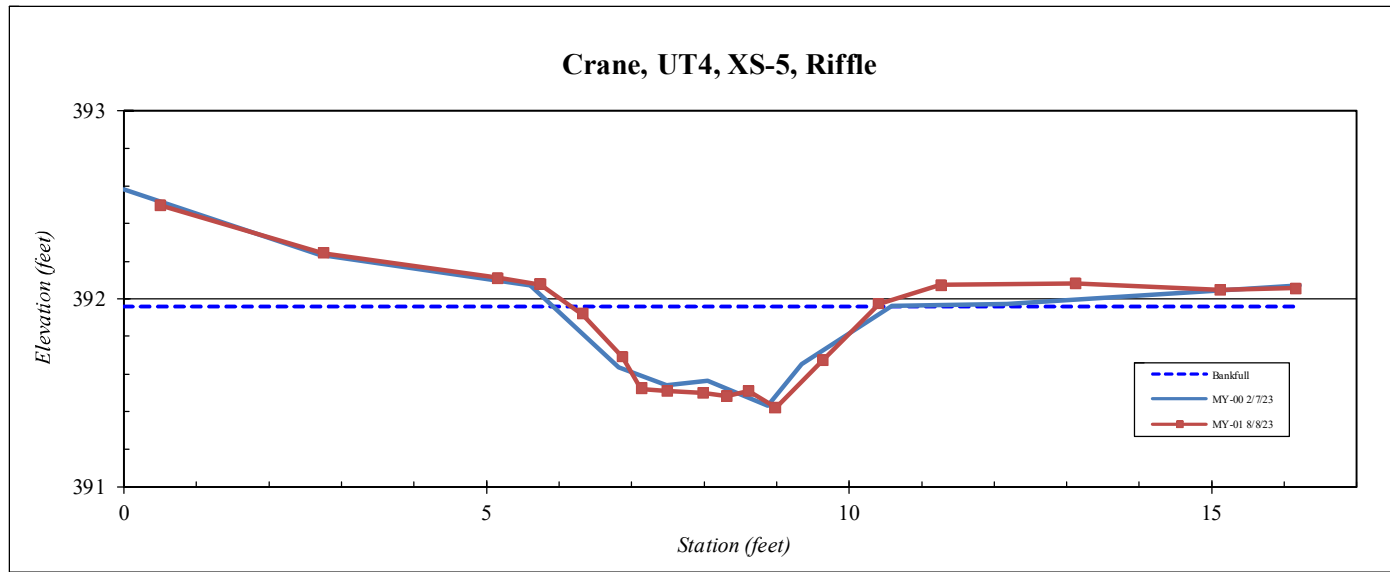
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT4, XS-5
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis



Stream Type

Station	Elevation
0.5	392.5
2.8	392.2
5.2	392.1
5.7	392.1
6.3	391.9
6.9	391.7
7.1	391.5
7.5	391.5
8.0	391.5
8.3	391.5
8.6	391.5
9.0	391.4
9.6	391.7
10.4	392.0
11.3	392.1
13.1	392.1
15.1	392.0
16.2	392.1

SUMMARY DATA	
Bankfull Elevation:	391.96
Bank Height Ratio:	1.03
Thalweg Elevation:	391.42
LTOB Elevation:	391.97
LTOB Max Depth:	0.55
LTOB Cross Sectional Area:	1.5



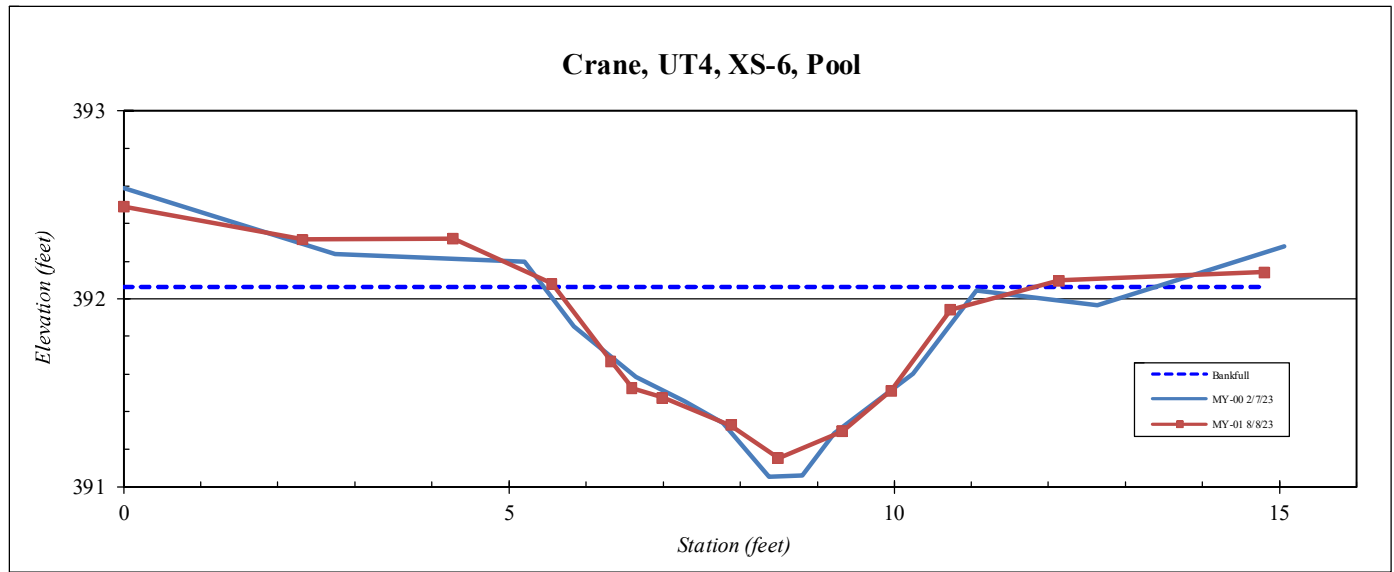
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT4, XS-6
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.0	392.5
2.3	392.3
4.3	392.3
5.6	392.1
6.3	391.7
6.6	391.5
7.0	391.5
7.9	391.3
8.5	391.2
9.3	391.3
10.0	391.5
10.7	391.9
12.1	392.1
14.8	392.1

SUMMARY DATA	
Bankfull Elevation:	392.06
Bank Hieght Ratio:	NA
Thalweg Elevation:	391.15
LTOB Elevation:	392.10
LTOB Max Depth:	0.94
LTOB Cross Sectional Area:	3.2



Stream Type



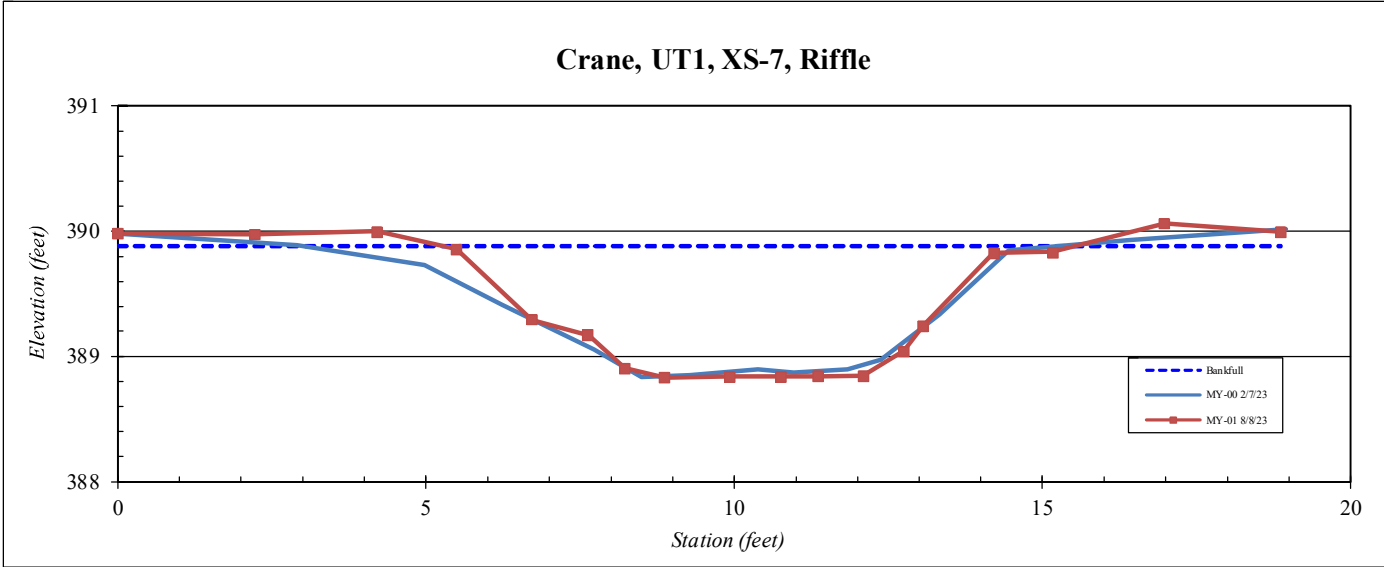
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT1, XS-7
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis



Station	Elevation
0.0	390.0
2.2	390.0
4.2	390.0
5.5	389.9
6.7	389.3
7.6	389.2
8.2	388.9
8.9	388.8
9.9	388.8
10.8	388.8
11.4	388.8
12.1	388.8
12.7	389.0
13.1	389.2
14.2	389.8
15.2	389.8
17.0	390.1
18.9	390.0

SUMMARY DATA	
Bankfull Elevation:	389.88
Bank Height Ratio:	0.94
Thalweg Elevation:	388.83
LTOB Elevation:	389.82
LTOB Max Depth:	0.99
LTOB Cross Sectional Area:	6.2

Stream Type



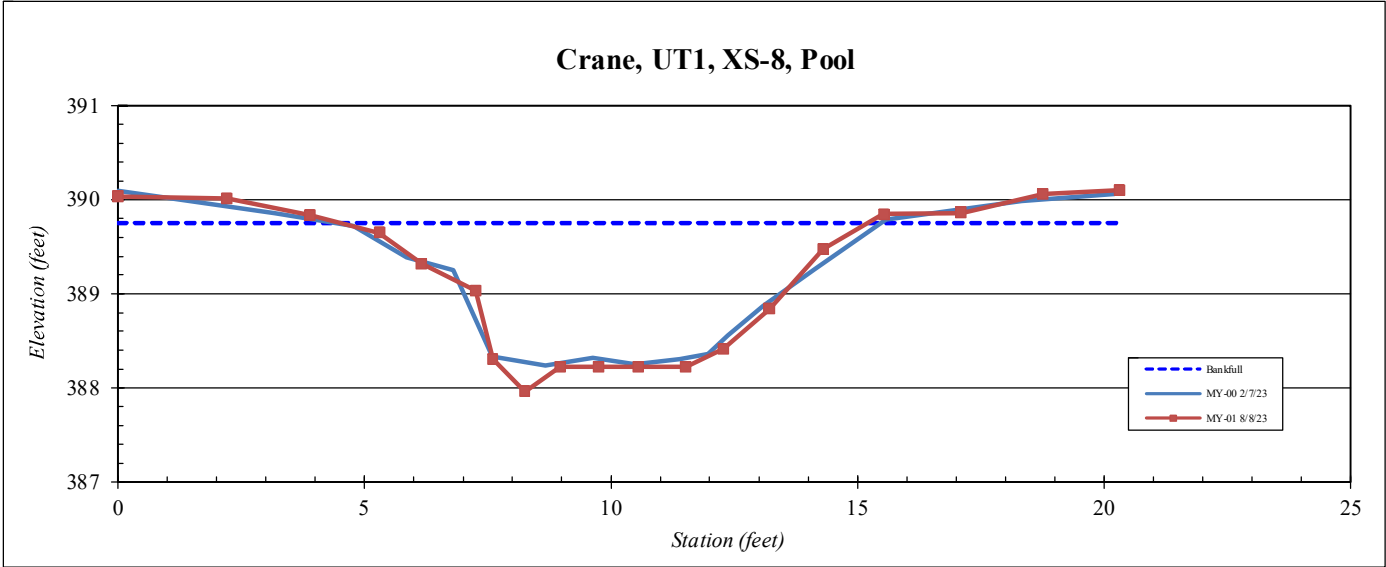
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT1, XS-8
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.0	390.0
2.2	390.0
3.9	389.8
5.3	389.6
6.2	389.3
7.3	389.0
7.6	388.3
8.3	388.0
9.0	388.2
9.8	388.2
10.5	388.2
11.5	388.2
12.3	388.4
13.2	388.8
14.3	389.5
15.5	389.8
17.1	389.9
18.8	390.1
20.3	390.1

SUMMARY DATA	
Bankfull Elevation:	389.75
Bank Height Ratio:	1.08
Thalweg Elevation:	388.02
LTOB Elevation:	389.90
LTOB Max Depth:	1.88
LTOB Cross Sectional Area:	11.3



Stream Type



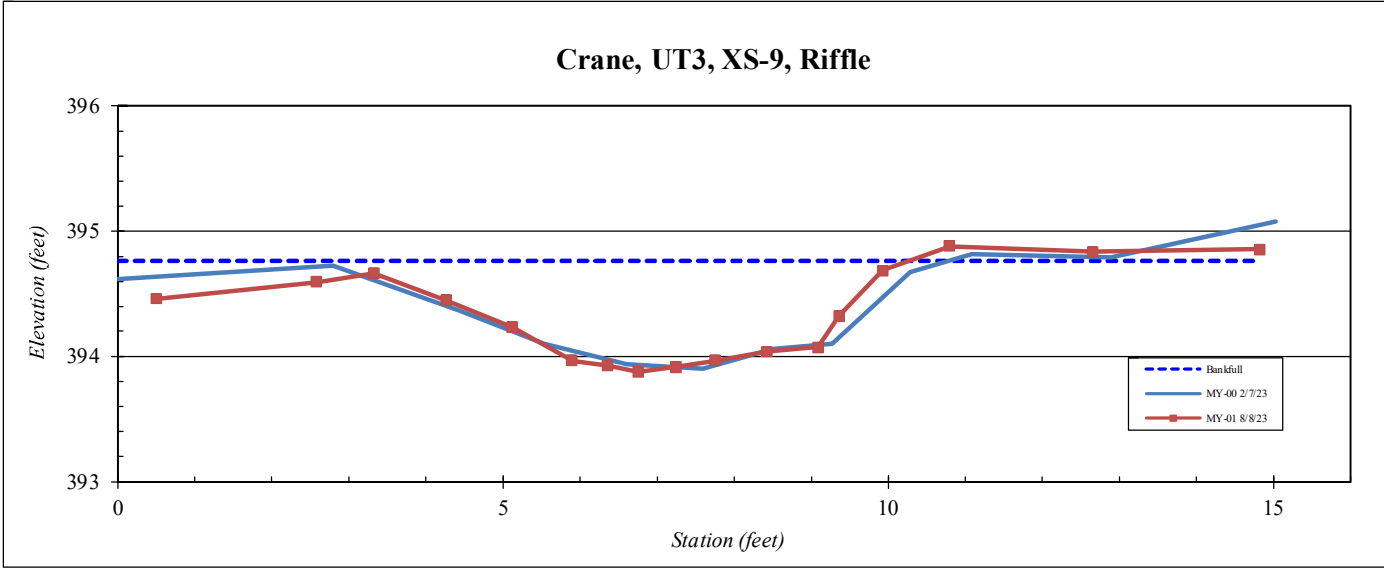
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT3, XS-9
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.5	394.5
2.6	394.6
3.3	394.7
4.3	394.4
5.1	394.2
5.9	394.0
6.4	393.9
6.8	393.9
7.2	393.9
7.7	394.0
8.4	394.0
9.1	394.1
9.4	394.3
9.9	394.7
10.8	394.9
12.7	394.8
14.8	394.9

SUMMARY DATA	
Bankfull Elevation:	394.76
Bank Hieght Ratio:	0.89
Thalweg Elevation:	393.88
LTOB Elevation:	394.66
LTOB Max Depth:	0.78
LTOB Cross Sectional Area:	3.2



Stream Type



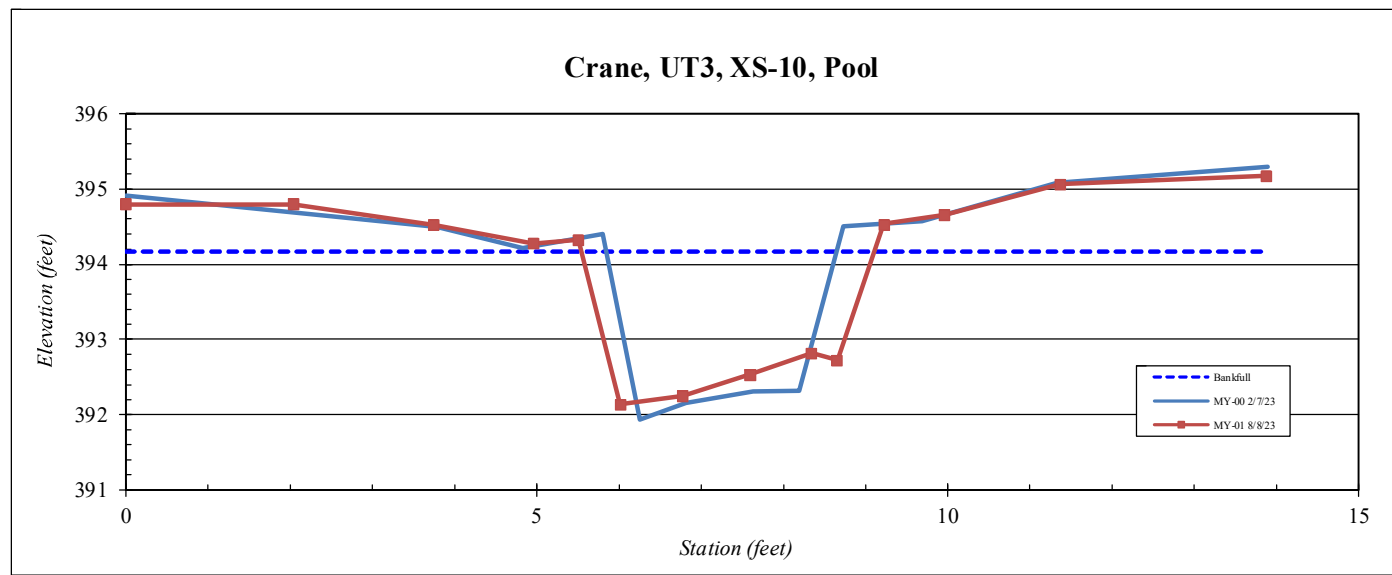
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT3, XS-10
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis



Station	Elevation
0.0	394.8
2.0	394.8
3.8	394.5
5.0	394.3
5.5	394.3
6.0	392.1
6.8	392.2
7.6	392.5
8.3	392.8
8.7	392.7
9.2	394.5
10.0	394.6
11.4	395.1
13.9	395.2

SUMMARY DATA	
Bankfull Elevation:	394.17
Bank Height Ratio:	1.07
Thalweg Elevation:	392.13
LTOB Elevation:	394.32
LTOB Max Depth:	2.19
LTOB Cross Sectional Area:	5.9

Stream Type	
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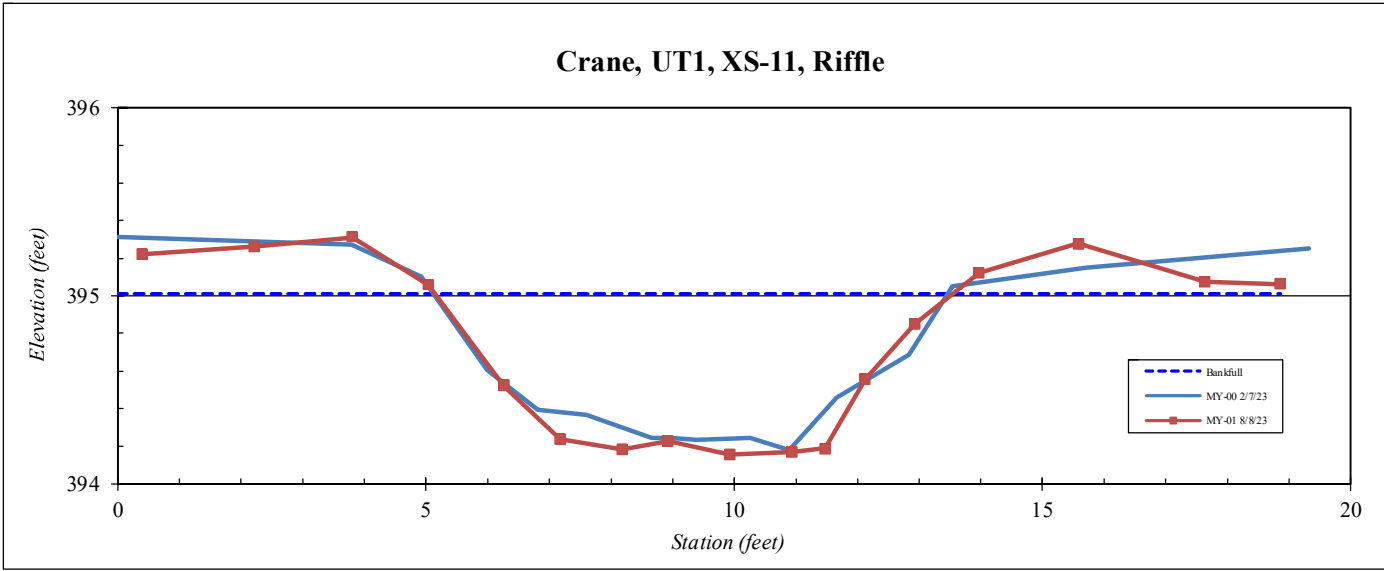
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT1, XS-11
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis



Station	Elevation
0.4	395.2
2.2	395.3
3.8	395.3
5.0	395.1
6.3	394.5
7.2	394.2
8.2	394.2
8.9	394.2
9.9	394.2
10.9	394.2
11.5	394.2
12.1	394.6
12.9	394.8
14.0	395.1
15.6	395.3
17.6	395.1
18.9	395.1

SUMMARY DATA	
Bankfull Elevation:	395.01
Bank Hieght Ratio:	1.05
Thalweg Elevation:	394.16
LTOB Elevation:	395.06
LTOB Max Depth:	0.90
LTOB Cross Sectional Area:	5.5

Stream Type



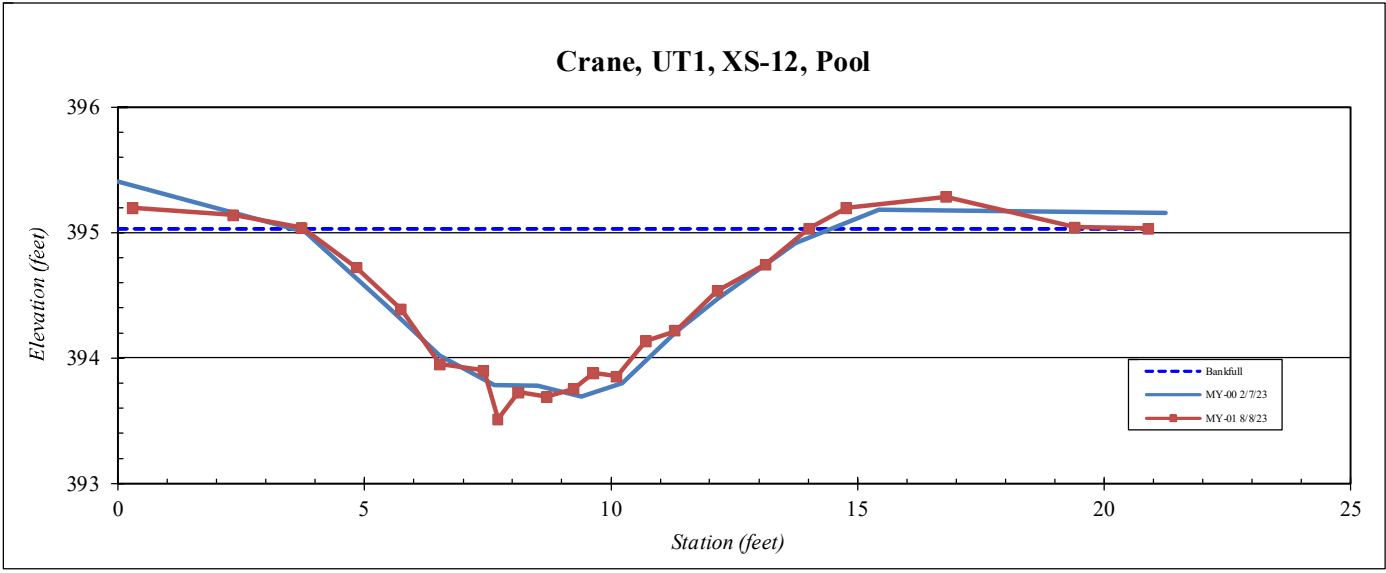
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT1, XS-12
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.3	395.2
2.3	395.1
3.7	395.0
4.8	394.7
5.7	394.4
6.5	393.9
7.4	393.9
7.7	393.5
8.1	393.7
8.7	393.7
9.2	393.8
9.6	393.9
10.1	393.9
10.7	394.1
11.3	394.2
12.2	394.5
13.1	394.7
14.0	395.0
14.8	395.2
16.8	395.3
19.4	395.0
20.9	395.0

SUMMARY DATA	
Bankfull Elevation:	395.03
Bank Height Ratio:	NA
Thalweg Elevation:	393.51
LTOB Elevation:	395.04
LTOB Max Depth:	1.53
LTOB Cross Sectional Area:	8.0



Stream Type



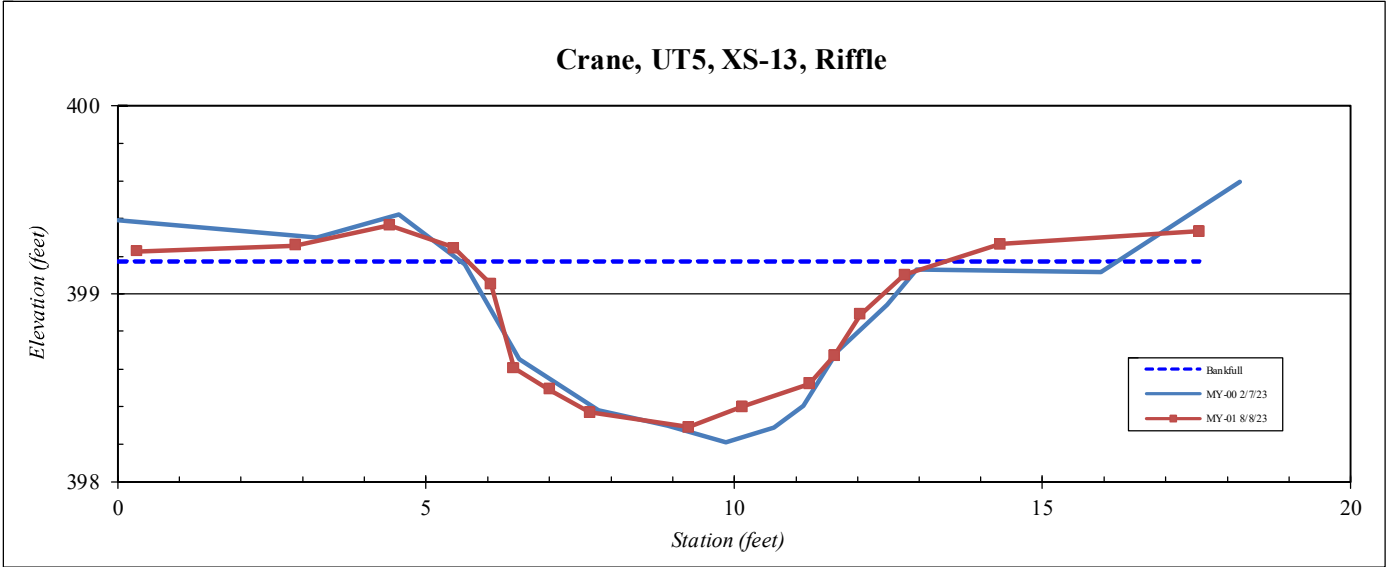
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT5, XS-13
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.3	399.2
2.9	399.3
4.4	399.4
5.4	399.2
6.0	399.1
6.4	398.6
7.0	398.5
7.7	398.4
9.3	398.3
10.1	398.4
11.2	398.5
11.6	398.7
12.0	398.9
12.8	399.1
14.3	399.3
17.5	399.3

SUMMARY DATA	
Bankfull Elevation:	399.17
Bank Height Ratio:	1.08
Thalweg Elevation:	398.29
LTOB Elevation:	399.25
LTOB Max Depth:	0.95
LTOB Cross Sectional Area:	5.0



Stream Type



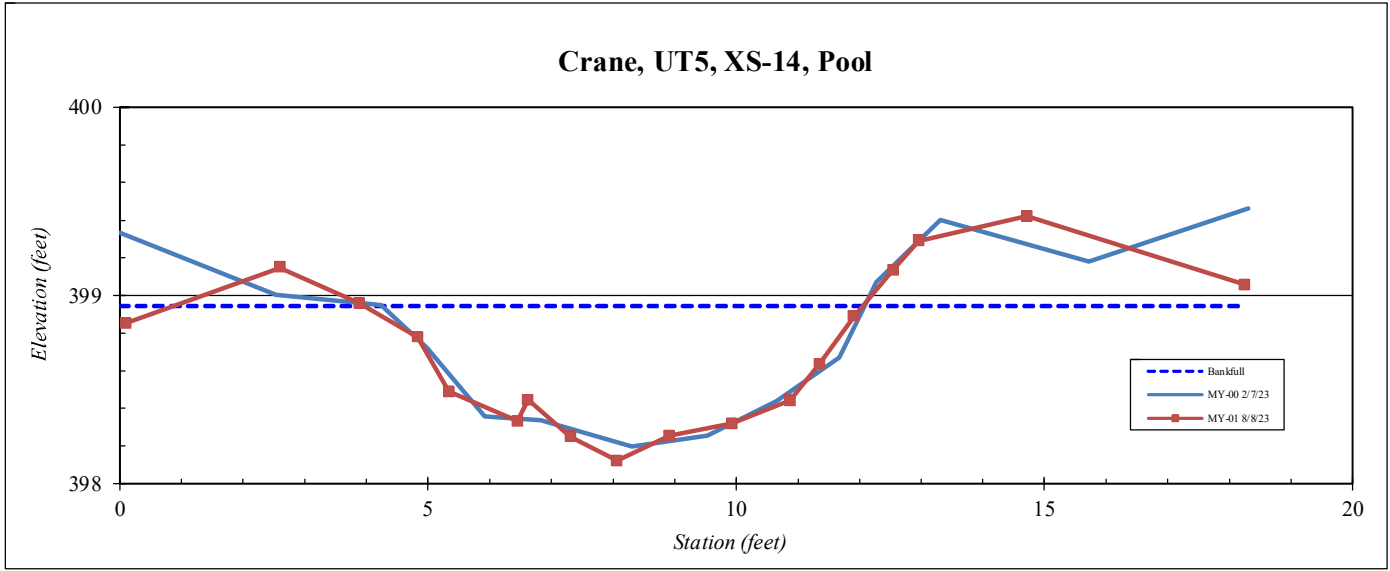
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT5, XS-14
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.1	398.9
2.6	399.1
3.9	399.0
4.8	398.8
5.3	398.5
6.5	398.3
6.6	398.4
7.3	398.2
8.1	398.1
8.9	398.3
9.9	398.3
10.9	398.4
11.4	398.6
11.9	398.9
12.5	399.1
13.0	399.3
14.7	399.4
18.2	399.1

SUMMARY DATA	
Bankfull Elevation:	398.94
Bank Height Ratio:	NA
Thalweg Elevation:	398.12
LTOB Elevation:	398.96
LTOB Max Depth:	0.84
LTOB Cross Sectional Area:	4.2



Stream Type



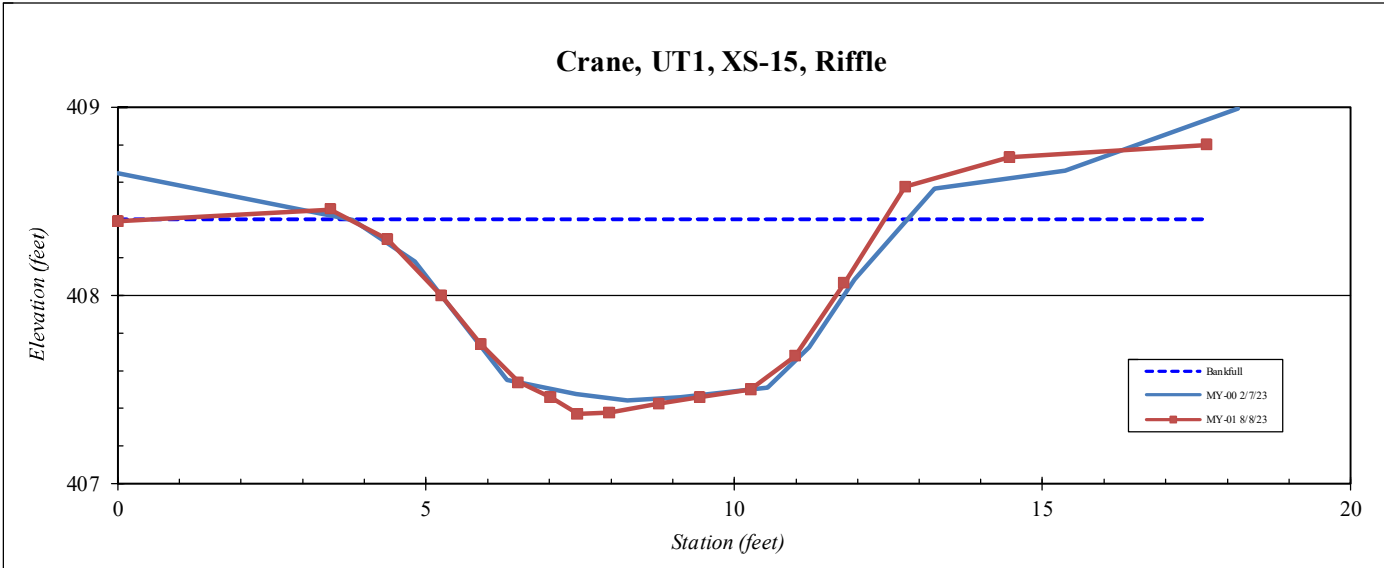
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT1, XS-15
Feature	Riffle
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.0	408.4
3.4	408.5
4.4	408.3
5.3	408.0
5.9	407.7
6.5	407.5
7.0	407.5
7.5	407.4
8.0	407.4
8.8	407.4
9.4	407.5
10.3	407.5
11.0	407.7
11.8	408.1
12.8	408.6
14.5	408.7
17.7	408.8

SUMMARY DATA	
Bankfull Elevation:	408.40
Bank Height Ratio:	1.05
Thalweg Elevation:	407.37
LTOB Elevation:	408.46
LTOB Max Depth:	1.09
LTOB Cross Sectional Area:	6.3



Stream Type



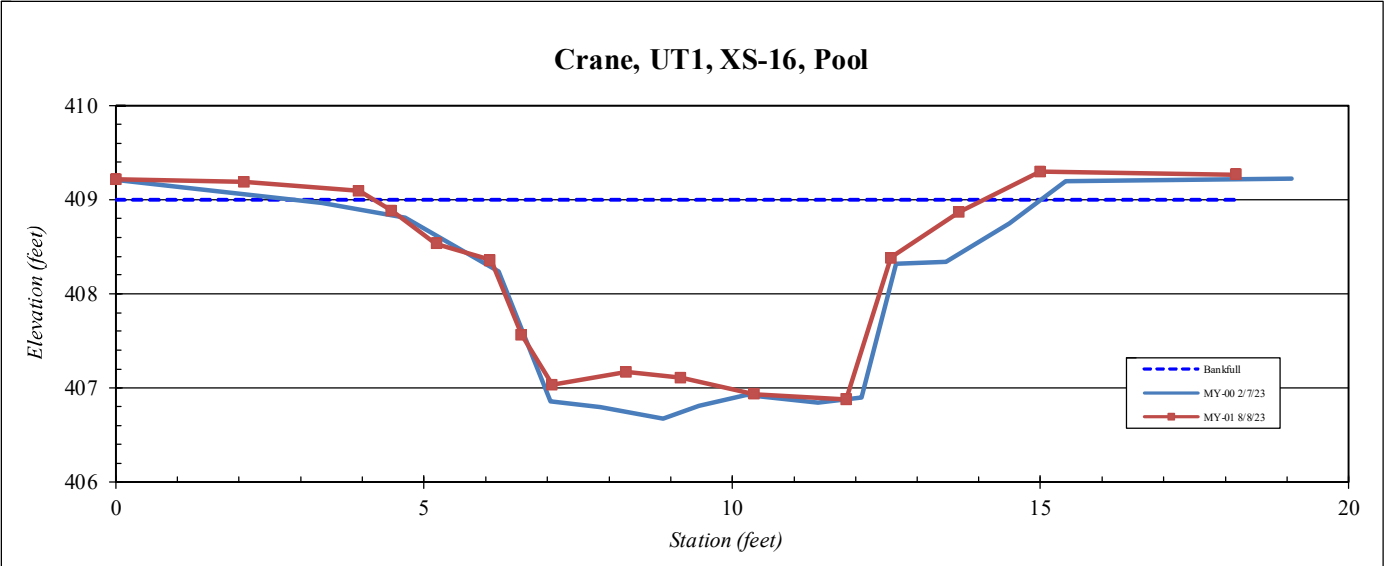
Site	Crane Site
Watershed:	Cape Fear River Basin, 03030004
XS ID	UT1, XS-16
Feature	Pool
Date:	8/8/2023
Field Crew:	A. Smith and D. Lewis

Station	Elevation
0.0	409.2
2.1	409.2
3.9	409.1
4.5	408.9
5.2	408.5
6.1	408.4
6.6	407.6
7.1	407.0
8.3	407.2
9.2	407.1
10.4	406.9
11.8	406.9
12.6	408.4
13.7	408.9
15.0	409.3
18.2	409.3

SUMMARY DATA	
Bankfull Elevation:	409.00
Bank Height Ratio:	NA
Thalweg Elevation:	406.88
LTOB Elevation:	409.10
LTOB Max Depth:	2.22
LTOB Cross Sectional Area:	13.9



Stream Type



**Table 9A. Baseline Stream Data Summary
Crane - UT 1**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Riffle Only										
Bankfull Width (ft)	4.3	6.7		12.5		7.7	8.9	8.5	11.0	3
Floodprone Width (ft)	9	75		100		50	150	100	100	3
Bankfull Mean Depth (ft)	0.4	0.9		1.2		0.6	0.6	0.6	0.6	3
Bankfull Max Depth (ft)	0.9	1.8		2.9		0.7	1	0.9	1.0	3
Bankfull Cross Sectional Area (ft ²)	5	5		5		5	5	5.1	6.7	3
Width/Depth Ratio	3.6	10.6		31.3		12	16	13.9	17.9	3
Entrenchment Ratio	1.6	13		23.3		6.5	16.8	9.1	11.8	3
Bank Height Ratio	1	1.7		2.8		1	1.3	1.0	1.0	3
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg 5					Ce 5		Ce 5		
Bankfull Discharge (cfs)	19					19		19		
Sinuosity (ft)	1.03					1.1		1.1		
Water Surface Slope (Channel) (ft/ft)	0.0179					0.0167		0.0167		
Other										

**Table 9B. Baseline Stream Data Summary
Crane - UT 2**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Riffle Only										
Bankfull Width (ft)	2.2	3.3		4.8		4.8	5.5	7.2	7.2	1
Floodprone Width (ft)	5	7		12		25	75	50.0	50.0	1
Bankfull Mean Depth (ft)	0.4	0.6		0.8		0.3	0.4	0.5	0.5	1
Bankfull Max Depth (ft)	0.6	1		1.4		0.4	0.6	1.0	1.0	1
Bankfull Cross Sectional Area (ft ²)	1.9	1.9		1.9		1.9	1.9	3.8	3.8	1
Width/Depth Ratio	2.8	6		12		12	16	13.8	13.8	1
Entrenchment Ratio	1.8	2.1		2.5		5.2	13.6	6.9	6.9	1
Bank Height Ratio	2.2	2.5		3.1		1	1.3	1.0	1.0	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	G 5					Ce 5		Ce 5		
Bankfull Discharge (cfs)	6.6					6.6		6.6		
Sinuosity (ft)	1.09					1.1		1.1		
Water Surface Slope (Channel) (ft/ft)	0.0145					0.0144		0.0144		
Other										

**Table 9C. Baseline Stream Data Summary
Crane - UT 3**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline		
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Riffle Only										
Bankfull Width (ft)	2.1	3.4		4.2		3.8	4.4	7.8	7.8	1
Floodprone Width (ft)	4	23		50		25	75	50.0	50.0	1
Bankfull Mean Depth (ft)	0.3	0.4		0.6		0.3	0.3	0.5	0.5	1
Bankfull Max Depth (ft)	0.6	0.8		1.1		0.4	0.5	0.8	0.8	1
Bankfull Cross Sectional Area (ft ²)	1.2	1.2		1.2		1.2	1.2	3.9	3.9	1
Width/Depth Ratio	3.5	10.1		14		12	16	15.6	15.6	1
Entrenchment Ratio	1.3	8.1		23.8		6.6	17.1	6.4	6.4	1
Bank Height Ratio	2	4		7.2		1	1.3	1.0	1.0	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg 5					Ce 5		Ce 5		
Bankfull Discharge (cfs)	4.2					4.2		4.2		
Sinuosity (ft)	1.01					1.1		1.1		
Water Surface Slope (Channel) (ft/ft)	0.0287					0.0264		0.0264		
Other										

**Table 9D. Baseline Stream Data Summary
Crane - UT 4**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline		
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Riffle Only										
Bankfull Width (ft)	1.8	3.3		4.8		3.9	4.6	4.7	7.5	2
Floodprone Width (ft)	8	50		26		50	100	75.0	75.0	2
Bankfull Mean Depth (ft)	0.3	0.5		0.7		0.3	0.3	0.3	0.4	2
Bankfull Max Depth (ft)	0.4	0.8		1.2		0.4	0.5	0.5	0.6	2
Bankfull Cross Sectional Area (ft ²)	1.3	1.3		1.3		1.3	1.3	1.4	2.7	2
Width/Depth Ratio	2.6	8.9		16		12	16	15.6	20.8	2
Entrenchment Ratio	1.2	9.8		15.6		6.1	15.8	9.9	16.0	2
Bank Height Ratio	1.3	1.9		2.8		1	1.3	1.0	1.0	2
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Eg 5					Ce 5		Ce 5		
Bankfull Discharge (cfs)	4.5					4.5		4.5		
Sinuosity (ft)	1.01					1.1		1.1		
Water Surface Slope (Channel) (ft/ft)	0.0145					0.0133		0.0133		
Other										

**Table 9E. Baseline Stream Data Summary
Crane - UT 5**

Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline		
	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Riffle Only										
Bankfull Width (ft)	3.7	4.1		4.7		6.1	7	10.3	10.3	1
Floodprone Width (ft)	6	8		11		50	150	100.0	100.0	1
Bankfull Mean Depth (ft)	0.6	0.7		0.8		0.4	0.5	0.4	0.4	1
Bankfull Max Depth (ft)	0.8	1		1.2		0.6	0.8	0.9	0.9	1
Bankfull Cross Sectional Area (ft ²)	3.1	3.1		3.1		3.1	3.1	4.4	4.4	1
Width/Depth Ratio	4.6	5.8		7.8		12	16	24.2	24.2	1
Entrenchment Ratio	1.3	1.9		2.6		8.2	21.3	9.7	9.7	1
Bank Height Ratio	1.8	2.9		4.8		1	1.3	1.0	1.0	1
Max part size (mm) mobilized at bankfull										
Rosgen Classification	Ge 5					Ce 5		Ce 5		
Bankfull Discharge (cfs)	11.3					11.3		11.3		
Sinuosity (ft)	1.01					1.1		1.1		
Water Surface Slope (Channel) (ft/ft)	0.0149					0.0136		0.0136		
Other										

Table 10A. Monitoring Data - Cross Section Morphology Monitoring Summary
(Crane/ DMS:100165) UT 1, UT 2, and UT 4

	UT 2 - Cross Section 1 (Pool)							UT 2 - Cross Section 2 (Riffle)							UT 4 - Cross Section 3 (Riffle)							UT 4 - Cross Section 4 (Pool)							UT 4 - Cross Section 5 (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	388.48	388.41						388.92	388.86						388.85	388.89							388.94	388.96						391.96	391.96					
Bank Height Ratio_Based on AB Bankfull ¹ Area	NA	NA						1.00	1.09						1.00	0.98							NA	NA						1.00	1.03					
Thalweg Elevation	387.36	387.33						387.92	387.87						388.24	388.22							388.06	388.04						391.43	391.42					
LTOB ² Elevation	388.48	388.44						388.92	388.95						388.85	388.88							388.94	388.96						391.96	391.97					
LTOB ² Max Depth (ft)	1.12	1.11						1.00	1.08						0.61	0.66							0.88	0.92						0.53	0.55					
LTOB ² Cross Sectional Area (ft ²)	5.09	5.32						3.78	4.39						2.73	2.60							3.04	3.04						1.40	1.47					
	UT 4 - Cross Section 6 (Pool)							UT 1 - Cross Section 7 (Riffle)							UT 1 - Cross Section 8 (Pool)																					
	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	392.04	392.06						389.84	389.88						389.72	389.69																				
Bank Height Ratio_Based on AB Bankfull ¹ Area	NA	NA						1.00	0.94						NA	NA																				
Thalweg Elevation	391.06	391.15						388.83	388.83						388.24	387.96																				
LTOB ² Elevation	392.04	392.10						389.84	389.82						389.72	389.65																				
LTOB ² Max Depth (ft)	0.99	0.94						1.01	0.99						1.48	1.69																				
LTOB ² Cross Sectional Area (ft ²)	3.03	3.25						6.73	6.24						9.71	9.28																				
<p>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:</p> <p>1 - Bank Height Ratio (BHR) takes the As-built bankfull area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.</p> <p>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 above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recorded and tracked above as LTOB max depth.</p>																																				
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)																																				

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

Table 10B. Monitoring Data - Cross Section Morphology Monitoring Summary
(Crane/ DMS:100165) UT 1, UT 3, and UT 5

	UT 3 - Cross Section 9 (Riffle)							UT 3 - Cross Section 10 (Pool)							UT 1 - Cross Section 11 (Riffle)							UT 1 - Cross Section 12 (Pool)							UT 5 - Cross Section 13 (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	394.72	394.76						394.40	394.17						395.05	395.01							395.00	395.03						399.13	399.17					
Bank Height Ratio_Based on AB Bankfull ¹ Area	1.00	0.89						NA	1.07						1.00	1.05							NA	1.00						1.00	1.08					
Thalweg Elevation	393.90	393.88						391.94	392.13						394.18	394.16							393.69	393.51						398.21	398.29					
LTOB ² Elevation	394.72	394.66						394.40	394.32						395.05	395.06							395.00	395.03						399.13	399.25					
LTOB ² Max Depth (ft)	0.82	0.78						2.46	2.19						0.87	0.90							1.31	1.52						0.92	0.95					
LTOB ² Cross Sectional Area (ft ²)	3.90	3.25						5.34	5.90						5.08	5.49							7.96	7.93						4.39	5.00					
	UT 5 - Cross Section 14 (Pool)							UT 1 - Cross Section 15 (Riffle)							UT 1 - Cross Section 16 (Pool)																					
	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	398.95	398.94						408.40	408.40						408.81	409.00																				
Bank Height Ratio_Based on AB Bankfull ¹ Area	NA	1.02						1.00	1.05						NA	NA																				
Thalweg Elevation	398.20	398.12						407.44	407.37						406.67	406.88																				
LTOB ² Elevation	398.95	398.96						408.40	408.46						408.81	409.10																				
LTOB ² Max Depth (ft)	0.75	0.84						0.96	1.09						2.14	2.22																				
LTOB ² Cross Sectional Area (ft ²)	4.02	4.16						5.83	6.30						12.88	13.90																				
<p>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:</p> <p>1 - Bank Height Ratio (BHR) takes the As-built bankfull area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.</p> <p>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 above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recorded and tracked above as LTOB max depth.</p>																																				
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)																																				

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

Appendix D: Hydrologic Data

Table 11. Verification of Bankfull Events

Table 12. Groundwater Hydrology Data

Groundwater Gauge Graphs

Table 13A-D. Channel Evidence

Surface Water Gauge Graphs

Figure D1. 30-70 Percentile Graph for Rainfall

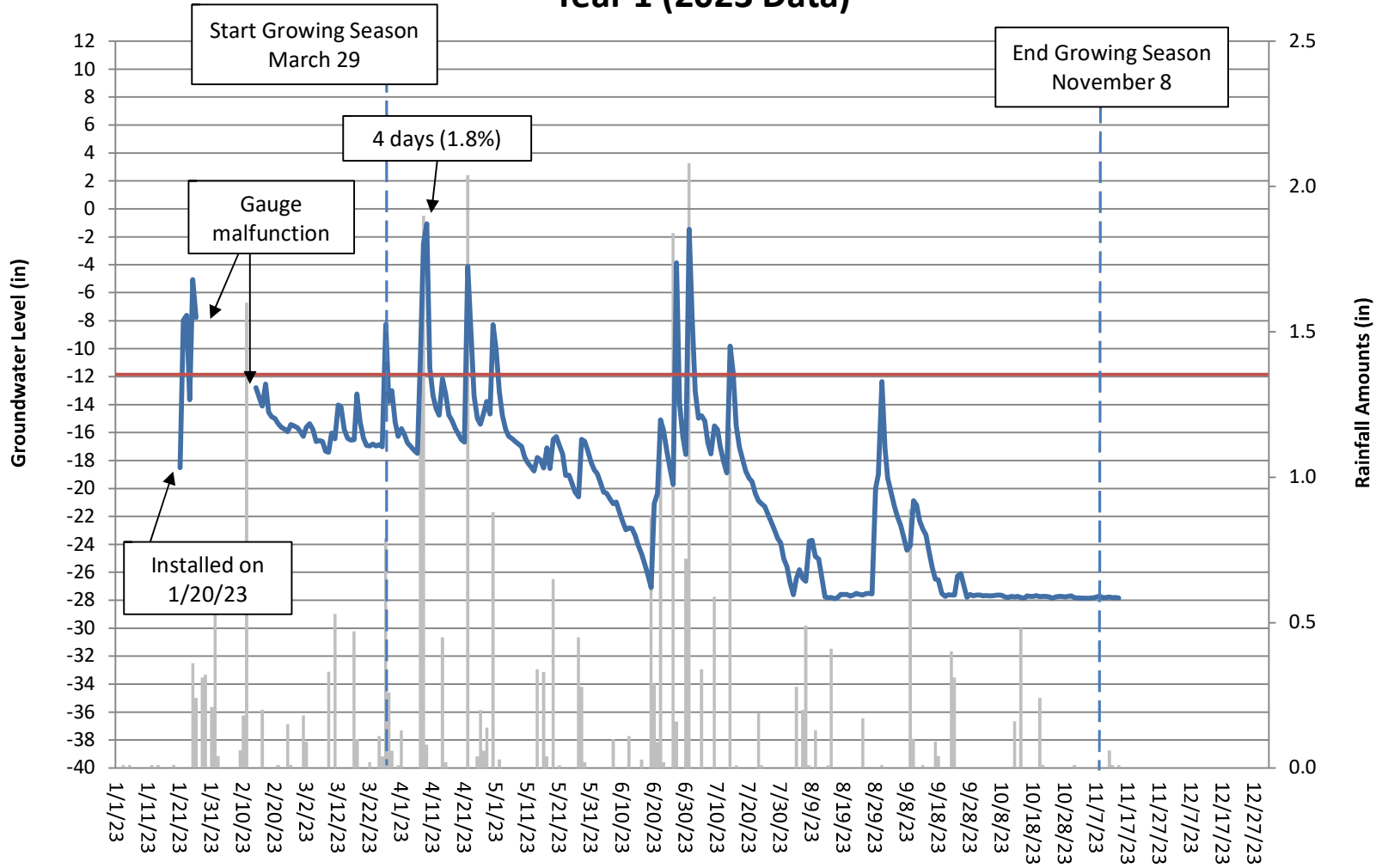
Table 11. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
July 1, 2023	July 1, 2023	Crest gauges on UT1 and UT2, as well as flow gauges on UT4 and UT5, documented a bankfull event after 2.80" of rain was recorded between June 30 and July 1, 2023 at an on-site rain gauge. UT1 crested at 1.5 ft, and UT2 crested at 1.22 ft.	--

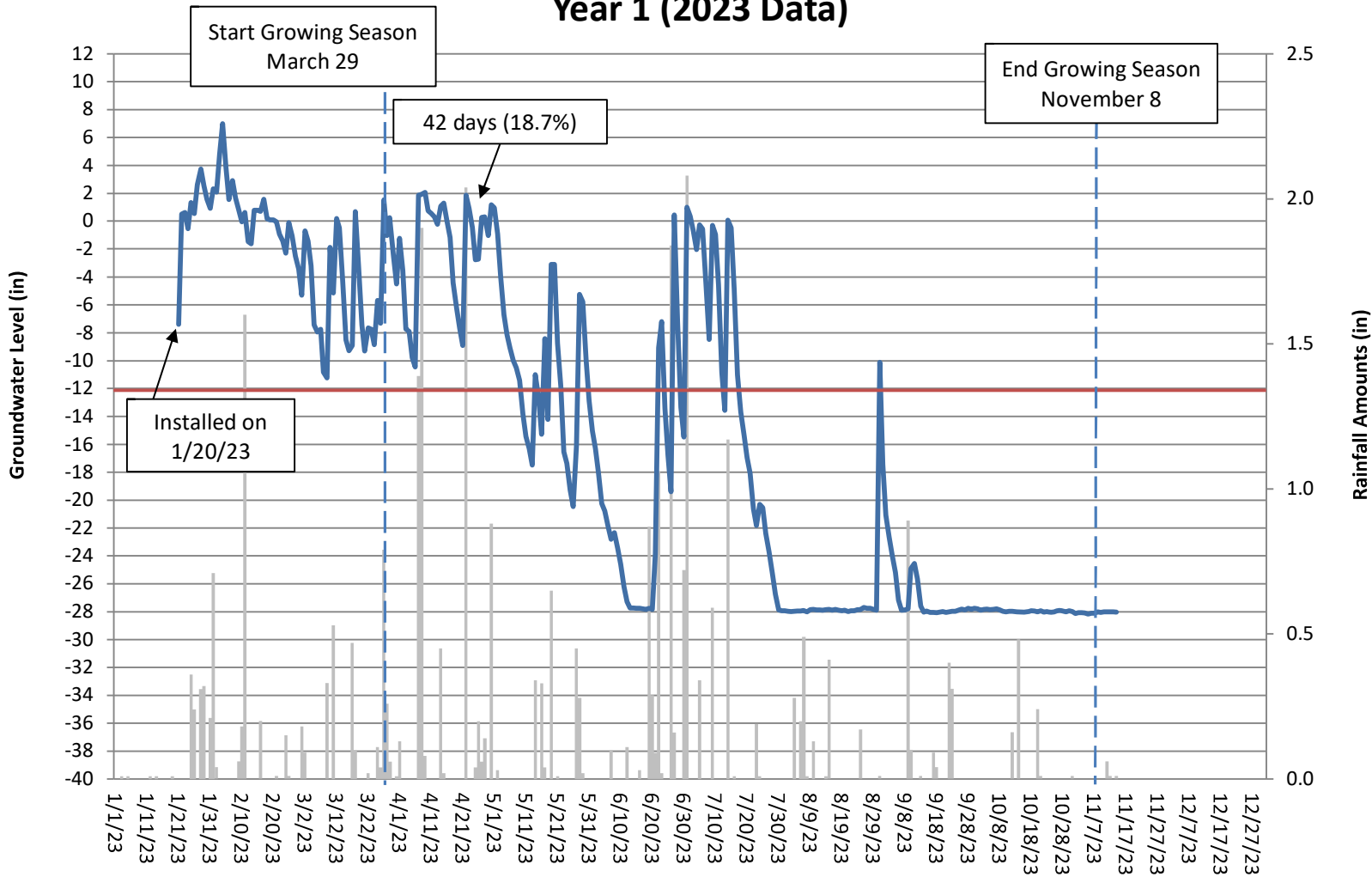
**Table 12. Groundwater Hydrology Data
Summary of Monitoring Period/Hydrology Success Criteria by Year**

Gauge	12% Hydroperiod Success Criteria Achieved – Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2023)	Year 2 (2024)	Year 3 (2025)	Year 4 (2026)	Year 5 (2027)	Year 6 (2028)	Year 7 (2029)
1	No – 4 Days (1.8%)						
2	Yes – 42 Days (18.7%)						
3	Yes – 45 Days (20.0%)						
4	No – 4 Days (1.8%)						
5	Yes – 27 Days (12.0%)						
6	Yes – 29 Days (12.9%)						
7	Yes – 57 Days (25.3%)						
8	No – 10 Days (4.4%)						
9	No – 22 Days (9.8%)						
10	Yes – 81 Days (36.0%)						
11	Yes – 73 Days (32.4%)						
12	No – 3 Days (1.3%)						
13	No – 6 Days (2.7%)						
14	No – 14 Days (6.2%)						
15	Yes – 32 Days (14.2%)						

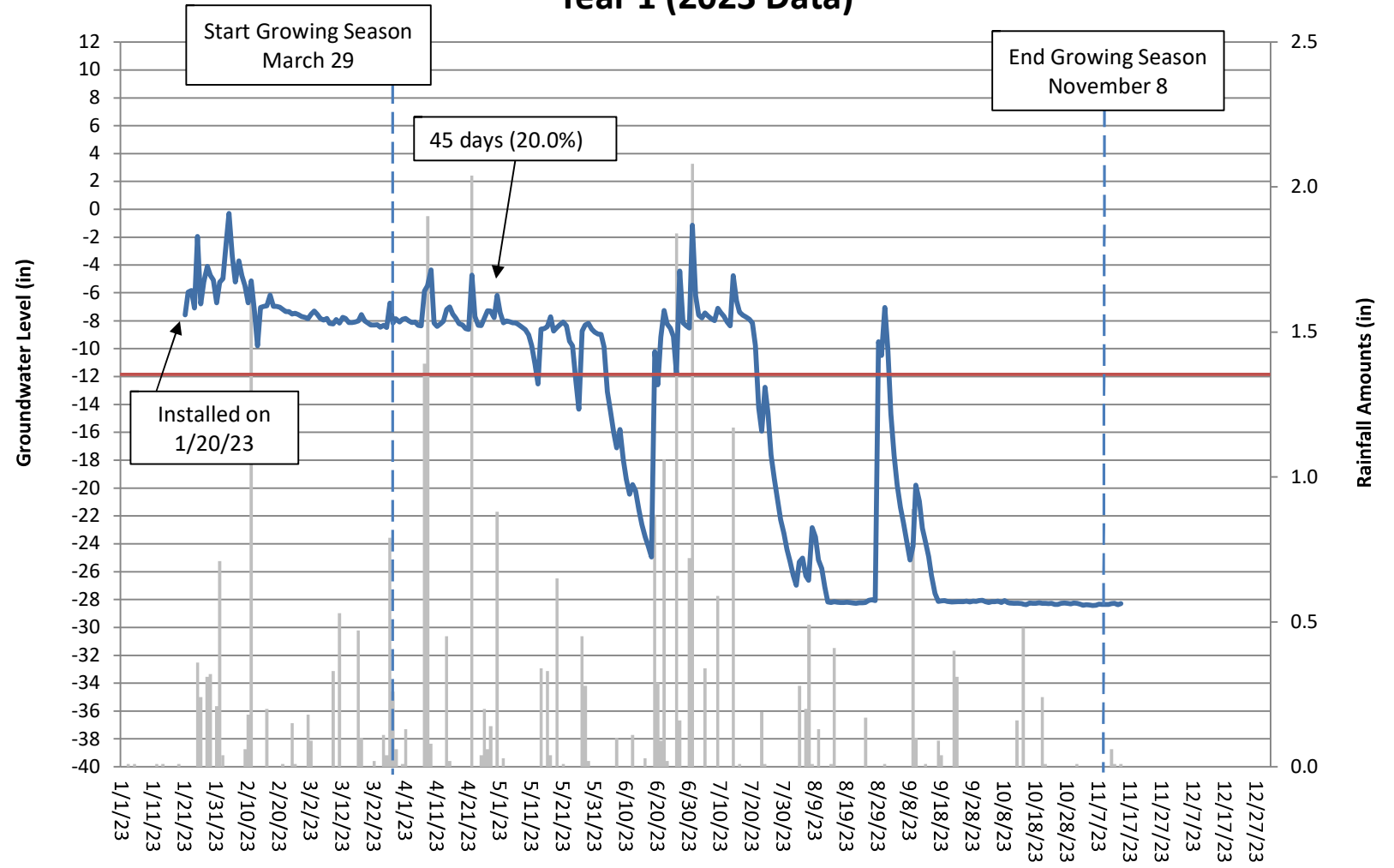
Crane Groundwater Gauge 1 Year 1 (2023 Data)



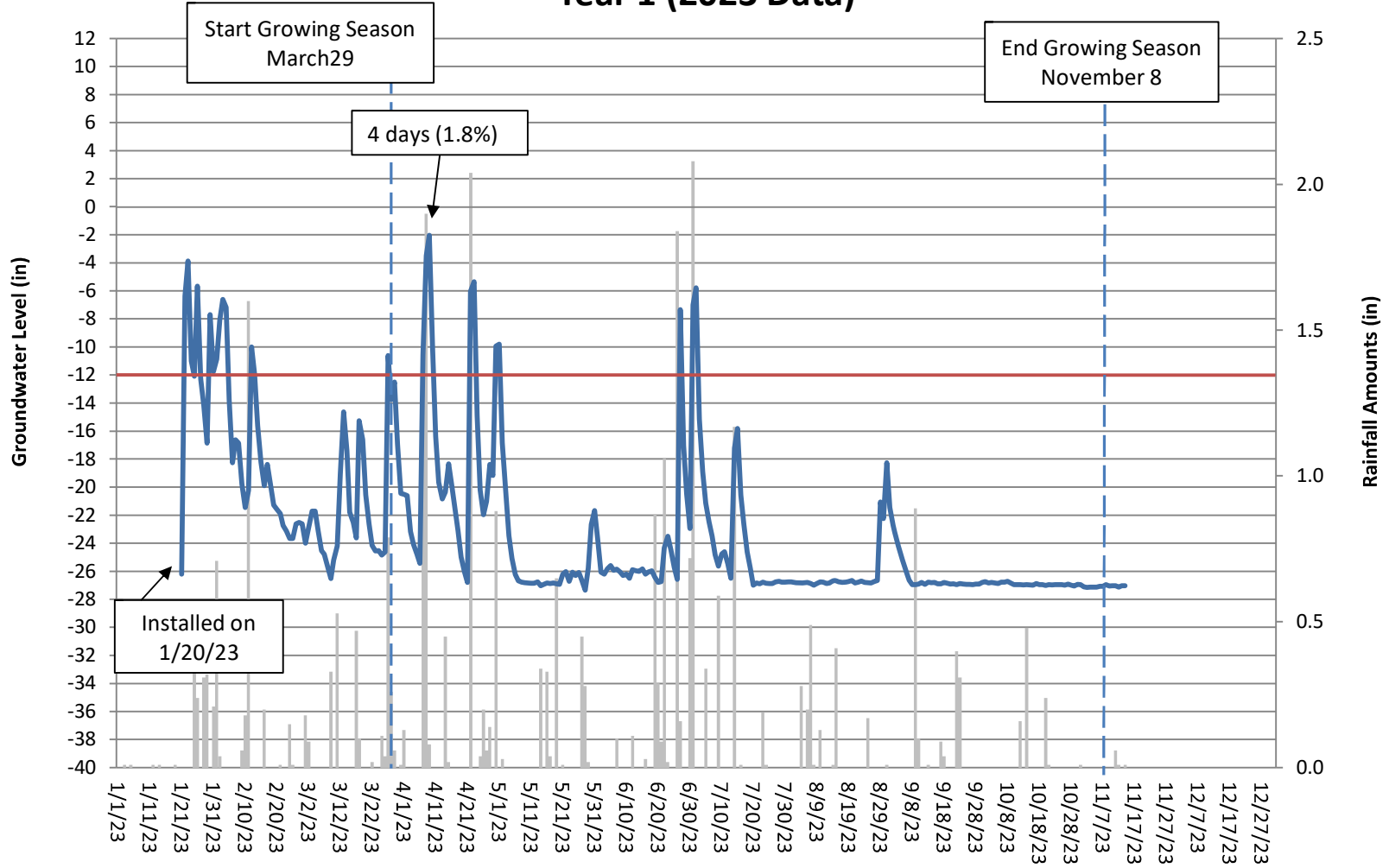
Crane Groundwater Gauge 2 Year 1 (2023 Data)



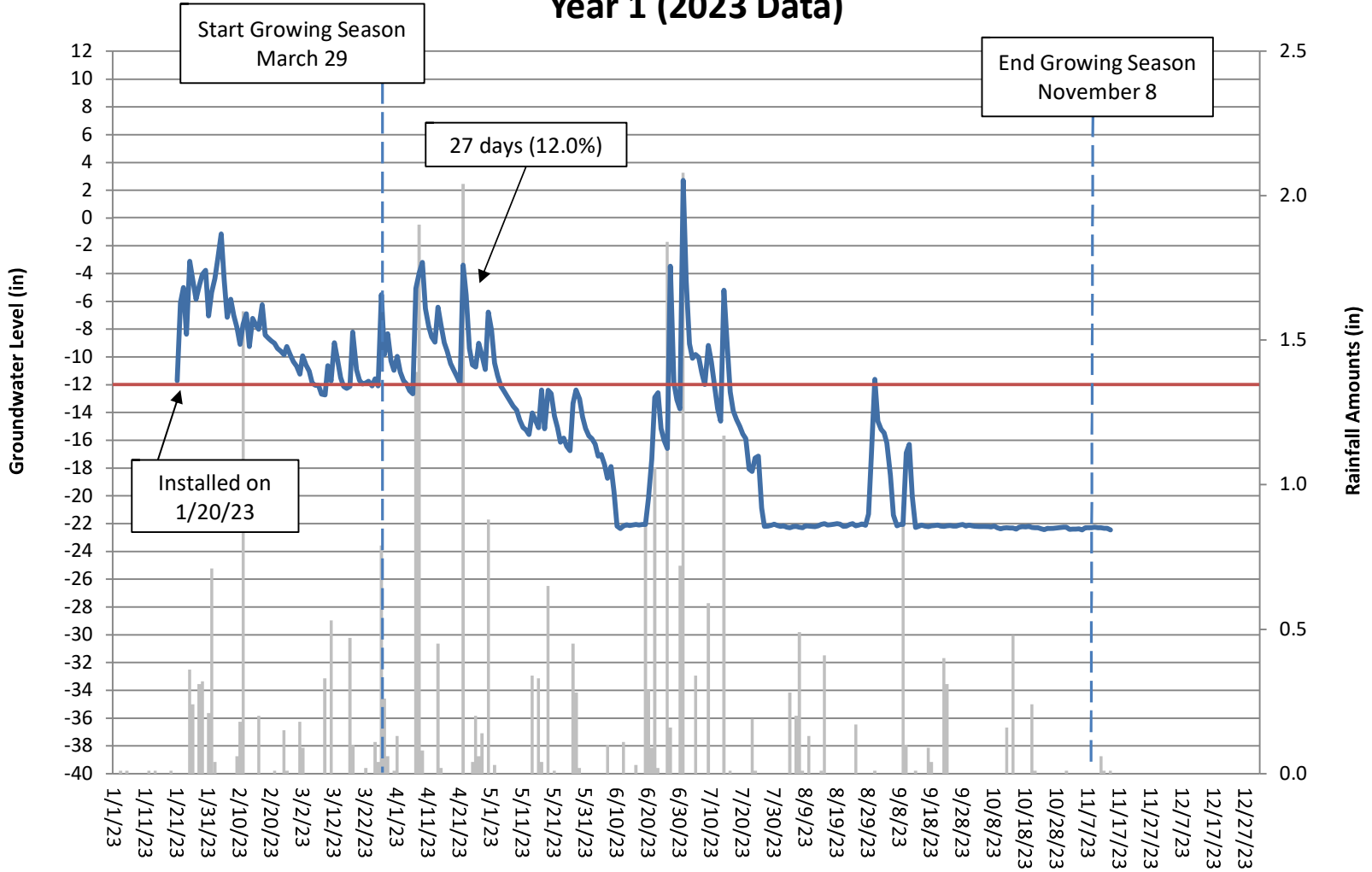
Crane Groundwater Gauge 3 Year 1 (2023 Data)



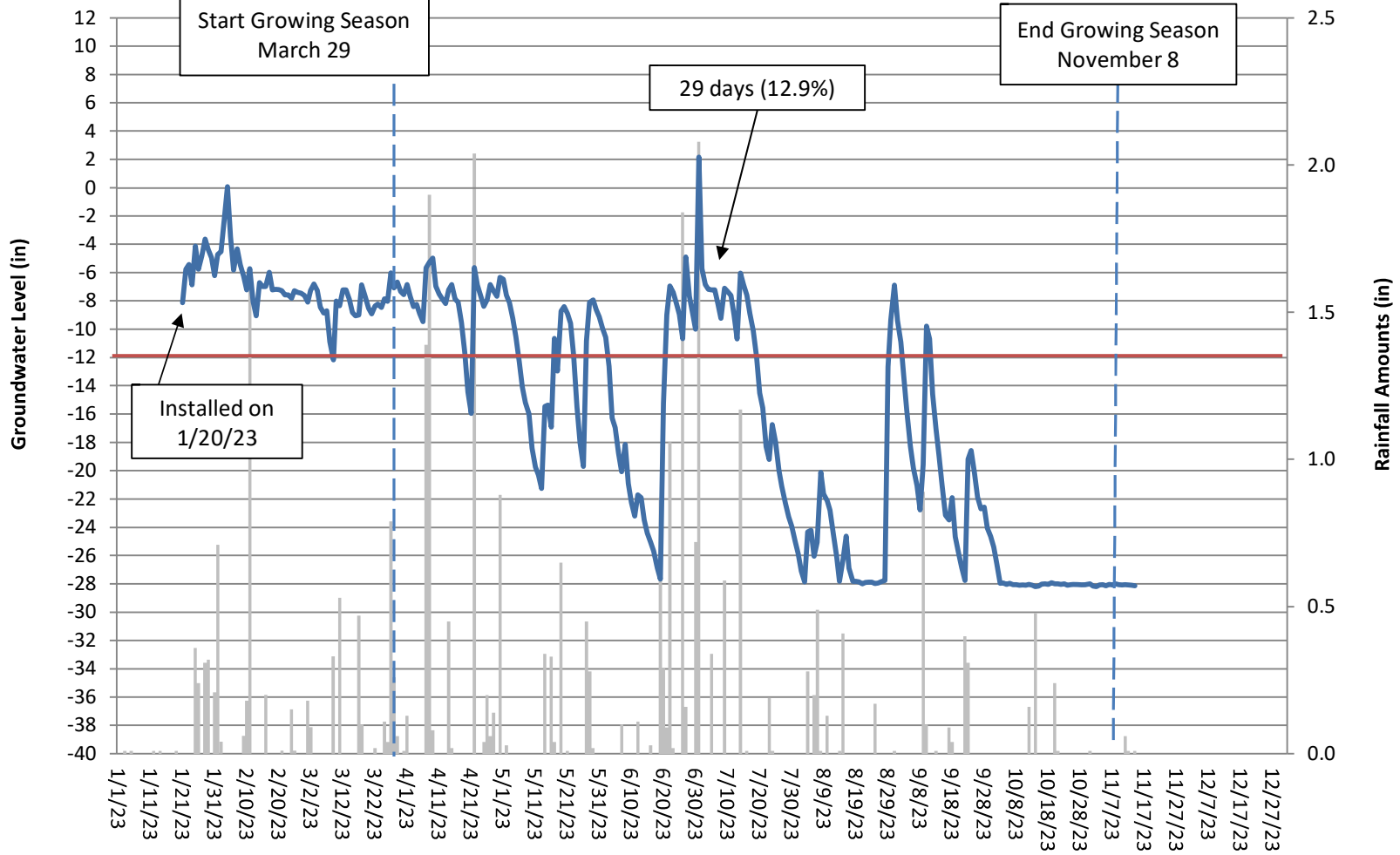
Crane Groundwater Gauge 4 Year 1 (2023 Data)



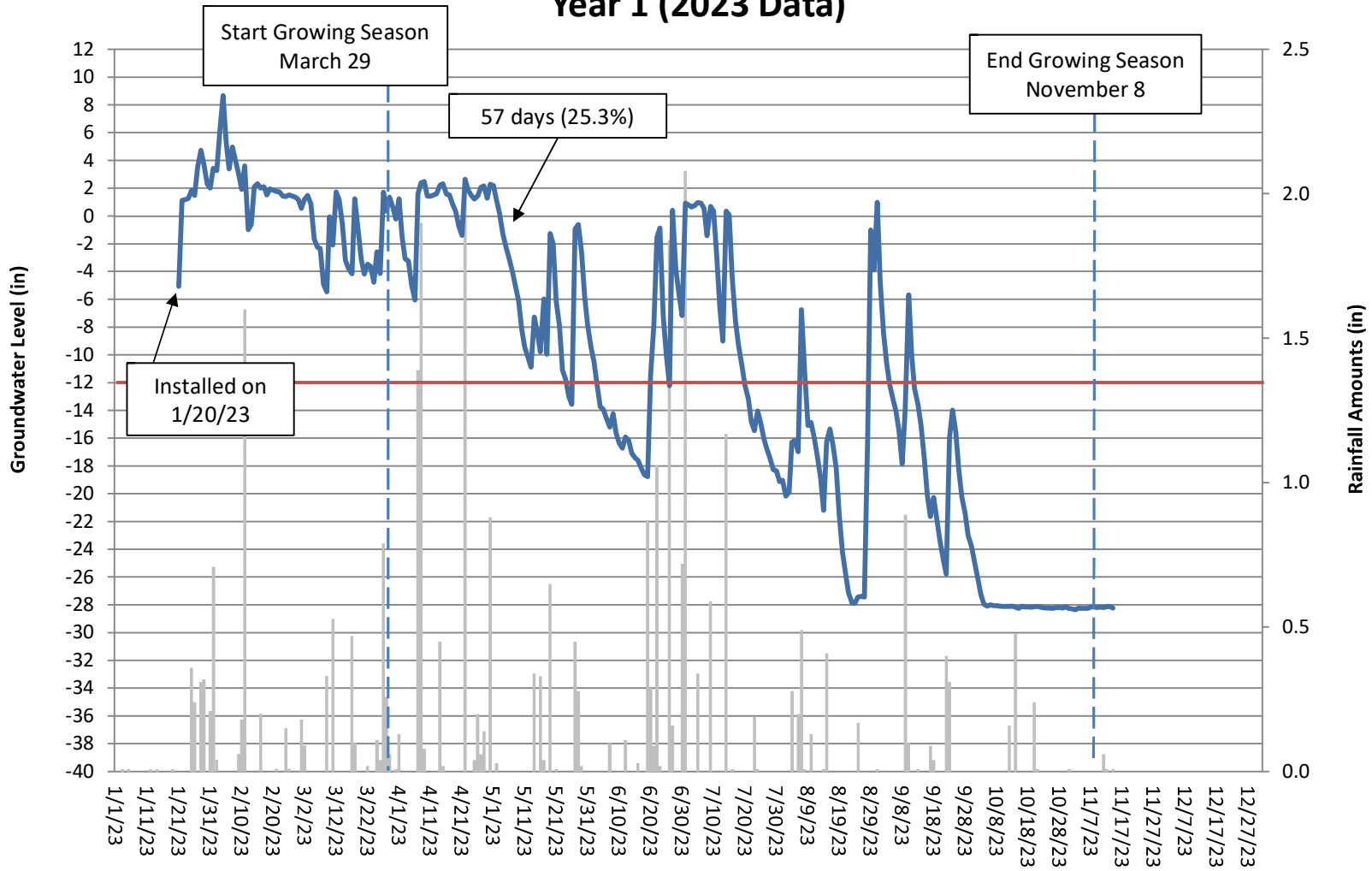
Crane Groundwater Gauge 5 Year 1 (2023 Data)



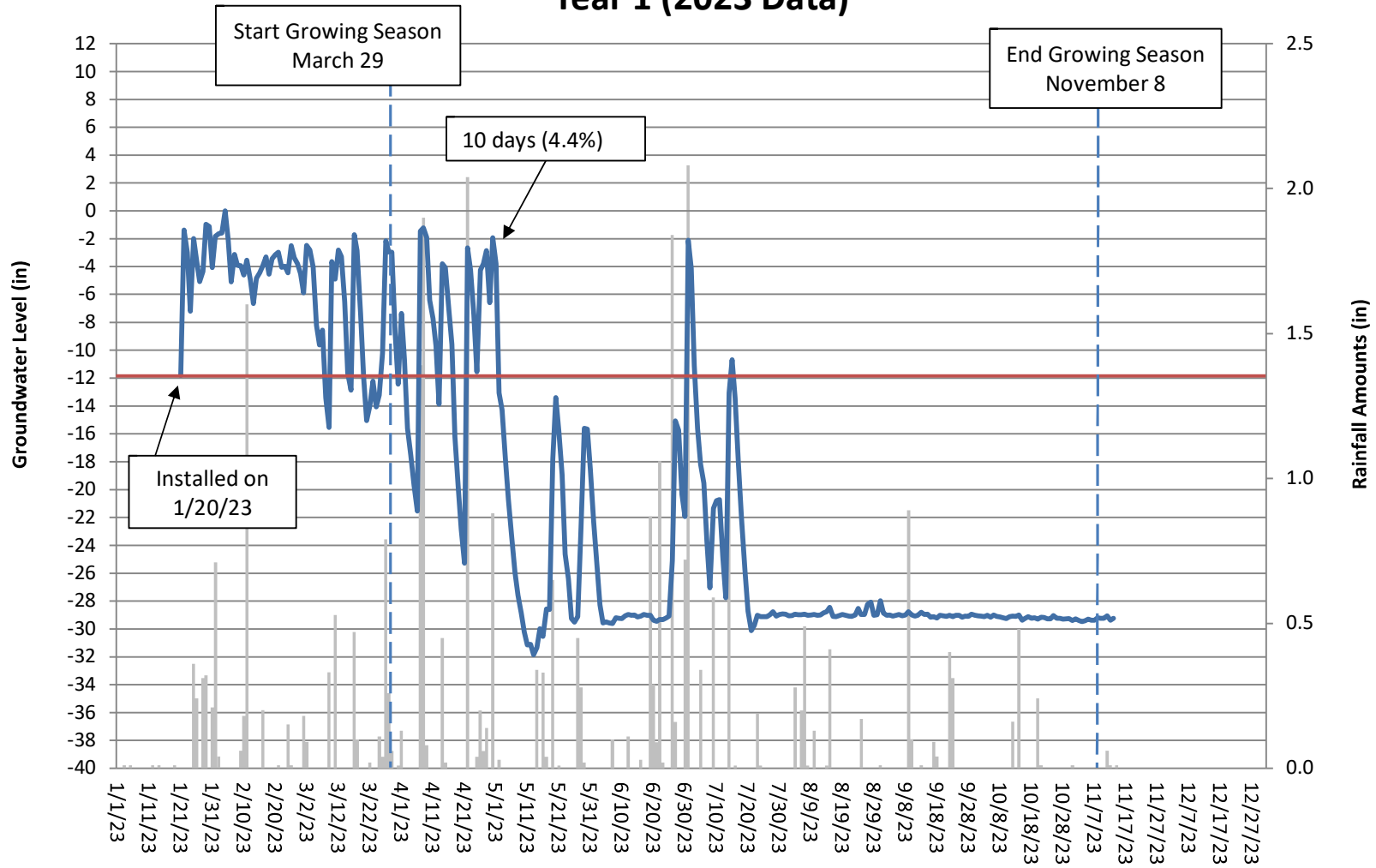
Crane Groundwater Gauge 6 Year 1 (2023 Data)



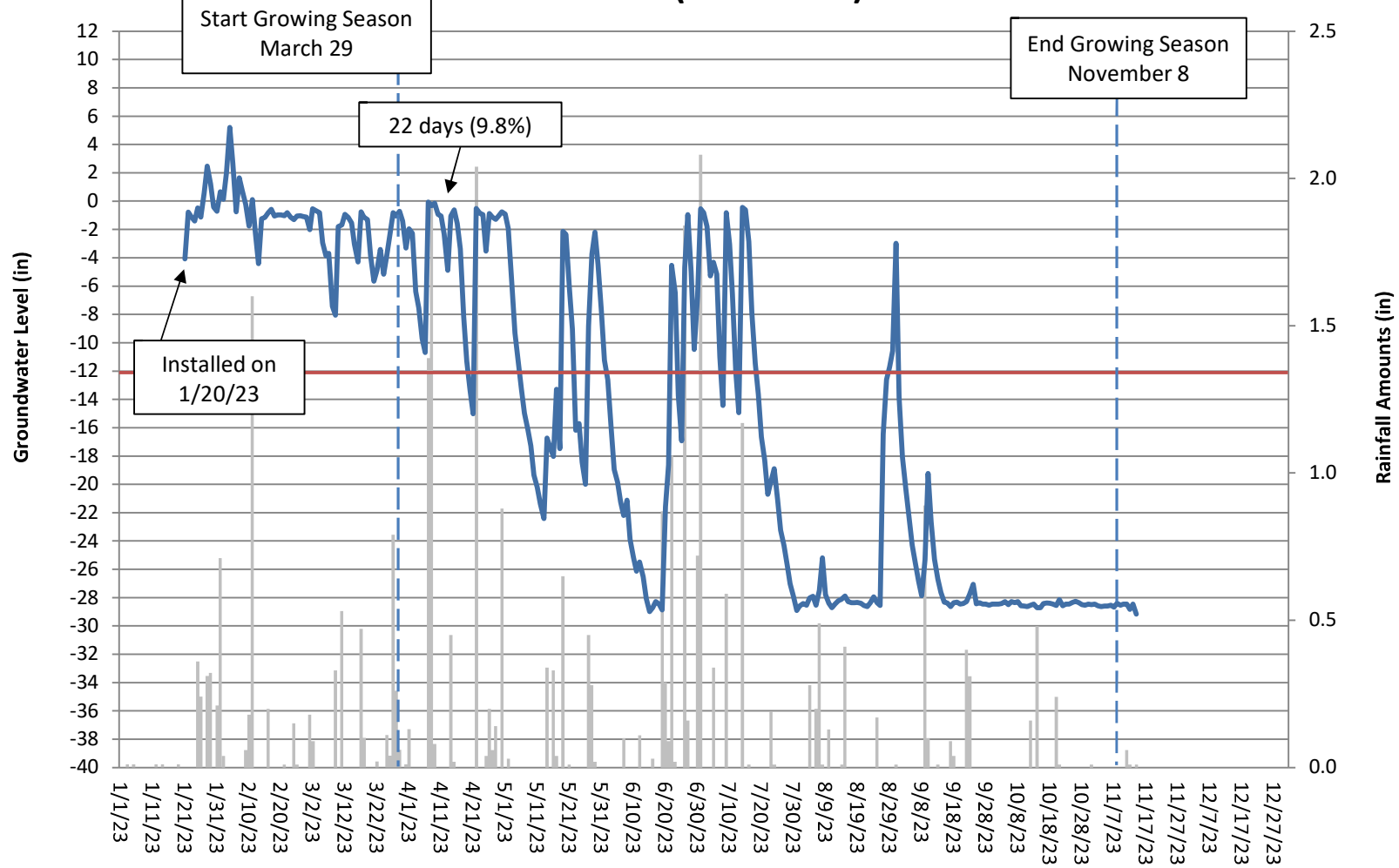
Crane Groundwater Gauge 7 Year 1 (2023 Data)



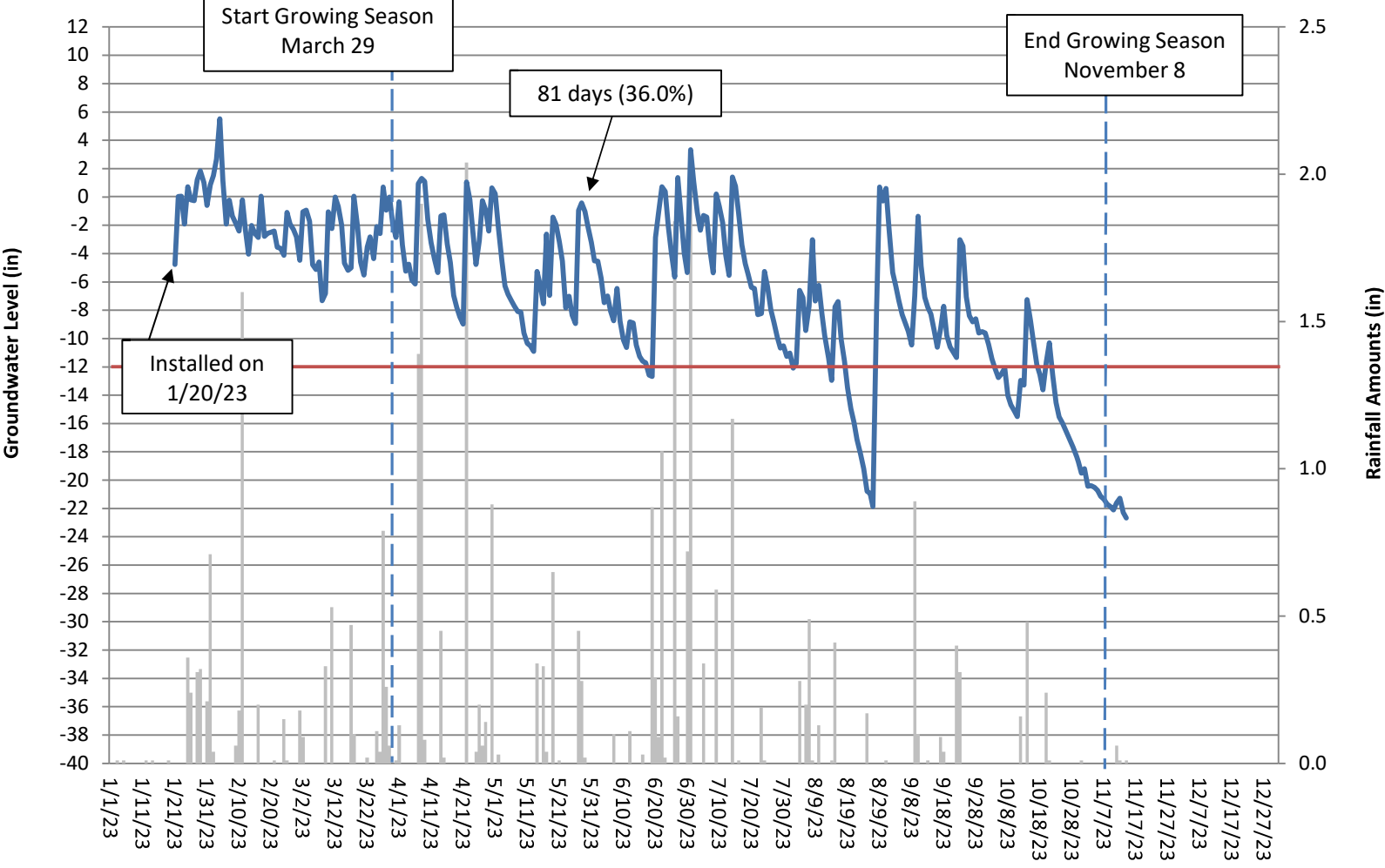
Crane Groundwater Gauge 8 Year 1 (2023 Data)



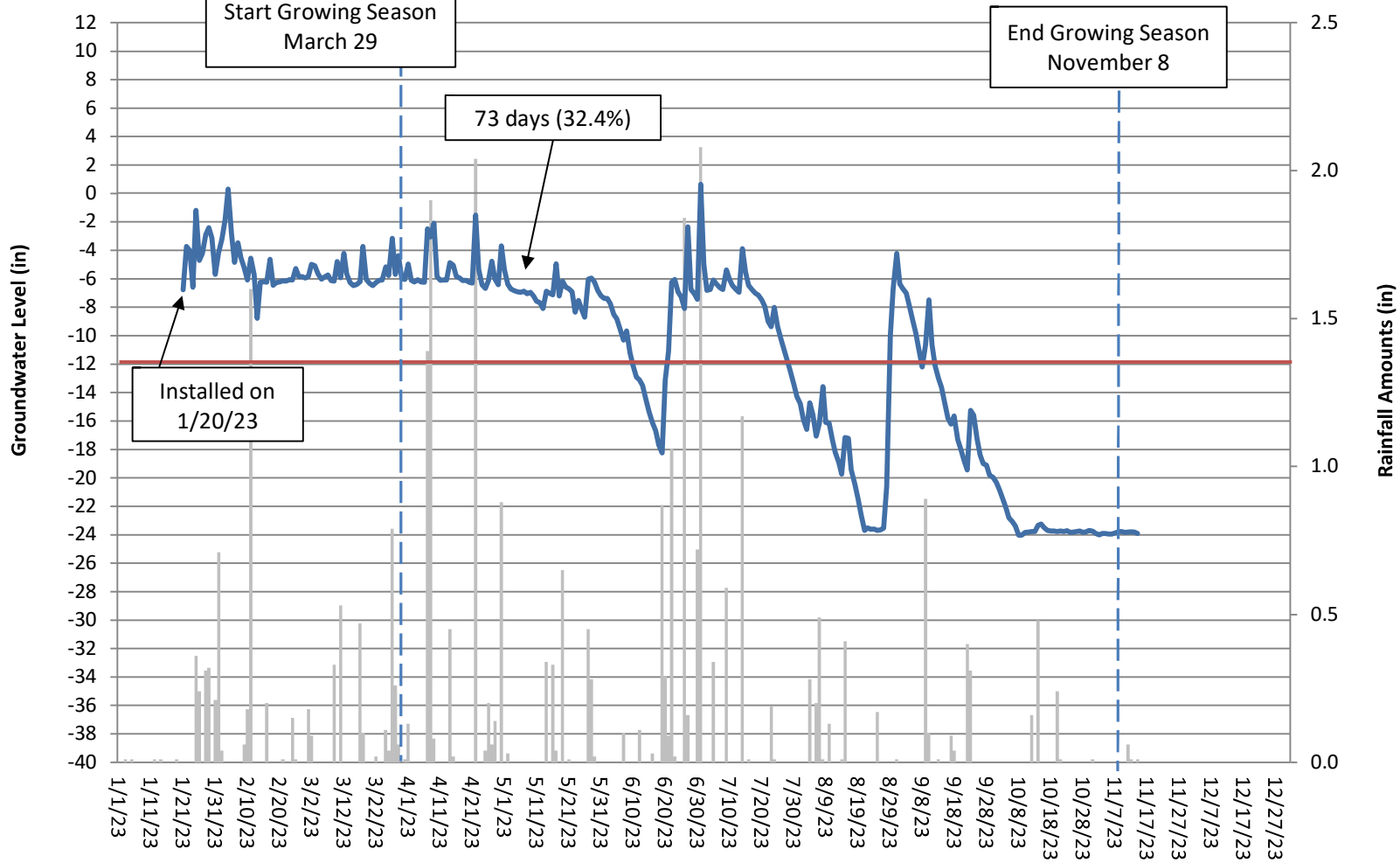
Crane Groundwater Gauge 9 Year 1 (2023 Data)



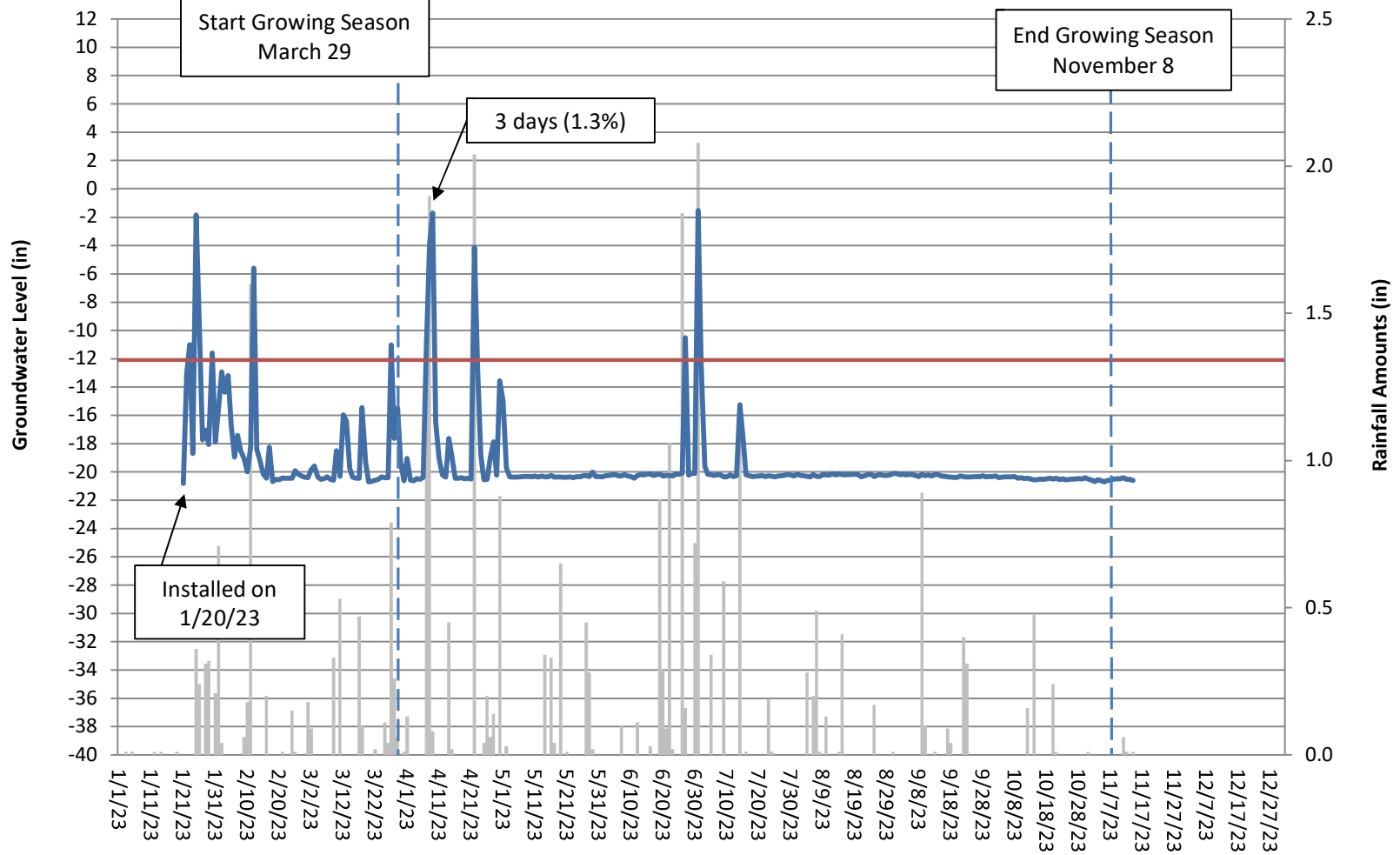
Crane Groundwater Gauge 10 Year 1 (2023 Data)



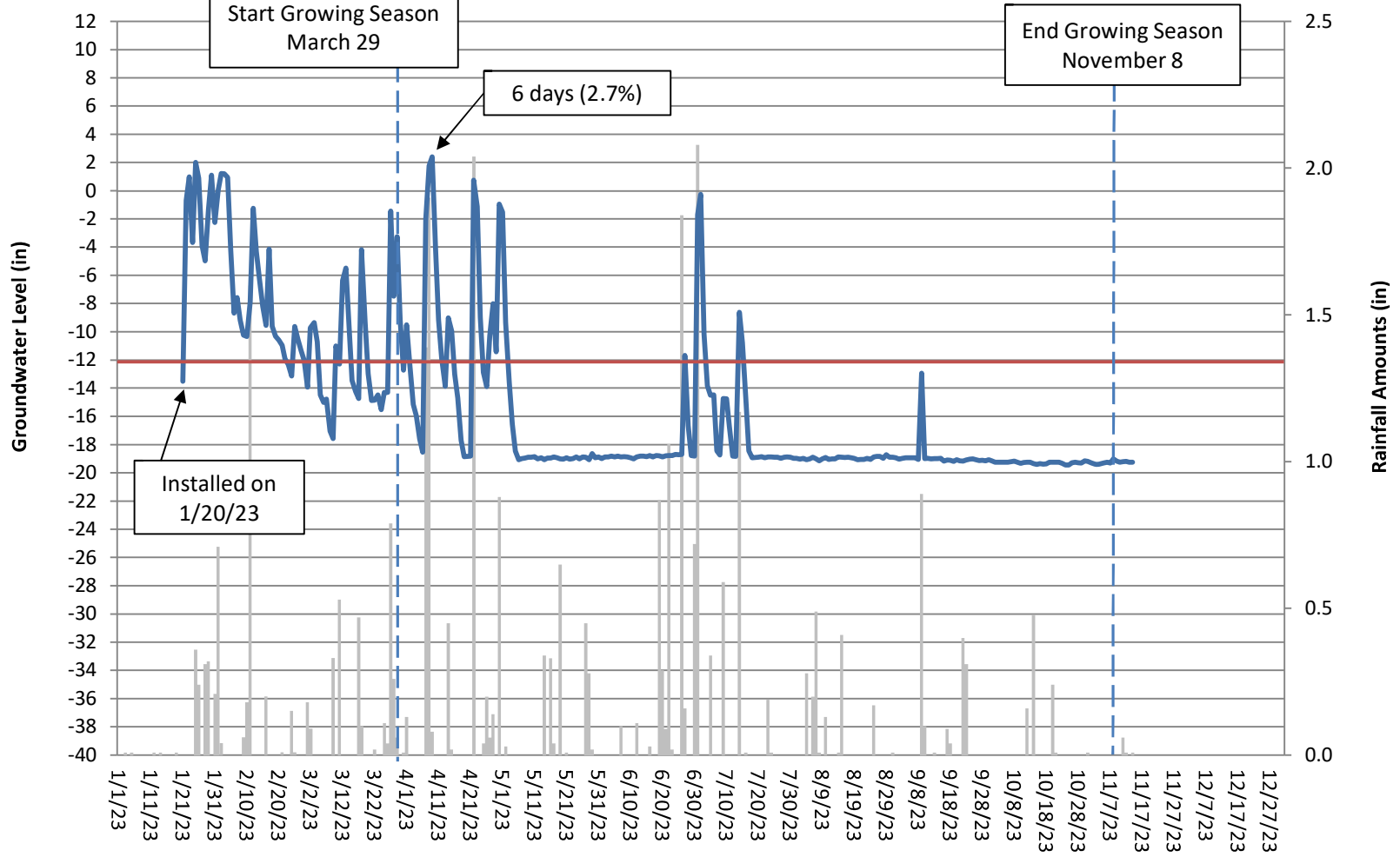
Crane Groundwater Gauge 11 Year 1 (2023 Data)



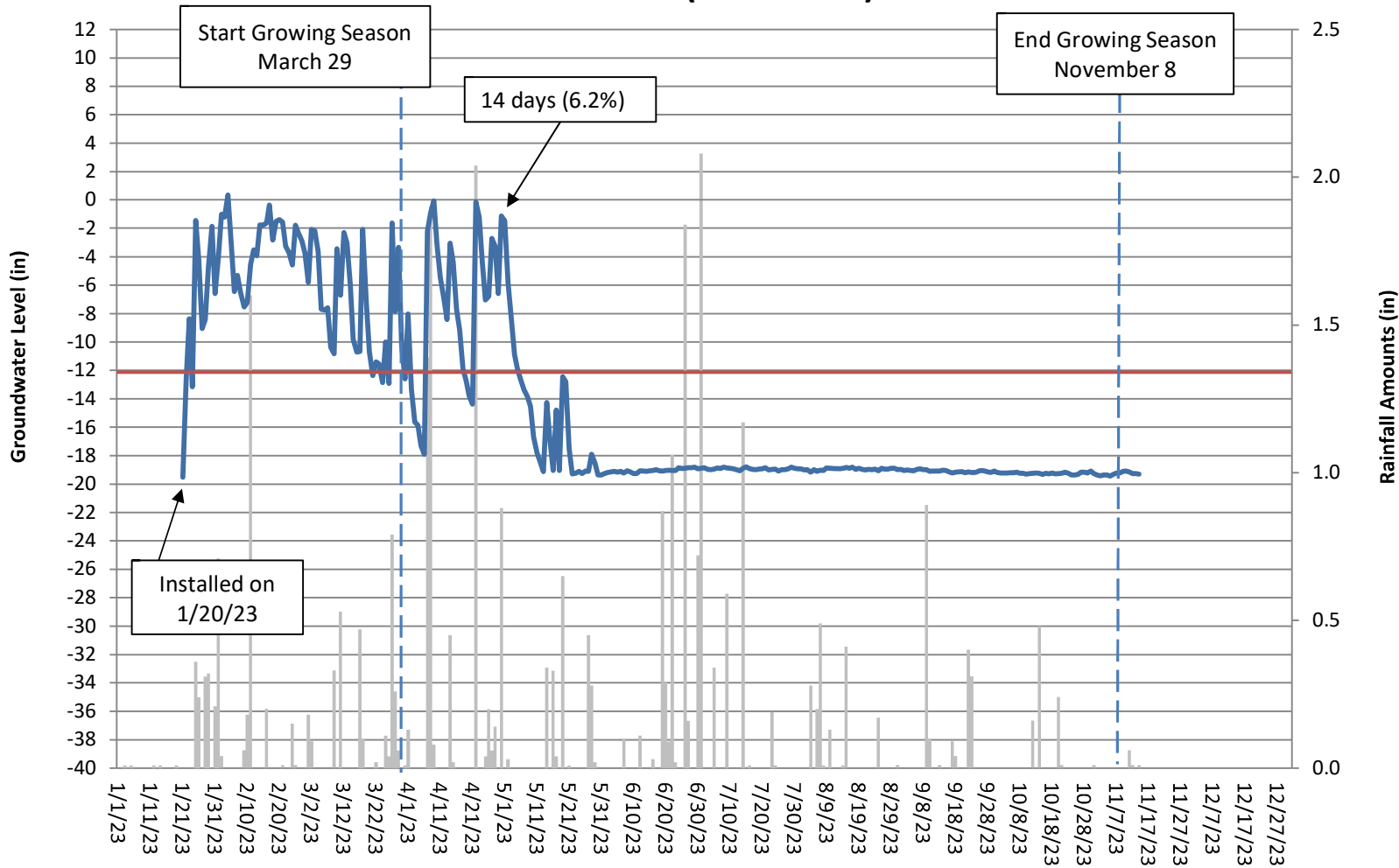
Crane Groundwater Gauge 12 Year 1 (2023 Data)



Crane Groundwater Gauge 13 Year 1 (2023 Data)



Crane Groundwater Gauge 14 Year 1 (2023 Data)



Crane Groundwater Gauge 15 Year 1 (2023 Data)

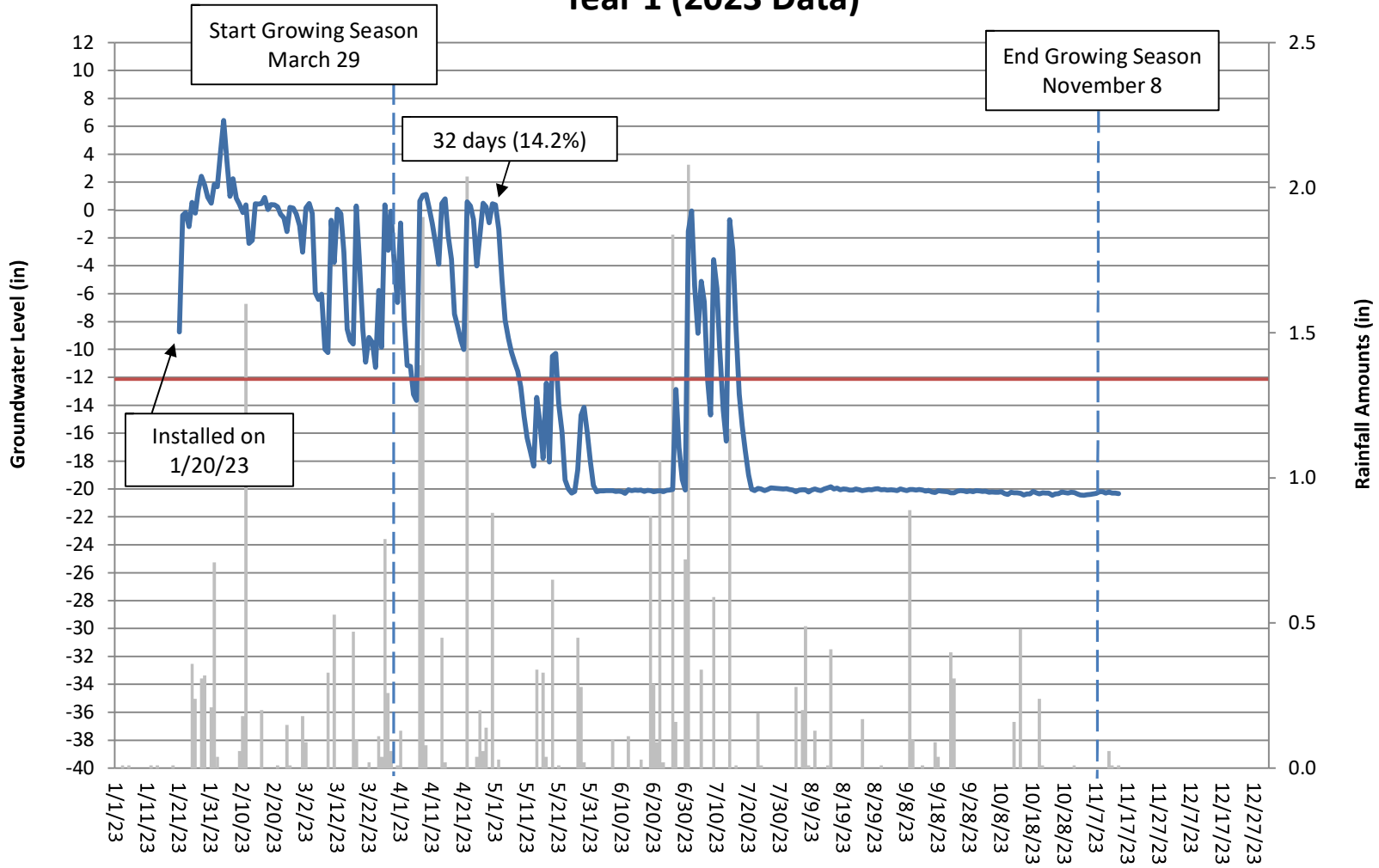


Table 13A. UT-2 Channel Evidence

UT-2 Channel Evidence	Year 1 (2023)
Max consecutive days channel flow	213
Total cumulative days channel flow*	241
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	

*New parameter as of MY-1 (2023), at the request of the IRT

Table 13B. UT-3 Channel Evidence

UT-3 Channel Evidence	Year 1 (2023)
Max consecutive days channel flow	214
Total cumulative days channel flow*	236
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	

*New parameter as of MY-1 (2023), at the request of the IRT

Table 13C. UT-4 Channel Evidence

UT-4 Channel Evidence	Year 1 (2023)
Max consecutive days channel flow	274
Total cumulative days channel flow*	297
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	

*New parameter as of MY-1 (2023), at the request of the IRT

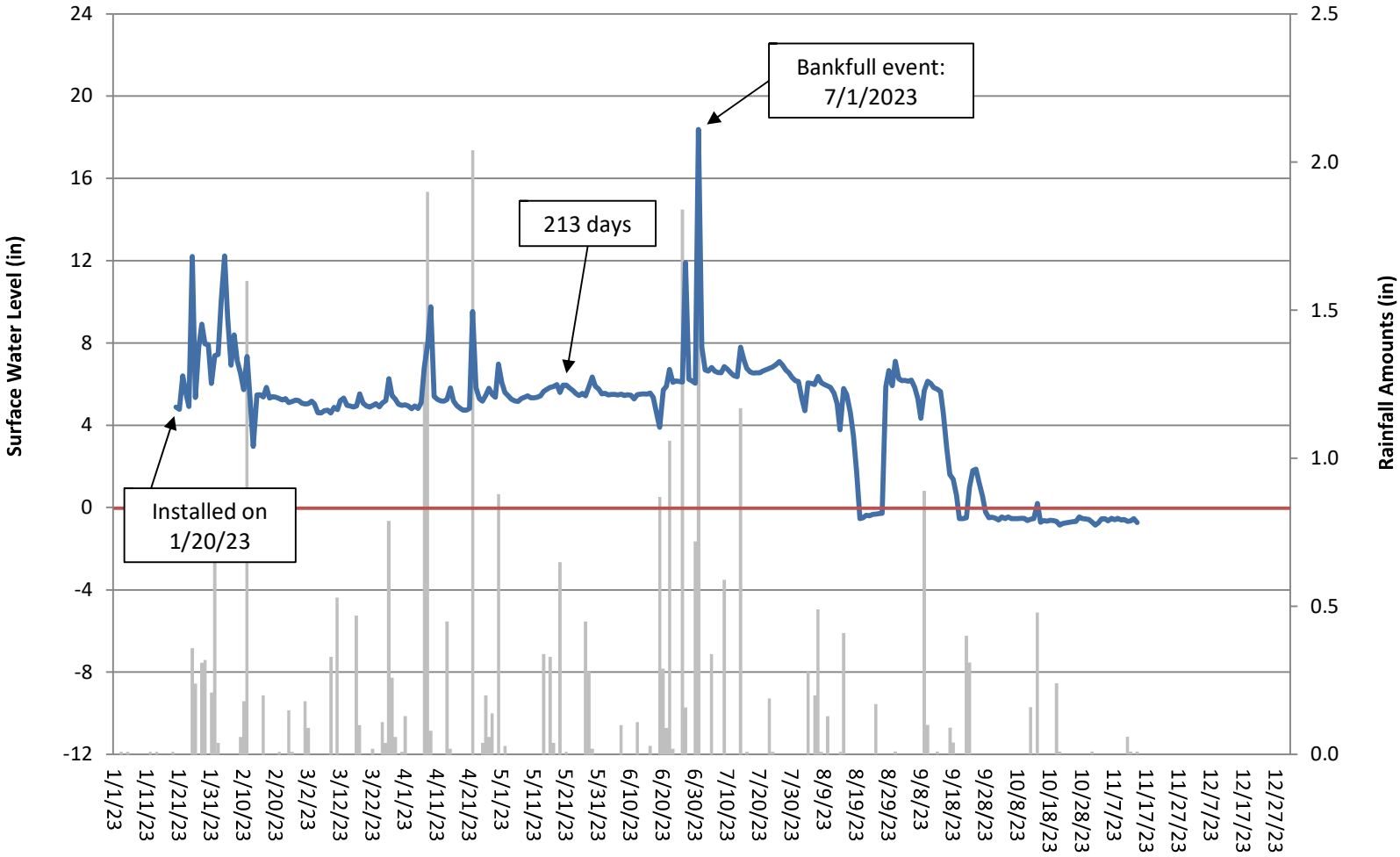
Table 13D. UT-5 Channel Evidence

UT-5 Channel Evidence	Year 1 (2023)
Max consecutive days channel flow	181
Total cumulative days channel flow*	239
Presence of litter and debris (wracking)	Yes
Leaf litter disturbed or washed away	Yes
Matted, bent, or absence of vegetation (herbaceous or otherwise)	Yes
Sediment deposition and/or scour indicating sediment transport	Yes
Water staining due to continual presence of water	Yes
Formation of channel bed and banks	Yes
Sediment sorting within the primary path of flow	Yes
Sediment shelving or a natural line impressed on the banks	Yes
Change in plant community (absence or destruction of terrestrial vegetation and/or transition to species adapted for flow or inundation for a long duration, including hydrophytes)	Yes
Development of channel pattern (meander bends and/or channel braiding) at natural topographic breaks, woody debris piles, or plant root systems	Yes
Exposure of woody plant roots within the primary path of flow	No
Other:	

*New parameter as of MY-1 (2023), at the request of the IRT

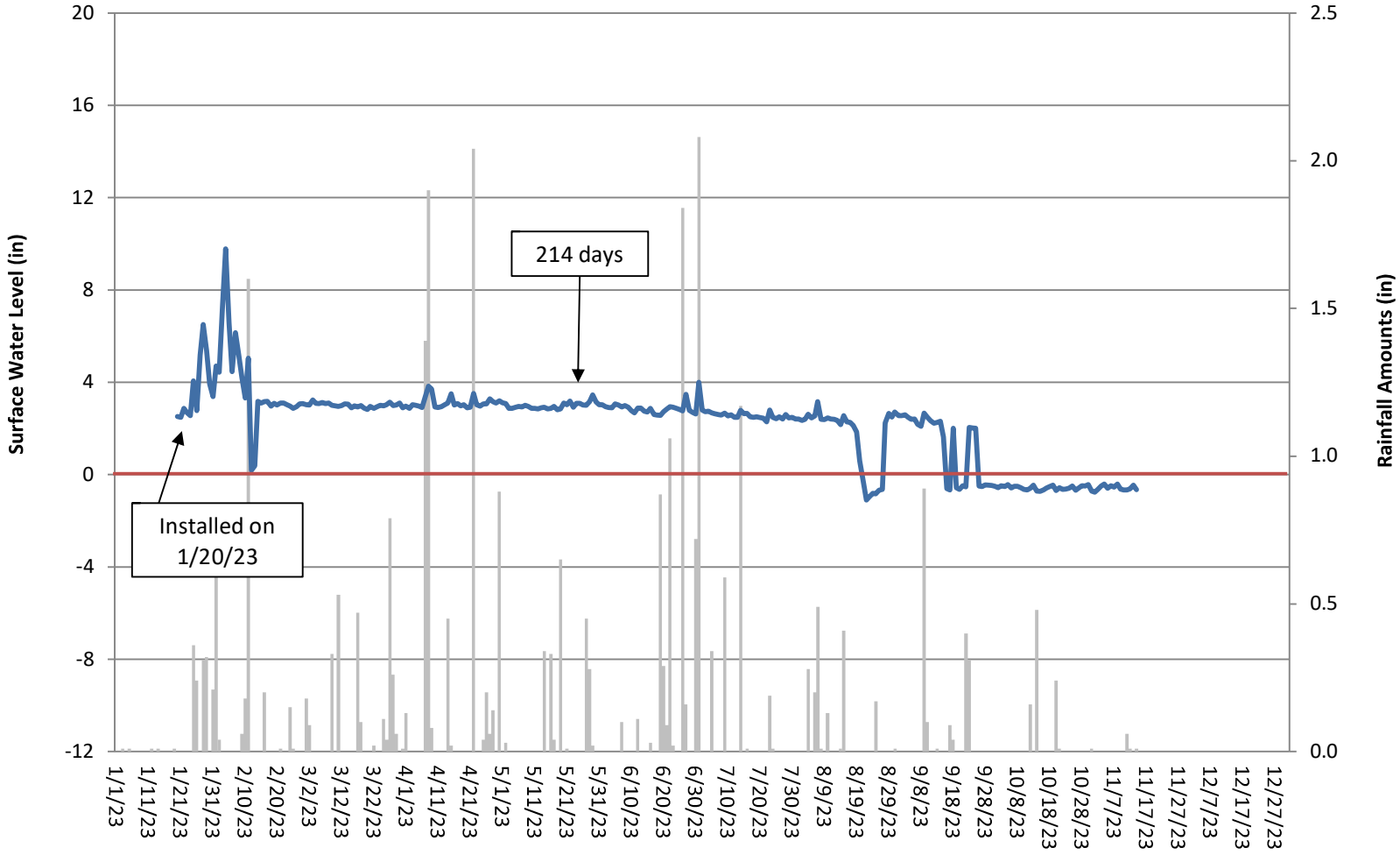
Crane UT2 Flow Gauge Year 1 (2023 Data)

Total Flow - 241 Days



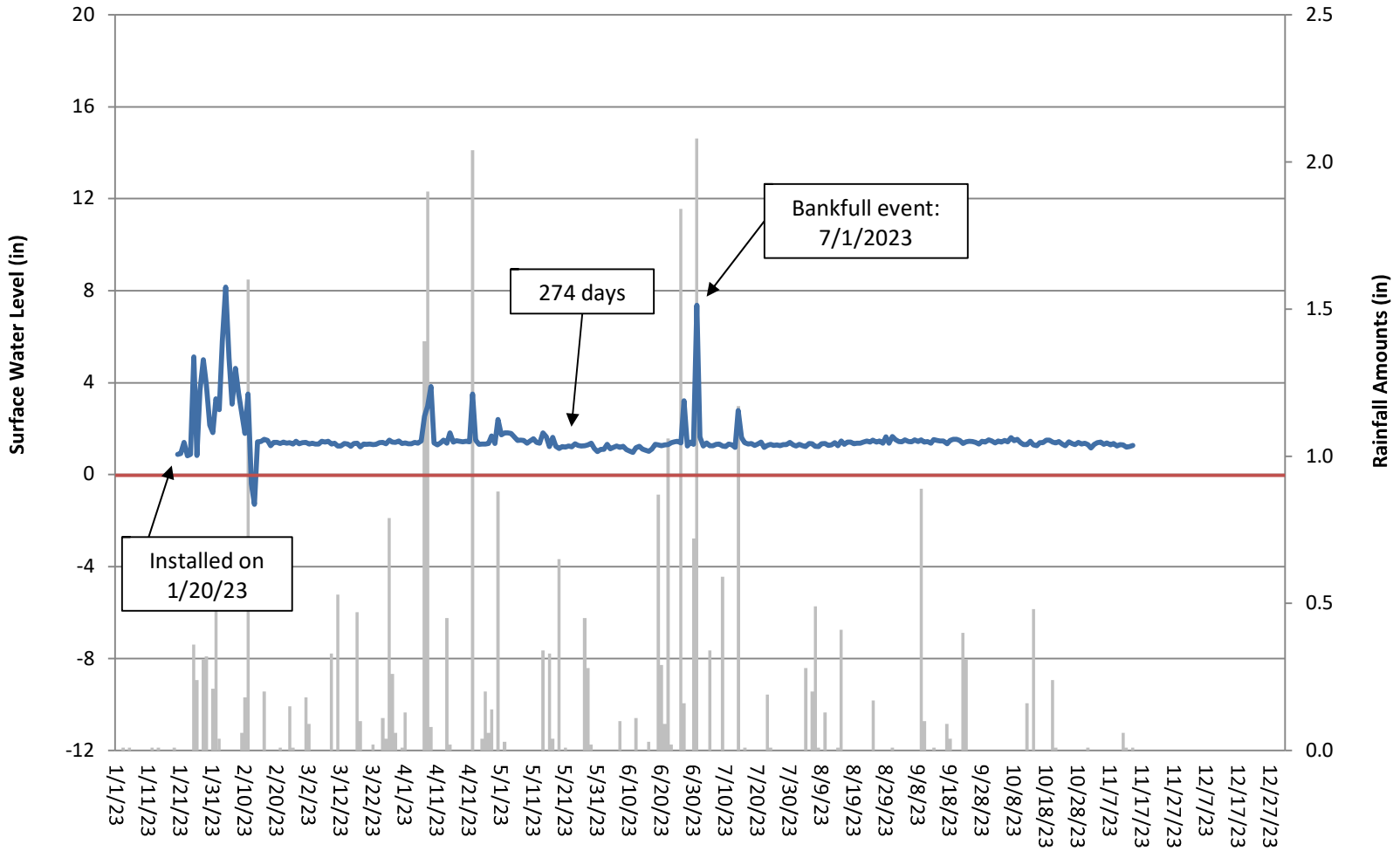
Crane UT3 Flow Gauge Year 1 (2023 Data)

Total Flow - 236 Days



Crane UT4 Flow Gauge Year 1 (2023 Data)

Total Flow - 297 Days



Crane UT5 Flow Gauge Year 1 (2023 Data)

Total Flow - 239 Days

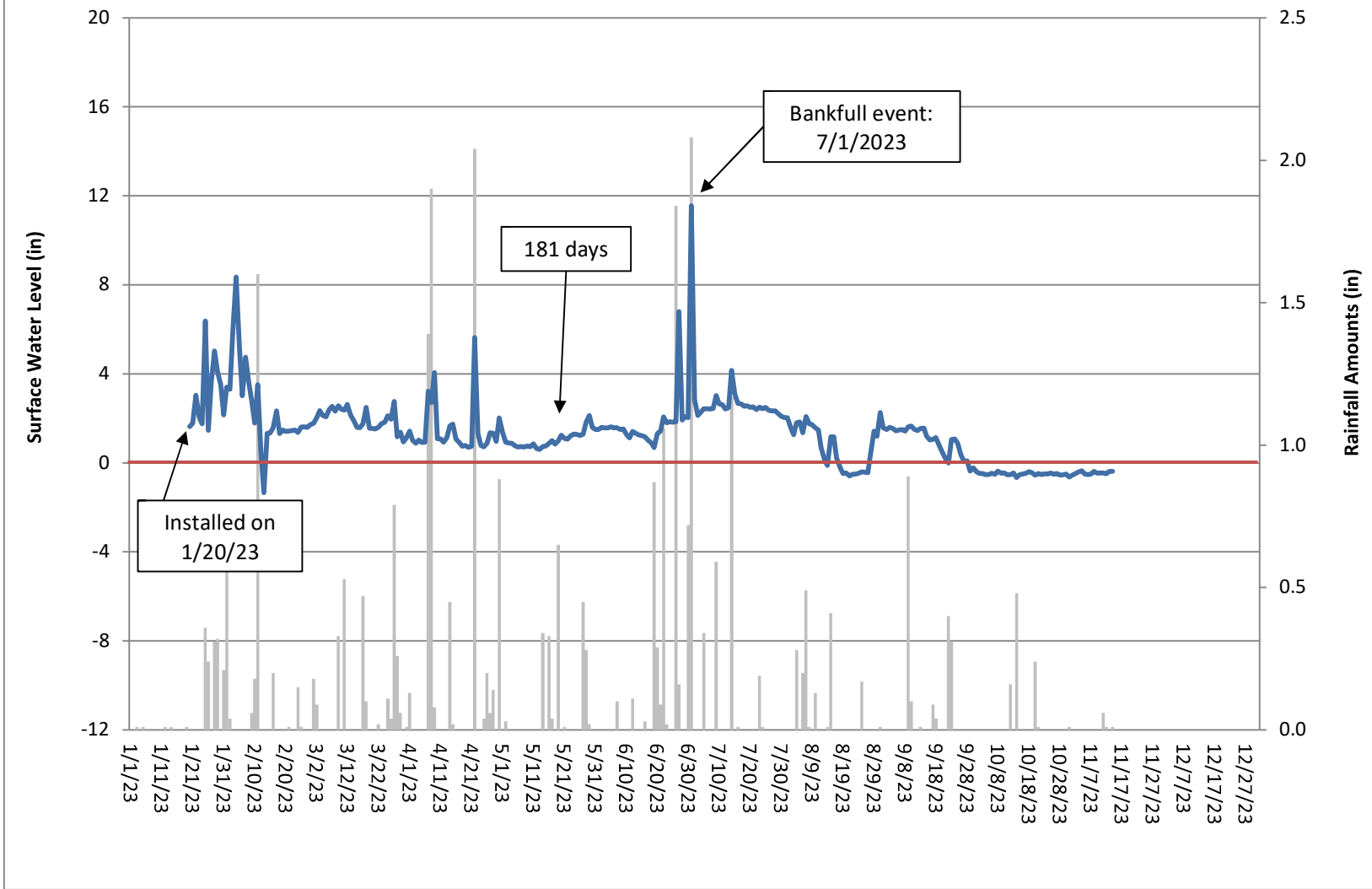
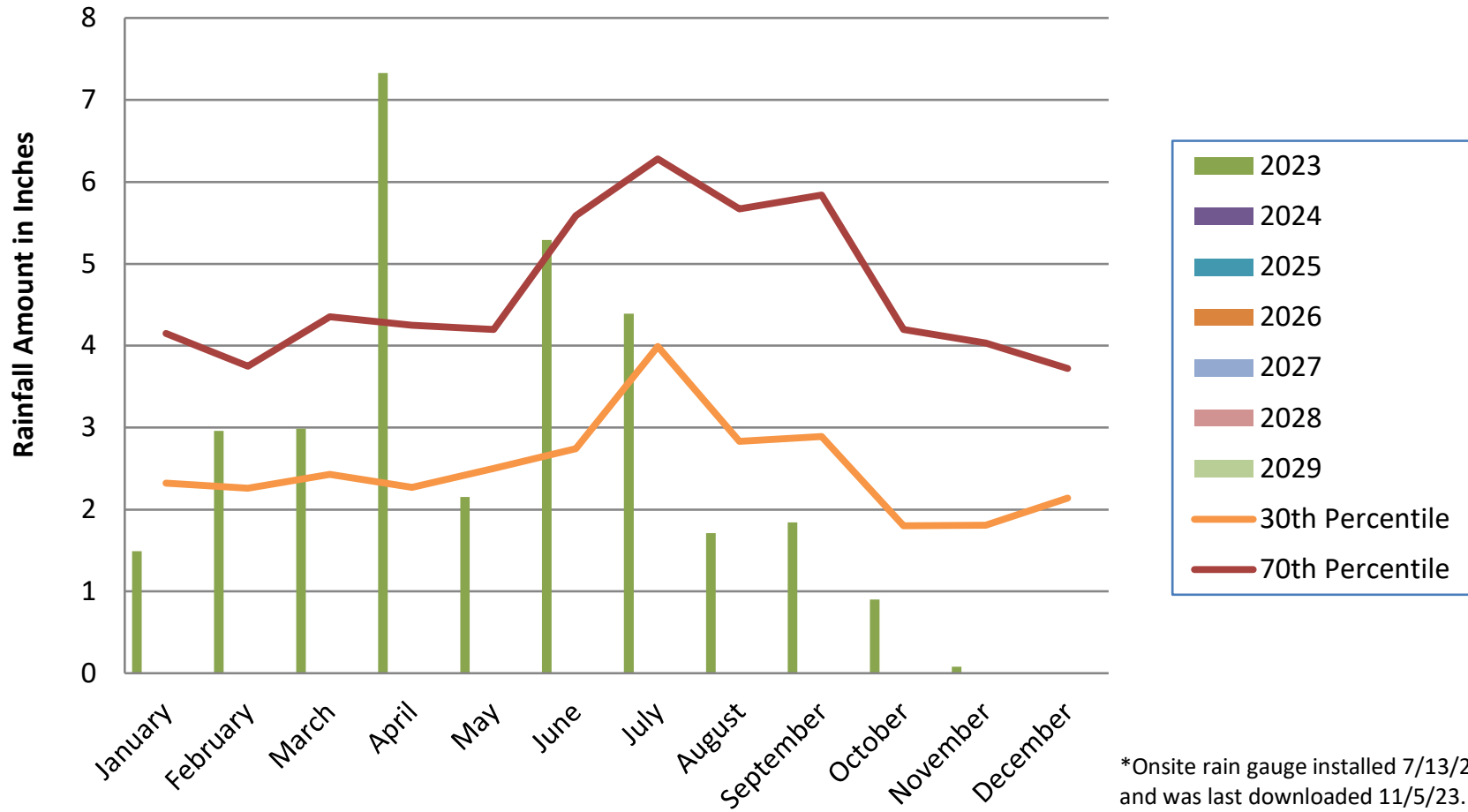


Figure D1: Crane 30-70 Percentile Graph for Rainfall

Current year data from onsite rain gauge*

30-70th percentile data from WETS Station: Sanford 8 NE, NC (1993-2023)



*Onsite rain gauge installed 7/13/22 and was last downloaded 11/5/23.

Appendix E: Project Timeline and Contact Info

Table 14. Project Timeline

Table 15. Project Contacts

Table 14. Project Timeline

Activity or Deliverable	Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted	NA	30-Jul-20
Mitigation Plan Approved	NA	14-Feb-22
Construction (Grading) Completed	NA	15-Jul-22
Planting Completed	NA	3-Feb-23
As-built Survey Completed	NA	1-Mar-23
MY0 Baseline Report	Jan-23	Mar-23
MY1 Monitoring Report	Nov-23	Feb-24
MY2+ Monitoring Reports		
Remediation Items (e.g. beaver removal, supplements, repairs etc.)		
Encroachment		

Table 15. Project Contacts

Crane Site/100165	
Provider Mitigation Provider POC	Restoration Systems, LLC 1101 Haynes Street, Suite 211 Raleigh, NC 27604 Ray Holz 919-755-9490
Designer Primary project design POC	Axiom Environmental, Inc. 218 Snow Ave Raleigh, NC 27603 Grant Lewis 919-215-1693
Construction Contractor Primary construction POC	Land Mechanics Designs, Inc. 126 Circle G Lane Willow Spring, NC 27592 Charles Hill 919-639-6132