Monitoring Report MY05

Sandy Bridge Restoration Site
DMS Contract 6400
DMS Project Number 96920

DWR #: 15-0414
USACE Action ID: 201500827
Rutherford County, North Carolina

Prepared for:
NCDMS, 1652 Mail Service Center, Raleigh, NC 27699-1652

Monitoring Data Collected: 2021
Date Submitted: December 2021

Monitoring and Design Firm

Prepared by:

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KCI ASSOCIATES OF NORTH CAROLINA, PA

ENGINEERS • SCIENTISTS • SURVEYORS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 (919) 783-9214 (919) 783-9266 Fax

January 21, 2022

Mr. Harry Tsomides
North Carolina Division of Mitigation Services
5 Ravenscroft Dr. #102
Asheville, NC 28801

Re: Response to Sandy Bridge Farm MY05 Report Comments

Dear Mr. Tsomides,

KCI has reviewed the comments prepared by the DMS for the Sandy Bridge Farm MY05 Report and has prepared the following responses:

- Please update the Monitoring Phase Performance Bond as necessary.
  KCI Response: The Performance Bond will be updated.

- Please include the meeting notes and figure from the June 28, 2021 meeting with KCI, DMS and IRT.
  KCI Response: These have been included in Appendix F – Other Data

- Please add a call out for the ponded BMP area on the CCPV, see Kim's 6/30/2021 email.
  KCI Response: This change has been made.

- Can the aerial photo in the Site Asset Map be updated? This 2015 photo shows the old channel alignment and pre-construction conditions.
  KCI Response: The aerial photo in the Site Asset Map has been updated to 2019 imagery.

- In Table 1, please take the riparian wetland assets (6.65 wmu) out one additional significant digit (currently tracked as 6.653 wmu).
  KCI Response: This change has been made.

- If beaver or dam removal has occurred since observed in August 2021, please update the project activities table.
  KCI Response: The last beaver dam removal was in August 2021. Beaver dams are currently present on the site and will be removed once the beavers have been trapped and removed from the site.

- It is understood that beaver have caused most of the vegetation damage and the site vegetation is doing well overall, but is KCI planning any additional planting and/or MY6 vegetation monitoring based on the MY5 plot attainment data? Please address the plot non-attainments in VPs 1, 3, 5, and 6 in more detail.

KCI Response: No additional planting is planned for the Sandy Bridge site. Overall the site is well vegetated with many large and healthy trees present throughout the site. While VP 1 and 3 are below the Year 5 success criteria of 260 stems/acre, they are above the Year 7 success criteria of 210 stems/acre and so do not present a long term problem for the site's success. Additionally, all 4 of the low performing veg plots have at least 283 stems/acre when including volunteers. All of the volunteer species in these plots, except for one American elm, are species that were included in the planting plan. So although the beavers have significantly damaged the vegetation on site it is still performing as expected. It is believed that over the long term, the large, high quality seed source of woody vegetation that is present on the site will make up for any of the small areas of the site that are below the expected standards, as demonstrated by the presence of high quality volunteers that can be found in nearly all of the veg plots.

- Is KCI considering the field discussion from the 2021 site visit that if the rehabilitation wetland near VP 7 and VP8 turns to more of a scrub-shrub or emergent wetland because of the high hydro period, that those boundaries be defined in the monitoring reports?
  KCI Response: KCI will continue to monitor this area closely but currently the supplemental planting that occurred in March 2020 appears to be effectively addressing the lack of woody vegetation in this area. The original bare root stems that were planted in this area appear to have been too small to outcompete the tear-thumb and other herbaceous species in this area but the larger, one-gallon trees that were planted in 2020 are doing well so far.

DIGITAL SUPPORT FILE COMMENTS

- Please submit the features characterizing the visual assessment as shape files or in a geodatabase.
  KCI Response: Shapefiles have been submitted for the visual assessment features.

- The annual means in the submitted veg data spreadsheet are not consistent with those included in the report. Please review and ensure that the submitted data supports the reported values.
  KCI Response: This correction has been made and the report reflects the submitted data.

Please contact me if you have any questions or would like clarification concerning these responses.

Sincerely,

Tim Morris
Project Manager

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PROJECT SUMMARY

The Sandy Bridge Farm Restoration Site (SBFRS) was completed in March 2017 and restored a total of 6.85 acres of riparian wetland (1.29 acres of wetland rehabilitation and 5.56 acres of wetland reestablishment) and 1,626 linear feet of stream. The SBFRS is a riparian system located in the Broad River Basin (03050105 8-digit cataloging unit) in Rutherford County, North Carolina that had been substantially modified to maximize the use of the area for grazing. The completed project will restore impacted agricultural lands to a functioning stream and wetland ecosystem with enhanced water quality, restored hydrology, and improved fish and wildlife habitat.

The SBFRS is protected by a 9.5 acre permanent conservation easement, held by the State of North Carolina. The site is located off of Rock Road, approximately 3 miles north of Rutherfordton, North Carolina. The project site is bounded by interspersed pastureland and forested land to the east, agricultural land and Rock Road to the north-northwest, and Catheys Creek to the southwest.

The North Carolina Ecosystem Enhancement Program's (NCEEP) publication in 2009 identified HUC 03050105070020 (Catheys Creek) as a Targeted Local Watershed (TLW). The goals and priorities for SBRFS are based on the information presented in the Broad River Basin Restoration Priorities: to restore wetland and stream functions, to maintain and enhance water quality, to restore hydrology, and to improve fish and wildlife habitat (NCEEP 2009). The project goals, which reflect those from the approved Mitigation Plan, are in line with the following basin priorities:

- Reduce sources of sediment and nutrients by restoring riparian buffer vegetation, excluding livestock, and restoring natural geomorphology.
- Prioritize project implementation in the Catheys Creek local watershed planning area.

The goals for the project are to:

- Restore a channelized stream to a meandering C-type channel with a floodplain.
- Buffer and reduce sediment impacts to the project stream.
- Restore a Piedmont Alluvial Forest Community.
- Restore a wetland hydroperiod to drained and livestock-impacted land.

The project goals will be addressed through the following objectives:

- Relocate a channelized stream to its historic landscape position.
- Install an appropriately-sized channel cross-section.
- Install bedform diversity with pools, riffles, and habitat structures.
- Demarcate the project easement boundaries and fence out livestock.
- Plant the site with native trees and shrubs and an herbaceous seed mix that supports the development of a Piedmont Alluvial Forest.
- Fill field ditches and redevelop wetland microtopography to slow the flow of surface and subsurface drainage.

To restore the site, select ditches across the site were modified or filled and incoming surface inputs and seeps were integrated to create a stream/wetland complex. Additionally, Tributary 1 to Catheys Creek was improved with Priority 1 stream restoration to re-meander the stream and elevate the groundwater table. The entire site was planted as a Piedmont Alluvial Forest community (Schafale 2012). The site was constructed as designed with no modification from the design plan.

The majority of monitoring components were installed in March 2017. Nine groundwater monitoring wells were installed to evaluate the attainment of jurisdictional wetland hydrology. A stream gauge was installed on Tributary 1 to Catheys Creek to record the occurrence of bankfull events. To determine the success of the planted mitigation areas, eight 10 m x 10 m permanent vegetation monitoring plots were established. The location of the planted stems relative to the origin within these plots, as well as the species, was recorded and planted stems were grouped into size categories (0-10 cm, 10-50 cm, 50-100 cm, >137 cm). Any volunteers found within the plots were also grouped into size categories by species, but separate from the planted stems. Six permanent photo reference points were established and will be taken annually. Four permanent cross-sections (two sets of coupled riffles and pools) were also established and a detailed longitudinal profile of the stream was taken. Wolman pebble counts were performed at both of the riffle cross-sections. The cross-section measurements will be repeated in future monitoring years, but the longitudinal profile will only be repeated if there are concerns about bed elevation adjustments. Reports will be submitted to DMS by the end of each monitoring year. During a site visit with the IRT on December 6, 2017, it was requested that KCI install three additional groundwater monitoring wells and two additional vegetation plots. On March 30, 2018 the three additional groundwater monitoring wells were installed along the area of the filled, pre-construction stream channel. On September 10, 2018, the two additional vegetation plots were installed near the southern end of the site.

Vegetative success criteria for the site is 320 woody stems/acre after three years, 260 woody stems/acre after five years, and 210 woody stems/acre after seven years. The baseline monitoring counted an average of 647 woody stems/acre. To meet the hydrologic success criteria, the upper 12 inches of the soil profile must have continuously saturated or inundated conditions for at least 10% of the growing season during normal weather conditions. The soil survey for Rutherford County estimates the growing season begins April 4 and ends November 6 (217 days), meaning the water table must be within 12 inches of the surface for at least 22 consecutive days during the growing season. A minimum of two bankfull events must also be recorded during the monitoring period. Bank height ratios should not exceed 1.2 and the entrenchment ratios should be 2.2 or greater. Visual assessments will also be used to identify problem areas.

MONITORING RESULTS

The site was planted in March 2017 with tree tube protection installed around many of the planted stems. The fifth-year monitoring was conducted July 15, 2021. The site averaged 401 planted stems/acre across all 10 plots. Six of the 10 plots had greater than 260 planted stems/acre, with Plots 1, 3, 5, and 6 not achieving the success criteria. Including volunteers, the site averaged 567 total stems/acre. The vegetation on the site has been impacted by beavers. Although there is still a good quantity of woody stems, many of the previously large and healthy stems have been chewed down to a smaller size or killed by beaver activity. Even with the beaver impacts, in general, the site is well vegetated, with widespread herbaceous coverage and many healthy planted stems. Two of the non-attaining plots (Plots 1 and 3) are above the Year 7 success criteria, and all four are above the Year 5 success criteria when volunteers are included (all of which in these plots are species from the approved planting plan except for one American Elm in VP5). A supplemental planting of the site occurred in March 2020. 524 one-gallon size trees were planted in the wetland rehabilitation area and 1,875 bare root trees were planted in the central portion of the site and around the stream. The planting in the wetland rehabilitation area was done as a means of addressing a small area of low growth and vigor caused by dense herbaceous vegetation. The planting in the central portion of the site was done to mitigate damage done by the beavers.

Daily rainfall data were obtained from the NC State Climate Office for a local weather station in Rutherfordton, NC. In 2021 the month of March experienced above average rainfall, while the

month of October experienced average rainfall. The months of January, February, April, May, June, July, August, September, and November experienced below average rainfall for the site. Overall, the area experienced well below average rainfall during the 2021 growing season. During the site's fifth growing season, 11 of the 12 groundwater monitoring wells had continuous saturation within 12 inches of the ground surface for 10% (22 days) or more of the 217 day growing season (April 4 to November 6).

The stream gauge has recorded multiple bankfull events in each year since construction, including 7 bankfull events in 2021. This large number of bankfull events is the desired outcome for this project. A component of the stream design was to provide regular recharging of the riparian wetlands from overbank stream flows. In June 2018, several large beaver dams were discovered towards the lower half of the stream. These dams were removed in early August 2018. KCI has been continuously monitoring for further signs of beaver activity, trapping beavers on-site and removing dams when they are found. In August 2020 KCI contracted with USDA APHIS-WS to provide ongoing beaver management. Additional dams were removed in November 2018, June 2019, August 2019, and October 2019, June 2020, September 2020, and December 2020. New dams were not built on the site until August 2021. These dams will be removed once the beavers on-site have been trapped and removed from the site. See Appendix B and Appendix D for more information.

Due to the presence of beavers on-site, there has been more aggradation in the stream channel than has been anticipated. KCI has been removing the beavers routinely, but when the dams are built, sediment has deposited in the channel. The fifth-year cross-section survey showed bed aggradation in all four cross-sections as well as aggradation on the banks of Cross-sections 1 and 2. When the beaver dams are removed for an extended period of time, there is evidence of the accumulated sediment washing out of the stream. An example of this can be seen when comparing the MY02 and MY03 surveys of XS2. During MY02, a mid-channel bar had formed within this cross-section but after the removal of the beaver dams and a period of several months without them being rebuilt, this bar was completely absent from the MY03 survey. Comparing the MY04 and MY05 surveys of XS4 also shows this pattern. Starting in MY03, a large beaver dam was located at the head of the riffle just downstream of XS4. This dam was removed multiple times during 2019 and 2020. After being removed in September 2020, this dam was not rebuilt, but a new dam was constructed upstream of XS4. Comparing the MY04 survey to the MY05 survey shows that the thalweg elevation in this cross-section has dropped approximately half a foot. KCI believes that if given enough time without backwater conditions, this trend will hold true for the entire site. It is also important to note that even with the rebuilding of the dams, the stream flow has stayed within the restored channel and no evidence of other channels forming in this system has been noted.

The monitored cross-section data have been calculated by adjusting the bankfull elevation to maintain the baseline bankfull area for each cross-section. A total cross-sectional metric has been added to the cross-section data to indicate the cross-sectional area below the baseline bankfull elevation. In instances where there has been some lateral aggradation and narrowing the data show the cross-section having a significantly higher bankfull width and higher width/depth ratio as compared to previous years. The comparison of cross-section plots between monitoring events illustrates that this change does not indicate a problematic change in cross-section condition. Future monitoring will show how the channel has adjusted to the varying backwater conditions and how the stream has processed the sediment from these events.

The right bank of the stream that flows adjacent to the project's southern boundary had been experiencing significant erosion due to several areas of obstruction in the center of this channel

that were diverting water into the banks. Although this stream is not part of the project, and is located outside of the easement bounds, the erosion on the right bank had encroached into the easement. In November 2019, KCI repaired and stabilized this area. This work involved removing the mid-channel obstructions and sloping back the eroding bank. 150 live stakes were planted along this bank in March 2020. During this work, several farm gates that had become buried in the project stream bank were removed and a small swale was dug to direct water into the site from fields adjacent to the eastern boundary of the site. This swale was designed to drain ponded conditions in these fields and dissipate the water throughout the wetlands on-site. See Appendix B for more information.

REFERENCES

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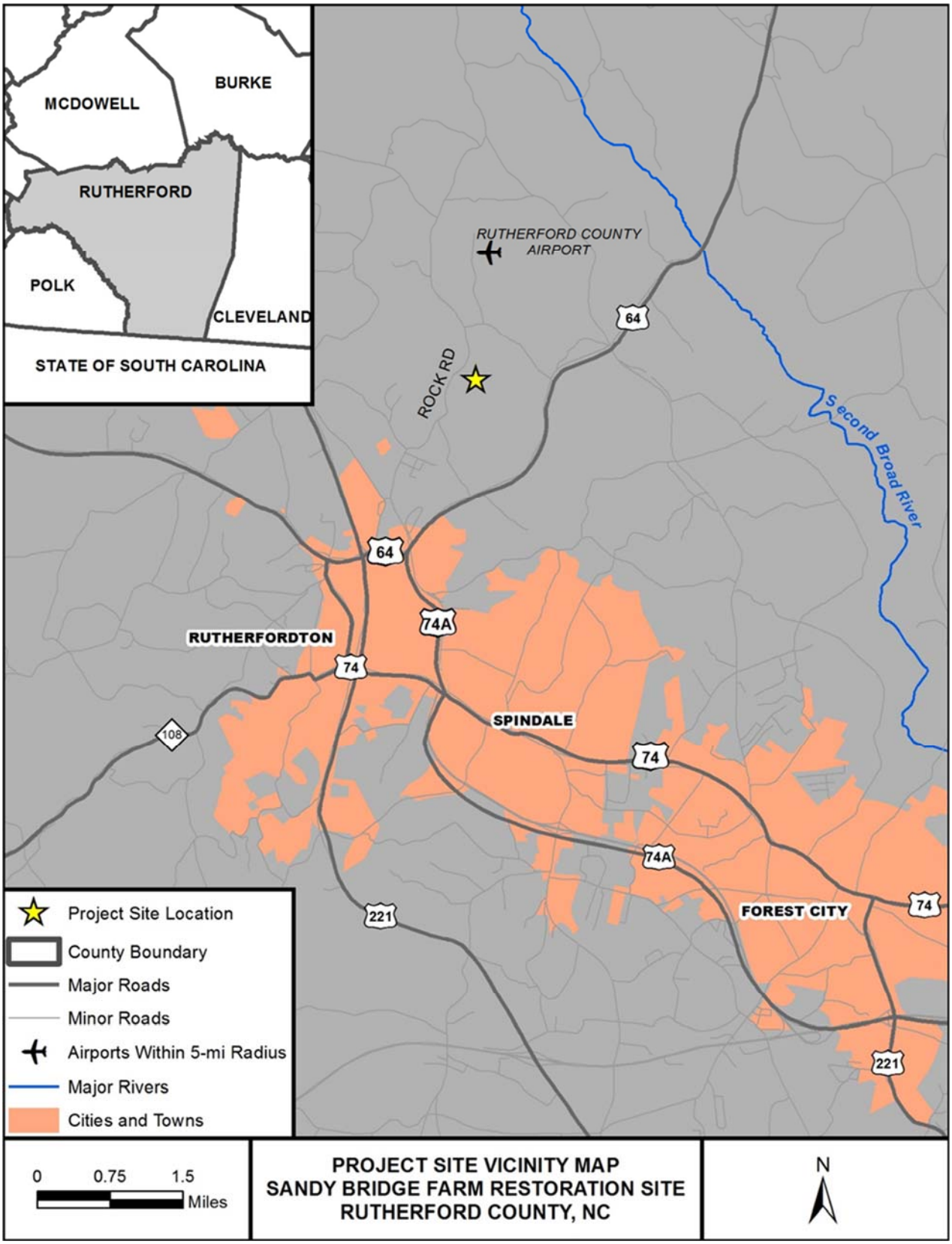
Schafale, M.P. and A.S. Weakley. 2012. Guide to the Natural Communities of North Carolina:
Fourth Approximation. Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment and Natural Resources. Raleigh, NC.


MCDOWELL
BURKE
RUTHERFORD
POLK
CLEVELAND
STATE OF SOUTH CAROLINA
RUTHERFORD COUNTY AIRPORT
ROCK RD
64
Second Broad River
RUTHERFORDTON
74A
74
SPINDALE
108
FOREST CITY
221
Project Site Location
County Boundary
Major Roads
Minor Roads
Airports Within 5-mi Radius
Major Rivers
Cities and Towns
0 0.75 1.5
Miles
PROJECT SITE VICINITY MAP
SANDY BRIDGE FARM RESTORATION SITE
RUTHERFORD COUNTY, NC
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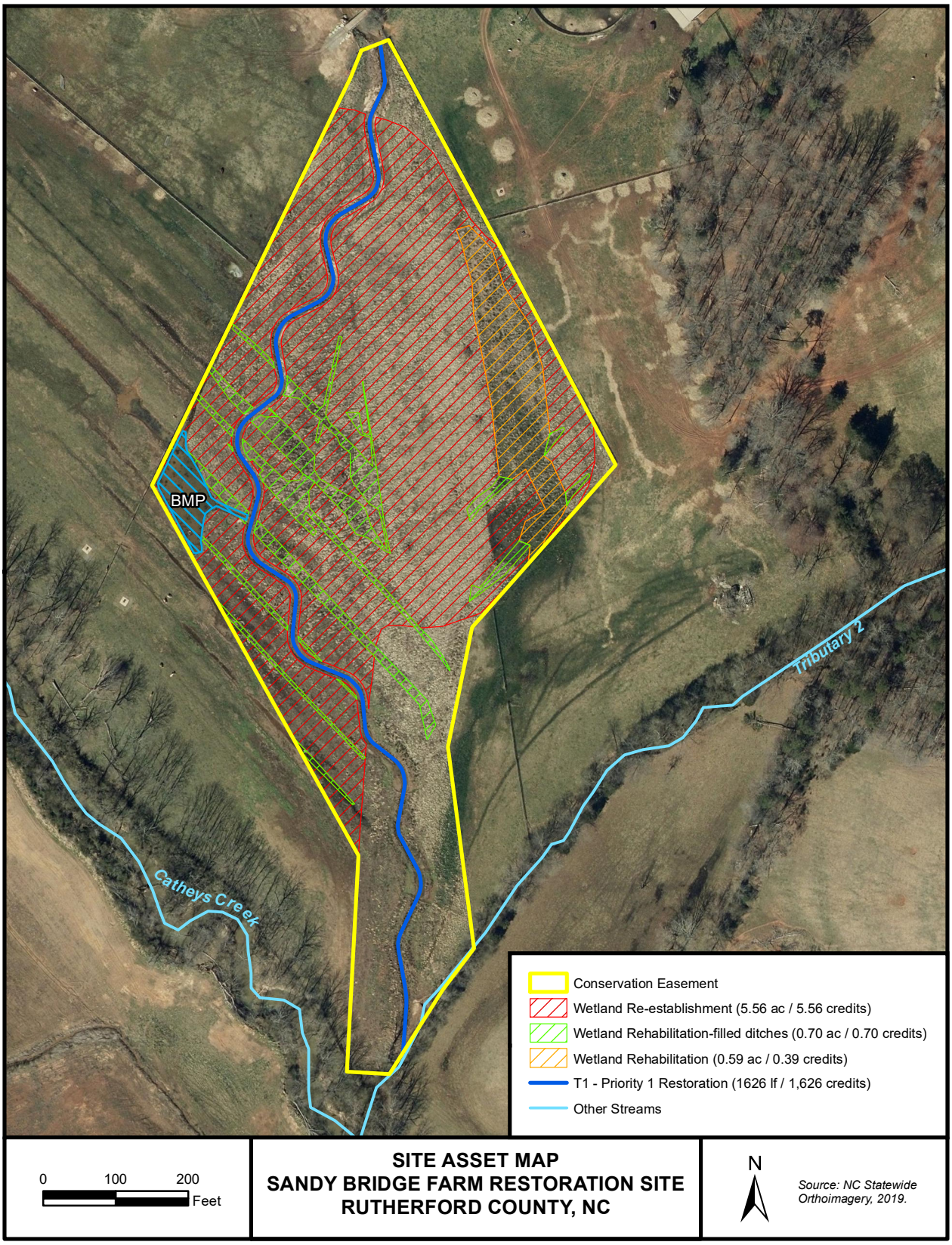


SITE ASSET MAP
SANDY BRIDGE FARM RESTORATION SITE
RUTHERFORD COUNTY, NC

Source: NC Statewide Orthoimagery, 2019.

APPENDIX A

Background Tables

Table 1. Project Components and Mitigation Credits
Sandy Bridge Farm Restoration Site, DMS Project #96920

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Credits	1,626		6.653						

Project Components

Project Component -or- Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage/ Acreage	Mitigation Ratio	Credits
Tributary 1	10+00 to 26+26	1,470 lf	PI	Restoration	1,626 lf	1:1	1,626
Wetland Reestablishment				Restoration	5.56 ac	1:1	5.56
Wetland Rehabilitation*		0.79 ac		Restoration	0.70 ac	1:1	0.70
Wetland Rehabilitation		0.59 ac		Restoration	0.59 ac	1.5:1	0.39

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetlands (Acres)		Non-Riparian Wetlands (Acres)	Buffer (square feet)	Upland (Acres)
		Riverine	Non-Riverine			
Restoration	1,626 lf					
Reestablishment		5.56 ac				
Rehabilitation		1.29 ac				
Enhancement						
Creation						
Preservation						
High Quality Preservation						

R= Restoration RE= Restoration Equivalent of Creation or Enhancement
*=wetland rehabilitation associated with filled ditches

Table 2. Project Activity & Reporting History Sandy Bridge Farm Restoration Sites, DMS Project #96920		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		June 2016
Final Design - Construction Plans		June 2016
Construction Grading Completed		Aug 29, 2016
Planting Completed		March 11, 2017
Baseline Monitoring/Report	March 2017	April 2017
Vegetation Monitoring	*March 21, 2017*	
Stream Survey	*March 20, 2017*	
Year 1 Monitoring	November 2017	December 2017
Vegetation Monitoring	*October 26, 2017*	
Stream Survey	*November 6, 2017*	
Additional Groundwater Gauges Installed		March 30, 2018
Beaver Dam Removal		August 20, 2018
Additional Vegetation Plots Installed		September 10, 2018
Beaver Dam Removal		November 6, 2018
Year 2 Monitoring	November 2018	December 2018
Vegetation Monitoring	*September 10, 2018*	
Stream Survey	*XS1 and 2: June 28, 2018 XS3 and 4: September 11, 2018*	
Beaver Dam Removal		June 14, 2019
Beaver Dam Removal		August 8, 2019
Beaver Dam Removal		October 17, 2019
Non-project Reach Repair		November 21, 2019
Year 3 Monitoring	November 2019	December 2019
Vegetation Monitoring	*July 11, 2019*	
Stream Survey	*June 19, 2019*	
Supplemental Planting		March 27, 2020
Beaver Dam Removal		June 12, 2020
Beaver Dam Removal		September 15, 2020
Beaver Dam Removal		December 18, 2020
Beaver Dam Removal		August 1, 2021
Year 4 Monitoring	November 2020	December 2020
Stream Survey	*November 4, 2020*	
Year 5 Monitoring	November 2021	December 2021
Vegetation Monitoring	*July 6, 2021*	
Stream Survey	*July 6, 2022*	

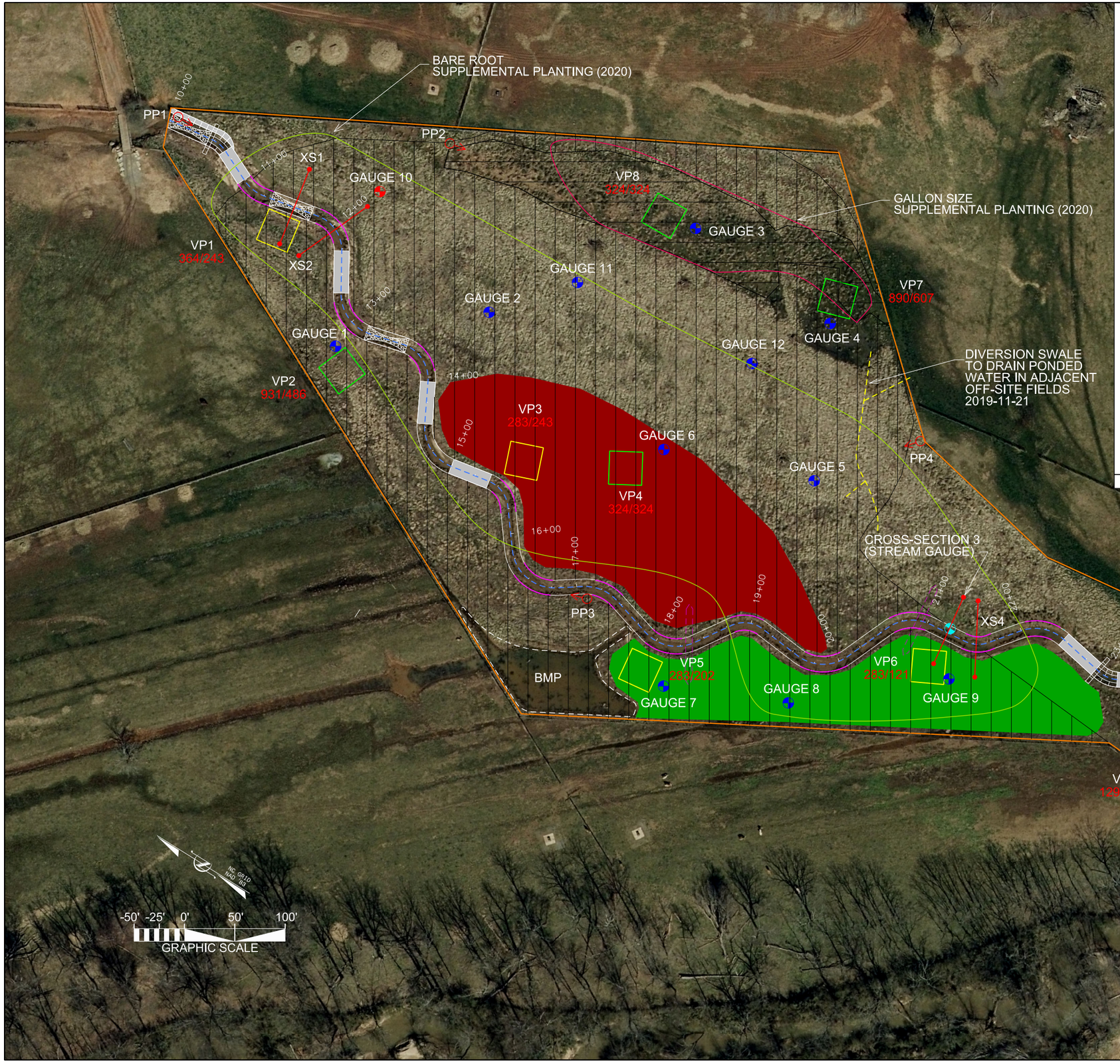
Table 3. Project Contacts Sandy Bridge Farm Restoration Sites, DMS Project #96920	
Design Firm	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	KCI Environmental Technologies and Construction 4505 Falls of Neuse Road, Suite 400 Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512
Planting Contractor	Conservation Services Inc. 1620 N. Delphine Ave. Waynesboro, VA 22980 Contact: Mr. David Coleman Phone: (540) 941-0067
Monitoring Performers	KCI Associates of North Carolina, PC 4505 Falls of Neuse Road Suite 400 Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Information Sandy Bridge Farm Restoration Site, DMS Project #96920			
Project Name	Sandy Bridge Farm Restoration Site		
County	Rutherford County		
Project Area (acres)	9.45 acres		
Project Coordinates (lat. and long.)	35.407997° N, -81.937000° W		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Broad		
USGS Hydrologic Unit 8-digit	03050105	**USGS Hydrologic Unit 14-digit**	03050105070020
DWQ Sub-basin	9-41-13-(0.5)		
Project Drainage Area (acres)	837 acres		
Project Drainage Area Percentage of Impervious Area	8%		
CGIA Land Use Classification	Mixed Hardwoods/Conifers 42% (350.0 ac), Managed Herbaceous Cover 39% (329.3 ac), Mountain Conifers 12% (99.5 ac), Mixed Shrubland 5% (43.5 ac), Low Intensity Developed 1% (11.0 ac)		
Existing Reach Summary Information			
Parameters	**T1**		
Length of reach (linear feet)	1,470 lf		
Valley classification	Valley Type VIII		
Drainage area (acres)	837 acres		
NCDWQ Water Quality Classification	WS-V (Water Supply – upstream)		
Morphological Description (stream type)	Ditched channel		
Evolutionary trend	Channelized		
Mapped Soil Series	Wehadkee-Chewacla Association		
Drainage class	Poorly drained; Somewhat poorly drained		
Soil Hydric status	Drained hydric		
Slope	0-1%		
FEMA classification	Zone AE		
Existing vegetation community	N/A (Pasture)		
Percent composition of exotic invasive vegetation	5%		
Existing Wetland Summary Information			
Parameters			
Size of Wetland (acres)	0.59 acres (Wetland Rehabilitation Area)		
Wetland Type	Headwater Seep		
Mapped Soil Series	Wehadkee-Chewacla Association		
Drainage class	Poorly drained; Somewhat poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Seepage/ Precipitation		
Hydrologic Impairment	Ditching and Grazing		
Existing vegetation community	Emergent Wetland		
Percent composition of exotic invasive vegetation	5%		

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	DWR# 15-0414 USACE Action ID# 201500827	Jurisdictional Determination
Waters of the United States – Section 401	Yes	DWR# 15-0414 USACE Action ID# 201500827	Jurisdictional Determination
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

APPENDIX B

Visual Assessment Data



LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY — 567/401
- WETLAND GAUGE ACHIEVING HYDRO. CRITERION
- WETLAND GAUGE BELOW HYDRO. CRITERION
- PHOTO POINT
- CROSS-SECTION
- CONSERVATION EASEMENT
- STREAM RESTORATION
- REMOVED BEAVER DAMS
- WETLAND REESTABLISHMENT
- WETLAND REHABILITATION
- STEP POOL
- RIFFLE GRADE CONTROL
- RIFFLE ENHANCEMENT
- STREAM AGGRADATION
- AREA OF POOR GROWTH RATE
- LOW STEM DENSITY AREA

IMAGE SOURCE: GOOGLE EARTH 2019

REVISIONS

DATE	DESCRIPTION	STNL

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE RD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

SANDY BRIDGE FARM
STREAM AND RIPARIAN WETLAND SITE

DMS PROJECT #96920
RUTHERFORD COUNTY, NORTH CAROLINA
MONITORING YEAR 05

DATE: NOV 2021
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW

Table 5 **Visual Stream Morphology Stability Assessment**
Sandy Bridge Farm Stream Restoration Site, DMS Project#96920, Assessment Date: 11/16/2021
Reach ID **Reach 1**
Assessed Length **1626**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			15	544	67%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	5	20			25%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	5	20			25%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	20	20			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	20	20			100%
		2. Thalweg centering at downstream of meander (Glide)	20	20			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
				Totals	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	8	8			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	5	5			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	6	6			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	5	5			100%

Table 6 **Vegetation Condition Assessment**

Sandy Bridge Farm Stream Restoration Site, DMS Project# 96920, Assessment Date: 11/16/2021

Planted Acreage **9.5**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	1	0.77	8.1%
			Total	1	0.77	8.1%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	1	1.16	12.2%
			Cumulative Total	2	1.93	20.3%
Easement Acreage	**9.5**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Photo Reference Photos

PP1 – MY-00 – 3/21/17

PP1 – MY-05 – 9/13/21

PP2 – MY-00 – 3/21/17

PP2 – MY-05 – 9/13/21

PP3 – MY-00 – 3/21/17

PP3 – MY-05 – 9/13/21

PP4 – MY-00 – 3/21/17

PP4 – MY-05 – 9/13/21

PP5– MY-00 – 3/21/17

PP5– MY-05 – 9/13/21

PP6– MY-00 – 3/21/17

PP6– MY-05 – 9/13/21

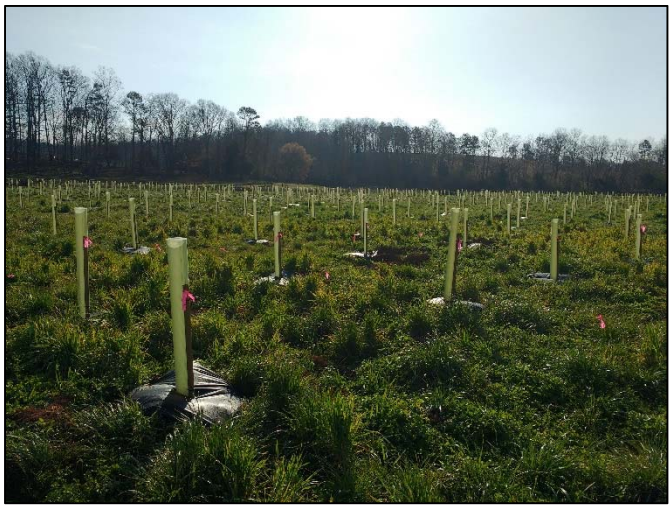
Vegetation Monitoring Plot Photos

Vegetation Plot 1 – MY-00 – 3/21/17

Vegetation Plot 1 – MY-05 – 7/6/21

Vegetation Plot 2 – MY-00 – 3/21/17

Vegetation Plot 2 – MY-05 – 7/6/21

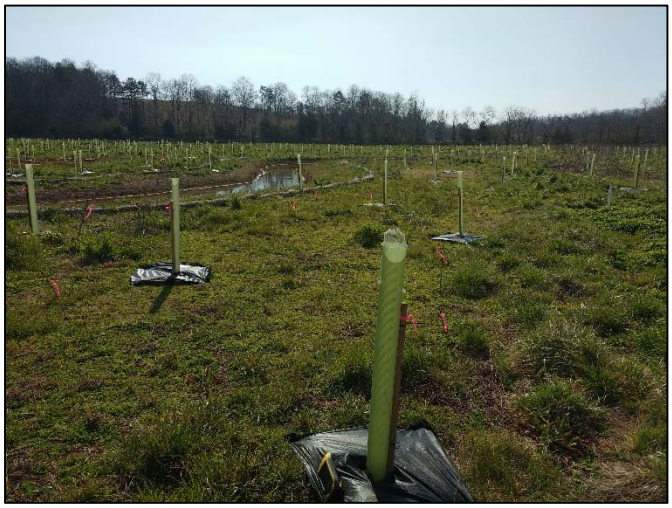


Vegetation Plot 3 – MY-00 – 3/21/17

Vegetation Plot 3 – MY-05 – 7/6/21

Vegetation Plot 4 – MY-00 – 3/21/17

Vegetation Plot 4 – MY-05 – 7/6/21



Vegetation Plot 5 – MY-00 – 3/21/17

Vegetation Plot 5 – MY-05 – 7/15/21

Vegetation Plot 6 – MY-00 – 3/21/17

Vegetation Plot 6 – MY-05 – 7/15/21

Vegetation Plot 7 – MY-00 – 3/21/17

Vegetation Plot 7 – MY-05 – 7/15/21

Vegetation Plot 8 – MY-00 – 3/21/17

Vegetation Plot 8 - MY-05 – 9/13/21

Vegetation Plot 9– MY-02 – 9/10/18

Vegetation Plot 9 - MY-05 – 7/15/21

Vegetation Plot 10– MY-02 – 9/10/18

Vegetation Plot 10 - MY-05 – 7/15/21

APPENDIX C

Vegetation Plot Data

Table 7. Stem Count by Plot and Species																
Sandy Bridge Farm Restoration Site, DMS Project #96920																
	Current Plot Data (MY05 2021)															
	Plot 01		**Plot 02**		**Plot 03**		**Plot 04**		**Plot 05**		**Plot 06**		**Plot 07**		**Plot 08**	
Species	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**	**Planted**	**Total**
American Elm (*Ulmus americana*)										1	1	1				
Bald Cypress (*Taxodium distichum*)													9	9	2	2
Black Walnut (*Juglans nigra*)																
Black Willow (*Salix nigra*)		1		8		1						4				
Box Elder (*Acer negundo*)																
Buttonbush (*Cephalanthus occidentalis*)	3	3	1	1					1	2			4	9		
Eastern Cottonwood (*Populus deltoides*)		1			2	2			2	2			1	1		
Green Ash (*Fraxinus pennsylvanica*)															2	2
Oak (*Quercus sp.*)							1	1								
Persimmon (*Diospyros virginiana*)			1	1												
Pin Oak (*Quercus palustris*)																
Red Chokeberry (*Aronia arbutifolia*)																
Red Maple (*Acer rubrum*)			1	1			4	4							1	1
River Birch (*Betula nigra*)			2	4	4	4	3	3					1	1		
Silky Dogwood (*Cornus amomum*)	3	3	6	6					2	2	1	1				
Smooth Sumac (*Rhus glabra*)																
Sugarberry (*Celtis laevigata*)																
Swamp Chestnut Oak (*Quercus michauxii*)																
Sycamore (*Platanus occidentalis*)		1	1	2										2		
Tulip Poplar (*Liriodendron tulipifera*)																
Water Tupelo (*Nyssa aquatica*)															1	1
Willow Oak (*Quercus phellos*)											1	1			2	2
Witch Hazel (*Hamamelis virginiana*)																
Unknown																
Stem count	6	9	12	23	6	7	8	8	5	7	3	7	15	22	8	8
size (ares)	1		1		1		1		1		1		1		1	
size (ACRES)	0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025	
Species count	2	5	6	7	2	3	3	3	3	4	3	4	4	5	5	5
Stems per ACRE	243	364	486	931	243	283	324	324	202	283	121	283	607	890	324	324

Table 7. Stem Count by Plot and Species
Sandy Bridge Farm Restoration Site, DMS Project #96920

	Current Plot Data (MY05 2021)				Annual Means									
	Plot 09		Plot 10		MY5 (2021)		MY03 (2019)		MY02 (2018)		MY01 (2017)		MY00 (2017)	
Species	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
American Elm (*Ulmus americana*)			2	2	3	4	6	7	6	6	7	7		
Bald Cypress (*Taxodium distichum*)					11	11					1	1		
Black Walnut (*Juglans nigra*)										1				
Black Willow (*Salix nigra*)						14		2		8		1		
Box Elder (*Acer negundo*)		3		5		8		15	8	8	9	9		
Buttonbush (*Cephalanthus occidentalis*)	1	2			10	17	8	10	9	9	16	16		
Eastern Cottonwood (*Populus deltoides*)					5	6	7	8	13	13				
Green Ash (*Fraxinus pennsylvanica*)	11	11	1	1	14	14	14	14					4	4
Oak (*Quercus sp.*)					1	1			1	1				
Persimmon (*Diospyros virginiana*)					1	1	1	1	2	2	2	2		
Pin Oak (*Quercus palustris*)									6	6	2	2		
Red Chokeberry (*Aronia arbutifolia*)	4	4			4	4	6	6	6	6	9	9		
Red Maple (*Acer rubrum*)		1			6	7	6	8	11	12	11	11		
River Birch (*Betula nigra*)					10	12	11	14	21	22	13	13		
Silky Dogwood (*Cornus amomum*)	4	5	1	1	17	18	20	24			1	2		
Smooth Sumac (*Rhus glabra*)									3	4	4	4		
Sugarberry (*Celtis laevigata*)							3	3	10	10	3	3		
Swamp Chestnut Oak (*Quercus michauxii*)	2	2	6	6	8	8	10	10	5	12	3	5		
Sycamore (*Platanus occidentalis*)	1	3	2	2	4	10	5	10	1	1	6	6	1	1
Tulip Poplar (*Liriodendron tulipifera*)							1	1	7	7	6	6		
Water Tupelo (*Nyssa aquatica*)					1	1					1	1		
Willow Oak (*Quercus phellos*)	1	1			4	4	6	6						
Witch Hazel (*Hamamelis virginiana*)														
Unknown											3	3	139	139
Stem count	24	32	12	17	99	140	104	139	109	128	97	101	144	144
size (ares)	1		1		10		10		10		8		8	
size (ACRES)	0.025		0.025		0.25		0.25		0.25		0.20		0.20	
Species count	7	9	5	6	15	17	14	16	15	17	17	18	3	3
Stems per ACRE	971	1295	486	688	401	567	421	563	441	518	491	511	728	728

APPENDIX D

Stream Measurement and Geomorphology Data

Table 8. Baseline Stream Data Summary
Sandy Bridge Farm Stream Restoration Site, DMS Project #96920

Parameter	Pre-Existing Condition					Reference Reach(es) Data					Design	As-built			
Dimension - Riffle	Min	Mean	Med	Max	n	Min	Mean	Med	Max	n	Proposed	Min	Mean	Max	n
Bankfull Width (ft)	31.5	32.9	330	34.0	4	14.8	16.7		18.6	2	15.0	15.4	17.2	18.9	2
Floodprone Width (ft)	60.9	72.9	69.3	92.0	4	>40	>47		>55	2	>38	>60	>68	>70	2
Bankfull Mean Depth (ft)	2.1	2.2	2.2	2.5	4	1.3	1.5		1.7	2	0.9	0.7	0.8	0.9	2
Bankfull Max Depth (ft)	3.1	3.4	3.4	3.7	4	1.9	2.2		2.4	2	1.3	1.5	1.5	1.5	2
Bankfull Cross-Sectional Area (ft^2)	66.6	73.2	71.2	84.0	4	25.0	25.1		25.1	2	12.7	13.2	13.5	13.8	2
Width/Depth Ratio	13.5	14.8	14.9	16.0	4	8.8	11.3		13.8	2	17.7	17.3	22.1	27.0	2
Entrenchment Ratio	1.9	2.2	2.2	2.7	4	>2.5	>2.5		>2.5	2	>2.5	3.8	4.0	4.1	2
Bank Height Ratio	1.1	1.4	1.3	1.7	4	1.2	1.4		1.5	2	1.0	1.0	1.0	1.0	2
Pattern															
Channel Beltwidth (ft)	*					60				1	35-60	35		60	2
Radius of Curvature (ft)	*					16			87	1	30-50	30		50	2
Rc:Bankfull width (ft/ft)	*					0.9			5.9	1	2.0-3.3	2.0		3.3	2
Meander Wavelength (ft)	*					66			191	1	134-160	134		160	2
Meander Width Ratio	*					4.1				1	8.9-10.7	8.9		10.7	2
Riffle Length (ft)												23	40	56	20
Riffle Slope (ft/ft)	0.000			0.010	2	0.013			0.035	2	0.002-0.008	0.000	0.006	0.014	20
Pool Length (ft)	*					14			33	2	17-55	11	22	39	20
Pool Spacing (ft)	*					50			105	2	55-90	25.9	78.3	102.2	19
Substrate and Transport Parameters															
SC% / Sa% / G% / C% / B% / Be%	18%/39%/43%/1%/0%/0%											66%/2%/22%/10%/1%/0%			
d16 / d35 / d50 / d84 / d95 (mm)	0.076/1.2/3.3/5.2/9.4/18											0.062/0.5/17.5/25.5/40/90			
Channel length (ft)	1,470										1,626	1,626			
Drainage Area (SM)	1.31					1.49					1.31	1.31			
Rosgen Classification	E4-G4					C4					C4	C4			
Sinuosity	1.0					1.3					1.2	1.2			
Water Surface Slope (ft/ft)	0.0043					0.0050					0.0038	0.0027			

*No data shown due to channelization/lack of bed diversity

Table 9. Cross-Section Morphology Data Tables
Sandy Bridge Farm Stream Restoration Site, DMS Project #96920

Dimension and Substrate	Cross-Section 1 (Riffle) Station 14+75							Cross-Section 2 (Pool) Station 16+40						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation	866.7	866.9	867.3	867.4	867.9	867.8		866.7	866.7	867.5	867.7	868.2	868.5	
Bankfull Width (ft)	15.4	15.7	18.1	13.8	9.9	10.5		18.8	19.6	18.6	21.0	13.6	13.5	
Floodprone Width (ft)	>80	>80	>80	>80	>80	>80		-	-	-	-	-	-	
Bankfull Mean Depth (ft)	0.9	0.9	0.8	1.0	1.4	1.3		1.4	1.4	1.4	1.3	2.0	2.0	
Bankfull Max Depth (ft)	1.5	1.7	2.0	2.1	2.2	2.1		2.7	2.7	2.2	2.7	2.4	2.5	
Bankfull Cross-Sectional Area (ft^2)	13.8	13.8	13.8	13.8	13.8	13.8		26.8	26.8	26.8	26.8	26.8	26.8	
Total Cross-Sectional Area (ft^2)	13.8	10.9	7.2	7.1	4.8	4.2		26.8	26.2	12.9	10.9	7.4	4.1	
Bankfull Width/Depth Ratio	17.3	17.9	23.6	13.4	7.1	8.1		-	-	-	-	-	-	
Bankfull Entrenchment Ratio	4.1	5.1	4.4	5.9	6.9	9.3		-	-	-	-	-	-	
Bankfull Bank Height Ratio	1.0	1.0	0.8	0.8	1.0	1.1		-	-	-	-	-	-	
d50 (mm)	35	26	0.7	0.6	4.4	0.6		-	-	-	-	-	-	
	Cross-Section 3 (Riffle) Station 101+73							Cross-Section 4 (Pool) Station 105+67						
	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Elevation	865.3	865.3	865.2	865.2	865.2	865.4		865.3	865.16	865.1	865.4	865.6	865.8	
Bankfull Width (ft)	15.7	17.3	15.4	16.7	16.2	15.6		18.7	18.1	17.1	20.4	35.1	20.5	
Floodprone Width (ft)	>70	>70	>70	>70	>70	>70		-	-	-	-	-	-	
Bankfull Mean Depth (ft)	0.8	0.8	0.9	0.8	0.8	0.8		1.5	1.6	1.7	1.4	0.8	1.4	
Bankfull Max Depth (ft)	1.5	1.6	1.6	1.7	1.7	1.5		3.0	3.1	3.0	1.9	1.6	2.3	
Bankfull Cross-Sectional Area (ft^2)	13.1	13.1	13.1	13.1	13.1	13.1		28.8	28.8	28.8	28.8	28.8	28.8	
Total Cross-Sectional Area (ft^2)	13.1	12.4	15.1	15.1	14.4	12.2		28.8	30.7	32.1	20.7	17.8	18.1	
Bankfull Width/Depth Ratio	18.8	22.8	18.0	19.7	20.0	18.5		-	-	-	-	-	-	
Bankfull Entrenchment Ratio	4.6	4.2	4.7	4.5	4.5	4.7		-	-	-	-	-	-	
Bankfull Bank Height Ratio	1.0	1.0	1.0	0.9	1.0	0.8		-	-	-	-	-	-	
d50 (mm)	0.062	0.062	0.062	0.062	0.52	0.24		-	-	-	-	-	-	

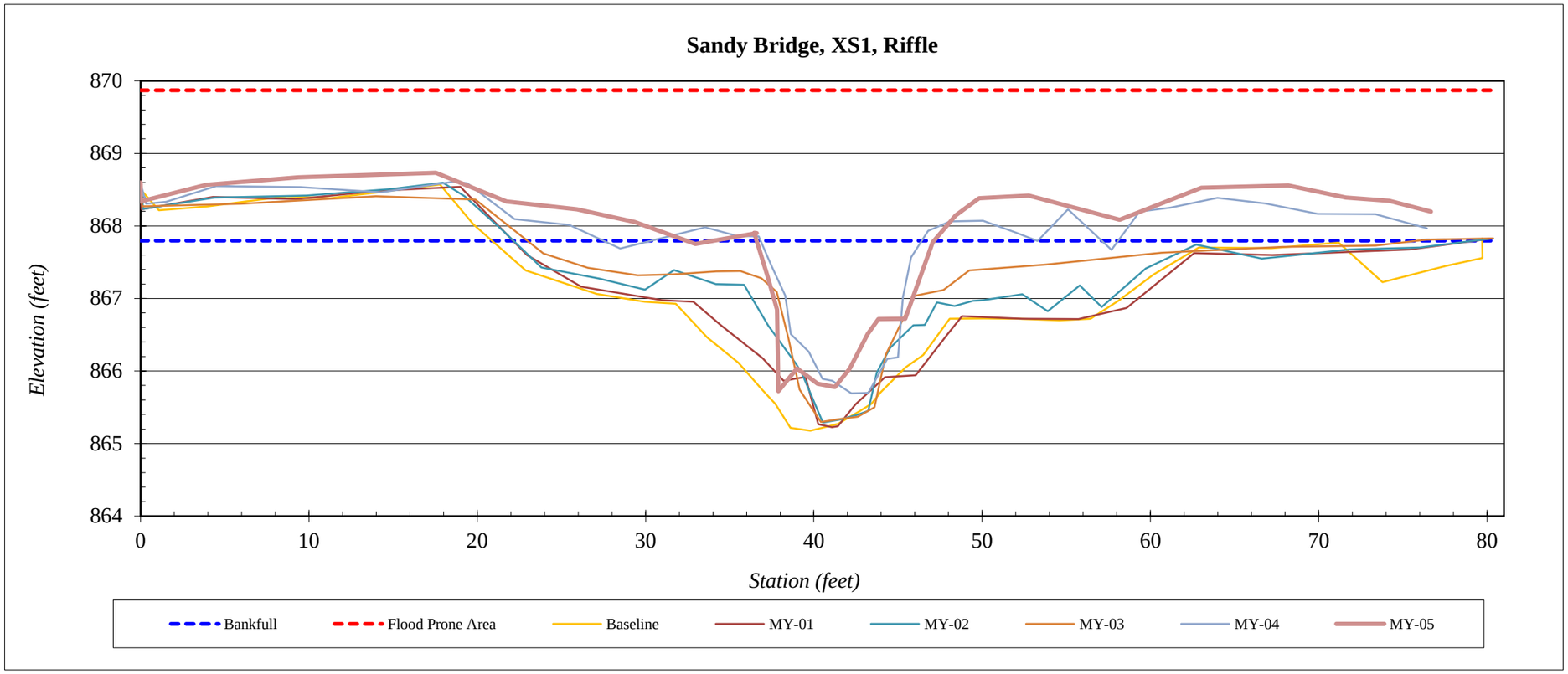
Calculations are based on a fixed bankfull area established during the baseline survey, and the resulting bankfull elevation. Total Cross-Sectional Area represents the cross-sectional area measured from the baseline bankfull elevation.

Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS1
Drainage Area:	837 acres
Date:	7/6/2021
Field Crew:	T. Seelinger, C. Pristupa

Station	Elevation
0.0	868.60
0.0	868.34
3.9	868.57
9.4	868.67
17.5	868.73
21.7	868.34
25.9	868.23
29.4	868.06
33.0	867.75
35.9	867.87
36.6	867.90
36.5	867.90
37.2	867.32
37.8	866.85
37.9	865.72
39.0	866.03
40.2	865.82
41.2	865.78
42.1	866.03
43.2	866.51
43.8	866.72
45.4	866.72
47.1	867.77
48.4	868.14
49.8	868.38
52.8	868.42
58.2	868.09
63.0	868.53
68.2	868.56
71.6	868.39
74.20	868.35
76.66	868.20

SUMMARY DATA	
Current Bankfull Elevation:	867.80
Bankfull Cross-Sectional Area:	13.8
Total Cross-Sectional Area:	4.2
Bankfull Width:	10.5
Flood Prone Area Elevation:	869.9
Flood Prone Width:	98.5
Max Depth at Bankfull:	2.1
Mean Depth at Bankfull:	1.3
W / D Ratio:	8.1
Entrenchment Ratio:	9.3
Bank Height Ratio:	1.1

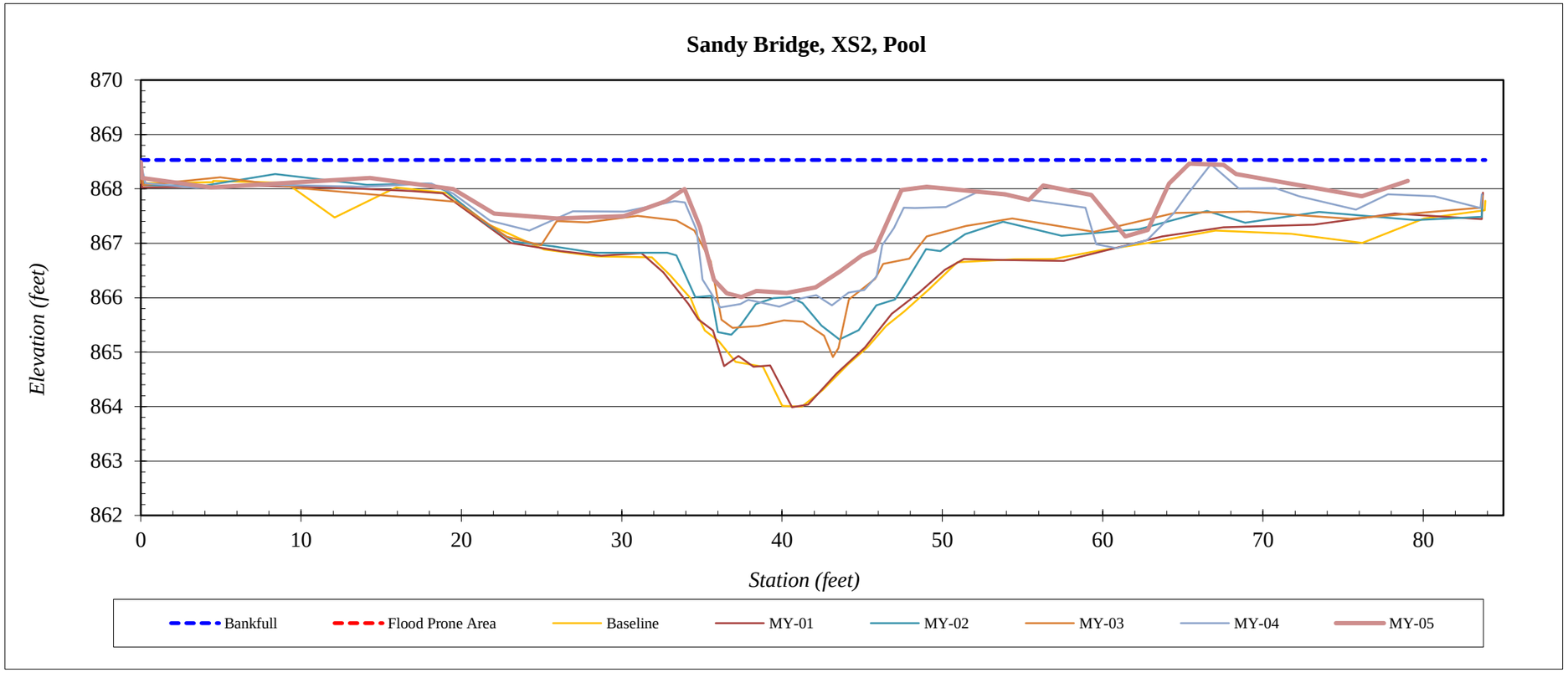


Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS2
Drainage Area:	837 acres
Date:	7/6/2021
Field Crew:	T. Seelinger, C. Pristupa

Station	Elevation
0.0	868.49
0.1	868.20
4.4	868.03
14.3	868.20
19.5	868.00
22.0	867.55
25.9	867.46
30.1	867.50
32.8	867.77
33.9	867.99
34.9	867.30
35.7	866.33
36.6	866.08
37.5	866.01
38.4	866.12
40.3	866.09
42.1	866.19
43.6	866.49
45.0	866.78
45.8	866.88
47.4	867.98
49.0	868.04
53.9	867.90
55.4	867.80
56.3	868.06
59.3	867.89
61.4	867.12
62.8	867.24
64.1	868.10
65.4	868.47
67.6	868.44
68.3	868.27
72.5	868.06
76.2	867.86
79.03	868.15

SUMMARY DATA	
Current Bankfull Elevation:	868.53
Bankfull Cross-Sectional Area:	26.8
Total Cross-Sectional Area:	4.1
Bankfull Width:	13.5
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	2.5
Mean Depth at Bankfull:	2.0
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---

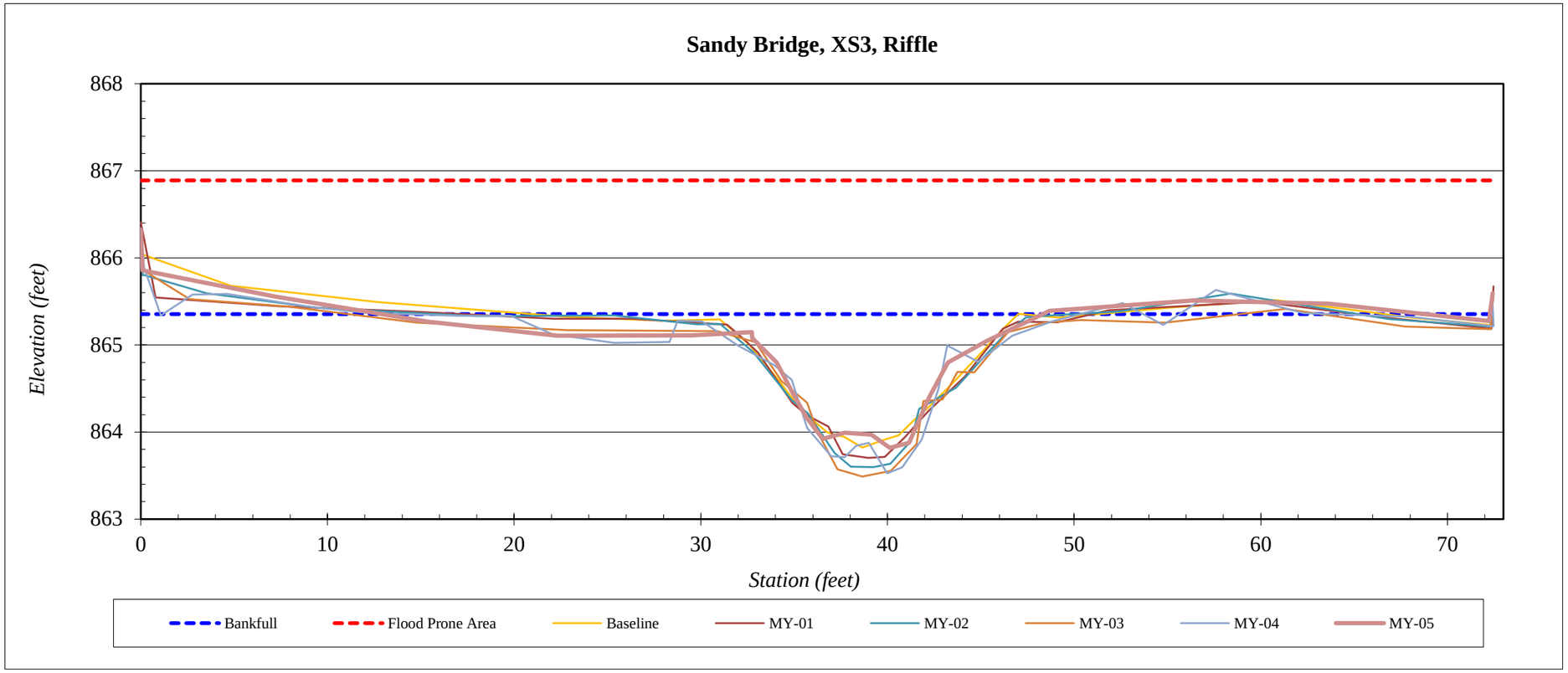


Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS3
Drainage Area:	837 acres
Date:	7/6/2021
Field Crew:	T. Seelinger, C. Pristupa

Station	Elevation
0.0	866.32
0.1	865.86
7.2	865.56
15.4	865.27
22.3	865.11
29.5	865.11
32.7	865.15
32.7	865.08
34.1	864.80
34.9	864.48
35.7	864.17
36.5	863.92
37.7	863.99
39.1	863.97
40.1	863.82
41.2	863.88
42.2	864.40
43.2	864.80
45.4	865.05
48.7	865.39
56.4	865.51
63.6	865.47
72.2	865.27
72.4	865.60

SUMMARY DATA	
Current Bankfull Elevation:	865.35
Bankfull Cross-Sectional Area:	13.1
Total Cross-Sectional Area:	12.2
Bankfull Width:	15.6
Flood Prone Area Elevation:	866.9
Flood Prone Width:	72.4
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	0.8
W / D Ratio:	18.5
Entrenchment Ratio:	4.7
Bank Height Ratio:	0.8

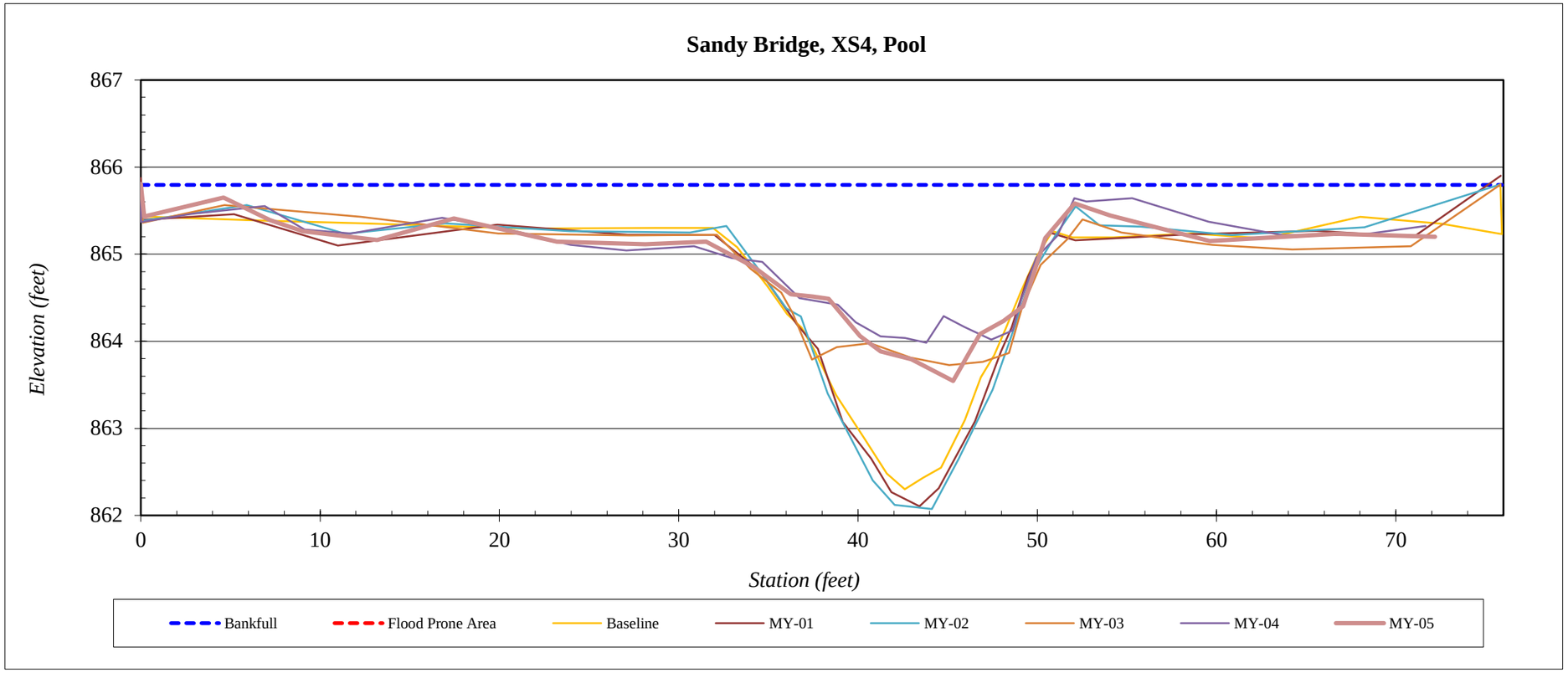


Cross-Section Plots

River Basin:	Broad
Site:	Sandy Bridge
XS ID	XS4
Drainage Area:	837 acres
Date:	7/6/2021
Field Crew:	T. Seelinger, C. Pristupa

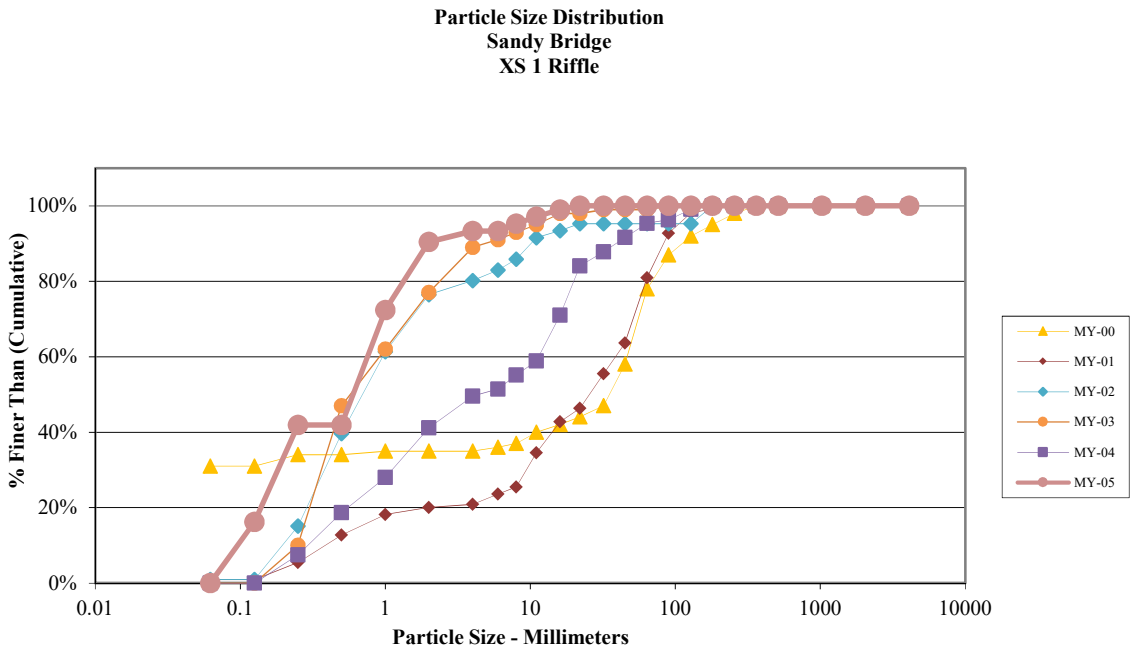
Station	Elevation
0.0	865.81
0.2	865.43
4.6	865.65
7.2	865.39
9.0	865.26
13.2	865.16
17.5	865.41
23.2	865.14
28.1	865.11
31.5	865.14
34.2	864.86
36.2	864.54
37.5	864.51
38.4	864.49
40.1	864.06
41.3	863.88
43.0	863.80
45.3	863.54
46.8	864.08
48.1	864.23
49.2	864.40
50.5	865.18
52.1	865.58
54.1	865.44
59.6	865.15
66.7	865.23
72.18	865.20

SUMMARY DATA	
Current Bankfull Elevation:	865.80
Bankfull Cross-Sectional Area:	28.8
Total Cross-Sectional Area:	18.1
Bankfull Width:	20.5
Flood Prone Area Elevation:	---
Flood Prone Width:	---
Max Depth at Bankfull:	2.3
Mean Depth at Bankfull:	1.4
W / D Ratio:	---
Entrenchment Ratio:	---
Bank Height Ratio:	---



Cross-Section 1 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	17
Fine	.125 - .25	A	27
Medium	.25 - .50	N	
Coarse	.50 - 1	D	32
Very Coarse	1 - 2	S	19
Very Fine	2 - 4		3
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	2
Medium	11.3 - 16	V	2
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	105

Note:



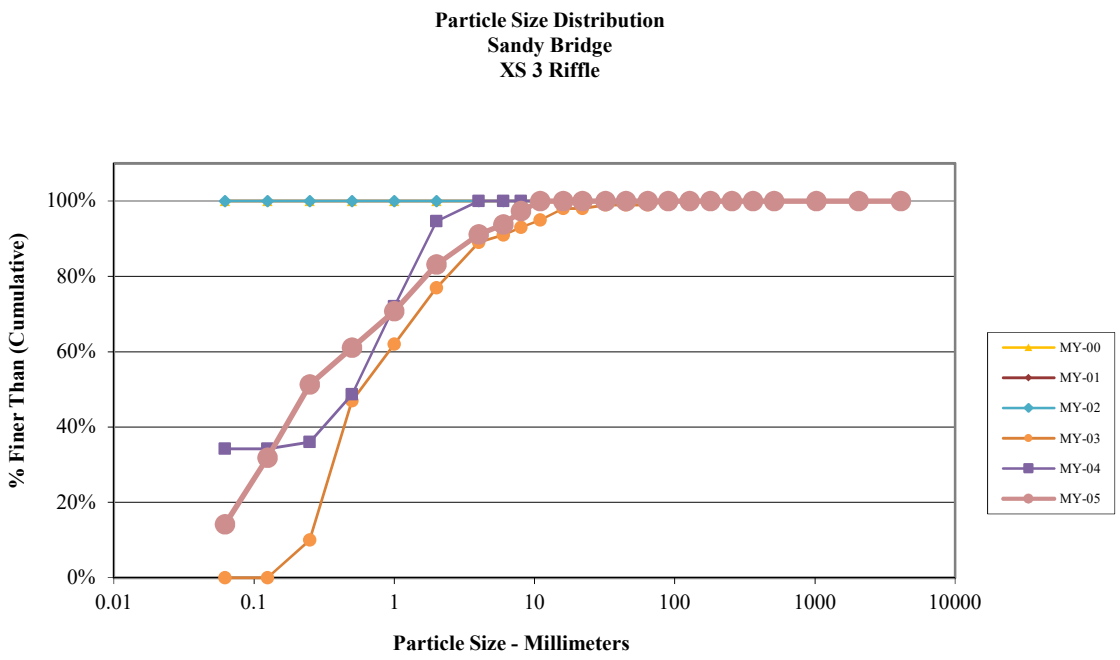
Size (mm)	
D16	0.12
D35	0.21
D50	0.6
D65	0.85
D84	1.6
D95	7.7

Size Distribution	
mean	0.4
dispersion	3.8
skewness	-0.13

Type	
silt/clay	0%
sand	90%
gravel	10%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Cross-Section 3 Riffle - MY-05			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	16
Very Fine	.062 - .125	S	20
Fine	.125 - .25	A	22
Medium	.25 - .50	N	11
Coarse	.50 - 1	D	11
Very Coarse	1 - 2	S	14
Very Fine	2 - 4		9
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	113

Note:



Size (mm)	
D16	0.067
D35	0.14
D50	0.24
D65	0.66
D84	2.1
D95	6.6

Size Distribution	
mean	0.4
dispersion	6.2
skewness	0.16

Type	
silt/clay	14%
sand	69%
gravel	17%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

APPENDIX E

Hydrologic Data

Sandy Bridge Farm Restoration Site
30-70 Percentile Graph
WETS Station Name: Lake Lure 2, NC

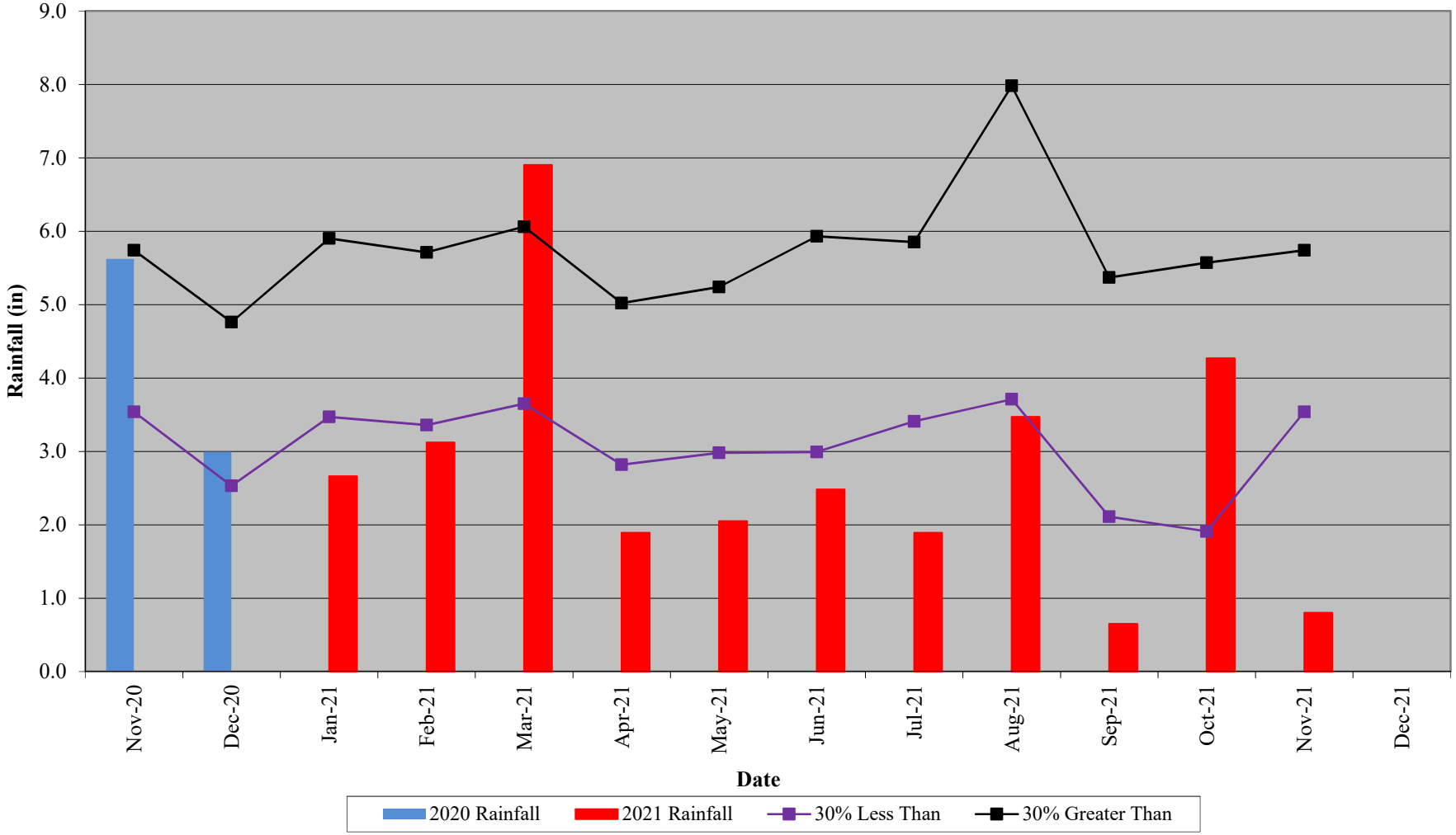


Table 10. Verification of Bankfull Events Sandy Bridge Farm Restoration Site, DMS Project #96920		
Date of Occurrence	**Method**	**Photo Number**
April 6, 2017	Onsite stream gauge	
April 24, 2017	Onsite stream gauge	
May 29, 2017	Onsite stream gauge	
August 3, 2017	Onsite stream gauge	
August 14, 2017	Onsite stream gauge	
August 15, 2017	Onsite stream gauge	
September 5, 2017	Onsite stream gauge	
October 23, 2017	Onsite stream gauge, photos taken on site	1
February 7, 2018	Onsite stream gauge, photos taken on site	2
February 11, 2018	Onsite stream gauge	
April 15, 2018	Onsite stream gauge	
April 24, 2018	Onsite stream gauge	
May 19, 2018	Onsite stream gauge	
May 30, 2018	Onsite stream gauge	
September 16, 2018	Onsite stream gauge	
October 11, 2018	Onsite stream gauge	3
January 4, 2019	Onsite stream gauge	
January 20, 2019	Onsite stream gauge	
January 24, 2019	Onsite stream gauge	
February 18, 2019	Onsite stream gauge	
February 21, 2019	Onsite stream gauge	
February 22, 2019	Onsite stream gauge	
April 8, 2019	Onsite stream gauge	
May 11, 2019	Onsite stream gauge	
June 18, 2019	Onsite stream gauge	
October 31, 2019	Onsite stream gauge	
January 12, 2020	Onsite stream gauge	
January 24, 2020	Onsite stream gauge	
February 6, 2020	Onsite stream gauge	
February 13, 2020	Onsite stream gauge	
March 25, 2020	Onsite stream gauge	
April 13, 2020	Onsite stream gauge	
January 1, 2021	Onsite stream gauge	
February 15, 2021	Onsite stream gauge	
March 18, 2021	Onsite stream gauge	
March 26, 2021	Onsite stream gauge	
March 31, 2021	Onsite stream gauge	
April 10, 2021	Onsite stream gauge	
August 17, 2021	Onsite stream gauge	4

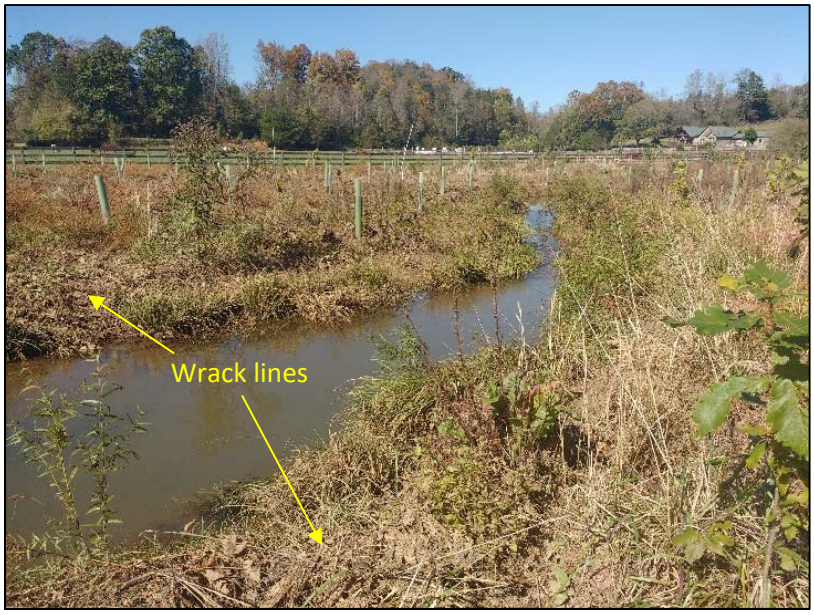
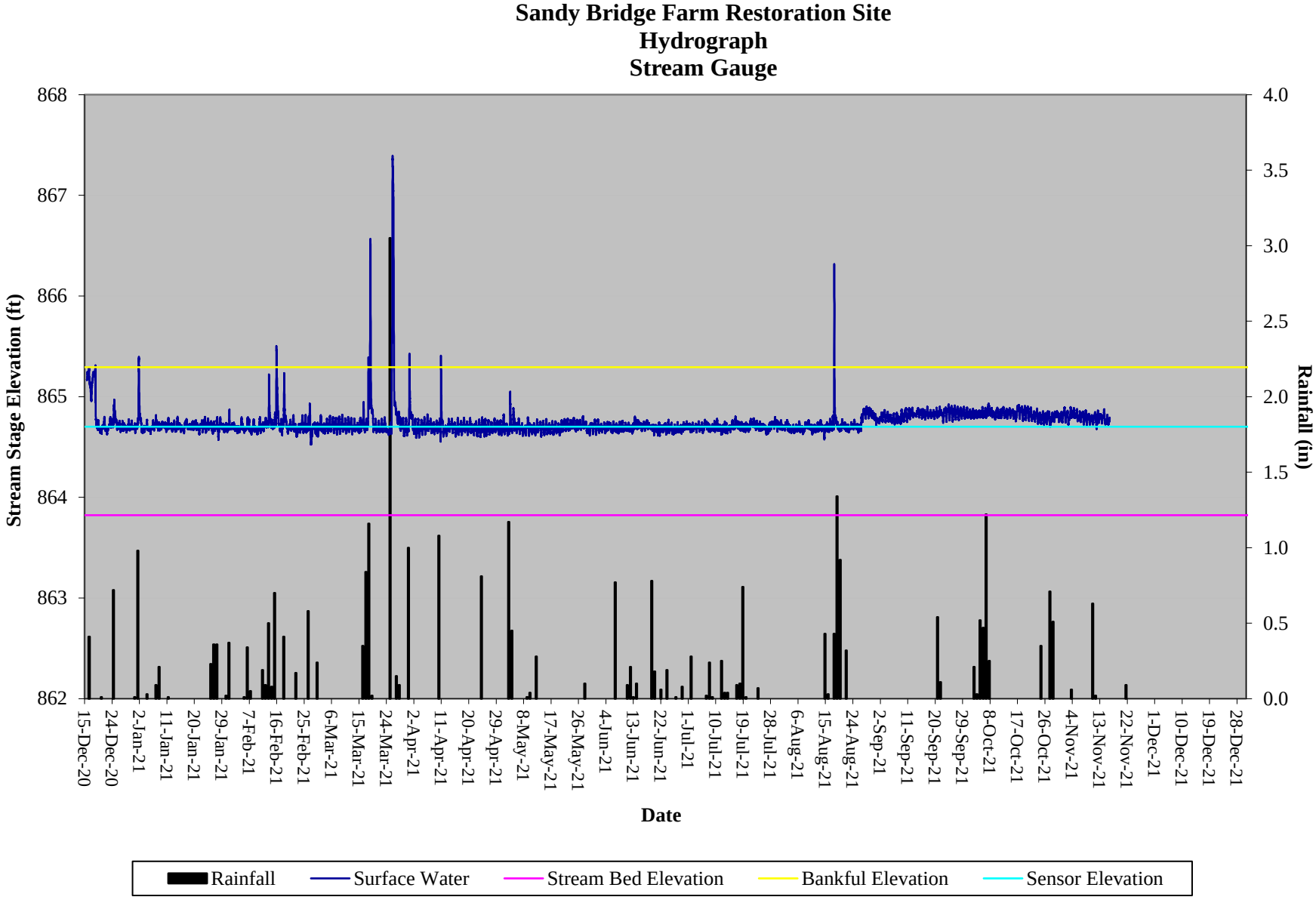


Photo 1. Sediment on plants and wrack lines above bankfull, 10/26/2017

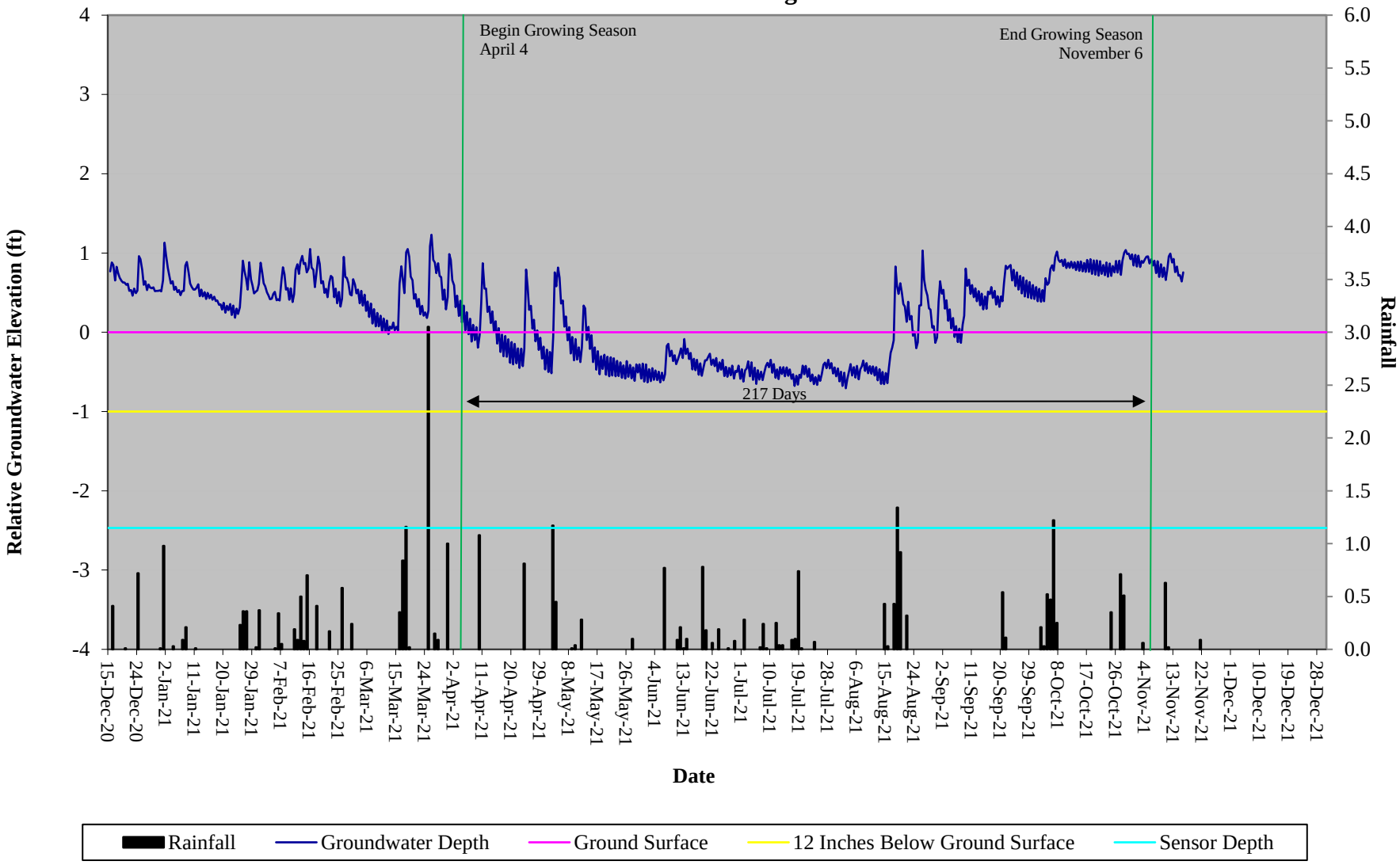

Photo 2. Bankfull event on site, 2/7/2018

Photo 3. Wrack lines above bankfull, 11/7/2018

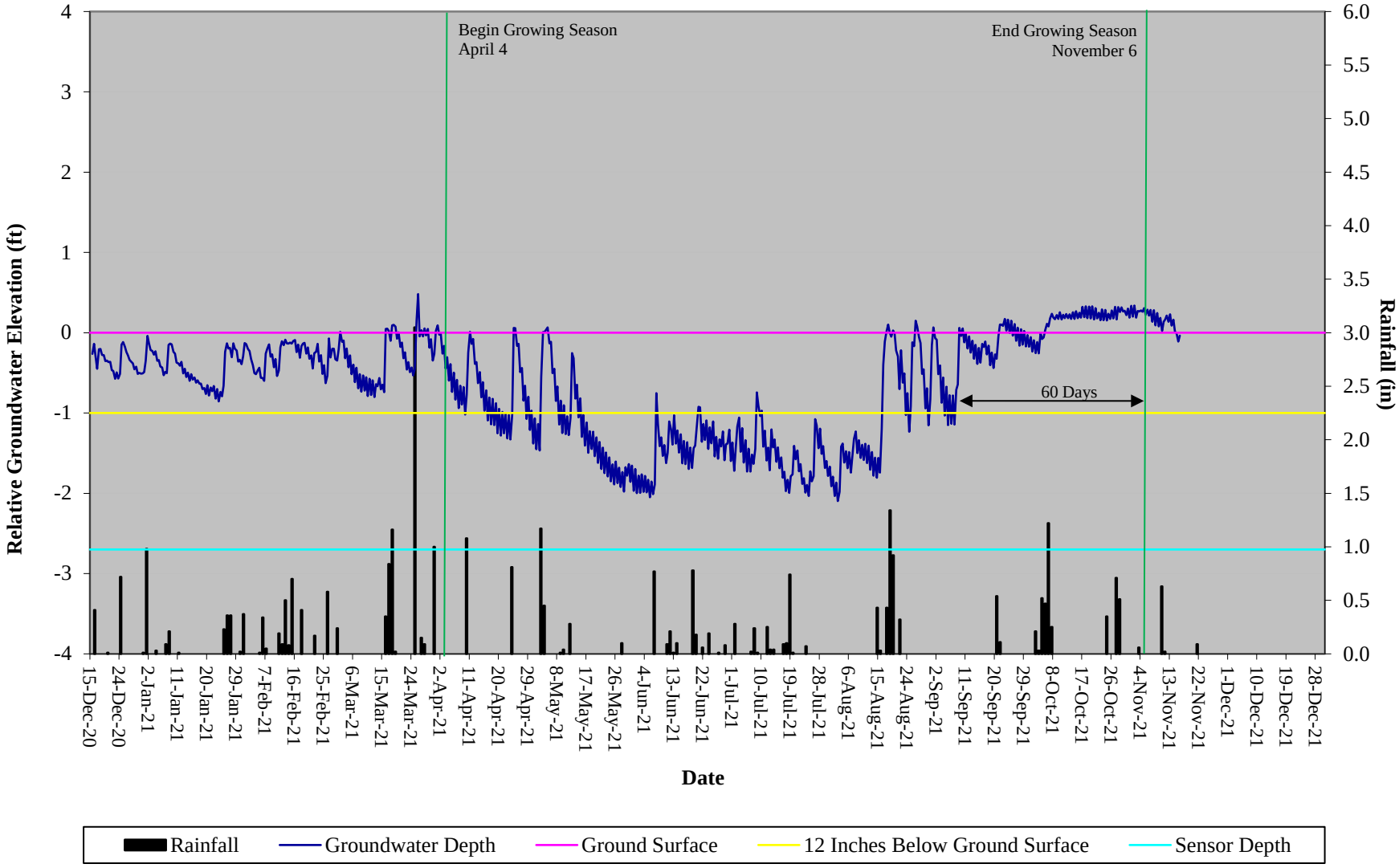
Photo 4. Wrack lines above bankfull, 9/13/2021


Sandy Bridge Farm Restoration Site
Hydrograph
Stream Gauge
Stream Stage Elevation (ft)
Rainfall (in)
Date
868
867
866
865
864
863
862
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
15-Dec-20
24-Dec-20
2-Jan-21
11-Jan-21
20-Jan-21
29-Jan-21
7-Feb-21
16-Feb-21
25-Feb-21
6-Mar-21
15-Mar-21
24-Mar-21
2-Apr-21
11-Apr-21
20-Apr-21
29-Apr-21
8-May-21
17-May-21
26-May-21
4-Jun-21
13-Jun-21
22-Jun-21
1-Jul-21
10-Jul-21
19-Jul-21
28-Jul-21
6-Aug-21
15-Aug-21
24-Aug-21
2-Sep-21
11-Sep-21
20-Sep-21
29-Sep-21
8-Oct-21
17-Oct-21
26-Oct-21
4-Nov-21
13-Nov-21
22-Nov-21
1-Dec-21
10-Dec-21
19-Dec-21
28-Dec-21
Rainfall
Surface Water
Stream Bed Elevation
Bankful Elevation
Sensor Elevation

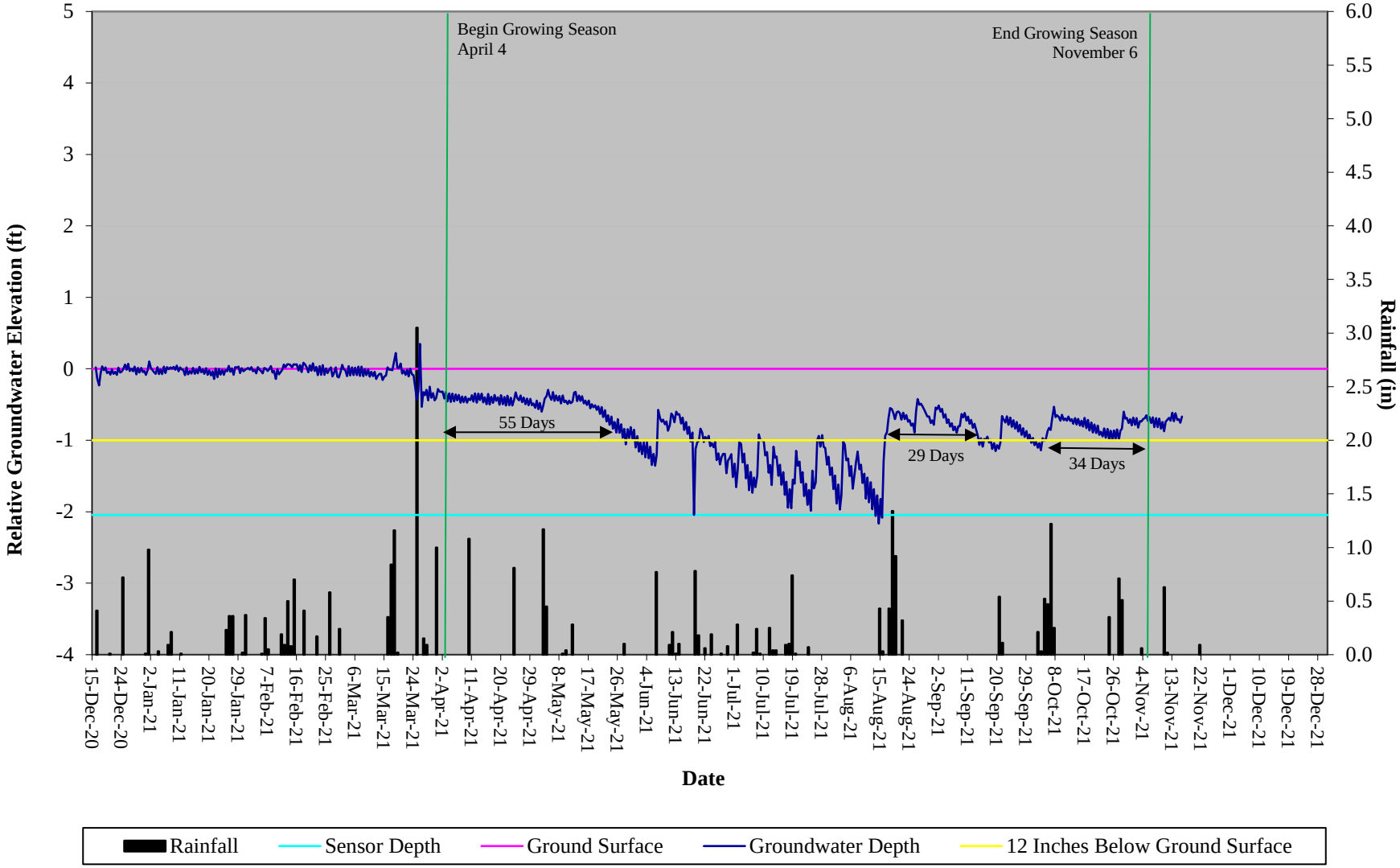
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 1



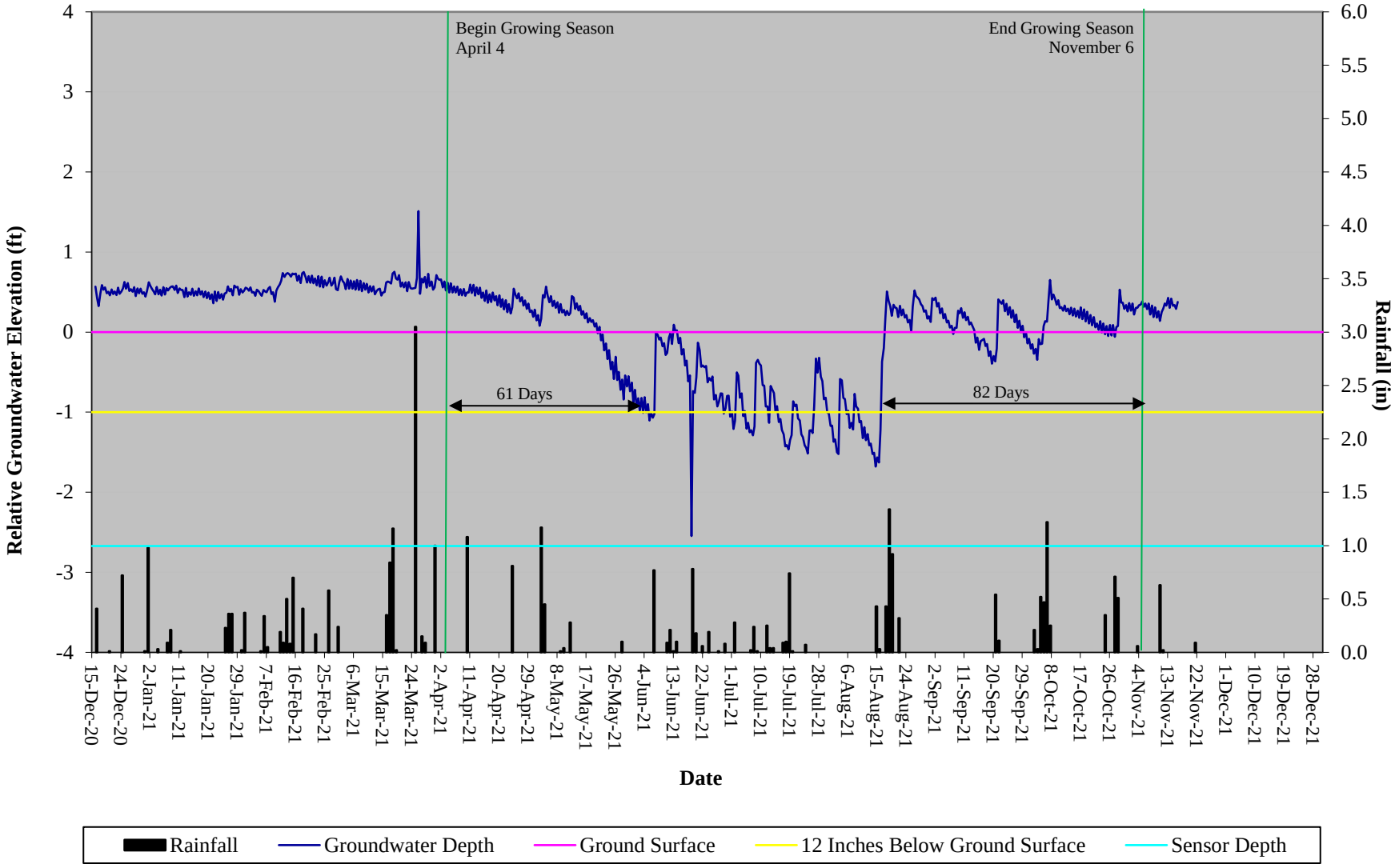
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 2



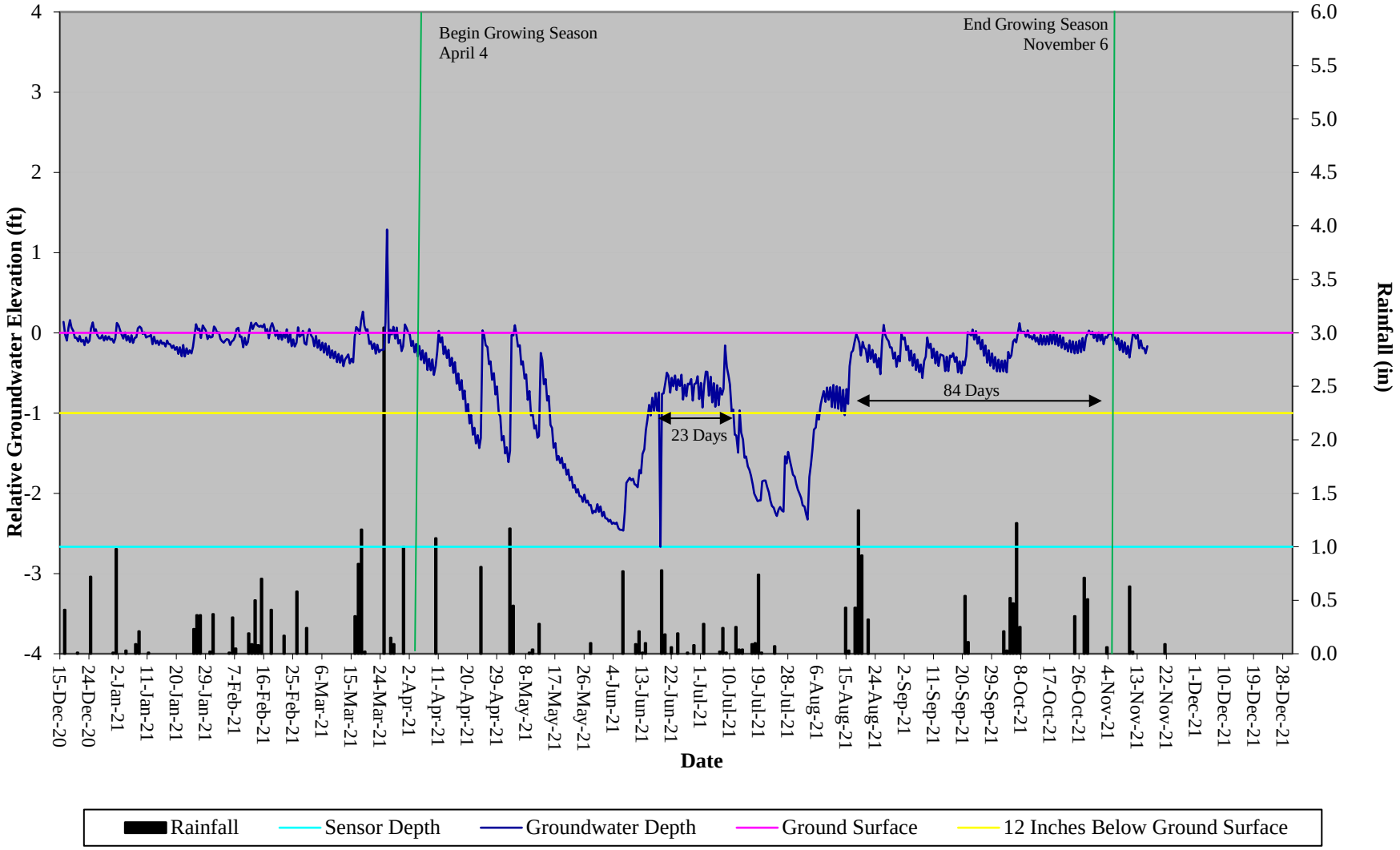
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 3



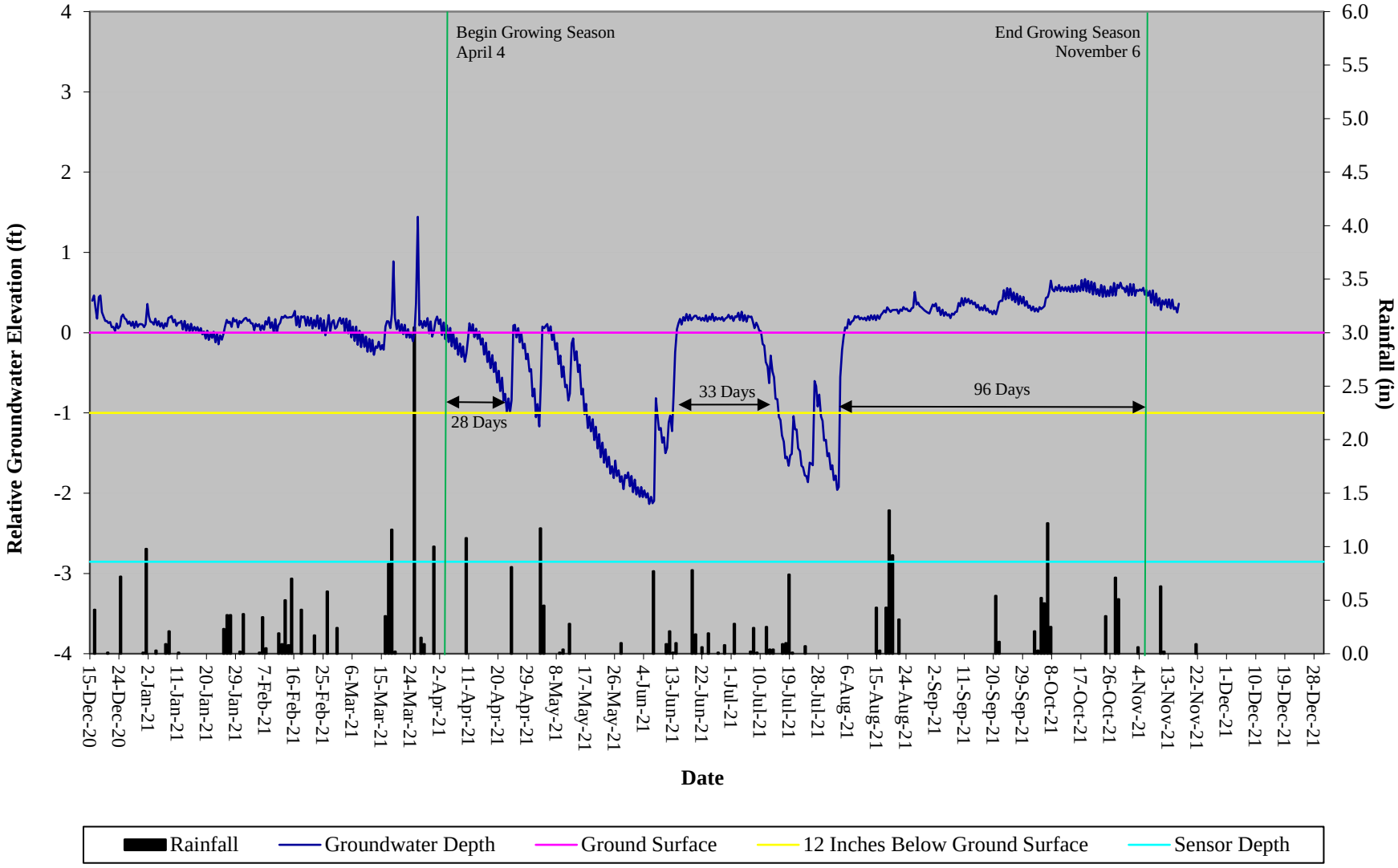
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 4



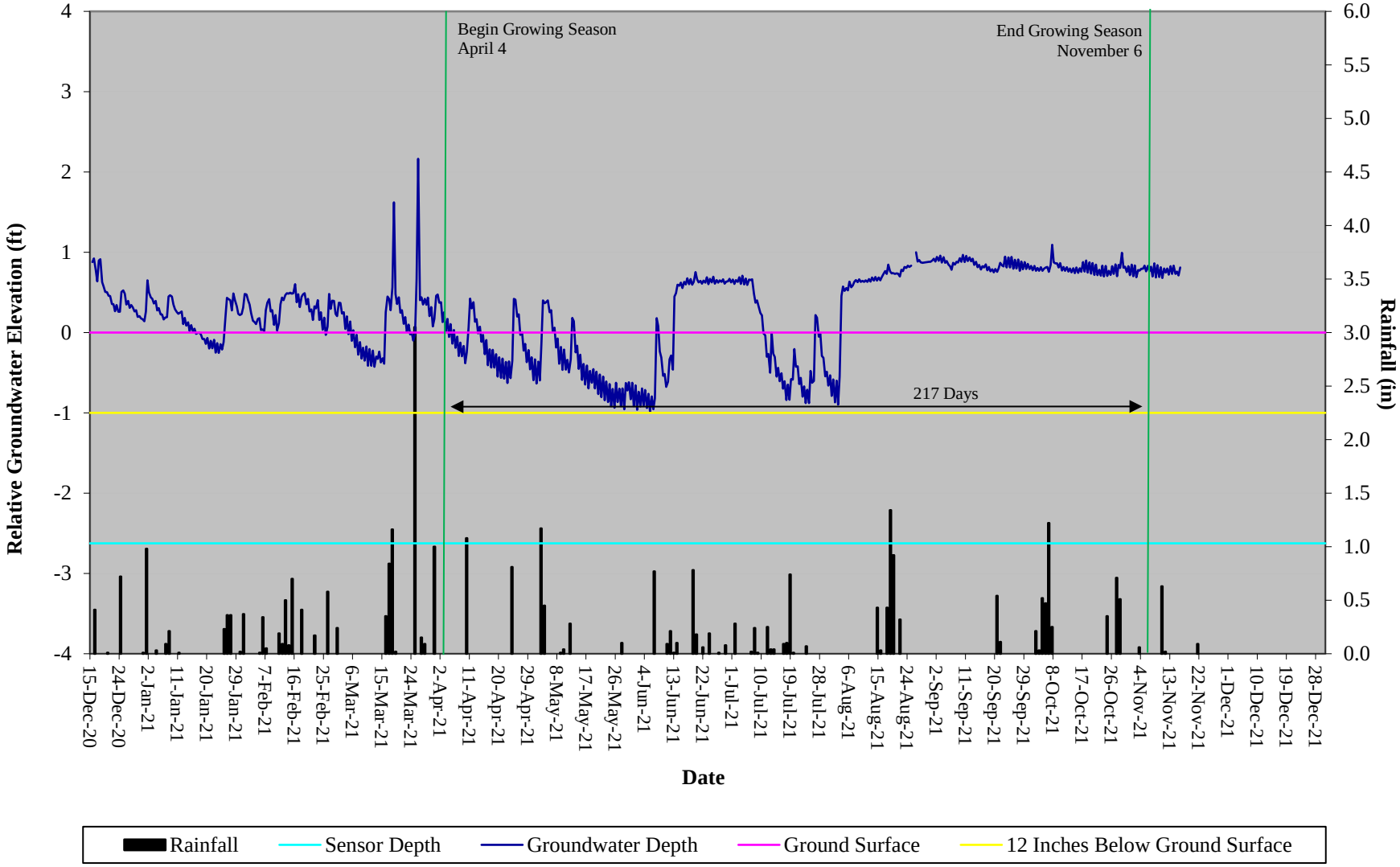
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 5

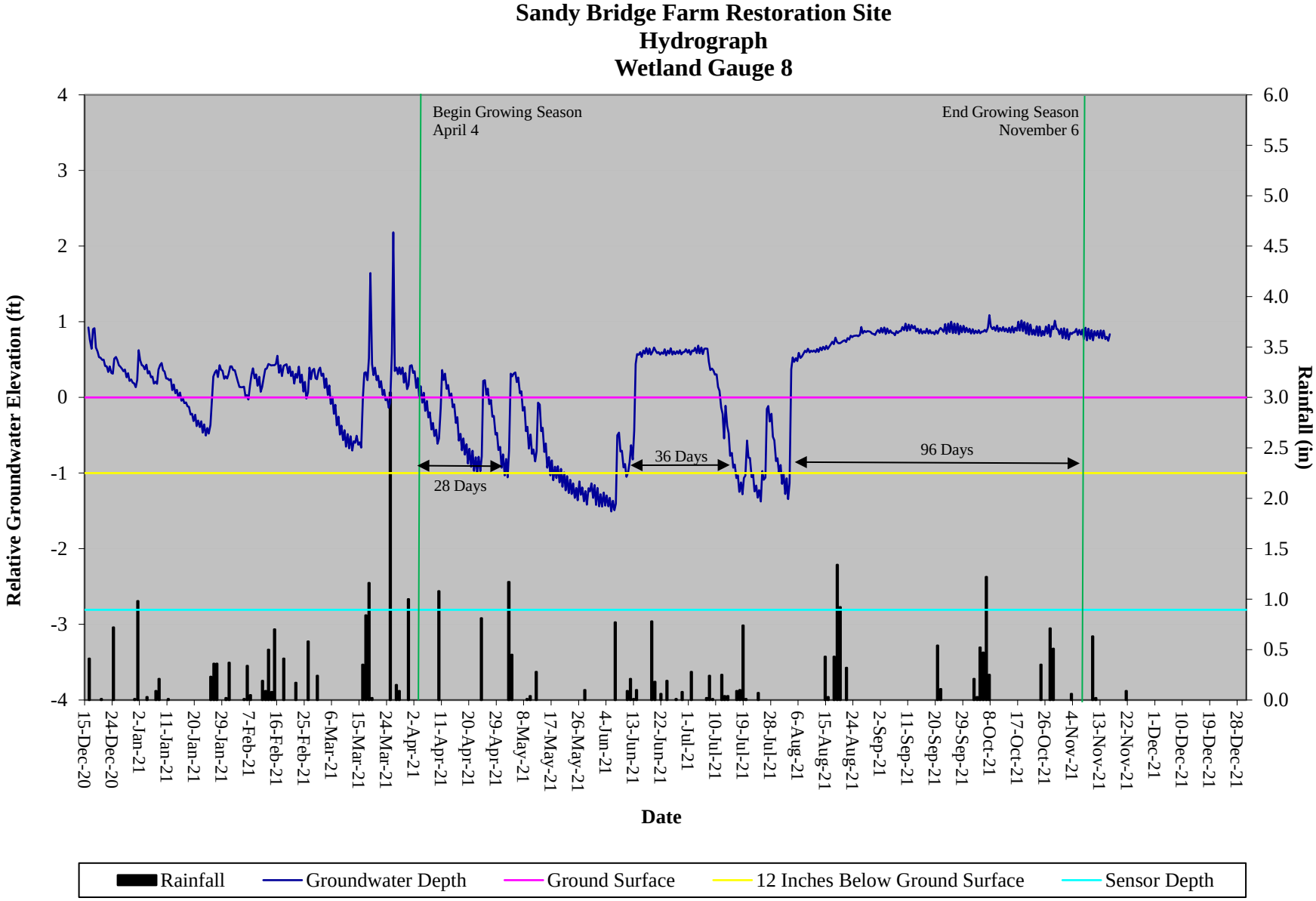


Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 6

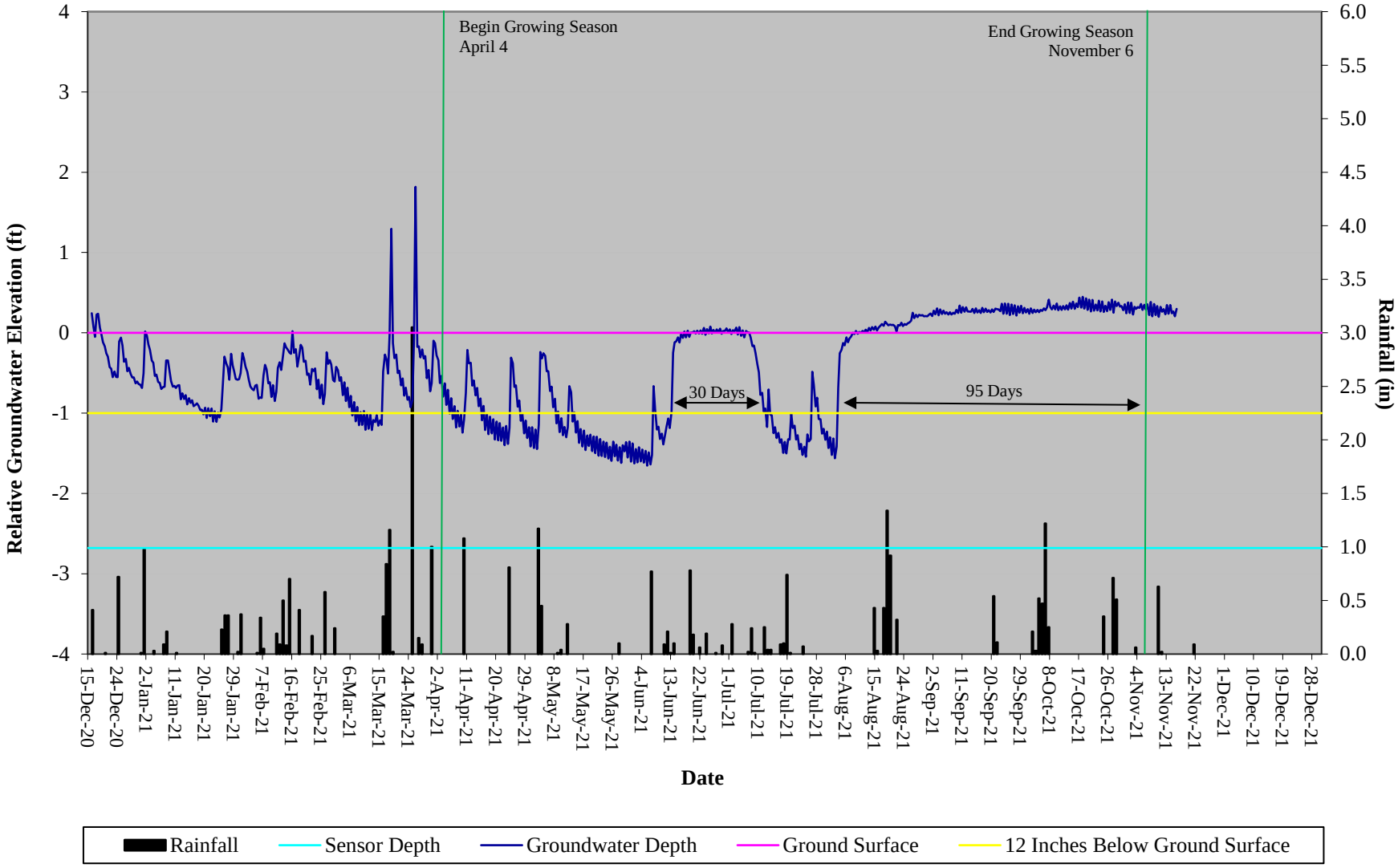


Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 7

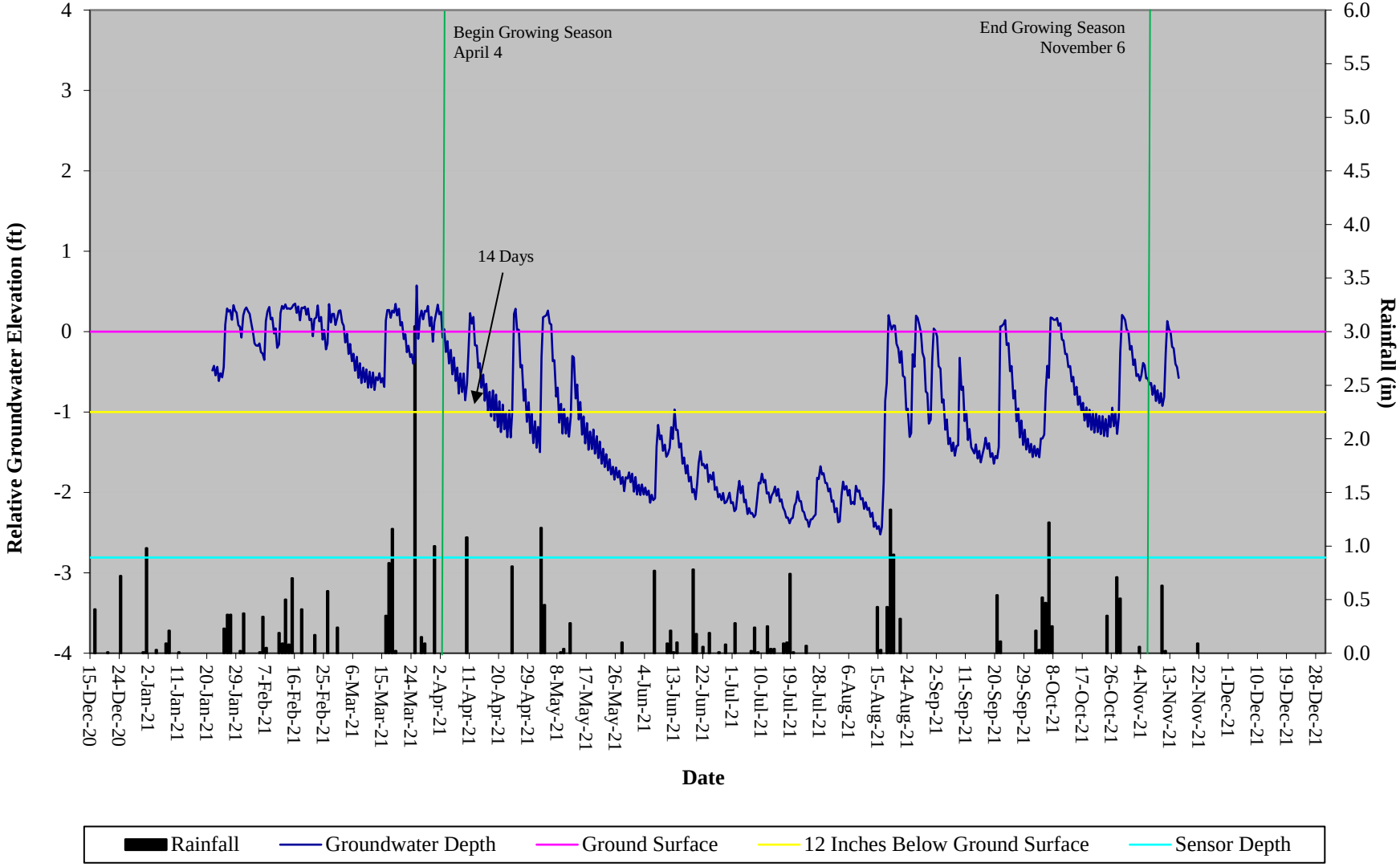



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 8
Begin Growing Season
April 4
End Growing Season
November 6
28 Days
36 Days
96 Days
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

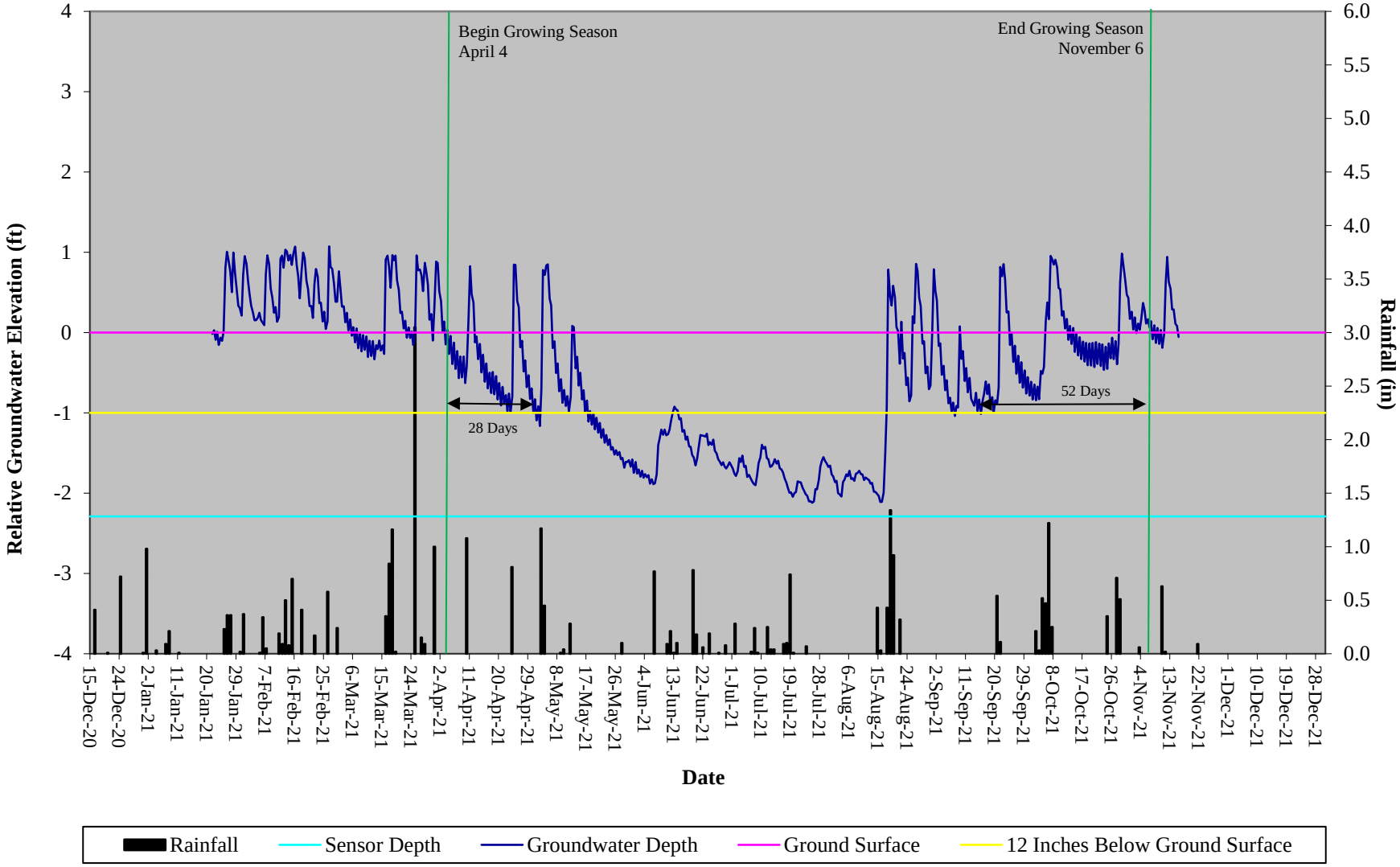
Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 9



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 10



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 11



Sandy Bridge Farm Restoration Site
Hydrograph
Wetland Gauge 12

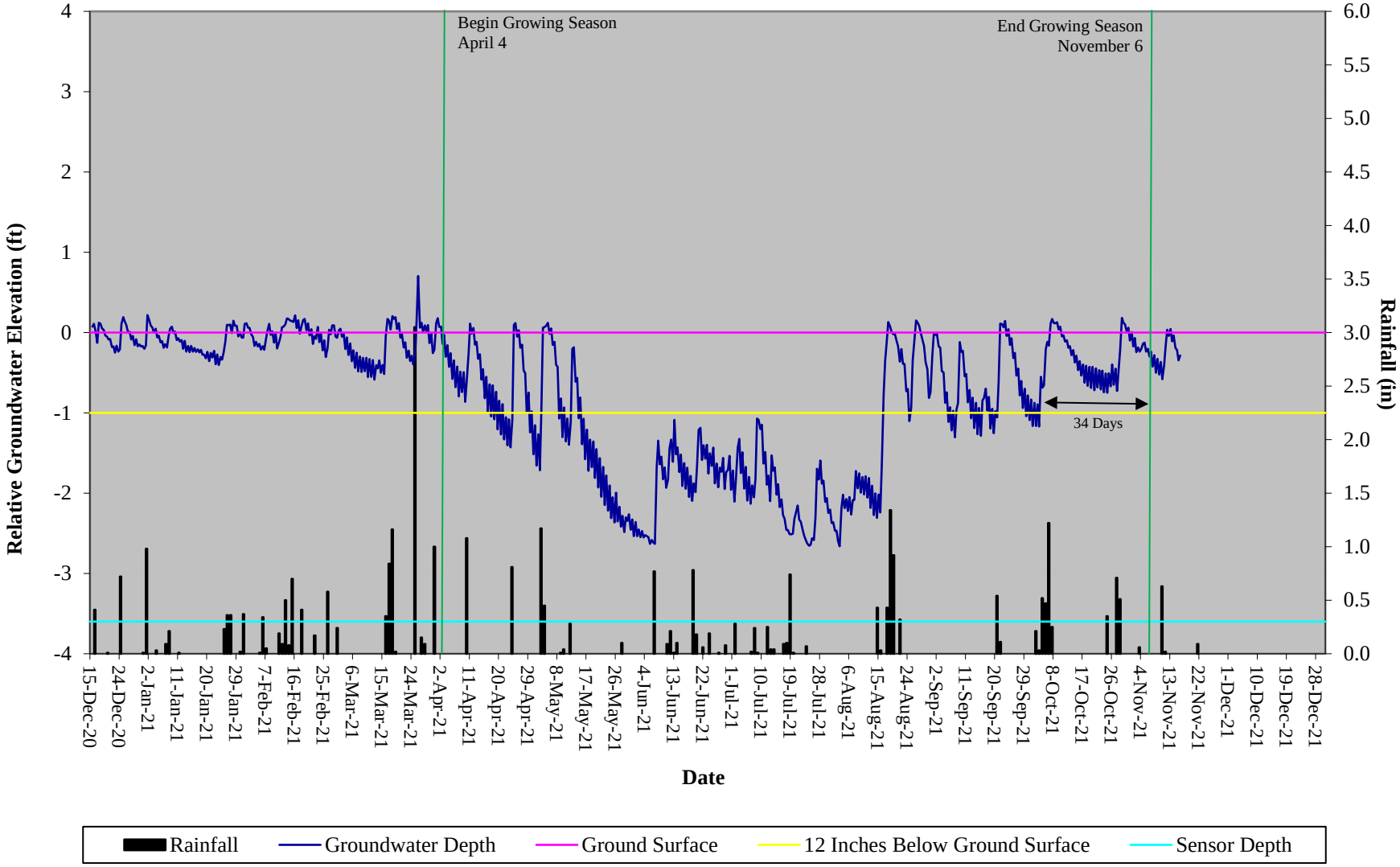


Table 11. Wetland Hydrology Criteria Attainment Sandy Bridge Farm Restoration Site, DMS Project #96920							
	Greater than 10% Continuous Saturation/Max Consecutive Days During Growing Season (Percentage)						
Gauge #	**MY-01 2017**	**MY-02 2018**	**MY-03 2019**	**MY-04 2020**	**MY-05 2021**	**MY-06 2022**	**MY-07 2023**
Gauge 1	Yes/30 (13.8%)	Yes/40 (18.4%)	Yes/46 (21.2%)	Yes/215 (99.1%)	Yes/217 (100.0%)		
Gauge 2	No/11 (5.1%)	Yes/35 (16.1%)	Yes/32 (14.7%)	Yes/126 (58.1%)	Yes/60 (27.6%)		
Gauge 3	Yes/110 (50.7%)	Yes/78 (35.9%)	Yes/162 (74.7%)	Yes/158 (72.8%)	Yes/55 (25.3%)		
Gauge 4	Yes/47 (21.7%)	Yes/105 (48.4%)	Yes/156 (71.9%)	Yes/158 (72.8%)	Yes/82 (37.8%)		
Gauge 5	No/11 (5.1%)	Gauge malfunction	Yes/44 (20.3%)	Yes/158 (72.8%)	Yes/84 (38.7%)		
Gauge 6	Yes/30 (13.8%)	Yes/63 (29.0%)	Yes/49 (22.6%)	Yes/209 (96.3%)	Yes/96 (44.2%)		
Gauge 7	Yes/22 (10.1%)	Yes/105 (48.4%)	Yes/162 (74.7%)	Yes/214 (98.6%)	Yes/217 (100.0%)		
Gauge 8	Yes/29 (13.4%)	Yes/43 (19.8%)	Yes/39 (18.0%)	Yes/209 (96.3%)	Yes/96 (44.2%)		
Gauge 9	No/15 (6.9%)	Yes/87 (40.1%)	Yes/40 (18.4%)	Yes/197 (90.8%)	Yes/95 (43.8%)		
Gauge 10*		No/8 (3.7%)	Yes/22 (10.1%)	Gauge malfunction	No/14 (6.5%)		
Gauge 11*		No/8 (3.7%)	Yes/25 (11.5%)	Gauge malfunction	Yes/52 (24.0%)		
Gauge 12*		Yes/38 (17.5%)	Yes/24 (11.1%)	Yes/217 (100%)	Yes/34 (15.7%)		

*=Gauge installed March 30, 2018

APPENDIX F

Other Data

Memoranda

ENGINEERS ♦ SURVEYORS ♦ SCIENTISTS ♦ CONSTRUCTION MANAGERS

LANDMARK CENTER II, SUITE 220 ♦ 4601 SIX FORKS ROAD ♦ RALEIGH, NC 27609 ♦ 919-783-9214 ♦ (FAX) 919-783-9266

TO:	Harry Tsomides, NC DMS, PM Todd Tugwell, USACE
FROM:	Tim Morris, KCI
DATE:	June 28, 2021
SUBJECT:	Sandy Bridge Farm Stream and Wetland Restoration Project IRT Credit Release Meeting KCI Project Number: 20157877 DMS Project Number: 96920 USACE Action ID: 201500827 DWR# 15-0414

Present:

IRT: Todd Tugwell (USACE), Kim Browning (USACE), Casey Haywood (USACE), Erin Davis (NC DEQ – DWR)

NCDMS: Harry Tsomides, Paul Wiesner and Matthew Reid, Melonie Allen

Mitigation Provider (KCI): Tim Morris, Kevin O'Briant, Tommy Seelinger

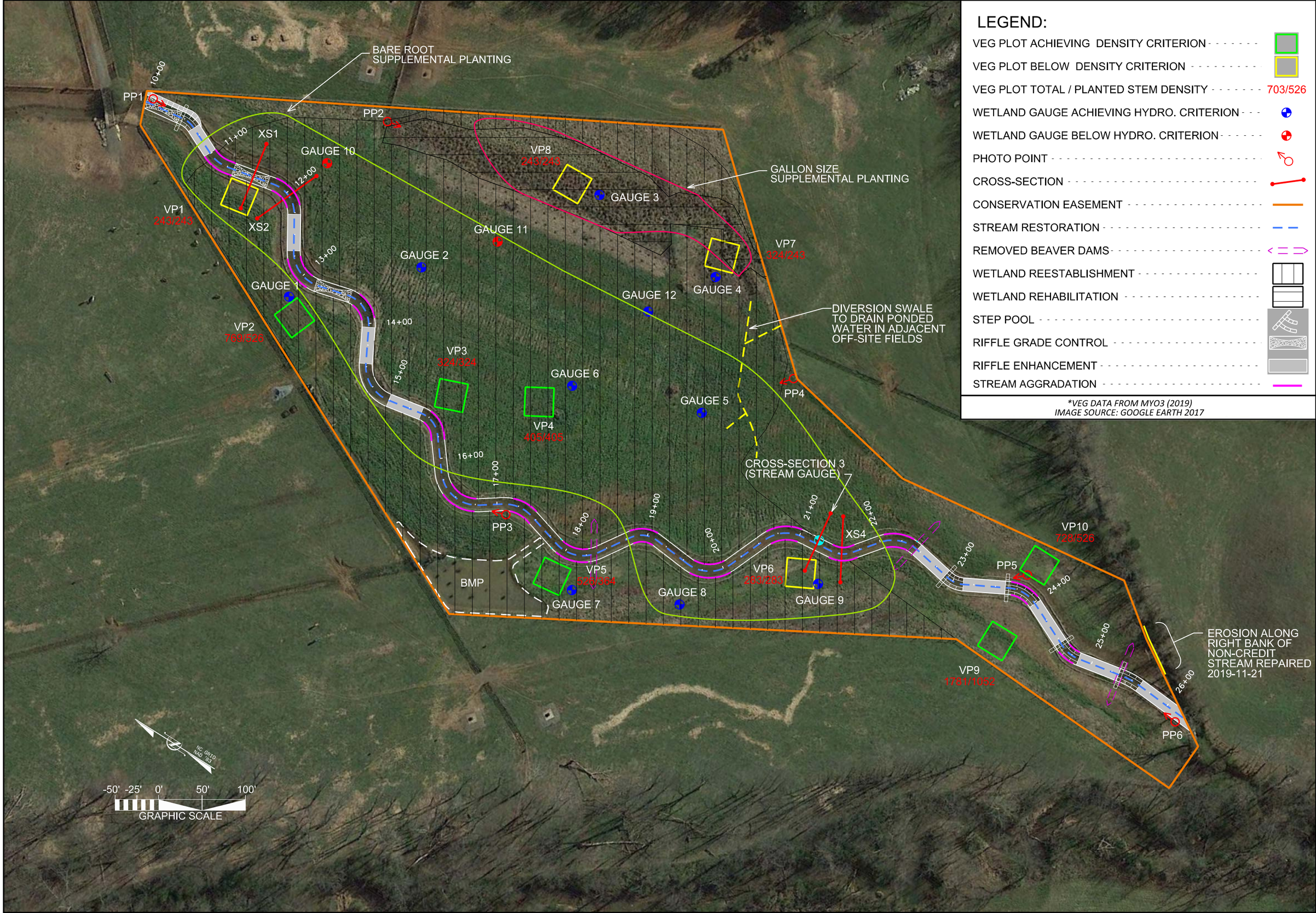
Meeting Notes:

- The field visit was conducted on June 22, 2021 starting at 11am. The conditions were overcast at the time of the site visit. The project stream was flowing at the time of the site visit. The site is currently in Monitoring Year 5.
- The field visit encompassed the majority of the site starting at the crossing at the upstream end of the project and working south along the stream. The site walk targeted potential problem areas around Veg Plots 1, 7 and 8 as well as the diversion swale, stream and BMP area. Beaver dams were also visited.
- KCI had recently completed fence repairs associated with an overbank event where debris had pushed over small sections of fence. These fences were repaired and reinforced in anticipation of future overbank events which occur on average about 8 times per year. The fence repairs were discussed during the meeting.
- Recent beaver activity was apparent on site. This was causing backwater in the stream as

well as the riparian areas. Beavers were not present on June 3rd during a monitoring visit but were noted on the site on June 13th when KCI was on site to do some fence repairs. USDA Aphis was contacted and traps were set on 6/21. One beaver had been trapped on 6/22 and traps remained in place until a second beaver was trapped and removed. When trapping is completed the dams would be breached and normal water elevations would be restored.

- Beaver activity has been a problem on this site since Year 1 monitoring. Management of beavers has been continuous and expensive throughout the monitoring period.
- This site could be a difficult site for the Stewardship program because there is no funding for wildlife management and the landowner has been vocal that he is not happy about the impact to his pastures created by the ongoing beaver activity.
- KCI will continue removing beavers through Year 7 monitoring.
- There were some areas that appeared to have low stem counts or possibly low vigor in areas near VP1, VP2 and Gauge 2 as well as the rehabilitation wetland near VP7 and VP8. These areas are very wet with dense herbaceous cover. The duration of inundation is likely the cause of poor stem survival and/or vigor. These low-density areas were replanted in March of 2020 however vegetation monitoring was not conducted in 2020 to determine the success of the newly planted stems. Vegetation monitoring will continue in 2021 (Year 5).
- IRT suggested that if the rehabilitation wetland near VP 7 and VP8 turns to more of a scrub-shrub or emergent wetland because of the high hydroperiod that those boundaries be defined in the monitoring reports.
- The IRT indicated that if the site were implemented today, it could be a candidate for a maximum hydroperiod as a performance standard; however, based on the IRT approved mitigation plan, the site is not subject to a maximum hydroperiod success criteria.
- At the end of the meeting, the NC IRT released project credits as proposed by NC DMS

Attachment (CCPV)



LEGEND:

- VEG PLOT ACHIEVING DENSITY CRITERION
- VEG PLOT BELOW DENSITY CRITERION
- VEG PLOT TOTAL / PLANTED STEM DENSITY — 703/526
- WETLAND GAUGE ACHIEVING HYDRO. CRITERION
- WETLAND GAUGE BELOW HYDRO. CRITERION
- PHOTO POINT
- CROSS-SECTION
- CONSERVATION EASEMENT
- STREAM RESTORATION
- REMOVED BEAVER DAMS
- WETLAND REESTABLISHMENT
- WETLAND REHABILITATION
- STEP POOL
- RIFFLE GRADE CONTROL
- RIFFLE ENHANCEMENT
- STREAM AGGRADATION

**VEG DATA FROM MYO3 (2019)*
IMAGE SOURCE: GOOGLE EARTH 2017

REVISIONS

SYM.	DESCRIPTION	DATE

NCDEQ DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE RD., SUITE 400
RALEIGH, NORTH CAROLINA 27609

SANDY BRIDGE FARM
STREAM AND RIPARIAN WETLAND SITE

DMS PROJECT #96920
RUTHERFORD COUNTY, NORTH CAROLINA
MONITORING YEAR 04

DATE: DEC 2020
SCALE: GRAPHIC

CURRENT CONDITION PLAN VIEW