St. Clair Creek Restoration Project
Year 8 Monitoring Report FINAL

Beaufort County, North Carolina

DMS Project ID No. 95015

DWR Project #13-0739, DEQ Contract #003986

USACE Action ID: 2008-02655

Tar-Pamlico River Basin: 03020104-040040

Project Info:	Monitoring Year: 8 Year of Data Collection: 2021 Year of Completed Construction: 2014 Submission Date: January 2022
Submitted To:	NC DEQ – Division of Mitigation Services 1652 Mail Service Center Raleigh, NC 27699 NC DEQ Contract ID No. 003986

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Report Prepared and Submitted by Michael Baker International

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1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,274 linear feet of perennial and intermittent headwater stream, 2.8 acres of riparian wetlands, and planted 17.5 acres of native riparian vegetation within the entire conservation easement along two unnamed tributaries (UT2 and UT3) to St. Clair Creek in Beaufort County, North Carolina (NC) (Figure 1). The St. Clair Creek Restoration Project (Site) is located in Beaufort County, approximately five miles east of the Town of Bath. The Site is located in the NC Division of Water Resources (NCDWR) subbasin 03-03-07 and the NC Department of Environmental Quality (NC DEQ) Division of Mitigation Services (DMS) Targeted Local Watershed (TLW) 03020104-040040 of the Tar-Pamlico River Basin. The project involved the restoration of a Coastal Plain Headwater Small Stream Swamp system (Schafale and Weakley 1990) from impairments within the project area due to past agricultural conversion and silviculture.

The primary restoration goals of the project were to improve ecological functions to the impaired areas within the Tar-Pamlico River Basin as described below:

- Create geomorphically stable conditions along the unnamed tributaries across the project,
- Implement agricultural BMPs to reduce nonpoint source inputs to the downstream estuary,
- Protect and improve water quality by reducing nutrient and sediment inputs,
- Restore stream and wetland hydrology by connecting historic flow paths and promoting natural flood processes, and
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.

To accomplish these goals, the following objectives were identified:

- Restore existing channelized streams by restoring the relic headwater valley and allowing diffuse flow, providing the streams access to their floodplains,
- Increase aquatic habitat value by allowing natural microtopography to form,
- Plant native species riparian buffer vegetation within the headwater valley and floodplain areas, and within the wetland areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, decrease erosion, and shade the stream to decrease water temperature,
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature, and
- Control invasive species vegetation within the project area and if necessary continue treatments during the monitoring period.

During Year 8 monitoring, the planted acreage performance categories were functioning at 100 percent with no bare areas or low stem density areas to report. The average density of total planted stems, based on data collected from the nine monitoring plots during Year 8 monitoring, is 594 stems per acre. Thus, the Year 8 data demonstrate that the Site has met the final success criteria of 210 stems per acre.

During the previous Year 7 monitoring, *Pinus taeda* (loblolly pine) saplings were thinned throughout the buffer on UT2, in particular in the middle and upper sections. However, during Year 8 monitoring, new, rapidly growing loblolly pine seedlings and short saplings were again found scattered throughout the riparian buffer of the UT2 area. It should be noted that the pines do not appear to be suppressing planted

species survival or growth as vegetation density appears strong throughout the project, even in areas with pine presence. Nevertheless, these pines will again be treated and heavily thinned during the winter and/or spring of 2022 prior to any IRT site closeout visits using hand/power tools and/or chemical applications. The project will continue to be observed for pine growth throughout the remaining monitoring period.

Year 8 wetland groundwater monitoring demonstrated that 5 of the 8 of the groundwater monitoring wells located in the wetland credited areas along UT2 and UT3 met the success criteria by recording water levels within 12 inches of the ground surface for a consecutive period greater than 12% of the growing season (33 days for the Site). Successful hydroperiods ranged from 13.8% to 18.8%. Well SCAW6 missed the target hydrology by just two days mid-March when a dry spell caused the groundwater to dip two inches below the target depth. Well SCAW8 also missed the target hydrology by just two days at the very end of March. All of the wells achieved their greatest consecutive success early in the year, just after the growing season began. All wetland restoration well data and reference well data collected during Year 8 monitoring are located in Appendix D.

Additionally, during Year 8 monitoring the gauge in wetland well SCAW4 failed very near the start of the growing season and thus was unable to provide any meaningful data during the critical success timeframe. It was sent to the manufacturer (In-Situ) for additional evaluation though they were unable to retrieve any additional data. However, in the past it had been one of the better performing wells and given how its performance tracked with the other successful wells, it seems likely it would have passed given the data recorded up until gauge failure.

It should also be noted that while the success criteria stated in the mitigation plan for wetland hydroperiod is 12%, the 10/24/16 Wilmington District Stream and Wetland Compensatory Mitigation Update document states that for the Tomotley soils series (which is mapped on the project site) the wetland hydroperiod range is 10% to 12%.

Additionally, there are two groundwater monitoring wells (SCAW9 and SCAW10) installed on 3/16/17 in areas located outside the project's currently approved mitigation plan wetland restoration areas. Well SCAW9 met the 12% hydroperiod success criteria with 13.8%, though SCAW10 did not with only 7.4%. Both well locations certainly appear quite wet. Please note these areas are not being requested for any credits of any kind at this time. Baker is simply conducting exploratory monitoring within *potential* future wetland restoration areas. The three potential areas total 1.1 acres and are all located outside the 50 ft buffer from the stream channel but within the conservation easement (see Figure 2 in Appendix B). Baker is not presenting this information here for formal approval or acceptance, but to simply inform DMS and the IRT of all project activity.

On-site flow through the restored headwater valleys of UT2 and UT3 was recorded through the use of seven installed pressure transducers as flow gauges. Each one met the success criteria in Year 8 by recording a consecutive flow event of 30 days or longer in 2021. Of note, Flow gauge SCFL#4 located towards the top of UT2 met the success criteria, recording its longest single duration flow event of 40 days in February and March. This is of particular significance as flow in the upper portion of UT2 and the results of Flow Gauge #4 have been the subject of IRT concern in the past. Additionally, an eighth flow gauge was installed further upstream of Gauge #4 on February 17, 2021. This section of stream had been observed to have flow earlier in January and February but was gauged to confirm flow to the IRT. It was installed too late in the year to positively confirm a minimum of 30 days of flow, though that length of flow can be inferred from field visits and videos collected during site visits in February and March, in addition to the limited flow gauge data. The complete flow gauge success summary Table 11 and all individual flow gauge graphs are found in Appendix D.

To help demonstrate flow in upper UT2, several videos were taken in February and March of 2021 along four transects across sections of the reach and also along the profile in order to help demonstrate what this upper section looks like during the winter and early spring. Please see the video links and a map showing their locations in Appendix B. Baker strongly encourages all members of the IRT to view these videos as they have generally only seen the site during the late spring or summer when the site appears quite different and much drier.

Additionally, during the previous MY7 two cross-section survey transects were conducted in the upper portion of Reach UT2 to help demonstrate channel formation and thus flow. It shows the substantial width of the channel swale that has formed and stabilized since construction. Please see the Memorandum included in Appendix D for more details.

Total observed area rainfall for the previous 12-month period from December 2020 through November 2021 was 59.2 inches, as compared to the Beaufort County WETS table for the same period of 50.0 inches annually (see Figure 5 in Appendix D). However, to simply conclude that the annual rainfall was above average would be misleading. In fact, the distribution of that rainfall was heavily weighted over the winter of 2020-2021 and then within the single month of June 2021, all of which were above the historic 70% probable (June was over twice that value). The remainder of the year was quite dry. Six of remaining months were at or below the historic 30% probable. The fall of 2021 was so dry that the site is currently under a Level D2: Severe Drought. This will almost certainly impact the stream flow and wetland hydrology in the winter and spring of 2021-2022, unless significant and consistent rainfall returns.

In addition, currently contracted riparian buffer credits have been included as part of the project as referenced by the "Site Viability for Buffer Mitigation" memo from Karen Higgins (NCDWR) dated 1/7/16 and included as an asset in this report (as found in Appendix A). As part of the St. Clair Creek Restoration project, Riparian Buffer credits in excess of the contracted 6.8 acres (296,208 square feet) will be provided. Monitoring for success of riparian buffers will continue to follow the existing vegetation monitoring protocol and success criteria as stated in the approved mitigation plan for stream and wetland vegetation success. Only vegetation plots 1-6 are located within the approved buffer credit areas and no additional vegetation monitoring plots are required to monitor buffer success as these existing plots serve to monitor the success of the vegetation of the headwater coastal plain stream and the associated riparian buffer. The Year 8 monitoring results demonstrate that the site has met the success criteria requirements for Riparian Buffer credits in each of vegetation plots 1-6 as described in the buffer memo, and with an overall average density of 492 stems/acre.

Summary information/data related to the Site and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report Appendices. Narrative background and supporting information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the North Carolina Division of Mitigation Services (NCDMS) website. All raw data supporting the tables and figures in the Appendices are available from NCDMS upon request.

2.0 METHODOLOGY

The seven-year monitoring plan for the Site includes criteria to evaluate the success of the stream, wetland and vegetation components of the project. The methodology and report template used to evaluate these components adheres to the NCDMS monitoring guidance document dated 11/7/11, which will continue to serve as the template for subsequent monitoring years. The specific locations of monitoring features, such as vegetation plots, flow gauges and wells are shown on the CCPV sheets found in Appendix B.

The growing season for the Beaufort County ends on December 6th, and the final well and flow data were collected on 12/15/21. The visual site assessment data contained in Appendix B were also collected in December 2021 as noted.

2.1 Stream Assessment – Reaches UT2 and UT3

The UT2 and UT3 mitigation approach involved the restoration of historic flow patterns and flooding functions in a multi-thread headwater stream system, monitoring efforts will focus on visual observations to document stability and the use of water level monitoring gauges to document saturation and flooding functions. The methods used and any related success criteria are described below for each parameter. Monitoring efforts focus on visual observations and in-channel flow gauges/pressure transducers to document stream success.

As-built Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the As-built Survey. This survey system collects point data with an accuracy of less than one tenth of a foot.

2.1.1 Hydrology

Total observed area rainfall for the previous 12-month period from December 2020 through November 2021 was 59.2 inches, as compared to the Beaufort County WETS table for the same period of 50.0 inches annually (see Figure 5 in Appendix D). However, to simply conclude that the annual rainfall was above average would be misleading. In fact, the distribution of that rainfall was heavily weighted over the winter of 2020-2021 and then within the single month of June 2021, all of which were above the historic 70% probable (June was over twice that value). The remainder of the year was quite dry. Six of remaining months were at or below the historic 30% probable. The fall of 2021 was so dry that the site is currently under a Level D2: Severe Drought. This will almost certainly impact the stream flow and wetland hydrology in the winter and spring of 2021-2022, unless significant and consistent rainfall returns.

Four automated flow gauges (pressure transducers) were originally installed in the UT2 channel along with two flow gauges installed in the UT3 channel. The gauges were installed approximately 500 feet apart within the restored systems to document flow duration. Additionally, a fifth flow gauge (SCFL#7) was installed approximately halfway between SCFL#4 and SCFL#3 on 6/6/18 in the upper portion of UT2, and a sixth flow gauge (SCFL#8) was installed on upper UT2 on 2/17/21 approximately halfway between SCFL#4 and the very top of the reach. As stated in the mitigation plan, annual success criteria are considered to have been met if 30 consecutive days of flow were observed at any point during the monitoring year, with two such 30-day flow events having been documented in separate monitoring years. The individual flow gauge graphs and the flow gauge success summary Table 11 are all located in Appendix D.

Additionally, during the previous Year 7 monitoring, two cross-section transects were conducted in the upper portion of Reach UT2 to help demonstrate flow and channel formation. Please see the Memorandum included in Appendix D for more details.

2.1.2 Photographic Documentation

The reaches were photographed longitudinally beginning at the downstream end of both reaches, moving upstream to the beginning of each reach. Photographs were taken looking at established locations throughout the restored stream valley. Points were close enough together to provide an

overall view of the reach lengths and valley crenulations. Photographs of the stream photo points, wetland wells, and flow gauges are all located in Appendix B.

2.2 Wetland Assessment

Wetland monitoring is conducted using eight automated groundwater-monitoring stations that are installed within the UT-2 and UT-3 wetland restoration areas, as well as two additional reference wells installed in the downstream portion of the UT-3 wetland restoration area. Installation of these groundwater monitoring stations follow Corps of Engineers Wetlands Research Program Technical Note VN-rs-4.1 (USACE 1997) and the water table monitoring standards follow Technical Note ERDC TN-WRAP-05-2 (USACE 2005). All wetland restoration well data collected during Year 8 monitoring are located in Appendix D.

The automated loggers are programmed to collect data to document groundwater levels in the restored wetland areas. The success criteria for wetland hydrology are considered to have been met when the site has groundwater within 12 inches of the soil surface for a consecutive number of days equal to a minimum of 12% of the growing season. For Beaufort County, the growing season is from February 28 to December 6 (282 days), so 12% is a minimum of 33.8 consecutive days for the Site.

It should also be noted that while the success criteria stated in the mitigation plan for wetland hydroperiod is 12%, the 10/24/16 Wilmington District Stream and Wetland Compensatory Mitigation Update document states that for the Tomotley soils series (which is mapped on the project site) the wetland hydroperiod range is 10% to 12%.

Two more groundwater monitoring wells (SCAW9 and SCAW10) were installed on 3/16/17 in areas located outside the project's currently approved mitigation plan wetland restoration areas (see Figure 2 in Appendix B). Please note these areas are not being requested for any credits of any kind at this time. Baker is simply conducting exploratory monitoring in potential future wetland restoration areas. The three potential areas total 1.1 acres and are all located outside the 50 ft buffer from the stream channel but within the conservation easement. Baker is not presenting this information here for formal approval or acceptance, but simply wishes to inform NCDMS and the IRT of all project activity.

Additionally, during Year 8 monitoring the gauge in wetland well SCAW4 failed very near the start of the growing season and thus was unable to provide any meaningful data during the critical success timeframe. It was sent to the manufacturer (In-Situ) for additional evaluation though they were unable to retrieve any additional data. However, in the past it had been one of the better performing wells and given how its performance tracked with the other successful wells, it seems likely it would have passed given the data recorded up until gauge failure.

2.2.1 Wetlands Modifications Review

A brief summary of previous wetlands modifications is presented here as a review of relevant project history. A more detailed description of this work was presented in the Year 3 report.

In the fall of 2015, the restoration site landowner cut a network of drainage ditches adjacent to the easement boundaries of both UT2 and UT3 with the intent to drain water away from his nearby pine plantation. The work was implemented without the knowledge of Baker and was discovered in the fall of 2015 during monitoring activities. To help remedy the situation, Baker oversaw three areas of drainage modifications to the project in March of 2016: 1) Three French drains were installed under the farm road along the northern portion of UT2 and were linked to wide, shallow swales cut into the buffer to reconnect water flow from the adjacent landowner's field that routinely ponded water behind the road. 2) The drainage ditch running parallel to the easement boundary along the western portion of UT2 was filled, and three wide, shallow swales were cut to connect the existing drainages within

the pine plantation to the project wetlands and buffer. 3) The drainage ditch running parallel to the easement boundary along the western edge of UT3 was filled, and a shallow swale was cut to connect drainage from the pine plantation into an existing shallow depression located within the existing wetland.

It was observed during the Year 8 monitoring that diffuse flow does move through all of the installed swales, and all remain stable and vegetated. Additional groundwater monitoring wells 5-8 were installed in April of 2016 specifically to observe the wetland restoration areas potentially affected by these modifications. The locations of this work are provided in Figure 2 in Appendix B.

2.3 Vegetation Assessment

In order to determine if the criteria are achieved, vegetation-monitoring quadrants were installed and are monitored across the restoration site in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the CVS-NCDMS data entry tool v 2.3.1 (CVS 2012). The vegetation monitoring plots are a minimum of 2 percent of the planted portion of the Site with nine plots established randomly within the Site's planted riparian buffer areas per Monitoring Levels 1 and 2. The sizes of individual quadrants are 100 square meters for woody tree species.

Complete Year 8 vegetation assessment information is provided in Appendix C.

2.3.1 Vegetation Concerns

During Year 8 monitoring, *Pinus taeda* (loblolly pine) seedlings and short saplings were again found scattered throughout the riparian buffer of the UT2 restoration area. It should be noted that the pines do not appear to be suppressing planted species survival or growth as vegetation density appears strong throughout the project, even in areas with pine presence. The pines were thinned in May and December of 2021, however, they will be thinned and treated again during the winter and/or spring of 2022 using hand/power tools and/or chemical applications. The entire project will continue to be observed for pine growth throughout the remaining monitoring period.

3.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services (DMS). 2011. Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation. November 7, 2011.

Schafale, M. P., and A. S. Weakley. 1990. Classification of the natural communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program. Division of Parks and Recreation,
NC DEQ. Raleigh, NC.

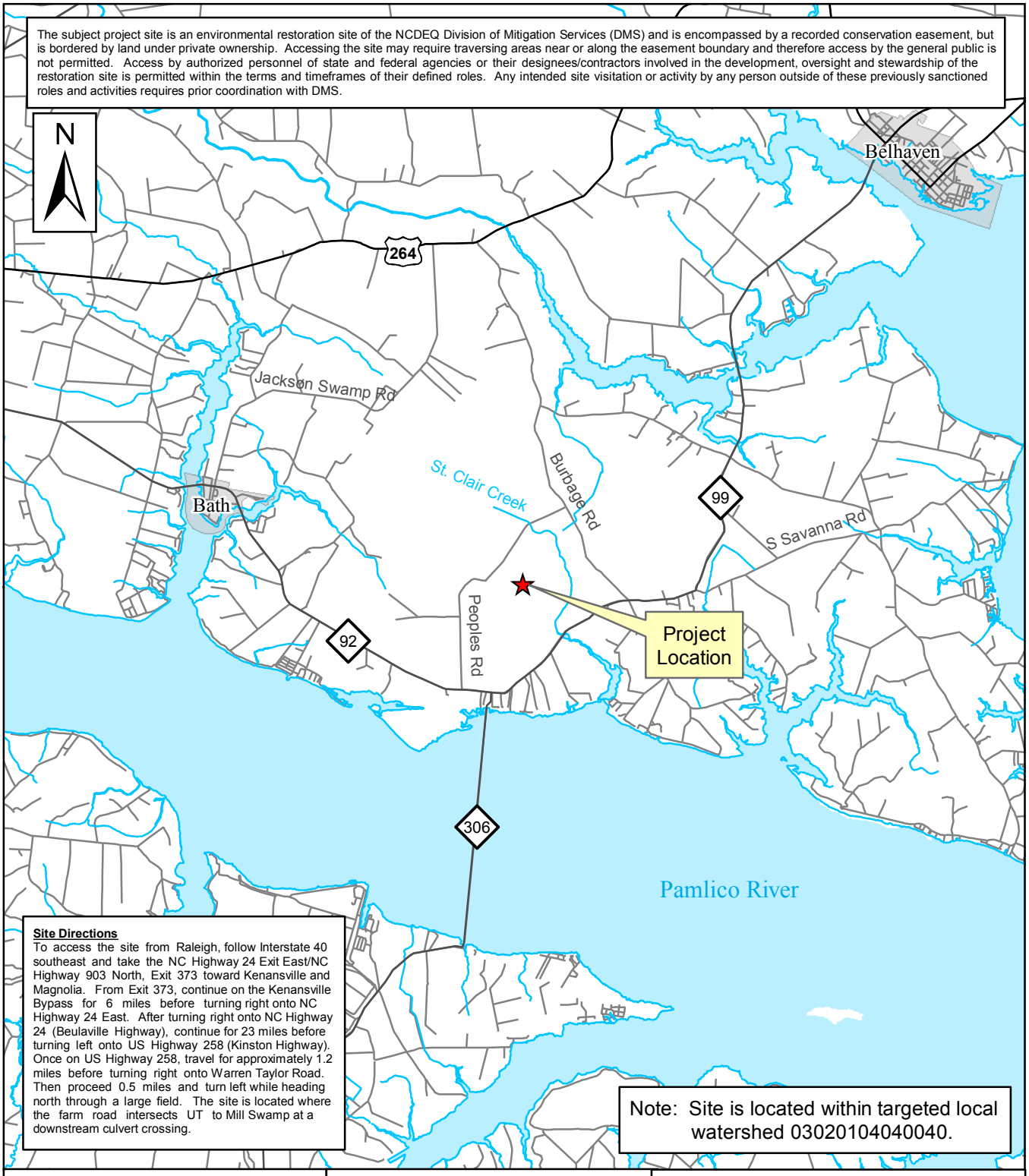
United States Army Corps of Engineers. 1997. Corps of Engineers Wetlands Research Program. Technical Note VN-rs-4.1. Environmental Laboratory. U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.

____. 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

Appendix A

Project Vicinity Map, Background Tables and Files

The subject project site is an environmental restoration site of the NCDEQ Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with DMS.



Site Directions
To access the site from Raleigh, follow Interstate 40 southeast and take the NC Highway 24 Exit East/NC Highway 903 North, Exit 373 toward Kenansville and Magnolia. From Exit 373, continue on the Kenansville Bypass for 6 miles before turning right onto NC Highway 24 East. After turning right onto NC Highway 24 (Beulaville Highway), continue for 23 miles before turning left onto US Highway 258 (Kinston Highway). Once on US Highway 258, travel for approximately 1.2 miles before turning right onto Warren Taylor Road. Then proceed 0.5 miles and turn left while heading north through a large field. The site is located where the farm road intersects UT to Mill Swamp at a downstream culvert crossing.

Note: Site is located within targeted local watershed 03020104040040.

Beaufort County

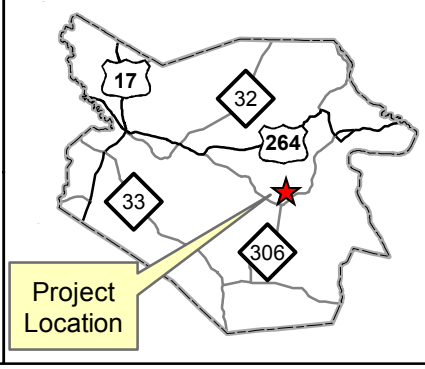


Figure 1
Project Vicinity Map
St. Clair Creek Restoration Site

NCDEQ -
Division of Mitigation Services

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0 0.5 1 2 3
Miles

Table 1. Project Components and Mitigation Credits
St. Clair Creek Restoration Project: DMS Project No ID. 95015

Mitigation Credits								
	Stream	**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorus Nutrient Offset**
Type	R	R	RE					
Totals	2,946.6 SMU / 327.4 SMU*	2.8 WMU	0			363,577 BMU		

Project Components						
Project Component or Reach ID	**Stationing/ Location**	**Existing Footage/ Acreage**	**Approach**	**Restoration/ Restoration Equivalent**	**Restoration Footage or Acreage**	**Mitigation Ratio**
UT2 Stream	12+64 – 34+00	2,660 LF	Headwater Restoration	1,805.6 SMU / 327.4 SMU*	2,133 LF	1:1
UT3 Stream	10+66 – 22+82	1,075 LF	Headwater Restoration	1,141 SMU	1,141 LF	1:1
UT2 Wetland	See plan sheets	0.0 AC	Restoration	1.1 WMU	1.1 WMU	1:1
UT3 Wetland	See plan sheets	0.0 AC	Restoration	1.7 WMU	1.7 WMU	1:1
UT2 Buffer	12+64 – 34+00	NA	Restoration	363,577 BMU	8.3 AC	1:1

Component Summation						
Restoration Level	**Stream (LF)**	**Riparian Wetland (AC)**		**Non-riparian Wetland (AC)**	**Buffer (ft^2) / (AC)**	**Upland (AC)**
		Riverine	Non-Riverine			
Restoration	3,274	2.8				
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						
Buffer Zone A: 0-50 ft					226002 / 5.2	
Buffer Zone B: 51-100 ft					137575 / 3.1	

BMP Elements			
Element	Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area

*The SMU credits shown here differ slightly from those presented in previous monitoring reports. They have been reduced by 327.4 SMU that have been deemed potentially at-risk in the uppermost section of Reach UT2.

Table 2. Project Activity and Reporting History
St. Clair Creek Restoration Project: DMS Project No ID. 95015

Activity or Report	Scheduled Completion	Data Collection Complete	Actual Completion or Delivery
Mitigation Plan Prepared	N/A	N/A	Jul-13
Mitigation Plan Amended	N/A	N/A	Sep-13
MItigation Plan Approved	N/A	N/A	Oct-13
Final Design – (at least 90% complete)	N/A	N/A	Nov-13
Construction Begins	N/A	N/A	Dec-13
Permanent seed mix applied to entire project area	N/A	N/A	Mar-14
Planting of live stakes	N/A	N/A	N/A
Planting of bare root trees	N/A	N/A	Apr-14
End of Construction	N/A	N/A	Apr-14
Survey of As-built conditions (Year 0 Monitoring-baseline)	N/A	May-14	Jun-14
Year 1 Monitoring (2014)	Nov-14	Dec-14	Dec-14
Year 2 Monitoring (2015)	Nov-15	Nov-15	Mar-16
Year 3 Monitoring (2016)	Nov-16	Dec-16	Jan-17
Pines thinned in Upper UT2	March 2016		
Ditches cut by landowner adjacent to easement were filled and new swales cut to connect drainage onto project.	Conducted in March 2016		
Additional groundwater wells #5-8 installed within credited area near newly cut swales.	Installed in April 2016		
Year 4 Monitoring (2017)	Nov-17	Dec-17	Jan-18
Additional groundwater wells #9 and #10 installed in non-credited areas.	Installed in March 2017		
Pines thinned in Upper UT2 and UT3. Privet treated on Upper UT2	May 2017		
Year 5 Monitoring (2018)	Nov-18	Jan-19	Jan-19
Additional flow gauge #7 installed	Installed in June 2018		
Year 6 Monitoring (2019)	Nov-19	Dec-19	Jan-20
Supplemental planting in Upper UT2	February 2019		
Pines thinned in Upper UT2	April 2019		
Year 7 Monitoring (2020)	Nov-20	Dec-20	Jan-21
Pines thinned in Upper UT2	May and December 2020		
Year 8 Monitoring (2021)	Nov-21	Dec-21	Jan-22
Pines thinned in Upper UT2	May and December 2021		

Table 3. Project Contacts Table St. Clair Creek Restoration Project: DMS Project ID No. 95015	
Designer	
Michael Baker International	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-481-5703
Construction Contractor	
KBS Earthworks	5616 Coble Church Rd Julian, NC 27283 Contact: Chris Sizemore, Telephone: 336-362-0289
Planting Contractor	
KBS Earthworks	5616 Coble Church Rd Julian, NC 27283 Contact: Chris Sizemore, Telephone: 336-362-0289
Seeding Contractor	
KBS Earthworks	5616 Coble Church Rd Julian, NC 27283 Contact: Chris Sizemore, Telephone: 336-362-0289
Seed Mix Sources	Green Resources, Tel. 336-855-6363
Nursery Stock Suppliers	Mellow Marsh Farm, 919-742-1200 ArborGen, 843-528-3204 Superior Tree, 850-971-5159
Monitoring Performers	
Michael Baker International	8000 Regency Parkway, Suite 600 Cary, NC 27518 Contact:
Stream Monitoring Point of Contact	Scott King, Tel. 919-481-5731
Vegetation Monitoring Point of Contact	Scott King, Tel. 919-481-5731
Wetland Monitoring Point of Contact	Scott King, Tel. 919-481-5731

Table 4. Project Attributes
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Project Information		
Project Name	St. Clair Creek Restoration Project	
County	Beaufort	
Project Area (acres)	17.5	
Project Coordinates (latitude and longitude)	35.452835 N, -76.76726215 W	
Watershed Summary Information		
Physiographic Province	Outer Coastal Plain	
River Basin	Tar-Pamlico	
USGS Hydrologic Unit 8-digit and 14-digit	03020104 / 03020104040040	
DWQ Sub-basin	03 03 07	
Project Drainage Area (AC)	89 (UT2), 30 (UT3)	
Project Drainage Area Percentage of Impervious Area	<1%	
CGIA Land Use Classification	3.02, Passively Managed Forest Stands, 2.01.01.07, Annual Row Crop Rotation;	
Stream Reach Summary Information		
Parameters	**Reach UT2**	**Reach UT3**
Length of Reach (LF)	2,133 (proposed) 2,660 (existing)	1,141 (proposed) 1,075 (existing)
Valley Classification (Rosgen)	X	X
Drainage Area (AC)	89	30
NCDWQ Stream Identification Score	36	20
NCDWQ Water Quality Classification	C; Sw, NSW	C; Sw, NSW
Morphological Description (Rosgen stream type)*	Channelized Headwater System (Perennial)	Channelized Headwater System (Intermittent)
Evolutionary Trend **	Restored G	Restored G
Underlying Mapped Soils	To, Hy, Ro	To, At
Drainage Class	Very poorly drained, poorly drained	Poorly drained, somewhat poorly drained
Soil Hydric Status	Hydric	Hydric
Average Channel Slope (ft/ft)	0.0006	0.0009
FEMA Classification	SFHA, AE	SFHA, AE
Native Vegetation Community	Coastal Plain Small Stream Swamp	Coastal Plain Small Stream Swamp
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%
Wetland Summary Information		
Parameters	**Wetland Along UT2**	
Size of Wetland (AC)	1.1	
Wetland Type	Riparian Riverine	
Mapped Soil Series	To – Tomotley fine sandy loam	
Drainage Class	Poorly drained	
Soil Hydric Status	Hydric	
Source of Hydrology	Groundwater	
Hydrologic Impairment	Disconnected floodplain from ditches, lowered water table	
Native Vegetation Community	Coastal Plain Small Stream Swamp	
Percent Composition of Exotic/Invasive Vegetation	<5%	
Parameters	**Wetland Along UT3**	
Size of Wetland (AC)	1.7	
Wetland Type	Riparian Riverine	
Mapped Soil Series	To – Tomotley fine sandy loam	
Drainage Class	Poorly drained	
Soil Hydric Status	Hydric	
Source of Hydrology	Groundwater	
Hydrologic Impairment	Disconnected floodplain from ditches, lowered water table	
Native Vegetation Community	Coastal Plain Small Stream Swamp	
Percent Composition of Exotic/Invasive Vegetation	<5%	

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation****
Waters of the United States – Section 404	Yes	Yes	(Appendix B)
Waters of the United States – Section 401	Yes	Yes	(Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	Yes	Yes	(Appendix B)
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)

Notes:

* Due to its channelized nature, the stream would most appropriately be classified as a Rosgen G stream type but use of this classification system on this channel is questionable due to its highly altered state. ** Supporting documentation is including in the approved Final Mitigation Plan.

Water Resources
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor

DONALD R. VAN DER VAART
Secretary

S. JAY ZIMMERMAN
Director

January 7, 2016

Kristin Miguez
DEQ-Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652
(via electronic mail)

DWR# 2013-0739

Re: Site Viability for Buffer Mitigation – St. Clair Creek Headwater Stream Site
off Peoples Road, Bath, NC
Beaufort County

Dear Ms. Miguez,

On October 5, 2015, Katie Merritt, with the Division of Water Resources (DWR), received a request from Jake Byers with Michael Baker Engineering, for a site visit at the St. Clair Creek Restoration Site located off Peoples Road in Bath, NC to determine the potential for Tar-Pamlico Neuse riparian buffer mitigation. On December 3, 2015, Ms. Merritt performed a site assessment of the subject site. Karen Higgins and Mac Haupt with the DWR along with you and Mr. Byers were also present. If approved, mitigating this site could provide riparian buffer mitigation credits within the 8-digit Hydrologic Unit Code 03020104 of the Tar-Pamlico River Basin and as allowed under 15A NCAC 02B .0295 (f).

Ms. Merritt's evaluation of the site as an alternative buffer mitigation option for buffer mitigation pursuant to Rule 15A NCAC 02B .0295 (o) (1) and (2) (effective November 1, 2015) is provided below:

UT2

- UT2 was approved as part of a Coastal Headwater Stream Mitigation Site (DWR# 2013-0739) by the IRT in 2013 and is in its second year of monitoring. A copy of the approved mitigation plan has been provided to the DWR.
- Preliminary site conditions along with the onsite visit in December 2015 suggests that the entire area along UT2 (0-100') is viable for riparian restoration and suitable for buffer mitigation credit at 1:1. Preliminary photos and documentation have been provided to the DWR.
- The buffer must be measured perpendicular to the length of the valley being restored. Approximately 8.35 acres (363,577 ft^2) have been planted and restored. A copy of the proposed restoration site has been provided to DWR.
- An agricultural ditch is present within the proposed riparian restoration and isn't planned to be removed. The presence of this ditch does not comply with the diffuse flow requirement of Rule .0295. However, DMS can apply Clarification Memo #2008-019 to

this project in order to calculate the deduction of buffer credit where diffuse flow cannot be attained.

- According to the St. Clair Creek Restoration Project Year 1 Monitoring Report submitted in April 2015, all 6 vegetative monitoring plots within the riparian areas are meeting the success criteria identified in Rule .0295. A copy of the Year 1 Monitoring Report has been provided to the DWR.
- A conservation easement of the proposed area, dated June 24th, 2013 has been provided to the DWR and is more accurately described as CE-1 and containing 11.55 acres, more or less. The easement document is located in the Beaufort County Register of Deeds, Book 1821, Pages 53-64.

A map showing the project site and the buffer mitigation areas assessed is provided and signed by Ms. Merritt on January 6, 2016. DWR did not assess this site for viability of nutrient offset and therefore only buffer mitigation is approved. DMS shall provide an annual monitoring report to Ms. Merritt for review and approval each year for four more years and until the performance standards have been met. The performance standards for buffer mitigation under Rule .0295 are the following:

(n) (2) (B) - A minimum of four native hardwood tree species or four native hardwood tree and native shrub species, where no one species is greater than 50 percent of the stems.
(o) (2) –All success criteria specified in the approval of the stream mitigation site by the Division shall be met.

Please provide an As-Built survey verifying the acreage proposed for buffer mitigation credit and a buffer credit ledger for this site to Ms. Merritt within 30 days from receipt of this letter. If you have any questions regarding this correspondence contact Katie Merritt at (919)-807-6371.

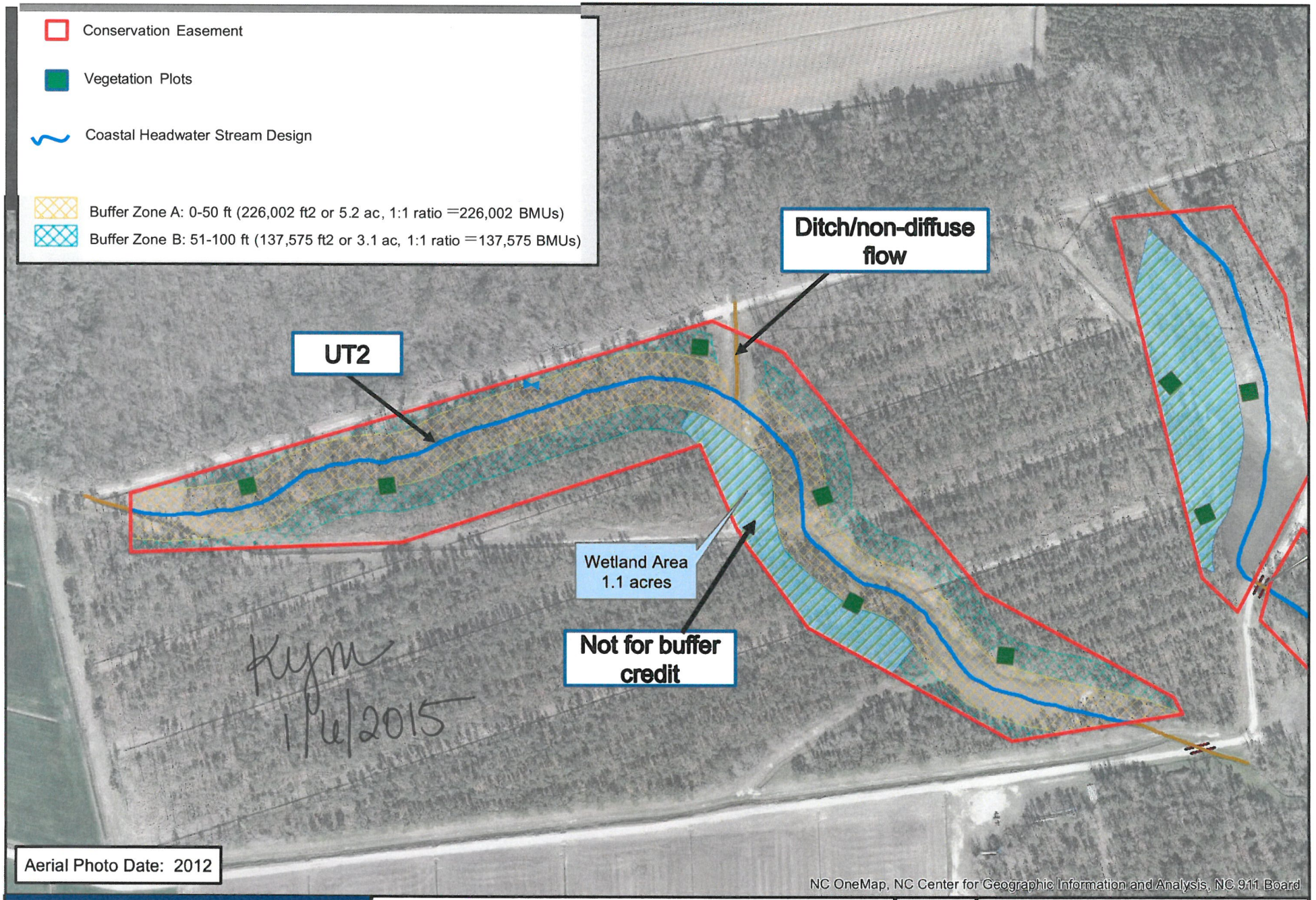
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Unit

KAH/*km*
Attachments: Site Aerial Map, DWR Clarification Memo #2008-019

cc:File Copy (Katie Merritt)



Michael Baker INTERNATIONAL

Buffer Asset Map
St. Clair Creek Site
Beaufort County, NC

Michael F. Easley
Governor

William G. Ross, Jr., Secretary
Department of Environment and Natural Resources

Coleen, H. Sullins, Director
Division of Water Quality

August 19, 2008
Buffer Interpretation/Clarification #2008-019

MEMORANDUM

RE: The Division of Water Quality's (DWQ's) stance on whether diffuse flow of stormwater through the newly restored buffers on mitigation sites should be a requirement. Diffuse flow is a requirement for buffer restoration or enhancement in the Neuse River Basin Buffer Rule 15A NCAC 02B.0242(9)(d)(iii), the Tar-Pamlico River Basin Buffer Rule 15A NCAC 02B.0260(9)(d)(iii), and the Catawba River Basin Buffer Rule 15A NCAC 02B.0244 (9)(d)(iii).

Diffuse flow is a requirement for all sites in a buffered basin for buffer mitigation and for for sites providing nutrient offset credit as well.

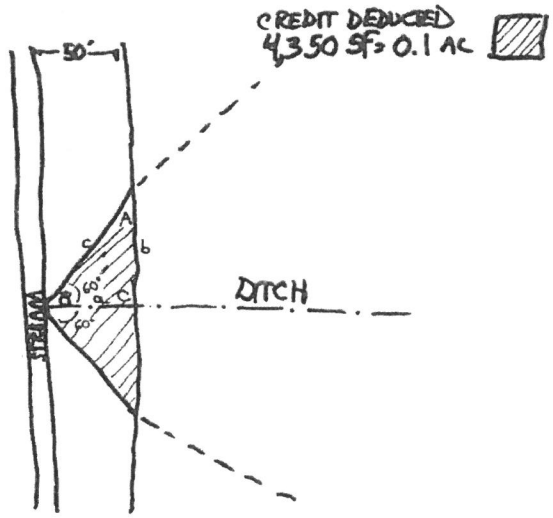
Current Policy: According to the Mitigation rules in the Neuse, Tar-Pamlico and Catawba buffer rules, a grading plan must be provided for buffer mitigation sites. In addition, those rules state that "The site shall be graded in a manner to ensure diffuse flow through the riparian buffer".

Problem: The question has been raised as to whether stormwater carried by lateral ditches that enter buffered streams should provide diffuse flow prior to that stormwater entering the restored buffers.

Solution: The Neuse, Tar-Pamlico and Catawba buffer rules with respect to buffer mitigation sites contain a very clear requirement that states that diffuse flow of stormwater must be maintained through the buffer. Unless otherwise approved by DWQ, all buffer mitigation sites must provide diffuse flow of stormwater from ditches and similar conveyances through the restored buffer.

Where such diffuse flow cannot be attained and where DWQ agrees that such treatment is not possible, deduction of buffer credit will be calculated as follows:

SCENARIO 1



401 Wetlands Certification Unit
1650 Mail Service Center, Raleigh, North Carolina 27699-1650
2321 Crabtree Boulevard, Suite 250, Raleigh, North Carolina 27604
Phone: 919-733-1786 / FAX 919-733-6893 / Internet: http://h2o.enr.state.nc.us/ncwetlands

A, B and C are angles. a, b, and c are distances (lengths)

DWQ believes that using an immediate drainage area extending at a 60-degree angle from the point of discharge to the stream is a reasonable approach to the issue of determining the area which is not draining through the restored buffer. To calculate the area of buffer being "short-circuited" by the ditch, the area of the right triangles shown in the figure above must be determined.

a = 50'
A = 30°
B = 60°

b = a cot A
b = 50 (1.732)
b = 86.6' (87')

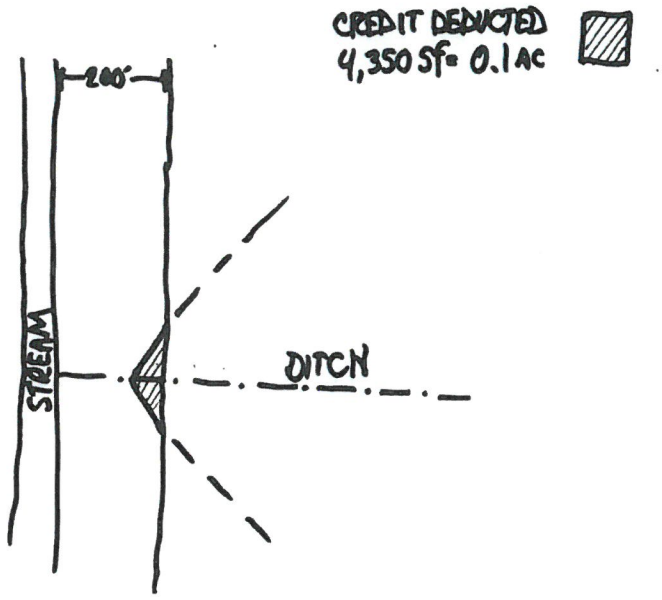
The area to be excluded from credit would be the area of the two right triangles:

Area = (a x b)/2
Area = (50 feet x 87feet)/2
Area = 2,175 SF

Total deducted area = 2,175 x 2 = 4,350 SF or 0.1 acres.

The example shown above assumes a buffer width of 50 feet from the top of bank (riparian buffer mitigation site). For nutrient offset sites, credit can be generated out to 200 feet from the top of bank. The policy applies to sites with larger buffers as follows:

SCENARIO 2



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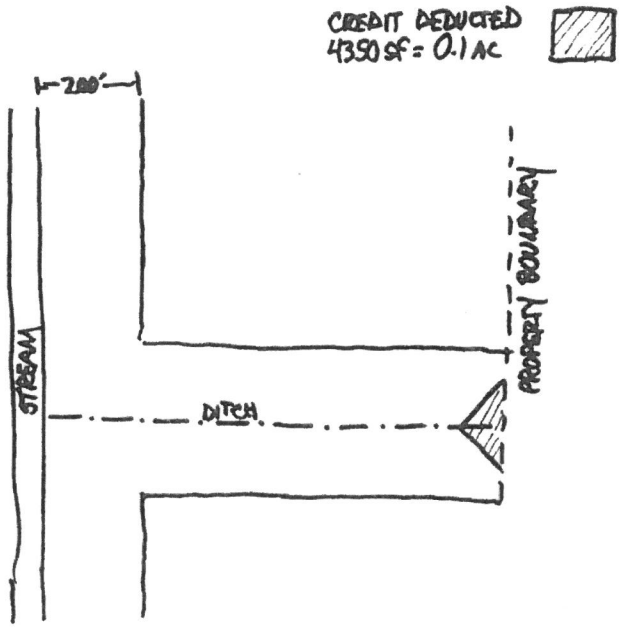
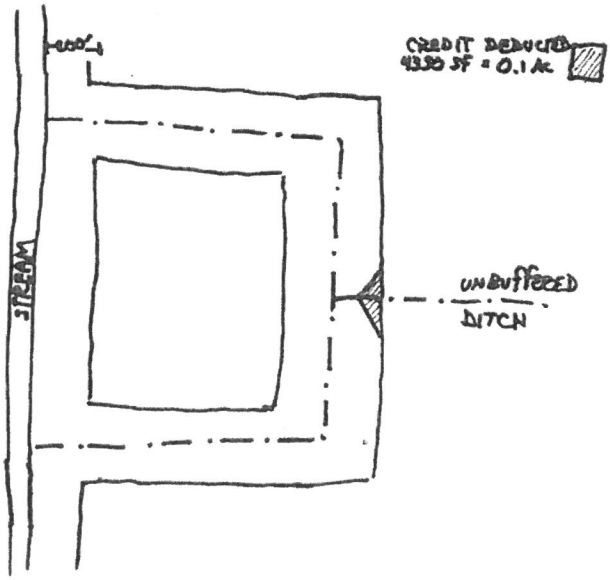
If a ditch leading to a buffered stream is buffered, then no credit is deducted from the stream buffer. If the upstream origin of the ditch is within the buffer, no credit is deducted. If the upstream origin of the ditch is not buffered (e.g. if the ditch begins upstream offsite), the credit deduction is applied to the most upstream portion of the ditch on the property.

SCENARIO 3



Where a network of interconnecting ditches occurs on a site, and all of the ditches are buffered, the only credit deduction would be at the point where an unbuffered ditch enters the project:

SCENARIO 4



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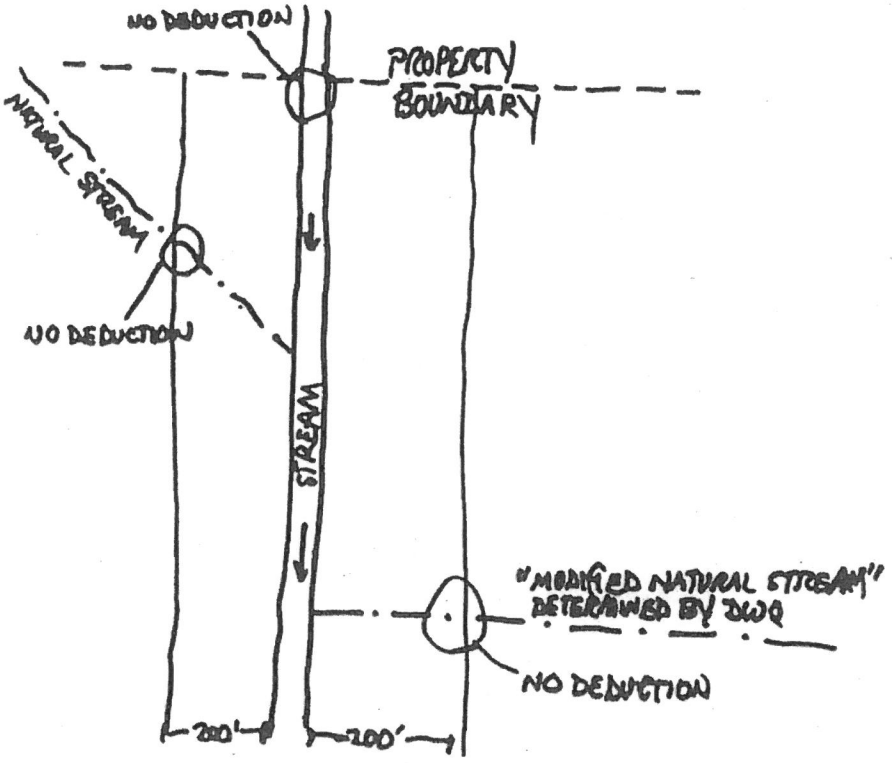
Where a natural stream enters the project site, no deduction of credit will occur. Also, when a natural stream or a modified natural stream flow into a buffered stream, no deduction of credit will occur. The modified natural stream must be subject to the buffer rules, and must be verified to be a modified natural stream (as opposed to a ditch) through an on-site determination by DWQ personnel.

SCENARIO 5



For any additional questions or clarifications on this issue, please contact Eric Kulz or Amy Chapman at (919) 733-1786.

Signature: _____ Date: 8/19/2008

Signature: _____ Date: 8/19/2008

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Michael Baker
INTERNATIONAL

Meeting Minutes

St. Clair RESTORATION PROJECT

DMS Project ID. 95015
DWR Project# 13-0739, Beaufort County
USACE Action ID: 2008-02655
Tar-Parmlico River Basin: 03020104-040040

Date Prepared:	May 20, 2019
Meeting Date, Time, Location:	May 16, 2019, 10:30 am On-site (Beaufort County, NC)
Attendees:	USACE – Kim Browning DMS – Jeff Schaffer, Jeremiah Dow, Melanie Allen DWR – Erin Davis WRC – Travis Wilson, Maria Dunn Baker – Drew Powers, Katie McKeithan
Subject:	Credit release site walkover with IRT
Recorded By:	Drew Powers

An on-site meeting was held on May 16th, 2019 at 10:30 am to discuss St.Clair Restoration Project (Full Delivery) in Beaufort County, NC. The purposes of this meeting were to:

1. Discuss credits to be released and to get ready for project closeout; and
2. Identify and discuss potential concerns/issues based on field observations.

General recent weather conditions have been hot and dry in the area.

UT2

The group met at the entrance of the path leading to the site off Peoples Road in Bath, NC. A general site overview and map orientation was provided and discussed. The group then started walking into the site near monitoring well 5 where Melanie and Erin took a soil sample within the wetland boundary. The soils showed mottling and developing hydric features. The group walked upstream.

Both Kim and Erin questioned if the site had previous supplemental planting due to the height of some of the trees they encountered. Katie replied that there had been supplemental planting (40 containerized plants were installed in early 2019). Erin mentioned that the vigor of the trees looked good for the most part and noticed an effort to control the pine tree population. Kim mentioned, with the surrounding pine tree population, that the elimination of all pine trees is inevitable but was glad to see that efforts have been made. Another soil sample was taken near monitoring well 2. Melanie and Erin both were more pleased with the results of this sample as it showed more distinct hydric indicators.

The group continued up UT2 towards flow gauge 3. As a group, we inspected the stream area looking at signs of water, flow, veg, and overall conditions of the stream. The stream was dry but had evidence of water and the group all agreed that water flows in this area. Katie shared all the flow gauges have already met 30 days of continuous flow this year (2019) and the Mitigation Plan's success criteria calls for two years with 30 consecutive days to be accepted. At this time the group separated and headed up to the main area of concern flow gauges 4 and 7. Along the way, Jeff referenced the coastal headwater streams guidance and how bed and bank formation is not the design for this Rosgen DA stream type. Kim seemed to recall the Mitigation Plan stating that and agreed with the design. She said she was more concerned with the flow of the water and amount of water that was moving through the system. Jeff mentioned that he has visited the site on many occasions and it typically has wet channel conditions with water up to his ankles. As the group made it to flow gauge 7 they noticed a small hole in the ground about 1" in diameter about 6" downstream of the gauge, that some believed could be tampering with the results. Both Kim and Travis questioned our results of 84 consecutive days as of March 26th this year considering how different flow gauge 7 and 3 were from each other. Travis mentioned that it might be appropriate to check the gauges and confirm that the gauges are reading properly. The group then headed to flow gauge 4 still looking at veg and channel condition. Melanie and Erin took another soil sample right by the gauge and confirmed the hydric soils and could see a difference in the wetland soils compared to the stream soils. Out of curiosity Erin took a soil sample on the floodplain outside of the swale. This confirmed that these soils were upland and much different than both the stream and wetlands previous. This concluded the UT2 portion of the walk through and the group decided to continue to UT3.

UT3

The group congregated at the top of UT3 at monitoring well 8 to orient themselves with the map and discuss the area. Erin mentioned that the veg looked good and could notice pine and sweetgum removal. Maria and Travis began looking at the ditches in the easement and outside the easement while Jeremiah, Erin, and Melanie took a soil sample by monitoring well 7. The soils were dry but showed good hydric indicators throughout the soil. After this the group fast tracked to the culverts at the bottom of UT3 to look for flow and culvert placement. On the way, Erin asked Drew if invasive have been treated and he replied that no invasive species have been an issue on this site. Once the group got to the culvert they made there way in the stream towards flow gauge 5. Kim saw no issues with the gauge or stream and Travis was fine with the culverts. This concluded the UT3 walk through.

This concluded the walkover and below are a few notes that were discussed back at the vehicles before departure.

Erin summarized soils:

- soils look better than expected, seeing hydric indicators except near veg plot 5 which was showing mottling and developing hydric indicators.
- dark surface soil
- wetlands were a sandy/loam and the reach turned silt
- stream soils differed from the wetland and upland soils

Travis commented:

- flow gauges should be checked for proper installation and maintenance to make sure they are accurately matching the onsite evidence of flow

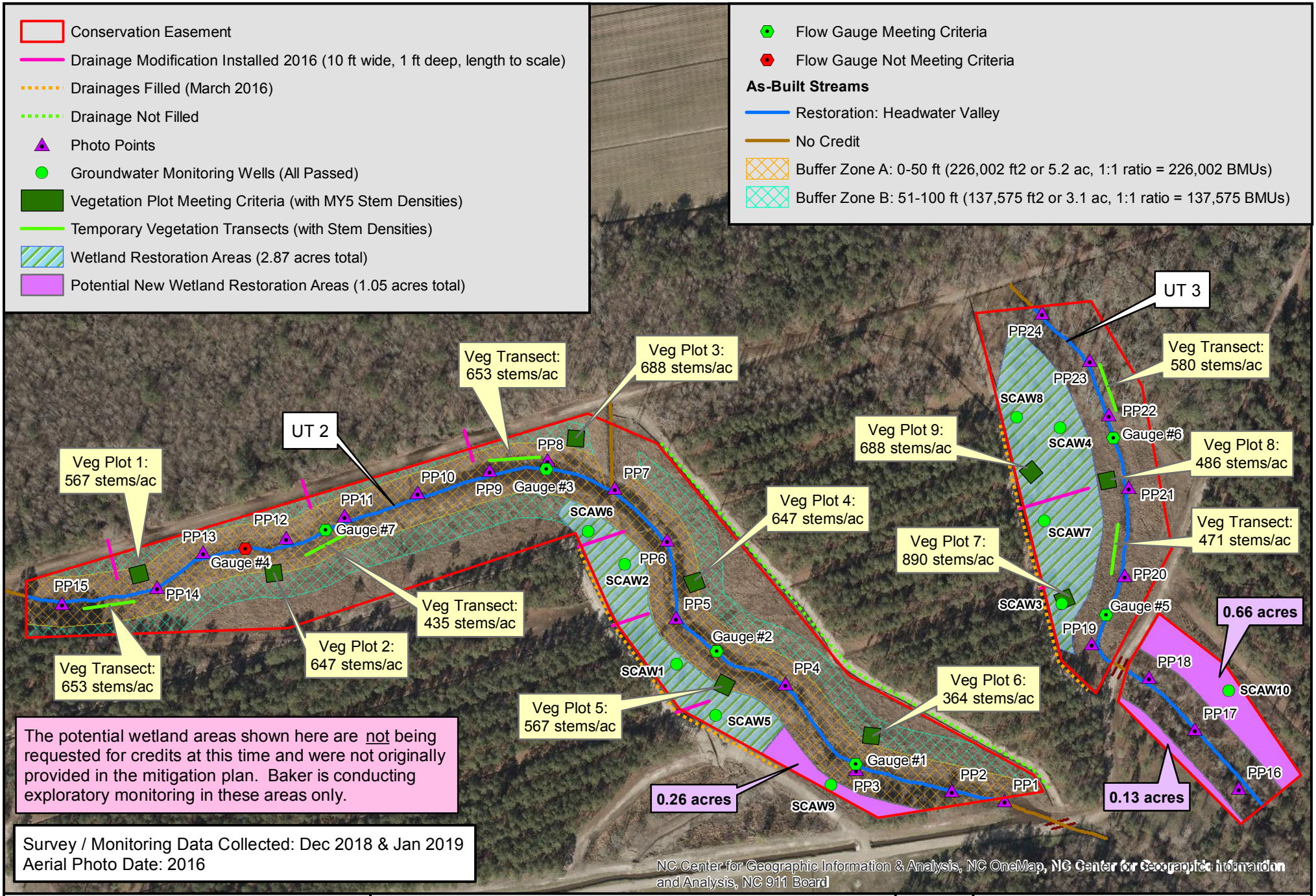
Kim's summary:

- USACE will be looking for a stream JD at close out. UT3 looks OK; however, the upper section of UT2 is questionable.
- Ditch manipulations from the adjacent ag fields (currently drained and being maintenance) may not be helping the site.
- Vegetation along UT3 does not look like a wetland with evidence of black berry and ant hills. Soils do appear to be wetting.
- Some of the vegetation onsite is a little short. There is a strong pine seed source, but Michael Baker has worked on the population on-site.
- Release:
    - At risk at top of UT2, recommend holding.
    - Wetlands held at MY 3 and 4, OK with releasing this year.
    - Melanie will make a recommendation for release.

This represents Baker Engineering's best interpretation of the meeting discussions. If anyone should find any information contained in these meeting notes to be in error and/or incomplete based on individual comments or conversations, please notify me with corrections/additions as soon as possible.

Most sincerely,

Andrew Powers
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518
Phone: 919-481-5732
Email: Andrew.Powers@mbakerintl.com



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0 250 500 Feet

N

NCDEQ - Division of Mitigation Services
Project # 95015

Figure 2
Current Conditions Plan View: MY5
St. Clair Creek Site
Beaufort County, NC

Rev: 14Jan2019

Appendix B

Visual Assessment Data

Conservation Easement
Cross-Section Survey Transects
Drainage Modification Installed 2016 (10 ft wide, 1 ft deep, length to scale)
Drainages Filled (March 2016)
Drainage Not Filled
Flow Gauges (All Passed in MY8)

Groundwater Monitoring Wells

Gauge Failure
Pass
Fail
Vegetation Plots (All Passed in MY8)
Wetland Restoration Areas (2.87 acres total)
Potential New Wetland Restoration Areas (1.05 acres total)

Photo Points

YouTube Video Locations

Profile Video
Transect Videos

As-Built Streams

Restoration: Headwater Valley
No Credit
Buffer Zone A: 0-50 ft (226,002 ft2 or 5.2 ac, 1:1 ratio = 226,002 BMUs)
Buffer Zone B: 51-100 ft (137,575 ft2 or 3.1 ac, 1:1 ratio = 137,575 BMUs)

UT 2
UT 3
Veg Plot 1: 445 stems/ac
Veg Plot 2: 647 stems/ac
Veg Plot 3: 647 stems/ac
Veg Plot 4: 607 stems/ac
Veg Plot 5: 526 stems/ac
Veg Plot 6: 364 stems/ac
Veg Plot 7: 890 stems/ac
Veg Plot 8: 486 stems/ac
Veg Plot 9: 728 stems/ac
PP1
PP2
PP3
PP4
PP5
PP6
PP7
PP8
PP9
PP10
PP11
PP12
PP13
PP14
PP15
PP16
PP17
PP18
PP19
PP20
PP21
PP22
PP23
PP24
Gauge #1
Gauge #2
Gauge #3
Gauge #4
Gauge #5
Gauge #6
Gauge #7
Gauge #8
SCAW1
SCAW2
SCAW3
SCAW4
SCAW5
SCAW6
SCAW7
SCAW8
SCAW9
SCAW10
XS-1
XS-2
0.26 acres
0.13 acres
0.66 acres

The potential wetland areas shown here are not being requested for credits at this time and were not originally provided in the mitigation plan. Baker is conducting exploratory monitoring in these areas only.

Monitoring Data Collected: Dec 2021
Aerial Photo Date: 2020

NC Center for Geographic Information & Analysis

Michael Baker INTERNATIONAL

NCDEQ - Division of Mitigation Services
Project # 95015

N

0 250 500 Feet

Figure 2
Current Conditions Plan View: MY8
St. Clair Creek Site
Beaufort County, NC

Table 5a. Visual Stream Morphology Stability Assessment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Reach ID: UT2

Assessed Length (LF): 2,133

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	NA	NA						
	3. Meander Pool Condition	1. Depth	NA	NA						
		2. Length	NA	NA						
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	NA	NA						
		2. Thalweg centering at downstream of meander bend (Glide)	NA	NA						
		3. Thalweg centering along valley	Yes	2,133 LF						
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	2,133	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	2,133	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	2,133	100%
		Totals			0	0	100%	0	2,133	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	NA	NA						
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	NA	NA						
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	NA	NA						
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	NA	NA						
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	NA	NA						

Table 5a. Visual Stream Morphology Stability Assessment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Reach ID: UT3

Assessed Length (LF): 1,141

Major Channel Category	Channel Sub-Category	Metric	Number Stable (Performing as Intended)	Total Number per As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Veg.	Footage with Stabilizing Woody Veg.	Adjusted % for Stabilizing Woody Veg.
1. Bed	1.Vertical Stability	1. Aggradation			0	0	100%			
		2. Degradation			0	0	100%			
	2. Riffle Condition	1. Texture Substrate	NA	NA						
	3. Meander Pool Condition	1. Depth	NA	NA						
		2. Length	NA	NA						
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	NA	NA						
		2. Thalweg centering at downstream of meander bend (Glide)	NA	NA						
		3. Thalweg centering along valley	Yes	1,141 LF						
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	1,141	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely			0	0	100%	0	1,141	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%	0	1,141	100%
		Totals			0	0	100%	0	1,141	100%
3. Engineering Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	NA	NA						
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	NA	NA						
	2a. Piping	Structures lacking any substantial flow underneath sill or arms	NA	NA						
	3. Bank Position	Bank erosion within the structures extent of influence does not exceed 15%	NA	NA						
	4. Habitat	Pool forming structures maintaining - Max Pool Depth	NA	NA						

Table 5b. Stream Problem Areas St. Clair Creek Restoration Project: DMS Project ID No. 95015			
Feature Issue	**Station Number**	**Suspected Cause**	**Photo Number**
None Observed	--	--	--

Table 6a. Vegetation Conditions Assessment St. Clair Creek Restoration Project: DMS Project ID No. 95015						
Reach ID: UT2						
Planted Acreage: 11.6						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	NA	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	NA	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	NA	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**
Easement Acreage:						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
5. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	NA	0	0.00	0.0%
6. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%

Table 6a. Vegetation Conditions Assessment St. Clair Restoration Project: DMS Project ID No. 95015						
Reach ID: UT3						
Planted Acreage: 5.9						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover both woody and herbaceous material.	0.1	NA	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	NA	0	0.00	0.0%
			Total	**0**	**0.00**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.25	NA	0	0.00	0.0%
			Cumulative Total	**0**	**0.00**	**0.0%**
Easement Acreage:						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	1000 ft²	NA	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	none	NA	0	0.00	0.0%

Table 6b. Vegetation Problem Areas
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Feature Issue	Station Number	Suspected Cause	Resolution
Loblolly Pine (*Pinus taeda)*	Scattered throughout buffer on upper UT-2	Post-restoraton seed source	Will be treated in early 2022 prior to closeout

St. Clair Restoration Site: Stream Photo Points (12/15/21)

Photo Point 1 – UT2

Photo Point 2 – UT2

Photo Point 3 – UT2

Photo Point 4 – UT2

Photo Point 5 – UT2

Photo Point 6 – UT2

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Stream Photo Points (12/15/21)

Photo Point 7 – UT2

Photo Point 8 – UT2

Photo Point 9 – UT2

Photo Point 10 – UT2

Photo Point 11 – UT2

Photo Point 12 – UT2

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Stream Photo Points (12/15/21)

Photo Point 13 – UT2

Photo Point 14 – UT2

Photo Point 15 – UT2

Photo Point 16 – UT3

Photo Point 17 – UT3

Photo Point 18 – UT3

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Stream Photo Points (12/15/21)

Photo Point 19 – UT3

Photo Point 20 – UT3

Photo Point 21 – UT3

Photo Point 22 – UT3

Photo Point 23 – UT3

Photo Point 24 – UT3

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Vegetation Plot Photos (12/17/21)

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

St. Clair Restoration Site: Vegetation Plot Photos (12/17/21)

Vegetation Plot 7

Vegetation Plot 8

Vegetation Plot 9

St. Clair Restoration Site: Hydrology Monitoring Stations (12/15/2021)

Auto Well – SCAW1

Auto Well – SCAW2

Auto Well – SCAW3

Auto Well – SCAW4

Supplemental Auto Well – SCAW5

Supplemental Auto Well – SCAW6

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Hydrology Monitoring Stations (12/15/2021)

Supplemental Auto Well – SCAW7

Supplemental Auto Well – SCAW8

Supplemental Auto Well – SCAW9

Supplemental Auto Well – SCAW10

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Hydrology Monitoring Stations (12/15/2021)

Flow Logger (UT2) – SCFL1

Flow Logger (UT2) – SCFL2

Flow Logger (UT2) – SCFL3

Flow Logger (UT2) – SCFL4

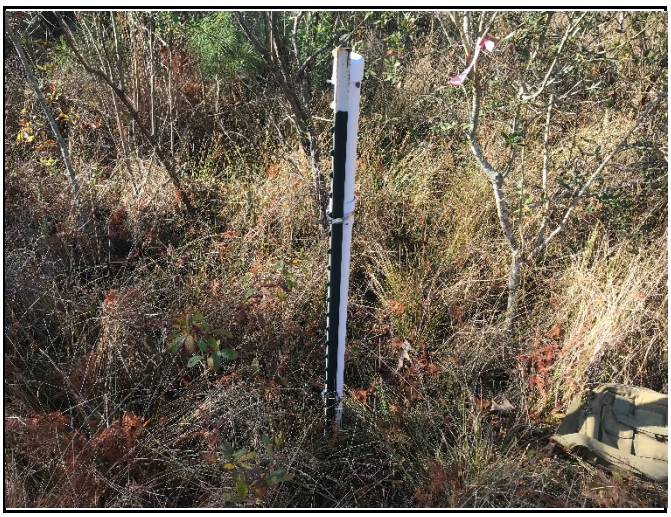
Flow Logger (UT3) – SCFL5

Flow Logger (UT3) – SCFL6

Note: Photos taken during a Level D2: Severe Drought

St. Clair Restoration Site: Hydrology Monitoring Stations (12/15/2021)

Flow Logger (UT2) – SCFL7



Flow Logger (UT2) – SCFL8 (installed 2/17/21)

Note: Photos taken during a Level D2: Severe Drought

UT2 Channel Transect Video Links and Location Map

From: King, Scott
To: Scott King (Scott.King@mbakerintl.com); Scott King; Powers, Andrew
Subject: St Clair YouTube video links
Date: Wednesday, May 5, 2021 11:58
Attachments: image001.png
image002.png

Upper UT2 (Feb 2021)
https://youtu.be/jCtWfAFXq5I

Transect UT2 (Feb 2021)
https://youtu.be/NyjH5YTtrwA

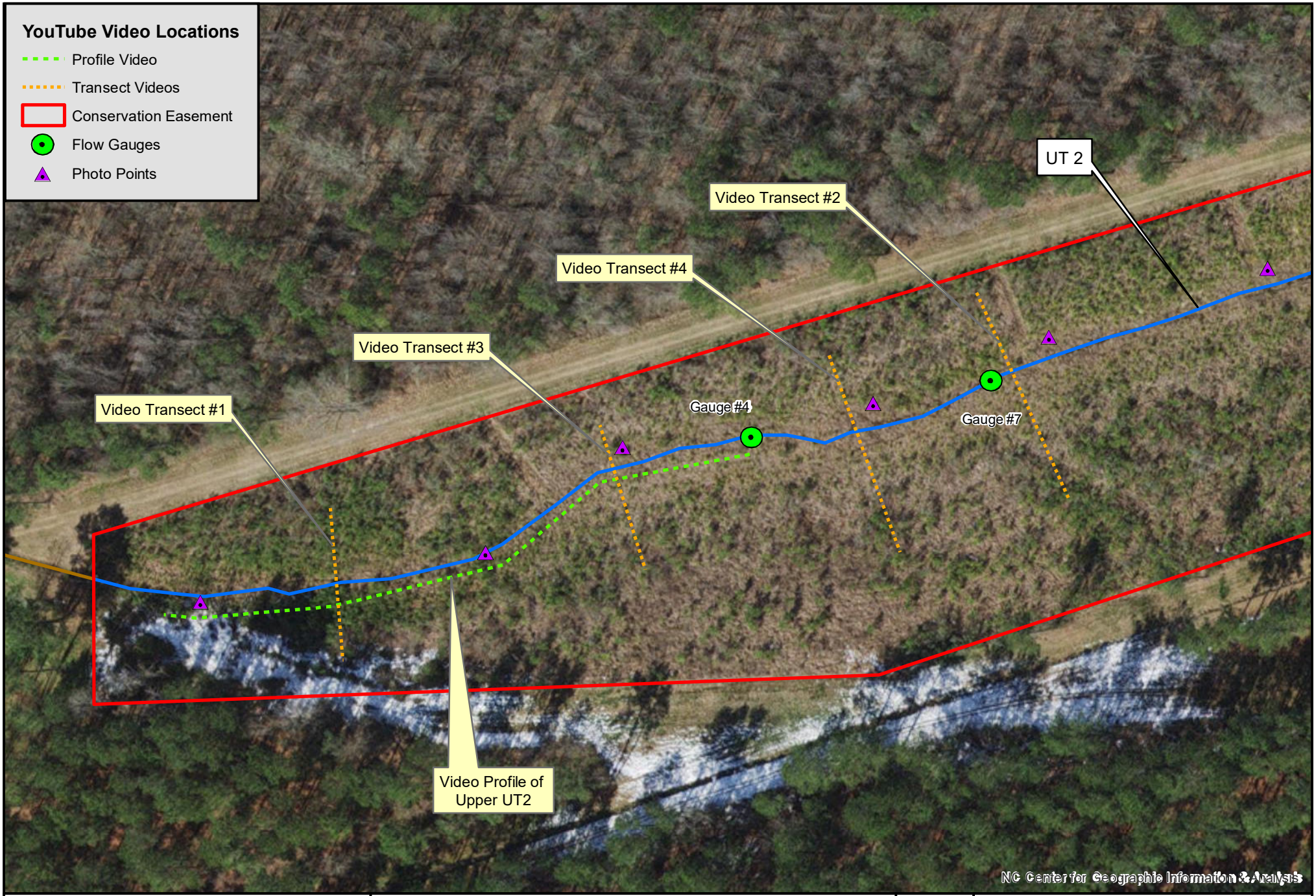
Minnows on UT2 (March 2021)
https://youtu.be/YwXlZOMfB1s

Transect at Top of UT2 (March 2021)
https://youtu.be/o6nMBpnwW0I

Transect on Upper UT2 (March 2021)
https://youtu.be/-K_4XNWJNnQ

Transect on Upper UT2 (March 2021)
https://youtu.be/A1bYXXsRjFw

Scott King, LSS, PWS | Soil Scientist - Ecosystem Restoration Group | Michael Baker International
8000 Regency Parkway, Suite 600 | Cary, NC 27518 | [O] 919-481-5731
scott.king@mbakerintl.com | www.mbakerintl.com



Michael Baker INTERNATIONAL

0 100 200 Feet

N

NCDEQ - Division of Mitigation Services
Project # 95015

YouTube Video Locations
St. Clair Creek Site
Beaufort County, NC

Rev: 14Jan2019

Appendix C

Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Plot ID	Vegetation Survival Threshold Met?	MY8 Planted Density / As-built Planted Stem Density*	Tract Mean
1	Y	445/728	594
2	Y	647/648	
3	Y	647/688	
4	Y	607/728	
5	Y	526/688	
6	Y	364/486	
7	Y	890/1,174	
8	Y	486/728	
9	Y	728/769	

Note: *MY8 Planted Density / As-built Planted Stem Density - reflects the changes in stem density based on the current total density of planted stems as compared to the original planted stem density from the As-built conditions.

Table 8. CVS Vegetation Metadata
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Report Prepared By	Andrew Powers
Date Prepared	12/21/2021 14:43
database name	MichaelBaker_MY8_2021_StClair_95015.mdb
database location	R:\125116\Monitoring\Post Restoration\Veg Plots\Year 8_2021
computer name	CARYLMHANCOCK1
file size	48361472
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95015
project Name	St Clair Creek Restoration Project
Description	
River Basin	Tar-Pamlico
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	9

Table 9a. CVS Stem Count of Planted Stems by Plot and Species
St. Clair Creek Restoration Project: DMS Project ID No. 95015

	Comment	Species	Species Type	Common Name	Total Planted Stems	# plots	avg# stems	plot 95015-01-0001-year:8	plot 95015-01-0002-year:8	plot 95015-01-0003-year:8	plot 95015-01-0004-year:7	plot 95015-01-0005-year:8	plot 95015-01-0006-year:8	plot 95015-01-0007-year:8	plot 95015-01-0008-year:8	plot 95015-01-0009-year:8	
		Aronia arbutifolia	Shrub	Red Chokeberry	5	2	2.5		4							1	
		Carpinus caroliniana	Shrub Tree	American hornbeam	5	4	1.25		1					1	1	2	
		Clethra alnifolia	Shrub	coastal sweetpepperbush	1	1	1	1									
		Fraxinus pennsylvanica	Tree	green ash	5	4	1.25	2			1			1		1	
		Morella cerifera	Shrub Tree	wax myrtle	2	2	1						1		1		
		Nyssa sylvatica	Tree	blackgum	7	3	2.33		1					4	2		
		Persea palustris	Tree	swamp bay	6	2	3								2	4	
		Quercus laurifolia	Tree	laurel oak	9	3	3	1		3		5					
		Quercus lyrata	Tree	overcup oak	15	7	2.14	4	2	1		2		2	1	3	
		Quercus michauxii	Tree	swamp chestnut oak	27	6	4.5	1	4		4	5	5	8			
		Quercus phellos	Tree	willow oak	11	6	1.83			5	1	1	1	2	1		
		Taxodium distichum	Tree	bald cypress	15	4	3.75		4	3	7		1				
		Ulmus americana	Tree	American elm	19	6	3.17	1		4	2		1	4		7	
		Vaccinium corymbosum	Shrub	highbush blueberry	1	1	1								1		
		Viburnum dentatum	Shrub Tree	southern arrowwood	4	2	2	1							3		
Totals:					**132**	**15**		**11**	**16**	**16**	**15**	**13**	**9**	**22**	**12**	**18**	

Table 9b. Stem Count for All Species (Planted and Volunteer) Arranged by Plot
St. Clair Creek Restoration Project: DMS Project ID No. 95015

Botanical Name	Common Name	Plots									
		1	2	3	4	5	6	7	8	9	
Tree Species											
Acer rubrum	red maple		2		1	1	2	1	1		
Fraxinus pennsylvanica	green ash	2			1			1		1	
Liquidambar styraciflua	sweetgum	7	2	5	4			4	3	3	
Nyssa sylvatica	blackgum		1				5	2		8	
Pinus taeda	loblolly pine					3	3	3	2	5	
Quercus laurifolia	laurel oak	1		3		5				9	
Quercus lyrata	overcup oak	5	2	1		2		2	1	3	
Quercus michauxii	swamp chestnut oak	1	4		4	5	6	8			
Quercus phellos	willow oak			5	2	1	1	2	1		
Taxodium distichum	bald cypress		4	3	7		1				
Ulmus americana	American elm	1		4	2		3	4		7	
Shrub Species											
Aronia arbutifolia	Red Chokeberry	0	4							1	
Baccharis	Salt myrtle	1		4	5	2	4	3	3		
Carpinus caroliniana	American hornbeam		3					1	1	3	
Clethra alnifolia	coastal sweetpepperbush	1								1	
Morella cerifera	wax myrtle	2				3	1		2		
Persea palustris	swamp bay								2	6	
Rhus copallinum	flameleaf sumac	1	4	6	4	1	1	2		2	
Vaccinium corymbosum	highbush blueberry								1		
Viburnum dentatum	southern arrowwood	1							3		
											Average Stems Per Acre
Stems Per Plot (December 2021)		23	26	31	30	23	27	33	20	49	
Total Stems/Acre Year 8 (December 2021)		931	1052	1255	1214	931	1093	1335	809	1983	**1178**
Total Stems/Acre Year 7 (December 2020)		1093	1174	1255	1174	1376	890	1497	931	1335	**1192**
Total Stems/Acre Year 6 (December 2019)		769	728	648	769	688	607	1012	486	809	**724**
Total Stems/Acre Year 5 (December 2018)		809	688	728	647	607	445	1012	486	809	**692**
Total Stems/Acre Year 4 (October 2017)		1052	1052	809	850	769	405	1133	680	728	**831**
Total Stems/Acre Year 3 (December 2016)		567	648	648	648	526	364	850	526	688	**607**
Total Stems/Acre Year 2 (November 2015)		607	648	648	648	526	405	1012	607	688	**643**
Total Stems/Acre Year 1 (December 2014)		688	648	648	648	648	445	1052	648	728	**683**
Total Stems/ Acre for Year 0 As-Built (Baseline Data)		728	648	688	728	688	486	1174	728	769	**737**

Table 9c. Yearly Density Per Plot
St. Clair Creek Restoration Project: DMS Project ID No. 95015

			Current Plot Data (MY8 2021)																									
			95015-01-0001			95015-01-0002			95015-01-0003			95015-01-0004			95015-01-0005			95015-01-0006			95015-01-0007			95015-01-0008			95015-01-0009		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubrum	red maple	Tree					2	2					1	1		1	1		2	2		1	1		1	1			
Aronia arbutifolia	Red Chokeberry	Shrub				4		4																			1		1
Baccharis	baccharis	Shrub		1	1					4	4		5	5		2	2		4	4		3	3		3	3			
Carpinus caroliniana	American hornbeam	Tree				1	2	3													1		1	1		1	2	1	3
Clethra alnifolia	coastal sweetpepperbush	Shrub	1		1																								
Cornus foemina	stiff dogwood	Shrub Tree																											
Fraxinus pennsylvanica	green ash	Tree	2		2							1		1							1		1				1		1
Juniperus virginiana	eastern redcedar	Tree											1	1															
Liquidambar styraciflua	sweetgum	Tree		7	7		2	2		5	5		4	4								4	4		3	3		3	3
Morella cerifera	wax myrtle	shrub		2	2											3	3	1		1				1	2	2			
Nyssa sylvatica	blackgum	Tree				1		1													4	1	5	2		2			
Persea palustris	swamp bay	tree																						2		2	4	2	6
Pinus taeda	loblolly pine	Tree														3	3		3	3		3	3		2	2		5	5
Quercus laurifolia	laurel oak	Tree	1		1				3		3				5		5												
Quercus lyrata	overcup oak	Tree	4	1	5	2		2	1		1				2		2				2		2	1		1	3		3
Quercus michauxii	swamp chestnut oak	Tree	1		1	4		4				4		4	5		5	5	1	6	8		8						
Quercus pagoda	cherrybark oak	Tree																											
Quercus phellos	willow oak	Tree							5		5	1	1	2	1		1	1		1	2		2	1		1			
Quercus rubra	northern red oak	Tree		2	2		1	1								1	1												
Rhus copallinum	flameleaf sumac	shrub		1	1		4	4		6	6		4	4		1	1		1	1		2	2					2	2
Salix nigra	black willow	Tree																											
Taxodium distichum	bald cypress	Tree				4		4	3		3	7		7				1		1									
Ulmus alata	winged elm	Tree																											
Ulmus americana	American elm	Tree	1		1				4		4	2		2				1	2	3	4		4				7		7
Unknown		Shrub or Tree																											
Vaccinium corymbosum	highbush blueberry	Shrub																						1		1			
Viburnum dentatum	southern arrowwood	Shrub	1		1																			3		3			
Stem count			11	14	25	16	11	27	16	15	31	15	16	31	13	11	24	9	13	22	22	14	36	12	11	22	18	13	31
size (ares)			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			6	6	11	6	5	10	5	3	8	5	6	10	4	6	10	5	6	9	7	6	12	6	5	10	6	5	9
Stems per ACRE			445	567	1,012	647	445	1,093	647	607	1,255	607	647	1,255	526	445	971	364	526	890	890	567	1,457	486	445	890	728	526	1,255

Scientific Name	Common Name	Species Type	MY8 (2021)			MY7 (2020)			MY6 (2019)			MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)		
			P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer rubrum	red maple	Tree		8	8		14	14					2	2												
Aronia arbutifolia	Red Chokeberry	Shrub	5		5	5		5	5		5	6		6	6		6	6		6	6		6	6		6
Baccharis	baccharis	Shrub		22	22		24	24		7	7															
Carpinus caroliniana	American hornbeam	Tree	5	3	8	5		5	4		4	4		4	3	1	4	4		4	4		4	3		3
Clethra alnifolia	coastal sweetpepperbush	Shrub	1		1	1		1	1		1	1		1	1		1	2		2	2		2	1		1
Cornus foemina	stiff dogwood	Shrub Tree																						2		2
Fraxinus pennsylvanica	green ash	Tree	5		5	5		5	5		5	5		5	5		5	5		5	5		5	4		4
Juniperus virginiana	eastern redcedar	Tree		1	1																					
Liquidambar styraciflua	sweetgum	Tree		28	28		25	25		3	3								7	7						
Morella cerifera	wax myrtle	shrub	2	6	8	2	15	17	2	1	3	2	2	4	1		1	1		1	1		1	1		1
Nyssa sylvatica	blackgum	Tree	7	1	8	7		7	7		7	7		7	7		7	5		5	7		7	6		6
Persea palustris	swamp bay	tree	6	2	8	6	1	7	6		6	6	1	7	6		6	6	2	8	6		6	6		6
Pinus taeda	loblolly pine	Tree		16	16		29	29		12	12								90	90						
Quercus laurifolia	laurel oak	Tree	9		9	9	5	14	9		9	9		9	8		8	8		8	8		8	14		14
Quercus lyrata	overcup oak	Tree	15	1	16	15	1	16	14	2	16	15	6	21	14	1	15	14		14	14		14	17		17
Quercus michauxii	swamp chestnut oak	Tree	27	1	28	27		27	27	2	29	27		27	27		27	26		26	27		27	25		25
Quercus pagoda	cherrybark oak	Tree														1	1		1	1						
Quercus phellos	willow oak	Tree	11	1	12	11	1	12	10	1	11	10	2	12	10		10	12		12	15		15	11		11
Quercus rubra	northern red oak	Tree		4	4					1	1															
Rhus copallinum	flameleaf sumac	shrub		21	21		17	17					1	1												
Salix nigra	black willow	Tree											1	1					1	1						
Taxodium distichum	bald cypress	Tree	15		15	15		15	16		16	16		16	16		16	16		16	16		16	19		19
Ulmus alata	winged elm	Tree																	2	2						
Ulmus americana	American elm	Tree	19	2	21	19	1	20	19		19	19	1	20	19		19	19		19	19		19	21		21
Unknown		Shrub or Tree																						5		5
Vaccinium corymbosum	highbush blueberry	Shrub	1		1	1		1	3		3	3	1	4	3		3	3		3	5		5	5		5
Viburnum dentatum	southern arrowwood	Shrub	4		4	4		4	4		4	7		7	8		8	8		8	8		8	6		6
Stem count			132	117	249	132	133	265	132	29	161	137	17	154	134	3	137	135	103	238	143	0	143	152	0	152
size (ares)			9			9			9			9			9			9			9			9		
size (ACRES)			0.22			0.22			0.22			0.22			0.22			0.22			0.22			0.22		
Species count			13	15	22	13	11	20	13	8	19	13	8	16	13	3	14	13	6	18	13	0	13	14	0	14
Stems per ACRE			594	526	1,120	594	598	1,192	594	130	724	616	76	692	603	13	616	607	463	1,070	643	0	643	683	0	683

Color for Density

Exceeds requirements by 10%

Total including volunteer

Table 9d. Vegetation Summary and Totals
St. Clair Creek Restoration Project: DMS Project ID No. 95015

St Clair Creek Restoration Project (#95015)
Year 8 (21-Dec-2021)

Vegetation Plot Summary Information

Plot #	Riparian Buffer Stems[1]	Stream/ Wetland Stems[2]	Live Stakes	Invasives	Volunteers[3]	Total[4]	Unknown Growth Form
1	9	11	0	0	14	**25**	0
2	12	16	0	0	11	**27**	0
3	16	16	0	0	15	**31**	0
4	15	15	0	0	16	**31**	0
5	13	13	0	0	11	**24**	0
6	8	9	0	0	13	**22**	0
7	n/a	22	0	0	14	**36**	0
8	n/a	12	0	0	10	**22**	0
9	n/a	18	0	0	13	**31**	0

Wetland/Stream Vegetation Totals

(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	445	567	1012	Yes
2	647	445	1093	Yes
3	647	607	1255	Yes
4	607	647	1255	Yes
5	526	445	971	Yes
6	364	526	890	Yes
7	890	567	1457	Yes
8	486	405	890	Yes
9	728	526	1255	Yes
Project Avg	**594**	**526**	**1120**	**Yes**

Riparian Buffer Vegetation Totals

(per acre)

Plot #	Riparian Buffer Stems[1]	Success Criteria Met?
1	364	Yes
2	486	Yes
3	647	Yes
4	607	Yes
5	526	Yes
6	324	Yes
7*	n/a	n/a
8*	n/a	n/a
9*	n/a	n/a
Project Avg	**492**	**Yes**

*These plots are not located in areas receiving riparian buffer credits

Stem Class	Characteristics
[1]Buffer Stems	Native planted hardwood stems including trees and native shrub species. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Appendix D

Hydrologic Data

Table 10. Wetland Restoration Area Well Success

St. Clair Creek Restoration Project: Project ID No. 95015

Well ID	Percentage of Consecutive Days <12 inches from Ground Surface[1]								Most Consecutive Days Meeting Criteria[2]								Percentage of Cumulative Days <12 inches from Ground Surface								Cumulative Days Meeting Criteria[3]							
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 8 (2021)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 8 (2021)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 8 (2021)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 8 (2021)
Wetland Monitoring Wells (Installed September 2013)																																
SCAW1	1.0	12.3	13.1	33.7	23.0	13.1	17.7	13.8	3	35	37	95	65	37	50	39	8.5	39.3	61.7	68.1	68.1	40.1	46.8	25.2	24	111	174	192	192	113	132	71
SCAW2	3.8	3.3	9.2	10.6	13.1	12.8	17.7	13.8	11	9	26	30	37	36	50	39	30.6	16.1	19.9	51.1	59.9	41.1	52.5	27.3	86	46	56	144	169	116	148	77
SCAW3	2.3	13.4	9.6	11.0	13.1	12.4	17.7	13.5	7	38	27	31	37	35	50	38	9.4	37.5	44.3	26.2	47.2	33.0	44.7	24.5	27	106	125	74	133	93	126	69
SCAW4**	7.8	12.3	6.0	11.0	22.3	13.1	17.4	--**	22	35	17	31	63	37	49	--**	17.3	20.3	35.8	25.9	57.8	25.5	34.4	7.8	49	57	101	73	163	72	97	21**
Supplemental Wetland Monitoring Wells (Installed April 2016)																																
SCAW5*	--	--	12.8	11.3	23.4	21.6	26.6	18.8	--	--	36	32	66	61	75	53	--	--	46.8	69.9	68.1	47.9	73.0	35.8	--	--	132	197	192	135	206	101
SCAW6*	--	--	3.9	10.3	12.4	12.8	15.6	7.4	--	--	11	29	35	36	44	21	--	--	19.9	32.6	53.9	33.0	37.9	19.1	--	--	56	92	152	93	107	54
SCAW7*	--	--	9.6	11.3	22.3	13.1	17.7	14.5	--	--	27	32	63	37	50	41	--	--	33.0	38.3	55.0	27.3	44.7	18.8	--	--	93	108	155	77	126	53
SCAW8*	--	--	4.6	11.3	12.8	12.4	16.0	11.0	--	--	13	32	36	35	45	31	--	--	22.0	23.8	50.0	19.1	31.6	14.5	--	--	62	67	141	54	89	41
Supplemental Wetland Monitoring Wells (Installed March 2017)																																
SCAW9*	--	--	--	9.9	12.1	11.0	17.7	13.8	--	--	--	28	34	31	50	39	--	--	--	45.4	55.0	36.2	48.9	27.0	--	--	--	128	155	102	138	76
SCAW10*	--	--	--	9.9	12.4	8.2	7.8	7.4	--	--	--	28	35	23	22	21	--	--	--	28.7	36.5	20.9	33.3	15.2	--	--	--	81	103	59	94	43
Reference Wells (Installed Spetember 2013)																																
SCAWREF1	24.8	57.9	40.9	41.1	--	--	--	--	70	163	115	116	--	--	--	--	46.4	93.7	77.9	70.1	--	--	--	--	131	264	220	198	--	--	--	--
SCAWREF2	27.0	60.1	43.8	40.9	38.2	21.6	0.0	--	66	170	124	115	108	61	0	--	44.5	94.1	76.9	67.1	66.5	26.6	0.0	--	126	257	217	189	188	75	0	--

[1]Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

[2]Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

[3]Indicates the total number of days within the monitored growing season with a water table 12 inches or less from the soil surface.

Growing season for Beaufort County is from February 28 to December 6 and is **282** days long. 12% of the growing season is **33.8** days.

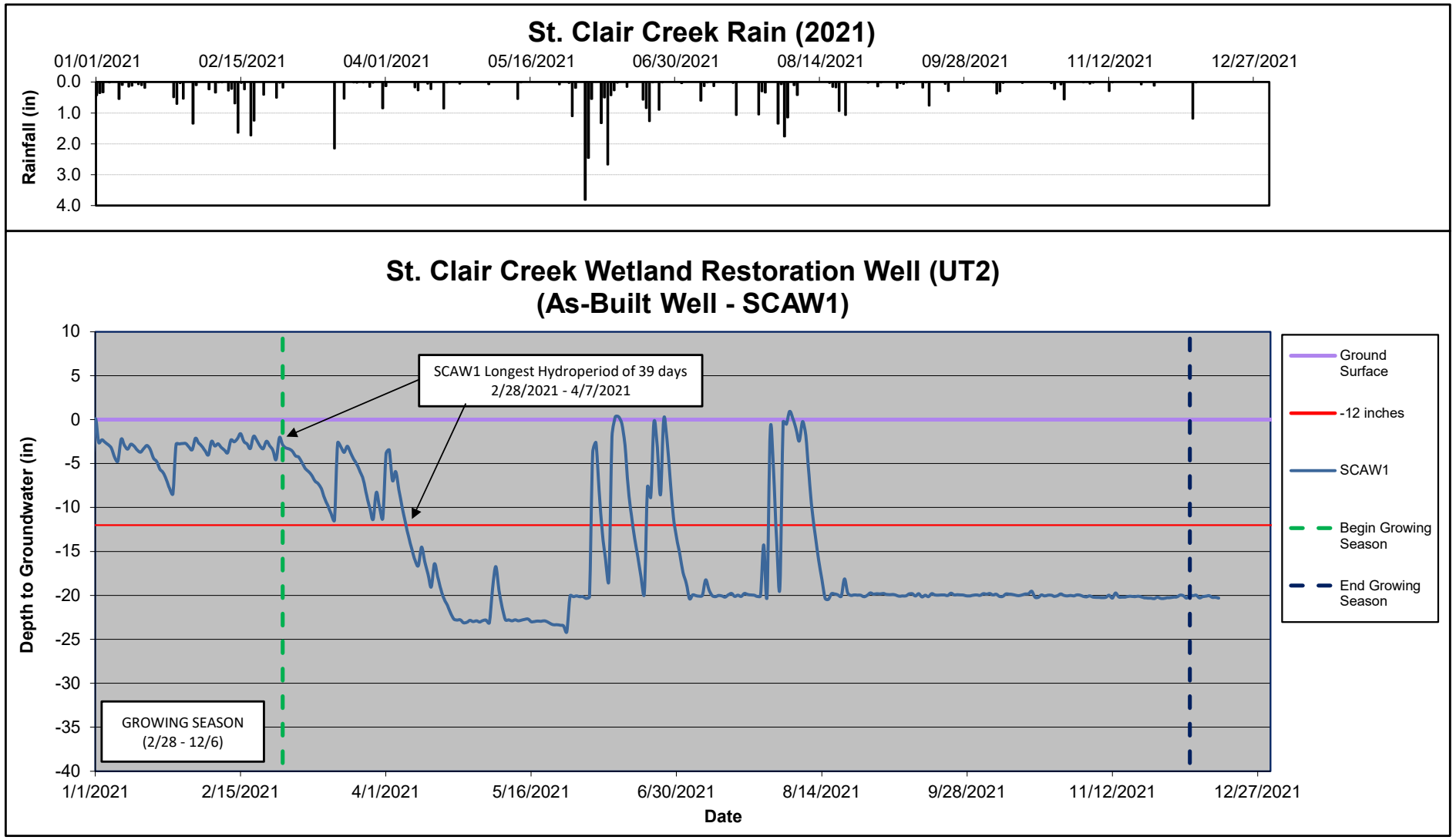
Note: The hydric Tomotley soil series present in the wetlands on site is listed as having an average hydroperiod of between **10-12%** in the IRT monitoring guidance document issued Oct. 2016

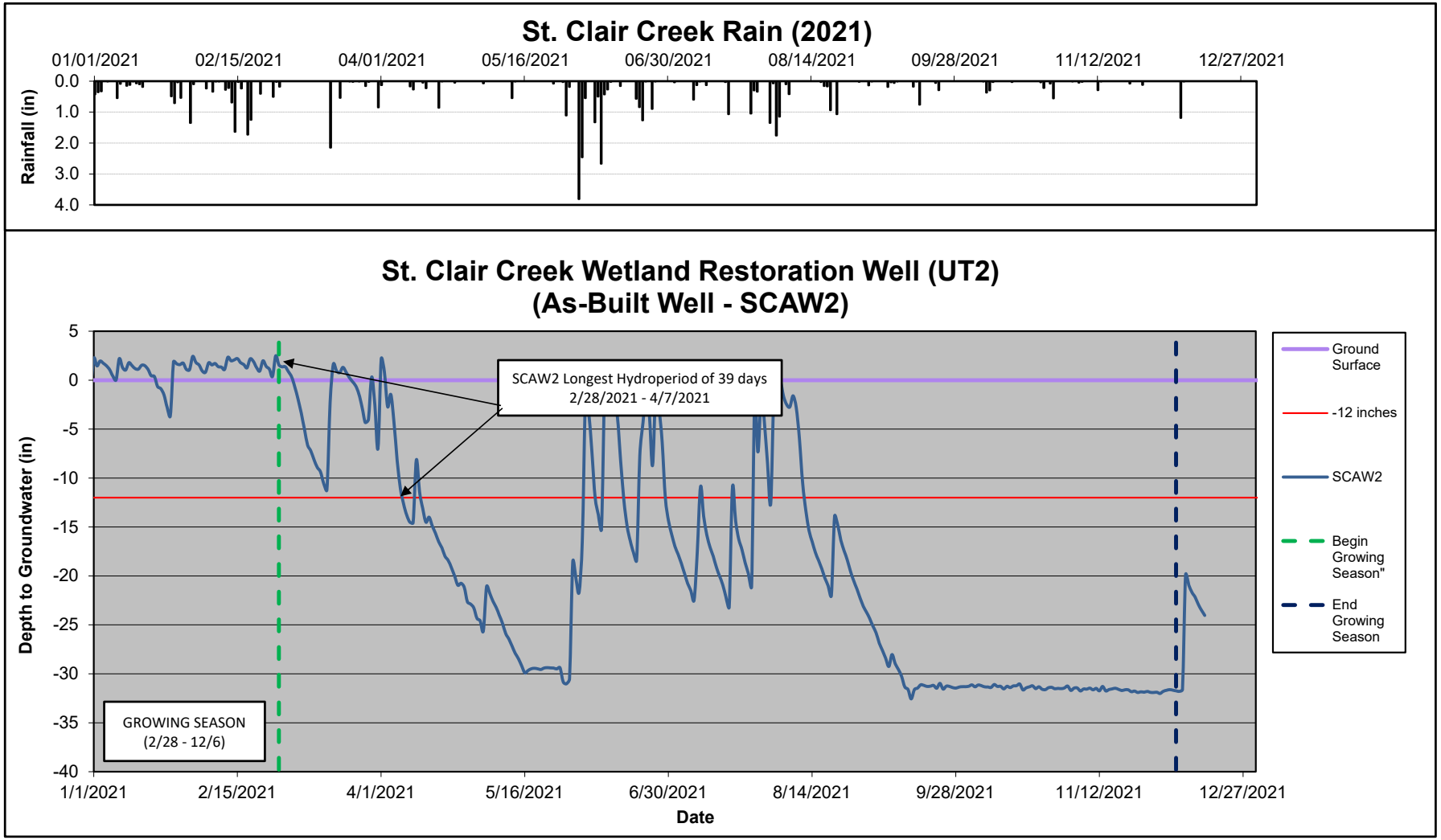
HIGHLIGHTED indicates wells that *did not* meet the success criteria for the most consecutive number of days within the monitored Year 8 growing season with a water 12 inches or less from the soil surface. For Year 8 wetland monitoring, five of the eight wells located in currently credited wetland areas exhibited hyrdroperiods greater than 12% during the 2021 growing season. Well SCAW4 had gauge failure at the start of the growing season, and SCAW8 missed by 2 days.

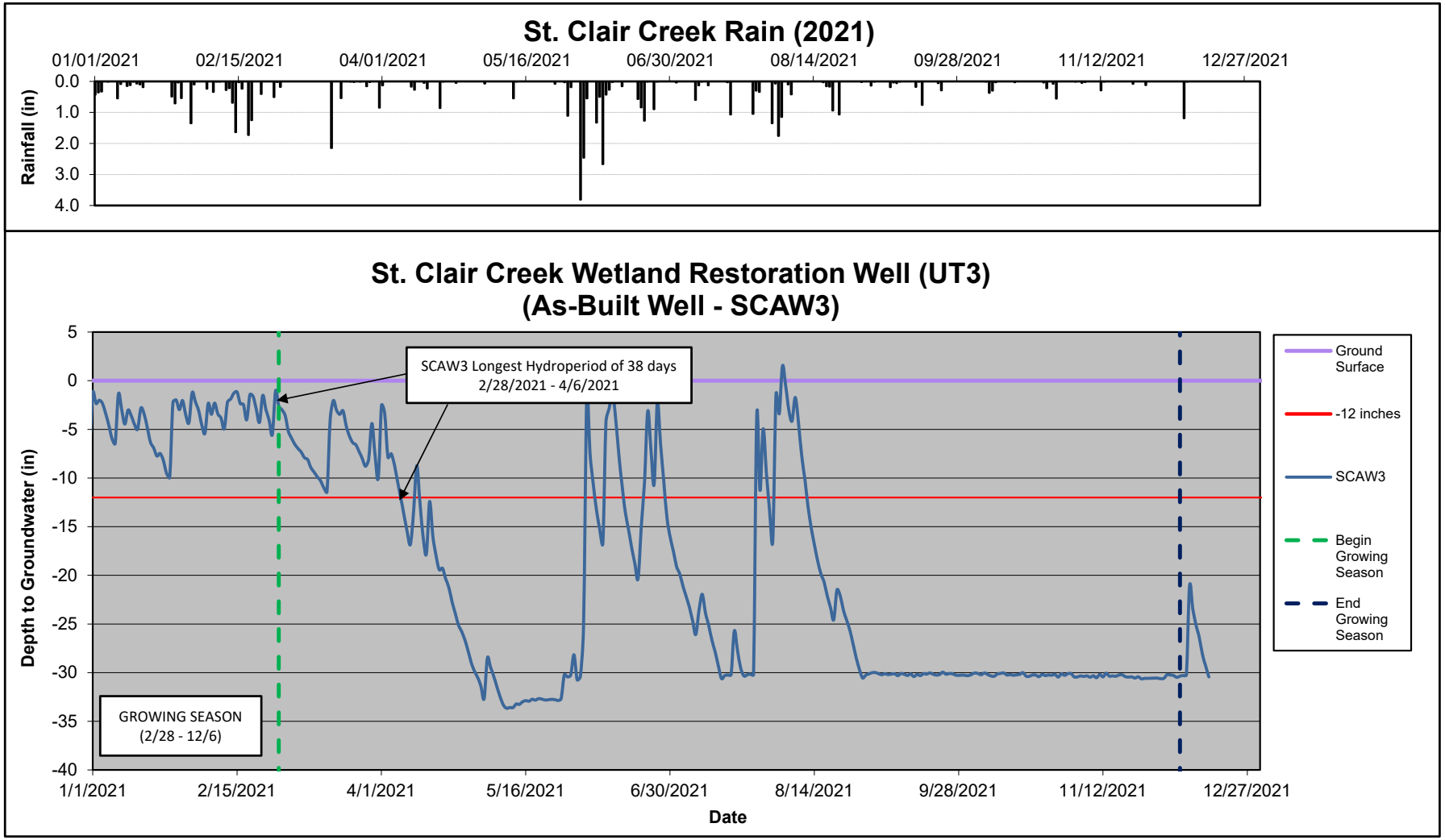
*To gather additional well data in the wetland restoration area, In-Situ groundwater monitoring dataloggers SCAW5 - SCAW 8 were installed in April 2016, several weeks after the growing season had begun. Two additional In-Situ groundwater monitoring dataloggers SCAW9 and SCAW10 were installed in March 2017, just over two weeks past the start of the growing season in 2017.

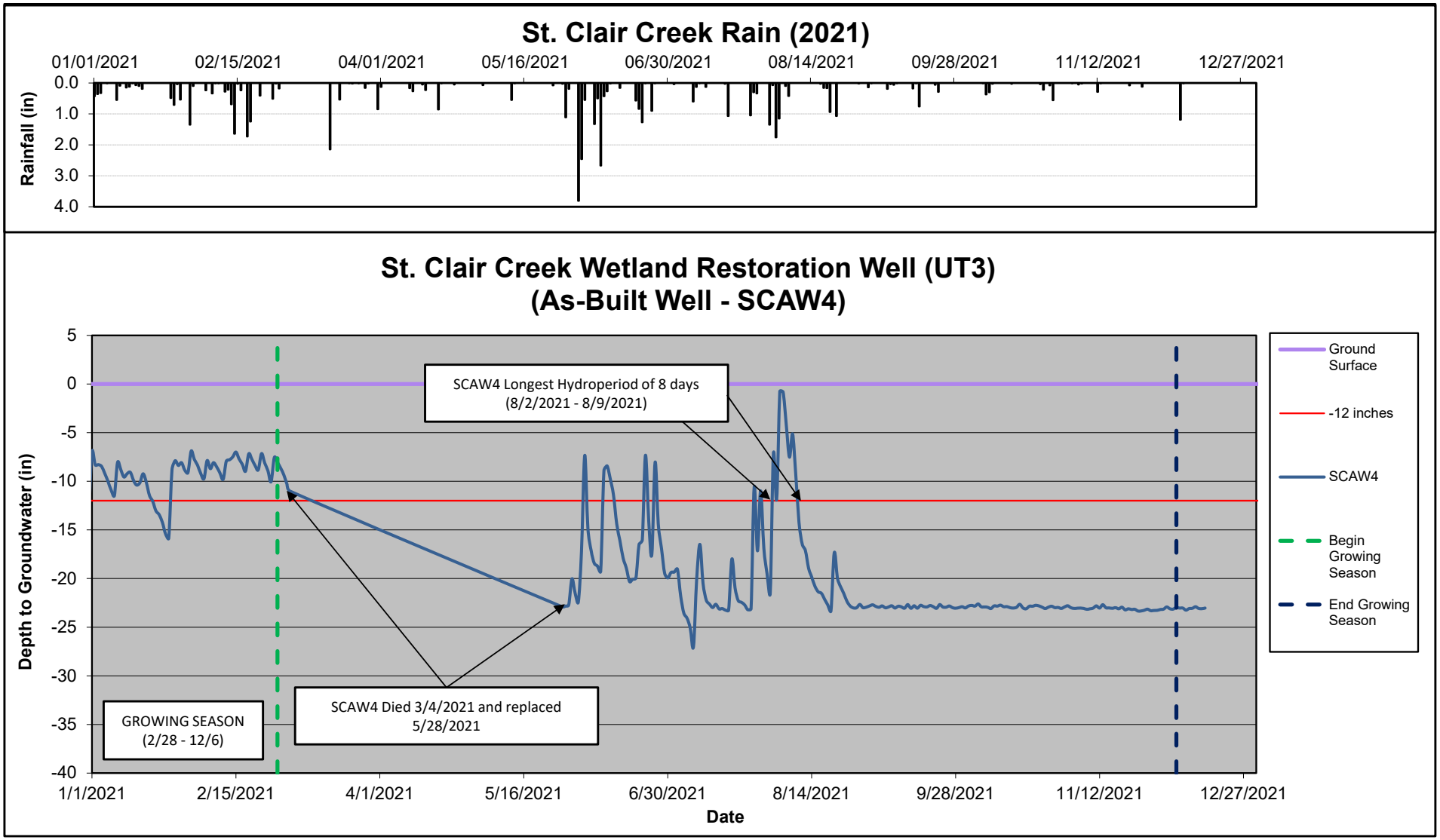
**SCAW4 gauge died at the very beginning of the MY8 growing season and thus missed the crucial success period timeframe.

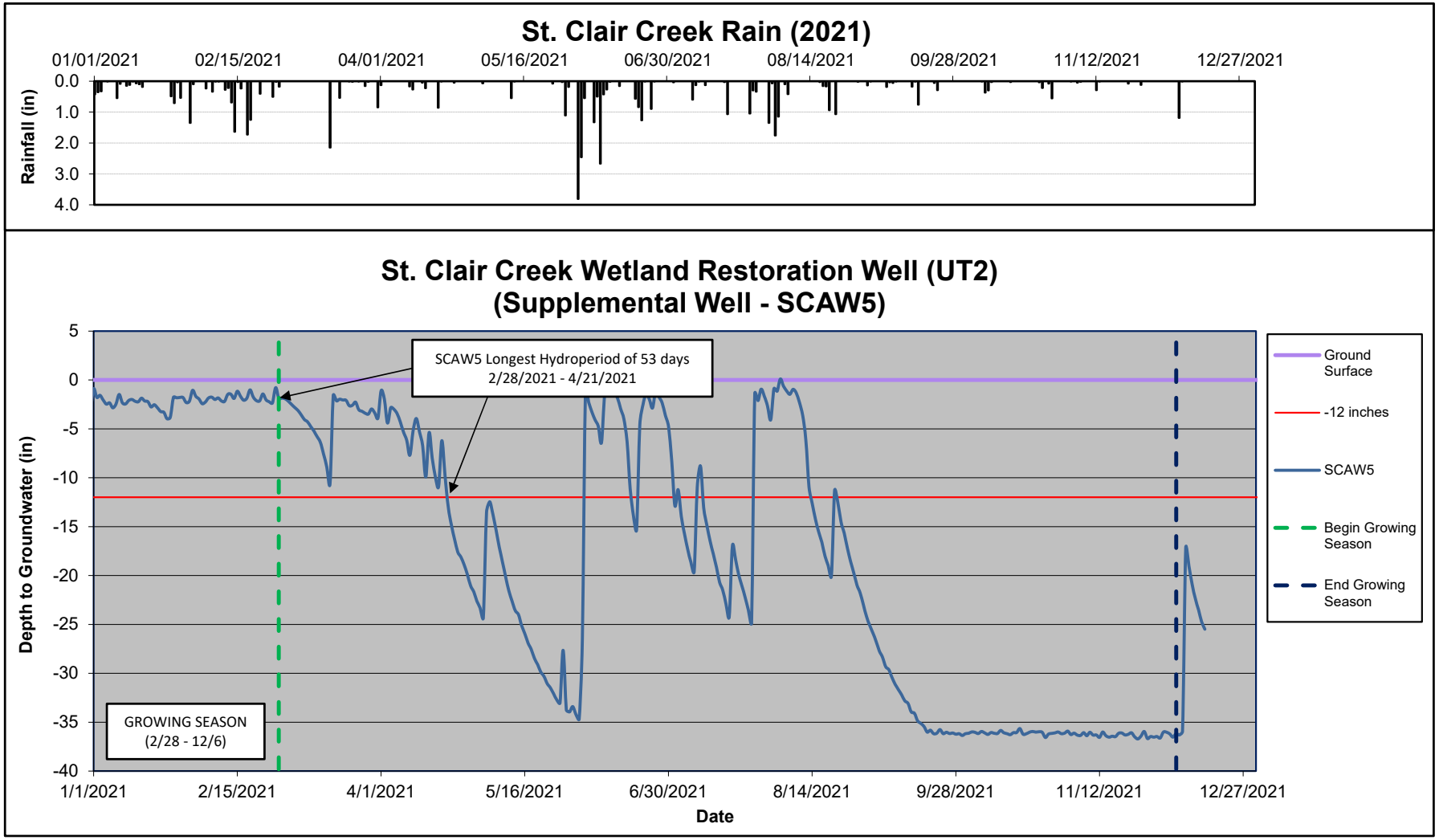
Figure 3. Wetland Gauge Graphs

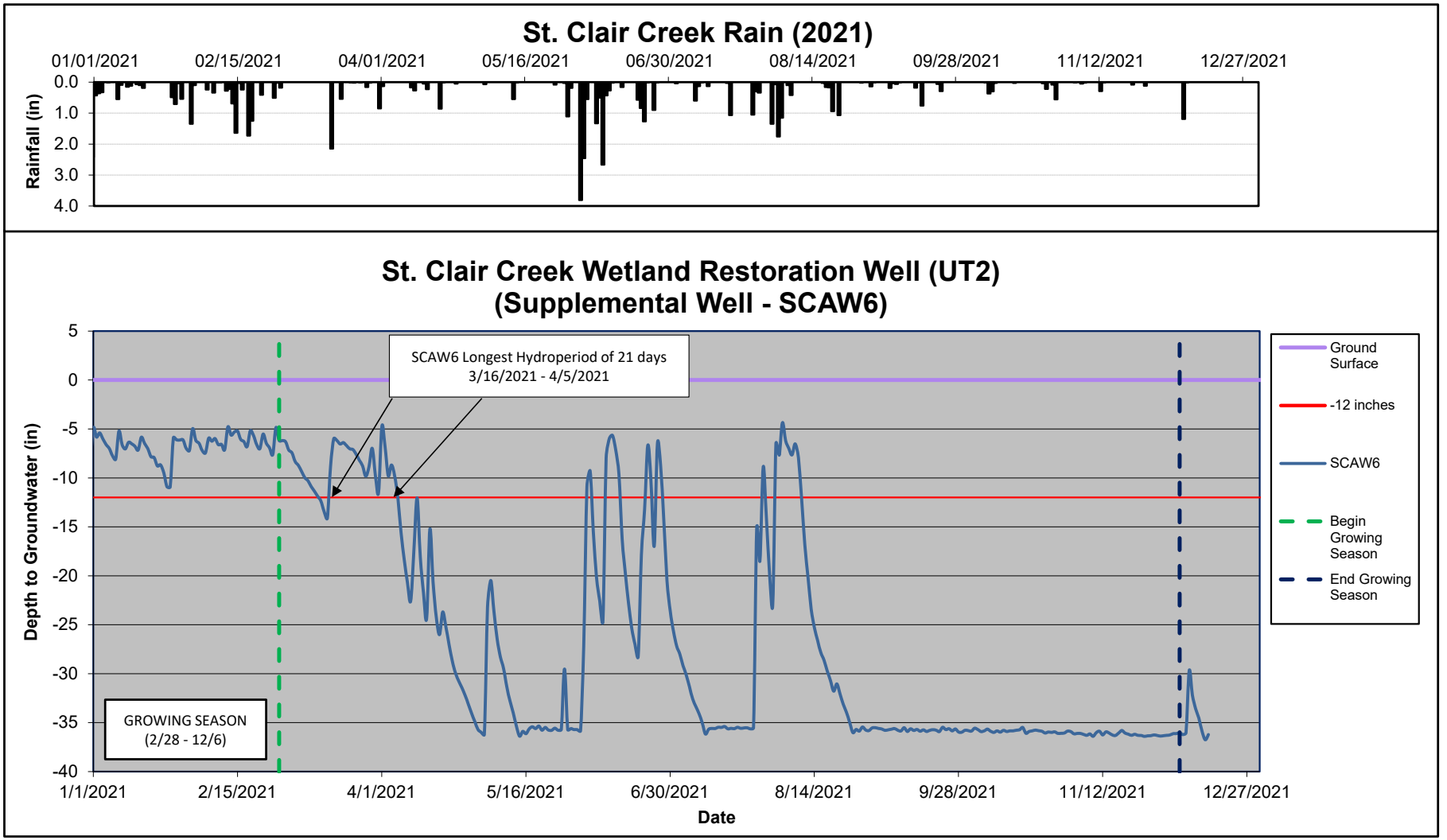


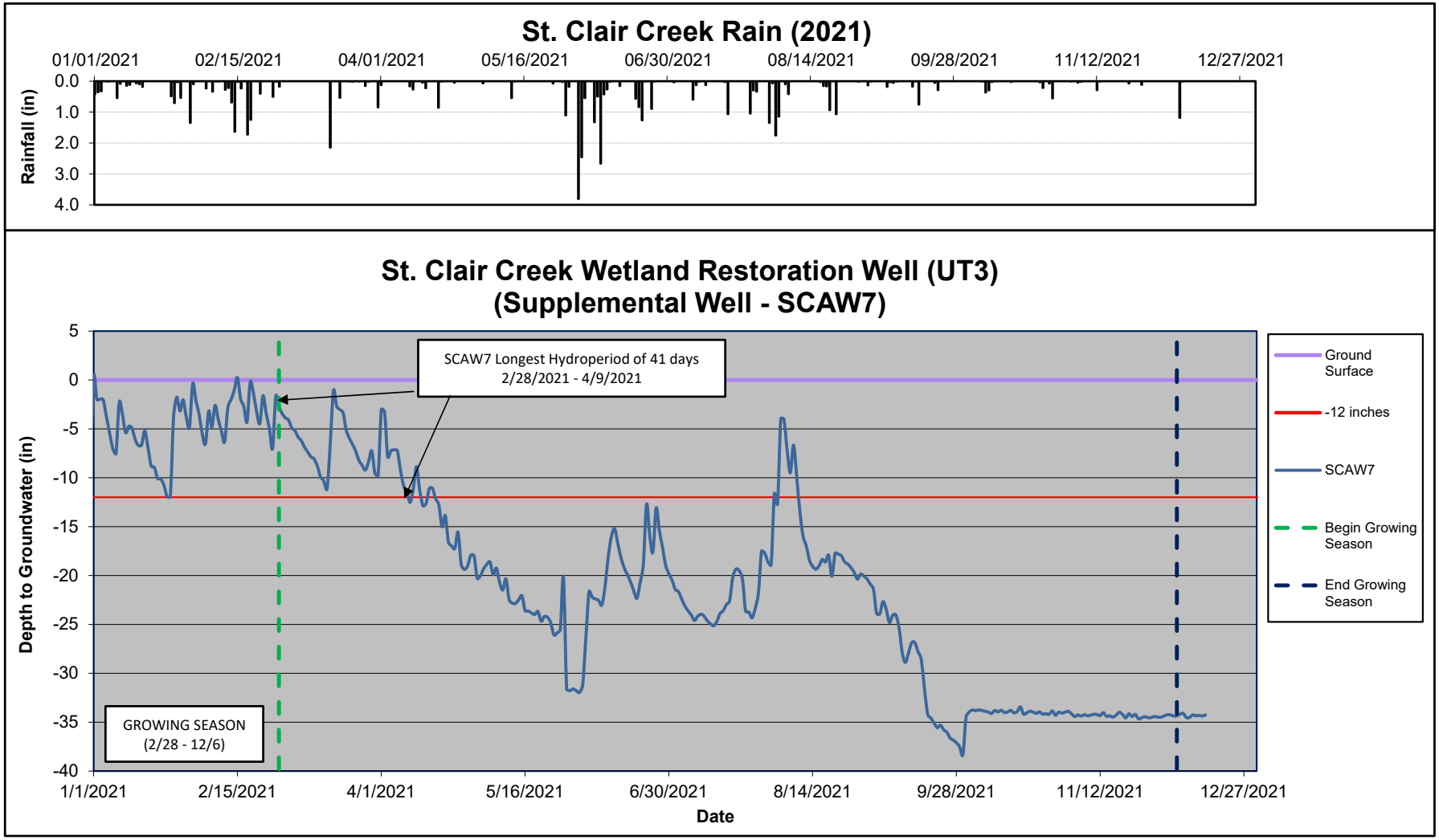

St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT2)
(As-Built Well - SCAW2)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW2 Longest Hydroperiod of 39 days
2/28/2021 - 4/7/2021
GROWING SEASON
(2/28 - 12/6)
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW2
Begin Growing Season"
End Growing Season

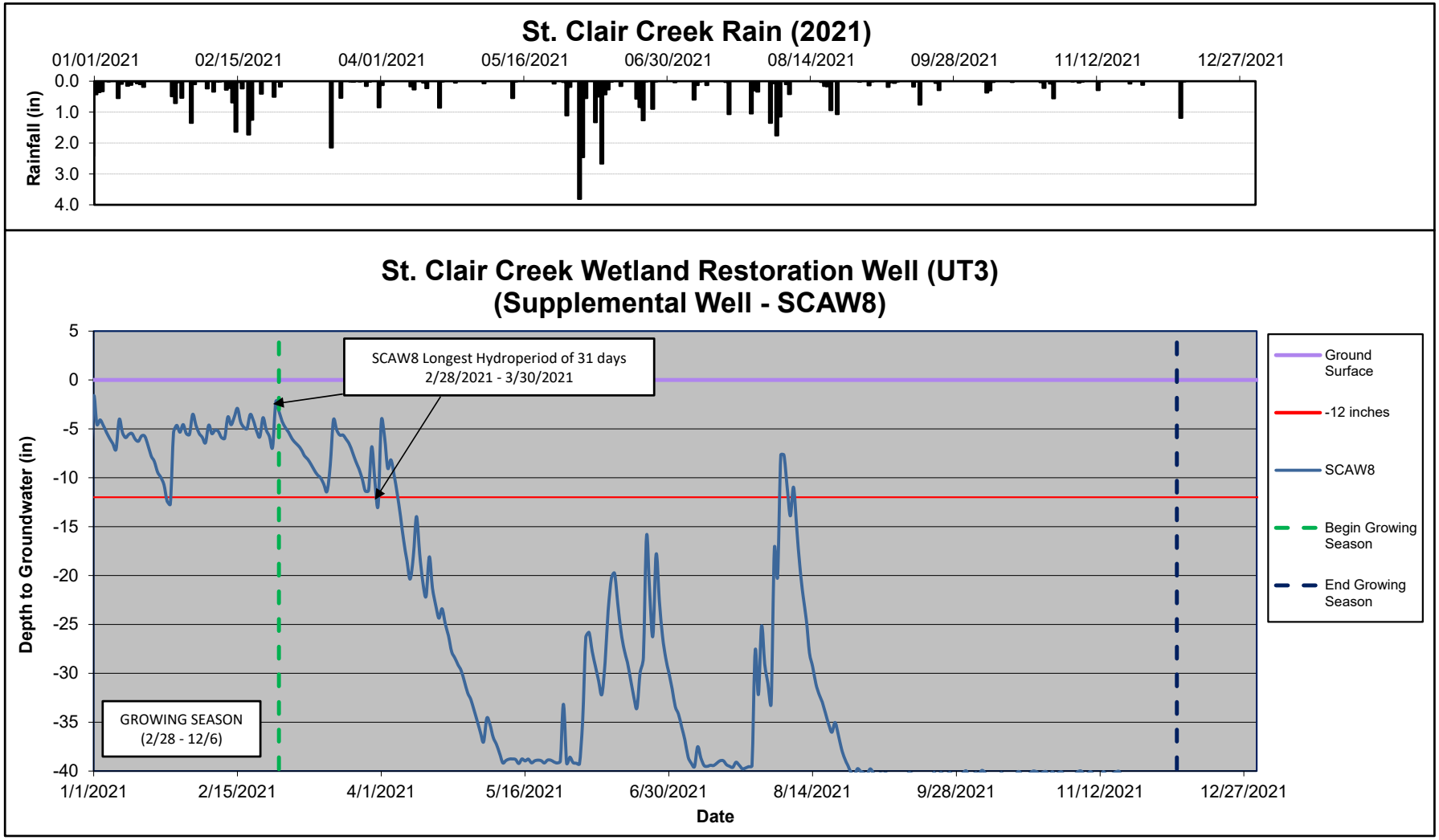

St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-Built Well - SCAW3)
SCAW3 Longest Hydroperiod of 38 days
2/28/2021 - 4/6/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW3
Begin Growing Season
End Growing Season

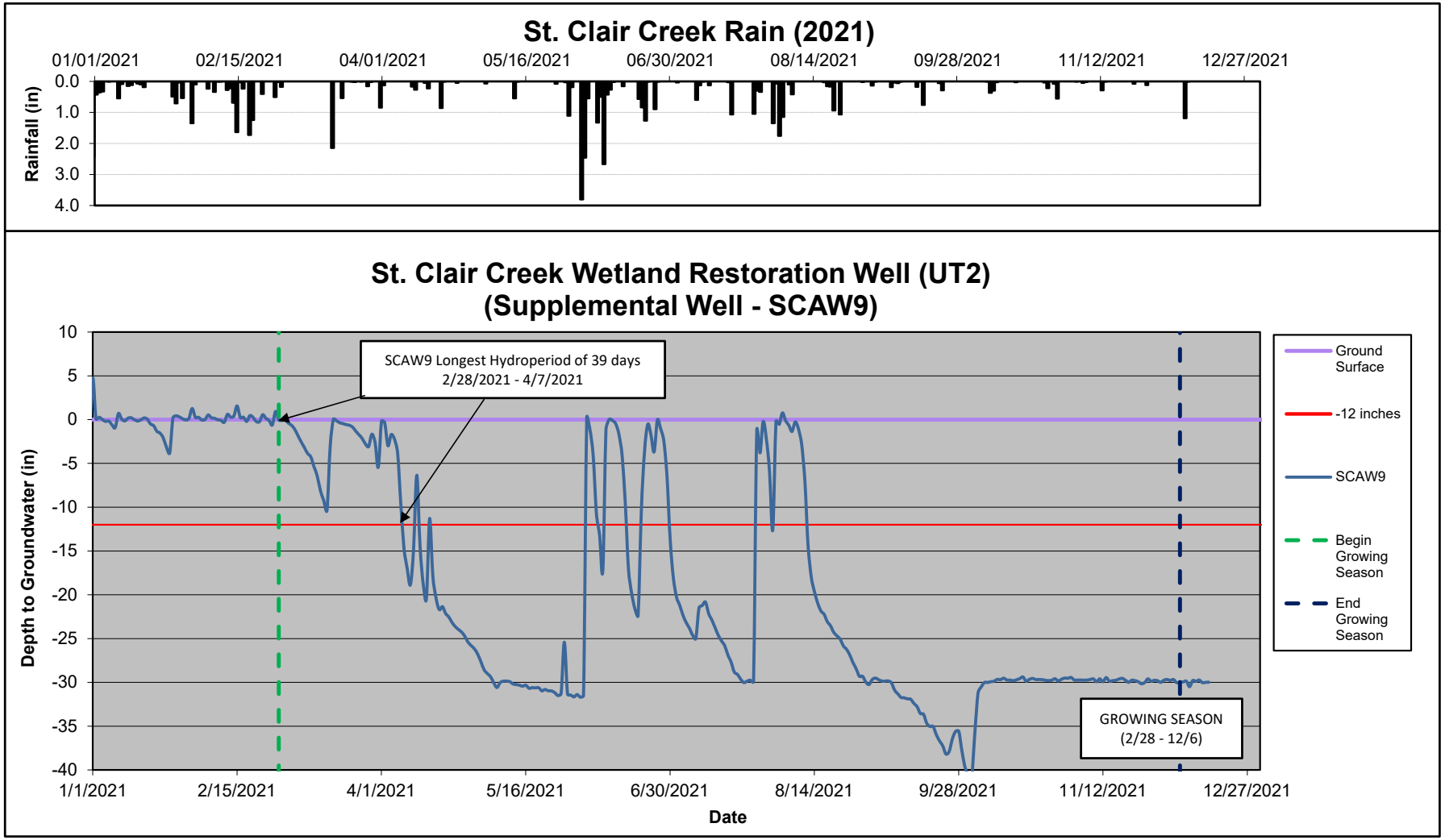

St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT3)
(As-Built Well - SCAW4)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
SCAW4 Longest Hydroperiod of 8 days
(8/2/2021 - 8/9/2021)
GROWING SEASON
(2/28 - 12/6)
SCAW4 Died 3/4/2021 and replaced
5/28/2021
Ground Surface
-12 inches
SCAW4
Begin Growing Season
End Growing Season
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date


St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW5)
SCAW5 Longest Hydroperiod of 53 days
2/28/2021 - 4/21/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW5
Begin Growing Season
End Growing Season


St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW6)
SCAW6 Longest Hydroperiod of 21 days
3/16/2021 - 4/5/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW6
Begin Growing Season
End Growing Season


St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT3)
(Supplemental Well - SCAW7)
SCAW7 Longest Hydroperiod of 41 days
2/28/2021 - 4/9/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW7
Begin Growing Season
End Growing Season


St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT3)
(Supplemental Well - SCAW8)
SCAW8 Longest Hydroperiod of 31 days
2/28/2021 - 3/30/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW8
Begin Growing Season
End Growing Season


St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT2)
(Supplemental Well - SCAW9)
SCAW9 Longest Hydroperiod of 39 days
2/28/2021 - 4/7/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW9
Begin Growing Season
End Growing Season

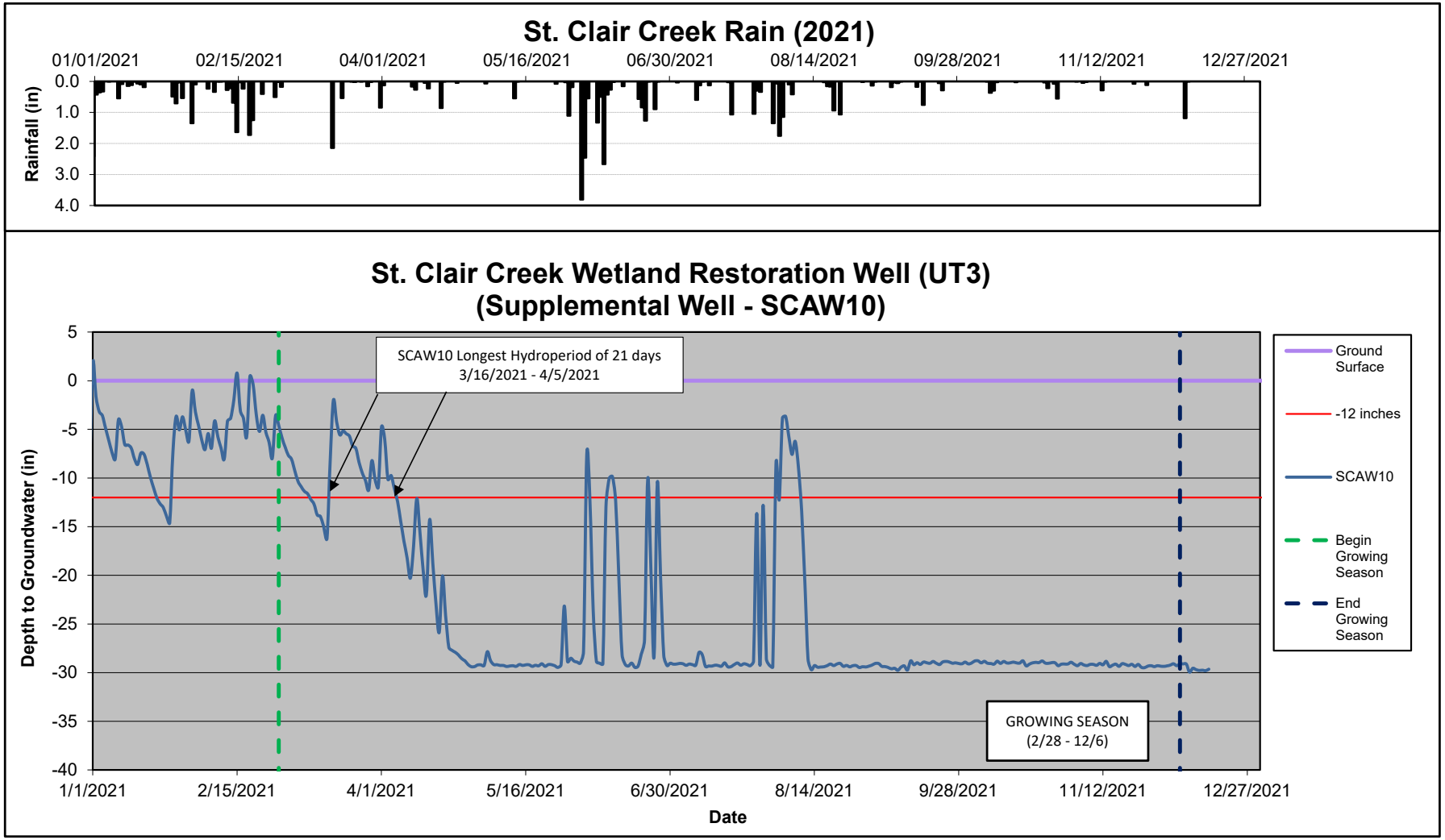

St. Clair Creek Rain (2021)
01/01/2021
02/15/2021
04/01/2021
05/16/2021
06/30/2021
08/14/2021
09/28/2021
11/12/2021
12/27/2021
Rainfall (in)
0.0
1.0
2.0
3.0
4.0
St. Clair Creek Wetland Restoration Well (UT3)
(Supplemental Well - SCAW10)
SCAW10 Longest Hydroperiod of 21 days
3/16/2021 - 4/5/2021
GROWING SEASON
(2/28 - 12/6)
Depth to Groundwater (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2021
2/15/2021
4/1/2021
5/16/2021
6/30/2021
8/14/2021
9/28/2021
11/12/2021
12/27/2021
Date
Ground Surface
-12 inches
SCAW10
Begin Growing Season
End Growing Season

Table 11. Flow Gauge Success
St. Clair Restoration Project: DMS Project ID No. 95019

Flow Gauge ID	Most Consecutive Days Meeting Criteria[1]								Cumulative Days Meeting Criteria[2]							
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 8 (2021)	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)	Year 6 (2019)	Year 7 (2020)	Year 8 (2021)
UT2 Flow Gauges (Installed March 21, 2014)																
SCFL1	71	43	83	63	152	224	227	111	-	206	224	328	363	342	343	174
SCFL2	64	43	84	60	121	121	89	111	-	201	232	204	270	214	253	176
SCFL3	61	25	86	35	63	120	88	110	-	174	203	287	328	271	255	148
SCFL4	24	17	46	29*	20	38	45	40	-	118	124	86	146	85	106	69
UT3 Flow Gauges (Installed July 17, 2015)																
SCFL5	57	44	62	30	57	74	73	66	NA	174	162	79	214	327	108	206
SCFL6	5	42	62	30	35	40	52	52	NA	116	180	191	214	103	87	83
UT2 Flow Gauge (Installed June 6, 2018)[3]																
SCFL7	NA	NA	NA	NA	60	117	78	74	NA	NA	NA	NA	162	167	180	132
UT2 Flow Gauge (Installed February 17, 2021)[4]																
SCFL8	NA	NA	NA	NA	NA	NA	NA	21	NA	NA	NA	NA	NA	NA	NA	44

Notes:

[1]Indicates the single greatest number of consecutive days within the monitoring year where flow was measured.

[2]Indicates the number of total number of days within the monitoring year where flow was measured.

*SCFL4 also recorded a 28-day consecutive flow event in 2017, in addition to the 29-day flow event shown above.

**SCFL8 was installed 6 weeks into 2021, though flow had been noted and recorded in the channel up to the installation date.

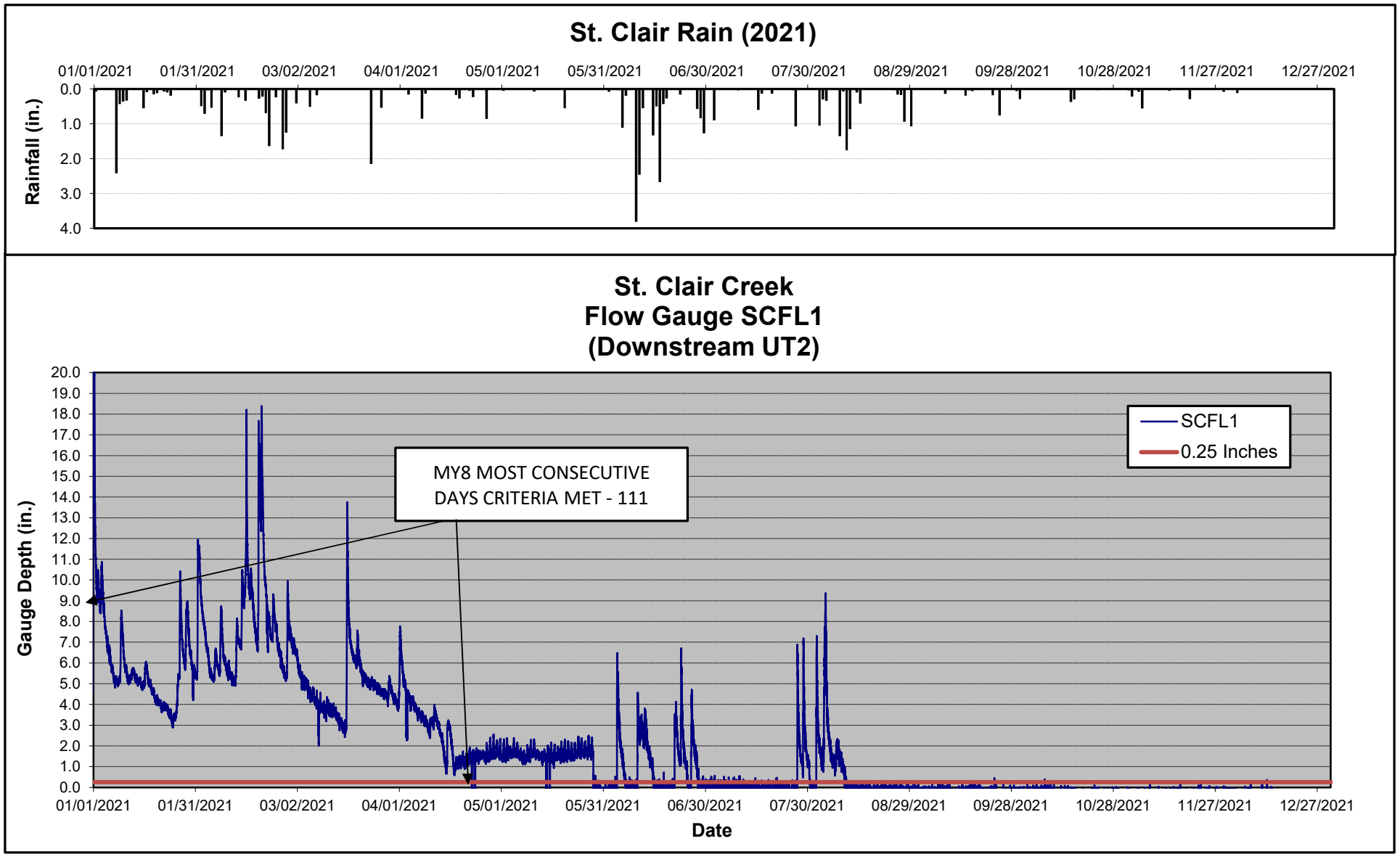
[3]SCFL7 was installed June 6, 2018 to gather additional flow data for upper UT2.

[4]SCFL8 was installed February 17, 2021 to gather additional flow data for upper UT2.

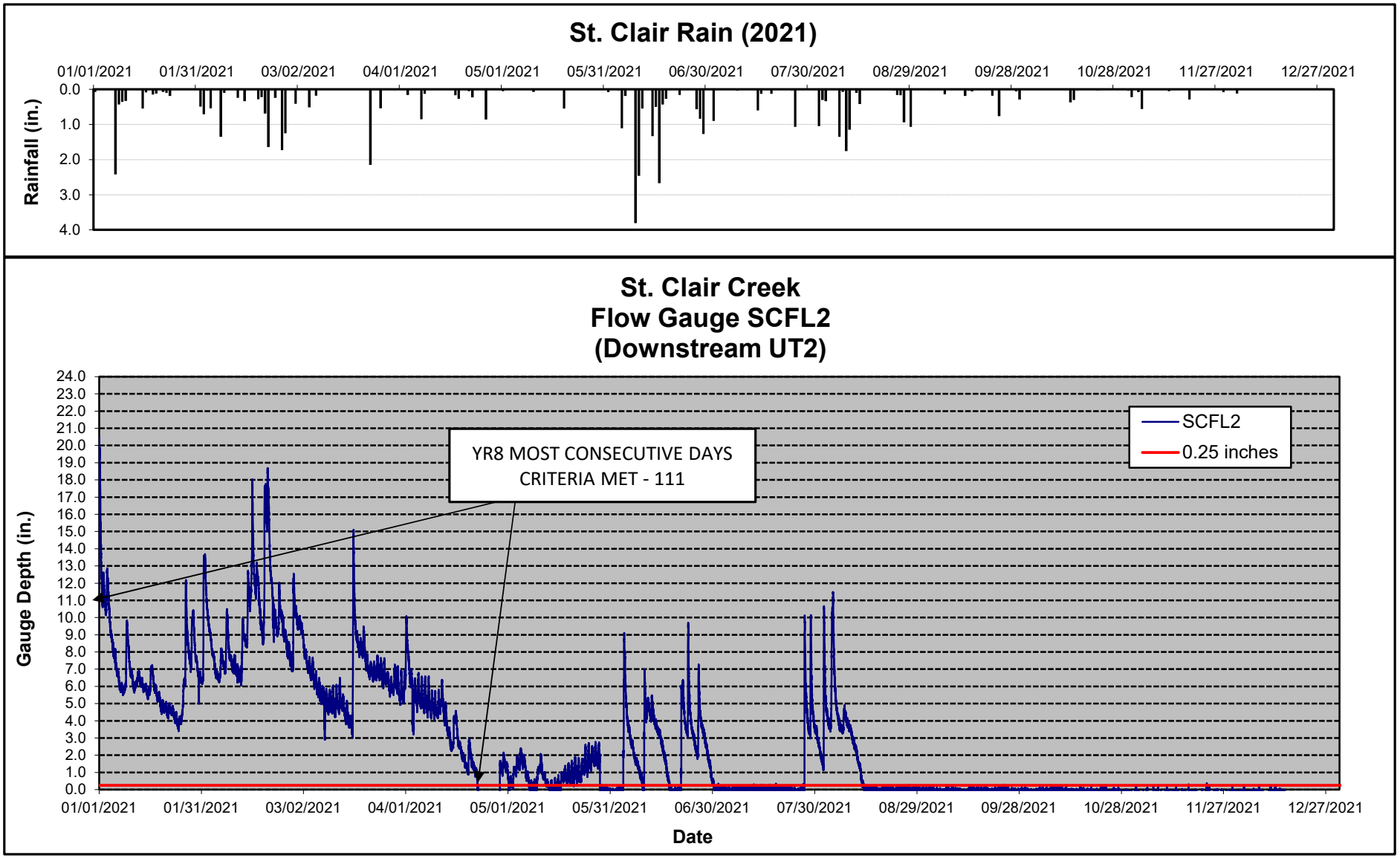
Success Criteria per St. Clair Creek Mitigation Plan: Two surface water flow events (when flow duration occurs for a minimum of 30 days) must be documented within a five-year monitoring period; otherwise, monitoring will continue for seven years or until two flow events have been documented in separate years. The automated gauges should document the occurrence of extended periods of shallow surface ponding, indicative of flow.

Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.25 inches.

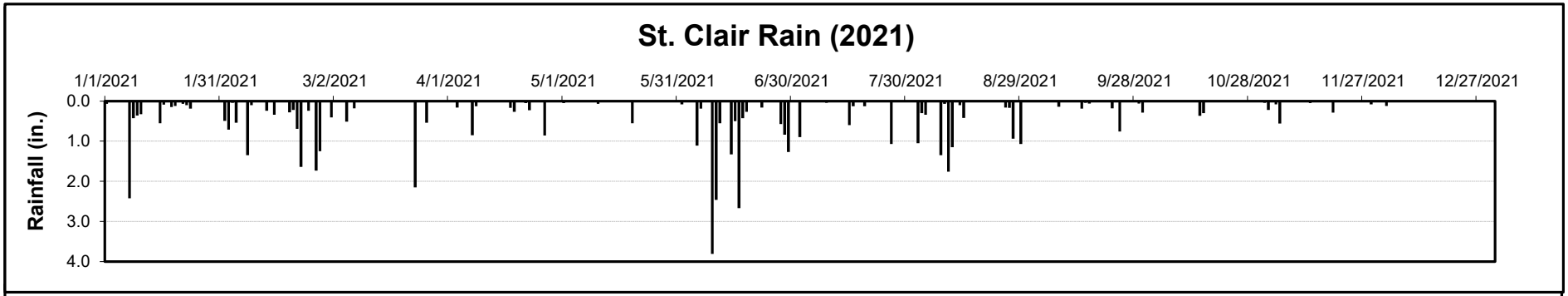
Figure 4. Flow Gauge Graphs

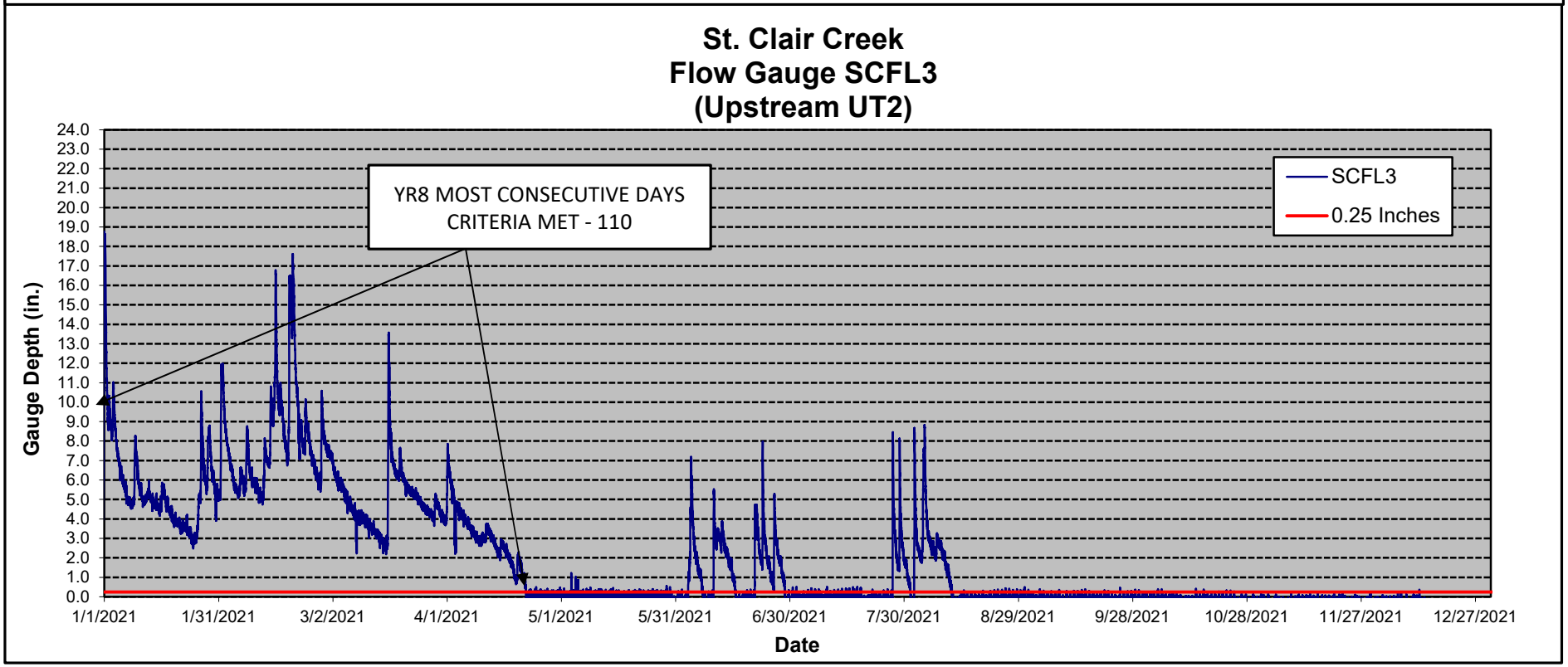


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg

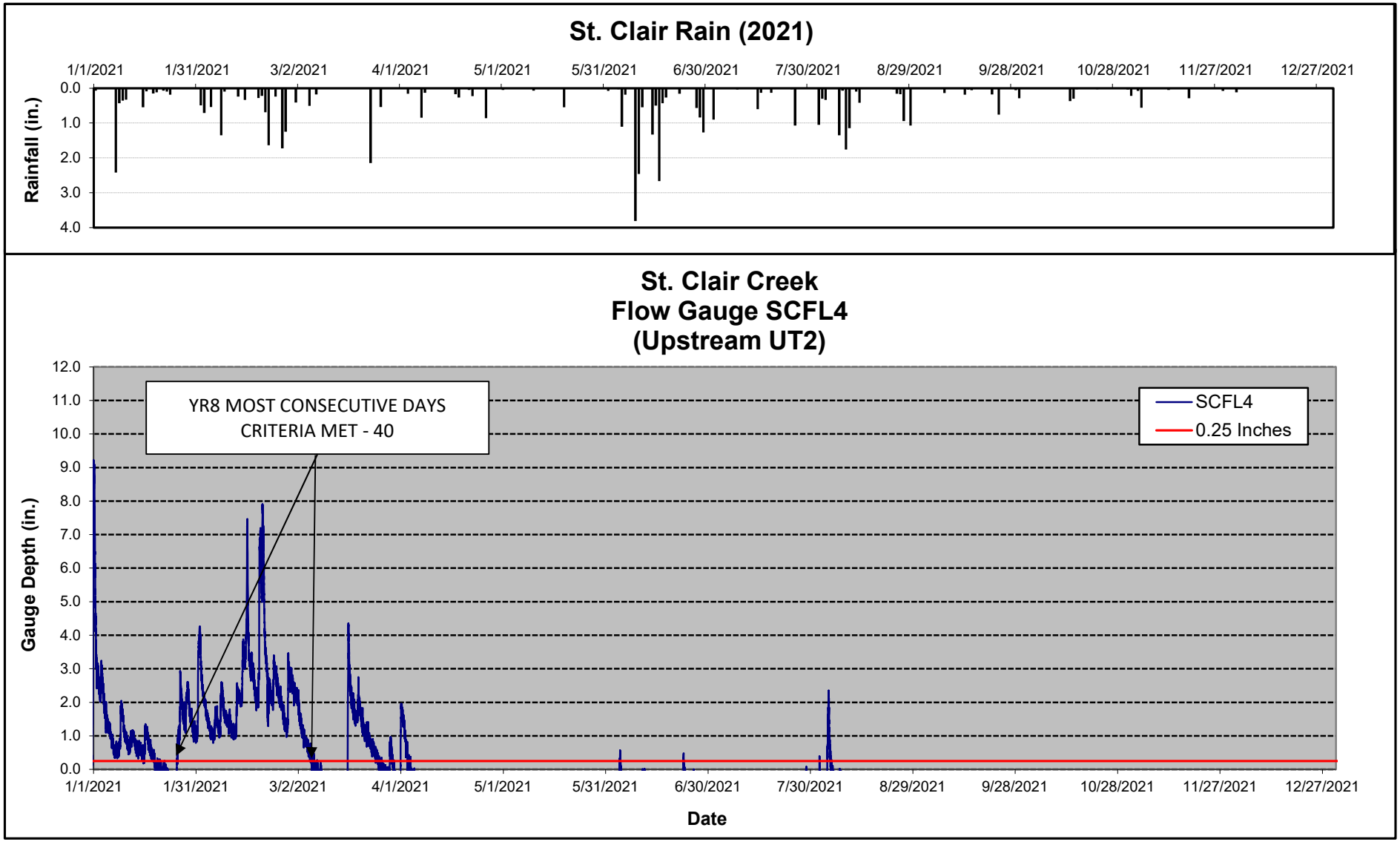


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg

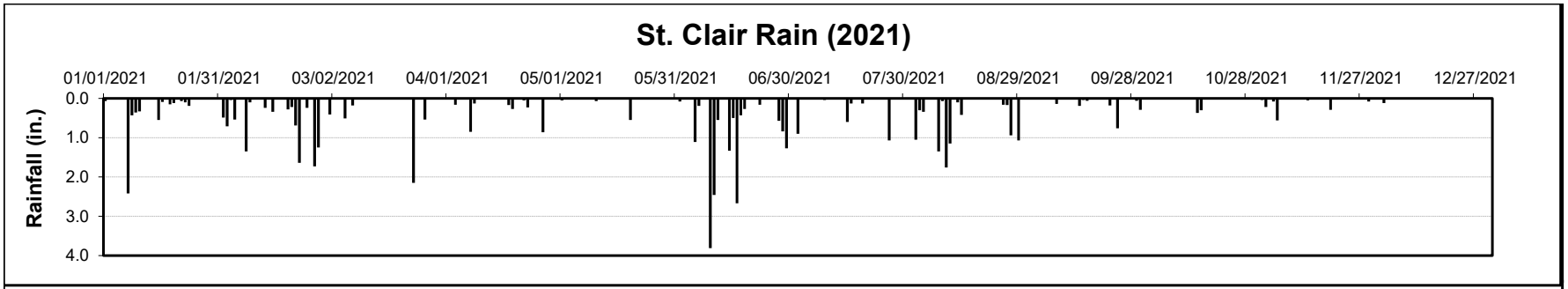


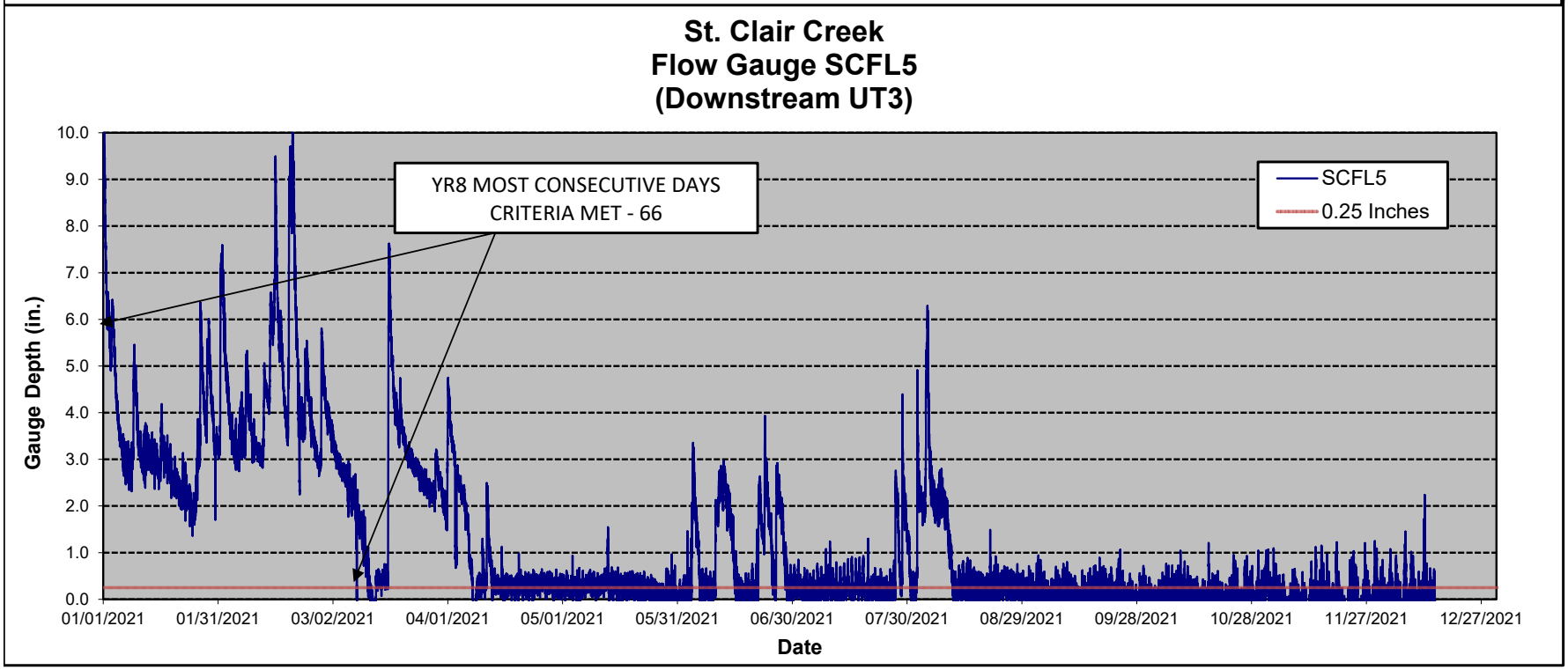


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg

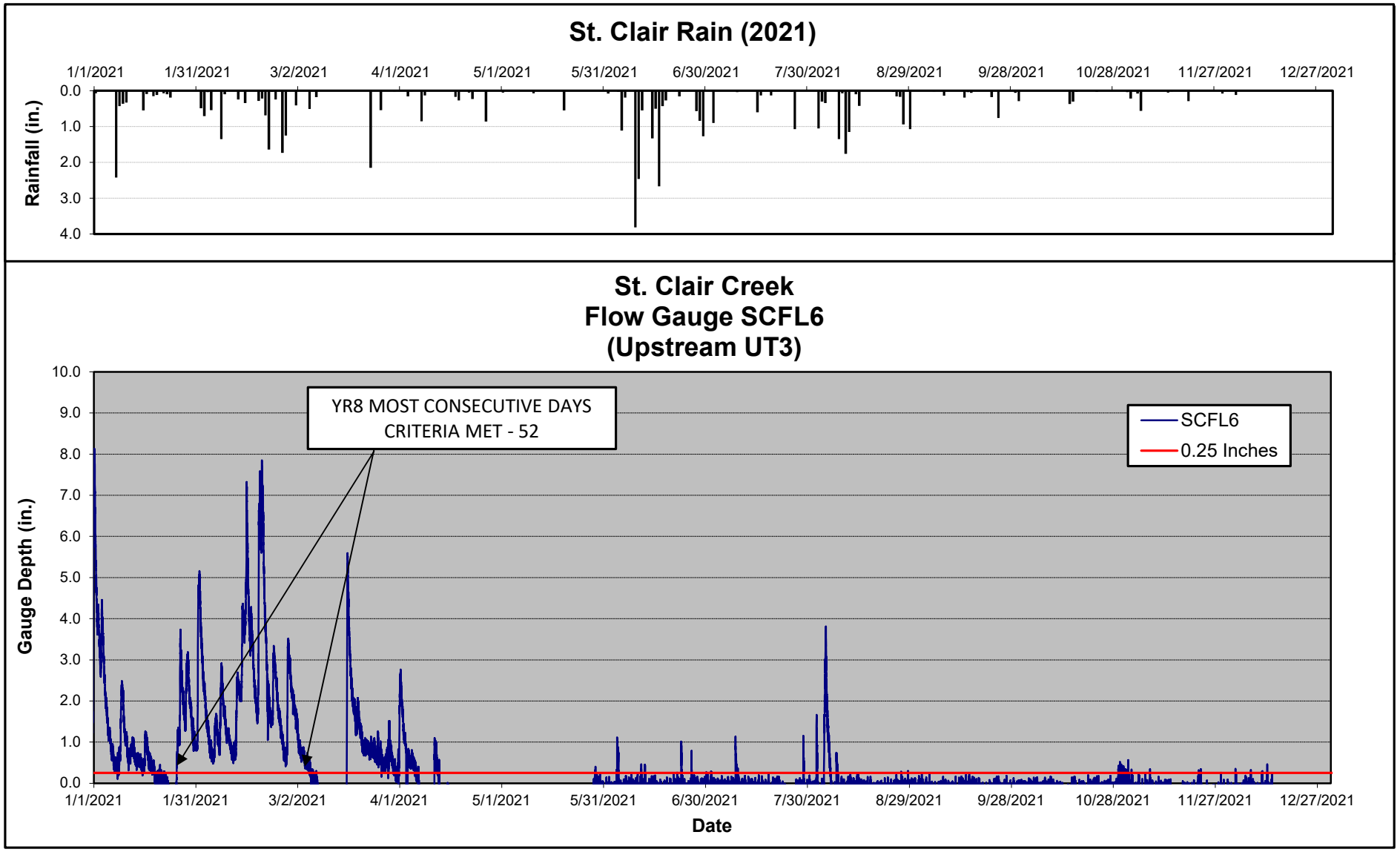


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg

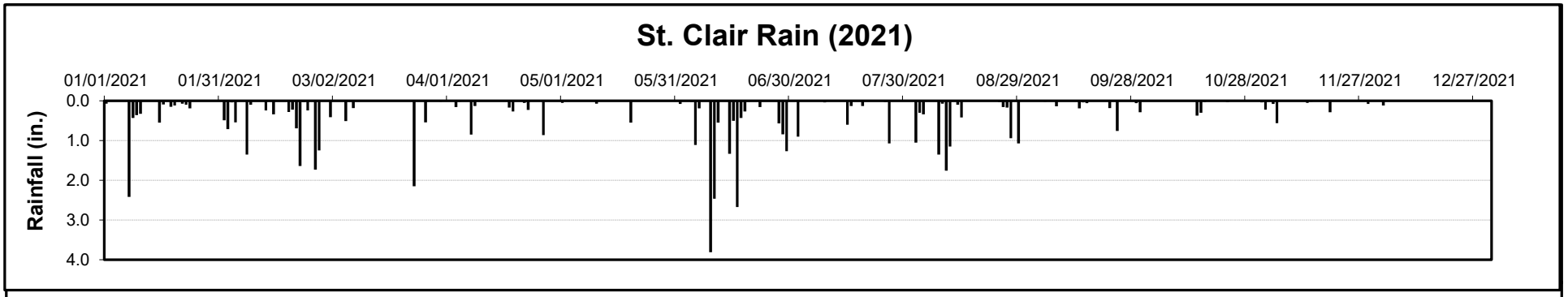


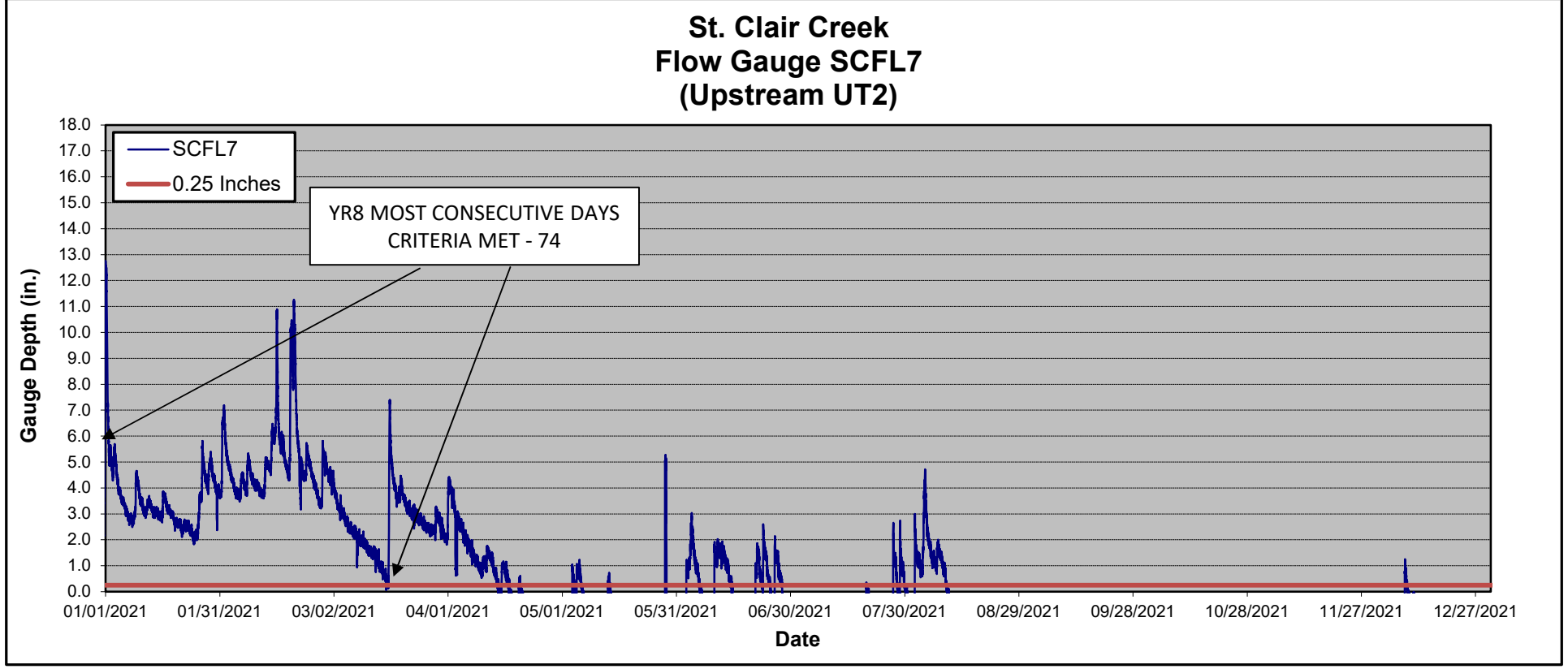


*0.25 inches denotes level at which flow occurs along the UT3 valley thalweg

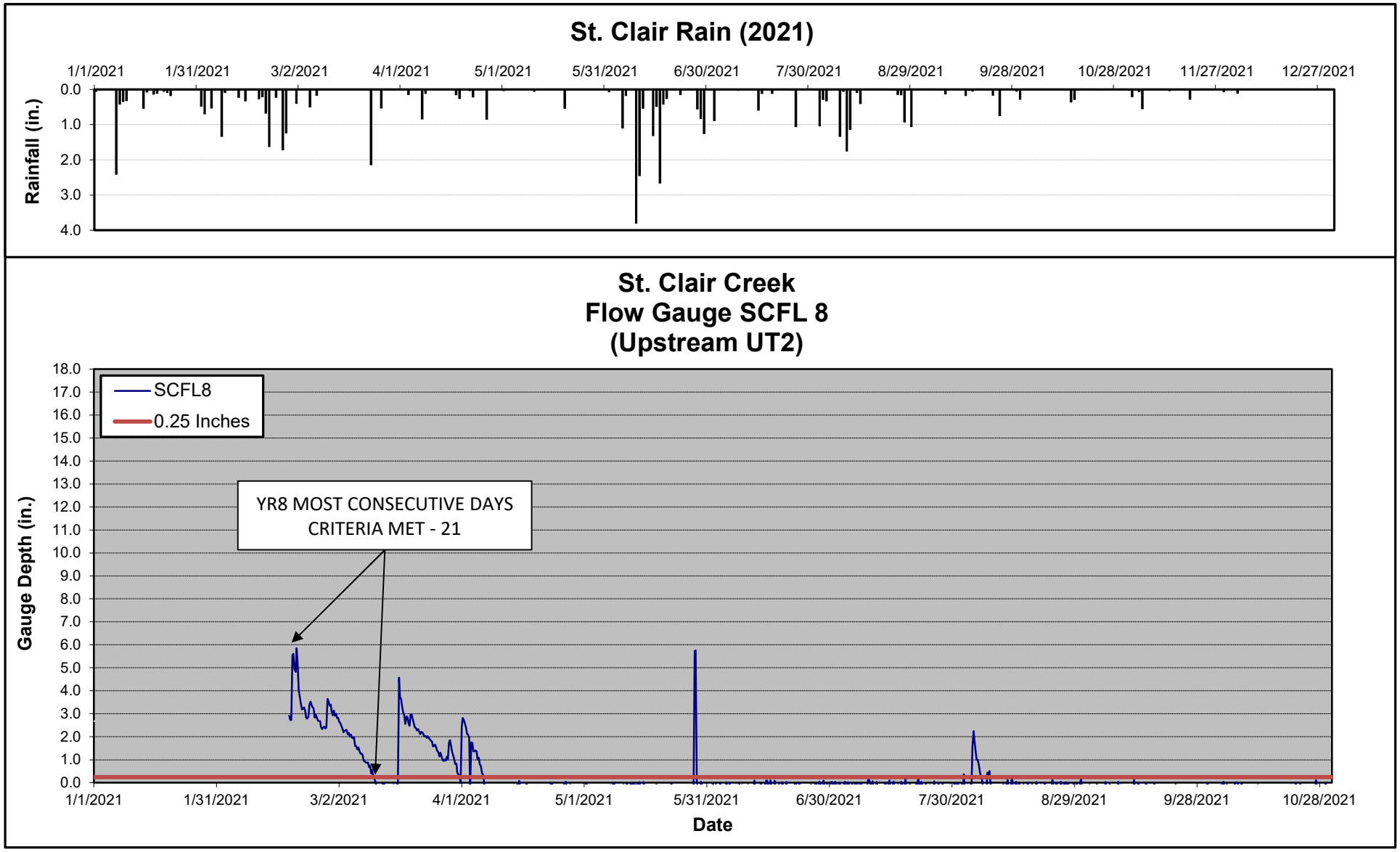


*0.25 inches denotes level at which flow occurs along the UT3 valley thalweg



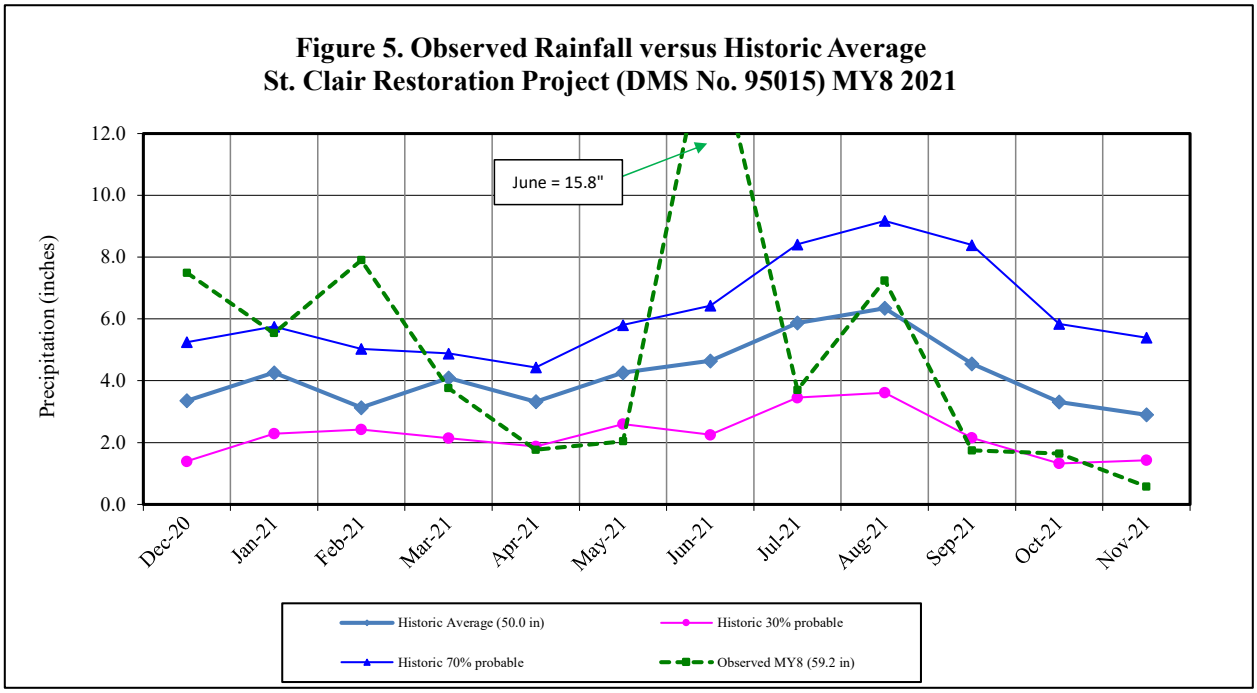


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg

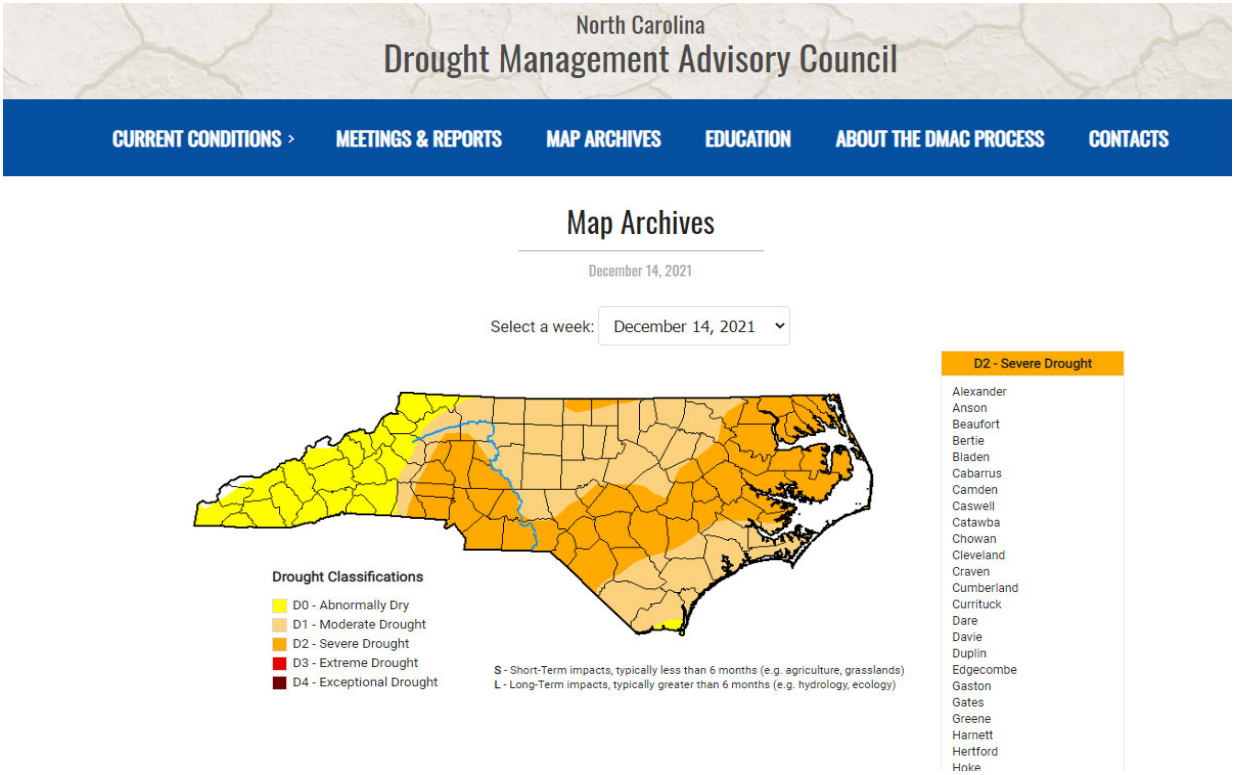


*0.25 inches denotes level at which flow occurs along the UT2 valley thalweg

Figure 5. Observed Rainfall versus Historic Average
St. Clair Restoration Project (DMS No. 95015) MY8 2021



Note: Beaufort County historic average rainfall is 50.0 in, while observed previous 12 months rainfall total recorded onsite was 59.2 in.



Source: www.ncdrought.org/map-archives

Michael Baker
INTERNATIONAL

Memorandem

St. Clair Creek Restoration Project: Channel Cross-Section Analysis for UT2 Flow

DMS Project ID. 95015
NC DEQ Contract# 003986
USACE Action ID: SAW-2008-02655, DWR# 13-0739
Tar-Pamlico River Basin: 03020104-040040

Date Prepared:	December 13, 2020
Subject:	Channel Cross-Section Analysis for UT2 Flow
Recorded By:	Scott King

During the monitoring period for the St Clair Creek project, the IRT has expressed reservations regarding the seasonal flow present in the upper section of Reach UT2. Specifically, whether or not there is enough flow present to develop an appropriate channel or channels common to headwater coastal plain systems.

The entire reach is seasonally thick with herbaceous vegetation, which serves to mask both the presence of water in the reach in photographs as well as the development of a threaded channel system. Even during field inspections it can be difficult to discern the level of scour and channel formation present in the reach. As such, Baker took two cross-section transects in the upper portion of UT2 on May 1, 2020 to better illustrate the current conditions in these locations.

Please find attached the results of these cross-sections. They reveal the presence of a distinct multi-thread channel with shallow water present in the two primary threads at the time of the survey in the upper transect, and larger channel development with shallow water present in the lower transect. Both transects show signs of channel scour and evolution, with rough, irregular rutting and scour found all across the transects, even along the relatively gentle adjacent side slopes draining into the channel.

As the tree canopy matures and generates more shade for the reach, it is expected that this will depress the extent of the herbaceous growth, which will in turn allow for even more scour and channel development as this growth certainly provides substantial protection during storm events. Even during the winter, the presence of dead or quiescent vegetation acts as a stabilizing influence. Furthermore, this entire headwater system is low-gradient as is common in this portion of the low-lying Coastal Plain, and during heavy storm events much of the entire surrounding landscape is often inundated, which in turn inhibits the presence of a higher-velocity scouring flow that might be found in steeper gradient systems.

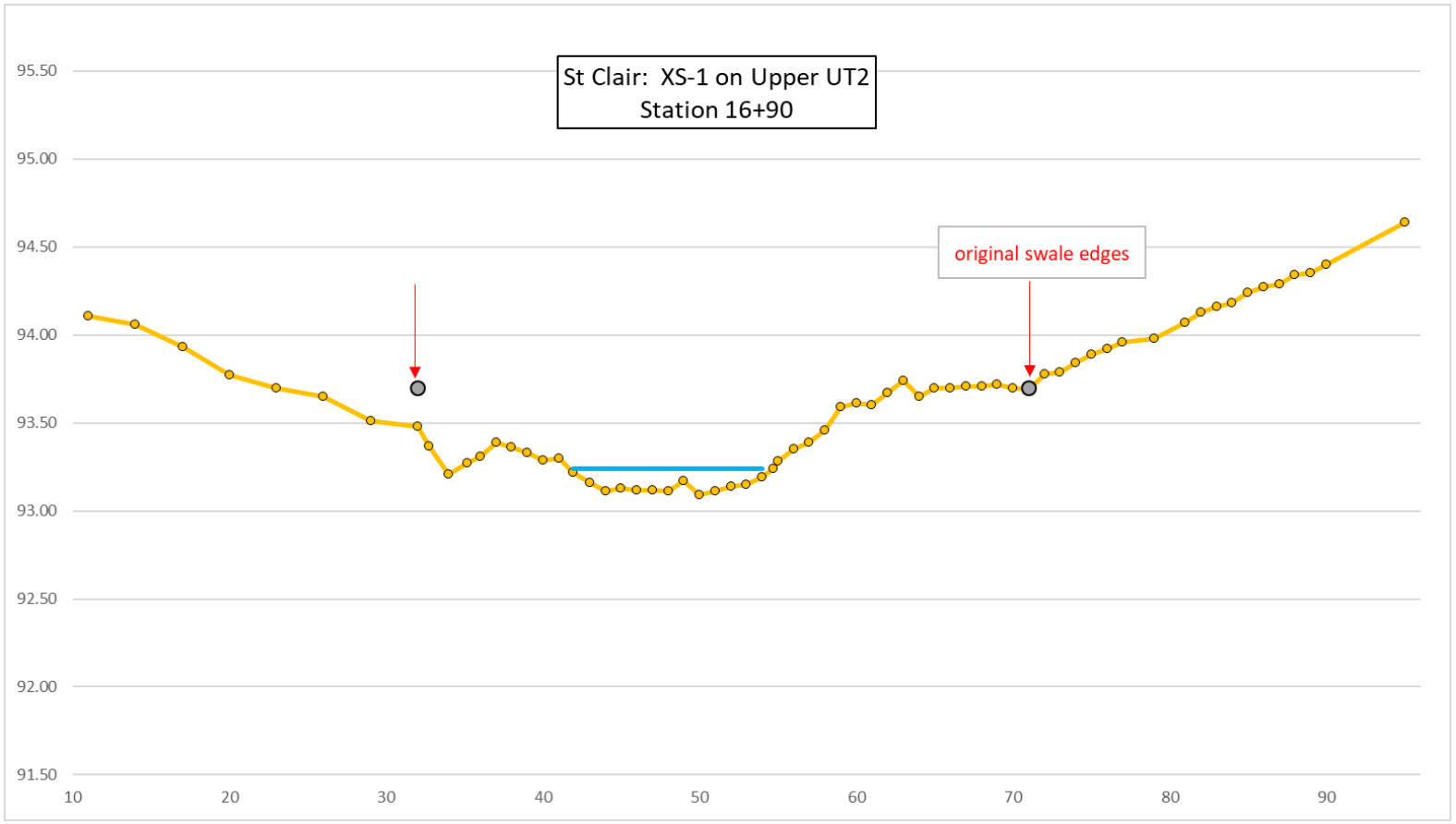
If the IRT finds these transects helpful for their evaluation of the upper portion of UT2, Baker would be happy to take several more transects for their future review.

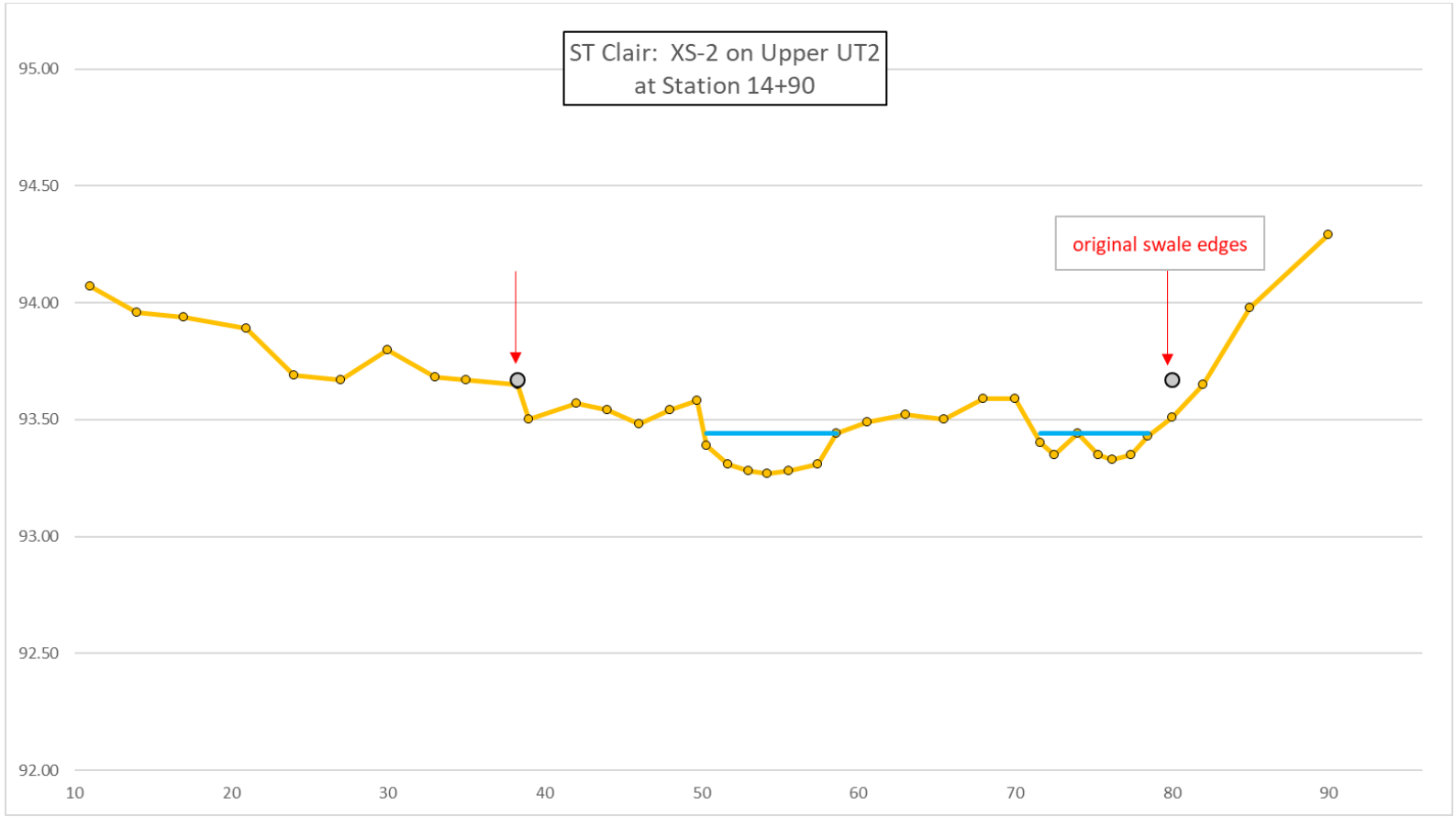
Most sincerely,

Scott King, LSS, PWS

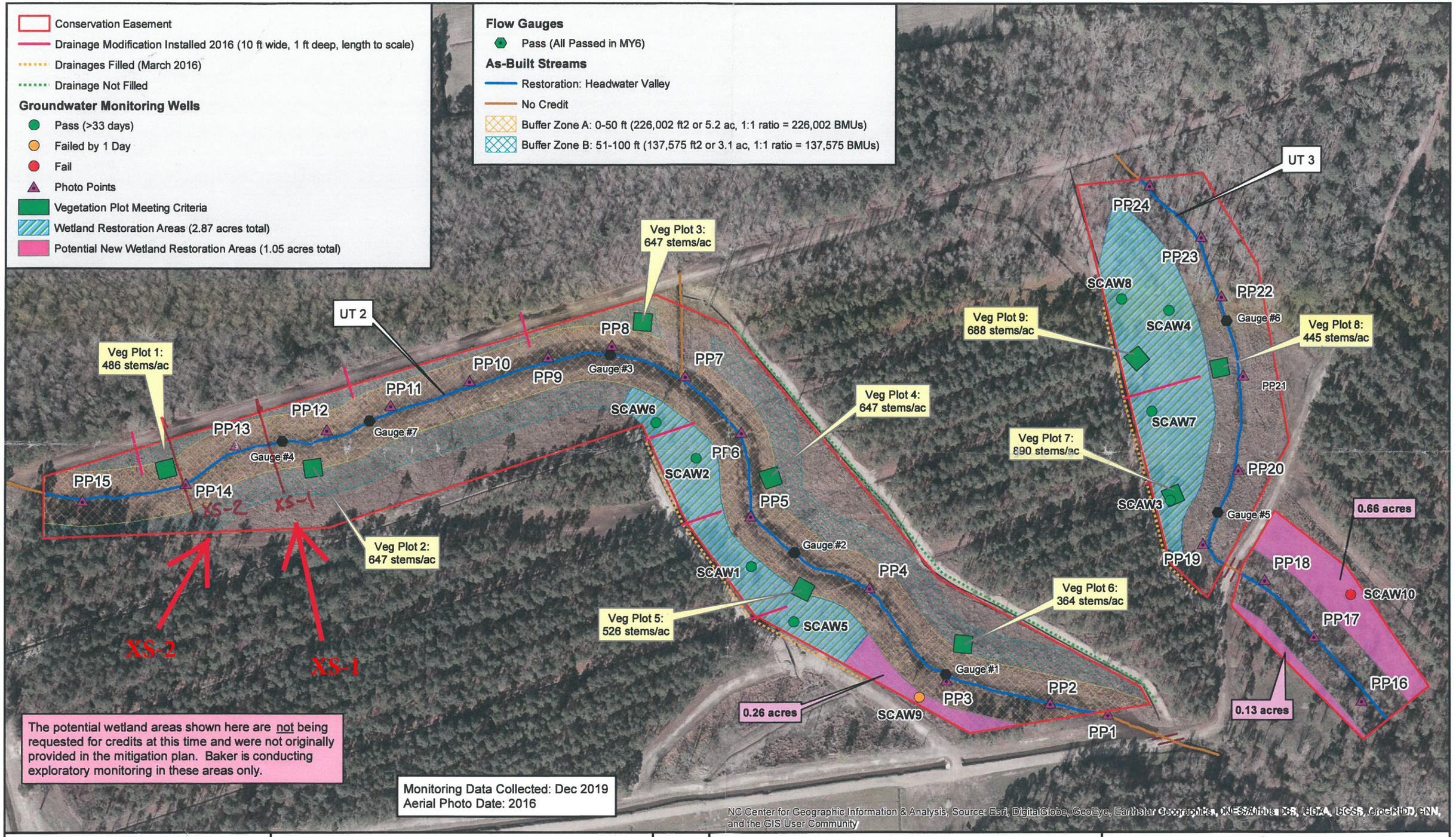
Scott.King@mbakerintl.com
919-219-6339 [M]

St Clair Cross Sections (collected 5/1/20):




ST Clair: XS-2 on Upper UT2
at Station 14+90
original swale edges
95.00
94.50
94.00
93.50
93.00
92.50
92.00
10
20
30
40
50
60
70
80
90

Cross-Section / Transect Location Map:



Michael Baker INTERNATIONAL

NCDEQ - Division of Mitigation Services
Project # 95015

N

0 250 500 Feet

Figure 2
Current Conditions Plan View: MY6
St. Clair Creek Site
Beaufort County, NC