
Monitoring Report – Year 3
FINAL VERSION
Edwards-Johnson Mitigation Project
Calendar Year of Data Collection: 2020

NCDEQ DMS Project Identification # 97080
NCDEQ DMS Contract # 6825
Neuse River Basin (Cataloging Unit 03020201)
USACE Action ID Number: SAW-2016-00883
NCDEQ DWR Project # 2016-0404
Johnston County, NC
Contracted Under RFP # 16-006477
Data Collection Period: September – October 2020
Submission Date: December 11, 2020



Prepared for:



North Carolina Department of Environmental Quality
Division of Mitigation Services
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Prepared by:



WATER & LAND SOLUTIONS

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Mitigation Project Name	Edwards-Johnson Mitigation Project	USACE Action ID	2016-00883
DMS ID	97080	DWR Permit	2016-0404 v2
River Basin	Neuse	Date Project Instituted	3/18/2016
Cataloging Unit	03020201	Date Prepared	4/21/2020
County	Johnston	Stream/Wet. Service Area	Neuse 03020201

 9/21/2020

Signature & Date of Official Approving Credit Release

- 1 - For NCDMS, no credits are released during the first milestone
- 2 - For NCDMS projects, the initial credit release milestone occurs when the as-built report (baseline monitoring report) has been made available to the NCIRT and posted it the NCDMS Portal, provided the following have been met:
- 1) Approved of Final Mitigation Plan
 - 2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
 - 3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.
 - 4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.
- 3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	Warm Stream Credits						
	Scheduled Releases %	Proposed Releases %	Proposed Released #	Not Approved # Releases	Approved Credits	Anticipated Release Year	Actual Release Date
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	906.930	0.000	906.930	2019	3/22/2019
3 - Year 1 Monitoring	10.00%	10.00%	302.310	302.310	0.000	2019	8/19/2019
4 - Year 2 Monitoring	10.00%	10.00%	604.620	0.000	604.620	2020	4/21/2020
5 - Year 3 Monitoring	10.00%					2021	
6 - Year 4 Monitoring	5.00%					2022	
7 - Year 5 Monitoring	10.00%					2023	
8 - Year 6 Monitoring	5.00%					2024	
9 - Year 7 Monitoring	10.00%					2025	
Stream Bankfull Standard	10.00%						
			Totals	302.310	1,511.550		

Total Gross Credits	3,023.100
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	1,511.500
Total Percentage Released	50.00%
Remaining Unreleased Credits	1,511.550

Notes

8/19/2019: No credit releases were approved by the NCIRT.

1/10/2020: DMS requesting release of credits for both monitoring years 1 and 2. 4/21/2021: IRT approved credit release for monitoring years 1 and 2.

Contingencies (if any)

Project Quantities

Mitigation Type	Restoration Type	Physical Quantity
Warm Stream	Restoration	2,949.000
Warm Stream	Preservation	741.000

Mitigation Project Name Edwards-Johnson Mitigation Project
 DMS ID 97080
 River Basin Neuse
 Cataloging Unit 03020201
 County Johnston

USACE Action ID 2016-00883
 DWR Permit 2016-0404 v2
 Date Project Instituted 3/18/2016
 Date Prepared 4/21/2020
 Stream/Wet. Service Area Neuse 03020201

							Stream Restoration Credits	Stream Restoration Equivalent Credits
Debits								
Beginning Balance (mitigation credits)							2,949.000	74.100
Released Credits							1,474.500	37.050
Unrealized Credits							0.000	0.000
Owning Program	Req. Id	TIP #	Project Name	USACE Permit #	DWR Permit #	DCM Permit #		
NCDOT Stream & Wetland ILF Program	REQ-008290	R-2721A	R-2721A - NC 540 - West of NC 55 to East of SR 1389	2009-02240	2018-1249		884.700	
NCDOT Stream & Wetland ILF Program	REQ-008187	I-5111 / I-4739	I-5111 / I-4739 - I-40 Widening (Wake & Johnston Counties)	2009-00556	2019-0593			22.230
Total Credits Debited							884.700	22.230
Remaining Available balance (Released credits)							589.800	14.820
Remaining balance (Unreleased credits)							1,474.500	37.050



December 11, 2020

NC Department of Environmental Quality

Division of Mitigation Services

Attn: Lindsay Crocker

217 West Jones Street, Suite 3000-A

Raleigh, NC 27603

RE: WLS Responses to NCDEQ DMS Review Comments for Task 9 Draft Monitoring Report Year 3 for the Edwards-Johnson Mitigation Project, NCDEQ DMS Full-Delivery Project ID #97080, Contract #006825, Neuse River Basin, Cataloging Unit 03020201, Johnston County, NC

Dear Ms. Crocker:

Water & Land Solutions, LLC (WLS) is pleased to present the Final Monitoring Report Year 3 for the Edwards-Johnson Mitigation Project to the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS). The Final Monitoring Report Year 3 were developed by addressing NCDEQ DMS's review comments.

Under this cover, we are providing the Final Monitoring Report Year 3, and the required digital data for each (the .pdf copies of the entire updated reports and the updated digital data) via electronic delivery. We are providing our written responses to NCDEQ DMS's review comments on the Draft Monitoring Report Year 3 below. Each of the DMS review comments is copied below in **bold** text, followed by the appropriate response from WLS in regular text:

Report:

- 1. DMS Comment: The project summary states that the site is "mostly meeting" for MY3 vegetation, but the report goes on to state that plots 3 and 4 are failing. Remove that statement in the summary as it is not accurate or consider other comments below in revision.** WLS Response: The word "mostly" was removed from the project summary statement. WLS updated vegetation Plots 3 and 4 to include stems planted in MY3 and the plots are now meeting MY3 success criteria.
- 2. DMS Comment: Page 6 and 7. Last sentence of paragraph 5.1 is incorrect, please review and revise. According to the table, confirm that there were 2 bankfull events in MY2 and 3 events in MY3.** WLS Response: The mitigation plan states, "Two separate bankfull events must be documented within the seven-year monitoring period. These two bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years. In addition to the two bankfull flow events, two "geomorphically significant" flow events (Qgs=0.66Q2) must also be documented during the monitoring period." As stated in the in the mitigation plan, the stream has met the bankfull requirements. The sentence in 5.1 has been updated to better reflect the requirements of the mitigation plan. Three bankfull events occurred in Year 2 and two bankfull events occurred in Year 3.
- 3. DMS Comment: The CCPV indicates areas of concern from MY2 were 0.43 (green shaded). Confirm that this is the acreage that was replanted with the ~245 plants (560 stems/acre)? Did WLS also replant the encroachment area along upper R1 (farm scallop)? If not, please add something to the text about the condition of that area.** WLS Response: The area on the CCPV that was replanted was ~0.43 acres (green) and

was planted with ~245 plants. The area of previous encroachment was planted in early 2019 and is in good vegetated condition (yellow).

- 4. DMS Comment: It is suggested in the text that VP 3 and 4 do not meet success because MY2 planted species were not included in the vegetative table and/or counted toward success. If this is true, update monitoring data and report to report vegetation for MY3 (including replants). The IRT guidance on not counting replants toward success is specific to MY5 and MY7 and does not apply in this case.** WLS Response: WLS misinterpreted the guidance in relation to counting newly planted stems. VP 3 and 4 are meeting success criteria by including the newly planted stems. Table 6 and section 5.5 have been updated accordingly.
- 5. DMS Comment: Because the lower energy sections of this stream (R3 upper and lower) occur where the stream flattens out, IRT has previously expressed concern regarding maintaining single thread and moving sediment through the system. DMS and WLS should watch these sections closely, as the 20% increase in bankfull area for pool at XS-6 may indicate sediment storage is out of balance there. Please provide any additional thoughts on how those areas are developing and maintaining flow and sediment balance in the report.** WLS Response: XS-6 is located in a pool on R3 upper. It is expected for pools to fluctuate as sediment is transported through the system, especially in a year of well above average rainfall. In comparison to the overlay graph, XS-6 is very similar to the as-built surveyed condition. Due to the low number of points taken during the MY0 as-built survey, WLS opted to use MY1 to calculate bankfull areas which contributed to the 20% change. Based on MY0-MY1 survey, XS-6 pool accumulated sediment, which was flushed out during MY3 heavy flows. During the fall monitoring data collection and visual survey, R3 upper is a stable and functioning as a single-thread stream system. R3 lower is maintaining stream flow throughout the year in a multi-threaded stream system, very similar to that found at the Pen Dell (DMS Project #97079) R5 preservation section located just north of the Project. WLS will continue to carefully monitor this channel segment.
- 6. DMS Comment: Update rain report for October and November if possible.** WLS Response: WLS updated Figure 5 with the October and November rain total.
- 7. DMS Comment: Confirm that the stream photos taken 3/2020 are still relevant for all streams in MY3.** WLS Response: All stream photos taken in March 2020 are still relevant for all locations in MY3. Photos were taken during the spring visual survey visit prior to the growing season.

Digital Deliverables:

- 1. DMS Comment: Please provide the “stream problem area” and “encroachment area planted” shapefiles for the current monitoring year that were included in Figure 1.** WLS Response: The shapefiles for “stream problem area” and “encroachment area planted” are included in the e-data.
- 2. DMS Comment: Include the visual assessment photos as JPEGs rather than a single PDF.** WLS Response: JPEGs of all photos are now included in the e-data.

Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

Catherine Manner

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1 Project Summary

Water and Land Solutions, LLC (WLS) completed the construction and planting of the Edwards-Johnson Mitigation Project (Project) full-delivery project for the North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) in March 2018. The Project is located in Johnston County, North Carolina between the Community of Archer Lodge and the Town of Wendell at 35.7251°, 78.35636°. The Project site is located in the NCDEQ Sub-basin 03-04-06, in the Lower Buffalo Creek Priority Sub-watershed 030202011504.

The Project involved the restoration, preservation, and permanent protection of four stream reaches (R1, R2, R3, and R4) totaling 3,729 linear feet of streams and their riparian buffers. WLS staff visited the site several times throughout Monitoring Year 3 (MY3) for monitoring activities. Data collection occurred between September and October 2020 (Table 2). This report presents the data for MY3. The Project meets the MY3 success criteria for stream hydrology and stream horizontal and vertical stability. Two low-stem-density areas totaling approximately 0.43 acres were replanted in February 2020. Based on these results, the Project is meeting MY3 success criteria and is expected to meet the Monitoring Year 4 (MY4) success criteria in 2021. Vegetation problem areas are present but minimal.

2 Project Background

2.1 Project Location, Setting, and Existing Conditions

The Project site is located in the Lower Buffalo Creek Priority Sub-watershed 030202011504 study area of the Neuse 01 Regional Watershed Plan, in the Wake-Johnston Collaborative Local Watershed Plan, and in Targeted Local Watershed 03020201180050.

The catchment area is 223 acres and has an impervious cover less than one percent. The dominant surrounding land uses are agriculture and mixed forest. Prior to construction, some of the riparian buffers were less than 50 feet wide.

2.2 Mitigation Project Goals and Objectives

WLS established project mitigation goals and objectives based on the resource condition and functional capacity of the watershed to improve and protect diverse aquatic resources comparable to stable headwater stream systems within the Piedmont Physiographic Province. The proposed mitigation types and design approaches described in the final approved mitigation plan considered the general restoration and resource protection goals and strategies outlined in the 2010 Neuse River Basin Restoration Priority Plan (RBRP). The functional goals and objectives were further defined in the 2013 Wake-Johnston Collaborative Local Watershed Plan and 2015 Neuse 01 Regional Watershed Plan and include:

- Reducing sediment and nutrient inputs to the upper Buffalo Creek Watershed,
- Restoring, preserving, and protecting wetlands, streams, riparian buffers, and aquatic habitat,
- Implementing agricultural BMPs and stream restoration in rural catchments together as “project clusters”.

The following site-specific goals were developed to address the primary concerns outlined in the LWP and RWP and include:



- Restore stream and floodplain interaction and geomorphically stable conditions by reconnecting historic flow paths and promoting more natural flood processes,
- Improve and protect water quality by reducing streambank erosion, nutrient and sediment inputs,
- Restore and protect riparian buffer functions and habitat connectivity in perpetuity by recording a permanent conservation easement,
- Implement agricultural BMPs to reduce nonpoint source inputs to receiving waters.

To accomplish these site-specific goals, the following function-based objectives will be measured and included with the performance standards to document overall project success as described in the table below:

Functional Category (Level)	Functional Goal / Parameter	Functional Design Objective
Hydrology (Level 1)	Improve Base Flow	Remove man-made pond dam and restore a more natural flow regime and aquatic passage.
Hydraulics (Level 2)	Reconnect Floodplain / Increase Floodprone Area Widths	Lower BHRs from >2.0 to 1.0-1.2 and maintain ERs at 2.2 or greater.
Geomorphology (Level 3)	Improve Bedform Diversity	Increase riffle/pool percentage to 70/30 and pool-to-pool spacing ratio 4-7X bankfull width.
	Increase Lateral Stability	Reduce BEHI/NBS streambank erosion rates comparable to downstream reference condition and stable cross-section values.
	Enhance Riparian Buffer Vegetation	Plant or protect native species vegetation a minimum 50' wide from the top of the streambanks with a composition/density comparable to reference condition.
Physicochemical (Level 4)	Improve Water Quality	Install water quality treatment basins along the riparian corridor and reduce sediment and nutrient levels.
Biology (Level 5)	Improve Macroinvertebrate Community and Aquatic Species Health	Incorporate native woody debris and bedform diversity into channel and change DWR bioclassification rating from 'Poor' to a minimum 'Fair' by Monitoring Year 7.

2.3 Project History, Contacts, and Timeframe

The chronology of the project history and activity is presented in Table 2. Relevant project contact information is presented in Table 3. Relevant project background information is presented in Table 4.

3 Project Mitigation Components

Refer to Figure 1 and Table 1 for the project components/asset information. A recorded conservation easement consisting of 10.96 acres protects and preserves all stream reaches, existing wetland areas, and riparian buffers in perpetuity.

3.1 Stream Mitigation Types and Approaches

Stream restoration practices involved raising the existing streambed and reconnecting the stream to the relic floodplain. Some portions of the existing degraded channels that were abandoned within the restoration areas were filled to decrease surface and subsurface drainage and raise the local water table.



The project also included restoring, enhancing, and protecting riparian buffers and riparian wetlands within the conservation easement. The vegetative components of this project included stream bank, floodplain, and transitional upland zones planting. The Site was planted with native species riparian buffer vegetation (Appendix C) and now protected through a permanent conservation easement. Table 1 (Appendix A) and Figure 1 (Appendix B) provide a summary of the project components.

3.1.1 R1 Preservation

Preservation was implemented along this reach since the existing stream and wetland system is mostly stable with a mature riparian buffer due to minimal historic impacts. The preservation area is being protected in perpetuity through a permanent conservation easement. This approach will extend the wildlife corridor from the Buffalo Creek floodplain boundary throughout a majority of the riparian valley, while providing a hydrologic connection and critical habitat linkage within the catchment area.

3.1.2 R2 Restoration

Work along R2 involved a Priority Level I Restoration approach by raising the bed elevation and reconnecting the stream with its abandoned floodplain. This approach will promote more frequent over bank flooding in areas with hydric soils, thereby creating favorable conditions for wetland re-establishment. The reach was restored using appropriate riffle-pool morphology with a conservative meander planform geometry that accommodates the valley slope and width. This approach allowed restoration of a stable channel form with appropriate bedform diversity, as well as, improved biological functions through increased aquatic and terrestrial habitats. Proposed in-stream structures included constructed wood riffles for grade control and habitat, log j-hook vanes, and log weirs/jams for encouraging step-pool formation energy dissipation, bank stability, and bedform diversity. Riparian buffers greater than 50 feet were enhanced and will be protected along the entire length of R2. Mature trees and significant native vegetation were protected and incorporated into the design.

Bioengineering techniques such as vegetated geolifts and live stakes were also used to protect streambanks and promote woody vegetation growth along the streambanks. The existing unstable channel was filled to an elevation sufficient to connect the new bankfull channel to its active floodplain using suitable fill material excavated from the newly restored channels and remnant spoil piles. Additionally, water quality treatment basins were installed to reduce direct sediment and nutrient inputs.

3.1.3 R3 (Upper Reach) Restoration

A Priority Level I Restoration approach was implemented for the upstream portion to improve stream functions and water quality. Prior to restoration activities, the reach exhibited both lateral and vertical instability, as shown by active headcuts and moderate bank erosion. A new single-thread meandering channel was constructed offline in this area before reconnecting with multiple relic channel features and the existing channel alignment farther downstream. In-stream structures, including log riffles, log weirs and log vanes were used to dissipate flow energy, protect streambanks, and eliminate potential for future incision. Shallow floodplain depressions and vernal pools were created or preserved in the floodplain to provide habitat diversity, nutrient cycling, and improved treatment of overland flows. Restored streambanks were graded to stable side slopes and the floodplain was reconnected to further promote stability and hydrological function.



3.1.4 R3 (Lower Reach) Preservation

Preservation was implemented along this reach since the existing stream and wetland system is mostly stable with a mature riparian buffer due to minimal historic impacts. The preservation is being protected in perpetuity through a permanent conservation easement. This approach will extend the wildlife corridor from the Buffalo Creek floodplain boundary throughout a majority of the riparian valley, while providing a hydrologic connection and critical habitat linkage within the catchment area.

3.1.5 R4 Restoration

The restoration of R4 involved raising the existing bed elevation gradually to reconnect the stream with its active floodplain. Prior to restoration activities, the existing channel began experiencing backwater conditions and sediment aggradation from a man-made pond. The failing dam and remnant spoil piles were removed, and the pond was drained to reconnect the new stream channel with its geomorphic floodplain. Channel and floodplain excavation in this reach segment included the removal of shallow legacy sediments (approx. 12” depth) to accommodate a new bankfull channel and in-stream structures, as well as a more natural step-pool morphology using grade control structures in the steeper transitional areas. Shallow floodplain depressions were created to provide habitat diversity, nutrient cycling, and improved treatment of overland flows. Riparian buffers greater than 50 feet were restored and protected along all R4.

4 Performance Standards

The applied success criteria for the Project will follow necessary performance standards and monitoring protocols presented in final approved mitigation plan. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the project throughout the monitoring period. Monitoring activities will be conducted for a period of seven years with the final duration dependent upon performance trends toward achieving project goals and objectives.

The following Proposed Monitoring Plan Summary from the approved final mitigation plan summarizes the measurement methods and performance standards. Specific success criteria components and evaluation methods follow.

Functional Category (Level)	Project Goal / Parameter	Measurement Method	Performance Standard	Potential Functional Uplift
Hydrology (Level 1)	Improve Base Flow Duration and Overbank Flows (i.e. channel forming discharge)	Remove man-made pond, pressure transducer, regional curve, regression equations, catchment assessment	Maintain seasonal flow for a minimum of 30 consecutive days during normal annual rainfall.	Create a more natural and higher functioning headwater flow regime and provide aquatic passage.
Hydraulics (Level 2)	Reconnect Floodplain / Increase Floodprone Area Widths	Bank Height Ratio, Entrenchment Ratio, crest gauge	Maintain average BHRs at 1.2 and increase ERs at 2.2 or greater and document bankfull/geomorphically significant flow events.	Provide temporary water storage and reduce erosive forces (shear stress) in channel during larger flow events.
	Improve Bedform Diversity	Pool to Pool spacing, riffle-pool sequence, pool max depth ratio, Longitudinal Profile	Increase riffle/pool percentage and pool-to-pool spacing ratios compared to reference reach conditions.	Provide a more natural stream morphology, energy dissipation and aquatic habitat/refugia.



Functional Category (Level)	Project Goal / Parameter	Measurement Method	Performance Standard	Potential Functional Uplift
Geomorphology (Level 3)	Increase Vertical and Lateral Stability	BEHI / NBS, Cross-sections and Longitudinal Profile Surveys, visual assessment	Decrease streambank erosion rates comparable to reference condition cross-section, pattern and vertical profile values.	Reduce sedimentation, excessive aggradation, and embeddedness to allow for interstitial flow habitat.
Geomorphology (Level 3)	Establish Riparian Buffer Vegetation	CVS Level I & II Protocol Tree Veg Plots (Strata Composition and Density), visual assessment	Within planted portions of the site, a minimum of 320 stems per acre must be present at year three; a minimum of 260 stems per acre must be present at year five; and a minimum of 210 stems per acre must be present at year seven.	Increase woody and herbaceous vegetation will provide channel stability and reduce streambank erosion, runoff rates and exotic species vegetation.
Physicochemical (Level 4)	Improve Water Quality	N/A	N/A	Reduction of excess nutrients and organic pollutants will increase the hyporheic exchange and dissolved oxygen (DO) levels.
Biology (Level 5)	Improve Benthic Macroinvertebrate Communities and Aquatic Health	DWR Small Stream/Qual v4 sampling, IBI (MY3, MY5, MY7)	N/A	Increase leaf litter and organic matter critical to provide in-stream cover/shade, wood recruitment, and carbon sourcing.

Note: Level 4 and 5 project parameters and monitoring activities will not be tied to performance standards nor required to demonstrate success for credit release.

4.1 Streams

4.1.1 Stream Hydrology

Two separate bankfull events must be documented within the seven-year monitoring period. These two bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years. In addition to the two bankfull flow events, two geomorphically significant flow events ($Q_{gs}=0.66Q_2$) must also be documented during the monitoring period. There are no temporal requirements regarding the distribution of the geomorphically significant flows.

4.1.2 Stream Profiles, Vertical Stability, and Floodplain Access

Stream profiles, as a measure of vertical stability will be evaluated by looking at Bank Height Ratios (BHR). The BHR shall not exceed 1.2 along the restored project reaches. This standard only applies to the restored project reaches where BHRs were corrected through design and construction. In addition, observed bedforms should be consistent with those observed for channels of the design stream type(s).

4.1.3 Stream Horizontal Stability

Cross-sections will be used to evaluate horizontal stream stability. There should be little change expected in as-built restoration cross-sections. If measurable changes do occur, they should be evaluated to determine if the changes represent a movement toward a more unstable condition (e.g., downcutting, erosion) or a movement towards increased stability (e.g., settling, vegetation establishment, deposition)



along the streambanks, decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen Stream Classification method and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

4.1.4 Streambed Material Condition and Stability

After construction, there should be minimal change in the particle size distribution of the streambed materials, over time, given the current watershed conditions and future sediment supply regime. Since the streams are predominantly sand-bed systems with minimal fine/coarse gravel, some coarsening is anticipated after restoration activities, however significant changes in particle size distribution are not expected. Streambed material condition is supplementary and is not part of success criteria.

4.1.5 Jurisdictional Stream Flow

The restored stream systems must be classified as at least intermittent, and therefore must exhibit base flow with at least 30 days of continuous flow during a year with normal rainfall conditions as described in the approved mitigation plan.

4.2 Vegetation

Vegetative restoration success for the project during the intermediate monitoring years will be based on the survival of at least 320, three-year-old planted trees per acre at the end of Year 3 of the monitoring period and at least 260, five-year-old, planted trees per acre at the end of Year 5 of the monitoring period. The final vegetative restoration success criteria will be achieving a density of not less than 210, seven-year-old planted stems per acre in Year 7 of monitoring. Planted vegetation (for projects in coastal plain and piedmont counties) must average seven feet in height at Year 5 of monitoring and 10 feet in height at Year 7 of monitoring. Volunteer stems will only be counted toward success if they are surviving for at least 2 years, are at least 12" tall, and are species from the approved planting list. For all of the monitoring years (Year 1 through Year 7), the number of Red maple (*Acer rubrum*) stems cannot exceed 20 percent of the total stems in any of the vegetation monitoring plots.

5 Monitoring Year 3 Assessment and Results

Annual monitoring was conducted during MY3 in accordance with the monitoring plan as described in the approved mitigation plan to document the site conditions. All monitoring device locations are depicted on the CCPV (Figure 1). MY3 results are provided in the appendices. The Project meets the MY3 success criteria for stream hydrology, stream horizontal and vertical stability, and vegetation. Stream Hydrology

5.1 Stream Hydrology

Monitoring to document the occurrence of the two required bankfull events (overbank flows) and the two required geomorphically significant flow events ($Q_{gs}=0.66Q_2$) within the monitoring period, along with floodplain access by flood flows, is being conducted using a crest gauge, installed on December 12, 2018, on the floodplain of and across the dimension of the restored channel at the left top of bank of Reach R2, immediately upstream of the confluence of Reach R2 and R4 (Figure 1), to record the watermark associated with the highest flood stage between monitoring site visits. Photographs are also being used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits. Two bankfull events occurred during MY3 (see table below). These events were documented using the described photography (Table 8). The documented occurrence of these two flow events in MY3



and the three events during MY2 satisfies the requirement of the occurrence of four bankfull events (overbank flows) in at least two separate years.

Monitoring Year	Documented Bankfull Events	Requirement Met
2	3	No
3	2	Yes

5.2 Stream Horizontal & Vertical Stability

Visual assessment and monitoring of 8 permanent cross sections were utilized for assessment of MY3 horizontal and vertical stream stability. The visual assessments for each stream reach concluded that the MY3 stream channel pattern and longitudinal profiles, instream structure locations, still closely match the profile design parameters and MY0/baseline conditions. The MY3 plan form geometry or pattern still fall within acceptable ranges of the design parameters for all restored reaches. One cross section, XS-6 (pool) located at station 29+56, exhibited a 20% change in bank height ratio when compared to MY1 data (BHR for pools is not used to determine stability). This is due to the movement of sediment throughout the stream system and is common in pools. It is not an indication of instability in the reach, based on visual assessment.

One area of erosion found during the visual assessments of MY2 totaling approximately 15 linear feet and located in a pool at a meander bend of R4 at approximately STA 18+00 has stabilized and no remedial action is needed. This area will continue to be monitored in MY4. An additional area on the right bank of R2 located at the transition of R1 to R2 at station 16+13 has approximately 10 linear feet of undercut bank and was noted during the spring 2020 visual assessment. This area is where the transition from preservation to restoration occurred. This area stabilized throughout MY3 and will continue to be monitored in MY4. Photographs of the two areas can be found in Appendix B. Overall, only minor (non-systemic) channel adjustments in riffle slopes, pool depths and pattern were observed and therefore did not present a stability concern or indicate a need for immediate remedial action.

5.3 Streambed Material Condition and Stability

A representative sediment sample was collected to assess streambed material condition and stability. The dominant substrate for the project was verified as very coarse sand. The post-construction riffle substrate sampling indicated no significant change in streambed material condition or stability during MY3.

5.4 Jurisdictional Stream Flow Documentation

Jurisdictional stream flow documentation and monitoring of restored intermittent reaches is achieved using a flow gauge (continuous-read pressure transducers) within the thalweg of the channel towards the middle portion of the Reach R4 (Figure 1). Additionally, to determine if rainfall amounts are normal for the given year, precipitation data was obtained from CLAY Central Crops Research Station in Johnston County, approximately nine miles southwest of the site. The flow gauge documented that the stream exhibited surface flow for a minimum of 30 consecutive days throughout some portion of the year during a year with normal rainfall conditions (Figure 4).



5.5 Vegetation

Vegetation monitoring for MY3 was conducted utilizing the four vegetation monitoring plots, with monitoring conducted in accordance with the CVS-EEP Level I & II Monitoring Protocol (CVS, 2008) and DMS Stream and Wetland Monitoring Guidelines (DMS, 2017). See Figure 1 in Appendix B for the vegetation monitoring plot locations. Summary data and photographs of each plot can be found in Appendix B.

Areas of low stem density were identified during MY2 in the vicinity of Plots 3 and 4 and were replanted in February 2020 (Figure 1) with approximately 245 stems with species from the approved planting list from the mitigation plan. The planting list and quantities are included in Appendix C. Plots 3 and 4 now meet required success criteria with 324 and 445 stems/acre, respectively.

The MY3 vegetation monitoring was also conducted utilizing visual assessment throughout the easement. One area of concern located on the left bank of R2 totaling approximately 0.35 acres was noted. Replanting of the area using containerized trees to increase survivability will occur prior to March 15th to meet success criteria for MY4 with species from the approved planting list from the mitigation plan. The results of the visual assessment did not indicate any additional significant negative changes to the existing vegetation community.

5.6 Wetlands

Wetland mitigation credits are not contracted or proposed for this project. One groundwater monitoring well was installed during the baseline monitoring along Reach R3. Two additional groundwater monitoring wells are installed along Reach R3 near station 33 + 75 and 37 + 00 (Figure 4). These wells were installed to document groundwater levels within the restoration area for reference and comparison to the preservation areas, at the request of the NCIRT (DWR). No performance standards for wetland hydrology success was proposed in the Mitigation Plan and therefore wetland mitigation monitoring is not included for this project. The well data are presented in the appendices.



6 References

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Appendices



Appendix A – Background Tables and Figures

Table 1. Mitigation Assets and Components
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Project Component (reach ID, etc.) ¹	Wetland Position and HydroType ²	Existing Footage or Acreage	Stationing	Mitigation Plan Footage or Acreage	As-Built Footage or Acreage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits*	Notes/Comments
R1		611	10+00 -16+11	611	611	P	-	10	61	Invasive Control, Permanent Conservation Easement.
R2		1007	16+11 - 27+94	1183	1180	R	PI	1	1183	Full Channel Restoration, Invasive Control, Permanent Conservation Easement.
R3 (upper)		629	27+94 - 36+09	815	853	R	PI	1	815	Full Channel Restoration, Invasive Control, Permanent Conservation Easement.
R3 (lower)		240	36+09 - 37+39	130	149	P	-	10	13	Invasive Control, Permanent Conservation Easement.
R4		815	10+00 - 19+36	951	936	R	PI/PII	1	951	Full Channel Restoration, Pond Removal, Invasive Control, Permanent Conservation Easement.

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)
		Riverine	Non-Riverine	
Restoration	2949			
Enhancement				
Enhancement I				
Enhancement II				
Creation				
Preservation	741			
High Quality Pres				

Overall Assets Summary

Asset Category	Overall Credits*
Stream	3,023
RP Wetland	
NR Wetland	

* Mitigation Credits are from the final approved mitigation plan, as verified by the as-built survey

**Table 2. Project Activity and Reporting History
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)**

Elapsed Time Since grading complete:	2 yrs 6 months
Elapsed Time Since planting complete:	2 yrs 6 months
Number of reporting Years⁰:	3

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Project Contract Execution	N/A	3/18/2016
Final Mitigation Plan Submittal	N/A	9/29/2017
Section 404 General (Regional and Nationwide) Permit Verification	N/A	1/12/2017
Begin Construction	N/A	3/23/2018
Mitigation Site Earthwork Completed	N/A	5/5/2018
Mitigation Site Planting Completed	N/A	5/5/2018
Installation of Monitoring Devices Completed	N/A	5/14/2018
Installation of Survey Monumentation and Boundary Marking	N/A	8/13/2018
As-built/Baseline (Year 0) Monitoring Report Submittal	6/23/2018	12/3/2018
Year 1 Monitoring Report Submittal	11/24/2018	12/4/2018
Year 2 Monitoring Report Submittal	10/18/2019	12/31/2019
Year 3 Monitoring Report Submittal	10/14/2019	12/11/2020
Year 4 Monitoring Report Submittal	N/A	N/A
Year 5 Monitoring Report Submittal	N/A	N/A
Year 6 Monitoring Report Submittal	N/A	N/A
Year 7 Monitoring Report Submittal	N/A	N/A

Table 3. Project Contacts Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)	
Mitigation Provider	Water & Land Solutions, LLC 7721 Six Forks Road, Suite 130, Raleigh, NC 27615
Primary Project POC	Catherine Manner Phone: 571-643-3165
Construction Contractor	RiverWorks Construction 114 W. Main Street, Suite 106, Clayton, NC 27520
Primary Project POC	Bill Wright Phone: 919-590-5193
Survey Contractor (Existing Condition Surveys)	WithersRavenel 115 MacKenan Drive, Cary, NC 27511
Primary Project POC	Marshall Wight, PLS Phone: 919-469-3340
Survey Contractor (Conservation Easement, Construction and As-Builts Surveys)	True Line Surveying, PC 205 West Main Street, Clayton, NC 27520
Primary Project POC	Curk T. Lane, PLS 919-359-0427
Planting Contractor	RiverWorks Construction 114 W. Main Street, Suite 106, Clayton, NC 27520
Primary Project POC	Bill Wright Phone: 919-590-5193
Seeding Contractor	RiverWorks Construction 114 W. Main Street, Suite 106, Clayton, NC 27520
Primary Project POC	Bill Wright Phone: 919-590-5193
Seed Mix Sources	Green Resource 5204 Highgreen Ct., Colfax, NC 27235
	Rodney Montgomery Phone: 336-215-3458
Nursery Stock Suppliers	Foggy Mountain Nursery (Live Stakes) 797 Helton Creek Rd, Lansing, NC 28643 Glenn Sullivan Phone: 336-977-2958
	Dykes & Son Nursery (Bare Root Stock) 825 Maude Etter Rd, Mcminnville, Tn 37110 Jeff Dykes Phone: 931-668-8833
Monitoring Performers	Water & Land Solutions, LLC 7721 Six Forks Road, Suite 130, Raleigh, NC 27615
Stream Monitoring POC	Emily Dunnigan Phone: 269-908-6306
Vegetation Monitoring POC	Emily Dunnigan Phone: 269-908-6306

Table 4. Project Information and Attributes

Project Name	Edwards-Johnson Mitigation Project				
County	Johnston				
Project Area (acres)	11.0				
Project Coordinates (latitude and longitude)	35.7245361 N, -78.3570806 W				
Planted Acreage (Acres of Woody Stems Planted)	3.69				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Neuse				
USGS Hydrologic Unit 8-digit	03020201				
DWR Sub-basin	30406				
Project Drainage Area (Acres and Square Miles)	223 acres, 0.35 sq mi				
Project Drainage Area Percentage of Impervious Area	2.30%				
CGIA Land Use Classification	2.01.03, 2.99.05, 413, 4.98 (33% crops/hay, 16% pasture, 51% mixed forest)				
Reach Summary Information					
Parameters	Reach 1	Reach 2	Reach 3 (upper)	Reach 3 (lower)	Reach 4
Length of reach (linear feet)	611	1173	770	130	1176
Valley confinement (Confined, moderately confined, unconfined)	unconfined	unconfined	unconfined	unconfined	unconfined
Drainage area (Acres and Square Miles)	96 acres, 0.15 sq mi	120 acres, 0.19 sq mi	211 acres, 0.33 sq mi	223 acres, 0.35 sq mi	55 acres, 0.09 sq mi
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Perennial	Perennial	Intermittent
NCDWR Water Quality Classification	C; NSW	C; NSW	C;NSW	C; NSW	C; NSW
Stream Classification (existing)	C5	G5c	E5(incised)	E5(incised)	G5c/Pond
Stream Classification (proposed)	C5	C5	C5	C5, D5	C5
Evolutionary trend (Simon)	I	III/IV	IV	V	III/IV
FEMA classification	N/A	N/A	N/A	Zone AE	N/A
Wetland Summary Information					
Parameters	Wetland 1	Wetland 2	Wetland 3		
Size of Wetland (acres)	N/A	N/A	N/A		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)					
Mapped Soil Series					
Drainage class					
Soil Hydric Status					
Source of Hydrology					
Restoration or enhancement method (hydrologic, vegetative etc.)					
Regulatory Considerations					
Parameters	Applicable?	Resolved?	Supporting Docs?		
Water of the United States - Section 404	Yes	Yes	Categorical Exclusion		
Water of the United States - Section 401	Yes	Yes	Categorical Exclusion		
Endangered Species Act	No	Yes	Categorical Exclusion		
Historic Preservation Act	No	N/A	Categorical Exclusion		
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A		
FEMA Floodplain Compliance	Yes	Yes	Categorical Exclusion		
Essential Fisheries Habitat	No	N/A	Categorical Exclusion		



Appendix B – Visual Assessment Data

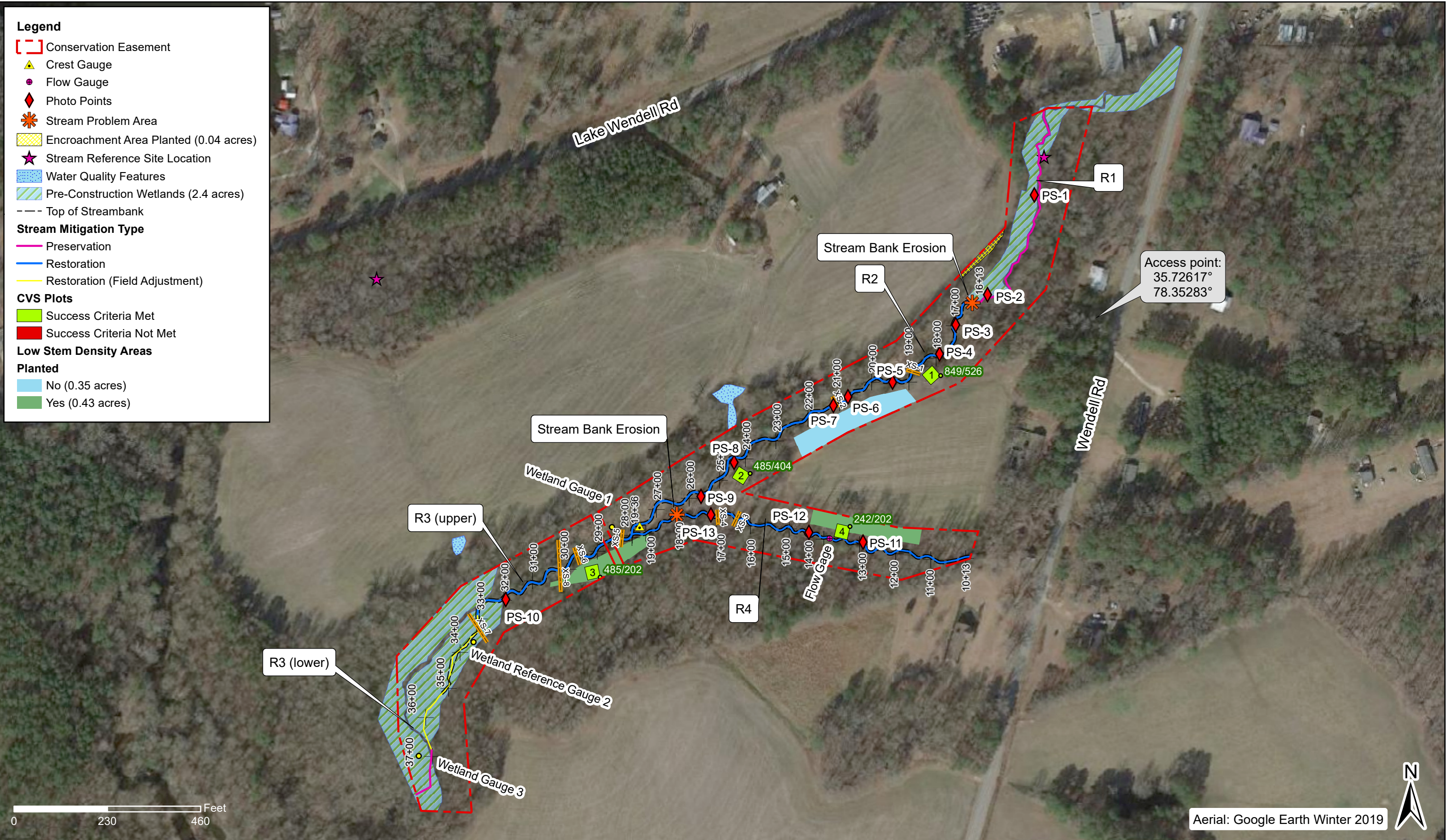


Table 5.
Project
Reach ID
Assessed Length

Visual Stream Morphology Stability Assessment
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
R1, R2, R3 (upper) and R3 (lower)
3609

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	15	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.			1	10	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
Totals					2	25	100%	0	0	100%
2. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	47	47			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	24	24			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	11	11			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	14	14			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	12	12			100%			

Table 5a. Project Planted Acreage ¹		Vegetation Condition Assessment Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080) 3.6					
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage	
1. Bare Areas	Very limited cover of both woody and herbaceous material.	1 acre	Pattern and Color	0	0.00	0.0%	
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	solid light blue	1	0.35	9.7%	
				Total	1	0.35	9.7%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%	
				Cumulative Total	1	0.35	9.7%

Easement Acreage ²		10.97				
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern ⁴	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	0	0.00	0.0%
5. Easement Encroachment Areas ³	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

¹ = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

² = The acreage within the easement boundaries.

³ = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

⁴ = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern species are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likely trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly early in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolizing invasives polygons, particularly for situations where the condition for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.



PS-1, Reach R1, facing upstream, April 12, 2018 (MY-00)



PS-1, Reach R1, facing upstream, March 10, 2020 (MY-03)



PS-2, Reach R1, facing downstream, Dec 6, 2018 (MY-01)



PS-2, Reach R1, facing downstream, March 10, 2020 (MY-03)



PS-3, Reach R2, facing upstream, Sta 17+00, April 23, 2018 (MY-00)



PS-3, Reach R2, facing upstream, Sta 17+00, March 10, 2020 (MY-03)



PS-4, Reach R2, facing downstream, Sta 18+00, April 23, 2018 (MY-00)



PS-4, Reach R2, facing downstream, Sta 18+00, March 10, 2020 (MY-03)



PS-5, Reach R2, facing downstream, Sta 19+50, Sept 17, 2018 (MY-00)



PS-5, Reach R2, facing downstream, Sta 19+50, March 10, 2020 (MY-03)



PS-6, Reach R2, facing upstream, Sta 20+75, April 23, 2018 (MY-00)



PS-6, Reach R2, facing upstream, Sta 20+75, March 10, 2020 (MY-03)



PS-7, Reach R2, facing downstream, Sta 21+00, April 23, 2018 (MY-00)



PS-7, Reach R2, facing downstream, Sta 21+00, March 10, 2020 (MY-03)



PS-8, Reach R2, facing downstream, Sta 24+50, April 23, 2018 (MY-00)



PS-8, Reach R2, facing downstream, Sta 24+50, March 10, 2020 (MY-03)



PS-9, Reach R2, facing upstream, Sta 25+75, April 23, 2018 (MY-00)



PS-9, Reach R2, facing upstream, Sta 25+75, March 10, 2020 (MY-03)



PS-10, Reach R3, facing downstream, Sta 32+00, April 19, 2018 (MY-00)



PS-10, Reach R3, facing downstream, Sta 32+00, March 10, 2020 (MY-03)



PS-11, Reach R4, facing upstream, Sta 13+00, June 11, 2018 (MY-00)



PS-11, Reach R4, facing upstream, Sta 13+00, March 10, 2020(MY-03)



PS-11, Reach R4, facing downstream, Sta 13+00, June 11, 2018 (MY-00)



PS-11, Reach R4, facing downstream, Sta 13+00, March 10, 2020 (MY-03)



PS-12, Reach R4, facing upstream, Sta 14+00, June 11, 2018 (MY-00)



PS-12, Reach R4, facing upstream, Sta 14+00, March 10, 2020 (MY-03)



PS-13, Reach R4, facing upstream, Sta 17+00, June 11, 2018 (MY-00)



PS-13, Reach R4, facing upstream, Sta 17+00, March 10, 2020 (MY-03)



Veg Plot 1, May 14, 2018 (MY-00)



Veg Plot 1, October 13, 2020 (MY-03)



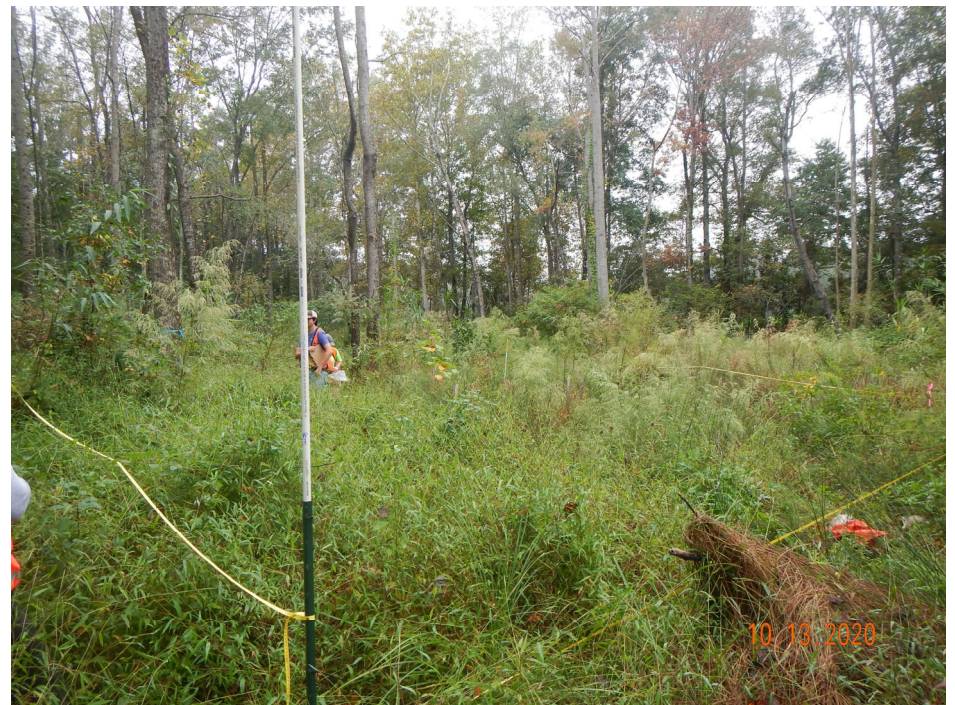
Veg Plot 2, May 14, 2018 (MY-00)



Veg Plot 2, October 13, 2020 (MY-03)



Veg Plot 3, May 14, 2018 (MY-00)



Veg Plot 3, October 13, 2020 (MY-03)



Veg Plot 4, May 14, 2018 (MY-00)
*plot origin at corner to the right



Veg Plot 4, October 13, 2020 (MY-03)



Appendix C – Vegetation Plot Data

Table 6b: February 2020 Replanting List

Quantity	Species	Type
50	<i>Betula nigra</i>	bare root
50	<i>Plantanus occidentalis</i>	bare root
25	<i>Quercus michauxii</i>	bare root
50	<i>Betula nigra</i>	1 gallon
20	<i>Quercus michauxii</i>	1 gallon
25	<i>Acer rubrum</i>	1 gallon
25	<i>Liriodendron tulipifera</i>	1 gallon



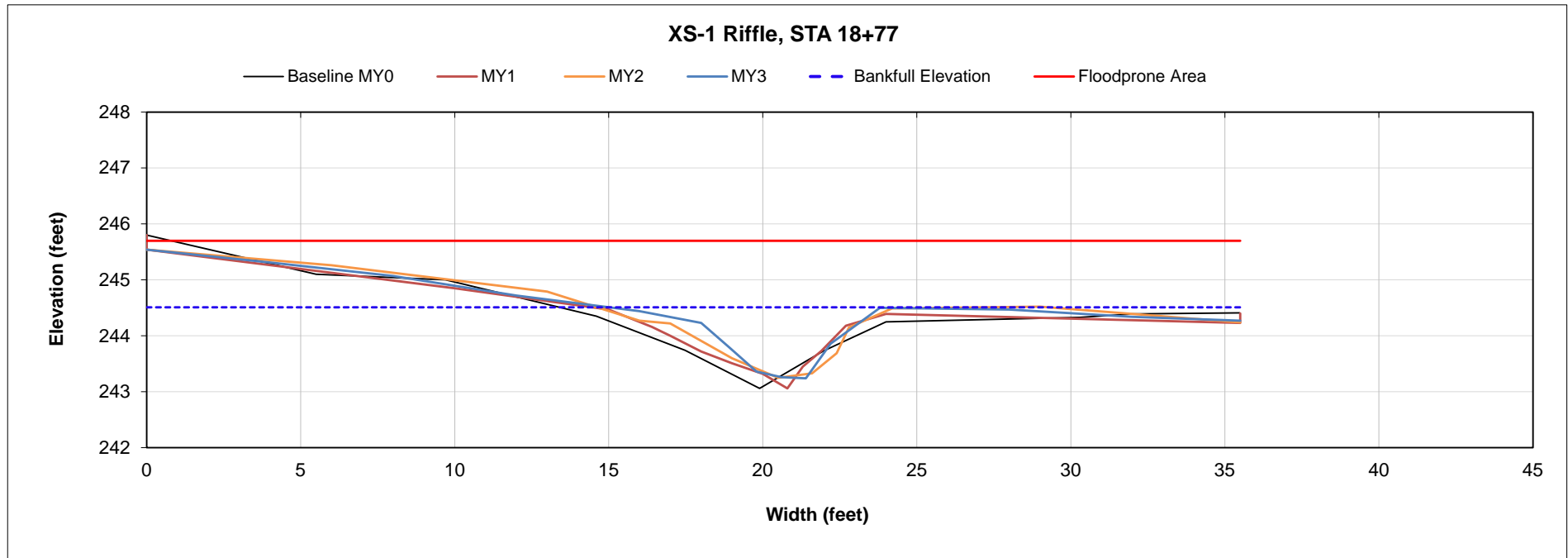
Appendix D – Stream Measurement and Geomorphology Data

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R2
Cross Section ID	XS-1
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	244.5
Low Bank Height Elevation (ft)	244.4
Bankfull Max Depth (ft)	1.3
Low Bank Height (ft)	1.2
Bank Height Ratio	0.9
Bankfull X-section Area (ft ²)	4.9
% Change Bank Height Ratio	10.0%



Looking Downstream



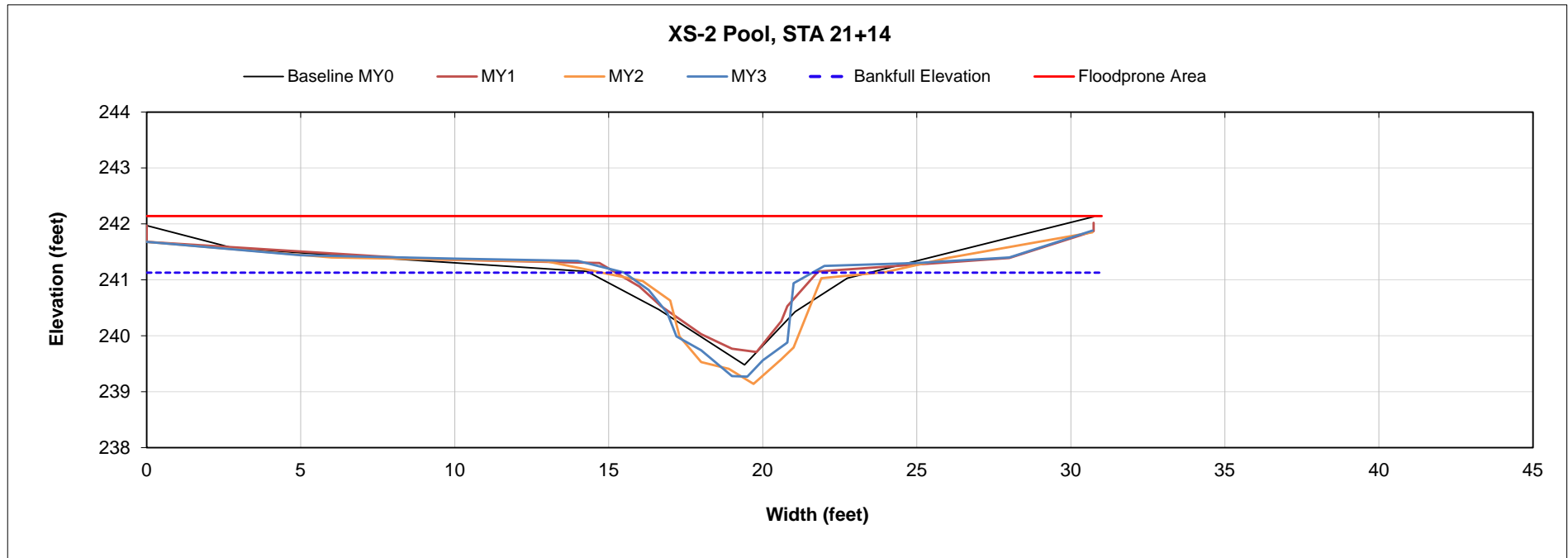
* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.
 ** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R2
Cross Section ID	XS-2
Field Crew	K. Obermiller, E. Dunnigan

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	241.1
Low Bank Height Elevation (ft)	241.1
Bankfull Max Depth (ft)	1.9
Low Bank Height (ft)	1.9
Bank Height Ratio	1.0
Bankfull X-section Area (ft ²)	6.5
% Change Bank Height Ratio	0.0%



Looking Downstream



* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.

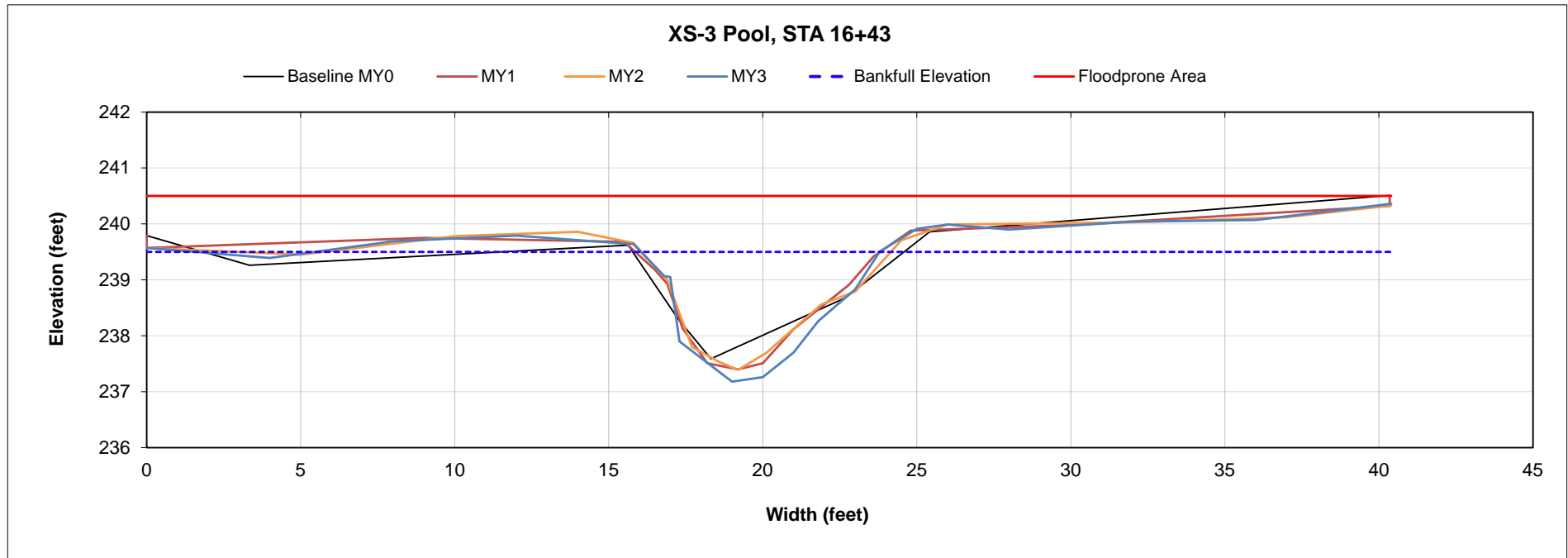
** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R4
Cross Section ID	XS-3
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	239.5
Low Bank Height Elevation (ft)	239.5
Bankfull Max Depth (ft)	2.3
Low Bank Height (ft)	2.3
Bank Height Ratio	1.0
Bankfull X-section Area (ft ²)	11.0
% Change Bank Height Ratio	0.0%



Looking Downstream



* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.
 ** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

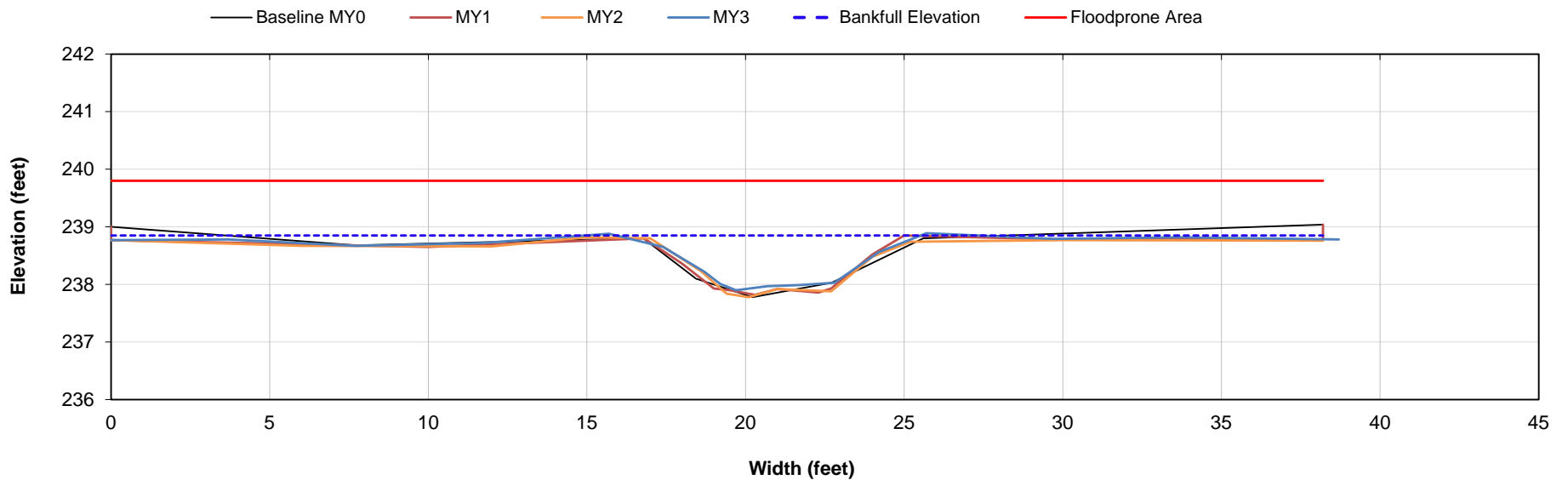
Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R4
Cross Section ID	XS-4
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	238.9
Low Bank Height Elevation (ft)	238.9
Bankfull Max Depth (ft)	0.9
Low Bank Height (ft)	1.0
Bank Height Ratio	1.0
Bankfull X-section Area (ft ²)	5.2
% Change Bank Height Ratio	0.0%



Looking Downstream

XS-4 Riffle, STA 16+97



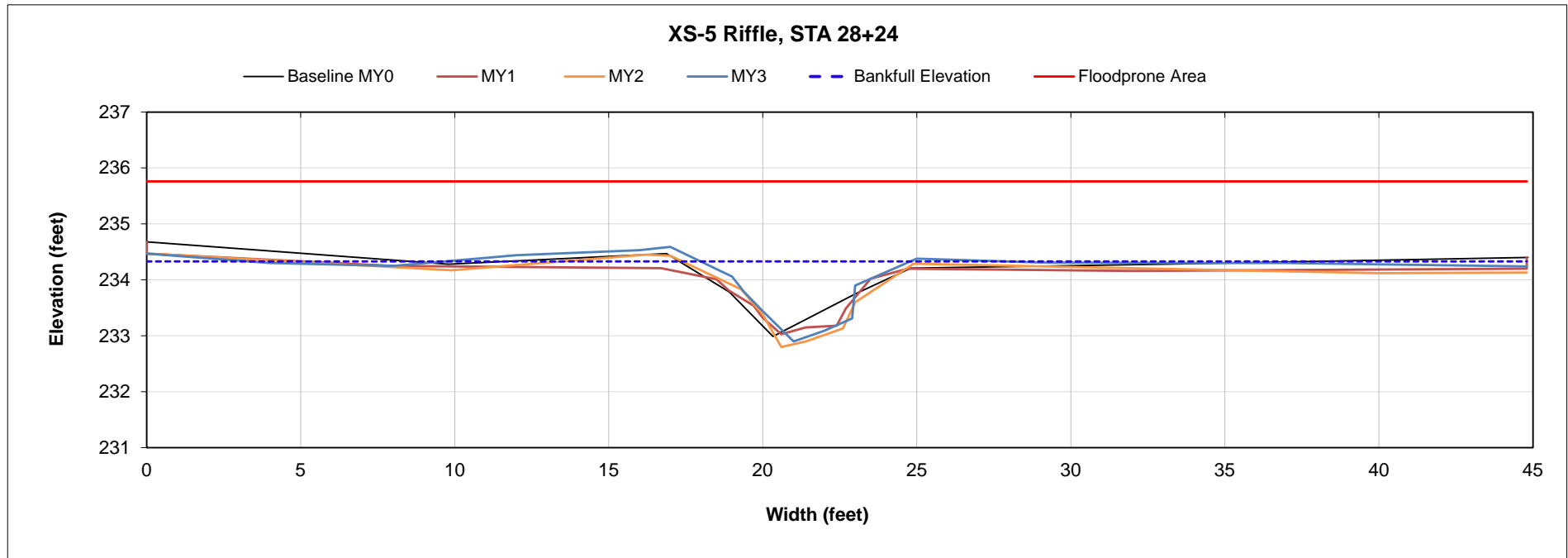
* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.
 ** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3
Cross Section ID	XS-5
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	234.3
Low Bank Height Elevation (ft)	234.4
Bankfull Max Depth (ft)	1.4
Low Bank Height (ft)	1.5
Bank Height Ratio	1.0
Bankfull X-section Area (ft ²)	4.7
% Change Bank Height Ratio	0.0%



Looking Downstream



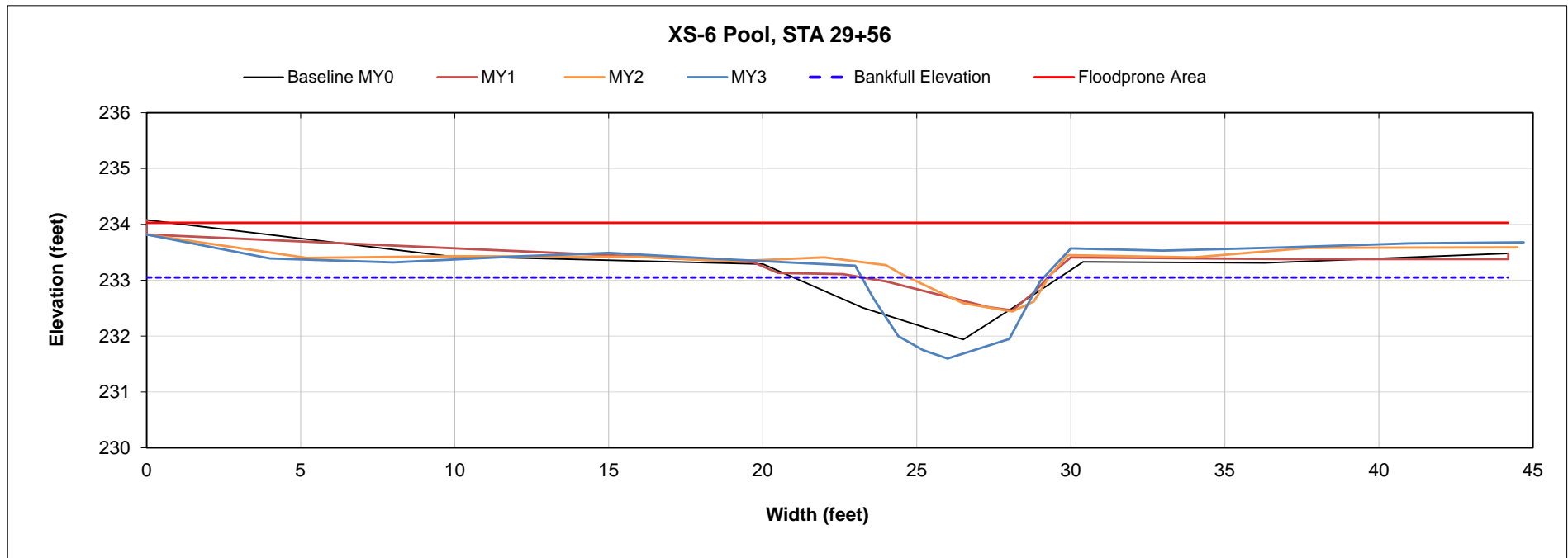
* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.
 ** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3
Cross Section ID	XS-6
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	233.0
Low Bank Height Elevation (ft)	233.3
Bankfull Max Depth (ft)	1.4
Low Bank Height (ft)	1.7
Bank Height Ratio	1.2
Bankfull X-section Area (ft ²)	5.6
% Change Bank Height Ratio	20.0%



Looking Downstream



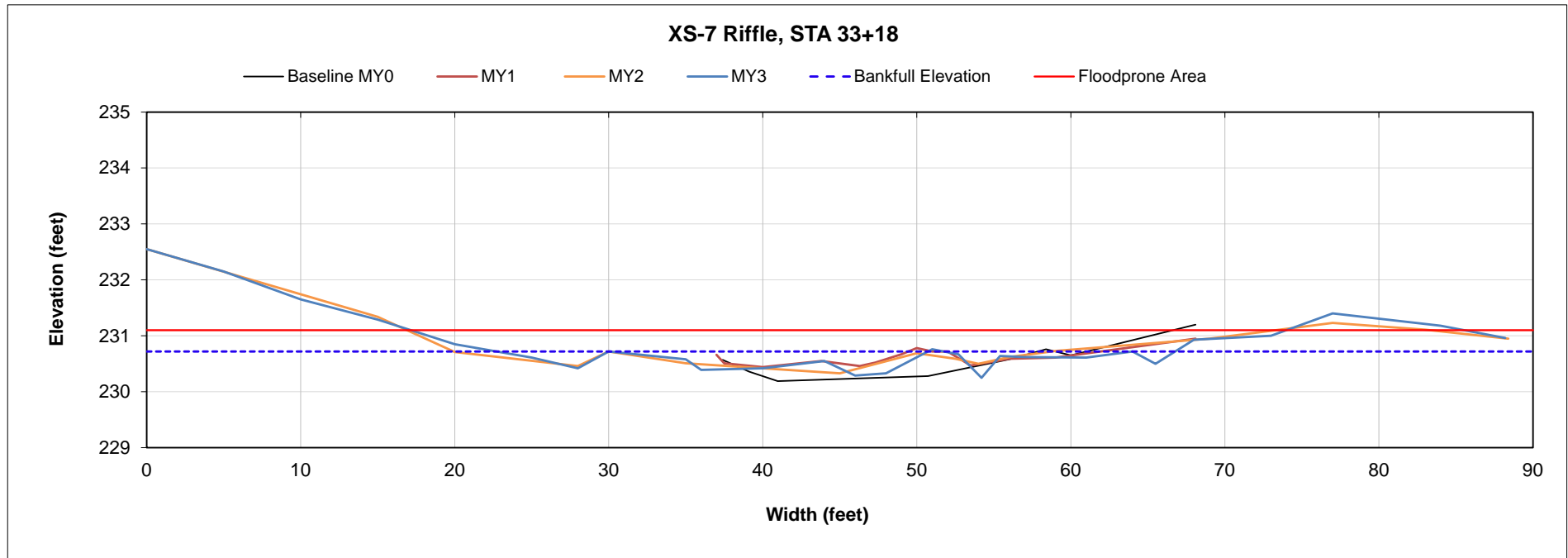
* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.
 ** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3 (Multi-Thread Channel)
Cross Section ID	XS-7
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	230.7
Low Bank Height Elevation (ft)	230.6
Bankfull Max Depth (ft)	0.4
Low Bank Height (ft)	0.4
Bank Height Ratio	0.9
Bankfull X-section Area (ft ²)	4.7
% Change Bank Height Ratio	10.0%



Looking Downstream



* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.

** MY1 used in place of as-built (MY0) due to issues with the as-built survey standards identified during MY1.

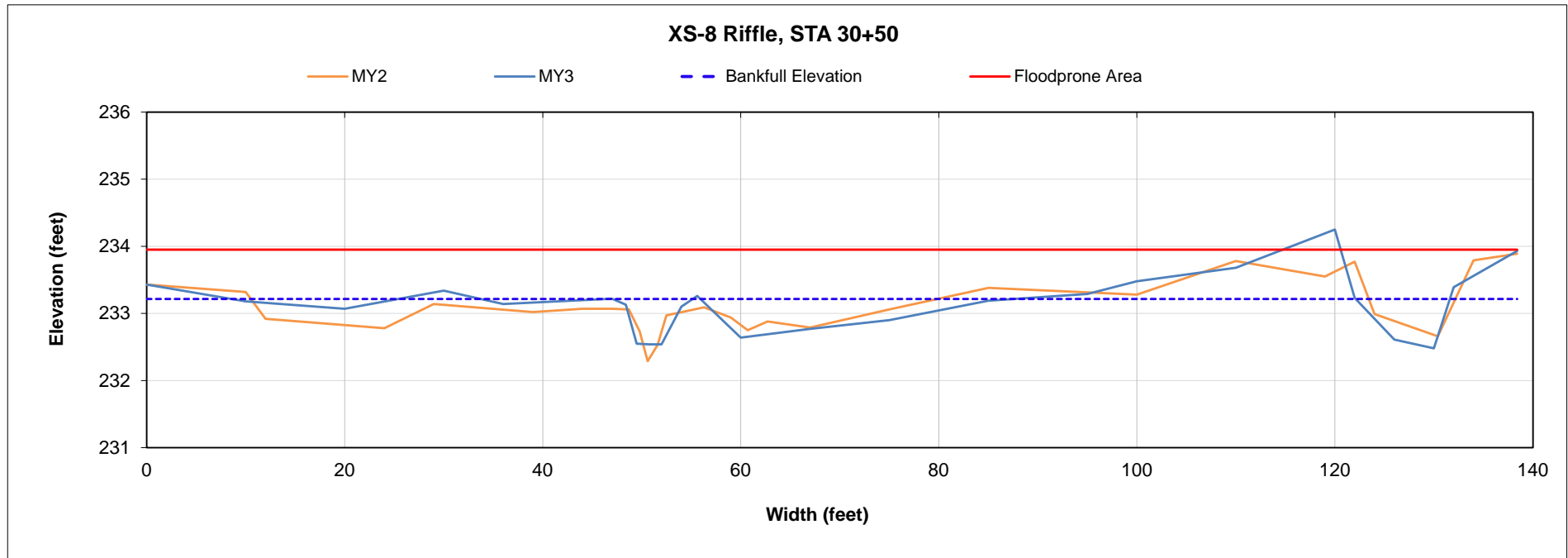
***X7 right and left pins extended per request after MY1

Project Name	Edwards-Johnson Mitigation Project
Project ID	97080
Reach ID	R3 (Multi-Thread Channel)
Cross Section ID	XS-8
Field Crew	E. Dunnigan, N. Childs

Dimension Data Summary: MY3 2020	
Bankfull Elevation (ft)	233.2
Low Bank Height Elevation (ft)	233.2
Bankfull Max Depth (ft)	0.7
Low Bank Height (ft)	0.7
Bank Height Ratio	1.0
Bankfull X-section Area (ft ²)	4.7
% Change Bank Height Ratio	0.0%



Looking Downstream



* Bank Height Ratio is calculated based on MY1 cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document produced by the technical industry work group consisting of the NCIRT, NCDMS, and Industry Practitioner sin NC (9/2018). The remainder of the bankfull dimensions are calculated based on the current year's low bank height.

** MY2 used in place of as-built (MY0) for BHR calculations.

***XS-8 was added during MY1 post-monitoring site visit

Edwards-Johnson
Figure 3: Pebble Count

Date Collected 9/21/2018 10/18/2019 9/30/2020

MATERIAL	PARTICLE	SIZE (mm)	MY 1	MY2	MY3	MY4	MY5	MY6	MY7
			Total #	Total #	Total #	Total #	Total #	Total #	Total #
SILT/CLAY	Silt / Clay	< .063	7	5	4				
	Very Fine	.063 - .125	4	6	2				
SAND	Fine	.125 - .25	14	7	20				
	Medium	.25 - .50	19	8					
	Coarse	.50 - 1.0	19	20	19				
	Very Coarse	1.0 - 2.0	19	13	17				
GRAVEL	Very Fine	2.0 - 2.8	7	7	1				
	Very Fine	2.8 - 4.0	4	7	2				
	Fine	4.0 - 5.6	2	7	2				
	Fine	5.6 - 8.0		4	11				
	Medium	8.0 - 11.0	1	3	7				
	Medium	11.0 - 16.0	1	6	9				
	Coarse	16 - 22.6	1	4	2				
	Coarse	22.6 - 32	2	3	1				
	Very Coarse	32 - 45			1				
	Very Coarse	45 - 64			2				
COBBLE	Small	64 - 90							
	Small	90 - 128							
	Large	128 - 180							
BOULDER	Large	180 - 256							
	Small	256 - 362							
BOULDER	Small	362 - 512							
	Medium	512 - 1024							
BOULDER	Large-Very Large	1024 - 2048							
	Bedrock	> 2048	100	100	100				
Total									

Cumulative	D16	0.16	0.2	0.18				
	D35	0.36	0.66	0.69				
	D50	0.62	1.1	1.2				
	D65	1.1	2.5	4				
	D84	2.4	7.8	11				
	D95	N/A	19	19				

MY3	Riffle	Pool
Channel materials		Channel materials
D16 =	0.51	D16 = 0.15
D35 =	1.1	D35 = 0.2
D50 =	1.7	D50 = 0.25
D65 =	6.2	D65 = 0.78
D84 =	9.8	D84 = 14
D95 =	15	D95 = 49

Weighted pebble count by bed features Edwards-Johnson Mitigation Project

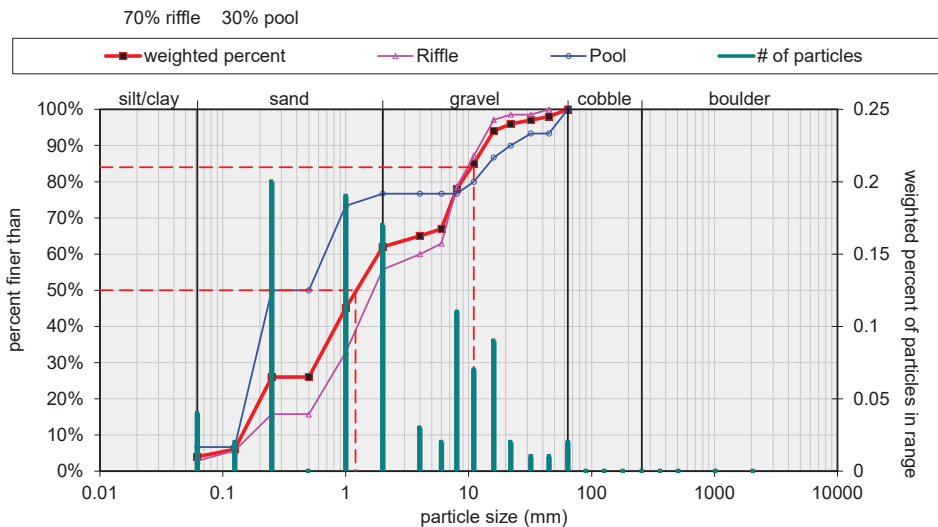


Table 7a. Baseline Stream Data Summary
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
	Min	Max	Min	Max	Min	Max	Min	Max
Reach ID: R1 (Preservation)								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	5.5	7.2	4.5	8.3	-	-	-	-
Floodprone Width (ft)	30.0	80.0	10.0	20.0	-	-	-	-
Bankfull Mean Depth (ft)	0.4	0.8	0.8	1.6	-	-	-	-
Bankfull Max Depth (ft)	0.5	0.9	0.9	1.3	-	-	-	-
Bankfull Cross Sectional Area (ft ²)	4.1	5.0	3.0	5.0	-	-	-	-
Width/Depth Ratio	8.2	15.2	6.2	14.2	-	-	-	-
Entrenchment Ratio	4.2	12.0	7.1	8.4	-	-	-	-
Bank Height Ratio	1.1	1.1	0.9	1.1	-	-	-	-
Profile								
Riffle Length (ft)	7.5	38.2	9.5	22.7	-	-	-	-
Riffle Slope (ft/ft)	0.011	0.014	0.009	0.015	-	-	-	-
Pool Length (ft)	4.1	7.9	6.1	8.7	-	-	-	-
Pool Max Depth (ft)	1.2	1.4	1.8	2.4	-	-	-	-
Pool Spacing (ft)	22.0	50.0	14.4	22.3	-	-	-	-
Pattern								
Channel Beltwidth (ft)	22.0	28.0	23.4	29.0	-	-	-	-
Radius of Curvature (ft)	11.3	19.1	11.2	17.5	-	-	-	-
Rc:Bankfull Width (ft/ft)	1.6	2.9	1.6	2.5	-	-	-	-
Meander Wavelength (ft)	27.0	60.0	43.4	65.1	-	-	-	-
Meander Width Ratio	2.2	6.4	3.9	4.5	-	-	-	-
Transport Parameters								
Boundary Shear Stress (lb/ft ²)	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankfull	-	-	-	-	-	-	-	-
Stream Power (W/m ²)	-	-	-	-	-	-	-	-
Additional Reach Parameters								
Rosgen Classification	C5	E5/C5	E5/C5	E5/C5	E5/C5	E5/C5	E5/C5	E5/C5
Bankfull Velocity (fps)	4.1	4.5	4.5	4.5	-	-	-	-
Bankfull Discharge (cfs)	20.0	---	---	---	-	-	-	-
Sinuosity	1.21	1.1 - 1.3	1.1 - 1.3	1.1 - 1.3	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	0.010	0.015	0.015	0.015	-	-	-	-
Bankfull Slope (ft/ft)	0.012	0.015	0.015	0.015	-	-	-	-

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R2								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	4.4	7.2	4.5	8.3	7.7		8.9	
Floodprone Width (ft)	30.0	70.0	10.0	20.0	20.0	50.0	32.0	
Bankfull Mean Depth (ft)	0.4	0.8	0.8	1.6	0.6		0.6	
Bankfull Max Depth (ft)	1.3	1.5	0.9	1.3	0.9		1.2	
Bankfull Cross Sectional Area (ft ²)	3.3	5.1	3.0	5.0	5.0		5.0	
Width/Depth Ratio	8.2	15.2	6.2	14.2	12.0		16.0	
Entrenchment Ratio	4.3	10.0	7.1	8.4	2.2		3.6	
Bank Height Ratio	1.1	1.6	0.9	1.1	1.0		1.0	
Profile								
Riffle Length (ft)	17.0	44.0	9.5	22.7	10.0	30.0	12.0	34.0
Riffle Slope (ft/ft)	0.011	0.013	0.009	0.015	0.010	0.022	0.017	0.029
Pool Length (ft)	3.9	6.0	6.1	8.7	6.0	9.0	6.2	9.9
Pool Max Depth (ft)	1.2	1.3	1.8	2.4	1.1	1.5	1.1	1.6
Pool Spacing (ft)	22.0	39.0	14.4	22.3	30.0	55.0	11.8	36.1
Pattern								
Channel Beltwidth (ft)	28.0		23.4	29.0	28.0	51.0	27.0	46.0
Radius of Curvature (ft)	11.3	19.1	11.2	17.5	15.0	25.0	13.0	29.0
Rc:Bankfull Width (ft/ft)	1.6	2.9	1.6	2.5	2.0	3.0	2.1	3.5
Meander Wavelength (ft)	31.0	45.0	43.4	65.1	55.0	100.0	35.0	88.0
Meander Width Ratio	2.3	6.4	3.9	4.5	3.0	8.0	4.4	7.6
Transport Parameters								
Boundary Shear Stress (lb/ft ²)	-		-		0.49		-	
Max part size (mm) mobilized at bankfull	-		-		2.00		-	
Stream Power (W/m ²)	-		-		31.00		-	
Additional Reach Parameters								
Rosgen Classification	G5		E5/C5		C5		C5	
Bankfull Velocity (fps)	4.1		4.5		4.7		4.7	
Bankfull Discharge (cfs)	26.0		-		26.0		26.0	
Sinuosity	1.16		1.1 - 1.3		1.17		1.17	
Water Surface Slope (Channel) (ft/ft)	0.011		0.015		0.011		0.012	
Bankfull Slope (ft/ft)	0.012		0.015		0.012		0.013	

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R3 (lower) Preservation								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	4.4	7.2	4.5	8.3	-	-	-	-
Floodprone Width (ft)	30.0	70.0	10.0	35.0	-	-	-	-
Bankfull Mean Depth (ft)	0.4	0.8	0.8	1.6	-	-	-	-
Bankfull Max Depth (ft)	0.5	0.9	0.9	1.3	-	-	-	-
Bankfull Cross Sectional Area (ft ²)	3.3	5.3	3.0	5.0	-	-	-	-
Width/Depth Ratio	8.0	20.0	6.2	14.2	-	-	-	-
Entrenchment Ratio	3.0	8.0	7.1	8.4	-	-	-	-
Bank Height Ratio	1.0	-	0.9	1.1	-	-	-	-
Profile								
Riffle Length (ft)	11.0	22.0	9.5	22.7	-	-	-	-
Riffle Slope (ft/ft)	0.008	0.009	0.009	0.015	-	-	-	-
Pool Length (ft)	5.0	8.0	6.1	8.7	-	-	-	-
Pool Max Depth (ft)	1.3	1.7	1.8	2.4	-	-	-	-
Pool Spacing (ft)	22.0	39.0	14.4	22.3	-	-	-	-
Pattern								
Channel Beltwidth (ft)	28.0	40.0	23.4	29.0	-	-	-	-
Radius of Curvature (ft)	11.0	19.0	11.2	17.5	-	-	-	-
Rc:Bankfull Width (ft/ft)	1.6	2.9	1.6	2.5	-	-	-	-
Meander Wavelength (ft)	27.0	50.0	43.4	65.1	-	-	-	-
Meander Width Ratio	6.4	8.5	3.9	4.5	-	-	-	-
Transport Parameters								
Boundary Shear Stress (lb/ft ²)	-	-	-	-	0.49	-	-	-
Max part size (mm) mobilized at bankfull	-	-	-	-	2.00	-	-	-
Stream Power (W/m ²)	-	-	-	-	29.00	-	-	-
Additional Reach Parameters								
Rosgen Classification	E5	E5/C5	-	-	-	-	-	-
Bankfull Velocity (fps)	4.1	4.0	-	-	-	-	-	-
Bankfull Discharge (cfs)	37.0	-	-	-	-	-	-	-
Sinuosity	1.21	1.1 - 1.3	-	-	-	-	-	-
Water Surface Slope (Channel) (ft/ft)	0.008	0.015	-	-	-	-	-	-
Bankfull Slope (ft/ft)	0.009	0.015	-	-	-	-	-	-

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R3 (upper)								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	4.4	7.2	4.5	8.3	8.2		8.8	18.4
Floodprone Width (ft)	30.0	70.0	10.0	35.0	30.0	80.0	38.0	27.0
Bankfull Mean Depth (ft)	1.0	1.8	0.8	1.6	0.7		0.6	0.3
Bankfull Max Depth (ft)	1.5	2.3	0.9	1.3	1.0		1.0	0.4
Bankfull Cross Sectional Area (ft ²)	3.3		3.0	5.0	5.6		5.5	4.7
Width/Depth Ratio	8.2	15.2	6.2	14.2	12.0		14.3	71.8
Entrenchment Ratio	4.3	10.0	7.1	8.4	3.7	8.0	4.3	1.5
Bank Height Ratio	1.1	1.7	0.9	1.1	1.0		1.0	1.0
Profile								
Riffle Length (ft)	33.0	55.0	9.5	22.7	12.0	33.0	10.0	30.0
Riffle Slope (ft/ft)	0.007	0.009	0.009	0.015	0.011	0.014	0.020	0.035
Pool Length (ft)	8.0	13.0	6.1	8.7	8.0	11.0	7.0	10.0
Pool Max Depth (ft)	1.4	2.0	1.8	2.4	1.4	2.0	1.1	1.6
Pool Spacing (ft)	22.0	39.0	14.4	22.3	25.0	51.0	11.8	35.5
Pattern								
Channel Beltwidth (ft)	28.0		23.4	29.0	25.0	45.0	30.0	45.0
Radius of Curvature (ft)	10.0		11.2	17.5	12.0	22.0	15.0	25.0
Rc:Bankfull Width (ft/ft)	1.6		1.6	2.5	2.0	3.0	2.5	4.2
Meander Wavelength (ft)	27.0		43.4	65.1	30.0	42.0	30.0	44.8
Meander Width Ratio	6.4		3.9	4.5	3.3	5.1	5.1	7.6
Transport Parameters								
Boundary Shear Stress (lb/ft ²)	-		-		0.51		-	
Max part size (mm) mobilized at bankfull	-		-		2.00		-	
Stream Power (W/m ²)	-		-		28.90		-	
Additional Reach Parameters								
Rosgen Classification	E5 incised		E5/C5		C5		C5	
Bankfull Velocity (fps)	4.1		4.5		5.7		4.5	
Bankfull Discharge (cfs)	34.0		-		34.0		34.0	
Sinuosity	1.20		1.1 - 1.3		1.20		1.16	
Water Surface Slope (Channel) (ft/ft)	0.007		0.015		0.009		0.009	
Bankfull Slope (ft/ft)	0.009		0.015		0.011		0.011	

Parameter	Pre-Restoration Condition		Reference Reach Data		Design		As-Built/ Baseline	
Reach ID: R4								
Dimension (Riffle)	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Width (ft)	6.9	-	4.5	8.3	6.6		8.8	
Floodprone Width (ft)	6.1	-	10.0	35.0	25.0	70.0	38.0	
Bankfull Mean Depth (ft)	2.4	-	0.8	1.6	0.5		0.6	
Bankfull Max Depth (ft)	3.1	-	0.9	1.3	0.7		1.0	
Bankfull Cross Sectional Area (ft ²)	15.8	-	3.0	5.0	3.6		5.5	
Width/Depth Ratio	5.6	-	10.3	14.2	12.0		14.3	
Entrenchment Ratio	1.0	-	2.0	5.0	3.8	10.0	4.3	
Bank Height Ratio	1.7	-	0.9	1.1	1.0		1.0	
Profile								
Riffle Length (ft)	17.0	44.0	5.1	13.9	13.0	31.0	12.0	27.0
Riffle Slope (ft/ft)	0.019	0.027	0.017	0.026	0.016	0.027	0.015	0.027
Pool Length (ft)	4.0	6.6	4.5	7.0	6.8	9.4	6.0	8.7
Pool Max Depth (ft)	1.9	2.2	1.1	1.7	1.1	1.6	1.1	1.6
Pool Spacing (ft)	38.0	87.0	10.0	30.0	22.0	50.0	19.0	41.0
Pattern								
Channel Beltwidth (ft)	-	-	23.4	29.0	22.0	35.0	19.0	31.0
Radius of Curvature (ft)	-	-	11.2	17.5	12.0	20.0	10.0	19.0
Rc:Bankfull Width (ft/ft)	-	-	1.6	2.5	1.8	3.0	2.1	3.4
Meander Wavelength (ft)	-	-	43.4	65.1	40.0	60.0	34.0	77.0
Meander Width Ratio	-	-	3.9	4.5	3.3	5.3	3.0	6.0
Transport Parameters								
Boundary Shear Stress (lb/ft ²)	-	-	-	-	0.48	-	-	-
Max part size (mm) mobilized at bankfull	-	-	-	-	2.00	-	-	-
Stream Power (W/m ²)	-	-	-	-	24.50	-	-	-
Additional Reach Parameters								
Rosgen Classification	G5c	C5	C5	C5	C5	C5	C5	C5
Bankfull Velocity (fps)	7.0	4.0	4.0	4.5	4.5	4.5	4.5	4.5
Bankfull Discharge (cfs)	16.0	-	-	16.0	16.0	16.0	16.0	16.0
Sinuosity	1.06	1.1 - 1.2	1.1 - 1.2	1.15	1.15	1.15	1.14	1.14
Water Surface Slope (Channel) (ft/ft)	0.019	0.015	0.015	0.017	0.017	0.017	0.017	0.017
Bankfull Slope (ft/ft)	0.018	0.015	0.015	0.017	0.017	0.017	0.017	0.017

**Table 7c. Monitoring Data - Stream Reach Summary
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)**

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R1 (Preservation)												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	-	-										
Riffle Slope (ft/ft)	-	-										
Pool Length (ft)	-	-										
Pool Max depth (ft)	-	-										
Pool Spacing (ft)	-	-										
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions </div>												
Pattern												
Channel Beltwidth (ft)	-	-										
Radius of Curvature (ft)	-	-										
Rc:Bankfull width (ft/ft)	-	-										
Meander Wavelength (ft)	-	-										
Meander Width Ratio	-	-										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.21											
Water Surface Slope (Channel) (ft/ft)	0.01											
BF slope (ft/ft)	0.012											
³ Ri% / Ru% / P% / G% / S%												
³ SC% / Sa% / G% / C% / B% / Be%												
³ d16 / d35 / d50 / d84 / d95 /												
² % of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern data will not typically be collected unless visual data, dimensional data or profile data

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R2												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	12	34										
Riffle Slope (ft/ft)	0.017	0.029										
Pool Length (ft)	6.2	9.9										
Pool Max depth (ft)	1.1	1.6										
Pool Spacing (ft)	11.8	36.1										
Pattern												
Channel Beltwidth (ft)	27	46										
Radius of Curvature (ft)	13	29										
Rc:Bankfull width (ft/ft)	2.1	3.5										
Meander Wavelength (ft)	35	88										
Meander Width Ratio	4.4	7.6										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.17											
Water Surface Slope (Channel) (ft/ft)	0.012											
BF slope (ft/ft)	0.013											
³ Ri% / Ru% / P% / G% / S%												
³ SC% / Sa% / G% / C% / B% / Be%												
³ d16 / d35 / d50 / d84 / d95 /												
² % of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R3 (upper)												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	10	30										
Riffle Slope (ft/ft)	0.02	0.035										
Pool Length (ft)	7	10										
Pool Max depth (ft)	1.1	1.6										
Pool Spacing (ft)	11.8	35.5										
Pattern												
Channel Beltwidth (ft)	30	45										
Radius of Curvature (ft)	15	25										
Rc:Bankfull width (ft/ft)	2.5	4.2										
Meander Wavelength (ft)	30	44.8										
Meander Width Ratio	5.1	7.6										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.16											
Water Surface Slope (Channel) (ft/ft)	0.009											
BF slope (ft/ft)	0.011											
³ Ri% / Ru% / P% / G% / S%												
³ SC% / Sa% / G% / C% / B% / Be%												
³ d16 / d35 / d50 / d84 / d95 /												
² % of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Parameter	Baseline		MY1		MY2		MY3		MY4		MY5	
Reach ID: R4												
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Profile												
Riffle Length (ft)	12	27										
Riffle Slope (ft/ft)	0.015	0.027										
Pool Length (ft)	6	8.7										
Pool Max depth (ft)	1.1	1.6										
Pool Spacing (ft)	19	41										
Pattern												
Channel Beltwidth (ft)	19	31										
Radius of Curvature (ft)	10	19										
Rc:Bankfull width (ft/ft)	2.1	3.4										
Meander Wavelength (ft)	34	77										
Meander Width Ratio	3	6										
Additional Reach Parameters												
Rosgen Classification	C5											
Sinuosity (ft)	1.14											
Water Surface Slope (Channel) (ft/ft)	0.017											
BF slope (ft/ft)	0.017											
³ Ri% / Ru% / P% / G% / S%												
³ SC% / Sa% / G% / C% / B% / Be%												
³ d16 / d35 / d50 / d84 / d95 /												
² % of Reach with Eroding Banks												
Channel Stability or Habitat Metric												
Biological or Other												

Pattern and Profile data will not typically be collected unless visual data, dimensional data or profile data indicate significant deviations from baseline conditions

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline



Appendix E – Hydrologic Data

Table 8

Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)

Date of Data Collection	Date of Occurrence	Method	Greater than Bankfull (Bkf) or Qgs ($Q2^{*0.66} = 50.66$ CFS) Stage?	Photo/ Notes	Measurement	Meets Requirement
9/17/2018	9/16-9/17/2018	Observed indicators of bankfull stage (wrack lines) after storm event	Bkf	Photo		No
7/26/2019	7/24/2019	Crest Gauge	Bkf	Photo	.25 ft	No
8/20/2019	unknown	Crest Gauge	Bkf	Photo	.28 ft	No
9/6/2019	9/5/2019	Crest Gauge	Bkf	Photo	.25 ft	No
9/6/2019	9/5/2019	Observed indicators of bankfull stage (wrack lines) after storm event	Bkf	Photo	NA	Yes
2/7/2020	2/6/2020	Crest Gauge	Bkf & Qgs	Photo	.85 ft	Yes
8/4/2020	8/4/2020	Crest Gauge	Bkf & Qgs	Photo	0.5 ft	Yes

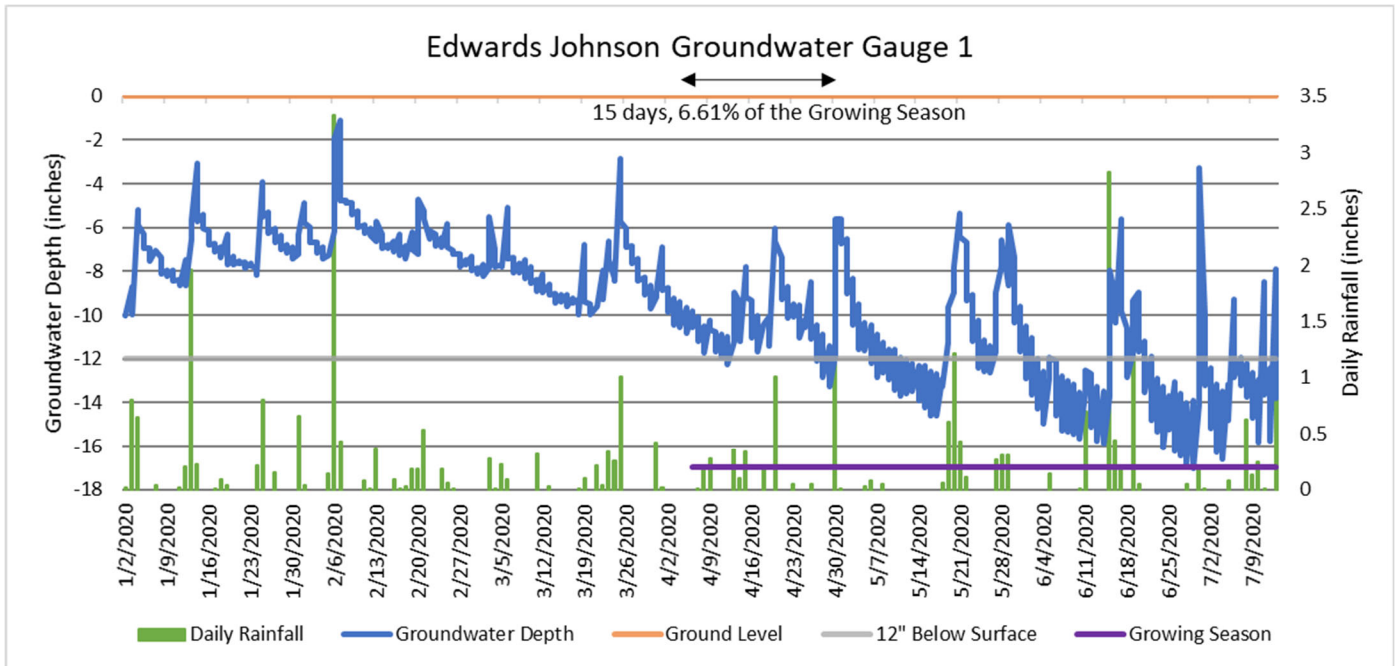
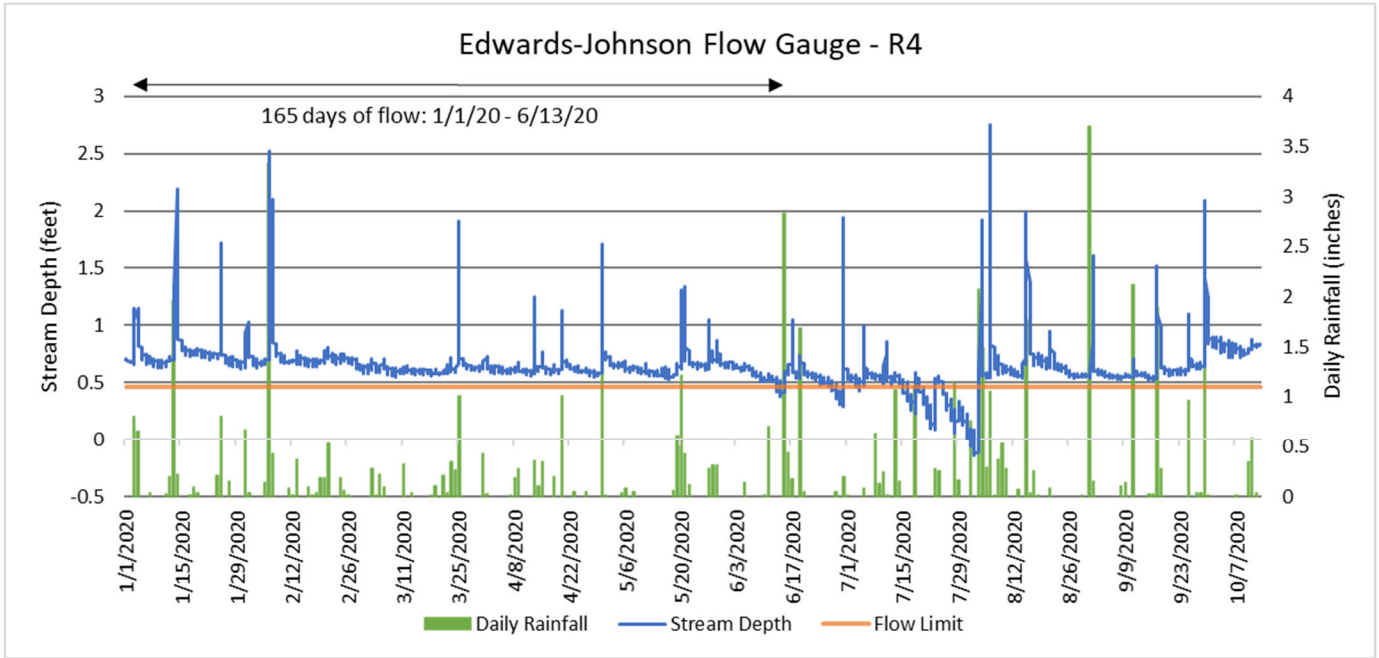


2/7/2020



8/4/2020

Figure 4: Groundwater Gauge Graphs



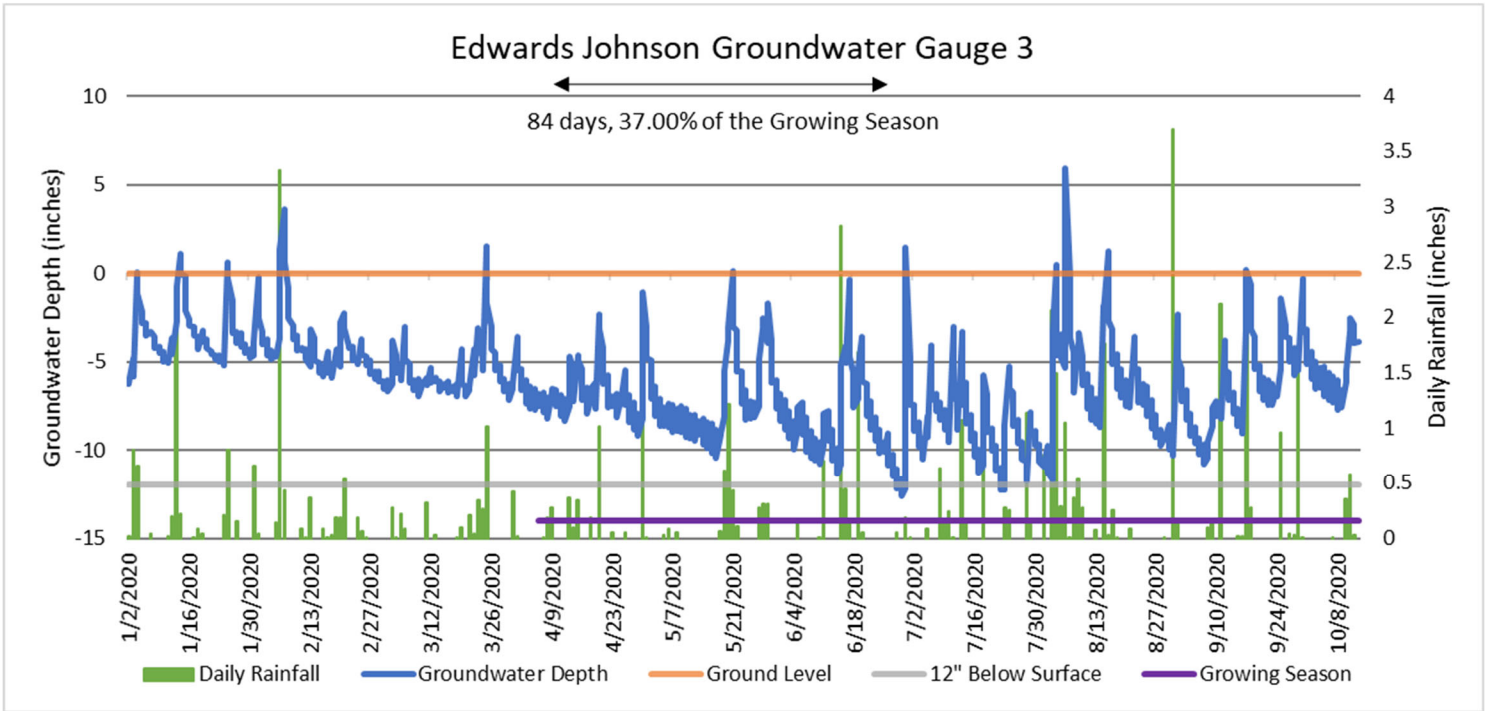
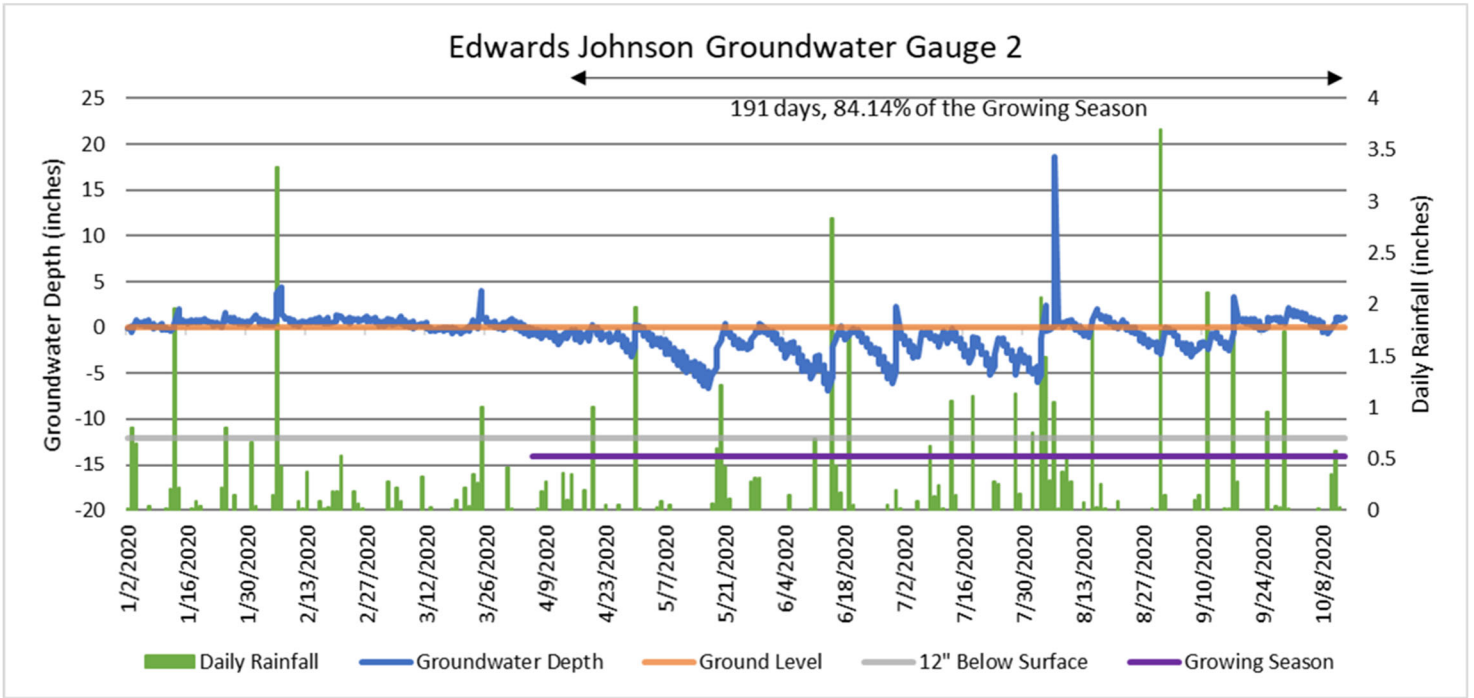
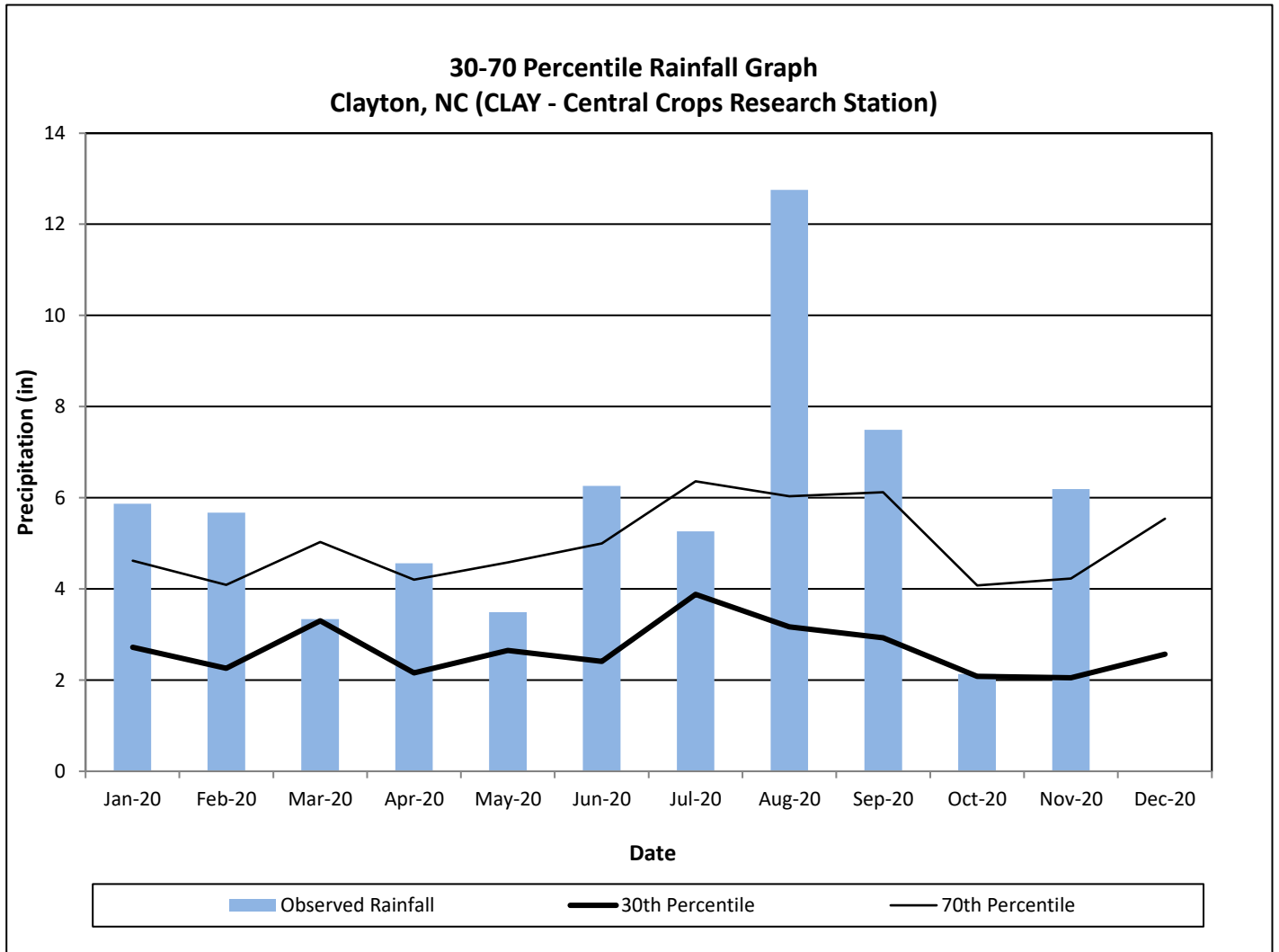


Figure 5: Monthly Rainfall Data
Edwards-Johnson Mitigation Project (NCDEQ DMS Project ID# 97080)
MY3 2020



*30th and 70th percentile rainfall data collected from weather station CLAY - Central Crops Research Station in Clayton, NC.

**Incomplete Month

Month	30%	70%	Observed
Jan-20	2.72	4.62	5.87
Feb-20	2.26	4.09	5.67
Mar-20	3.30	5.03	3.34
Apr-20	2.16	4.20	4.56
May-20	2.65	4.58	3.49
Jun-20	2.41	5.00	6.26
Jul-20	3.88	6.36	5.26
Aug-20	3.17	6.03	12.75
Sep-20	2.93	6.12	7.49
Oct-20	2.08	4.08	2.13
Nov-20	2.05	4.23	6.19
Dec-20	2.57	5.54	**