MY0 FINAL MONITORING REPORT

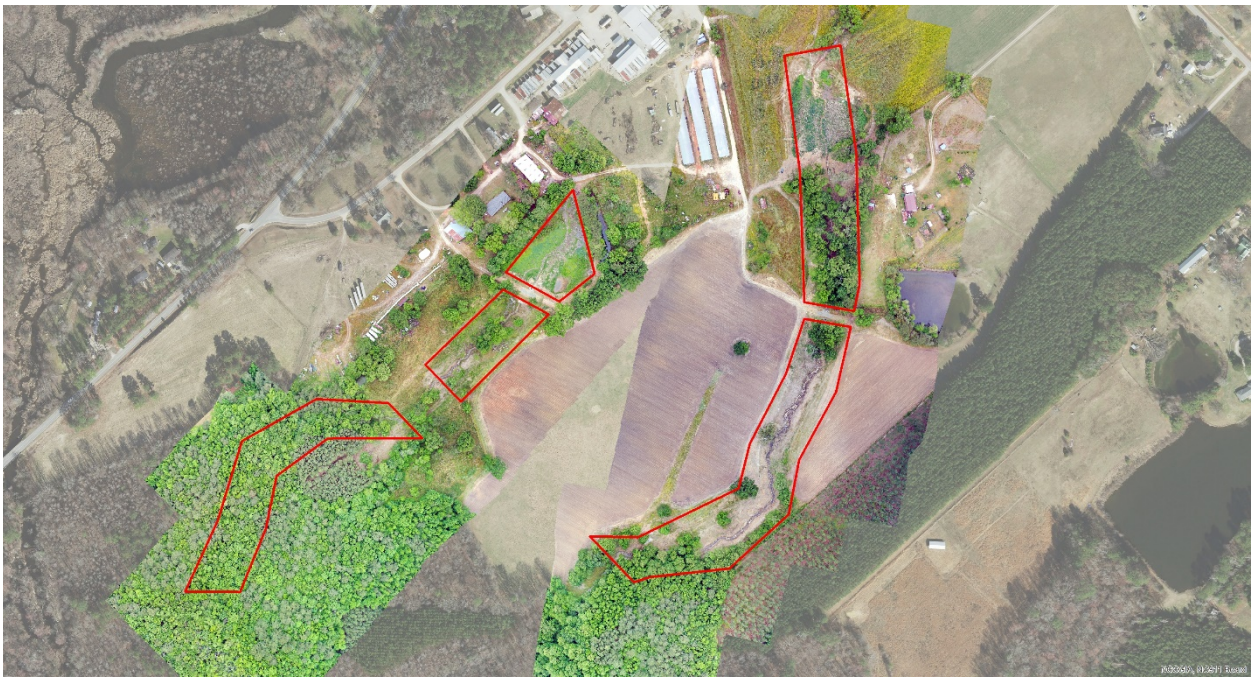
Odell's House Mitigation Project

Johnston County

Neuse River Basin

CU 03020201

DMS Project # 100041
DMS Contract # 7420
Contracted RFP # 16-007279
USACE Action ID Number: SAW-2018-00431
DWR Project # 2018-0200
Calendar Year of Data Collection: 2021



Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Mitigation Services
ENVIRONMENTAL QUALITY

WATER & LAND SOLUTIONS
7721 SIX FORKS ROAD, SUITE 130, RALEIGH, NC 27615
(919) 614 - 5111 | waterlandsolutions.com

July 16, 2021

NC Department of Environmental Quality
Division of Mitigation Services
Attn: Lindsay Crocker, Project Manager
217 W. Jones Street, Suite 3000
Raleigh, NC 27609

RE: WLS Responses to NCDEQ DMS Review Comments for Task 6 Submittal, Draft Baseline Monitoring Report for the Odell's House Mitigation Project, DMS Full-Delivery Project ID #100041, Contract #7420, Neuse River Basin, Cataloging Unit 03020201, Johnston County, NC

Dear Ms. Crocker:

Water & Land Solutions, LLC (WLS) is pleased to present the Final Baseline Monitoring Report (including record drawings) for the Odell's House Mitigation Project to the North Carolina Department of Environmental Quality (NCDEQ) Division of Mitigation Services (DMS). Per the DMS review comments, WLS has updated the Final As-Built Baseline Monitoring Report and associated deliverables accordingly. We are providing the electronic deliverables via cloud link. The electronic deliverables are organized under the following folder structure as required under the digital submission requirements:

1. Report PDF
2. Support Files
    - 1_ Tables
    - 2_CCPV
    - 3_Veg
    - 4_Geomorph
    - 5_Hydro
    - 6_Photos

We are providing our written responses to DMS' review comments on the Draft As-Built Baseline Report below. Each of the DMS review comments is copied below in **bold** text, followed by the appropriate response from WLS in regular text:

General:

- **Page 1, indicates linear feet of construction and wetland. Clarify that this is the design, not as-built footage.** Response: Language was added to indicate that these numbers are based on design.

- **The stream geomorphology tables show that the bankfull discharge from pre to design to post remained constant. Explain how this occurred or correct calculations.** Response: The discharge numbers in the table are correct for pre, design, and MY0 for all reaches. The bankfull discharge estimate is held constant throughout and what varies is the cross-sectional area and velocity. As cross- sectional area increases, the velocity decreases and vice versus. The bankfull discharge is chosen and held at a constant and the designed cross-sectional area is based on that

number. For 'C' stream types, the design channels acceptable velocity ranges are between 3-5 ft/s and for 'B' stream types it is between 4-6 ft/s.

- **The stream geomorphology tables do not appear to be populated correctly. The 'n' columns are showing many more cross-sections than were taken. Please explain or revise, contact DMS for verbal explanation. This may also apply to recently reviewed Buffalo Creek Tributaries.** Response: The definition of the 'n' columns was misunderstood and has been corrected accordingly.

- **The Mitigation Plan indicates that macrobenthic invertebrate monitoring will occur to show pre- and post-response. Please provide this data and show monitoring on location on the CCPV in the baseline report.** Response: Data from the invertebrate monitoring occurred pre-construction and is included in App F. Data is not tied to a performance standard and repeat sampling will occur in MY3. The location of sampling is shown on the CCPV.

- **Describe if there was any temporary or permanent cover planted in the vegetation section of the baseline report.** Response: Temporary and permanent seeding occurred during construction and followed the mitigation plan. The report has been updated to include the temporary/permanent seeding.

- **It was noted in the field that given the dense vegetative conditions, it was very difficult to discern any flow paths for R1 and R5 (headwater valley through the ponds). It was also noted that much of the accumulated/legacy sediment was left along pond bottoms, creating some very mushy areas for ponded water. DMS thinks that the headwater stream areas through the ponds may be at-risk for credit and advises WLS to consider that as the project moves forward.** Response: This concern was addressed in the mitigation plan Section 6.7.1 site construction methods and in more detail within Section 6.7.3 and the USACE IRT mitigation plan response. WLS followed the construction approach described in the mitigation plan, however during construction the contractor did not remove excess legacy sediments greater than 12" across the entire pond bottom areas. Extreme wetness and saturated soil conditions during the winter months prevented the contractor from removing all legacy sediments throughout R1 and R5. The contractor incorporated suitable fill material and woody debris to construct the headwater pilot channels across the low point of valley (pond bottom) as shown on the mitigation plan design, as-built drawings, and orthophotos. The mushy areas were graded as floodplain depressions and are expected to fill in with vegetation during the monitoring period. WLS observed surface flow after construction prior to vegetation establishment. We understand the recent herbaceous vegetation growth makes it difficult to observe surface flow and will monitor surface flow per the mitigation plan Section 8.2.3. Any subterranean flow will be documented to determine if a corrective action is required during the monitoring period.

- **The "fencing encroachment" area shown on the CCPV appeared to be a slight variation in the fence install that was corrected and fence moved. If that is the case, it is ok to leave this off the CCPV since it was quickly corrected following construction and did not result in any vegetation damage. This comment also applies to the visual assessment table.** Response: The encroachment area has been removed from the CCPV, report, and table.

- **Please label the wetland areas on the detailed pages of the CCPV (1a and 1b).** Response: The wetland areas have been labeled on Figures 1a and 1b.

- **Provide elevation of wetland gages in a table format or on drawings if possible/available.** Response: The elevation of wetland gauges was not surveyed during as-built.

- **Include any pictures and/or drone videos to assist IRT in visualizing.** Response: Drone videos and photos are included in the Photos folder of E-Data.

Riparian Buffer MY0:

- **Confirm that the headwater mitigation credit requires 7 years of monitoring per alternative mitigation.** Response: Headwater mitigation credit requires 7 years of monitoring.

- **Replace Table 1 with the current DWR/DMS credit table (available at DWR or DMS website for templates). Confirm that shapefiles are attributed (labeled) to match these tables and that the physical area calculations reflect the table.** Response: Table 1 has been updated to the current format and the attribute tables match the data in Table 1.

- **Confirm that the new as-built top of bank was used to calculate as-built buffer conditions and that the table was updated to reflect surveyed as-built conditions.** Response: The new top of bank was used to calculate the as-built buffer conditions and the table has been updated appropriately.

Electronic Comments:

- **Please include the zero credit spatial features that connect creditable features if possible (e.g. easement breaks).** Response: The zero credit features are included in the e-data.

- **The following stream segments, excluding the headwater restoration segments, have lengths that do not match the asset table – presented below as feature length vs. asset table length. Please review and address these differences.**
    - **R4: 199 ft. vs. 192 ft.**
    - **R6: 422 ft. vs. 438 ft.**
    - **R7 (Upper): 673 ft. vs. 659 ft.**

  Response: The stream lengths in the asset table now match the attribute table. The differences noted by DMS were a result of transferring from CAD into GIS.

- **Please include spatial features characterizing the Pre-Existing Channel.** Response: The pre-existing channel is included in the e-data.

Please contact me if you have any questions or comments.

Sincerely,

Water & Land Solutions, LLC

Catherine Manner
Water & Land Solutions, LLC
7721 Six Forks Road, Suite 130

Raleigh, NC 27615
Office Phone: (919) 614-5111
Mobile Phone: (571) 643-3165
Email: catherine@waterlandsolutions.com

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LIST OF APPENDICES

1 Project Summary

1.1 Project Location and Description

The Odell's House Mitigation Project ("Project") is a North Carolina Department of Environmental Quality (NCDEQ), Division of Mitigation Services (DMS) full-delivery stream and wetland mitigation project contracted with Water & Land Solutions, LLC (WLS) in response to RFP 16-007279. The Project provides stream and wetland mitigation credits in the Neuse River Basin (Cataloging Unit 03020201). The project site is in Johnston County, North Carolina, between the Town of Wendell and the Community of Archer Lodge. The Project is in the Lower Buffalo Creek Priority Sub-watershed 030202011504, study area for the Neuse 01 Regional Watershed Plan Phase II, Final Report (RWP), and in the Targeted Local Watershed 03020201180050, of the Neuse River Basin.

The Project involved the restoration, enhancement, preservation and permanent protection of eight stream reaches (R1, R2, R3, R4, R5, R6, R7 upper, and R7 lower), 6 wetland areas (W1, W2, W3, W4, W5, and W6), and their riparian buffers, totaling approximately 4,313 linear feet of designed streams, and 453,057.200 square feet of riparian buffers. Stream restoration is within the conservation easement and the existing powerline right-of-way. The Project also includes riparian wetland restoration (re-establishment and rehabilitation), enhancement and the preservation of 3.890 acres (based on design). The Project will provide significant ecological improvements and functional uplift through stream and wetland restoration and will decrease nutrient and sediment loads within the watershed. The mitigation plan provides a detailed project summary and Table 1 provides a summary of project assets. Figure 1a-c illustrates the project mitigation components.

Prior to construction, landowners historically manipulated streams and ditched riparian wetland systems to provide areas for crop production and cattle grazing. Cattle had complete access to streams and wetlands except for R7 and W5/W6, resulting in eroded banks, habitat destruction, and poor water quality. Two man-made ponds existed where reaches R1 and R5 are now located.

1.2 Project Quantities and Credits

The Project mitigation components include a combination of Stream Restoration, Enhancement, and Preservation activities, as well as Riparian Wetland Restoration (Re-establishment & Rehabilitation) Enhancement, and Preservation, as summarized in the Table 1 below.

Table 1. Odell's House (ID-100041) Project Mitigation Quantities and Credits							
Project Segment	Original Mitigation Plan Ft/Ac	As-Built Ft/Ac	Original Mitigation Category	Original Restoration Level	Original Mitigation Ratio (X:1)	Credits	Comments
Stream							
R1	437	533	Warm	R	1.00000	437.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R2	526	518	Warm	EII	2.50000	210.400	Livestock Exclusion, Invasive Control, Supplemental Planting, Habitat Structures, Permanent Conservation Easement
R3	1,091	1,103	Warm	R	1.00000	1,091.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R4	190	199	Warm	EII	3.00000	63.333	Livestock Exclusion, Invasive Control, Supplemental Planting, Habitat Structures, Permanent Conservation Easement
R5	340	392	Warm	R	1.00000	340.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R6	432	422	Warm	R	1.00000	432.000	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement
R7 (upper)	625	674	Warm	EI	1.50000	416.667	Dimension, Pattern and Profile modified, Livestock Exclusion, Supplemental Planting, Permanent Conservation Easement
R7 (lower)	412	461	Warm	P	10.00000	41.200	Permanent Conservation Easement
					Total:	**3,031.600**	
Wetland							
W1	0.476	0.477	R	REE	1.00000	0.476	Livestock Exclusion, Pond drainage, Limited soil manipulation, and Planting
W2	0.416	0.413	R	REE	1.00000	0.416	Livestock Exclusion, Pond drainage, Limited soil manipulation, and Planting
W3	0.666	0.645	R	RH	1.50000	0.444	Limited soil manipulation and Planting
W4	0.234	0.227	R	REE	1.00000	0.234	Limited soil manipulation, Restored groundwater hydrology and Planting
W5	1.654	1.636	R	E	2.50000	0.662	Restored hydrology and Planting
W6	0.444	0.440	R	P	10.00000	0.044	Permanent Conservation Easement
					Total:	**2.276**	

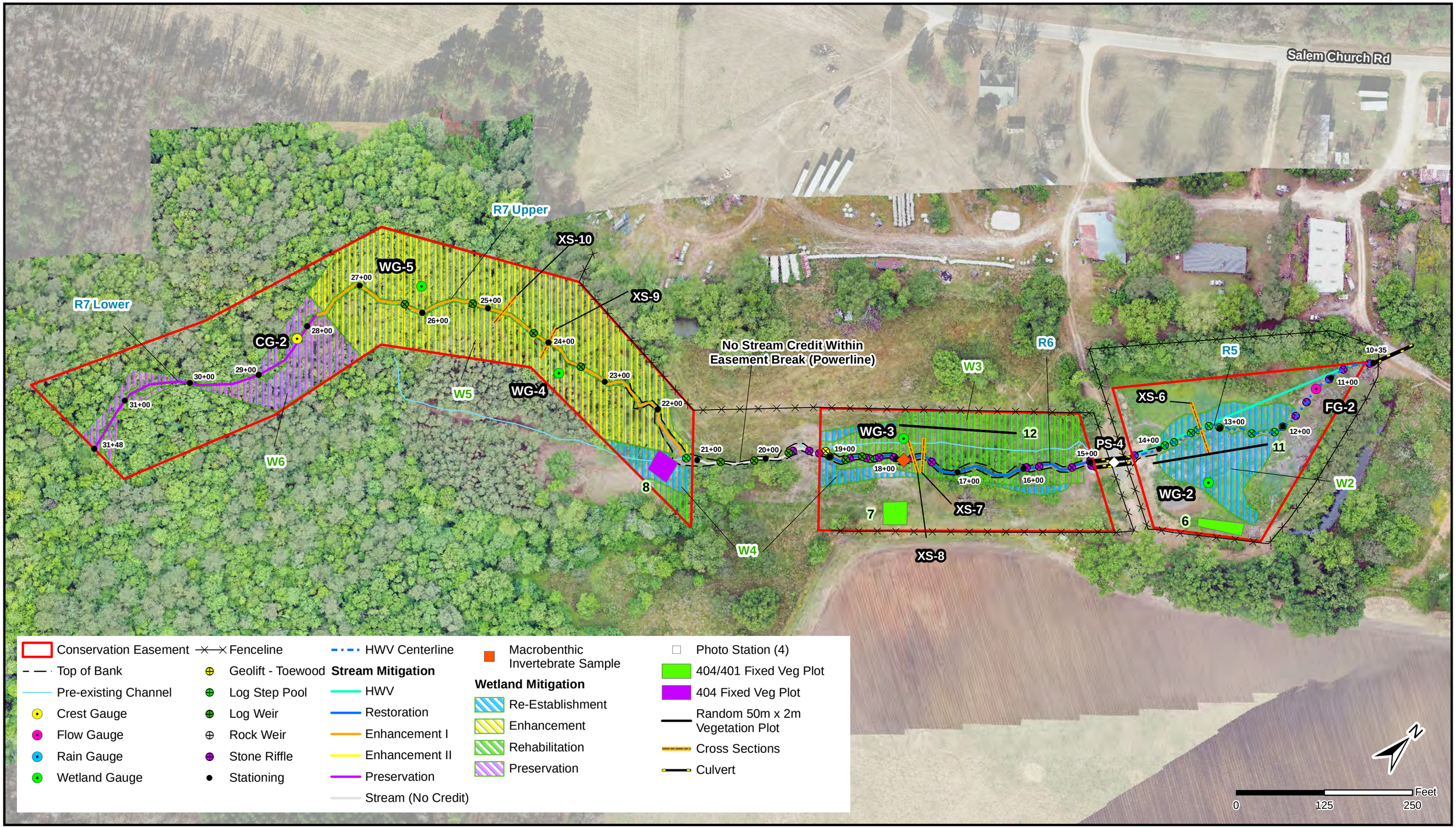
Project Credits						
	Stream			Riparian	Non-Rip	Coastal
Restoration Level	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	2,300.000					
Re-establishment				1.126		
Rehabilitation				0.444		
Enhancement				0.662		
Enhancement I	416.667					
Enhancement II	273.733					
Creation						
Preservation	41.200			0.044		
Totals	**3,031.600**			**2.276**		

Total Stream Credit	**3,031.600**
Total Wetland Credit	**2.276**

1.3 Current Condition Plan View

The following pages present the Current Condition Plan View (CCPV).

WATER & LAND™ SOLUTIONS	Mitigation Services ENVIRONMENTAL QUALITY	**Odells House Mitigation Project** **Johnston County, North Carolina**	USACE Action ID Number: SAW-2018-00431 June 2021 MY0	USACE Current Conditions Plan View Monitoring Year 0 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1a



WATER & LAND™ SOLUTIONS

NC Mitigation Services ENVIRONMENTAL QUALITY

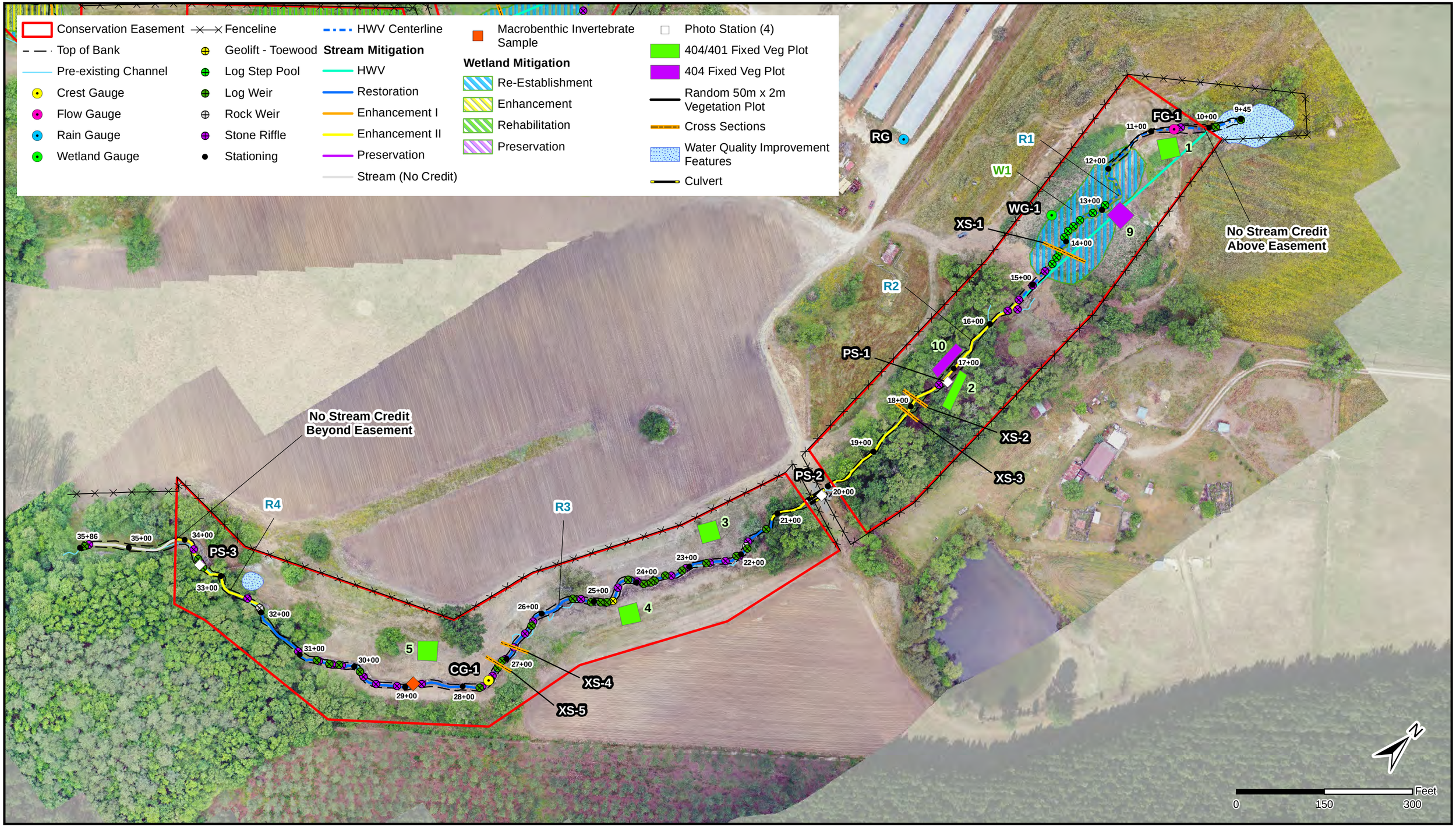
Odells House Mitigation Project
Johnston County, North Carolina

USACE Action ID Number:
SAW-2018-00431
June 2021
MY0

USACE
Current Conditions Plan View
Monitoring Year 0

NAD 1983 2011 State Plane
North Carolina FIPS 3200 FT US

FIGURE
1b



WATER & LAND™ SOLUTIONS	NC Mitigation Services ENVIRONMENTAL QUALITY	**Odells House Mitigation Project** **Johnston County, North Carolina**	USACE Action ID Number: SAW-2018-00431 June 2021 MY0	USACE Current Conditions Plan View Monitoring Year 0 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 1 c

2 Goals, Performance Criteria, and Functional Improvements

2.1 Project Goals and Objectives

The Project will meet the goals and objectives described in the Odell's House Final Approved Mitigation Plan and address the general restoration goals and opportunities outlined in the DMS Neuse River Basin Watershed Restoration Priorities (RBRP). More specifically, three out of the four functional goals and objectives outlined in the Wake-Johnston Collaborative Local Watershed Plan (LWP) as well as the Neuse 01 RWP will be met by:

- Reducing sediment and nutrient inputs to the 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".

To accomplish these project-specific goals, the following objectives will be measured to document overall project success:

- 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;
- Incorporate water quality improvement features to reduce nonpoint source inputs to receiving waters

Table 2: Summary: Goals, Performance and Results					
Goal	**Objective/Treatment**	**Likely Functional Uplift**	**Performance Criteria**	**Measurement**	**Cumulative Monitoring Results**
Improve Stream Base Flow Duration	Improve and/or remove existing stream crossings and restore a more natural flow regime and aquatic passage.	Create a more natural and higher functioning headwater flow regime and provide aquatic passage; re-establish appropriate wetland hydroperiods and provide hydrologic storage	Maintain seasonal flow on intermittent stream for a minimum of 30 consecutive days during normal annual rainfall	2 Flow gauges (R1 & R5)	Data in MY1
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Design BHRs to not exceed 1.2 and increase ERs no less than 2.2 for Rosgen 'C' and 'E' stream types and 1.4 for 'B' stream types.	Provide temporary water storage and reduce erosive forces (shear stress) in channel during larger flow events.	Minimum of four bankfull events in separate years. Wetland hydrology for 8% of growing season.	2 Crest Gauges/pressure transducers (R3 & R7 Lower) and 5 wetland groundwater gauges (W1, W2, W3, & W5)	Data in MY1
Improve stabilty of stream channels	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments showing progression towards stability.	10 Cross section surveys	all cross sections BHR<1.2
Establish Riparian Buffer Vegetation	Plant native species vegetation a minimum 50' wide from the top of the streambanks with a composition/density comparable to downstream reference condition.	Increase woody and herbaceous vegetation will provide channel stability and reduce streambank erosion, runoff rates and exotic species vegetation.	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 average height of seven feet; and a minimum of 210 stems per acre and average ten foot tree heights must be present at year seven.	Tree data for 12 Veg Plots (species & height), visual assessment	12/12 veg plots met - 2021

2.2 Project Success Criteria

The success criteria for the Project will follow the approved performance standards and monitoring protocols from the final approved mitigation plan; which was developed in compliance with the USACE October 2016 Guidance, USACE Stream Mitigation Guidelines (April 2003 and October 2005), and 2008 Compensatory Mitigation Final Rule. Cross-section and vegetation plot data will be collected in Years 0, 1, 2, 3, 5, and 7. Stream hydrology data and visual monitoring will be reported annually. Specific success criteria components and evaluation methods are described below.

2.2.1 Streams

***Stream Hydrology*:** Four separate bankfull or over bank events must be documented within the seven-year monitoring period and the stream hydrology monitoring will continue until four bankfull events have been documented in separate years. Stream hydrology monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to top of bank elevation (see appendix D for installation diagrams). Recorded water depth above the top of bank elevation will document a bankfull event. The devices will record water depth hourly and will be inspected quarterly. In addition to the pressure transducers, traditional cork gauges will be installed at bankfull elevation and will be used to document bankfull events with photographs.

Stream Profiles, Vertical Stability, and Floodplain Access: Stream profiles, as a measure of vertical stability and floodplain access will be evaluated by looking at Bank Height Ratios (BHR). In addition, observed bedforms should be consistent with those observed for channels of the design stream type(s). The BHR shall not exceed 1.2 along the restored Project stream reaches. This standard only applies to restored reaches of the channel where BHRs were corrected through design and construction. Vertical stability will be evaluated with visual assessment, cross-sections and, if directed by the IRT, longitudinal profile.

Stream Horizontal Stability: Cross-sections will be used to evaluate horizontal stream stability on restored streams. 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.

Stream cross-section monitoring will be conducted using a Topcon RL-H5 Laser Level. Three-dimensional coordinates associated with cross-section data will be collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data will be collected at ten cross-sections. Survey data will be imported into Microsoft Excel® and the DMS Shiny App for data processing and analysis.

Reference photo transects will be taken at each permanent cross-section. Lateral photos should not indicate excessive erosion or continuing degradation of the streambanks. Photographs will be taken of both streambanks at each cross-section. A survey tape stretched between the permanent cross-section monuments/pins will be centered in each of the streambank photographs. The water elevation will be shown in the lower edge of the frame, and as much of the streambank as possible will be included in each photo. Photographers will attempt to consistently maintain the same area in each photo over time.

Jurisdictional Stream Flow: Monitoring of stream flow will be conducted to demonstrate that the restored stream systems classified as intermittent exhibit surface flow for a minimum of 30 consecutive days throughout some portion of the year during a year with normal rainfall conditions. Stream flow monitoring will be accomplished with pressure transducers installed in pools and correlating sensor depth to the downstream top of riffle elevation (see appendix D for installation diagrams). If the pool water depth is at or above the top of riffle elevation, then the channel will be assumed to have surface flow. The devices will record water elevation twice per day and will be inspected quarterly to document surface hydrology and provide a basis for evaluating flow response to rainfall events.

The stage recorders include an automatic pressure transducer (HOBO Water Level (13 ft) Logger) set in PVC piping in the channel. The elevation of the bed and top of bank at each stage recorder location will be recorded to be able to document presence of water in the channel and out of bank events. Visual observations (i.e. wrack or debris lines) and traditional cork crest gauges will also be used to document out of bank events.

Channel Formation: During monitoring years 1 through 4, the preponderance of evidence must demonstrate a concentration of flow indicative of headwater stream channel formation within the

topographic low-point of the valley or crenulation as documented by the following indicators for reaches R1 and R5:

- Scour (indicating sediment transport by flowing water)
- Sediment deposition (accumulations of sediment and/or formation of ripples)
- Sediment sorting (sediment sorting indicated by grain-size distribution with the primary path of flow)
- Multiple observed flow events (must be documented by gauge data and/or photographs)
- Destruction of terrestrial vegetation
- Presence of litter and debris
- Wracking (deposits of drift material indicating surface water flow)
- Vegetation matted down, bent, or absent (herbaceous or otherwise)
- Leaf litter disturbed or washed away

During monitoring years 5 through 7, the stream must successfully meet the requirements above and the preponderance of evidence must demonstrate the development of stream bed and banks as documented by the following indicators:

- Bed and banks (may include the formation of stream bed and banks, development of channel pattern such as meander bends and/or braiding at natural topographic breaks, woody debris, or plant root systems)
- Natural line impressed on the bank (visible high-water mark)
- Shelving (shelving of sediment depositions indicating transport)
- Water staining (staining of rooted vegetation)
- Change in plant community (transition to species adapted for flow or inundation for a long duration, including hydrophytes)
- Changes in character of soil (texture and/or chroma changes when compared to the soils abutting the primary path of flow)

2.2.2 Wetlands

Wetland Hydrology: The performance standard for wetland hydrology will be 12 percent based on the suggested wetland saturation thresholds for soils taxonomic subgroups. The proposed success criteria for wetland hydrology will be when the soils are saturated within 12 inches of the soil surface for 12 percent (27 days) of the 227-day growing season (March 21st through November 3rd) based on WETS data table for Johnston County, NC. The saturated conditions should occur during a period when antecedent precipitation has been normal or drier than normal for a minimum frequency of 5 years in 10 (USACE, 2005 and 2010b). Precipitation data will be obtained from an on-site rain gauge and the Clayton (CLAY) Research Weather Station, approximately 9 miles southeast of the Project site. If a normal year of precipitation does not occur during the first seven years of monitoring, WLS will continue to monitor the Project hydrology until the Project site has been saturated for the appropriate hydroperiod. If rainfall amounts for any given year during the monitoring period are abnormally low, reference wetland

hydrology data will be compared to determine if there is a correlation with the weather conditions and site variability.

2.2.3 Vegetation

Vegetation monitoring will occur in the fall each required monitoring year, prior to leaf drop. Plots will be monitored in years 1, 2, 3, 5, and 7. Vegetative success for the Project during the intermediate monitoring years will be based 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 that must average seven feet in height at the end of Year 5 of the monitoring period. The final vegetative restoration success criteria will be achieving a density of no less than 210, seven-year-old planted stems per acre that must average ten feet in height in Year 7 of monitoring.

Vegetation success will be monitored at a total of nine permanent vegetation plots (10m x 10m) and 3 random vegetation transects (50m x 2m and 20m x 5m). Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data will be processed using the DMS Shiny App. In the field, the four corners of each plot will be permanently marked with PVC at the origin and rebar at the other corners. Tree species and height will be recorded for each planted stem and photos of each plot are to be taken from the origin each monitoring year.

2.2.4 Visual Assessment

WLS will conduct visual assessments in support of mitigation performance monitoring. Visual assessments of all stream reaches will be conducted twice per monitoring year with at least five months in between each site visit for each of the seven years of monitoring. Photographs will be used to visually document system performance and any areas of concern related to streambank and bed stability, condition of in-stream structures, channel migration, active headcuts, live stake mortality, invasive plant species or animal browsing, easement boundary encroachments, cattle exclusion fence damage, and general streambed conditions.

3 Project Attributes

3.1 Design Approach

3.1.1 Stream

The Project stream design approach included a combination of Stream Restoration, Enhancement, and Preservation activities. Priority Level I restoration approaches were incorporated with the design of both single-thread meandering channels and headwater stream valleys. All non-vegetated areas within the conservation easement were planted with native species vegetation and any areas of invasive species were removed and/or treated.

Restoration: R1, R3, R5, and R6

- **R1 –** R1 begins near the top of what was previously a farm pond. The outlet pipe and earthen dam was removed, and the pond was drained to reconnect the new stream channel with its geomorphic floodplain. The reach was restored as a Rosgen 'DA' stream type. This approach

allowed the restoration of a stable headwater channel with appropriate bedform diversity, as well as improved ecological function through increased aquatic and terrestrial habitats. The valley bottom within the old pond bed was graded to restore the natural microtopographic variability that is common within headwater stream and wetland systems. A small pilot channel was graded to allow the natural flow path to maintain a defined channel form as vegetation becomes established. One agricultural BMP was installed above R1 to capture, attenuate, and treat concentrated flow that would otherwise enter the riparian buffer as untreated water. The BMP was constructed outside of the conservation easement and was fenced to restrict cattle access.

- **R3 –** R3 begins at a culvert crossing downstream of R2. Work along R3 involved a Priority Level I Restoration. A majority of the channel was restored in its natural valley location with minor adjustments to channel planform. The reach was restored as a Rosgen 'B4' stream type. This approach allowed the restoration of a stable channel form with appropriate bedform diversity, as well as improved ecological function through increased aquatic and terrestrial habitats. A dilapidated CMP pipe was replaced and a bankfull culvert was added to improve flood flows and aquatic life passage. A fence was constructed outside of the conservation easement to restrict cattle access.

- **R5 –** Similar to R1, R5 begins near the top of what was previously a farm pond. An existing pipe was removed and replaced near station 10+00 to redirect flows within the natural valley. In addition, the existing pond drainage pipe was removed at the permanent easement crossing and the embankment was lowered. A new culvert and bankfull pipe was installed near station 14+50 to improve flood flows and aquatic life passage. The reach was restored as a Rosgen 'DA' stream type. This approach allows restoration of a stable headwater channel with appropriate bedform diversity, as well as improved ecological function through increased aquatic and terrestrial habitats. The valley bottom within the old pond bed was graded to restore the natural microtopographic variability that is common within headwater systems. Similar to R1, a small pilot channel was graded to allow the natural flow path to maintain a defined channel form as vegetation becomes established. A fence was constructed outside of the conservation easement to restrict cattle access.

- **R6 –** R6 begins at the culvert outlet below R5 and the previously existing pond dam. Work along R6 involved a Priority Level I Restoration. The remnant channel was back filled, and a majority of this reach was constructed offline in the low part of the valley. The reach was restored as a Rosgen 'B4c' stream type. This approach allows restoration of a stable channel form with appropriate bedform diversity, as well as improved ecological function through increased aquatic and terrestrial habitats. A fence was constructed outside of the conservation easement to restrict cattle access.

Enhancement Level II: R2 and R4

- **R2 –** R2 begins at the terminus of R1. An Enhancement Level II approach was utilized along the entire reach. Construction activities consisted of strategic mechanized removal of invasive species

vegetation (i.e. golden bamboo), grading existing or disturbed stream banks back to a stable dimension, installing erosion control matting, and supplemental riparian buffer planting and live stakes. The reach is classified as a Rosgen 'C5' stream type. A fence was constructed outside of the conservation easement to restrict cattle access.

- **R4 –** R4 begins at the terminus of R3. An Enhancement Level II approach was utilized along this reach. Construction activities consisted of strategic mechanized removal of invasive species, in-stream structure installation to stabilize an existing headcut and bank erosion, grading the stream banks back to the existing stable dimension, installing erosion control matting, and supplemental riparian buffer planting and live stakes. The reach in this section is classified as a Rosgen 'E5' stream type. A fence was constructed outside of the conservation easement to restrict cattle access.

Enhancement Level I: R7 upper

- **R7 upper -** The upper section of R7 begins at the terminus of R6. The reach was constructed as a Rosgen 'DA' stream type. The remnant straightened channel and small pond were backfilled and a pilot channel was relocated within the natural valley. This work allows diffuse flows across the R7 floodplain and extensive wetting of the adjacent wetlands. Small in-stream structures in the form of log weirs were installed to increase bedform diversity. The low flows through R7 upper now follow historic flow patterns and spread out through channel depressions, restoring a more natural stream hydrology function.

Preservation: R7 lower

- **R7 lower -** The downstream section of R7 is currently classified as a Rosgen 'E5' stream type. The Preservation approach extends the wildlife corridor from the Buffalo Creek floodplain boundary throughout a majority of the riparian valley, while providing a natural hydrologic connection and critical habitat linkage within the catchment area.

3.1.2 Wetland

Riparian Wetland Re-establishment: W1, W2, and W4

Areas of hydric soils were documented along portions of the project floodplains areas. These hydric soil areas and pond impoundments were restored to higher functioning riparian wetlands as a direct result of implementing Priority Level I stream restoration, pond removal, limited soil manipulation and removal of soils (less than 1-foot depth) and planting native vegetation. The restored groundwater hydrology will allow the wetland areas to regain their natural or historic functions.

Riparian Wetland Rehabilitation: W3

Areas of significantly degraded riparian wetlands (poorly functioning) were also documented along portions of the project floodplains areas. These poorly functioning wetland areas were restored as a direct result of implementing a Priority Level I stream restoration, removal of livestock, limited soil manipulation

and removal (less than 1-foot depth) and planting native vegetation. The groundwater hydrology will be restored and allow the wetland areas to regain their natural or historic functions.

Riparian Wetland Enhancement: W5

As described above, the restoration activities provide significant functional uplift across the project area. The activities also improve and enhance the hyporheic zone interaction and hydrology to existing wetland areas. Wetland enhancement areas were planted with native wet tolerant species. The restoration of the stream channels will also improve areas of adjacent wetlands through higher water table conditions (elevated stream profile) and a more frequent over-bank flooding regime.

Riparian Wetland Preservation: W6

Areas of highly functioning riparian wetlands were also documented along lower portions of R7 floodplain. These wetland areas benefited from upstream functional uplift as a direct result of implementing a Priority Level I restoration, removal of livestock and planting native vegetation. The groundwater hydrology will be improved upstream which allow these wetland areas to maintain their natural or historic functions.

3.2 Project Attributes

See Table 3 below for Project Attributes.

Table 3. Project Attribute Table								
Project Name	Odell's House Mitigation Project							
County	Johnston							
Project Area (acres)	15.092							
Project Coordinates (latitude and longitude decimal degrees)	35.71589, -78.35345							
Project Watershed Summary Information								
Physiographic Province	Piedmont							
River Basin	Neuse							
USGS Hydrologic Unit 8-digit	3020201							
DWR Sub-basin	03-04-06							
Project Drainage Area (acres)	41.8 (R7 lower) and 95.4 (R4)							
Project Drainage Area Percentage of Impervious Area	<1%							
Land Use Classification	2.01.03, 2.01.01, 3.02 (69% cultivated crops/hay, 2% grass/herbaceous, 25% mixed forest, 4% pond)							
Reach Summary Information								
Parameters	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7 (upper)**	**R7 (lower)**
Pre-project length (feet)	N/A (pond)	632	1169	392	N/A (pond)	610	468	412
Post-project (feet)	533	518	1103	199	392	422	674	461
Valley confinement (Confined, moderately confined, unconfined)	N/A	moderately confined	moderately confined	unconfined	N/A	unconfined	unconfined	unconfined
Drainage area (acres)	42.9	64	83.2	95.4	19.4	30.7	39.7	41.8
Perennial, Intermittent, Ephemeral	N/A	Perennial	Intermittent	Intermittent	N/A	Intermittent	Intermittent	Intermittent
NCDWR Water Quality Classification	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW
Dominant Stream Classification (existing)	N/A (pond)	C5	G5	E5	N/A (pond)	E5	G5	E5/DA
Dominant Stream Classification (proposed)	DA/E5	C5	B5	E5	DA/E5	B5c	B5c	E5
Dominant Evolutionary class (Simon) if applicable	N/A	IV/V	III	IV/V	N/A	III	I	I
Wetland Summary Information								
Parameters	**W1**	**W2**	**W3**	**W4**	**W5**	**W6**		
Pre-project (acres)	0.476	0.416	0.666	0.234	1.654	0.444		
Post-project (acres)	0.476	0.416	0.666	0.234	1.654	0.444		
Wetland Type (non-riparian, riparian)	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine	Riparian Riverine		
Mapped Soil Series	Water, Cowarts loamy sand	Water	Leaf silt loam, Cowarts loamy sand	Leaf silt loam, Cowarts loamy sand	Leaf silt loam, Bonneau sand, Wedowee sandy loam	Bonneau sand, Leaf silt loam		
Soil Hydric Status	N/A, non hydric	N/A	Hydric, non hydric	Hydric, non hydric	Hydric, non hydric	non-hydric, Hydric		
Regulatory Considerations								
Parameters	**Applicable?**			**Resolved?**		**Supporting Docs?**		
Water of the United States - Section 404	Yes			Yes		PCN/404 permit		
Water of the United States - Section 401	Yes			Yes		PCN/401 permit		
Endangered Species Act	Yes			Yes		Categorical Exclusion		
Historic Preservation Act	Yes			Yes		Categorical Exclusion		
Coastal Zone Management Act (CZMA or CAMA)	No			N/A		N/A		
Essential Fisheries Habitat	No			N/A		N/A		

4 Monitoring Year 0 Assessment and Results

4.1 As-built Survey

An as-built survey conducted under the responsible charge of a North Carolina Professional Land Surveyor (Marshall Wight, PLS with WithersRavenel), was utilized to document the as-built or baseline condition of the Project post-construction. The Project construction and planting were completed in March and April 2021 and as-built survey was completed in May 2021. Cattle were removed from the site prior to construction and permanent fencing was completed in April 2021. Baseline monitoring activities occurred in March - May 2021.

4.2 As-Built Plans/ Record Drawings

The results of the as-built survey establish and document post-construction or baseline conditions and will be used for comparing annual post-construction monitoring data. The as-built plans or record drawings were developed utilizing the final construction plans as the "background", and then overlaying the as-built survey information on the plan and profile sheets. Any significant adjustments or deviations made to the final construction plans during construction are shown as redline mark-ups or callouts on the as-built survey plan sheets. The as-built plans/record drawings were submitted separately.

4.3 As-Built/ Baseline Assessment

No significant deviations were documented between the final construction plans and the as-built condition that may affect channel performance, channel lengths, or changes in vegetation species planted. Along R1, the channel alignment was adjusted from approximate design station 11+62 to 12+37 due to poor/wet soil conditions in the remnant pond bottom. Upper R6 was also slightly adjusted from approximate station 16+00 to 17+37 to protect existing vegetation and prevent root damage within the dripline. Lastly, upper R7 was realigned from approximate station 12+17 to 14+59 to more closely follow the existing flow paths and floodplain contours. The in-stream structure installation generally followed the proposed design in these locations and additional woody material was installed along R1 and R5 respectively. Lastly, six log riffles were replaced with three log weirs and woody debris along upper R7 to increase bedform diversity and minimize disturbance to existing wetland vegetation. No major issues or mitigating factors were observed immediately after construction which require consideration or remedial action.

4.4 Morphological Assessment

Morphological data for the as-built profile was collected in March 2021. Refer to Appendices A and C for summary data tables, morphological plots, and stream photographs.

4.4.1.1 Stream Horizontal Pattern & Longitudinal Profile

The MY0 stream channel pattern and longitudinal profiles closely match the design parameters. The MY0 plan form geometry or pattern fell within acceptable ranges of the design parameters for all restored reaches. These minor channel adjustments in riffle slopes, pool depths and pattern do not present a stability concern or indicate a need for remedial action and will be assessed visually during the annual assessments.

4.4.1.2 Stream Horizontal Dimension

The MY0 channel dimensions generally match the design parameters and are within acceptable and stable ranges of tolerance. It is expected that over time that some pools may accumulate fine sediment and organic matter, however, this is not an indicator of channel instability. Maximum riffle depths are also expected to fluctuate slightly throughout the monitoring period as the channels adjust to the new flow regime and catchment conditions.

4.5 Stream Hydrology

4.5.1 Stream Flow

Two pressure transducers (flow gauges) were installed in March 2021 on reaches R1 and R5 to document baseflow conditions. The flow gauge locations are within the upper one-third of the project reaches as shown on the CCPV and data will be included in the Monitoring Year 1 Report.

4.5.1.1 Bankfull Events

Two crest gauges were installed in March 2021 to document bankfull events. WLS installed a conventional cork crest gauge, along with a pressure transducer to validate flood status on R3 and R7 lower. Stream hydrology data will be included in the Monitoring Year 1 Report in this section and in the appendices. Recorder locations are shown on the CCPV.

4.5.2 Headwater Stream Channel Formation

During monitoring years 1 through 4, the preponderance of evidence must demonstrate a concentration of flow indicative of channel formation within the topographic low-point of the valley or crenulation as documented by the indicators listed in section 2.2.1. This evidence will be addressed in the Monitoring Year 1 Report.

4.5.3 Wetlands

Five groundwater wells were installed in March 2021 to monitor wetland hydrology. Groundwater well locations are shown on the CCPV and the data will be included in subsequent monitoring reports.

4.5.4 Vegetation

Monitoring of the nine permanent vegetation plots and three random plots/transects was completed during the first week of May 2021. Vegetation data and photos can be found in Appendix B. The MY0 average planted density is 748 stems per acre, which exceeds the interim measure of vegetative success of at least 320 planted stems per acre at the end of the third monitoring year. Each plot also met the interim measure requirement with 607 – 1,214 stems per acre. Volunteer species were not noted at baseline monitoring but are expected to establish in upcoming years.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. Temporary and permanent seeding of the project was completed during and following construction activities per the mitigation plan.

A large population of golden bamboo (*Phyllostachys aurea*) existed along the left floodplain of R2 prior to construction. Construction activities included bamboo removal in this area by ripping the roots/rhizomes,

cut stump herbicide treatments, and foliar spray of small shoots. Herbicide treatments used 50 percent glyphosate for cut/stump and three percent for foliar spray. This area will continue to be monitored closely and any treatments will be documented in future monitoring reports.

Appendix A:
Visual Assessment Data

Visual Stream Morphology Stability Assessment Table
Vegetation Condition Assessment Table
Photos: Cross-Section Photos
Photos: Stream Photo Points (Culvert Crossings and EII Reaches)

Table 4: Visual Stream Stability Assessment

Reach	R1, R2, R3, R4, R5, R6, R7 (upper and lower)
Assessed Stream Length	4,302
Assessed Bank Length	5,384

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
				Totals	0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	116	116		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	34	34		100%

Visual Vegetation Assessment

Planted acreage **11.17**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	0.00	0.0%
		Total	0.00	0.0%
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
		Cumulative Total	0.00	0.0%

Easement Acreage **15.1**

Vegetation Category	Definitions	Mapping Threshold	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.10 acres	0.00	0.0%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	0.00	

R1, XS-1, Upstream (MY-00)

R1, XS-1, Left Bank (MY-00)

R1, XS-1, Downstream (MY-00)

R1, XS-1, Right Bank (MY-00)

R2, XS-2, Upstream (MY-00)

R2, XS-2, Left Bank (MY-00)

R2, XS-2, Downstream (MY-00)

R2, XS-2, Right Bank (MY-00)

R2, XS-3, Upstream (MY-00)

R2, XS-3, Left Bank (MY-00)

R2, XS-3, Downstream (MY-00)

R2, XS-3, Right Bank (MY-00)

R3, XS-4, Upstream (MY-00)

R3, XS-4, Left Bank (MY-00)

R3, XS-4, Downstream (MY-00)

R3, XS-4, Right Bank (MY-00)

R3, XS-5, Upstream (MY-00)

R3, XS-5, Left Bank (MY-00)

R3, XS-5, Downstream (MY-00)

R3, XS-5, Right Bank (MY-00)

R5, XS-6, Upstream (MY-00)

R5, XS-6, Left Bank (MY-00)

R5, XS-6, Downstream (MY-00)

R5, XS-6, Right Bank (MY-00)

R6, XS-7, Upstream (MY-00)

R6, XS-7, Left Bank (MY-00)

R6, XS-7, Downstream (MY-00)

R6, XS-7, Right Bank (MY-00)

R6, XS-8, Upstream (MY-00)

R6, XS-8, Left Bank (MY-00)

R6, XS-8, Downstream (MY-00)

R6, XS-8, Right Bank (MY-00)

R7 upper, XS-9, Upstream (MY-00)

R7 upper, XS-9, Left Bank (MY-00)

R7 upper, XS-9, Downstream (MY-00)

R7 upper, XS-9, Right Bank (MY-00)

R7 upper, XS-10, Upstream (MY-00)

R7 upper, XS-10, Left Bank (MY-00)

R7 upper, XS-10, Downstream (MY-00)

R7 upper, XS-10, Right Bank (MY-00)

PS-1 – R2, EII, Upstream (MY-00)

PS-1 – R2, EII, Downstream (MY-00)

PS-2 – R2 Culvert Crossing, Upstream (MY-00)

PS-2 – R2 Culvert Crossing, Downstream (MY-00)

PS-3 – R4, EII, Upstream (MY-00)

PS-3 – R4, EII, Downstream (MY-00)

PS-4 – R5 Culvert Crossing, Upstream (MY-00)

PS-4 – R5 Culvert Crossing, Downstream (MY-00)

Appendix B:
Vegetation Plot Data

Redline Plant List
Vegetation Performance Standards Summary Table
Vegetation Plot Counts and Densities Table
Photos: Vegetation Plot Photos
Veg Plot Maps

Odell's House Mitigation Project Red-line Planting List				
Species	**Common Name**	**Stems**	**% Planted**	**Mitigation Plan %**
Fraxinus pennsylvanica	Green Ash	228	3.00%	3%
Betula nigra	River birch	608	8.00%	12%
Quercus michauxii	Swamp chestnut oak	608	8.00%	10%
Quercus pagoda	Cherrybark oak	532	7.00%	10%
Platanus occidentalis	American sycamore	684	9.00%	12%
Quercus nigra	Water Oak	532	7.00%	10%
Liriodendron tulipifera	Tulip Poplar	684	9.00%	12%
Quercus phellos	Willow Oak	532	7.00%	10%
Diospyros virginiana	Persimmon	456	6.00%	4%
Carpinus caroliniana	Ironwood	456	6.00%	3%
Hamamelis virginiana	Witch Hazel	456	6.00%	3%
Asimina triloba	Pawpaw	456	6.00%	4%
Lindera benzoin	Spicebush	456	6.00%	4%
Alnus serulatta	Tag Alder	456	6.00%	0%
Corylus americana	Hazelnut	456	6.00%	3%
Total		**7,600**	**100%**	

* changes from mitigation plan in red

*Tag Alder was not planted within potential Nutrient Buffer Areas

Vegetation Performance Standards Summary Table (Data Collected: 5/6/2021)												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	688	2	9	0	648	2	9	0	607	2	8	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	769	2	9	0	607	2	8	0	1214	2	9	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	850	2	8	0	769	2	6	0	688	2	8	0
	Veg Plot Group 1 R				Veg Plot Group 2 R				Veg Plot Group 3 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1												
Monitoring Year 0	648	2	7	0	688	2	11	0	810	2	11	0

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

Odell's House Stem Counts and Densities Table

Planted Acreage	11.17
Date of Initial Plant	2021-03-03
Date(s) of Supplemental Plant(s)	#N/A
Date(s) Mowing	#N/A
Date of Current Survey	2021-03-23
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 R	Veg Plot 11 R	Veg Plot 12 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total	Total
Species Included in Approved Mitigation Plan	Asimina triloba	pawpaw	Tree	FAC			1	1	1	1	2	2	1	1											1
	Betula nigra	river birch	Tree	FACW	1	1	2	2	1	1	1	1			8	8	2	2	1	1	1	1		1	2
	Carpinus caroliniana	American hornbeam	Tree	FAC	2	2					3	3					1	1	3	3	1	1		2	
	Corylus americana	American hazelnut	Shrub	FACU			1	1							1	1	1	1						2	
	Diospyros virginiana	common persimmon	Tree	FAC									1	1	1	1			1	1			2	1	2
	Fraxinus pennsylvanica	green ash	Tree	FACW	1	1									4	4			6	6	2	2		2	1
	Hamamelis virginiana	American witchhazel	Tree	FACU	1	1	2	2	1	1	1	1							1	1					1
	Lindera benzoin	northern spicebush	Tree	FACW			1	1					1	1			1	1							1
	Liriodendron tulipifera	tuliptree	Tree	FACU	4	4	2	2	4	4	4	4	7	7			5	5			2	2	6		4
	Platanus occidentalis	American sycamore	Tree	FACW	4	4	2	2	4	4	3	3	2	2	5	5	6	6	7	7	1	1	1	2	5
	Quercus michauxii	swamp chestnut oak	Tree	FACW	2	2	2	2					1	1	3	3							1	1	2
	Quercus nigra	water oak	Tree	FAC	1	1			1	1	1	1	1	1	3	3					2	2	2	2	
	Quercus pagoda	cherrybark oak	Tree	FACW			3	3	1	1	2	2			2	2	1	1			3	3	2	3	
	Quercus phellos	willow oak	Tree	FACW	1	1			2	2	2	2	1	1	3	3	4	4			5	5	2	1	1
Sum	Performance Standard				17	17	16	16	15	15	19	19	15	15	30	30	21	21	19	19	17	17	16	17	20
Post Mitigation Plan Species	Alnus serrulata	hazel alder	Tree	FACW																				1	1
Sum	Proposed Standard				17	17	16	16	15	15	19	19	15	15	30	30	21	21	19	19	17	17	16	18	21
Mitigation Plan Performance Standard	Current Year Stem Count				17		16		15		19		15		30		21		19		17		16	17	20
	Stems/Acre				688		648		607		769		607		1214		850		769		688		648	688	810
	Species Count				9		9		8		9		8		9		8		6		8		7	10	10
	Dominant Species Composition (%)				24		19		27		21		47		27		29		37		29		38	17	24
	Average Plot Height				2		2		2		2		2		2		2		2		2		2	2	2
	% Invasives				0		0		0		0		0		0		0		0		0		0	0	0
Post Mitigation Plan Performance Standard	Current Year Stem Count				17		16		15		19		15		30		21		19		17		16	18	21
	Stems/Acre				688		648		607		769		607		1214		850		769		688		648	729	850
	Species Count				9		9		8		9		8		9		8		6		8		7	11	11
	Dominant Species Composition (%)				24		19		27		21		47		27		29		37		29		38	17	24
	Average Plot Height				2		2		2		2		2		2		2		2		2		2	2	2
	% Invasives				0		0		0		0		0		0		0		0		0		0	0	0

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

Fixed Veg Plot 1 (MY-00)

Fixed Veg Plot 3 (MY-00)

Fixed Veg Plot 2 (MY-00)

Fixed Veg Plot 4 (MY-00)

Fixed Veg Plot 5 (MY-00)

Fixed Veg Plot 7 (MY-00)

Fixed Veg Plot 6 (MY-00)

Fixed Veg Plot 8 (MY-00)

Fixed Veg Plot 9 (MY-00)

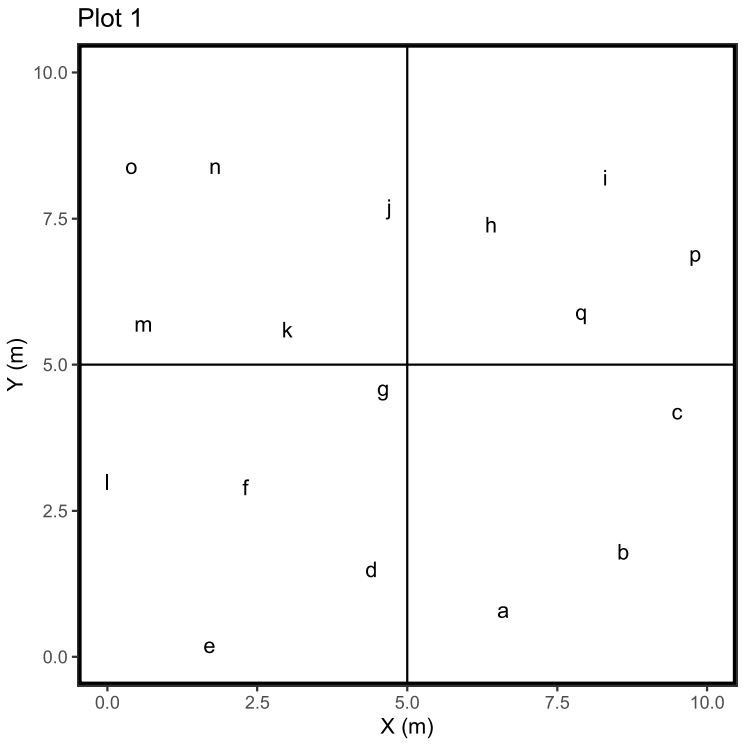
Random Veg Plot 10 (MY-00)

Random Veg Plot 11 (View Northeast) (MY-00)

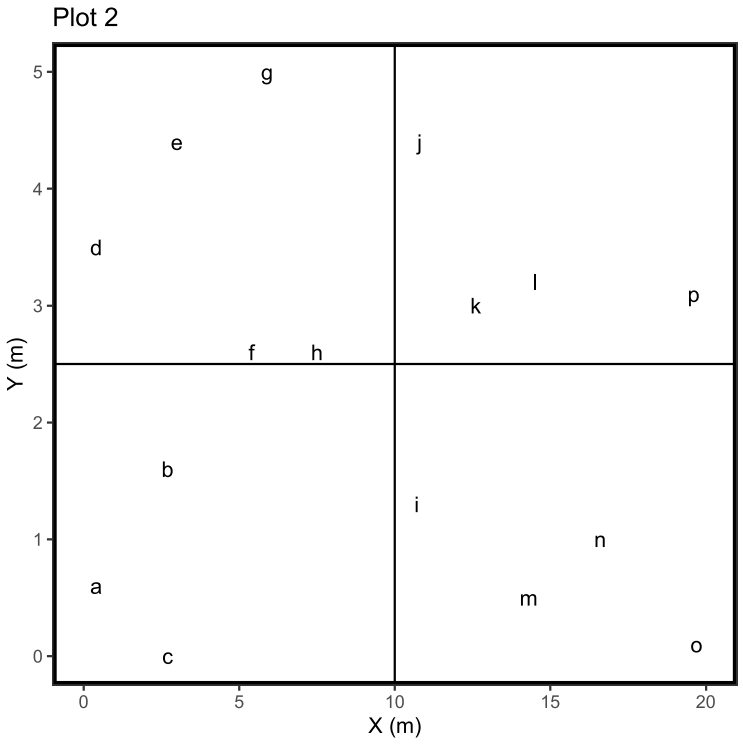
Random Veg Plot 11 (View Southwest) (MY-00)

Random Veg Plot 12 (View Southwest) (MY-00)

Random Veg Plot 12 (View Northeast) (MY-00)

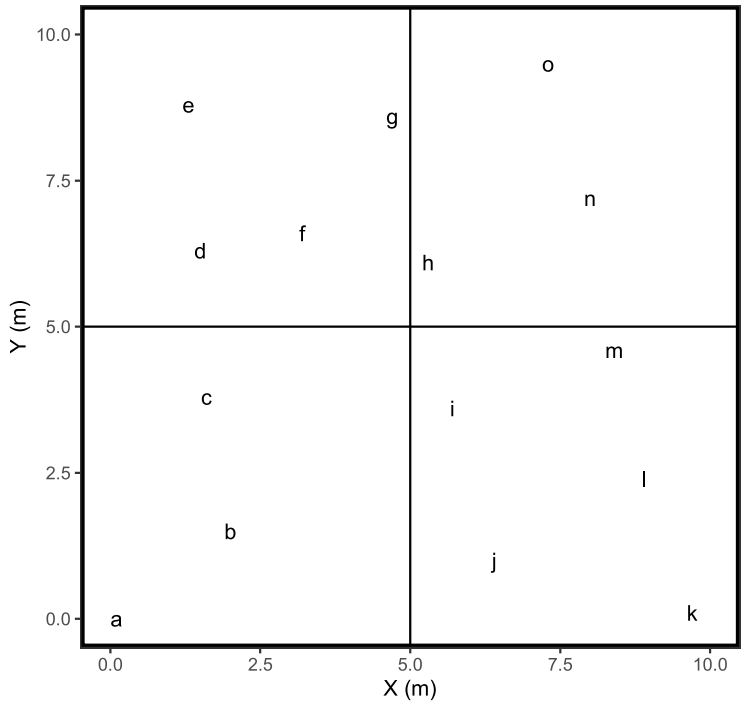


Plot ID	Scientific Name	Common Name	Map ID
1	Liriodendron tulipifera	tuliptree	a
1	Platanus occidentalis	American sycamore	b
1	Liriodendron tulipifera	tuliptree	c
1	Platanus occidentalis	American sycamore	d
1	Quercus nigra	water oak	e
1	Quercus phellos	willow oak	f
1	Liriodendron tulipifera	tuliptree	g
1	Betula nigra	river birch	h
1	Carpinus caroliniana	American hornbeam	i
1	Hamamelis virginiana	American witchhazel	j
1	Fraxinus pennsylvanica	green ash	k
1	Quercus michauxii	swamp chestnut oak	l
1	Quercus michauxii	swamp chestnut oak	m
1	Platanus occidentalis	American sycamore	n
1	Platanus occidentalis	American sycamore	o
1	Liriodendron tulipifera	tuliptree	p
1	Carpinus caroliniana	American hornbeam	q



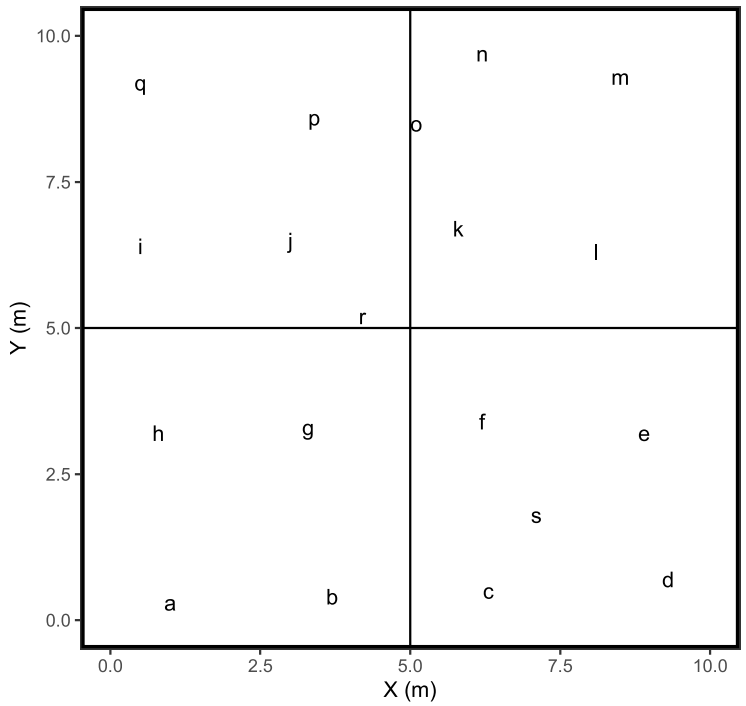
Plot ID	Scientific Name	Common Name	Map ID
2	Quercus pagoda	cherrybark oak	a
2	Quercus pagoda	cherrybark oak	b
2	Hamamelis virginiana	American witchhazel	c
2	Betula nigra	river birch	d
2	Quercus pagoda	cherrybark oak	e
2	Betula nigra	river birch	f
2	Asimina triloba	pawpaw	g
2	Corylus americana	American hazelnut	h
2	Platanus occidentalis	American sycamore	i
2	Liriodendron tulipifera	tuliptree	j
2	Liriodendron tulipifera	tuliptree	k
2	Quercus michauxii	swamp chestnut oak	l
2	Hamamelis virginiana	American witchhazel	m
2	Quercus michauxii	swamp chestnut oak	n
2	Platanus occidentalis	American sycamore	o
2	Lindera benzoin	northern spicebush	p

Plot 3



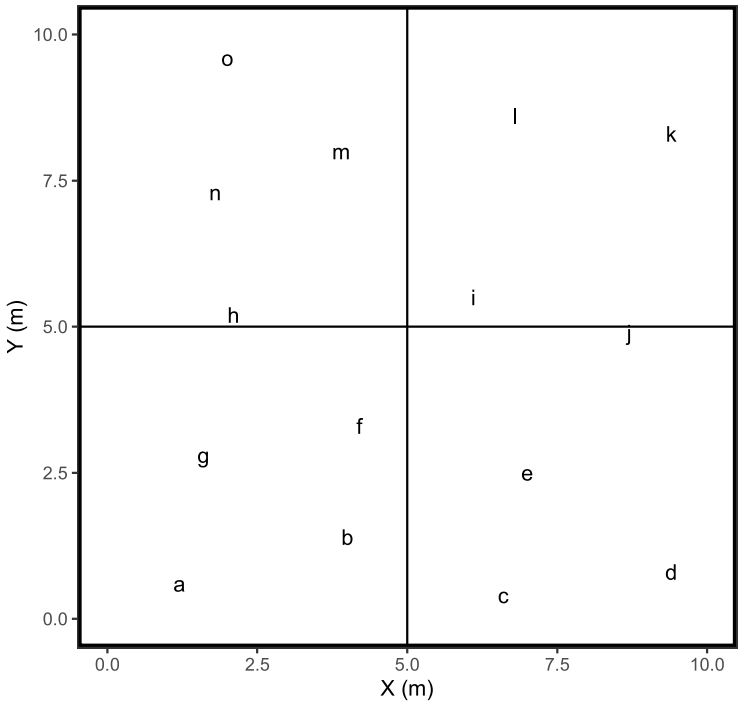
Plot ID	Scientific Name	Common Name	Map ID
3	Platanus occidentalis	American sycamore	a
3	Hamamelis virginiana	American witchhazel	b
3	Quercus phellos	willow oak	c
3	Platanus occidentalis	American sycamore	d
3	Asimina triloba	pawpaw	e
3	Platanus occidentalis	American sycamore	f
3	Liriodendron tulipifera	tuliptree	g
3	Quercus pagoda	cherrybark oak	h
3	Liriodendron tulipifera	tuliptree	i
3	Liriodendron tulipifera	tuliptree	j
3	Quercus phellos	willow oak	k
3	Platanus occidentalis	American sycamore	l
3	Liriodendron tulipifera	tuliptree	m
3	Betula nigra	river birch	n
3	Quercus nigra	water oak	o

Plot 4



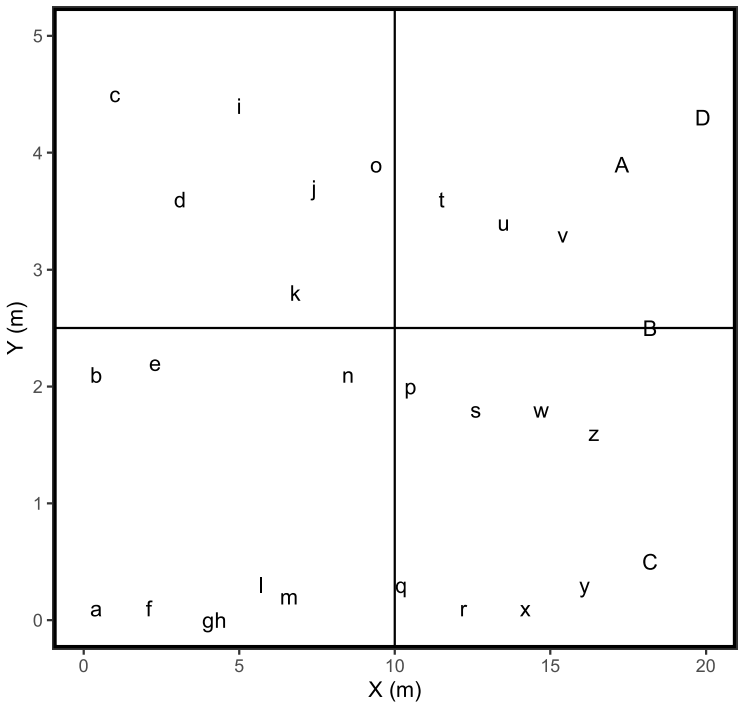
Plot ID	Scientific Name	Common Name	Map ID
4	Quercus phellos	willow oak	a
4	Liriodendron tulipifera	tuliptree	b
4	Carpinus caroliniana	American hornbeam	c
4	Quercus pagoda	cherrybark oak	d
4	Quercus pagoda	cherrybark oak	e
4	Platanus occidentalis	American sycamore	f
4	Carpinus caroliniana	American hornbeam	g
4	Liriodendron tulipifera	tuliptree	h
4	Asimina triloba	pawpaw	i
4	Asimina triloba	pawpaw	j
4	Quercus phellos	willow oak	k
4	Platanus occidentalis	American sycamore	l
4	Liriodendron tulipifera	tuliptree	m
4	Liriodendron tulipifera	tuliptree	n
4	Betula nigra	river birch	o
4	Carpinus caroliniana	American hornbeam	p
4	Quercus nigra	water oak	q
4	Platanus occidentalis	American sycamore	r
4	Hamamelis virginiana	American witchhazel	s

Plot 5

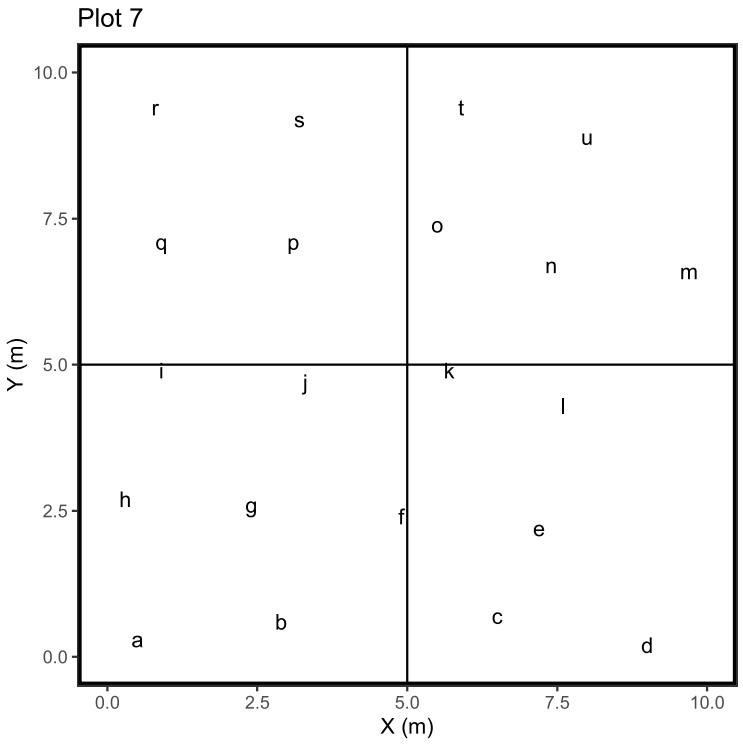


Plot ID	Scientific Name	Common Name	Map ID
5	Diospyros virginiana	common persimmon	a
5	Liriodendron tulipifera	tuliptree	b
5	Quercus michauxii	swamp chestnut oak	c
5	Platanus occidentalis	American sycamore	d
5	Liriodendron tulipifera	tuliptree	e
5	Quercus phellos	willow oak	f
5	Lindera benzoin	northern spicebush	g
5	Asimina triloba	pawpaw	h
5	Liriodendron tulipifera	tuliptree	i
5	Quercus nigra	water oak	j
5	Platanus occidentalis	American sycamore	k
5	Liriodendron tulipifera	tuliptree	l
5	Liriodendron tulipifera	tuliptree	m
5	Liriodendron tulipifera	tuliptree	n
5	Liriodendron tulipifera	tuliptree	o

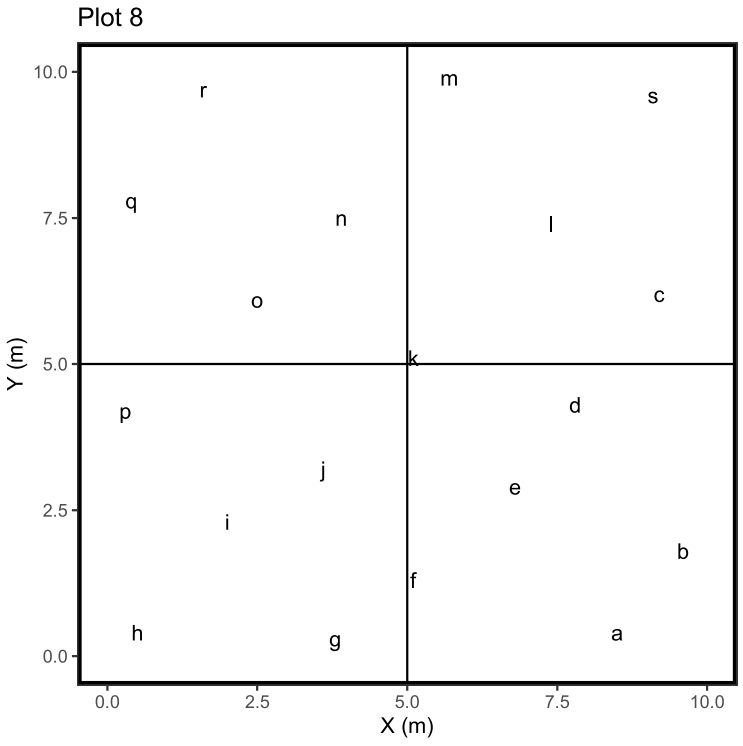
Plot 6



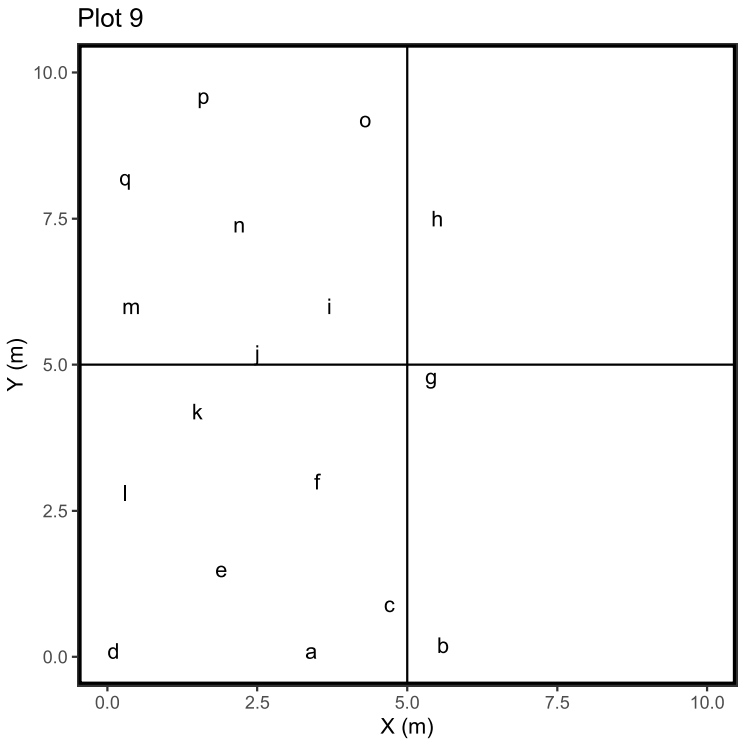
Plot ID	Scientific Name	Common Name	Map ID
6	Diospyros virginiana	common persimmon	a
6	Quercus phellos	willow oak	b
6	Quercus phellos	willow oak	c
6	Fraxinus pennsylvanica	green ash	d
6	Quercus pagoda	cherrybark oak	e
6	Platanus occidentalis	American sycamore	f
6	Fraxinus pennsylvanica	green ash	g
6	Corylus americana	American hazelnut	h
6	Quercus phellos	willow oak	i
6	Quercus nigra	water oak	j
6	Quercus nigra	water oak	k
6	Betula nigra	river birch	l
6	Platanus occidentalis	American sycamore	m
6	Quercus pagoda	cherrybark oak	n
6	Platanus occidentalis	American sycamore	o
6	Betula nigra	river birch	p
6	Betula nigra	river birch	q
6	Quercus michauxii	swamp chestnut oak	r
6	Betula nigra	river birch	s
6	Platanus occidentalis	American sycamore	t
6	Platanus occidentalis	American sycamore	u
6	Quercus nigra	water oak	v
6	Betula nigra	river birch	w
6	Betula nigra	river birch	x
6	Fraxinus pennsylvanica	green ash	y
6	Betula nigra	river birch	z
6	Quercus michauxii	swamp chestnut oak	A
6	Betula nigra	river birch	B
6	Fraxinus pennsylvanica	green ash	C
6	Quercus michauxii	swamp chestnut oak	D



Plot ID	Scientific Name	Common Name	Map ID
7	Carpinus caroliniana	American hornbeam	a
7	Platanus occidentalis	American sycamore	b
7	Platanus occidentalis	American sycamore	c
7	Betula nigra	river birch	d
7	Quercus phellos	willow oak	e
7	Betula nigra	river birch	f
7	Corylus americana	American hazelnut	g
7	Platanus occidentalis	American sycamore	h
7	Lindera benzoin	northern spicebush	i
7	Liriodendron tulipifera	tuliptree	j
7	Platanus occidentalis	American sycamore	k
7	Platanus occidentalis	American sycamore	l
7	Quercus phellos	willow oak	m
7	Quercus phellos	willow oak	n
7	Platanus occidentalis	American sycamore	o
7	Liriodendron tulipifera	tuliptree	p
7	Quercus pagoda	cherrybark oak	q
7	Quercus phellos	willow oak	r
7	Liriodendron tulipifera	tuliptree	s
7	Liriodendron tulipifera	tuliptree	t
7	Liriodendron tulipifera	tuliptree	u



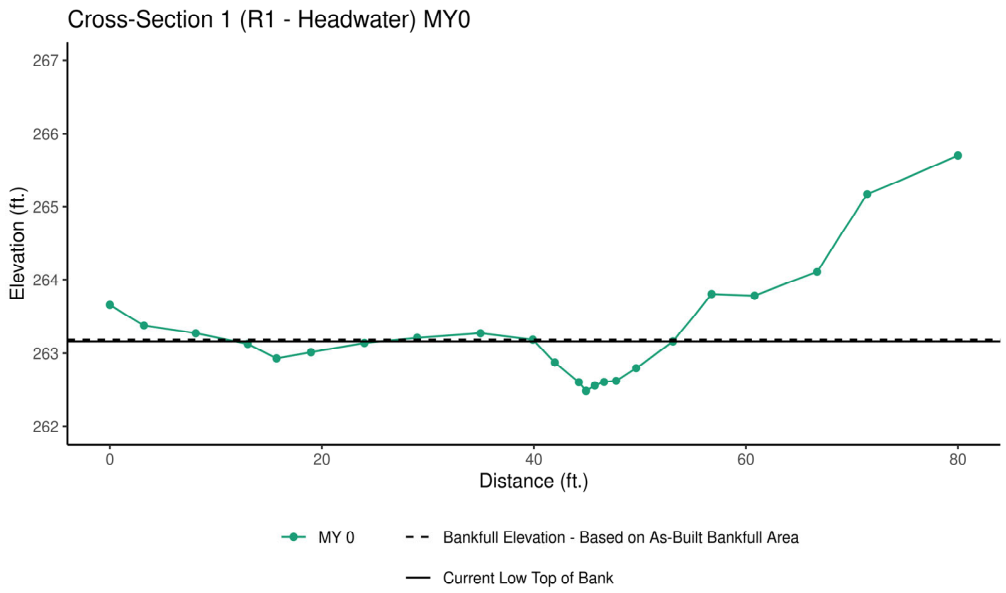
Plot ID	Scientific Name	Common Name	Map ID
8	Fraxinus pennsylvanica	green ash	a
8	Diospyros virginiana	common persimmon	b
8	Carpinus caroliniana	American hornbeam	c
8	Fraxinus pennsylvanica	green ash	d
8	Fraxinus pennsylvanica	green ash	e
8	Platanus occidentalis	American sycamore	f
8	Platanus occidentalis	American sycamore	g
8	Fraxinus pennsylvanica	green ash	h
8	Platanus occidentalis	American sycamore	i
8	Platanus occidentalis	American sycamore	j
8	Carpinus caroliniana	American hornbeam	k
8	Betula nigra	river birch	l
8	Carpinus caroliniana	American hornbeam	m
8	Fraxinus pennsylvanica	green ash	n
8	Platanus occidentalis	American sycamore	o
8	Platanus occidentalis	American sycamore	p
8	Platanus occidentalis	American sycamore	q
8	Fraxinus pennsylvanica	green ash	r
8	Hamamelis virginiana	American witchhazel	s



Plot ID	Scientific Name	Common Name	Map ID
9	Liriodendron tulipifera	tuliptree	a
9	Liriodendron tulipifera	tuliptree	b
9	Quercus nigra	water oak	c
9	Quercus nigra	water oak	d
9	Quercus phellos	willow oak	e
9	Quercus phellos	willow oak	f
9	Quercus phellos	willow oak	g
9	Fraxinus pennsylvanica	green ash	h
9	Fraxinus pennsylvanica	green ash	i
9	Carpinus caroliniana	American hornbeam	j
9	Platanus occidentalis	American sycamore	k
9	Quercus pagoda	cherrybark oak	l
9	Quercus pagoda	cherrybark oak	m
9	Quercus phellos	willow oak	n
9	Quercus phellos	willow oak	o
9	Quercus pagoda	cherrybark oak	p
9	Betula nigra	river birch	q

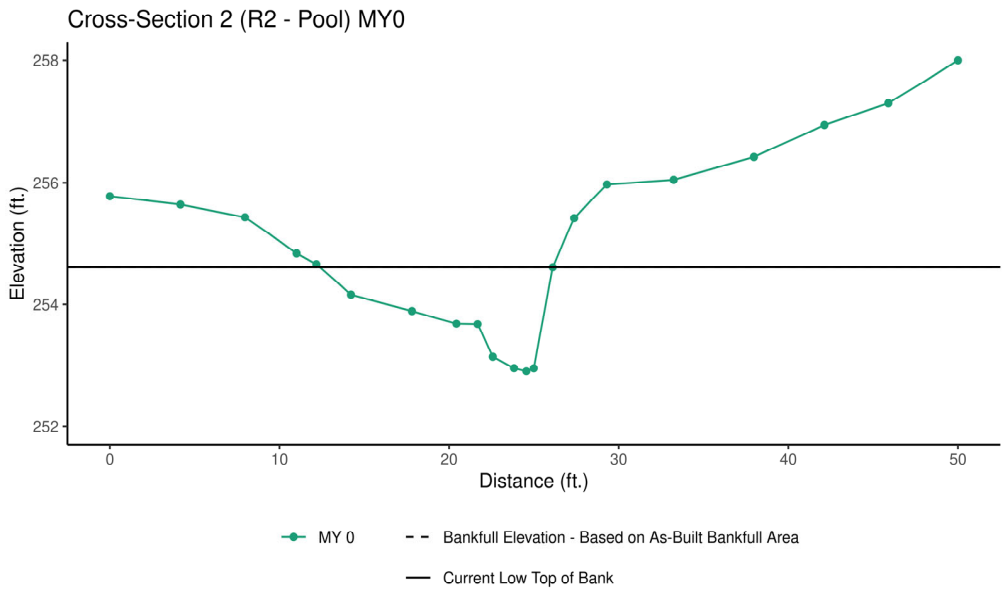
Appendix C:
Stream Geomorphology Data

Cross-Sections with Annual Overlays
Baseline Longitudinal Profile
Baseline Stream Data Summary Tables
Cross-Section Morphology Data



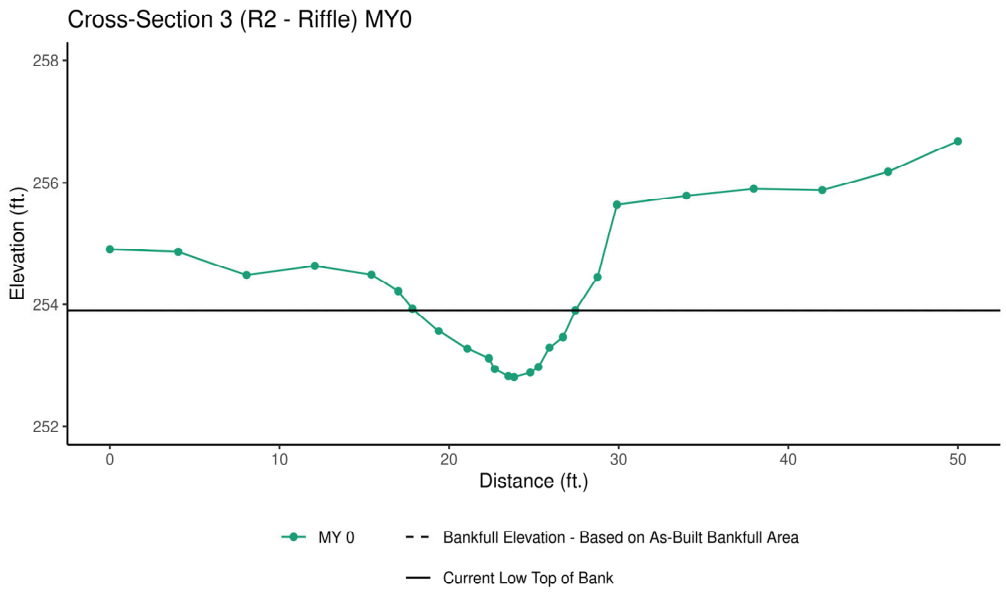
Distance	Elevation	Features
0	263.66	TLP
3.21762102	263.377	
8.1012209	263.268	
13.0068711	263.123	
15.7230882	262.931	
18.9721333	263.013	
24.0131884	263.136	
28.9898673	263.206	
34.9634537	263.268	
39.8961583	263.181	TLB, BKF
41.9740322	262.875	
44.2414602	262.6	LEW
44.9172464	262.483	THW
45.7456592	262.555	
46.6212066	262.603	REW
47.7577308	262.618	
49.6458951	262.797	
53.1173216	263.157	TRB
56.7610276	263.804	
60.8177063	263.782	
66.7124862	264.11	
71.4457487	265.174	
80	265.698	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	263.18							
Bank Height Ratio - Based on As-Built Bankfull Area	0.96							
Thalweg Elevation	262.48							
LTOB Elevation	263.16							
LTOB Max Depth	0.674							
LTOB Cross Sectional Area	4.77							



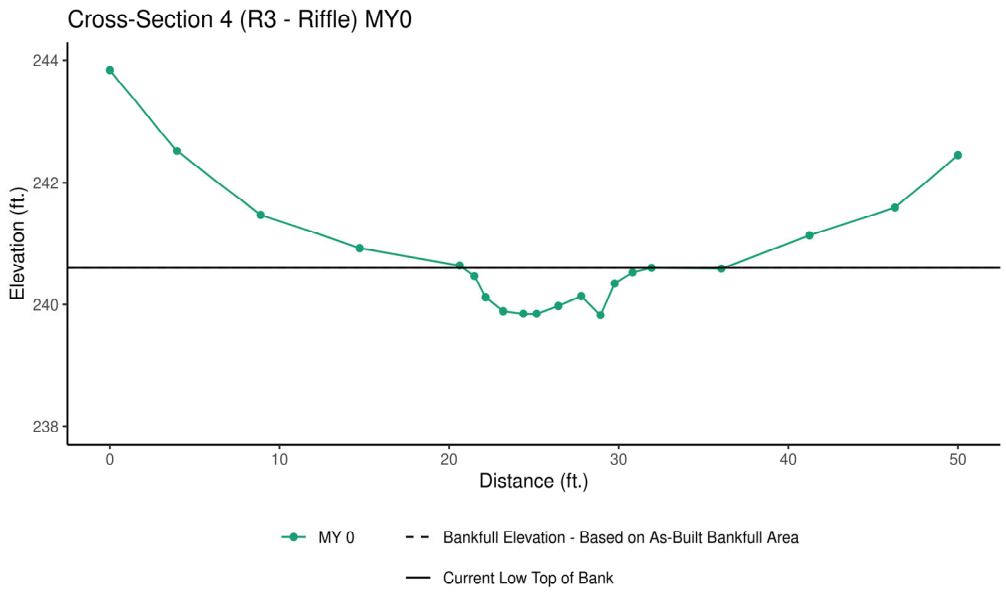
Distance	Elevation	Features
0	255.772	TLP
4.16149649	255.637	
7.96496585	255.428	
11.007553	254.835	
12.1749619	254.66	TLB
14.2163795	254.155	
17.8122883	253.891	
20.4328914	253.682	
21.6817288	253.675	
22.5765706	253.143	LEW
23.8282721	252.957	
24.5543602	252.906	THW
24.9935798	252.955	REW
26.1109158	254.61	TRB, BKF
27.3725572	255.414	
29.3058486	255.971	
33.2406827	256.048	
37.9718276	256.416	
42.1271405	256.945	
45.8967429	257.296	
50	258	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	254.61							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	252.91							
LTOB Elevation	254.61							
LTOB Max Depth	1.704							
LTOB Cross Sectional Area	11.76							



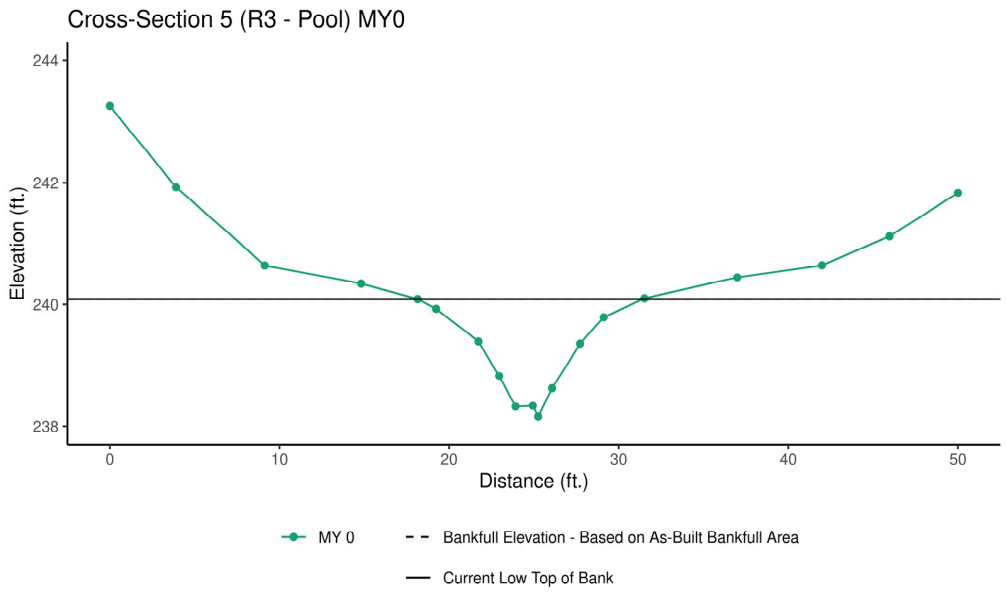
Distance	Elevation	Features
0	254.901	TLP
4.03151312	254.86	
8.05891389	254.479	
12.0820873	254.633	
15.4218492	254.484	
17.0051659	254.212	
17.8380307	253.93	TLB
19.388986	253.558	
21.0775378	253.272	
22.3455016	253.118	
22.6948921	252.943	LEW
23.4904365	252.825	
23.8309149	252.809	THW
24.7871188	252.885	
25.2678376	252.977	REW
25.918131	253.288	
26.71262	253.456	
27.4435581	253.904	TRB, BKF
28.7524682	254.444	
29.8957815	255.632	
33.9938929	255.781	
37.9593341	255.899	
42.0014874	255.877	
45.8818011	256.178	
50	256.675	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	253.90							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	252.81							
LTOB Elevation	253.90							
LTOB Max Depth	1.095							
LTOB Cross Sectional Area	6.03							



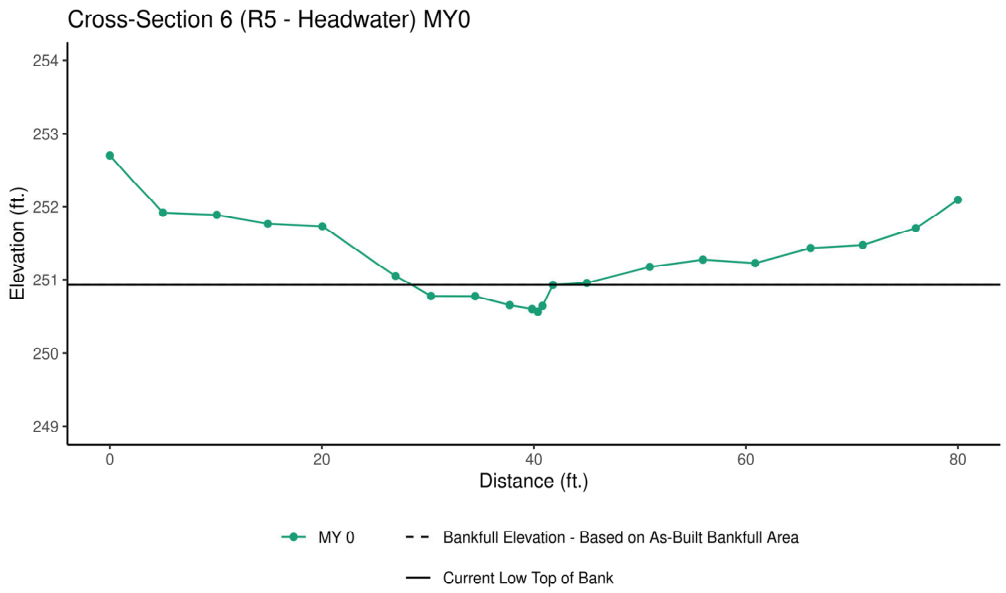
Distance	Elevation	Features
0	243.839	TLP
3.95452715	242.514	
8.89212427	241.467	
14.7295684	240.919	
20.623485	240.639	TLB
21.486855	240.462	
22.149498	240.115	LEW
23.1882395	239.892	
24.3784161	239.85	
25.1576374	239.849	THW
26.4426693	239.976	
27.7896542	240.132	
28.9273996	239.826	
29.7624802	240.338	REW
30.819244	240.523	
31.9363554	240.601	TRB, BKF
36.0512331	240.588	
41.2482107	241.125	
46.281841	241.588	
50	242.442	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	240.60							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	239.85							
LTOB Elevation	240.60							
LTOB Max Depth	0.752							
LTOB Cross Sectional Area	4.90							



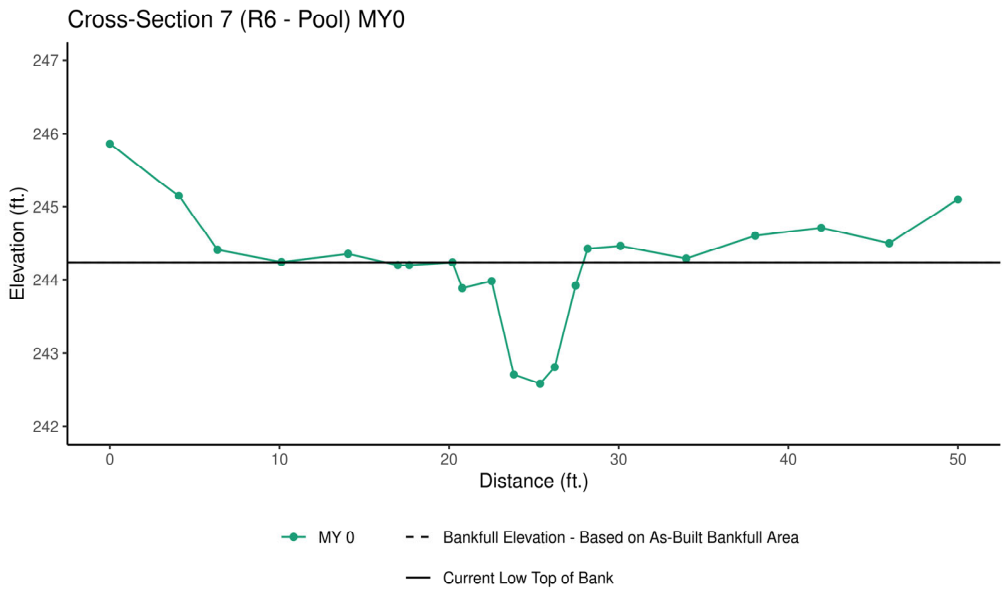
Distance	Elevation	Features
0	243.251	TLP
3.90129889	241.924	
9.12909289	240.639	
14.8138033	240.335	
18.1463366	240.085	TLB, BKF
19.233291	239.928	
21.7313279	239.389	LEW
22.9514465	238.825	
23.9180688	238.323	
24.9357467	238.336	THW
25.2514991	238.159	
26.0717019	238.622	
27.7204923	239.353	REW
29.1177418	239.79	
31.5173604	240.097	TRB
36.9876084	240.438	
41.9813675	240.642	
45.9617756	241.11	
50	241.829	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	240.09							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	238.34							
LTOB Elevation	240.09							
LTOB Max Depth	1.749							
LTOB Cross Sectional Area	10.02							



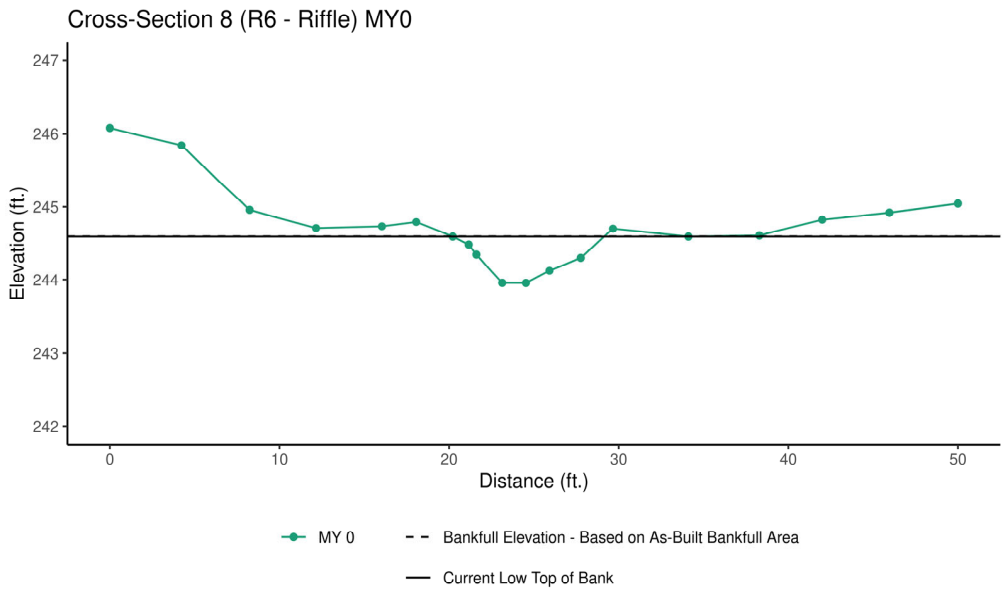
Distance	Elevation	Features
0	252.697	TLP
5.00446241	251.92	
10.0878593	251.89	
14.8985366	251.766	
20.044288	251.729	
26.9519767	251.052	TLB
30.2900103	250.778	
34.4575034	250.776	
37.717808	250.657	
39.8296093	250.605	
40.3774576	250.569	THW
40.8095245	250.647	REW
41.7972294	250.928	TRB, BKF
44.9950278	250.954	
50.9320066	251.18	
55.9426926	251.278	
60.8786019	251.231	
66.1009831	251.433	
71.0224593	251.475	
76.0234489	251.704	
80	252.094	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	250.93							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	250.57							
LTOB Elevation	250.93							
LTOB Max Depth	0.359							
LTOB Cross Sectional Area	2.55							



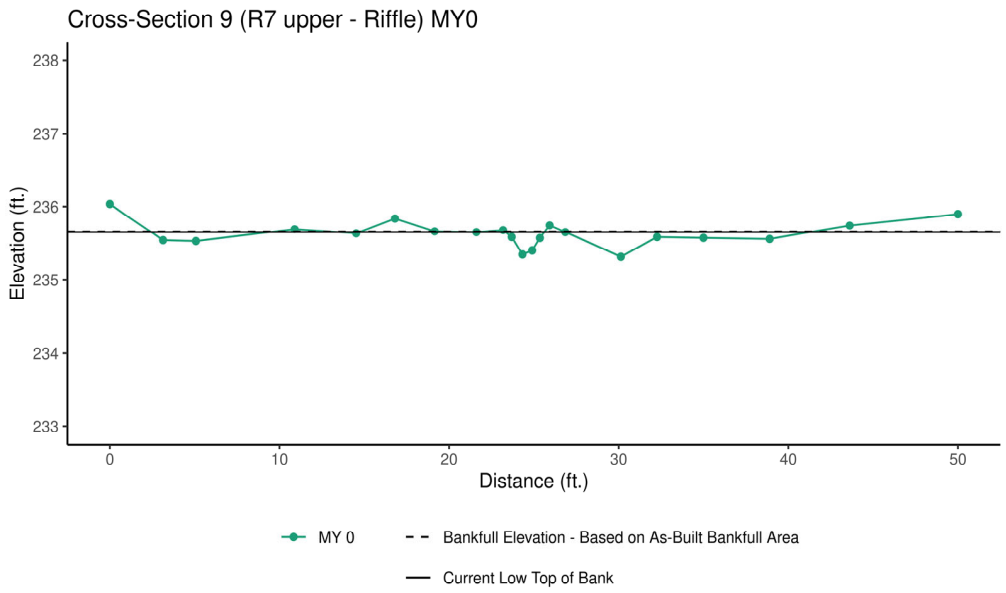
Distance	Elevation	Features
0	245.859	TLP
4.06531881	245.15	
6.34482159	244.411	
10.1161799	244.246	
14.0444837	244.356	
16.9767609	244.204	
17.6503834	244.204	
20.1993214	244.242	TLB, BKF
20.7724056	243.884	
22.5087482	243.98	LEW
23.8193192	242.707	
25.3651806	242.579	THW
26.2278646	242.812	
27.4620956	243.919	REW
28.1685243	244.425	TRB
30.1043234	244.462	
33.9797334	244.294	
38.0488834	244.6	
41.9404591	244.708	
45.9495869	244.498	
50	245.099	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	244.24							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	242.58							
LTOB Elevation	244.24							
LTOB Max Depth	1.663							
LTOB Cross Sectional Area	6.78							



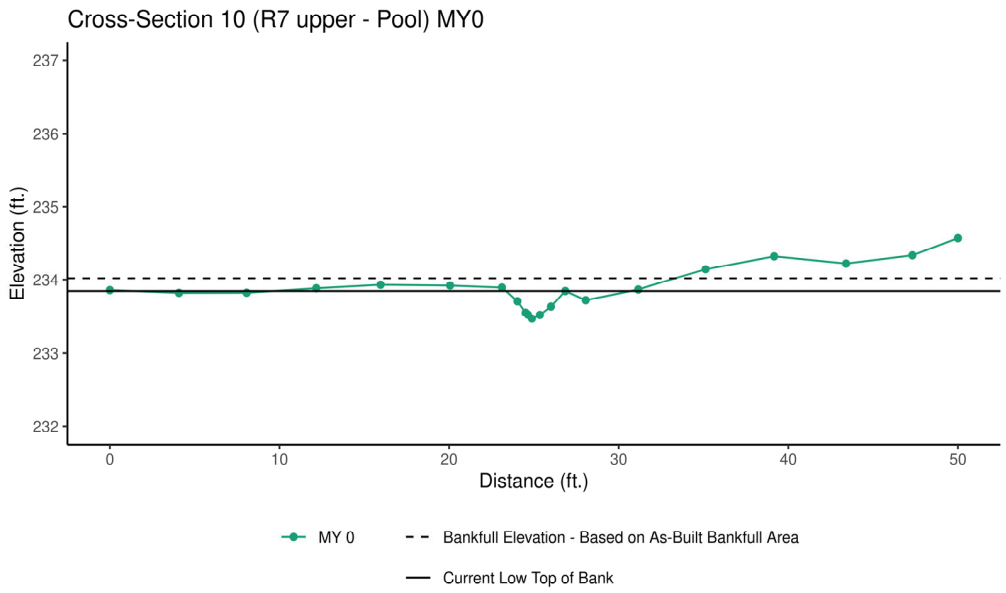
Distance	Elevation	Features
0	246.08	TLP
4.22098531	245.838	
8.24019302	244.958	
12.1560777	244.704	
16.0390876	244.729	
18.0612763	244.791	
20.2145515	244.588	TLB
21.1587208	244.479	
21.609788	244.347	LEW
23.1343721	243.956	THW
24.5295715	243.955	
25.9175317	244.127	
27.7622968	244.302	REW
29.661418	244.696	
34.1093706	244.588	TRB, BKF
38.2920663	244.603	
41.9982984	244.823	
45.9587526	244.92	
50	245.044	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	244.59							
Bank Height Ratio - Based on As-Built Bankfull Area	1.00							
Thalweg Elevation	243.96							
LTOB Elevation	244.59							
LTOB Max Depth	0.632							
LTOB Cross Sectional Area	3.23							



Distance	Elevation	Features
0	236.034	TLP
3.1349504	235.54	
5.07291258	235.528	
10.8944722	235.69	
14.5207868	235.633	
16.8093882	235.839	
19.1489961	235.66	
21.6081564	235.649	
23.1828047	235.677	TLB
23.69206	235.582	LEW
24.3258246	235.35	THW
24.8979	235.403	
25.3532398	235.569	
25.927702	235.745	REW
26.8508177	235.649	TRB, BKF
30.1282337	235.319	
32.2623764	235.582	
34.996658	235.571	
38.9002414	235.556	
43.6166778	235.742	
50	235.9	TRP

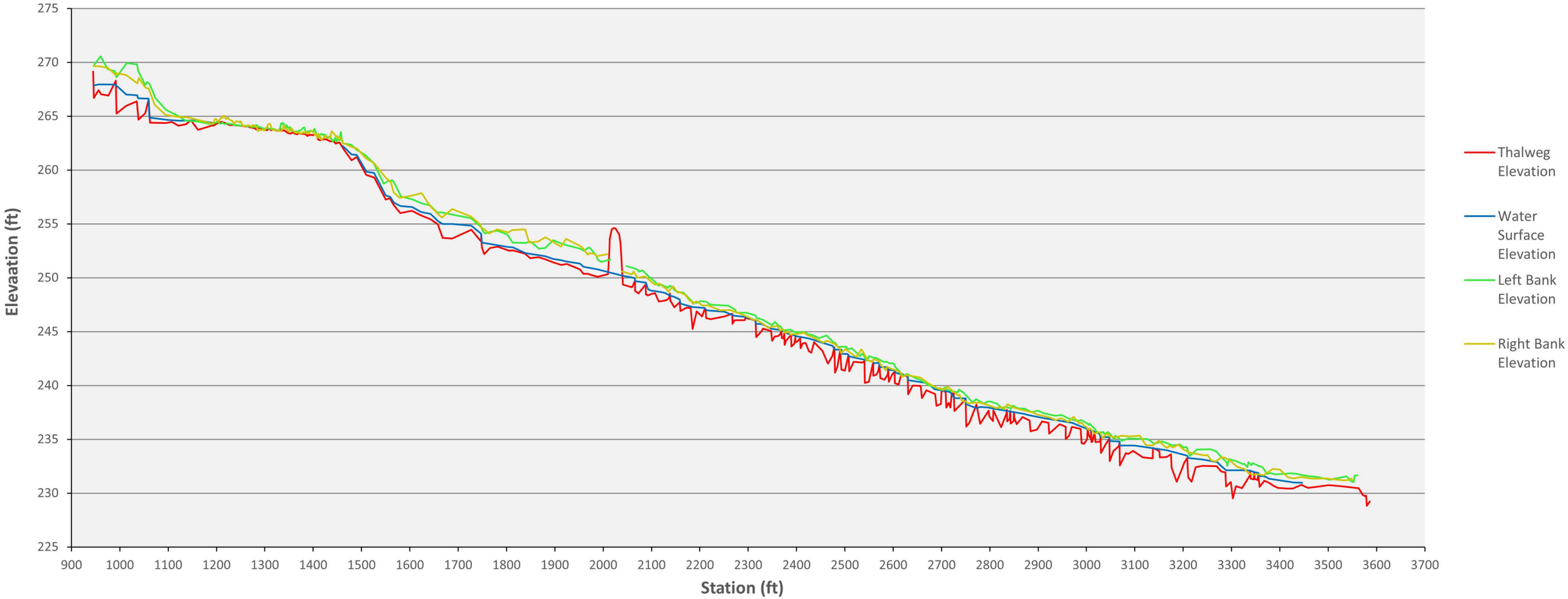
	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	235.65							
Bank Height Ratio - Based on As-Built Bankfull Area	0.97							
Thalweg Elevation	235.35							
LTOB Elevation	235.65							
LTOB Max Depth	0.299							
LTOB Cross Sectional Area	0.39							



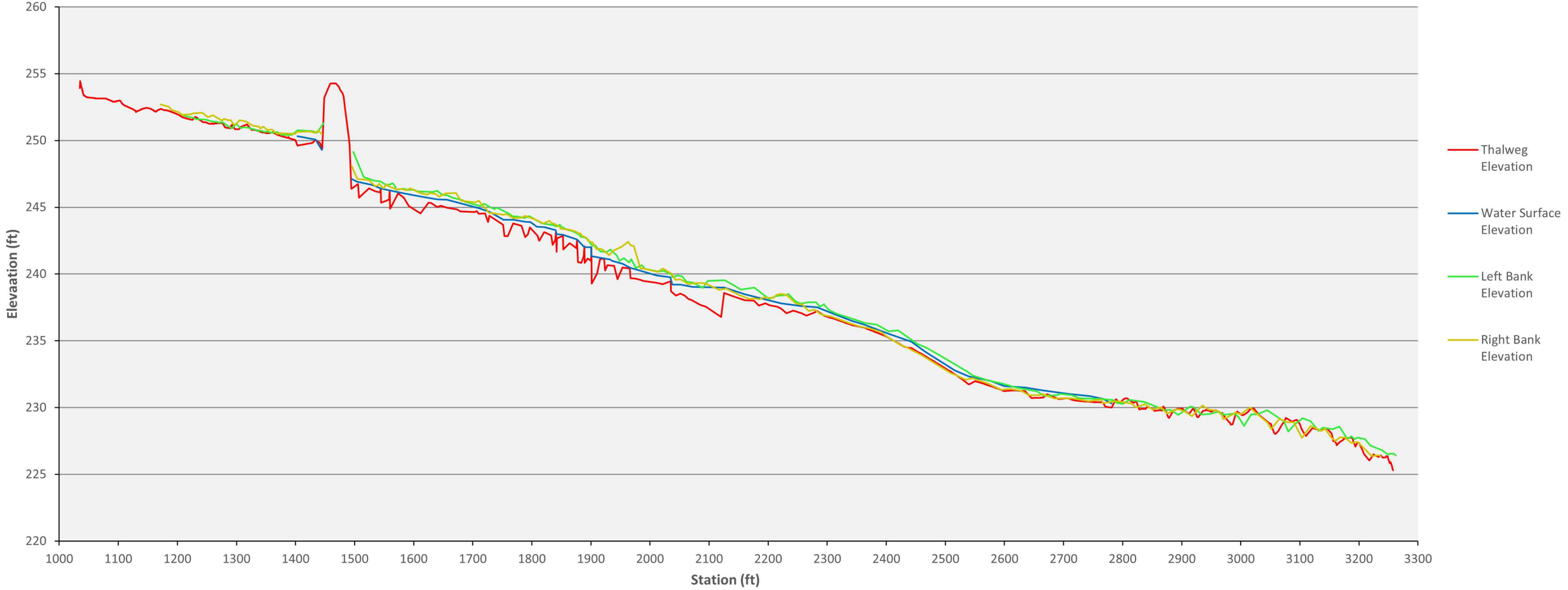
Distance	Elevation	Features
0	233.858	TLP
4.07528551	233.82	
8.0649266	233.822	
12.1713	233.883	
15.963298	233.93	
20.058336	233.919	
23.1165907	233.892	TLB, BKF
24.028201	233.708	LEW
24.5076751	233.555	
24.6497585	233.527	
24.8844045	233.474	THW
25.35148	233.524	
26.0052017	233.637	REW
26.8511769	233.845	TRB
28.0551381	233.722	
31.1541693	233.866	
35.1212256	234.147	
39.1651712	234.323	
43.4049889	234.226	
47.3148504	234.337	
50	234.566	TRP

	MY0	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation - Based on As-Built Bankfull Area	233.89							
Bank Height Ratio - Based on As-Built Bankfull Area	0.68							
Thalweg Elevation	233.47							
LTOB Elevation	233.85							
LTOB Max Depth	0.371							
LTOB Cross Sectional Area	0.70							

Odell's House Mitigation Project
Longitudinal Profile - R1, R2, R3, R4
As-Built (MY0 2021)(Data Collected May 2021)



Odell's House Mitigation Project
Longitudinal Profile - R5, R6, R7
As-Built (MY0 2021)(Data Collected May 2021)



Baseline Stream Data Summary Odell's House, R1											Odell's House, R2										Odell's House, R3									
Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		N/A			0		6.0		13.2	1.0		11.0			1.0		8.0		9.5	1.0		5.7			1.0		8.0		11.1	1.0
Floodprone Width (ft)		N/A			0	31.3	115.0		62.6	1.0		27.0			1.0	25.0	50.0		29.3	1.0		11.5			1.0	25.0	30.0		34.3	1.0
Bankfull Mean Depth (ft)		N/A			0		0.5		0.4	1.0		0.3			1.0		0.5		0.6	1.0		1.0			1.0		0.6		0.5	1.0
Bankfull Max Depth (ft)		N/A			0		0.7		0.7	1.0		0.7			1.0		0.7		1.1	1.0		1.4			1.0		0.8		0.8	1.0
Bankfull Cross Sectional Area (ft^2)		N/A			0		3.2		5.1	1.0		3.7			1.0		4.2		6.0	1.0		5.6			1.0		4.8		5.4	1.0
Width/Depth Ratio		N/A			0		11.4		34.3	1.0		33.0			1.0		15.2		15.0	1.0		5.8			1.0		13.3		23.2	1.0
Entrenchment Ratio		N/A			0	5.2	19.2		4.7	1.0		2.5			1.0	3.1	6.3		3.1	1.0		2.0			1.0	3.1	3.8		3.1	1.0
Bank Height Ratio		N/A			0		1.0		1.0	1.0		1.0			1.0		1.0		1.0	1.0		1.4			1.0		1.0		1.0	1.0
Max part size (mm) mobilized at bankfull	N/A					19.0		17.0			25.0					37.0		42.0			46.0					35.0		32.0		
Rosgen Classification	Pond					DA/E5		DA			C5					C5		C5			G5					B5		B5c		
Bankfull Discharge (cfs)	11.0					11.0		11.0			14.5					14.5		14.5			20.0					20.0		20.0		
Sinuosity (ft)	N/A					1.08		1.16			1.07					1.07		1.04			1.20					1.12		1.10		
Water Surface Slope (Channel) (ft/ft)	N/A					0.0089		0.0107			0.0168					0.0168		0.0195			0.0133					0.0142		0.0152		
Other																														

Baseline Stream Data Summary Odell's House, R5											Odell's House, R6										Odell's House, R7 upper									
Parameter	Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)			Pre-Existing Condition (applicable)					Design		Monitoring Baseline (MY0)		
Riffle Only	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n	Min	Mean	Med	Max	n	Min	Max	Min	Max	n
Bankfull Width (ft)		N/A			0		5.5		13.4	1.0		4.1			1.0		6.0		8.9	1.0					1.0		6.0		2.2	1.0
Floodprone Width (ft)		N/A			0	49.0	103.0		38.1	1.0		53.3			1.0	22.0	40.0		44.0	1.0					1.0	126.0	145.0		49.6	1.0
Bankfull Mean Depth (ft)		N/A			0		0.3		0.2	1.0		0.6			1.0		0.4		0.4	1.0					1.0		0.4		0.2	1.0
Bankfull Max Depth (ft)		N/A			0		0.4		0.4	1.0		1.1			1.0		0.5		0.6	1.0					1.0		0.5		0.3	1.0
Bankfull Cross Sectional Area (ft^2)		N/A			0		1.8		2.6	1.0		2.5			1.0		2.4		3.3	1.0					1.0		2.4		0.4	1.0
Width/Depth Ratio		N/A			0		16.8		68.9	1.0		6.8			1.0		15.2		24.0	1.0		4.2			1.0		15.2		14.0	1.0
Entrenchment Ratio		N/A			0	8.9	18.7		2.8	1.0		12.9			1.0	3.7	6.7		4.9	1.0		1.5			1.0	21.0	24.2		22.2	1.0
Bank Height Ratio		N/A			0		1.0		1.0	1.0		2.3			1.0		1.0		1.0	1.0		1.3			1.0		1.0		1.0	1.0
Max part size (mm) mobilized at bankfull	N/A					10.0		7.0			32.0					22.0		20.0								20.0		11.0		
Rosgen Classification	Pond					DA/E5		DA			E5					B5c		B5c			G5 / Channelized					B5c		B5c		
Bankfull Discharge (cfs)	10.0					10.0		10.0			10.0					10.0		10.0			10.0					10.0		10.0		
Sinuosity (ft)	N/A					1.08		1.09			1.05					1.12		1.09			1.03					1.07		1.09		
Water Surface Slope (Channel) (ft/ft)	N/A					0.0077		0.0083			0.0145					0.0135		0.0129			0.0153					0.0123		0.0131		
Other																														

Cross-Section Morphology Data

Odell's House Mitigation Project: DMS #100041 (Data Collected 3/24/2021)

	Cross-Section 1 (Headwater - R1)							Cross-Section 2 (Pool - R2)							Cross-Section 3 (Riffle - R2)							Cross Section-4 (Riffle - R3)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	263.18							254.61							253.90							240.60						
Bank Height Ratio_Based on AB Bankfull[1] Area	0.96							1.00							1.00							1.00						
Thalweg Elevation	262.48							252.91							252.81							239.85						
LTOB[2] Elevation	263.16							254.61							253.90							240.60						
LTOB[2] Max Depth (ft)	0.67							1.70							1.10							0.75						
LTOB[2] Cross Sectional Area (ft^2)	4.77							11.76							6.03							4.90						

	Cross-Section 5 (Pool - R3)							Cross-Section 6 (Headwater - R5)							Cross-Section 7 (Pool - R6)							Cross-Section 8 (Riffle - R6)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	240.09							250.93							244.24							244.59						
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00							1.00							1.00							1.00						
Thalweg Elevation	238.34							250.57							242.58							243.96						
LTOB[2] Elevation	240.09							250.93							244.24							244.59						
LTOB[2] Max Depth (ft)	1.75							0.36							1.66							0.63						
LTOB[2] Cross Sectional Area (ft^2)	10.02							2.55							6.78							3.23						

	Cross-Section 9 (Riffle - R7 upper)							Cross-Section 10 (Pool - R7 upper)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	235.65							233.89						
Bank Height Ratio_Based on AB Bankfull[1] Area	0.97							0.68						
Thalweg Elevation	235.35							233.47						
LTOB[2] Elevation	235.65							233.85						
LTOB[2] Max Depth (ft)	0.30							0.37						
LTOB[2] Cross Sectional Area (ft^2)	0.39							0.70						

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

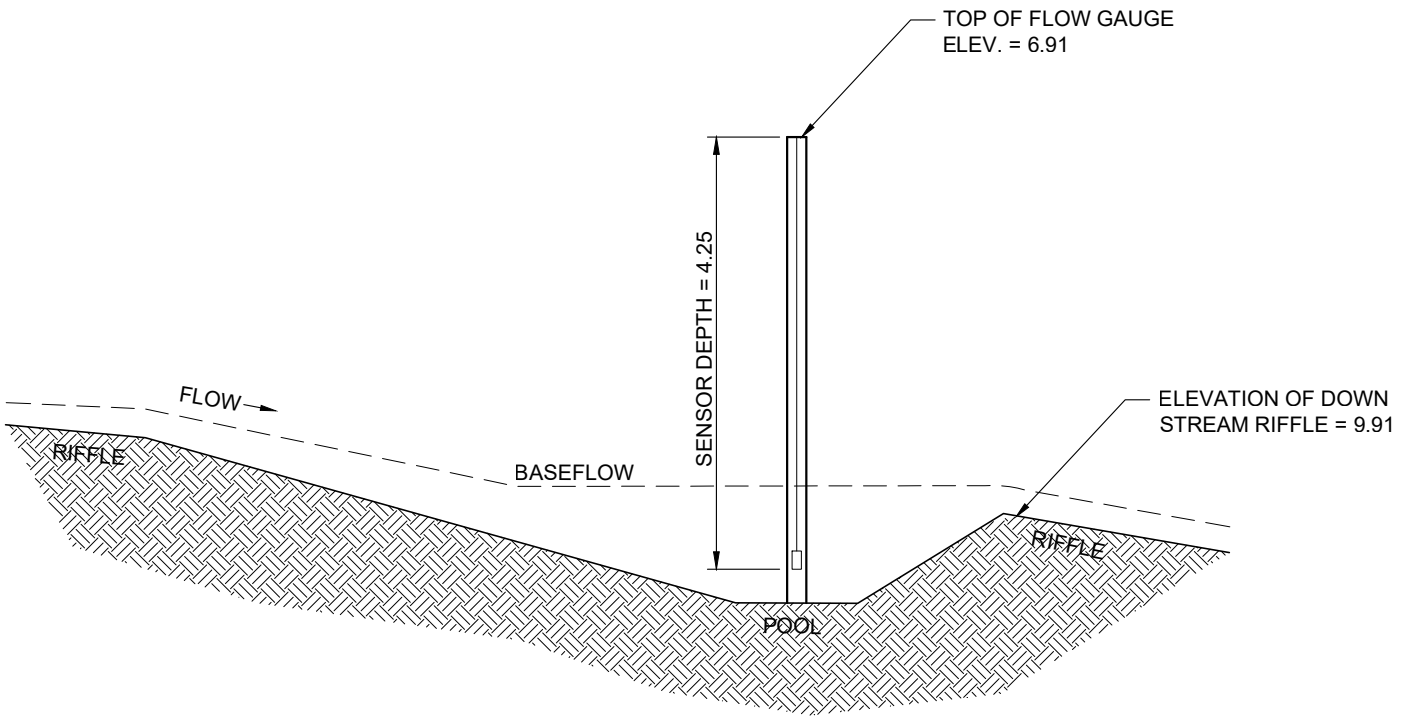
1 - **Bank Height Ratio (BHR)** takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section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

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

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

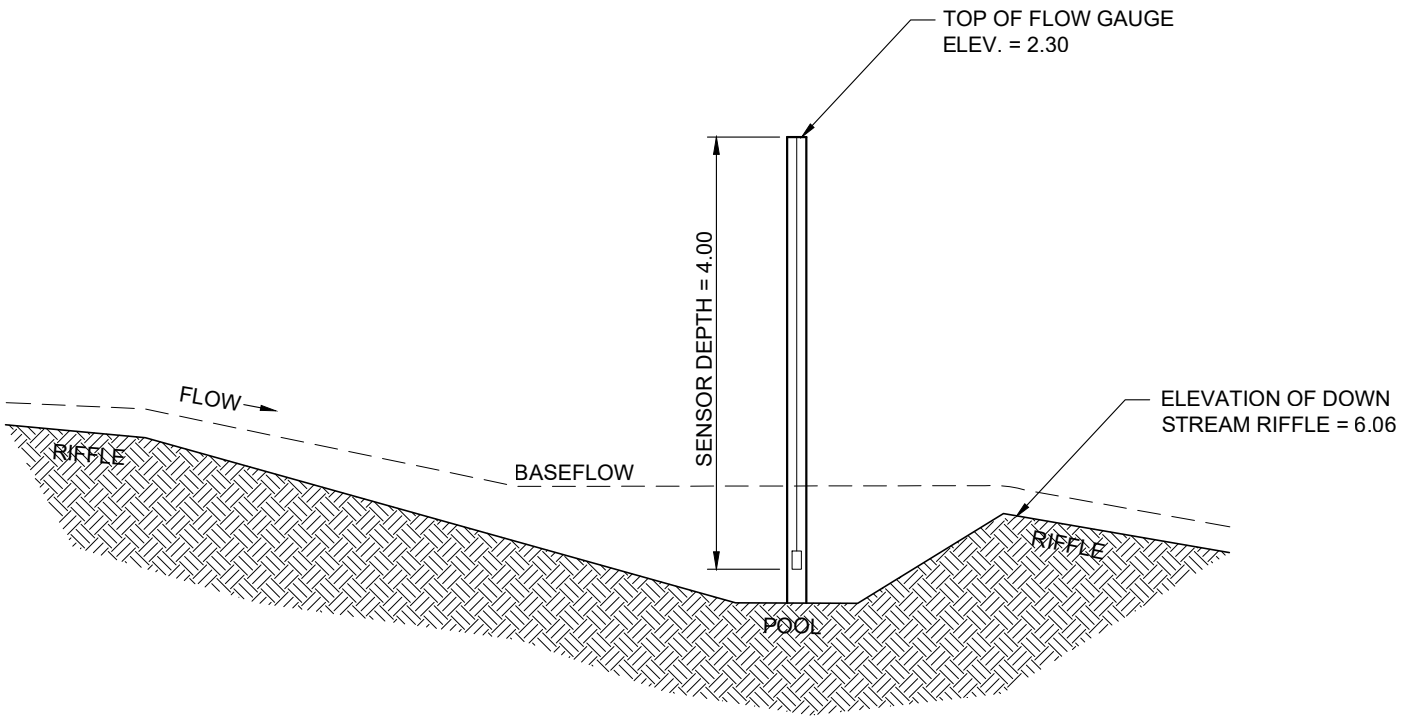
Appendix D:
Hydrologic Data

Flow Gauge and Crest Gauge Diagrams
Photos: Surface Flow and Wetland Gauges



FLOW GAUGE #1 - R1

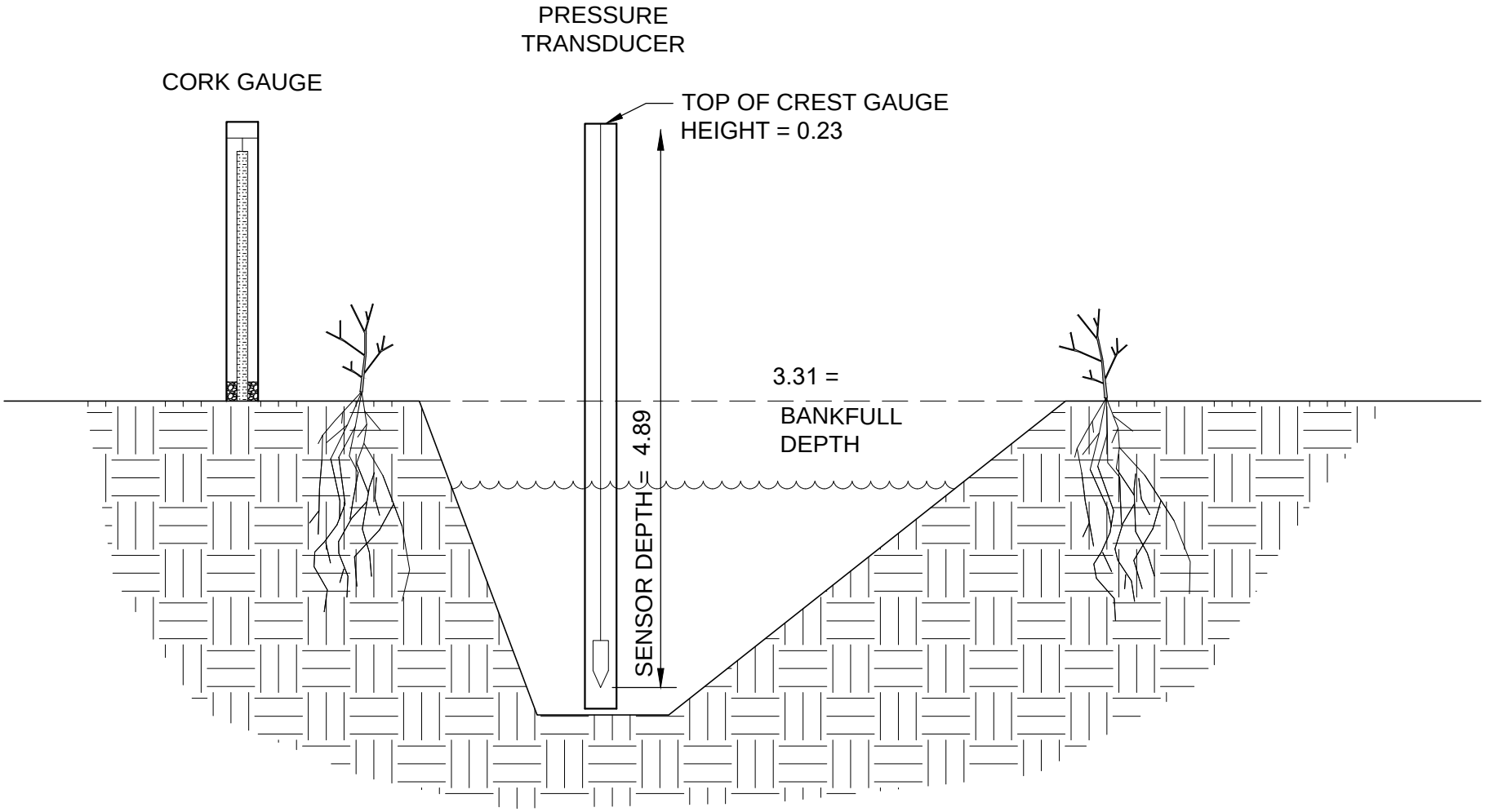
Flow Depth = (Sensor Depth + Top) - Elevation of Riffle
Flow Depth = (4.25 + 6.91) - 9.91
Flow Depth = 1.25 feet



FLOW GAUGE #2 - R5

Flow Depth = (Sensor Depth + Top) - Elevation of Riffle
Flow Depth = (4.00 + 2.30) - 6.06
Flow Depth = 0.24 feet

CROSS SECTIONAL VIEW OF STREAM



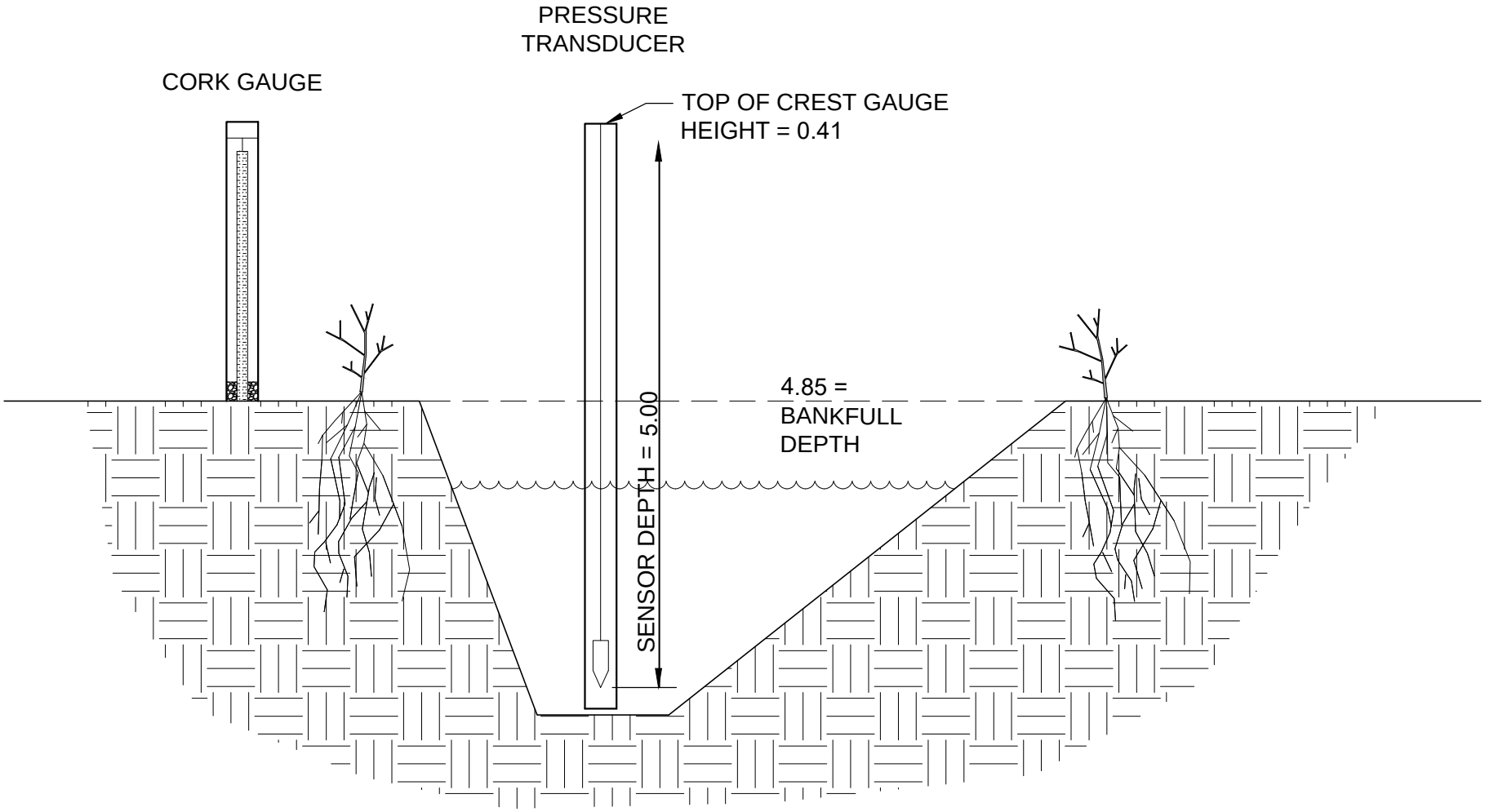
Crest Gauge CG-1 (R3)

Bankfull Event Depth (for transducer) = (Top of Gauge + Sensor Depth) - Bankfull Depth

Bankfull Event Depth = (0.23 + 4.89) - 3.31

Bankfull Event Depth = 1.81 feet

CROSS SECTIONAL VIEW OF STREAM



Crest Gauge CG-2 (R7 lower)

Bankfull Event Depth (for transducer) = (Top of Gauge + Sensor Depth) - Bankfull Depth

Bankfull Event Depth = (0.41 + 5.00) - 4.85

Bankfull Event Depth = 0.56 feet

Flow Gauge (FG-1) – R1

Flow Gauge (FG-2) – R5

Crest Gauge (CG-1, Pressure Transducer) – R3

Crest Gauge (CG-1, Cork) – R3

Crest Gauge (CG-2, Pressure Transducer) – R7 lower

Crest Gauge (CG-2, Cork) – R7 lower

Wetland Gauge (WG-1) – W1

Wetland Gauge (WG-2) – W2

Wetland Gauge (WG-3) – W3

Wetland Gauge (WG-4) – W5

Wetland Gauge (WG-5) – W6

Appendix E:
Project Timeline and Contact Info

Project Timeline and Contacts Table		
Activity or Deliverable	**Data Collection Complete**	**Task Completion or Deliverable Submission**
Project Instituted	N/A	1/2/2018
Mitigation Plan Approved	N/A	8/26/2020
Construction (Grading) Completed	N/A	3/25/2021
Planting Completed	N/A	4/1/2021
As-built Survey Completed	NA	6/11/2021
MY-0 Baseline Report	5/6/2021	6/15/2021
MY1+ Monitoring Reports		
Remediation Items (e.g. beaver removal, supplements, repairs etc.)		
Encroachment		

Project Name/Number	
Provider	7721 Six Forks Road Suite 130
Water & Land Solutions, LLC	Raleigh, NC 27615
Mitigation Provider POC: Emily Dunnigan	(269) 908-6306
Designer	7721 Six Forks Road Suite 130
Water & Land Solutions, LLC	Raleigh, NC 27615
Primary project design POC: Chris Tomsic, WLS	(828) 492-3287
Construction Contractor	2889 Lowery Street
North State Environmental, Inc.	Winston-Salem, NC 27101
Primary contractor POC: Andrew Roten	(336) 406-9078

Appendix F:

Other Data

Macrobenthic Survey Data

Macrobenthic Sampling Data

R3 - Odell's House Mitigation Site			
Monitoring Year	MY0		
Biotic Index Score	NA*		
Water Quality Level	NA*		

**No benthics were collected during sampling*

View Upstream

View Downstream

Macrobenthic Sampling Data

R7 - Odell's House Mitigation Site			
Monitoring Year	MY0		
Biotic Index Score	NA*		
Water Quality Level	NA*		

**No benthics were collected during sampling*

View Upstream

View Downstream

DEPARTMENT OF ENVIRONMENTAL QUALITY - DIVISION OF MITIGATION SERVICES

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NORTH CAROLINA
NCDEQ - DMS PROJECT ID # 100041
NCDEQ - DMS CONTRACT # 7420 UNDER RFP 16-007279
NEUSE RIVER BASIN (CU 03020201)
USACE ACTION ID # SAW-2018-00431
DWR ID # 2018-0200
TYPE OF WORK : STREAM, BUFFER AND WETLAND MITIGATION

SURVEY CERTIFICATE
"I, MARSHALL G. WIGHT, CERTIFY THAT THIS PROJECT WAS COMPLETED UNDER MY DIRECT AND RESPONSIBLE CHARGE FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION; THAT THIS GROUND SURVEY WAS PERFORMED AT THE 95 PERCENT CONFIDENCE LEVEL TO MEET FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC/PLANIMETRIC SURVEY TO THE ACCURACY OF CLASS A AND VERTICAL ACCURACY WHEN APPLICABLE TO CLASS C STANDARD, AND THAT THE ORIGINAL DATA WAS OBTAINED ON MARCH 19TH 2021; THAT THE SURVEY WAS COMPLETED ON MAY 18TH, 2021; THAT CONTOURS SHOWN AS [BROKEN LINES] MAY NOT MEET THE STATED STANDARD; AND ALL COORDINATES ARE BASED ON NAD 83 (2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88"

THIS DOCUMENT ORIGINALLY ISSUED AND SEALED BY MARSHALL G. WIGHT, L-5034, ON

NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

DocuSigned by:
Marshall Wight
62C73F441B864C1...
8/16/2021

PROJECT SUMMARY

Project Reach Designation	Type of Mitigation	Creditable Units (LF)	Mitigation Ratio (X:1)	Stream Mitigation Credits (SMCs)
R1	Stream Restoration (PI/HW)	437	1	437.000
R2	Stream Enhancement Level II	526	2.5	210.400
R3	Stream Restoration (PI)	1,091	1	1,091.000
R4	Stream Enhancement Level II	190	3	63.333
R5	Stream Restoration (PI/HW)	340	1	340.000
R6	Stream Restoration (PI)	432	1	432.000
R7 (upper)	Stream Enhancement Level I	625	1.5	416.667
R7 (low er)	Stream Preservation	412	10	41.200
Total		**4,053**		**3,031.600**

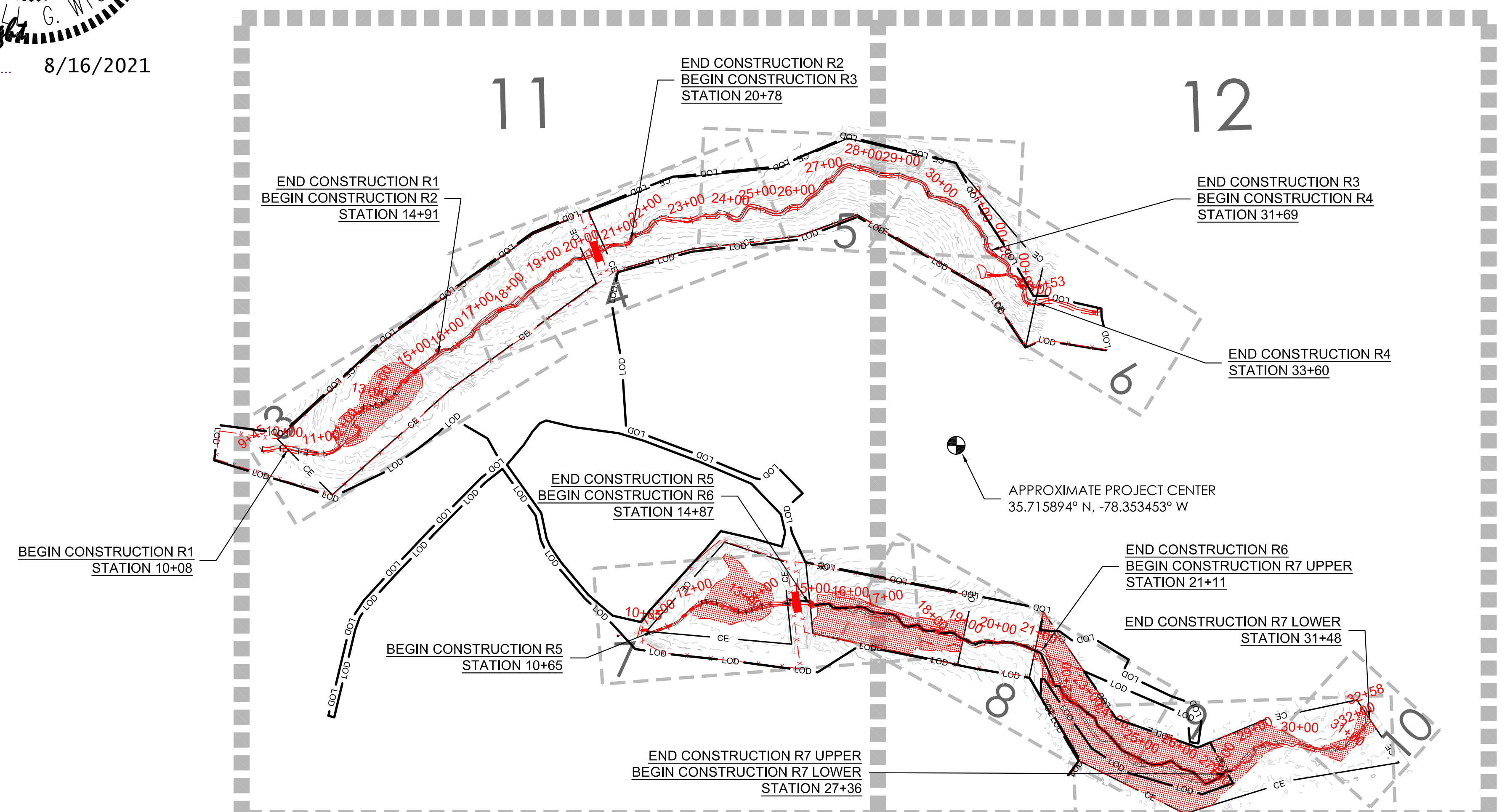
Note 1: No mitigation credits were calculated outside the conservation easement boundaries.

Note 2: R1 and R5 credits are calculated based on headwater valley length.

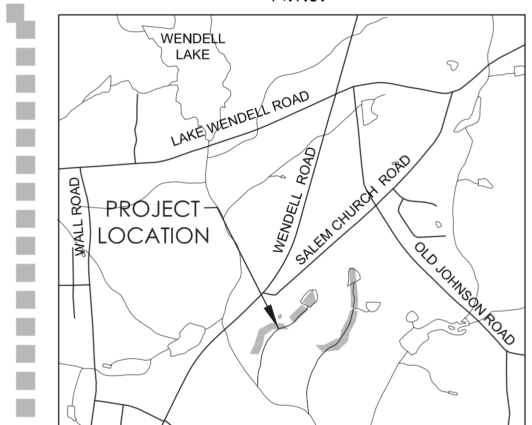
Project Wetland Area	Type of Mitigation	Proposed Wetland Area (AC)	Mitigation Ratio (X:1)	Riparian Wetland Mitigation Credits (WMCs)
W1	Wetland Re-establishment	0.476	1	0.476
W2	Wetland Re-establishment	0.416	1	0.416
W3	Wetland Rehabilitation	0.666	1.5	0.444
W4	Wetland Re-establishment	0.234	1	0.234
W5	Wetland Enhancement	1.654	2.5	0.662
W6	Wetland Preservation	0.444	10	0.044
Total		**3.890**		**2.276**

Note 1: No mitigation credits were calculated outside the conservation easement boundaries.

SHEET INDEX



VICINITY MAP
N.T.S.



WATER & LAND SOLUTIONS
7721 Six Forks Rd., Suite 130
Raleigh, NC 27615
(919)614-5111
waterlandsolutions.com

PROJECT ENGINEER
8/16/2021
NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC
DocuSigned by:

ENGINEERING SERVICES BY
WLS ENGINEERING, PLLC
6 DULA SPRINGS RD.
WEAVERVILLE, NC 28787
FIRM LICENSE NO. P-1480

REVISIONS

A	DRAFT MIT PLAN	2-24-20
B	FINAL DRAFT MIT PLAN	5-15-20
C	FINAL MIT PLAN	8-12-20
D	FINAL MIT PLAN	9-8-20
E	IFC PLANS	10-12-20
F	AS-BUILT PLANS	6-14-21
G	AS-BUILT PLANS (REVISED)	8-13-21

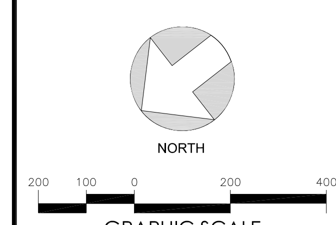
PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-003
FILENAME	ASB_01_ODELLS HOUSE_COVER.DWG
DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 400'
VERT. SCALE	N/A



SHEET NAME

COVER SHEET

SHEET NUMBER

1

AS-BUILT

LEGEND

- ROOTWAD
- LOG VANE
- LOG WEIR
- LOG STEP-POOL
- CONSTRUCTED STONE RIFFLE
- CONSTRUCTED LOG RIFFLE
- GEOLIFT W/ TOEWOOD
- RIP RAP
- OUTLET CHANNEL
- CE — CE: CONSERVATION EASEMENT BOUNDARY
- 100: EXISTING MAJOR CONTOUR
- 101: EXISTING MINOR CONTOUR
- LOD — LOD: LIMITS OF DISTURBANCE
- WLB — WLB: EXISTING WETLAND BOUNDARY
- EXISTING WOODLINE
- AS-BUILT TOP OF STREAM BANK
- EXISTING PROPERTY BOUNDARY
- EXISTING FENCE
- 15+00: AS-BUILT CENTERLINE (THALWEG)
- EXISTING FARM PATH
- EXISTING TREE
- FLOODPLAIN DEPRESSION
- WATER QUALITY TREATMENT FEATURE
- x: AS-BUILT FIELD FENCE
- AS-BUILT WETLAND BOUNDARY

AS-BUILT

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8/16/2021

NORTH CAROLINA PROFESSIONAL SEAL 36916 ENGINEER CHRISTOPHER A. TOMSIC

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REVISIONS

A	DRAFT MIT PLAN	2-24-20
B	FINAL DRAFT MIT PLAN	5-15-20
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E	IFC PLANS	10-12-20
F	AS-BUILT PLANS	6-14-21
G	AS-BUILT PLANS (REVISED)	8-13-21

PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

DRAWING INFORMATION

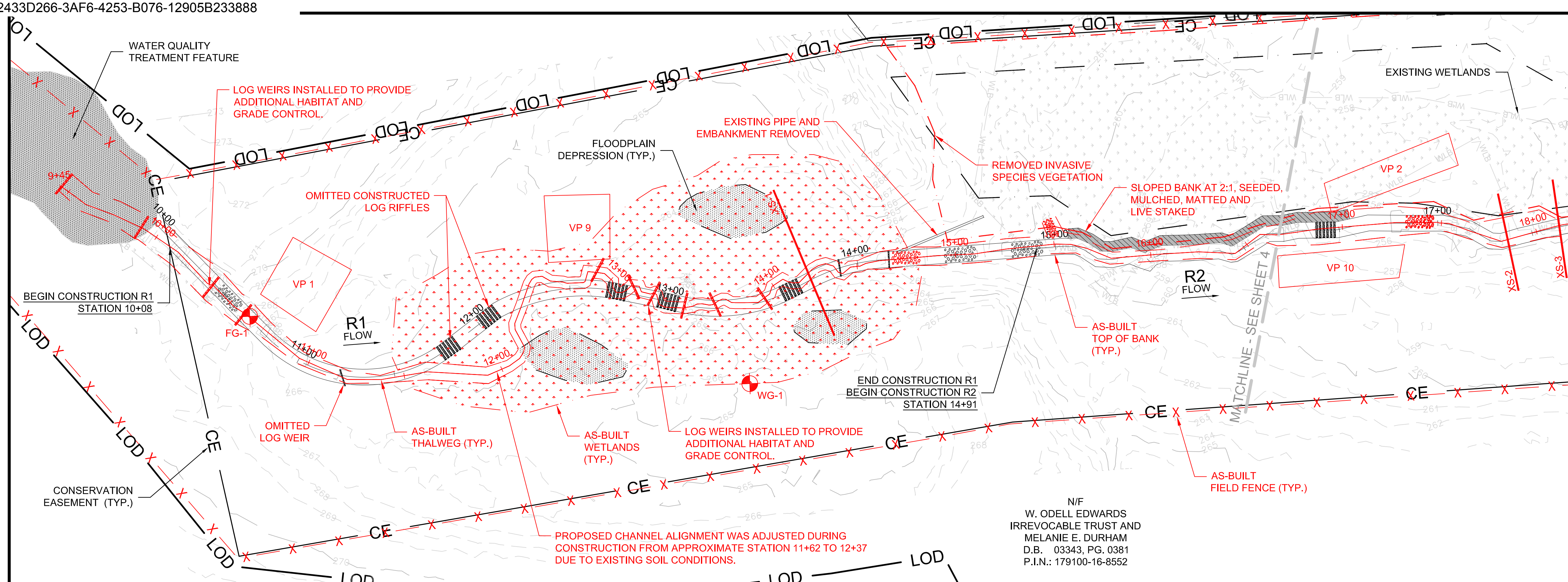
PROJECT NO.	18-003
FILENAME	ASB_02_ODELLS HOUSE_LEGEND.DWG
DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	N/A
VERT. SCALE	N/A

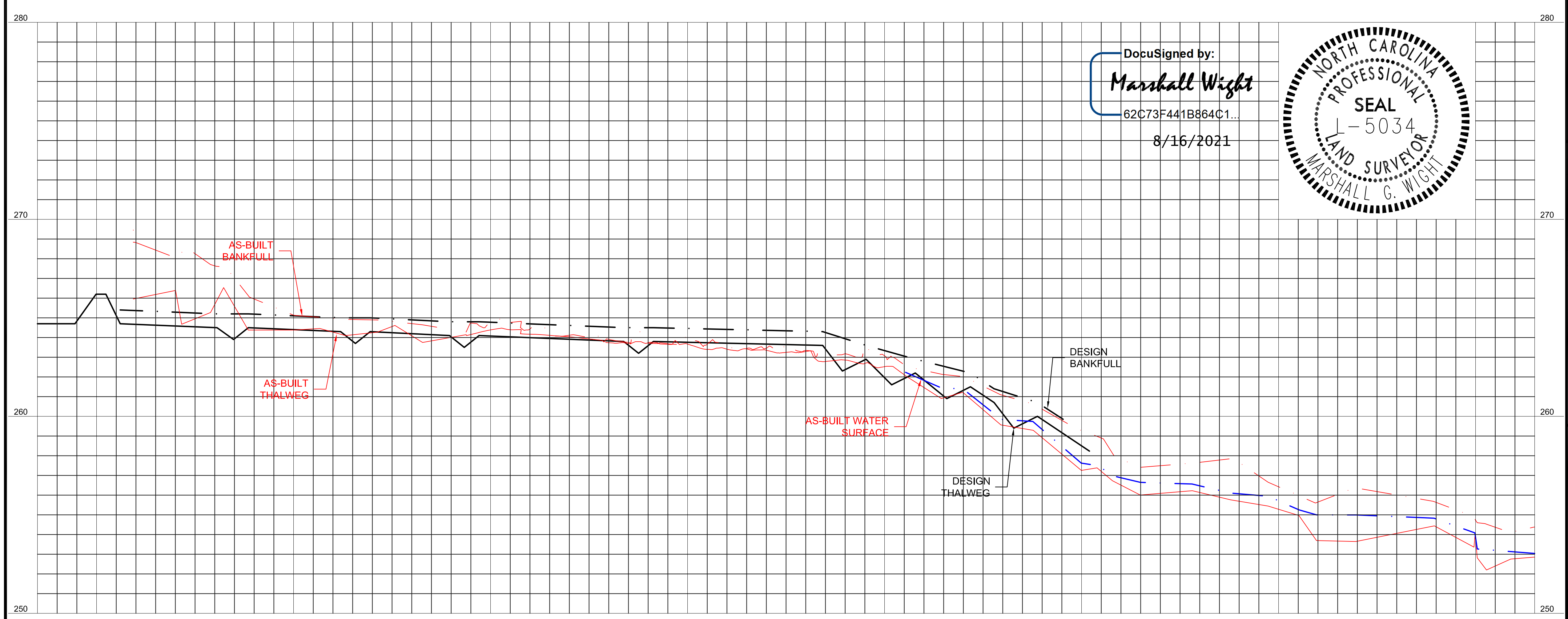
SHEET NAME

LEGEND

SHEET NUMBER

2





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PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-003
FILENAME	ASB_03_10_ODELL'S HOUSE_PLAN AND PROFILE.DWG
DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60

GRAPHIC SCALE

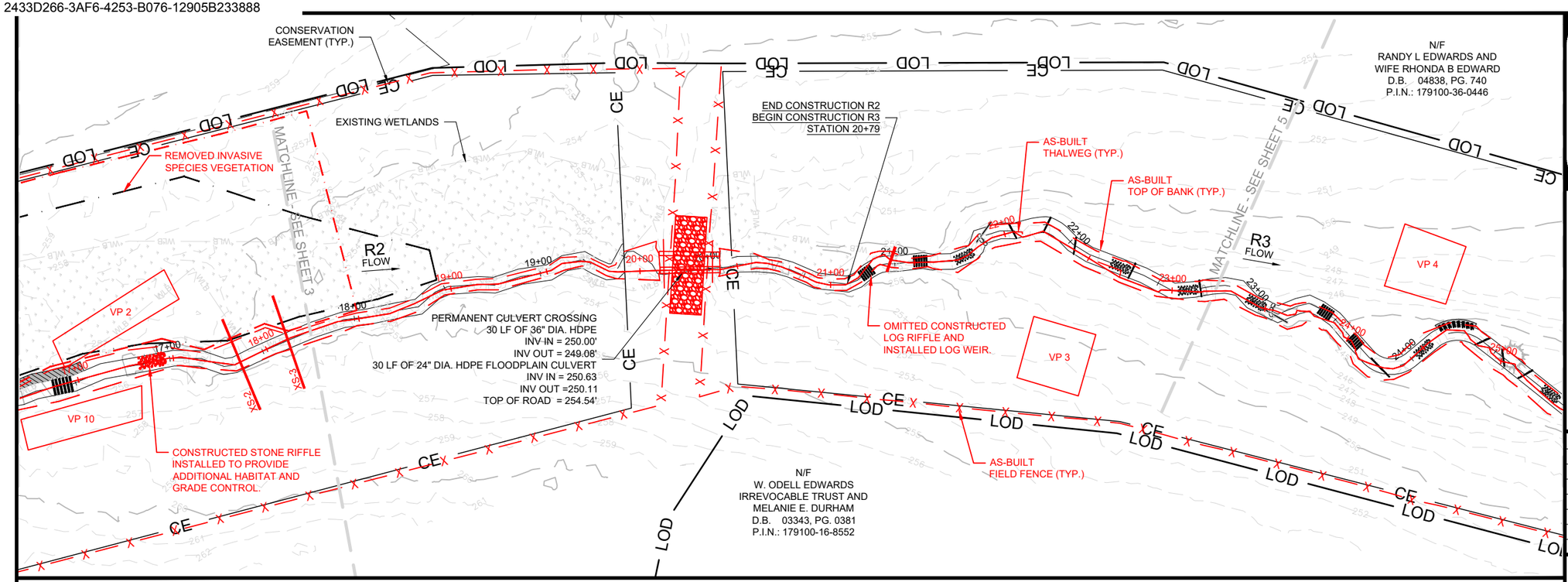
SHEET NAME

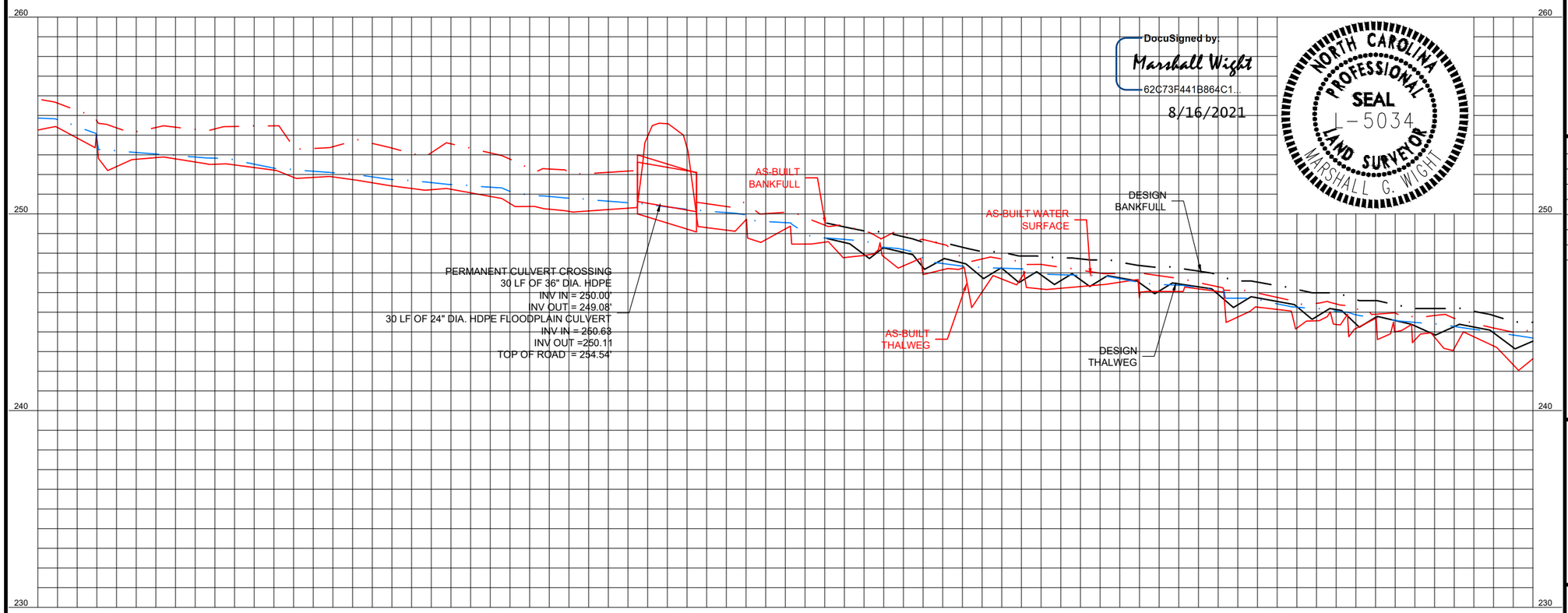
R1 & R2

PLAN AND PROFILE

SHEET NUMBER

3





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ENGINEER
CHRISTOPHER A. TOMSIC
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JOHNSTON COUNTY, NC

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DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60
GRAPHIC SCALE

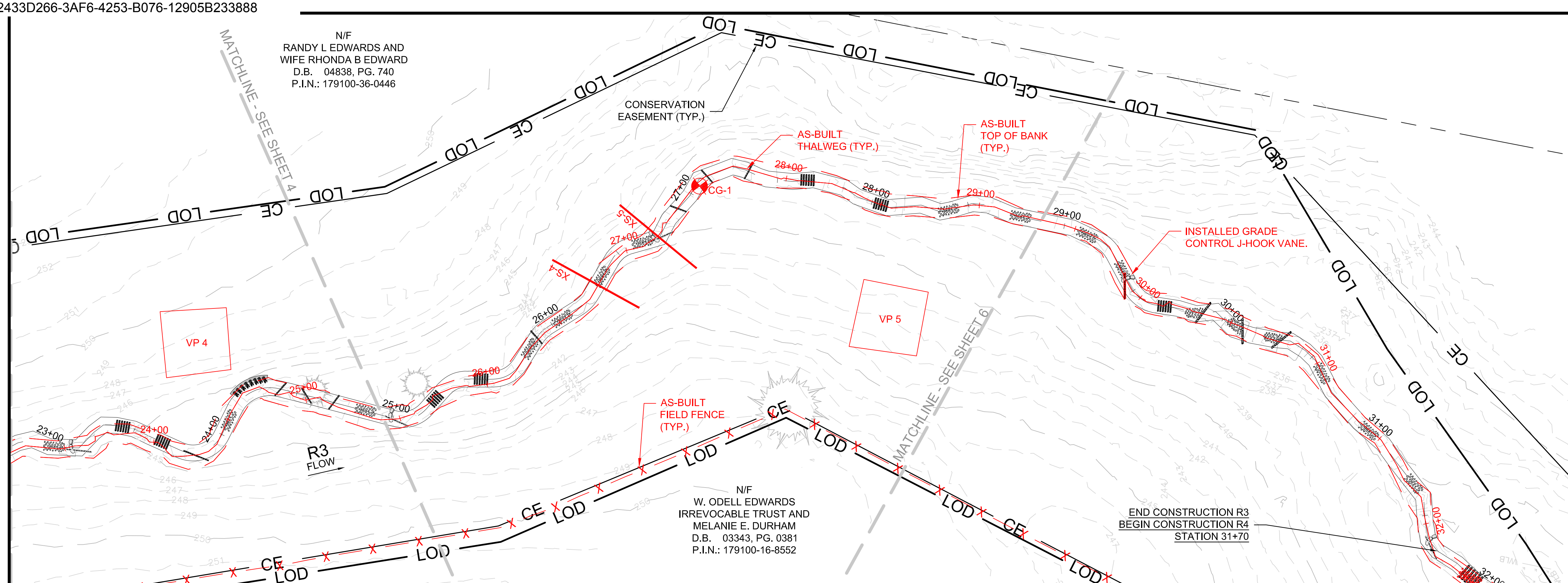
SHEET NAME

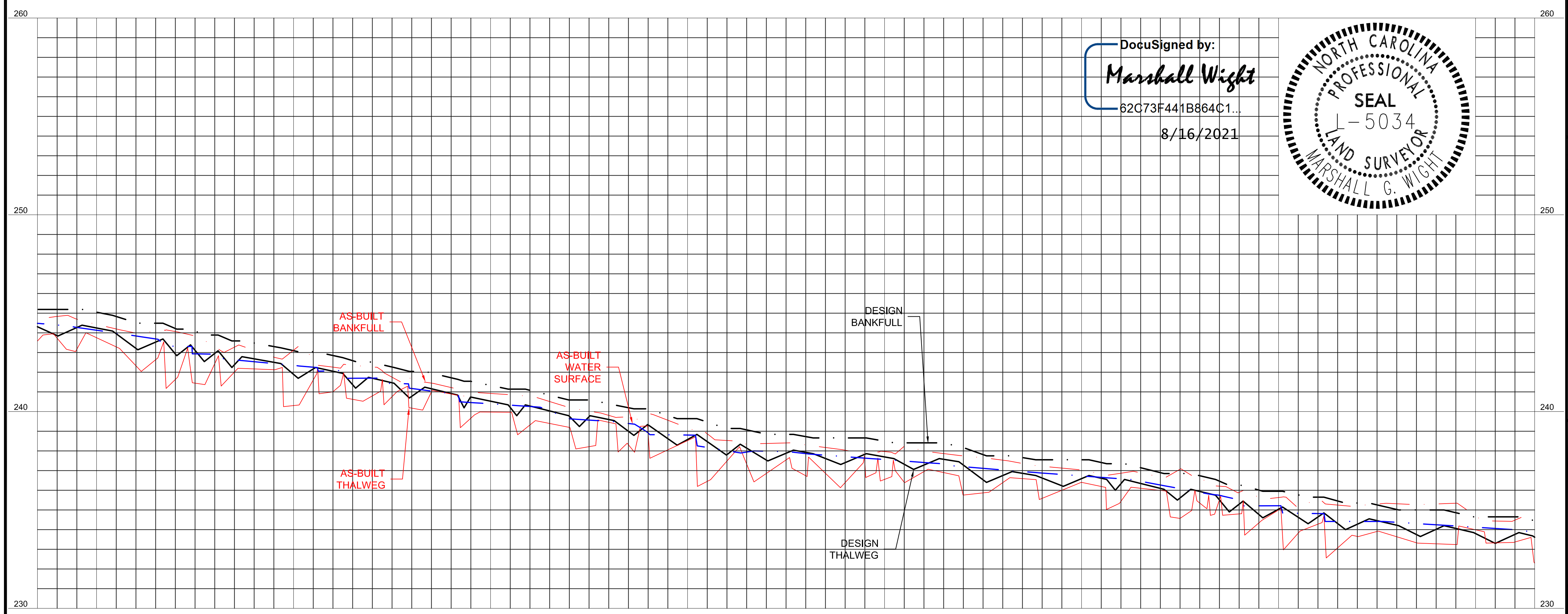
R2 & R3

PLAN AND PROFILE

SHEET NUMBER

4





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ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

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DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60
GRAPHIC SCALE

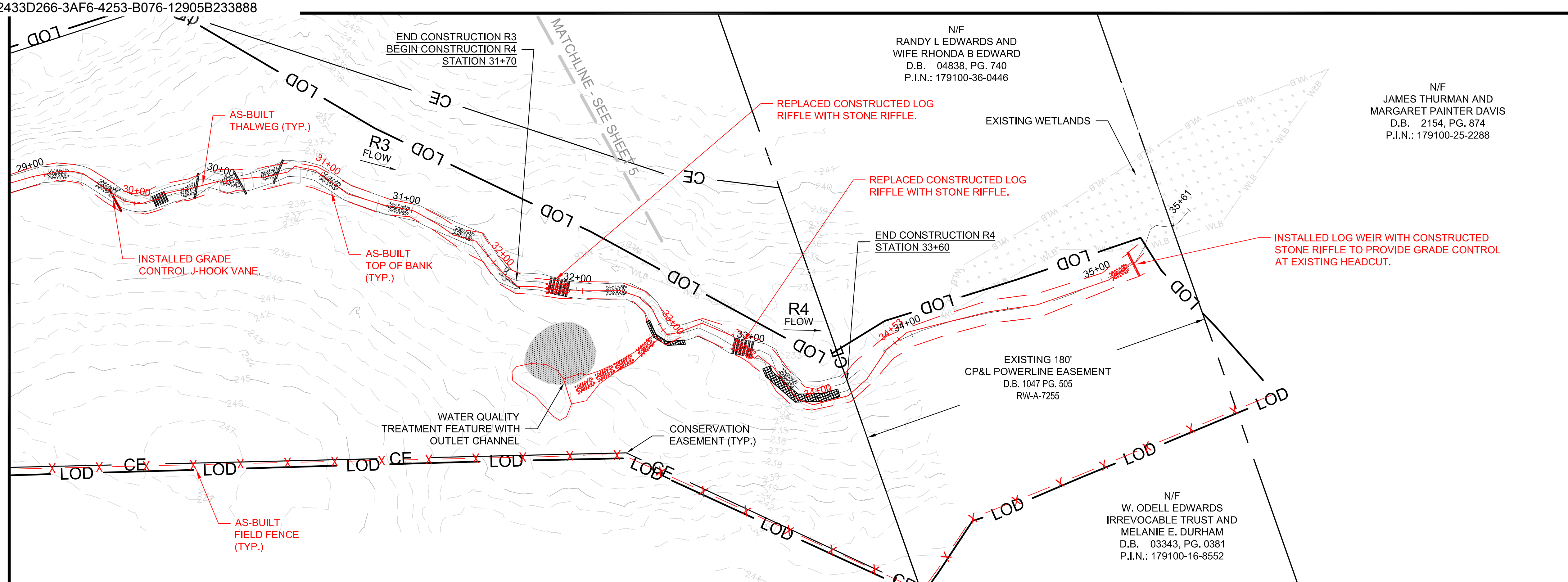
SHEET NAME

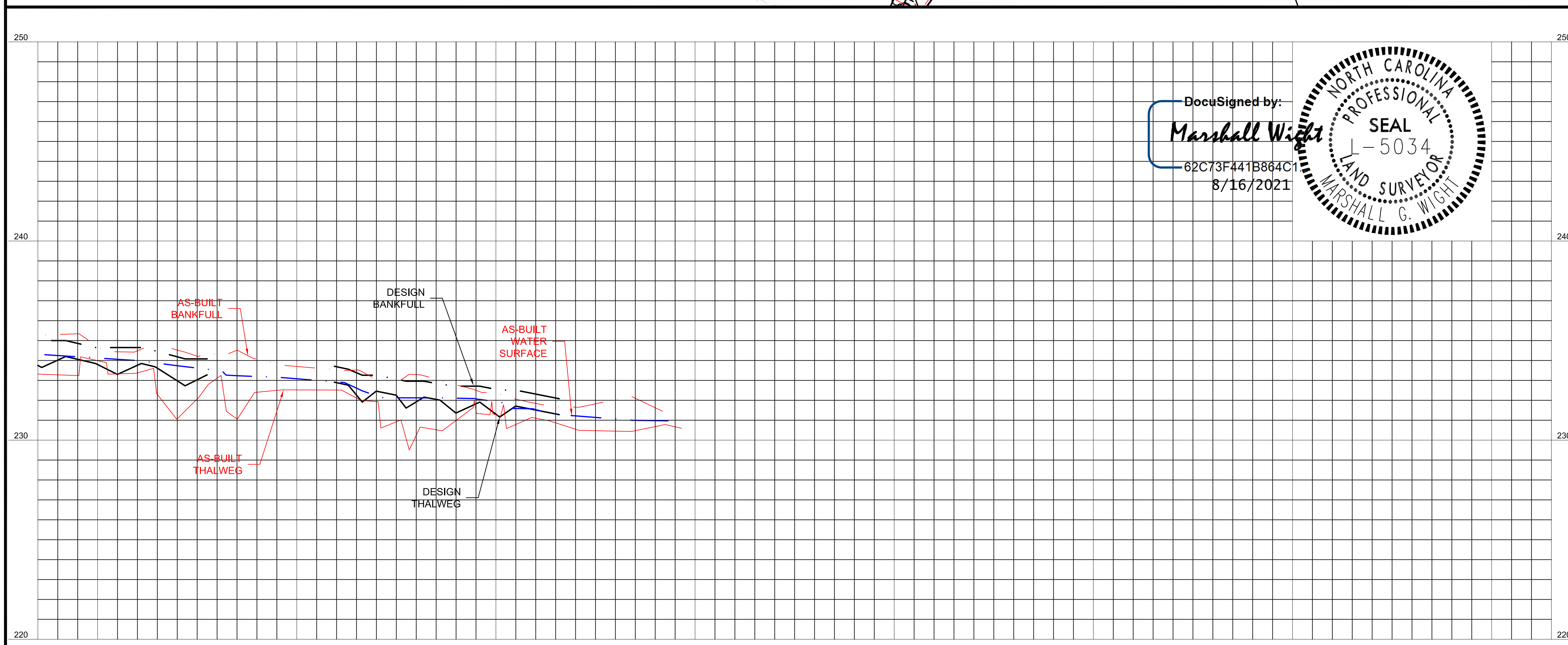
R3 & R4

PLAN AND PROFILE

SHEET NUMBER

5





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PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

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DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60
GRAPHIC SCALE

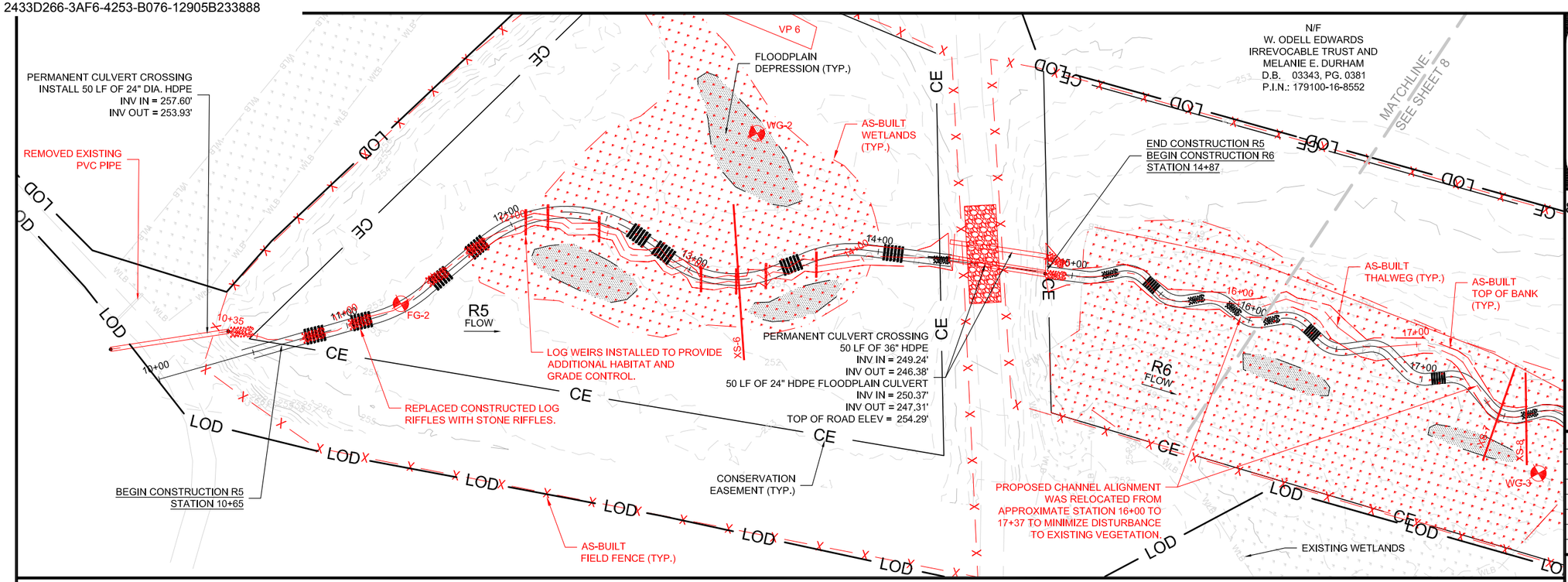
SHEET NAME

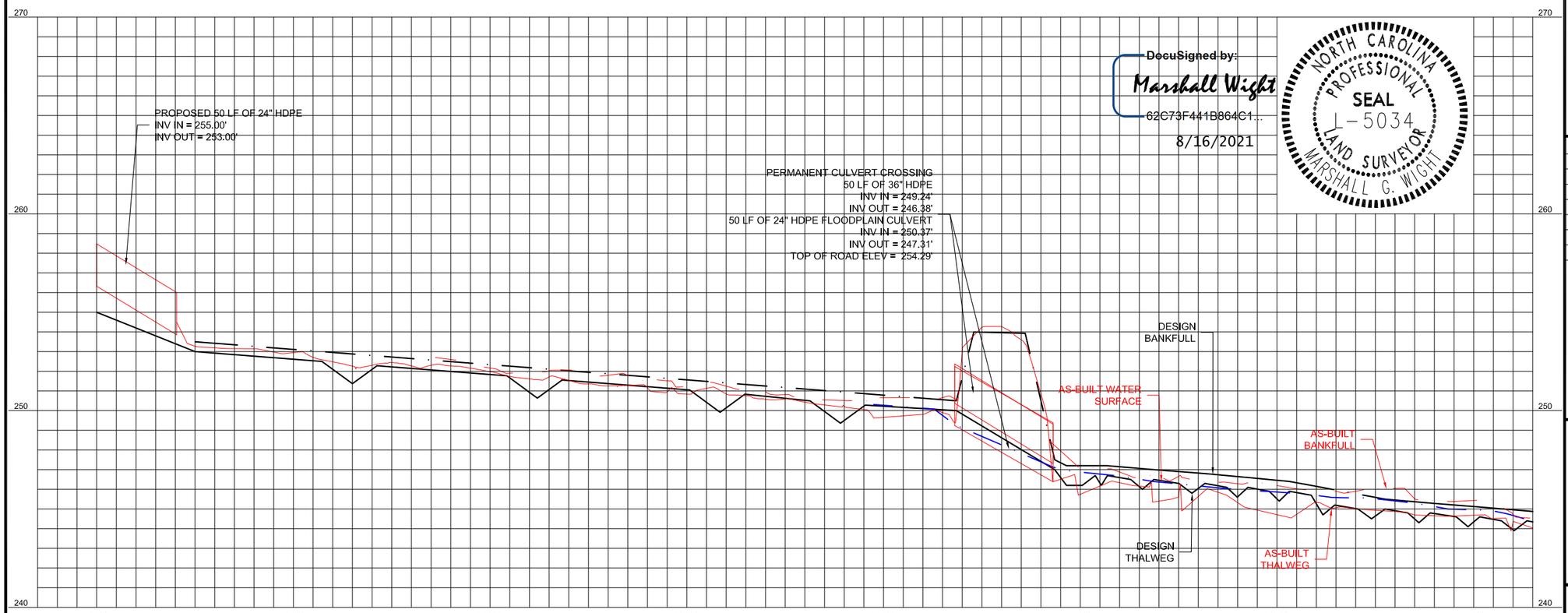
R3 & R4

PLAN AND PROFILE

SHEET NUMBER

6





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PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

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DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60
GRAPHIC SCALE

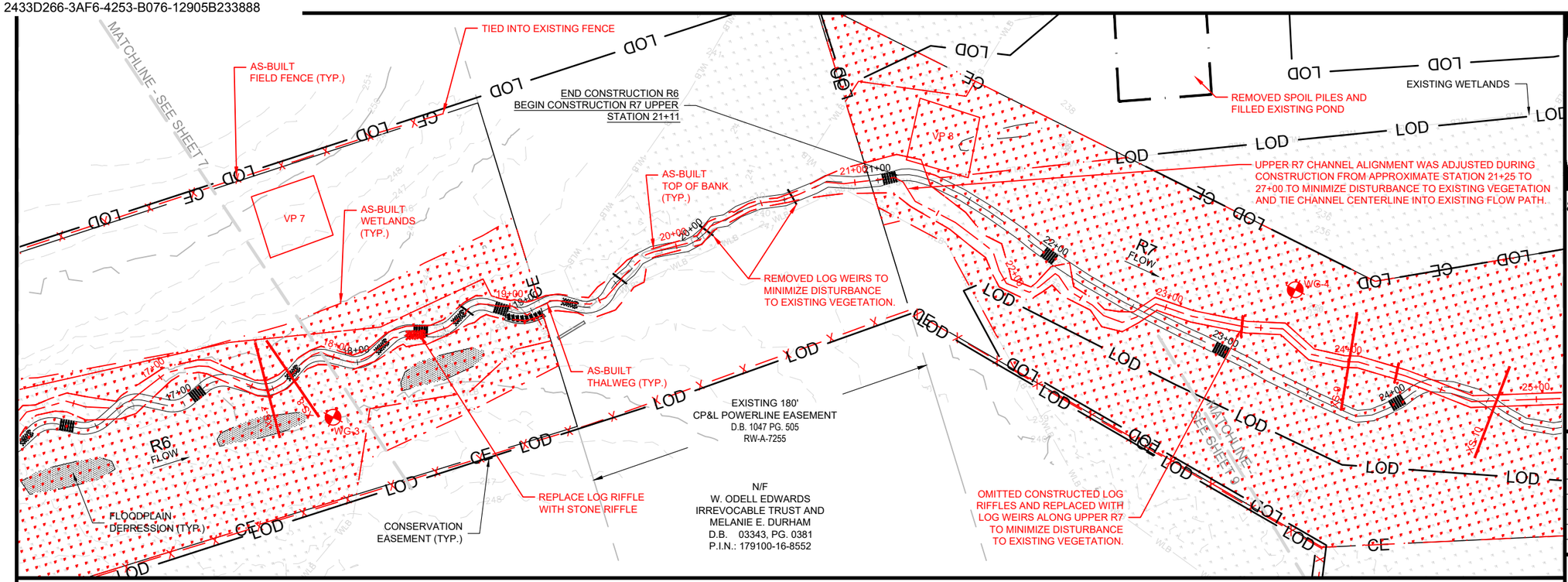
SHEET NAME

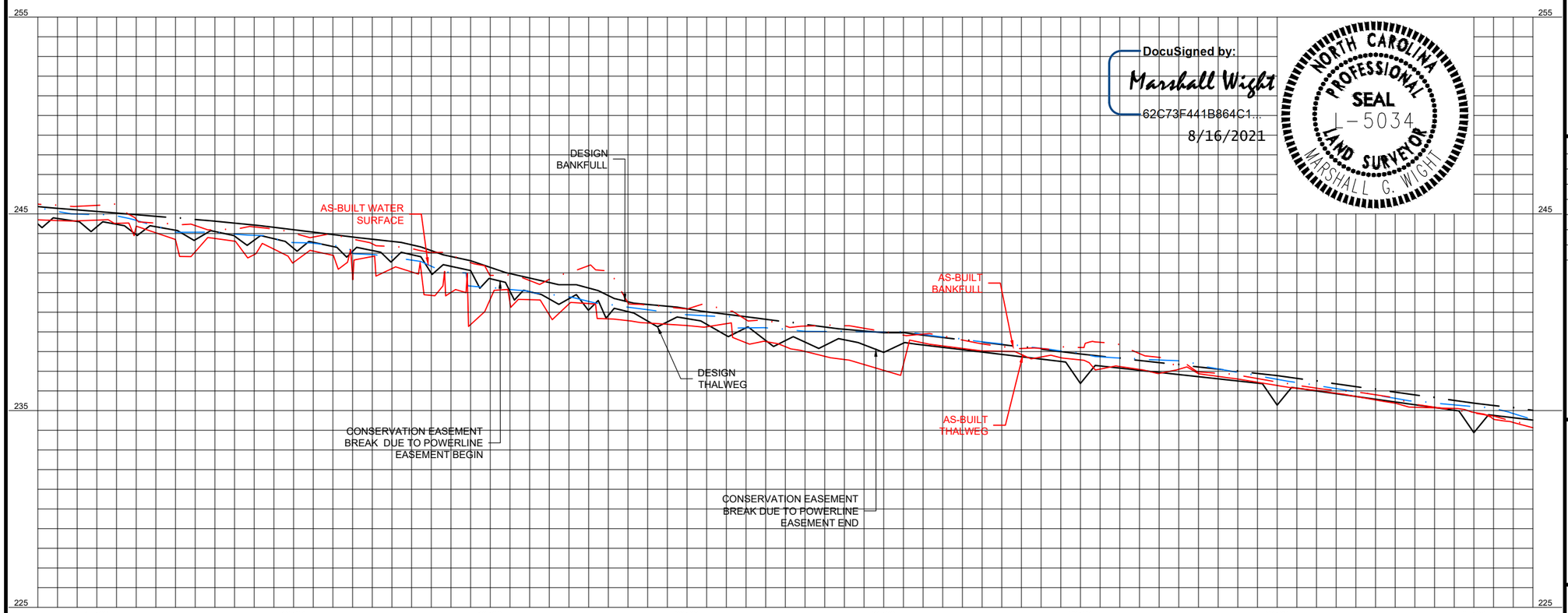
R5 & R6

PLAN AND PROFILE

SHEET NUMBER

7





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REVISIONS

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PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

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DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60
GRAPHIC SCALE

SHEET NAME

R6 & R7

PLAN AND PROFILE

SHEET NUMBER

8

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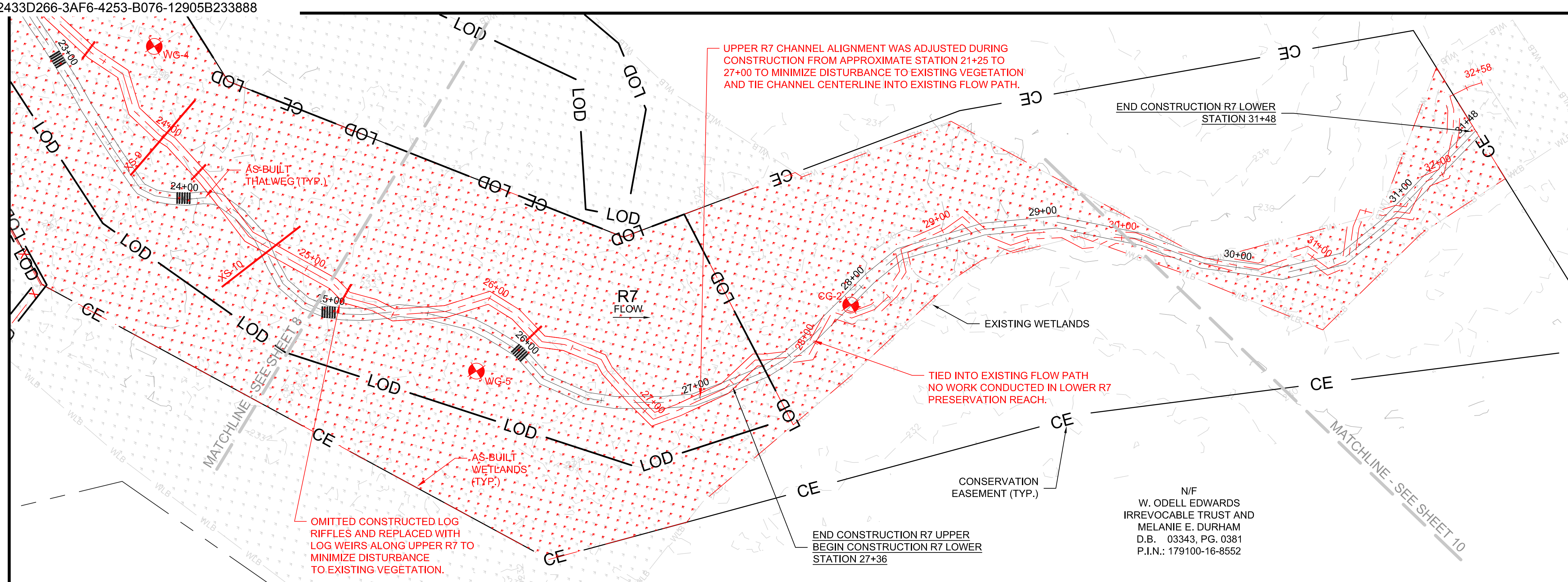

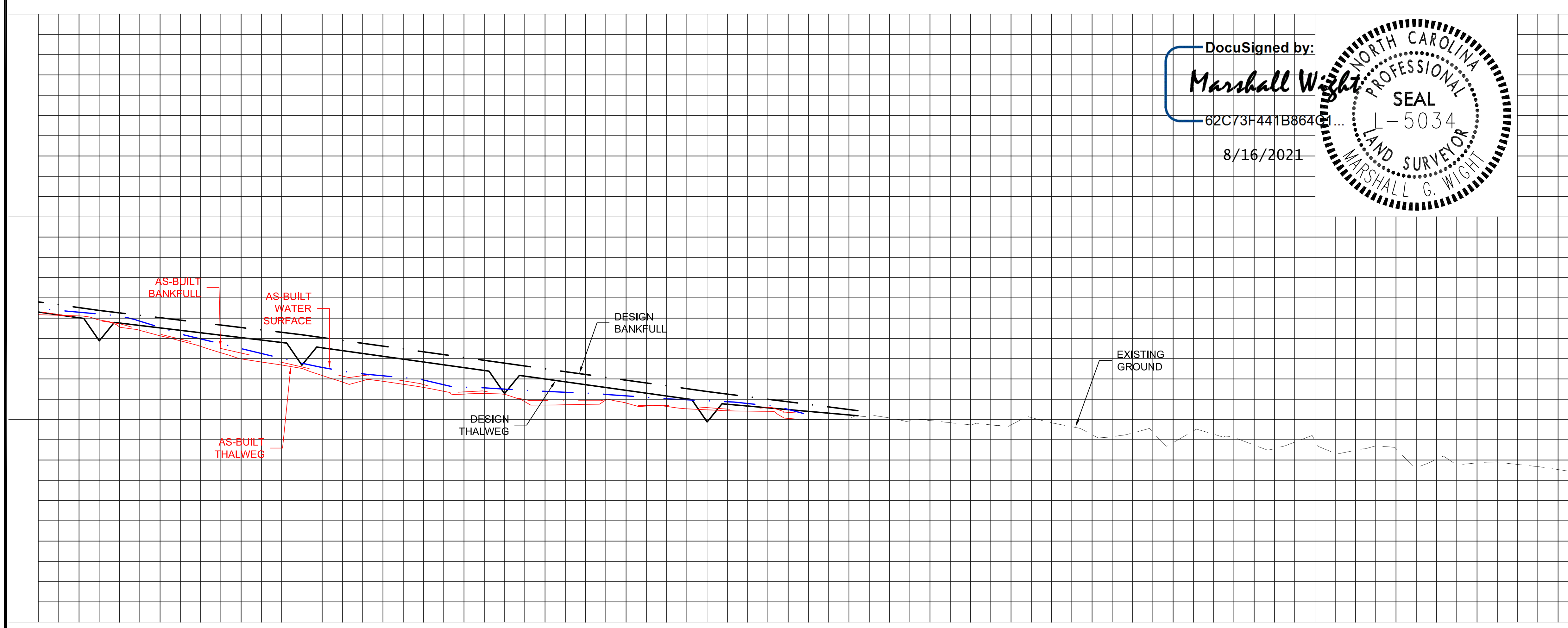

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8/16/2021
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PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-003
FILENAME	[illegible]
DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60
GRAPHIC SCALE

SHEET NAME

R7

PLAN AND PROFILE

SHEET NUMBER

9

AS-BUILT

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JOHNSTON COUNTY, NC

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HORIZ. SCALE	1" = 60'
VERT. SCALE	1" = 3'

NORTH

30 15 0 30 60

GRAPHIC SCALE

SHEET NAME

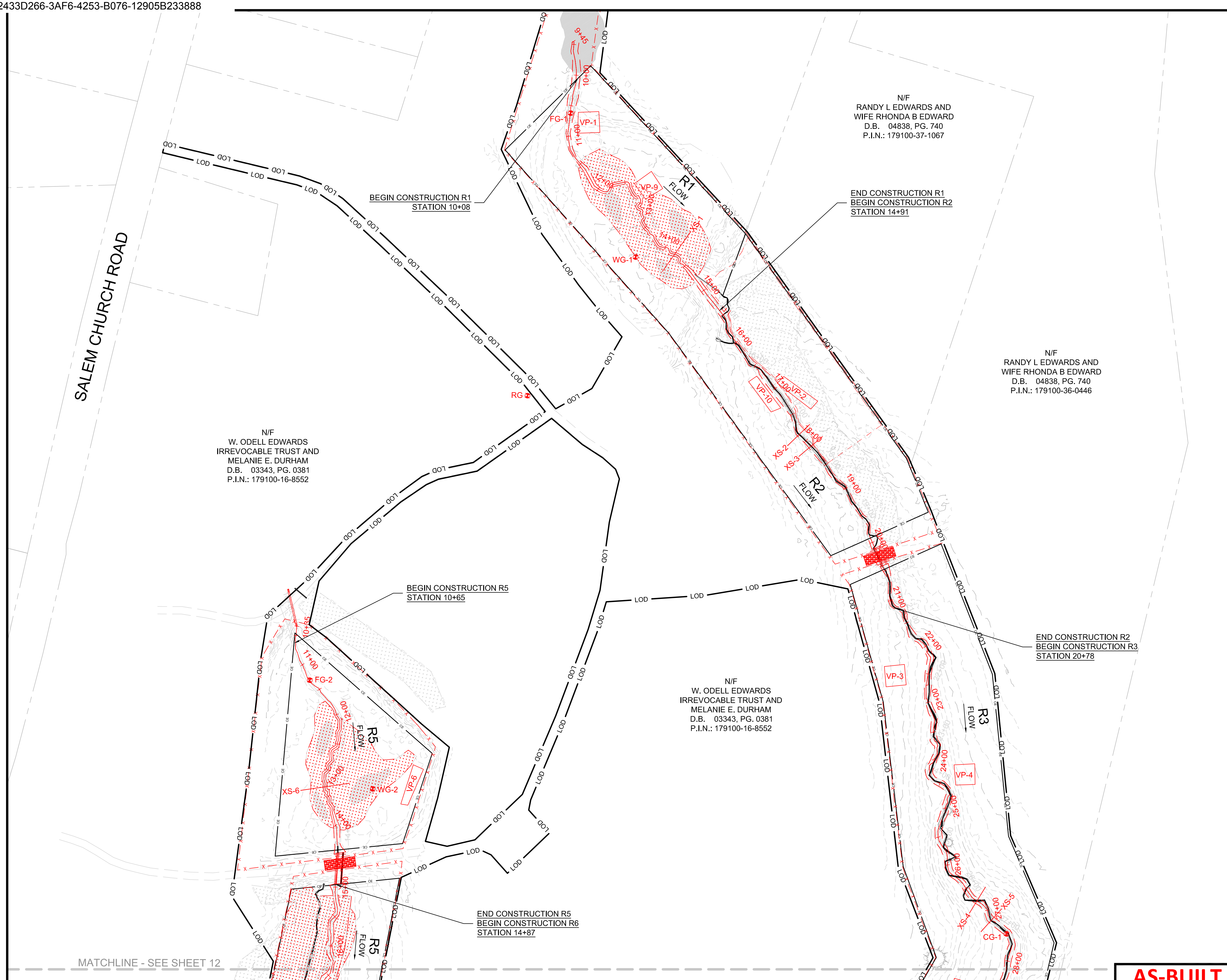
R7

PLAN AND PROFILE

SHEET NUMBER

10

DocuSign Envelope ID: 2433D266-3AF6-4253-B076-12905B233888



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G	AS-BUILT PLANS (REVISED)	8-13-21

PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

DRAWING INFORMATION

PROJECT NO.	18-003
FILENAME	ASB_11_12_ODELL'S HOUSE_MONITORING PLAN.DWG
DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 150'
VERT. SCALE	N/A

NORTH

75 37.5 0 75 150

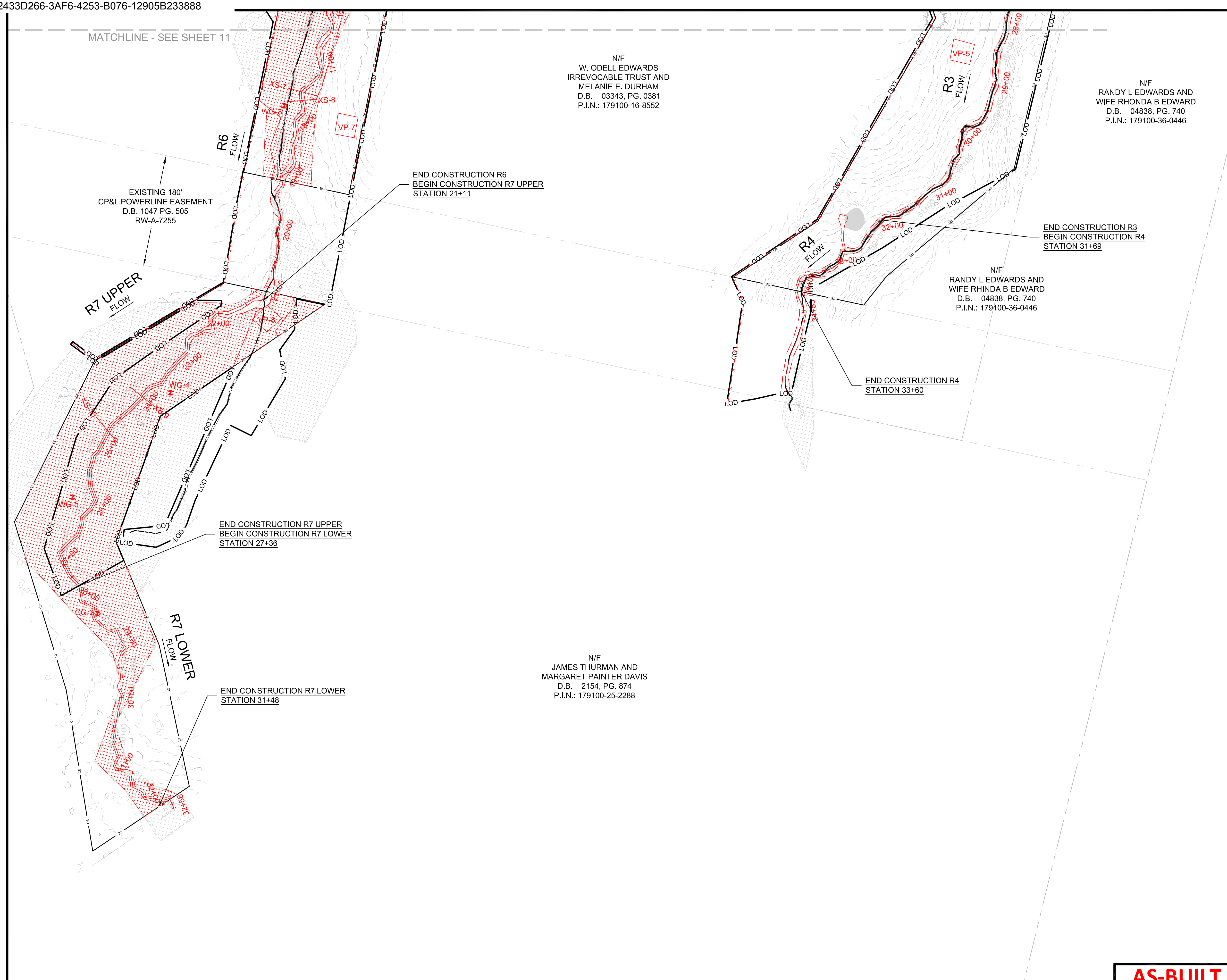
GRAPHIC SCALE

SHEET NAME

MONITORING PLAN

SHEET NUMBER

11



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PROJECT NAME

ODELL'S HOUSE MITIGATION PROJECT

JOHNSTON COUNTY, NC

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DESIGNED BY	CAT
DRAWN BY	AL
DATE	8-13-21
HORIZ. SCALE	1" = 150'
VERT. SCALE	N/A

NORTH

75 37.5 0 75 150

GRAPHIC SCALE

SHEET NAME

MONITORING PLAN

SHEET NUMBER

12

Table 1. Odell's House Mitigation Site, DWR #2018-0200v1, Project Credits

Neuse 03020201 - Outside Falls Lake	Project Area
19.16394	N Credit Conversion Ratio (ft^2/pound)
N/A	P Credit Conversion Ratio (ft^2/pound)

Credit Type	Location	Subject? (enter NO if ephemeral or ditch [1])	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (ft^2)	Total (Creditable) Area of Buffer Mitigation (ft^2)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Convertible to Riparian Buffer?	Riparian Buffer Credits	Convertible to Nutrient Offset?	Delivered Nutrient Offset: N (lbs)	Delivered Nutrient Offset: P (lbs)
Buffer	Rural	Yes	Coastal Headwater	Restoration	0-100	R1	36,185	36,185	1	100%	1.00000	N/A	36,185.000	No	—	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	R2 (right bank)	36,352	36,352	2	100%	2.00000	N/A	18,176.000	No	—	—
Buffer	Rural	Yes	I / P	Enhancement	0-100	R2 (left bank)	54,325	54,325	2	100%	2.00000	N/A	27,162.500	No	—	—
Buffer	Rural	Yes	I / P	Restoration	0-100	R3	126,221	126,221	1	100%	1.00000	N/A	126,221.000	Yes	6,586.386	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	R4 (right bank)	10,360	10,360	2	100%	2.00000	N/A	5,180.000	No	—	—
Buffer	Rural	Yes	Coastal Headwater	Restoration	0-100	R5	28,116	28,116	1	100%	1.00000	N/A	28,116.000	No	—	—
Buffer	Rural	Yes	Coastal Headwater	Restoration	101-200	R5	8,493	8,493	1	33%	3.03030	N/A	2,802.693	No	—	—
Buffer	Rural	Yes	I / P	Restoration	0-100	R6	31,084	31,084	1	100%	1.00000	N/A	31,084.000	Yes	1,622.014	—
Buffer	Rural	Yes	I / P	Restoration	101-200	R3	6,320	6,320	1	33%	3.03030	N/A	2,085.602	Yes	329.779	—
Buffer	Rural	Yes	Coastal Headwater	Restoration	101-200	R1	10,456	10,456	1	33%	3.03030	N/A	3,450.483	No	—	—
Buffer	Rural	Yes	I / P	Restoration	101-200	R7 upper	1,922	1,922	1	33%	3.03030	N/A	634.261	Yes	100.283	—
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						Totals:	349,835	349,835								

Enter Preservation Credits Below

Eligible for Preservation (ft^2): 116,612

Credit Type	Location	Subject?	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Total (Creditable) Area for Buffer Mitigation (ft^2)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits
Buffer	Rural	Yes	I / P	Preservation	0-100	R3 (left bank)	60,900	60,900	10	100%	10.00000	6,090.000
	Rural	Yes	I / P		0-100	R7 lower	42,323	42,323	10	100%	10.00000	4,232.300
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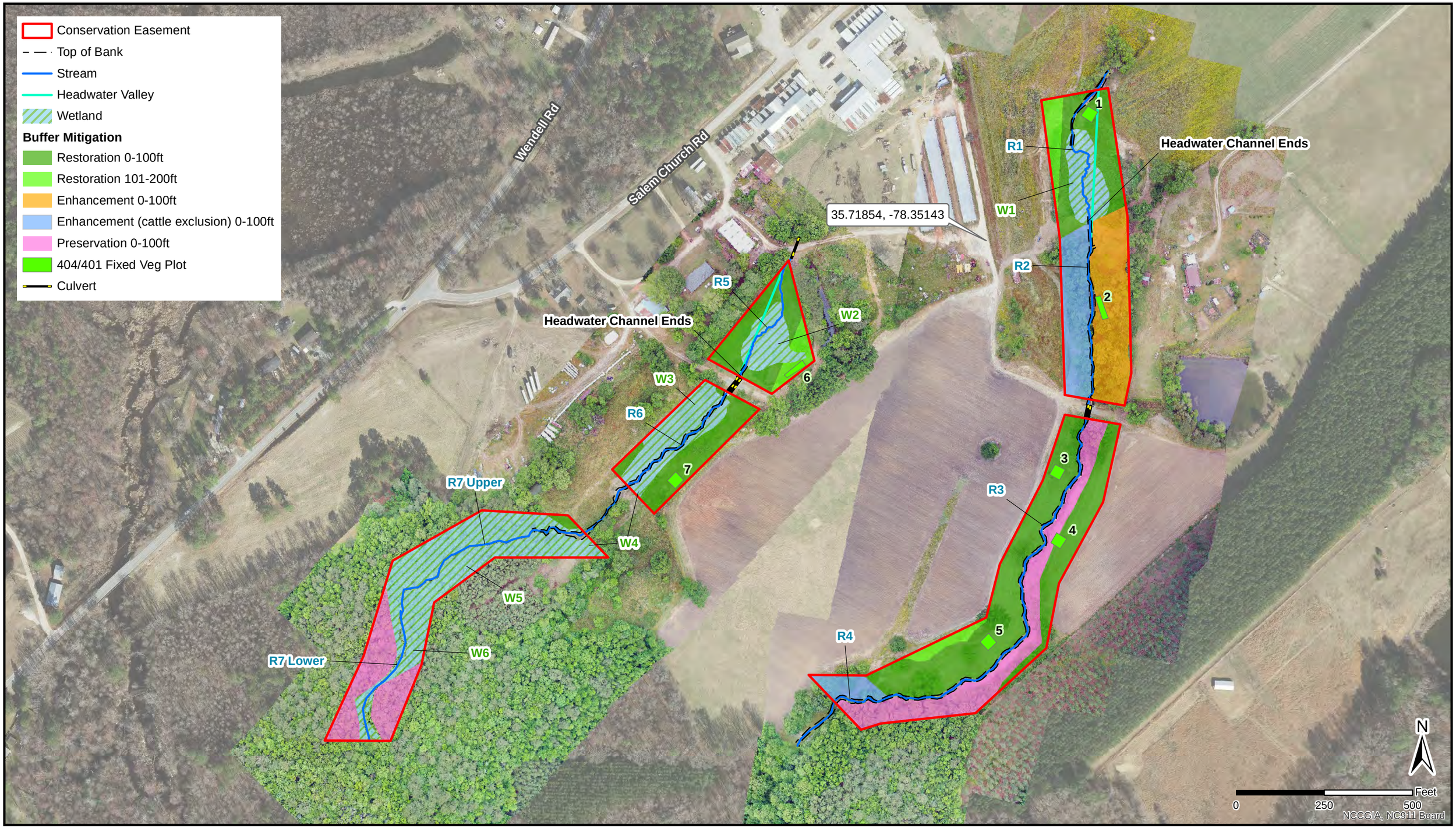
						Preservation Area Subtotal (ft^2):		103,222				
						Preservation as % Total Area of Buffer Mitigation:		22.1%				
						Ephemeral Reaches as % Total Area of Buffer Mitigation:		0.0%				

TOTAL AREA OF BUFFER MITIGATION (TABM)		
Mitigation Totals	**Square Feet**	**Credits**
Restoration:	248,798	230,579.039
Enhancement:	101,037	50,518.500
Preservation:	103,222	10,322.300
Total Riparian Buffer:	453,057	291,419.839
TOTAL NUTRIENT OFFSET MITIGATION		
Mitigation Totals	**Square Feet**	**Credits**
Nutrient Offset: Nitrogen:	0	0.000
Nutrient Offset: Phosphorus:		0.000

1. The Randleman Lake buffer rules allow some ditches to be classified as subject according to 15A NCAC 02B .0250 (5)(a).

last updated 11/22/2019



WATER & LAND™ SOLUTIONS	NC Mitigation Services ENVIRONMENTAL QUALITY	**Odells House Nutrient Offset and Riparian Buffer Project Johnston County, North Carolina**	DWR Project Number: DWR-2018-0200 June 2021 MY0	Current Conditions Plan View Monitoring Year 0 NAD 1983 2011 State Plane North Carolina FIPS 3200 FT US	FIGURE 3