# BASELINE MONITORING DOCUMENT AND AS-BUILT BASELINE REPORT

FINAL

## SANDY BRANCH MITIGATION SITE

Chatham County, NC
NCDEQ Contract No. 7527
DMS Project Number 100060
USACE Action ID Number SAW-2018-01167
NCDWR Project Number 2018-0786

Data Collection Period: September 2020 - January 2021
Draft Submission Date: March 22, 2021
Final Submission Date: April 27, 2021

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**PREPARED FOR:**

**NC Department of Environmental Quality**
**Division of Mitigation Services**
1652 Mail Service Center
Raleigh, NC 27699-1652

April 27, 2021

Jeremiah Dow
N.C. Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

RE: As-Built Baseline Report Sandy Branch Mitigation Site, DMS ID# 100060
Cape Fear River Basin – CU# 03030003
Chatham County, North Carolina
Contract No. 7527

Dear Mr. Dow,

We have reviewed the comments on the As-Built Baseline Report for the above referenced project dated April 5, 2021 and have revised the report based on these comments. The revised documents are submitted with this letter. Below are responses to each of your comments. For your convenience, the comments are reprinted with our response in italics.

**As-built Baseline Report**

1. Appendix 4: Morphological Summary Data and Plots
   a. Please verify data in Table 7a (i.e., W/D ratio for MY0 is listed as 1.0).

   *The W/D ratio for MY0 in Table 7a was corrected to 13.9.*

2. Appendix 5: Record Drawings
   a. Please add DWR number and DMS Contract number to Title Sheet.

   *DWR number and DMS contract number were added to Title Sheet.*

   b. Sheet 0.3: Under the As-Built features, the As-Built 5' Major Contour has 1' intervals in the plan sheets. Recommend removing 5' or 1' contour line from drawings, or fixing the 5' contour lines.

   *Contour lines were updated in the drawings.*

   c. Sheet 1.08: Please consistently label features. For example, MW5 & MW6 on Sheet 1.08 should be GWG5 and GWG6.

   *Feature names were changed to be consistent throughout all plan sheets.*

d. Please depict the Limits of Disturbance on all Plan and Profile sheets.

*Limits of Disturbance were added to all Plan and Profile sheets.*

e. It is very difficult to discern between design top of bank and as-built top of bank. Please change the graphic depiction or color of these to make them more visible or provide higher resolution as-built/record drawing sheets.

*The graphic depiction was altered to create more contrast between the design top of bank and the as-built top of bank.*

3. Digital Files
   a. Please submit structure features as points.

*All structure features have been submitted as points.*

If you have any questions, please contact me by phone (919) 851-9986, or by email (jlorch@wildlandseng.com).

Sincerely,

**Jason Lorch**, *Monitoring Coordinator*

**PREPARED BY:**

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## EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Sandy Branch Mitigation Site (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore a stream and wetland complex within Chatham County, NC. The Sandy Branch Mitigation site utilizes stream restoration, wetland re-establishment, and wetland rehabilitation approaches. The project streams total 3,286 linear feet (LF) of perennial streams. Wetland re-establishment and rehabilitation total 8.540 acres. The Site will generate 3,286.000 stream credits and 7.267 wetland credits. All stream lengths were measured along the stream centerline for stream credit calculations.

The Site is located approximately seven miles southeast of Siler City, NC (Figure 1) in the Cape Fear River Basin 8-Digit Hydrologic Unit Code (HUC) 03030003. The Site is located within the DMS Targeted Local Watershed (TLW) for the Cape Fear River Basin Hydrologic Unit Code (HUC) 03030003070050 (Bear Creek TLW) and the NC DWR Subbasin 03-06-12. The Sandy Branch Mitigation Site is one of the projects identified in the Upper Rocky River Local Watershed Plan as a priority for stream and wetland restoration. Sandy Branch and two unnamed tributaries (UT1 and UT2) are located on the Site. The downstream drainage area of the Site is 463 acres. The Site contains tributaries to Bear Creek, which flows into the Rocky River and eventually the Deep River. The 18.10-acre Site is protected with a permanent conservation easement.

The project goals established in the Mitigation Plan (Wildlands, 2019) were completed with consideration of goals and objectives described in the Cape Fear River Basin Restoration Priorities (RBRP) plan. The project goals include:

- Improve stream channel stability;
- Improve instream habitat;
- Reconnect channels with floodplains and riparian wetlands;
- Restore wetland hydrology, soils, and plant communities;
- Restore and enhance native floodplain vegetation; and
- Permanently protect the Site from harmful land uses.

The project will contribute to achieving the goals for the watershed listed in the Cape Fear RBRP and provide ecological benefits within the Cape Fear River Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, others, such as reduced pollutant and sediment loading, have farther reaching effects.

Site construction was completed in September 2020, and planting was completed in January 2021. As-built surveys were conducted between September 2020 and January 2021. No major adjustments were made during construction. Baseline (MY0) profiles and cross-section dimensions closely match the design parameters. Cross-section widths and pool depths occasionally deviate from the design parameters but fall within a normal range of variability for natural streams. The Site has been built as designed and is expected to meet the upcoming monitoring year's performance criteria.

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## APPENDICES

# Section 1: PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

## 1.1 Project Location and Setting

The Sandy Branch Mitigation Site (Site) is located in central Chatham County, approximately seven miles southeast of Siler City, NC (Figure 1). From Raleigh, NC, take I-40 W then take US-1 S towards Sanford. In 31.5 miles take exit 70B from US-421 N toward Siler City/Greensboro. Follow US-421 for 14.5 miles and then turn left onto Elmer Moore Rd. The project will be on your left in 0.1 miles. A conservation easement was recorded on 18.10 acres of the Site. The Site contains tributaries to Bear Creek, which flows into the Rocky River, and eventually the Deep River. The Site is located approximately 2.75 miles upstream of the Bear Creek (Chatham) Aquatic Habitat, a Significant Natural Heritage Area that is located at the confluence of Bear Creek and Sandy Branch. The Site is located within the DMS Targeted Local Watershed (TLW) for the Cape Fear River Basin Hydrologic Unit Code (HUC) 03030003070050 (Bear Creek TLW) and the NC DWR Subbasin 03-06-12. The Sandy Branch Mitigation Site is one of the projects identified in the Upper Rocky River Local Watershed Plan as a priority for stream and wetland restoration. The 2009 Cape Fear River Basin Restoration Priorities' (RBRP) Cataloging Unit (CU)-wide functional objectives as well as the TLW goals identified the provision of habitat for the endangered mussel population (creeper, Atlantic pigtoe, brook floater and notched rainbow) and the Cape Fear Shiner as a primary goal. Improving water quality is listed as one of the necessities for achieving this goal.

The Site is located in the Carolina Slate Belt of the Piedmont Physiographic Province. The Piedmont Province is characterized by gently rolling, well rounded hills with long low ridges and elevations ranging from 300-1500 feet above sea level. The Site topography and relief are typical for the region. The Carolina Slate Belt consists of heated and deformed volcanic and sedimentary rocks. The area is called "Slate Belt" because of the slatey cleavage of many of the surficial rocks. The region's geology also includes coarse-grained intrusive granites.

Prior to construction activities, cattle were grazed along Sandy Branch Reach 1 and 2, UT1 and UT2. Cattle access to these streams resulted in significant ecological impacts. Table 4 in Appendix 1 and Tables 7a-b in Appendix 4 present additional information on pre-restoration conditions.

## 1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits within the Cape Fear River Basin. While benefits such as habitat improvement and geomorphic stability are limited to the Site, reduced nutrient and sediment loading have farther reaching effects. Table 1 below describes expected outcomes to water quality and ecological processes associated with the project goals and objectives. These goals were established and completed with careful consideration of goals and objectives described in the RBRP and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

**Table 1: Mitigation Goals and Objectives –** *Sandy Branch Mitigation Site*

| Goal | Objective | Expected Outcomes |
|---|---|---|
| Improve stream channel stability. | Reconstruct stream channels that will maintain stable pattern and profile, considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. | Reduce and control sediment inputs. Contribute to protection of, or improvement to, a Nutrient-Sensitive Water. |

| Goal | Objective | Expected Outcomes |
|---|---|---|
| Improve instream habitat. | Install habitat features such as constructed riffles, lunker logs and structures, and brush toe into restored streams. Add woody material to channel beds. Construct pools of varying depth. | Improve aquatic communities in project streams. |
| Reconnect channels with floodplains and riparian wetlands. | Reconstruct stream channels with appropriate bankfull dimensions and depths, relative to the existing floodplain. | Reduce shear stress on channels, hydrate adjacent wetland areas, and filter pollutants from overbank flows. |
| Restore wetland hydrology, soils, and plant communities. | Re-establish and rehabilitate riparian wetlands by raising stream beds and planting native wetland species. | Improve terrestrial habitat. Contribute to protection of, or improvement to, a Nutrient-Sensitive Water. |
| Restore and enhance native floodplain vegetation. | Plant native tree species in riparian zones where currently insufficient. | Reduce and control sediment inputs, reduce and manage nutrient inputs, provide a canopy to shade streams and reduce thermal loadings, contribute to protection of, or improvement to, a Nutrient-Sensitive Water. |
| Permanently protect the Site from harmful uses. | Establish a conservation easement on the Site. | Prevent development and agricultural uses that would damage the Site or reduce the benefits of the project. |

## 1.3 Project Structure, Restoration Type, and Approach

The final Mitigation Plan was approved in December 2019. Construction activities were completed by Main Stream Earthwork in September 2020. The baseline as-built survey was completed by Summit Design and Engineering Services in January 2021. The planting was completed by Bruton Natural Systems, Inc. in January 2021. Refer to Appendix 1 for detailed project activity, history, contact information, and watershed/Site background information.

### 1.3.1 Project Structure

The project provides 3,286.000 stream credits and 7.267 wetland credits. Refer to Figure 2 Project Component / Asset Map for the stream restoration feature exhibits and Table 1 in Appendix 1 for the project components and mitigation credits for the Site.

### 1.3.2 Restoration Type and Approach

The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions. The project consists of the stream restoration activities as described below (Table 2) and illustrated in Figure 2.

**Table 2: Restoration Type and Approach Per Reach** – *Sandy Branch Mitigation Site*

| Stream | Reach | Primary Stressors/Impairments | Treatment Approach | Restoration Activity |
|---|---|---|---|---|
| Sandy Branch | R1 | Erosion, lack of riparian vegetation | Restoration – Priority 1 | Plan, Pattern, Profile, Planting, Fencing |
| | R2 | Incision, erosion, lack of riparian vegetation | Restoration – Priority 1 | Plan, Pattern, Profile, Planting, Fencing |
| UT1 | | Incision, erosion, lack of habitat | Restoration – Priority 1 | Plan, Pattern, Profile, Planting, Fencing |
| UT2 | | Incision, erosion | Restoration – Priority 1 | Plan, Pattern, Profile, Planting, Fencing |

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on many successful Piedmont and Slate Belt restoration projects (Underwood, Foust, Holman Mill, Maney Farm, and Agony Acres Mitigation Sites) and is appropriate for the goals and objectives for this Site.

The morphologic design parameters are shown in Appendix 4, Tables 7a – 7b for the restoration reaches, and fall within the ranges specified for C4 streams (Rosgen, 1996). The specific values for the design parameters were selected based on designer experience and judgment and were verified with morphologic data form reference reach data sets.

## 1.4 Project History, Contacts, and Attribute Data

The Site was restored by Wildlands Engineering through a full delivery contract with DMS. Tables 2, 3, and 4 in Appendix 1 provide detailed information regarding the Project Activity and Reporting History, Project Contacts, and Project Information and Attributes.

# Section 2: PERFORMANCE STANDARDS

The stream performance standards for the project will follow approved standards presented in the Wilmington District Stream and Wetland Compensatory Mitigation Updated in October 2016 by the North Carolina Interagency Review Team (NCIRT). Annual monitoring and semi-annual site visits will be conducted by qualified personnel to assess the condition of the project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring.

## 2.1 Streams

### 2.1.1 Dimension

Riffle cross-sections on the restoration reaches should be largely stable and should only show minor changes in bankfull area, maximum depth ratio, and width-to-depth ratio. Per guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored channels to be considered stable. Riffle cross-sections should largely fall within the parameters defined for channels of that stream classification. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

### 2.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

### 2.1.3 Substrate

Channel substrate materials will be sampled in restoration reaches using the reach-wide pebble count method. Reaches should show maintenance of coarser substrate in the riffles than in the pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring and will not be conducted during annual monitoring unless observations indicate a trend toward finer substrate and a comparison is needed.

### 2.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

### 2.1.5 Hydrology Documentation

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented within the seven-year monitoring period and individual events must occur in separate years. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented.

## 2.2 Vegetation

Vegetative performance for riparian buffers associated with the stream restoration component of the project (buffer widths 0 – 50ft) will be in accordance with the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. The success criteria is an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre at the end of MY5, and a final vegetation survival rate of 210 stems per acre at the end of MY7. Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation monitoring will be conducted between July 1st and the end of the of the growing season. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. In fixed vegetation plots, planted woody stems will be marked annually as needed and given a coordinate, based off a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current year's living planted stems.

The extent of invasive species coverage will be monitored and controlled as necessary throughout the required seven-year monitoring period.

## 2.3 Wetlands

The final performance standard for wetland hydrology is based on the soil type on the Site and associated USACE guidance shall be free groundwater surface within 12 inches of the ground surface for 10% of the growing season under normal precipitation conditions.

## 2.4 Visual Assessment

Visual assessments should support the specific performance standards for each metric as described above.

## 2.5 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Annual Monitoring Report Template (June, 2017), the monitoring reports will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background;
- Monitoring Current Condition Plan View (CCPV) maps with major project elements noted such as grade control structures, vegetation plots, permanent cross-sections, groundwater wells, and crest gauges;
- Photographs showing views of the restored Site taken from fixed point stations;
- Assessment of the stability of the Site based on the cross-sections;
- Vegetative data as described above including the establishment of any undesirable plant species;
- A description of damage by animals or vandalism; and
- Maintenance issues and recommended remediation measures will be detailed and documented.

# Section 3: MONITORING PLAN

Monitoring will consist of collecting morphological, hydrologic, and vegetative data to assess the project performance based on the restoration goals and objectives on an annual basis until performance criteria have been met. The performance of the project will be assessed using measurements of the stream channel's dimension, substrate composition, permanent photographs, surface water hydrology, and vegetation. Any areas identified as high priority problems, such as streambank instability, aggradation/degradation, or lack of vegetation establishment will be evaluated on a case-by-case basis. The problem areas will be visually noted, and remedial actions will be discussed with DMS staff to determine a plan of action. A remedial action plan will be submitted if substantial maintenance is required. The monitoring period will extend seven years beyond completion of construction or until performance criteria have been met.

## 3.1 Stream

Geomorphic assessments will follow guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification document (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al, 2003). Refer to Figure 3 in Appendix 2 and Record Drawings in Appendix 5 for monitoring locations discussed below.

### 3.1.1 Dimension

A total of eight cross-sections were installed along the stream restoration reaches. Two cross-sections were installed per 1,000 linear feet of stream restoration work, with riffle and pool sections in proportion to DMS guidance. Each cross-section was permanently marked with pins to establish its location. Cross-section surveys include points measured at all breaks in slope; including top of bank, bankfull, edge of water, and thalweg to monitor any deviations in dimension. If moderate bank erosion is observed along a stream reach during the monitoring period, a series of bank pins will be installed in representative areas where erosion is occurring for reaches with a bankfull width of greater than five feet. If required, bank pins will be installed in at least three locations (one in upper third of the pool, one at the mid-point of the pool, and one in the lower third of the pool). If bank pins are required, they will be monitored by measuring exposed rebar and maintaining pins flush to bank to capture bank erosion progression. Annual cross-section surveys will be conducted in monitoring years MY1, MY2, MY3, MY5, and MY7. Photographs will be taken annually of the cross-sections looking upstream and downstream.

### 3.1.2 Pattern and Profile

Longitudinal profile surveys will not be conducted during the seven-year monitoring period unless other indicators during the annual monitoring show a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the DMS Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (DMS, 2011) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Stream pattern and profile will be assessed visually as described below in section 3.1.6.

### 3.1.3 Substrate

A reach-wide pebble count will be performed in four reaches (Sandy Branch Reach 1 and 2, UT1, and UT2) during monitoring years 1, 2, 3, 5, and 7 for classification purposes and to show that riffles remain coarser than pools. Riffle cross-section pebble counts were conducted during as-built baseline monitoring only unless observations indicate a trend toward finer substrate and a comparison is needed.

### 3.1.4 Photo Reference Points

A total of 18 permanent photograph reference points were established along the stream reaches after construction. Permanent markers were established so that the same locations and view directions on the Site are photographed each year. Longitudinal stream photographs will be taken looking upstream and downstream once a year to visually document stability. Cross-sectional photos will be taken at each permanent cross-section looking upstream and downstream. Representative digital photos of each permanent photo point will be taken on the same day the stream assessments are conducted.

### 3.1.5 Hydrology Documentation

One automated crest gauge was installed on Site. The crest gauge was installed in a surveyed riffle cross-section on Sandy Branch Reach 2. Crest gauge data will be downloaded during site visits to determine if a bankfull event has occurred since the last visit. Additionally, photographs will be collected to document the occurrence of debris lines and sediment deposition as evidence of bankfull events.

### 3.1.6 Visual Assessment

Visual assessments will be performed at the Site on a semi-annual basis during the seven-year monitoring period. Problem areas will be noted such as channel instability (i.e. lateral and/or vertical instability, in-stream structure failure/instability and/or piping, or headcuts), vegetated health (i.e. low stem density, vegetation mortality, invasive species or encroachment), beaver activity, or livestock access. Areas of concern will be mapped and accompanied by a written description in the annual report. Problem areas will be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

## 3.2 Vegetation

Planted woody vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006) to monitor and assess the planted woody vegetation. A total of thirteen standard 10 meter by 10 meter vegetation plots were established within the project easement area. Three of the thirteen vegetation plots will be relocated randomly on an annual basis to monitor vegetation health across the Site.

Vegetation plots were randomly established between the conservation easement boundaries and five feet from the top of stream banks. Fixed vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs were taken at the origin looking diagonally across the plot to the opposite corner during the baseline monitoring in January 2021. Subsequent annual assessments following the baseline survey will capture the same reference photograph locations. Planted woody stems will be marked annually, as needed, based off a known origin so they can be found in subsequent monitoring years.

Species composition, density, and survival rates will be evaluated on an annual basis by plot and for the entire Site. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems. Vegetation surveys will be conducted during monitoring years 1, 2, 3, 5, and 7.

## 3.3 Wetlands

Twelve groundwater monitoring wells equipped with pressure transducers were installed to assess hydrology in wetland re-establishment and rehabilitation areas. Pressure transducers will record groundwater pressure at least twice daily. Monitoring well data will be analyzed in consideration of recorded precipitation, reference well data, and growing season dates. Data from groundwater wells will be downloaded at regular intervals and included in annual monitoring reports.

The estimated growing season for Chatham County is approximately March 18th through November 17th based on NRCS WETS Tables. A soil temperature probe was installed on-site to determine growing season dates for each individual monitoring year. Per USACE guidance, the probe was located at a depth of 12 inches. The growing season will be defined as that portion of the year where soil temperature remains above 41 degrees Fahrenheit. Soil temperature must be corroborated with bud break and the growing season may not begin before March 1st of each year when calculating hydroperiods. If a wetland zone does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed, and the hydrograph will be compared to that of the reference wetlands to assess whether atypical weather conditions occurred during the monitoring period. Monitoring wells and soil temperature probe locations are shown on Figure 3 in Appendix 2.

# Section 4: LAND MANAGEMENT AND CONTINGENCY PLAN

Wildlands will perform maintenance as needed at the Site. A physical inspection of the Site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following construction and may include one or more of the following components.

## 4.1 Stream

Stream problem areas will be mapped and included in the CCPV as part of the annual stream assessment. Stream problems areas may include bank erosion, structure failure, beaver dams, aggradation/degradation, etc. Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water runoff flows into the channel may also require maintenance to prevent bank failures and head-cutting.

## 4.2 Vegetation

Vegetation shall be maintained to ensure the health and vigor of the targeted community. Vegetative problem areas will be mapped and included in the CCPV as part of the annual vegetation assessment. Vegetation problem areas may include planted vegetation not meeting performance criteria, persistent invasive species, barren areas with little to no herbaceous cover, or grass suffocation/crowding of planted stems. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture rules and regulations.

## 4.3 Site Boundary

Site boundary issues will be mapped and included in the CCPV as part of the annual visual assessment. Site boundaries shall be identified in the field to ensure clear distinction between the Site and adjacent properties. Boundaries are marked with conservation easement signs attached to metal posts. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

# Section 5: AS-BUILT CONDITION (BASELINE)

The Site construction and as-built surveys were completed between September 2020- January 2021. The survey included developing an as-built topographic surface; as well as, surveying the as-built channel centerlines, top of banks, structures, and cross-sections.

## 5.1 As-Built/Record Drawings

A sealed half-size set of record drawings are in Appendix 5 which includes the post-construction survey, alignments, structures, and monitoring features. No significant field adjustments were made during construction that differ from the design plans. Minimal adjustments were made during construction, where needed, based on field evaluation and are listed below.

### 5.1.1 Sandy Branch Reach 1

- Station 100+32 boulder sill not installed due to elevation of existing bedrock.
- Station 100+41 – Station 100+60 boulder toe substituted for log vane due to elevation of existing bedrock.

### 5.1.2 Sandy Branch Reach 2

- Station 111+36 angled log sill substituted for boulder sill due to material availability.
- Station 119+98 angled log sill substituted for boulder sill due to material availability.
- Station 126+74 angled log sill substituted for boulder sill due to material availability.
- Station 127+53 boulder sill not installed due to removal of drop over pool.
- Station 127+74 – Station 128+05 boulder toe added for additional bank stability.
- Station 128+97 – Station 129+25 brush toe substituted for boulder toe due to material availability.

### 5.1.3 UT1

- Station 200+68 angled log sill substituted for boulder sill due to material availability.
- Station 200+84 – Station 200+69 boulder toe added for additional bank stability.

### 5.1.4 UT2

- Station 302+68 rock floodplain outlet added due to observed overland flow.

## 5.2 Baseline Data Assessment

Baseline monitoring (MY0) was conducted between September and January 2021. The first annual monitoring assessment (MY1) will be completed in late 2021. The streams will be monitored for a total of seven years, with the final monitoring activities concluding in 2027. The close-out for the Site will be conducted in 2028 given the performance criteria have been met.

### 5.2.1 Morphological State of the Channel

Refer to Appendix 2 for stream photographs and Appendix 4 for summary data tables and morphological plots.

Profile

The MY0 longitudinal profiles closely match the design profile. On the design profiles, pools and riffles were depicted as straight lines with consistent slopes. The as-built surveyed profiles are not as consistent in slope due to the size of the rock used for construction. Pool and riffle depths and slopes are expected to be maintained near design parameter values. The variations in slope and depth do not

constitute a problem or indicate a need for remedial actions and will be assessed visually during the site walks.

Dimension
The MY0 channel dimensions fall within specified design parameter ranges. The channels are expected to maintain dimensions of C4 Rosgen type channels. Summary data and cross-section plots of each project reach are included in Appendix 4.

Pattern
The MY0 pattern metrics fall within the design parameter ranges for all reaches. No major changes to design alignments were made during construction. Pattern data will be evaluated in MY5 if channel dimensions or profile indicate that significant geomorphic changes have occurred.

Sediment Transport
As-built shear stress and velocities are similar to design calculations and should reduce the risk of further erosion along the reaches. The substrate data for each constructed reach was compared to the design shear stress parameters from the mitigation plan to assess the potential for bed degradation. The shear stresses calculated for the constructed channels are within the allowable range, which indicates the channel is not at risk to trend toward channel degradation.

### 5.2.2 Hydrology
Bankfull events recorded following completion of construction will be reported in the MY1 report.

### 5.2.3 Wetlands
Wetland data recorded following completion of construction will be reported in the MY1 report. Groundwater well photographs are in Appendix 2.

### 5.2.4 Vegetation
The MY0 vegetation survey was completed in January 2021. The MY0 planted density is 573 stems per acre which exceeds the MY3 interim stem density requirement of 320 planted stems per acre. Vegetation Plot photographs are included in Appendix 2 and summary data for each plot are included in Tables 6a and 6b in Appendix 3.

# Section 6: REFERENCES


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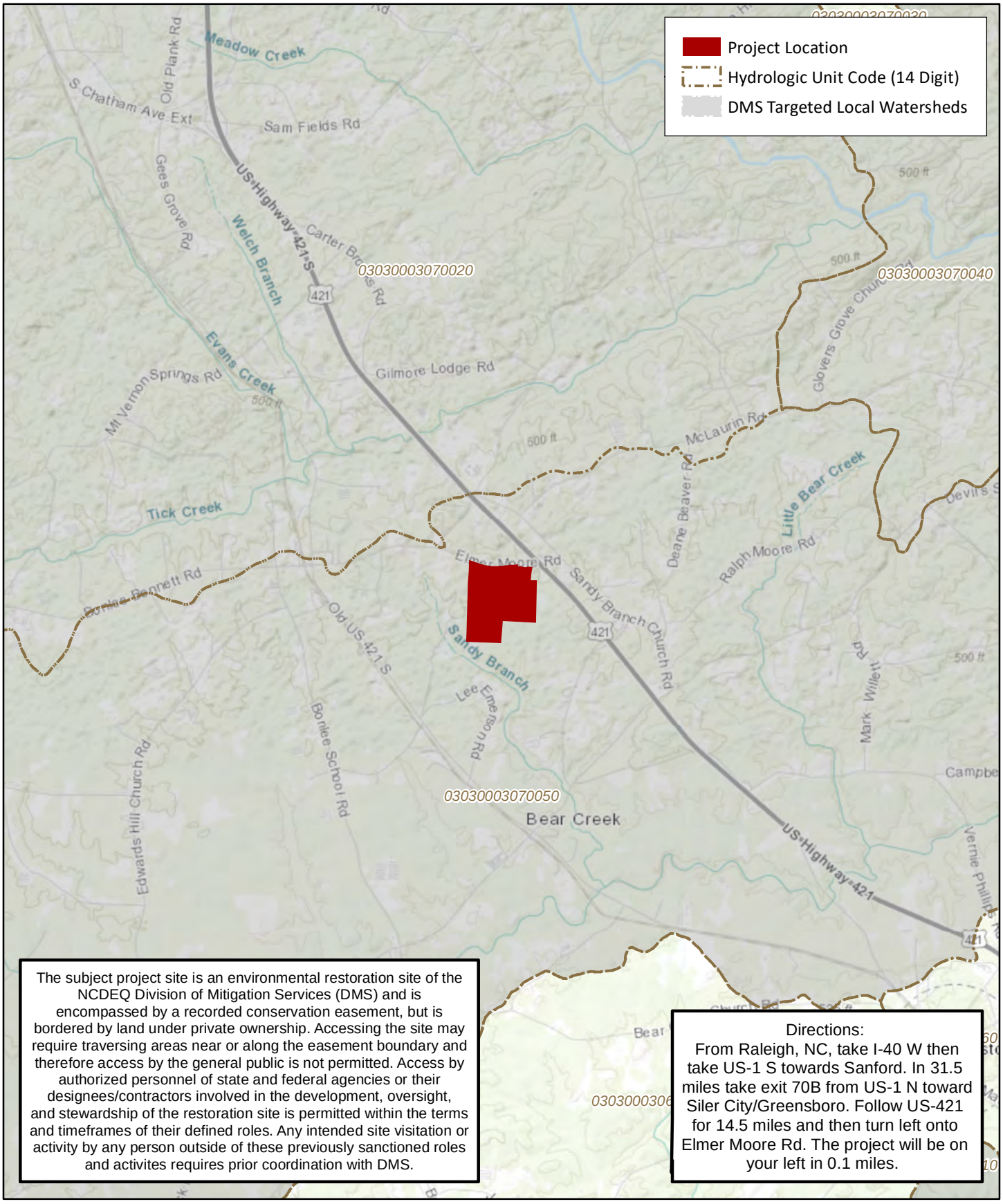
# APPENDIX 1. General Figures and Tables




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

Directions:
From Raleigh, NC, take I-40 W then take US-1 S towards Sanford. In 31.5 miles take exit 70B from US-1 N toward Siler City/Greensboro. Follow US-421 for 14.5 miles and then turn left onto Elmer Moore Rd. The project will be on your left in 0.1 miles.

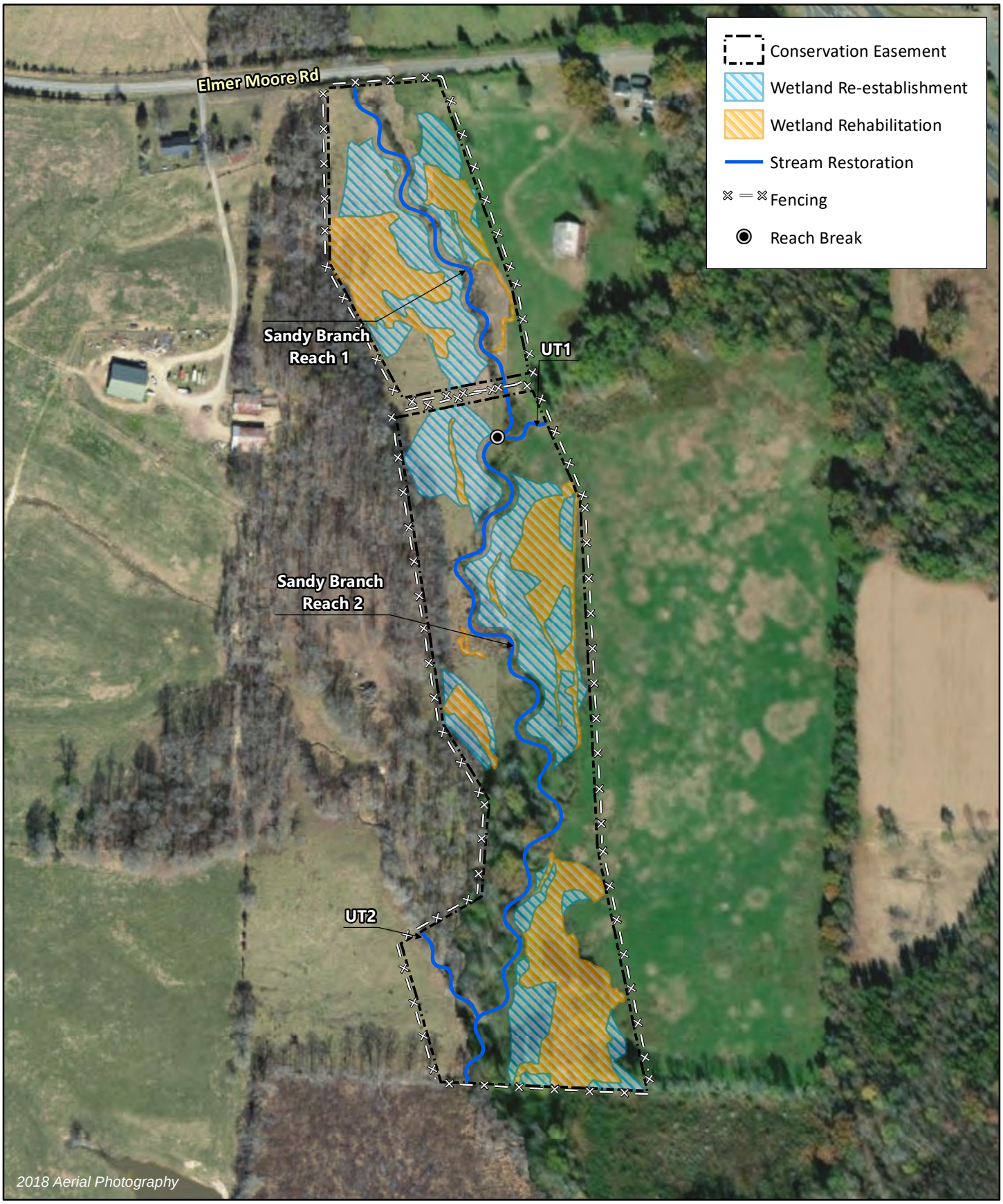
WILDLANDS ENGINEERING

0 0.5 1 Miles

N

Figure 1 - Project Vicinity Map
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 0 - 2021

*Chatham County, NC*




WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 2 - Project Component / Asset Map
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 0 - 2021
*Chatham County, NC*

**Table 1. Project Components and Mitigation Credits**
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

| PROJECT COMPONENTS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Reach ID** | **Existing Footage or Acreage** | **Mitigation Plan Footage or Acreage** | **Mitigation Category** | **Restoration Level** | **Priority Level** | **Mitigation Ratio (X:1)** | **Project Credits** | **As-Built Footage or Acreage** | **Comments** |
| **STREAMS** | | | | | | | | | |
| Sandy Branch Reach 1 | 838 | 861 | Warm | R | P1 | 1 | 861.000 | 849 | Full Channel Restoration, Planted Buffer, Fencing Out Livestock |
| | 50 | 40 | Warm | N/A | N/A | N/A | N/A | 40 | External Crossing, Culvert |
| | 126 | 110 | Warm | R | P1 | 1 | 110.000 | 104 | Full Channel Restoration, Planted Buffer, Fencing Out Livestock |
| Sandy Branch Reach 2 | 1,931 | 1,929 | Warm | R | P1 | 1 | 1,929.000 | 1,919 | Full Channel Restoration, Planted Buffer, Fencing Out Livestock |
| UT1 | 102 | 131 | Warm | R | P1 | 1 | 131.000 | 125 | Full Channel Restoration, Planted Buffer, Fencing Out Livestock |
| UT2 | 257 | 255 | Warm | R | P1 | 1 | 255.000 | 254 | Full Channel Restoration, Planted Buffer, Fencing Out Livestock |
| **WETLANDS** | | | | | | | | | |
| Wetland Re-Establishment | N/A | 4.721 | Riparian | R | N/A | 1 | 4.721 | 4.721 | Hydrologic Restoration, Conservation Easement, Planted |
| Wetland Rehabilitation | 3.819 | 3.819 | Riparian | RE | N/A | 1.5 | 2.546 | 3.819 | Hydrologic Restoration, Conservation Easement, Planted |

| PROJECT CREDITS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Restoration Level** | **Stream** | | | **Riparian Wetland** | | **Non-Riparian Wetland** | **Coastal Marsh** |
| | **Warm** | **Cool** | **Cold** | **Riverine** | **Non-Riverine** | | |
| Restoration | 3,286.000 | | | | | | |
| Enhancement I | | | | | | | |
| Enhancement II | | | | | | | |
| Preservation | | | | | | | |
| Re-Establishment | | | | 4.721 | | | |
| Rehabilitation | | | | 2.546 | | | |
| Enhancement | | | | | | | |
| Creation | | | | | | | |
| **Totals** | **3,286.000** | | | **7.267** | | | |

**Table 2. Project Activity and Reporting History**
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

| Activity or Report | | Data Collection Complete | Completion or Scheduled Delivery |
|---|---|---|---|
| Mitigation Plan | | December 2019 | December 2019 |
| Final Design - Construction Plans | | June 2020 | June 2020 |
| Construction | | September 2020 | September 2020 |
| Temporary S&E mix applied to entire project area [1] | | September 2020 | September 2020 |
| Permanent seed mix applied to reach/segments [1] | | September 2020 | September 2020 |
| Bare root and live stake plantings for reach/segments | | January 2021 | January 2021 |
| Baseline Monitoring Document (Year 0) | Stream Survey | September 2020 | March 2021 |
| | Vegetation Survey | January 2021 | |
| Year 1 Monitoring | Stream Survey | 2021 | December 2021 |
| | Vegetation Survey | 2021 | |
| Year 2 Monitoring | Stream Survey | 2022 | December 2022 |
| | Vegetation Survey | 2022 | |
| Year 3 Monitoring | Stream Survey | 2023 | December 2023 |
| | Vegetation Survey | 2023 | |
| Year 4 Monitoring | | | December 2024 |
| Year 5 Monitoring | Stream Survey | 2025 | December 2025 |
| | Vegetation Survey | 2025 | |
| Year 6 Monitoring | | | December 2026 |
| Year 7 Monitoring | Stream Survey | 2027 | December 2027 |
| | Vegetation Survey | 2027 | |

[1]Seed and mulch is added as each section of construction is completed.

**Table 3. Project Contact Table**
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

| | |
|---|---|
| **Designer**<br>Greg Turner, PE | **Wildlands Engineering, Inc.**<br>312 West Millbrook Road, Suite 225<br>Raleigh, NC 27609<br>919.851.9986 |
| **Construction Contractor** | **Main Stream Earthwork, Inc.**<br>631 Camp Dan Valley Rd.<br>Reidsville, NC 27320 |
| **Planting Contractor** | **Bruton Natural Systems, Inc**<br>P.O. Box 1197<br>Fremont, NC 27830 |
| **Seeding Contractor** | **Main Stream Earthwork, Inc.**<br>631 Camp Dan Valley Rd.<br>Reidsville, NC 27320 |
| **Seed Mix Sources** | **Green Resources**<br>P.O. Box 429<br>Colfax, NC 27235 |
| **Nursery Stock Suppliers**<br>Bare Roots | **Dykes and Sons Nursery and Greenhouse**<br>825 Maude Etter Rd<br>McMinnville, TN 37110 |
| Live Stakes | **Bruton Natural Systems, Inc** |
| **Monitoring Performers**<br>Monitoring, POC | **Wildlands Engineering, Inc.**<br>Jason Lorch<br>919.851.9986 |

**Table 4. Project Information and Attributes**

Sandy Branch Mitigation Site

DMS Project No. 100060

**Monitoring Year 0 - 2021**

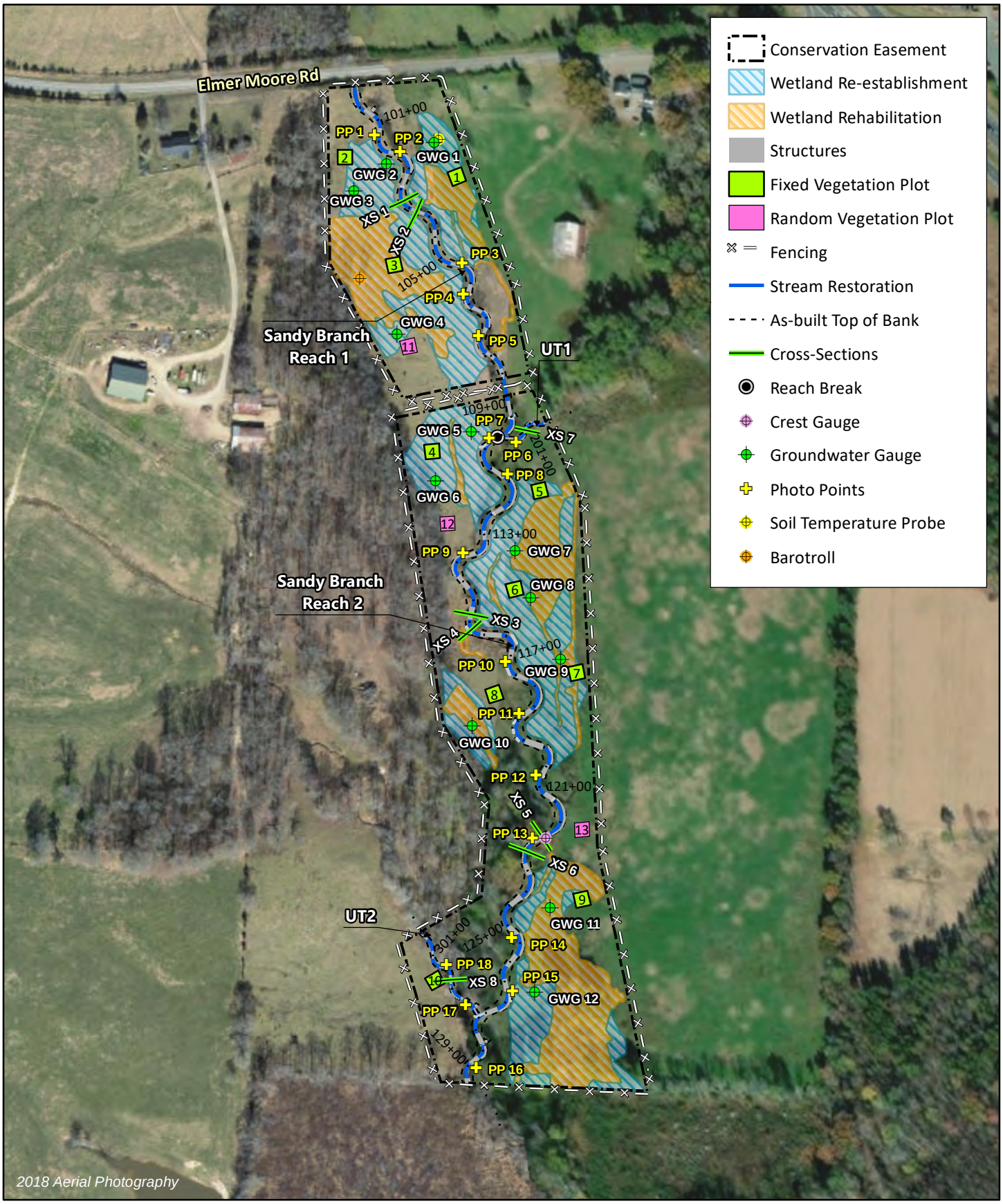
| PROJECT INFORMATION | | | | |
|---|---|---|---|---|
| Project Name | Sandy Branch Mitigation Site | | | |
| County | Chatham County | | | |
| Project Area (acres) | 18.10 | | | |
| Planted (acres) | 15.87 | | | |
| Project Coordinates (latitude and longitude) | 35°38'35"N 79°23'14"W | | | |
| **PROJECT WATERSHED SUMMARY INFORMATION** | | | | |
| Physiographic Province | Carolina Slate Belt of the Piedmont Physiographic Province | | | |
| River Basin | Cape Fear River | | | |
| USGS Hydrologic Unit 8-digit | 03030003 | | | |
| USGS Hydrologic Unit 14-digit | 03030003070050 | | | |
| DWR Sub-basin | 03-06-12 | | | |
| Project Drainiage Area (acres) | 463 | | | |
| Project Drainage Area Percentage of Impervious Area (2011) | 1.5% | | | |
| CGIA Land Use Classification (2011) | 49% Cultivated Crops and Hay, 36% Forested, 13% Developed, 1% Shrubland, 1% Grassland/Herbaceous | | | |
| **REACH SUMMARY INFORMATION** | | | | |
| **Parameters** | **Sandy Branch Reach 1** | **Sandy Branch Reach 2** | **UT1** | **UT2** |
| Length of Reach (linear feet) - Post-Restoration | 953 | 1,919 | 125 | 254 |
| Drainage Area (acres) | 323 | 388-463 | 35 | 73 |
| NCDWR Stream Identification Score | 48 | | 44.5 | 45.5 |
| NCDWR Water Quality Classification | C, NSW | | | |
| Morphological Desription (stream type) | Perennial | | | |
| Evolutionary Trend (Simon's Model) - Pre-Restoration | Stage III: Degradation | | | |
| Underlying Mapped Soils | CmB - Cid-Lignum complex | | | |
| FEMA Classification | N/A | | | |

| REGULATORY CONSIDERATIONS | | | |
|---|---|---|---|
| **Regulation** | **Applicable?** | **Resolved?** | **Supporting Documentation** |
| Waters of the United States - Section 404 | Yes | Yes | USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134. |
| Waters of the United States - Section 401 | Yes | Yes | |
| Division of Land Quality (Dam Safety) | N/A | N/A | N/A |
| Endangered Species Act | Yes | Yes | Sandy Branch Mitigation Plan; Wildlands determined "no effect" on Chatham County listed endangered species.Per the new standard from the United States Fish and Wildlife Service (USFWS) Raleigh Field Office, Wildlands submitted the Sandy Branch Mitigation Site Self-Certification Letter on July 9, 2018. USFWS had no comment during the thirty-day review period. All documents and correspondence submitted to the USFWS are included in the Appendix. |
| Historic Preservation Act | Yes | Yes | Correspondence from SHPO on April 16, 2018 indicating they were not aware of any historic resources that would be affected by the project. |
| Coastal Zone Management Act (CZMA)/Coastal Area Management Act | No | N/A | N/A |
| FEMA Floodplain Compliance | No | N/A | N/A |
| Essential Fisheries Habitat | No | N/A | N/A |

**Table 5. Monitoring Component Summary**
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

| Parameter | Monitoring Feature | Quantity / Length by Reach | | | | Frequency |
|---|---|---|---|---|---|---|
| | | Sandy Branch Reach 1 | Sandy Branch Reach 2 | UT1 | UT2 | |
| **Dimension** | Riffle Cross-Sections | 1 | 2 | 1 | 1 | Year 1, 2, 3, 5, and 7 |
| | Pool Cross-Sections | 1 | 2 | 0 | 0 | Year 1, 2, 3, 5, and 7 |
| **Pattern** | Pattern | N/A | | | | N/A |
| **Profile** | Longitudinal Profile | | | | | MY0 (Unless Required) |
| **Substrate** | Reach Wide Pebble Count | 1 RW | 1 RW | 1 RW | 1 RW | Year 1, 2, 3, 5, and 7 |
| **Hydrology** | Transducer: Crest Gauge (CG) or Flow Gauge (FG) | 1 CG | | N/A | | Quarterly |
| **Vegetation** | CVS Level 2 Vegetation Plots | 10 Fixed; 3 Random | | | | Year 1, 2, 3, 5, and 7 |
| **Wetlands** | Groundwater Well | 12 | | | | Quarterly |
| **Visual Assessment** | | Yes | | | | Semi-Annual |
| **Exotic and Nuisance Vegetation** | | | | | | Semi-Annual |
| **Project Boundary** | | | | | | Semi- Annual |
| **Reference Photos** | Photographs | 18 | | | | Annual |

# APPENDIX 2. Visual Assessment Data




WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3 - Monitoring Plan View
Sandy Branch Mitigation Site
DMS Project No. 100060
Monitoring Year 0 - 2021
*Chatham County, NC*

**STREAM PHOTOGRAPHS**

| | |
|---|---|
|  |  |
| **PHOTO POINT 1 Sandy Branch R1 – upstream *(09/23/2020)*** | **PHOTO POINT 1 Sandy Branch R1 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 2 Sandy Branch R1 – upstream *(09/23/2020)*** | **PHOTO POINT 2 Sandy Branch R1 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 3 Sandy Branch R1 – upstream *(09/23/2020)*** | **PHOTO POINT 3 Sandy Branch R1 – downstream *(09/23/2020)*** |

**PHOTO POINT 4 Sandy Branch R1 – upstream *(09/23/2020)***

**PHOTO POINT 4 Sandy Branch R1 – downstream *(09/23/2020)***

**PHOTO POINT 5 Sandy Branch R1 – upstream *(09/23/2020)***

**PHOTO POINT 5 Sandy Branch R1 – downstream *(09/23/2020)***

**PHOTO POINT 6 UT1 – upstream *(09/23/2020)***

**PHOTO POINT 6 UT1 – downstream *(09/23/2020)***

**PHOTO POINT 7 Sandy Branch R2 – upstream *(09/23/2020)***

**PHOTO POINT 7 Sandy Branch R2 – downstream *(09/23/2020)***

**PHOTO POINT 8 Sandy Branch R2 – upstream *(09/23/2020)***

**PHOTO POINT 8 Sandy Branch R2 – downstream *(09/23/2020)***

**PHOTO POINT 9 Sandy Branch R2 – upstream *(09/23/2020)***

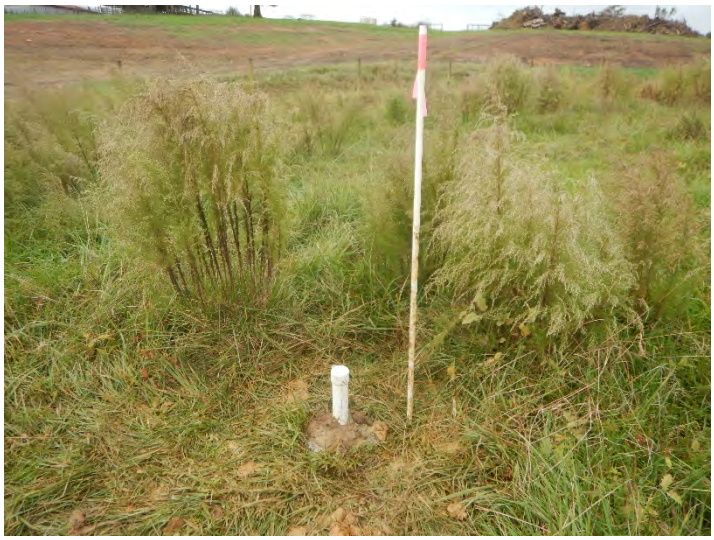
**PHOTO POINT 9 Sandy Branch R2 – downstream *(09/23/2020)***

| | |
|---|---|
|  |  |
| **PHOTO POINT 10 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 10 Sandy Branch R2 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 11 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 11 Sandy Branch R2 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 12 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 12 Sandy Branch R2 – downstream *(09/23/2020)*** |

| | |
|---|---|
|  |  |
| **PHOTO POINT 13 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 13 Sandy Branch R2 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 14 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 14 Sandy Branch R2 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 15 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 15 Sandy Branch R2 – downstream *(09/23/2020)*** |

| | |
|---|---|
|  |  |
| **PHOTO POINT 16 Sandy Branch R2 – upstream *(09/23/2020)*** | **PHOTO POINT 16 Sandy Branch R2 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 17 UT2 – upstream *(09/23/2020)*** | **PHOTO POINT 17 UT2 – downstream *(09/23/2020)*** |
|  |  |
| **PHOTO POINT 18 UT2 – upstream *(09/23/2020)*** | **PHOTO POINT 18 UT2 – downstream *(09/23/2020)*** |

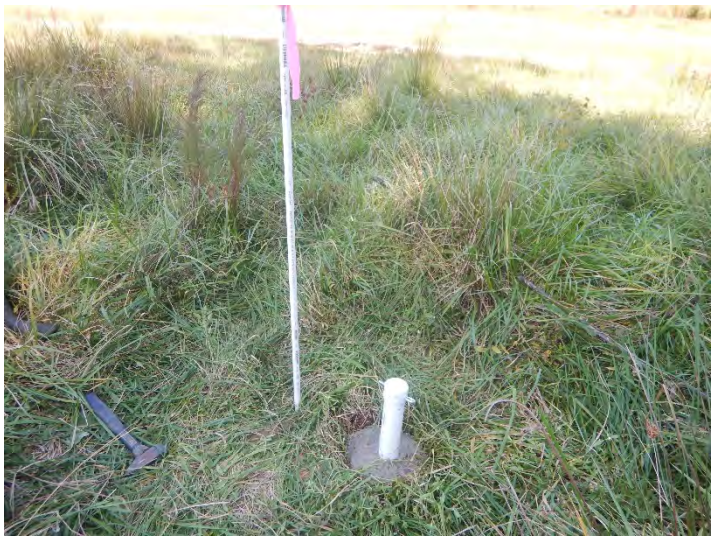
**GROUNDWATER WELL PHOTOGRAPHS**

| | |
|---|---|
|  |  |
| **GROUNDWATER WELL 1** ***(09/23/2020)*** | **GROUNDWATER WELL 2** ***(09/23/2020)*** |
|  |  |
| **GROUNDWATER WELL 3** ***(09/23/2020)*** | **GROUNDWATER WELL 4** ***(09/23/2020)*** |
|  |  |
| **GROUNDWATER WELL 5** ***(09/23/2020)*** | **GROUNDWATER WELL 6** ***(09/23/2020)*** |

**GROUNDWATER WELL 7 *(09/23/2020)***

**GROUNDWATER WELL 8 *(09/23/2020)***

**GROUNDWATER WELL 9 *(09/23/2020)***



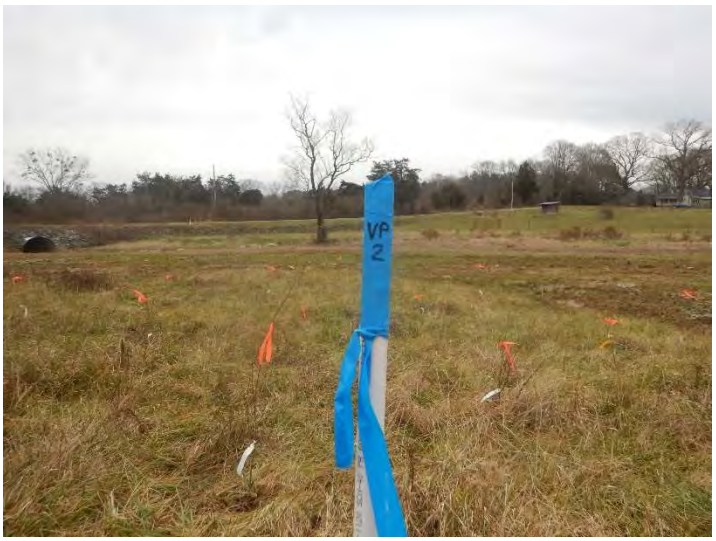
**GROUNDWATER WELL 10 *(09/23/2020)***

**GROUNDWATER WELL 11 *(09/23/2020)***

**GROUNDWATER WELL 12 *(09/23/2020)***

**VEGETATION PLOT PHOTOGRAPHS**


**FIXED VEG PLOT 1** *(01/11/2021)*




**FIXED VEG PLOT 2** *(01/11/2021)*

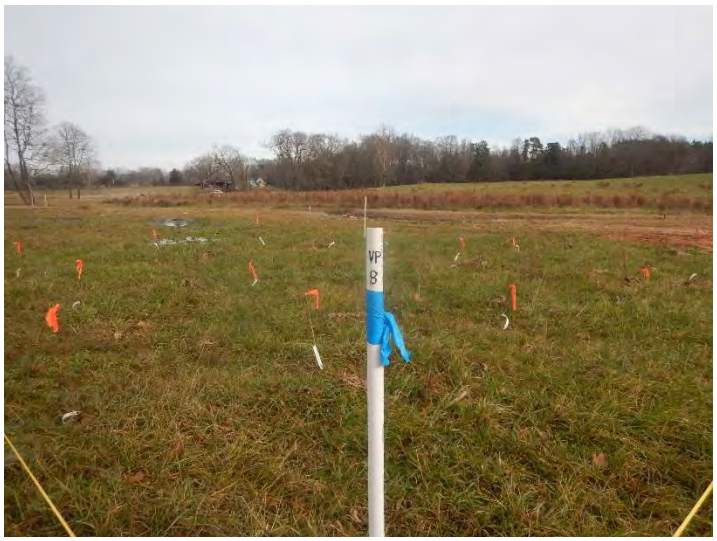

**FIXED VEG PLOT 3** *(01/11/2021)*


**FIXED VEG PLOT 4** *(01/11/2021)*


**FIXED VEG PLOT 5** *(01/11/2021)*


**FIXED VEG PLOT 6** *(01/11/2021)*


**FIXED VEG PLOT 7** *(01/11/2021)*




**FIXED VEG PLOT 8** *(01/11/2021)*


**FIXED VEG PLOT 9** *(01/11/2021)*


**FIXED VEG PLOT 10** *(01/11/2021)*


**RANDOM VEG PLOT 11** *(01/11/2021)*


**RANDOM VEG PLOT 12** *(01/11/2021)*

**RANDOM VEG PLOT 13** *(01/11/2021)*

# APPENDIX 3. Vegetation Plot Data

Table 6a. Fixed Plots: Planted and Total Stem Counts
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

| | | | Current Plot Data (MY0 2021) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | VP 1 | | | VP 2 | | | VP 3 | | | VP 4 | | | VP 5 | | |
| **Scientific Name** | **Common Name** | **Species Type** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** |
| *Acer negundo* | Boxelder | Tree | 1 | 1 | 1 | | | | 1 | 1 | 1 | | | | 1 | 1 | 1 |
| *Betula nigra* | River Birch | Tree | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| *Celtis laevigata* | Sugarberry | Shrub Tree | 1 | 1 | 1 | | | | | | | 1 | 1 | 1 | 1 | 1 | 1 |
| *Diospyros virginiana* | Persimmon | Tree | 1 | 1 | 1 | | | | | | | 2 | 2 | 2 | | | |
| *Platanus occidentalis* | Sycamore | Tree | 2 | 2 | 2 | 4 | 4 | 4 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 2 |
| *Quercus michauxii* | Swamp Chestnut Oak | Tree | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 1 | 1 | 1 | 4 | 4 | 4 |
| *Quercus nigra* | Water Oak | Tree | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | 1 | 1 | 1 |
| *Quercus pagoda* | Cherrybark Oak | Tree | 2 | 2 | 2 | | | | 2 | 2 | 2 | | | | 1 | 1 | 1 |
| *Quercus phellos* | Willow Oak | Tree | | | | 3 | 3 | 3 | 3 | 3 | 3 | | | | 4 | 4 | 4 |
| *Quercus shumardii* | Shumard Oak | Tree | | | | | | | | | | | | | | | |
| *Salix nigra* | Black Willow | Tree | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 | 1 | | | |
| *Ulmus rubra* | Slippery Elm | Tree | | | | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | | | |
| | | **Stem count** | 14 | 14 | 14 | 15 | 15 | 15 | 14 | 14 | 14 | 12 | 12 | 12 | 16 | 16 | 16 |
| | | **size (ares)** | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | |
| | | **size (ACRES)** | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | |
| | | **Species count** | 9 | 9 | 9 | 6 | 6 | 6 | 8 | 8 | 8 | 7 | 7 | 7 | 8 | 8 | 8 |
| | | **Stems per ACRE** | 567 | 567 | 567 | 607 | 607 | 607 | 567 | 567 | 567 | 486 | 486 | 486 | 647 | 647 | 647 |

**Color for Density**

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

**PnoLS -** Planted Stems Excluding Live Stakes

**P-all -** All Planted Stems

**T -** All Woody Stems

Table 6a. Fixed Plots: Planted and Total Stem Counts

Sandy Branch Mitigation Site

DMS Project No. 100060

**Monitoring Year 0 - 2021**

| | | | Current Plot Data (MY0 2021) | | | | | | | | | | | | | | | Annual Means | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | VP 6 | | | VP 7 | | | VP 8 | | | VP 9 | | | VP 10 | | | MY0 (2021) | | |
| **Scientific Name** | **Common Name** | **Species Type** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** | **PnoLS** | **P-all** | **T** |
| *Acer negundo* | Boxelder | Tree | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 7 | 7 |
| *Betula nigra* | River Birch | Tree | 4 | 4 | 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 26 | 26 | 26 |
| *Celtis laevigata* | Sugarberry | Shrub Tree | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | 5 | 5 | 5 |
| *Diospyros virginiana* | Persimmon | Tree | 1 | 1 | 1 | | | | | | | 2 | 2 | 2 | | | | 6 | 6 | 6 |
| *Platanus occidentalis* | Sycamore | Tree | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 24 | 24 | 24 |
| *Quercus michauxii* | Swamp Chestnut Oak | Tree | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 23 | 23 | 23 |
| *Quercus nigra* | Water Oak | Tree | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 9 | 9 | 9 |
| *Quercus pagoda* | Cherrybark Oak | Tree | | | | 1 | 1 | 1 | | | | 2 | 2 | 2 | | | | 8 | 8 | 8 |
| *Quercus phellos* | Willow Oak | Tree | | | | 4 | 4 | 4 | 2 | 2 | 2 | 1 | 1 | 1 | 4 | 4 | 4 | 21 | 21 | 21 |
| *Quercus shumardii* | Shumard Oak | Tree | | | | | | | 1 | 1 | 1 | | | | 2 | 2 | 2 | 3 | 3 | 3 |
| *Salix nigra* | Black Willow | Tree | | | | | | | | | | | | | | | | 3 | 3 | 3 |
| *Ulmus rubra* | Slippery Elm | Tree | | | | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 11 | 11 | 11 |
| | | **Stem count** | 15 | 15 | 15 | 14 | 14 | 14 | 15 | 15 | 15 | 15 | 15 | 15 | 16 | 16 | 16 | 146 | 146 | 146 |
| | | **size (ares)** | | 1 | | | 1 | | | 1 | | | 1 | | | 1 | | | 10 | |
| | | **size (ACRES)** | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.02 | | | 0.25 | |
| | | **Species count** | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 12 | 12 | 12 |
| | | **Stems per ACRE** | 607 | 607 | 607 | 567 | 567 | 567 | 607 | 607 | 607 | 607 | 607 | 607 | 647 | 647 | 647 | 591 | 591 | 591 |

**Color for Density**

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

**PnoLS -** Planted Stems Excluding Live Stakes

**P-all -** All Planted Stems

**T -** All Woody Stems

Table 6b. Random Plots: Planted and Total Stem Counts
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

| | | | Current Plot Data (MY0 2021) | | | | | | Annual Means | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | VP 11 | | VP 12 | | VP 13 | | MY0 (2021) | |
| Scientific Name | Common Name | Species Type | Te | Total | Te | Total | Te | Total | Te | Total |
| *Acer negundo* | Boxelder | Tree | 1 | 1 | 1 | 1 | 0 | 0 | 2 | 2 |
| *Betula nigra* | River Birch | Tree | 3 | 3 | 5 | 5 | 4 | 4 | 12 | 12 |
| *Platanus occidentalis* | Sycamore | Tree | 6 | 6 | 2 | 2 | 0 | 0 | 8 | 8 |
| *Quercus michauxii* | Swamp Chestnut Oak | Tree | 2 | 2 | 1 | 1 | 3 | 3 | 6 | 6 |
| *Quercus nigra* | Water Oak | Tree | 0 | 0 | 2 | 2 | 0 | 0 | 2 | 2 |
| *Quercus phellos* | Willow Oak | Tree | 2 | 2 | 3 | 3 | 1 | 1 | 6 | 6 |
| *Quercus shumardii* | Shumard Oak | Tree | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Ulmus rubra* | Slippery Elm | Tree | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | | **Stem count** | 15 | 15 | 14 | 14 | 9 | 9 | 38 | 38 |
| | | **size (ares)** | 1 | | 1 | | 1 | | 2 | |
| | | **size (ACRES)** | 0.02 | | 0.02 | | 0.02 | | 0.07 | |
| | | **Species count** | 6 | 6 | 6 | 6 | 4 | 4 | 8 | 8 |
| | | **Stems per ACRE** | 607 | 607 | 567 | 567 | 364 | 364 | 513 | 513 |

**Color for Density**

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

**Te** - Number of stems including exotic species

**Total** - Number of stems excluding exotic species

# APPENDIX 4. Morphological Summary Data and Plots

**Table 7a. Baseline Stream Data Summary**

Sandy Branch Mitigation Site

DMS Project No. 100060

**Monitoring Year 0 - 2021**

| | PRE-EXISTING CONDITIONS | | | DESIGN | | MONITORING BASELINE (MY0) | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Sandy Branch R1** | | | | | | | |
| **Riffle Only** | **Min** | **Max** | **n** | **Min** | **Max** | **Min** | **Max** | **n** |
| Bankfull Width (ft) | 6.6 | | 1 | 14.0 | | 14.4 | | 1 |
| Floodprone Width (ft) | >60 | | 1 | >30.8 | | 100 | | 1 |
| Bankfull Mean Depth | 1 | | 1 | 0.9 | | 1 | | 1 |
| Bankfull Max Depth | 1.6 | | 1 | 1.3 | | 1.5 | | 1 |
| Bankfull Cross Sectional Area ($ft^2$) | 6.6 | | 1 | 13.2 | | 14.9 | | 1 |
| Width/Depth Ratio | 6.5 | | 1 | 14.8 | | 13.9 | | 1 |
| Entrenchment Ratio | >9.1 | | 1 | >2.20 | | 6.9 | | 1 |
| Bank Height Ratio | 1.0 | | 1 | 1.00 | 1.20 | 1.0 | | 1 |
| Max part size (mm) mobilized at bankfull | 87 | | | 88 | | 82.7 | | |
| Rosgen Classification | E4/F4 | | | C4 | | C4 | | |
| Bankfull Discharge (cfs) | 22 | | | 44.0 | | 51 | | |
| Sinuosity | 1.10 | | | 1.16 | | 1.16 | | |
| Water Surface Slope ($ft/ft)^2$ | 0.0100 | 0.0140 | --- | 0.002 | 0.011 | 0.007 | | |
| Other | --- | | | --- | | --- | | |
| **Parameter** | **Sandy Branch R2** | | | | | | | |
| **Riffle Only** | **Min** | **Max** | **n** | **Min** | **Max** | **Min** | **Max** | **n** |
| Bankfull Width (ft) | 7.3 | 11 | 3 | 16.0 | | 15.0 | 16.9 | 2 |
| Floodprone Width (ft) | 11.0 | 40 | 3 | >35.2 | | 70 | 80 | 2 |
| Bankfull Mean Depth | 1.2 | 1.6 | 3 | 1.1 | | 0.9 | 1.0 | 2 |
| Bankfull Max Depth | 1.7 | 2.1 | 3 | 1.5 | | 1.4 | 1.5 | 2 |
| Bankfull Cross Sectional Area ($ft^2$) | 9.1 | 14.0 | 3 | 17.5 | | 14.0 | 16.3 | 2 |
| Width/Depth Ratio | 4.7 | 8.4 | 3 | 14.6 | | 16.2 | 17.5 | 2 |
| Entrenchment Ratio | 1.5 | 3.7 | 3 | >2.20 | | 4.1 | 5.3 | 2 |
| Bank Height Ratio | 1.8 | 2.4 | 3 | 1.0 | 1.2 | 1.0 | 1.0 | 2 |
| Max part size (mm) mobilized at bankfull | --- | | | --- | | 68.3 | | |
| Rosgen Classification | F4 | | | C4 | | C4 | | |
| Bankfull Discharge (cfs) | 29 | 39 | --- | 51.0 | 58.0 | 53 | 57 | 2 |
| Sinuosity | 1.20 | | | 1.27 | | 1.27 | | |
| Water Surface Slope ($ft/ft)^2$ | 0.0041 | 0.0090 | --- | 0.004 | 0.024 | 0.006 | | |
| Other | --- | | | --- | | --- | | |

**Table 7b. Baseline Stream Data Summary**

Sandy Branch Mitigation Site

DMS Project No. 100060

**Monitoring Year 0 - 2021**

| | PRE-EXISTING CONDITIONS | | | DESIGN | | MONITORING BASELINE (MY0) | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **UT1** | | | | | | | |
| **Riffle Only** | **Min** | **Max** | **n** | **Min** | **Max** | **Min** | **Max** | **n** |
| Bankfull Width (ft) | 3.3 | | 1 | 7.0 | | 7.7 | | 1 |
| Floodprone Width (ft) | 12 | | 1 | >15.4 | | 55.0 | | 1 |
| Bankfull Mean Depth | 0.63 | | 1 | 0.6 | | 0.7 | | 1 |
| Bankfull Max Depth | 1.2 | | 1 | 0.8 | | 1.2 | | 1 |
| Bankfull Cross Sectional Area ($ft^2$) | 2.1 | | 1 | 4.0 | | 5.3 | | 1 |
| Width/Depth Ratio | 5.2 | | 1 | 12.3 | | 11.3 | | 1 |
| Entrenchment Ratio | 3.7 | | 1 | >2.20 | | 7.1 | | 1 |
| Bank Height Ratio | 2.9 | | 1 | 1.0 | 1.2 | 1.0 | | |
| Max part size (mm) mobilized at bankfull | --- | | | --- | | 62.6 | | |
| Rosgen Classification | E4/F4 | | | C4 | | C4 | | |
| Bankfull Discharge (cfs) | 7.7 | | | 9.0 | | 13 | | |
| Sinuosity | 1.10 | | | 1.14 | | 1.14 | | |
| Water Surface Slope ($ft/ft)^2$ | 0.0270 | | --- | 0.003 | 0.020 | 0.008 | | |
| Other | --- | | | --- | | --- | | |
| **Parameter** | **UT2** | | | | | | | |
| **Riffle Only** | **Min** | **Max** | **n** | **Min** | **Max** | **Min** | **Max** | **n** |
| Bankfull Width (ft) | 2.9 | | 1 | 9.0 | | 9.9 | | 1 |
| Floodprone Width (ft) | 6 | | 1 | >19.8 | | 80.0 | | 1 |
| Bankfull Mean Depth | 1.4 | | 1 | 0.7 | | 0.8 | | 1 |
| Bankfull Max Depth | 1.7 | | 1 | 1.0 | | 1.3 | | 1 |
| Bankfull Cross Sectional Area ($ft^2$) | 4.1 | | 1 | 6.5 | | 8.1 | | 1 |
| Width/Depth Ratio | 2.1 | | 1 | 12.5 | | 12.2 | | 1 |
| Entrenchment Ratio | 2.2 | | 1 | >2.20 | | 8.1 | | 1 |
| Bank Height Ratio | 2.5 | | 1 | 1.0 | 1.2 | 1.0 | | |
| Max part size (mm) mobilized at bankfull | --- | | | --- | | 77.4 | | |
| Rosgen Classification | F4 | | | C4 | | C4 | | |
| Bankfull Discharge (cfs) | 15 | | | 16.0 | | 27 | | |
| Sinuosity | 1.10 | | | 1.09 | | 1.09 | | |
| Water Surface Slope ($ft/ft)^2$ | 0.0084 | 0.0140 | --- | 0.004 | 0.025 | 0.008 | | |
| Other | --- | | | --- | | --- | | |

**Table 8. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Sandy Branch Mitigation Site

DMS Project No. 100060

**Monitoring Year 0 - 2021**

| | Sandy Branch Reach 1 | | | | | | | | | | | | Sandy Branch Reach 2 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cross-Section 1 (Pool) | | | | | | Cross-Section 2 (Riffle) | | | | | | Cross-Section 3 (Riffle) | | | | | | Cross-Section 4 (Pool) | | | | | |
| **Dimension** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** |
| Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area | N/A | | | | | | 473.58 | | | | | | 465.71 | | | | | | N/A | | | | | |
| Bank Height Ratio - Based on AB Bankfull[1] Area | N/A | | | | | | 1.00 | | | | | | 1.00 | | | | | | N/A | | | | | |
| Thalweg Elevation | 470.62 | | | | | | 472.04 | | | | | | 464.27 | | | | | | 461.58 | | | | | |
| LTOB[2] Elevation | 474.01 | | | | | | 473.58 | | | | | | 465.71 | | | | | | 465.78 | | | | | |
| LTOB[2] Max Depth (ft) | 3.4 | | | | | | 1.5 | | | | | | 1.4 | | | | | | 4.2 | | | | | |
| LTOB[2] Cross Sectional Area ($ft^2$) | 38.9 | | | | | | 14.9 | | | | | | 16.3 | | | | | | 56.7 | | | | | |

| | Sandy Branch Reach 2 | | | | | | | | | | | | UT1 | | | | | | UT2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cross-Section 5 (Riffle) | | | | | | Cross-Section 6 (Pool) | | | | | | Cross-Section 7 (Riffle) | | | | | | Cross-Section 8 (Riffle) | | | | | |
| **Dimension** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** | **Base** | **MY1** | **MY2** | **MY3** | **MY5** | **MY7** |
| Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area | 461.37 | | | | | | N/A | | | | | | 469.34 | | | | | | 459.29 | | | | | |
| Bank Height Ratio - Based on AB Bankfull[1] Area | 1.00 | | | | | | N/A | | | | | | 1.00 | | | | | | 1.00 | | | | | |
| Thalweg Elevation | 459.87 | | | | | | 458.14 | | | | | | 468.11 | | | | | | 457.99 | | | | | |
| LTOB[2] Elevation | 461.37 | | | | | | 461.17 | | | | | | 469.34 | | | | | | 459.29 | | | | | |
| LTOB[2] Max Depth (ft) | 1.5 | | | | | | 3.3 | | | | | | 1.2 | | | | | | 1.3 | | | | | |
| LTOB[2] Cross Sectional Area ($ft^2$) | 14.0 | | | | | | 38.6 | | | | | | 5.3 | | | | | | 8.1 | | | | | |

[1]Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation.

[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.

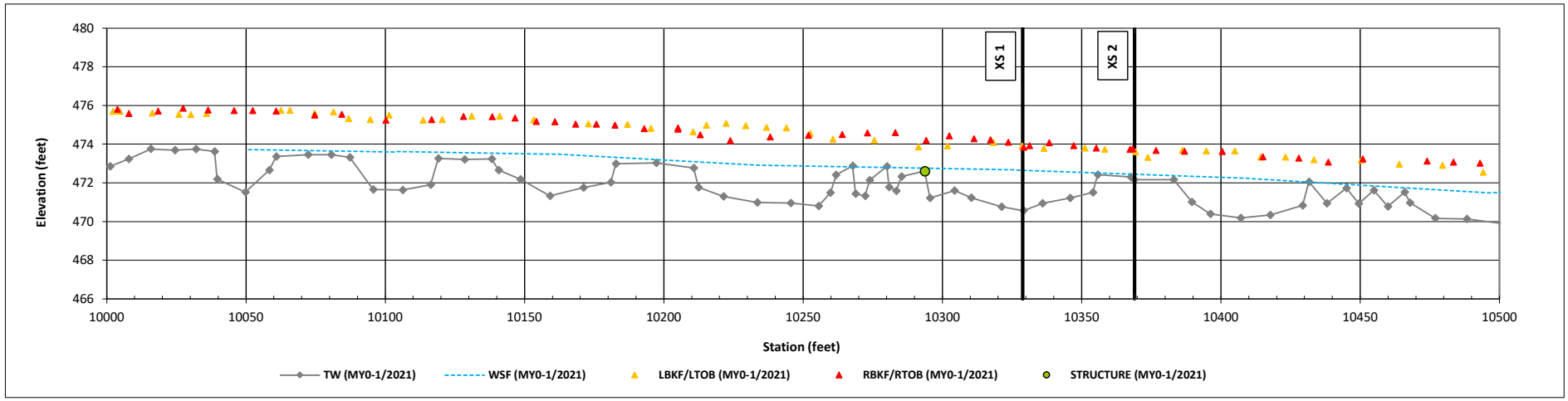
## Longitudinal Profile Plots

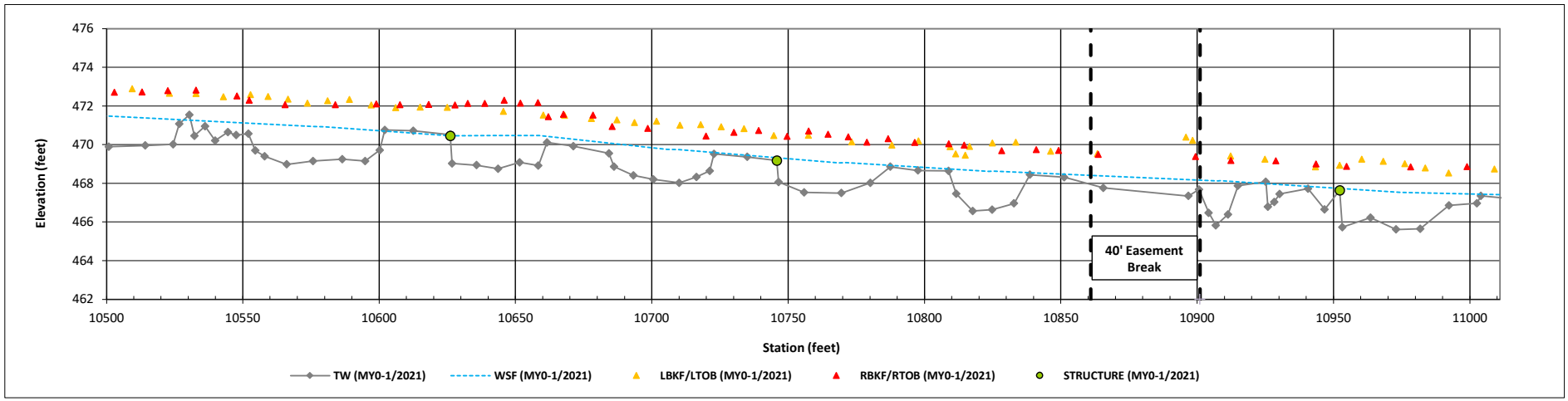
Sandy Branch Mitigation Site

DMS Project No. 100061

**Monitoring Year 0 - 2021**

**Sandy Branch Reach 1 (STA 100+00 to 110+11)**



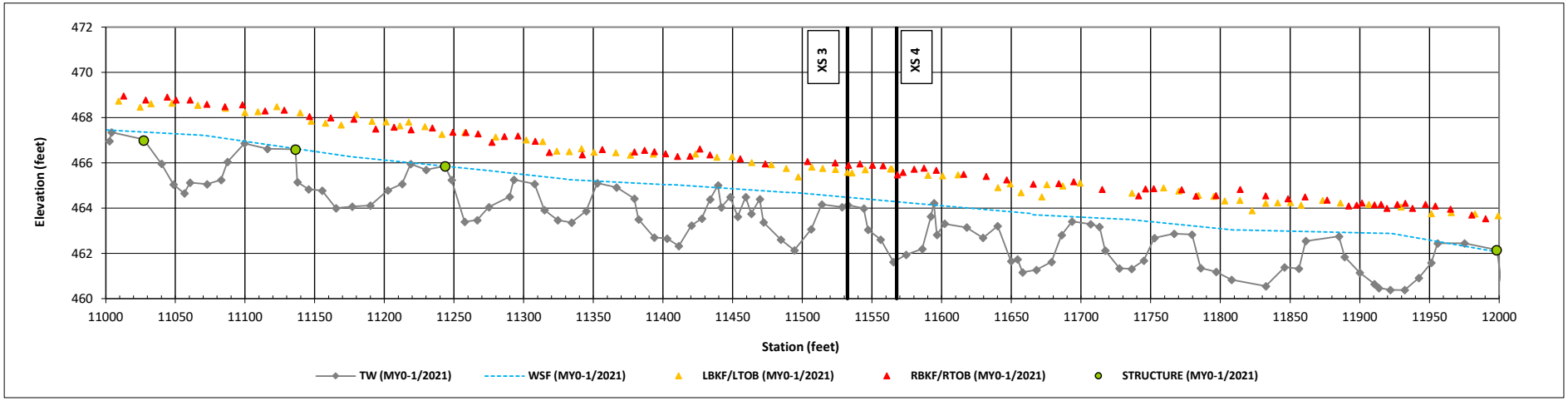
## Longitudinal Profile Plots

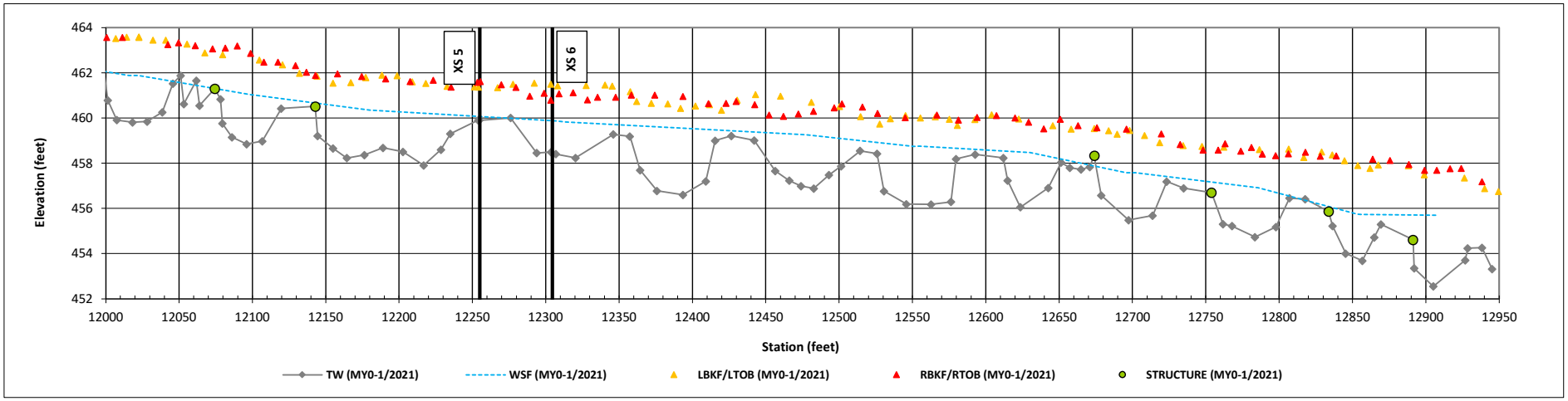
Sandy Branch Mitigation Site

DMS Project No. 100060

**Monitoring Year 0 - 2021**

**Sandy Branch Reach 2 (STA 110+11 to 129+40)**

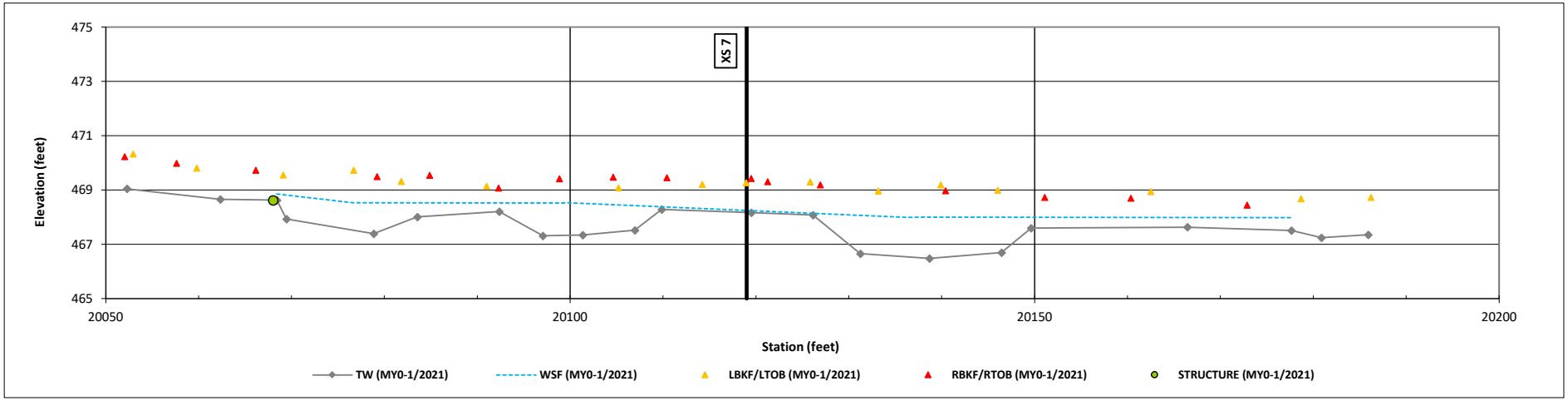


## Longitudinal Profile Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**UT1 (STA 200+61 to 201+92)**



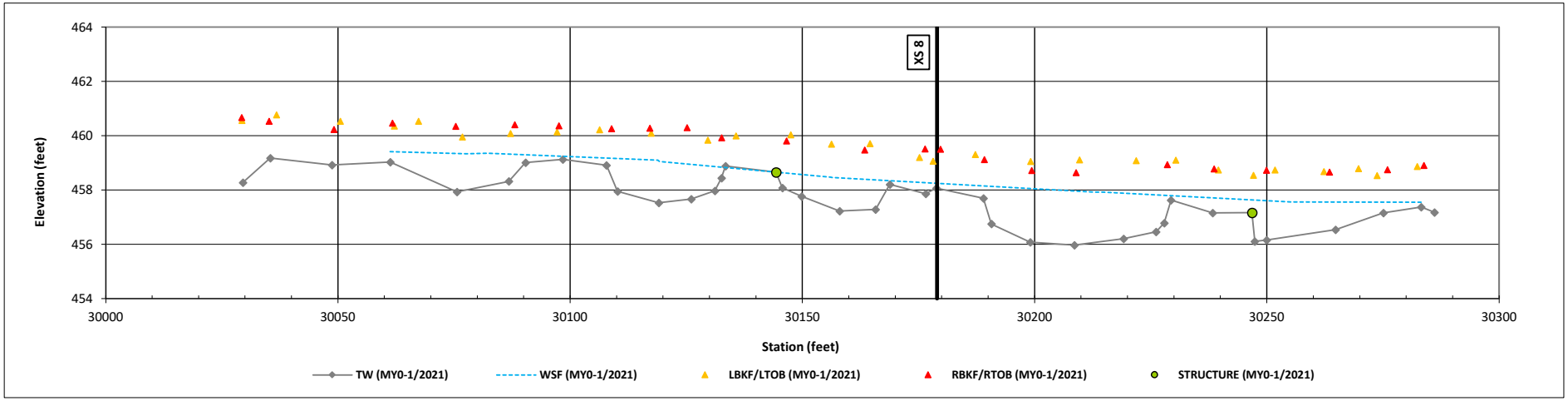
## Longitudinal Profile Plots

Sandy Branch Mitigation Site

DMS Project No. 100061

**Monitoring Year 0 - 2021**

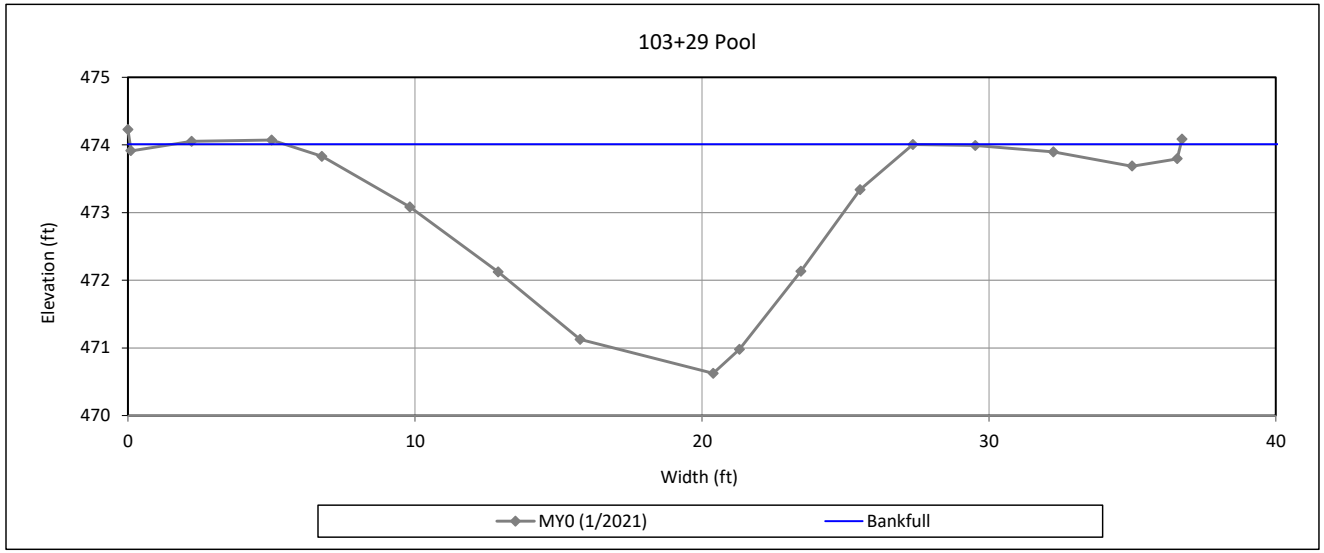
**UT2 (STA 300+38 to 302+93)**



## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 1 - Sandy Branch R1**




| Bankfull Dimensions | |
|---|---|
| 38.9 | x-section area (ft.sq.) |
| 21.9 | width (ft) |
| 1.8 | mean depth (ft) |
| 3.4 | max depth (ft) |
| 23.2 | wetted perimeter (ft) |
| 1.7 | hydraulic radius (ft) |
| 12.3 | width-depth ratio |

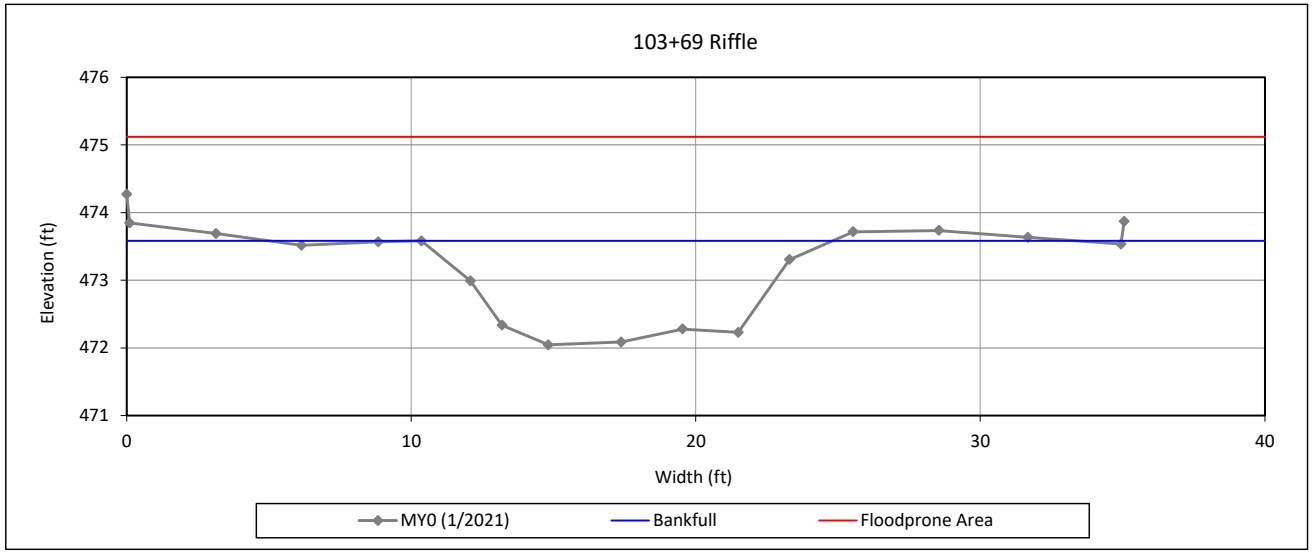
Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 2 - Sandy Branch R1**




Bankfull Dimensions

| | |
|---|---|
| 14.9 | x-section area (ft.sq.) |
| 14.4 | width (ft) |
| 1.0 | mean depth (ft) |
| 1.5 | max depth (ft) |
| 15.1 | wetted perimeter (ft) |
| 1.0 | hydraulic radius (ft) |
| 13.9 | width-depth ratio |
| 100.0 | W flood prone area (ft) |
| 6.9 | entrenchment ratio |
| 1.0 | low bank height ratio |

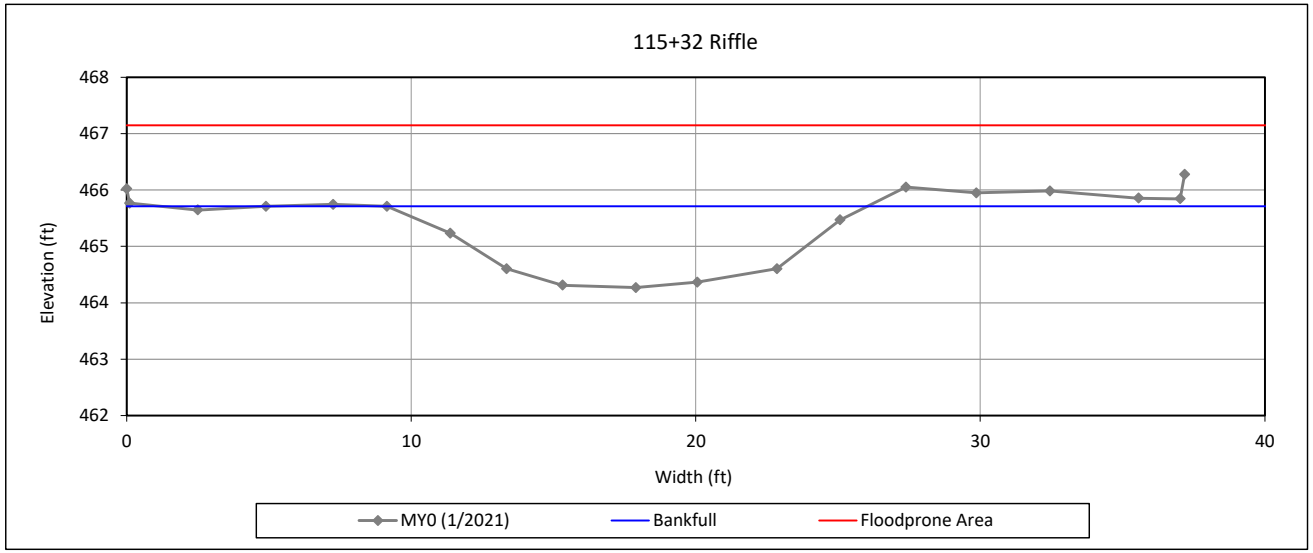
Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 3 - Sandy Branch R2**




Bankfull Dimensions

| | |
|---|---|
| 16.3 | x-section area (ft.sq.) |
| 16.9 | width (ft) |
| 1.0 | mean depth (ft) |
| 1.4 | max depth (ft) |
| 17.3 | wetted perimeter (ft) |
| 0.9 | hydraulic radius (ft) |
| 17.5 | width-depth ratio |
| 70.0 | W flood prone area (ft) |
| 4.1 | entrenchment ratio |
| 1.0 | low bank height ratio |

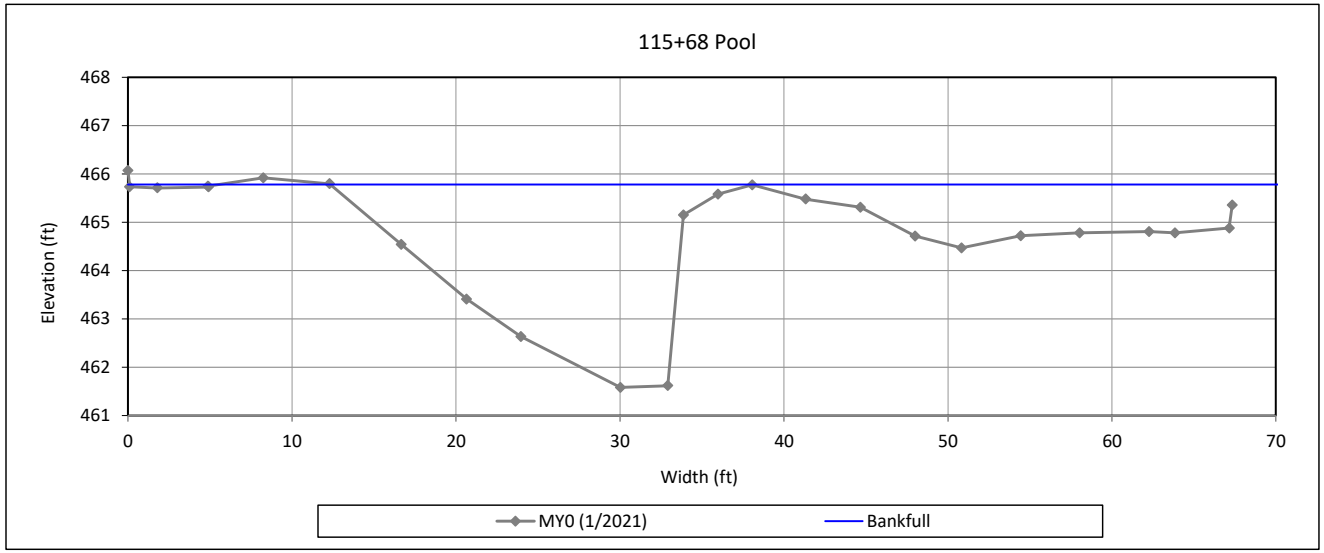
Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 4 - Sandy Branch R2**




| Bankfull Dimensions | |
|---|---|
| 56.7 | x-section area (ft.sq.) |
| 25.7 | width (ft) |
| 2.2 | mean depth (ft) |
| 4.2 | max depth (ft) |
| 29.0 | wetted perimeter (ft) |
| 2.0 | hydraulic radius (ft) |
| 11.7 | width-depth ratio |

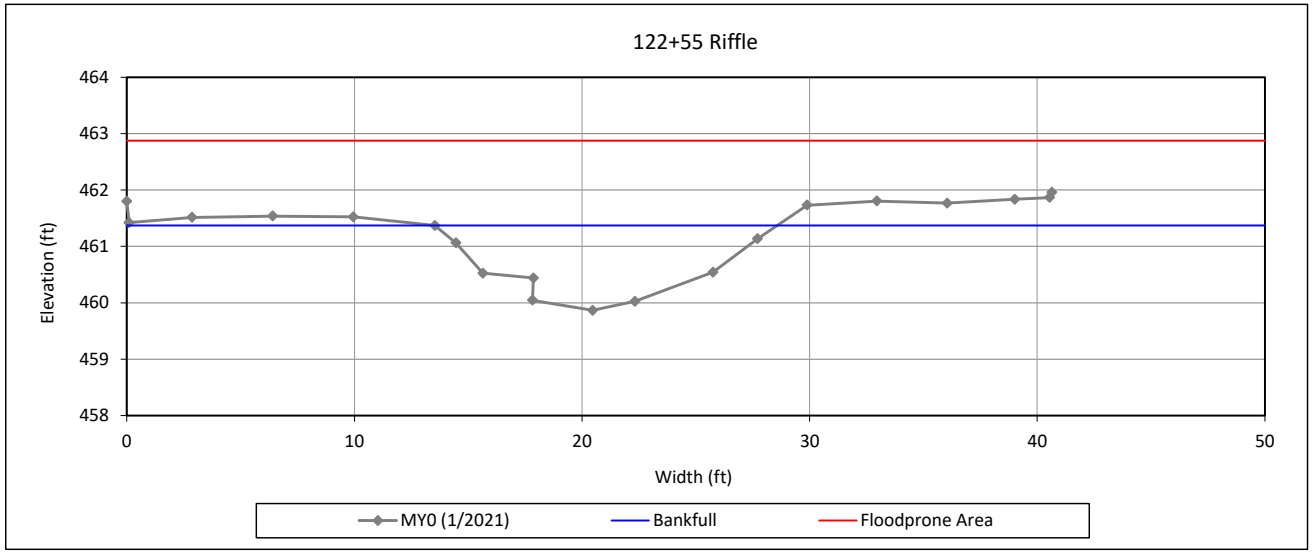
Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 5 - Sandy Branch R2**




Bankfull Dimensions

| | |
|---|---|
| 14.0 | x-section area (ft.sq.) |
| 15.0 | width (ft) |
| 0.9 | mean depth (ft) |
| 1.5 | max depth (ft) |
| 15.8 | wetted perimeter (ft) |
| 0.9 | hydraulic radius (ft) |
| 16.2 | width-depth ratio |
| 80.0 | W flood prone area (ft) |
| 5.3 | entrenchment ratio |
| 1.0 | low bank height ratio |

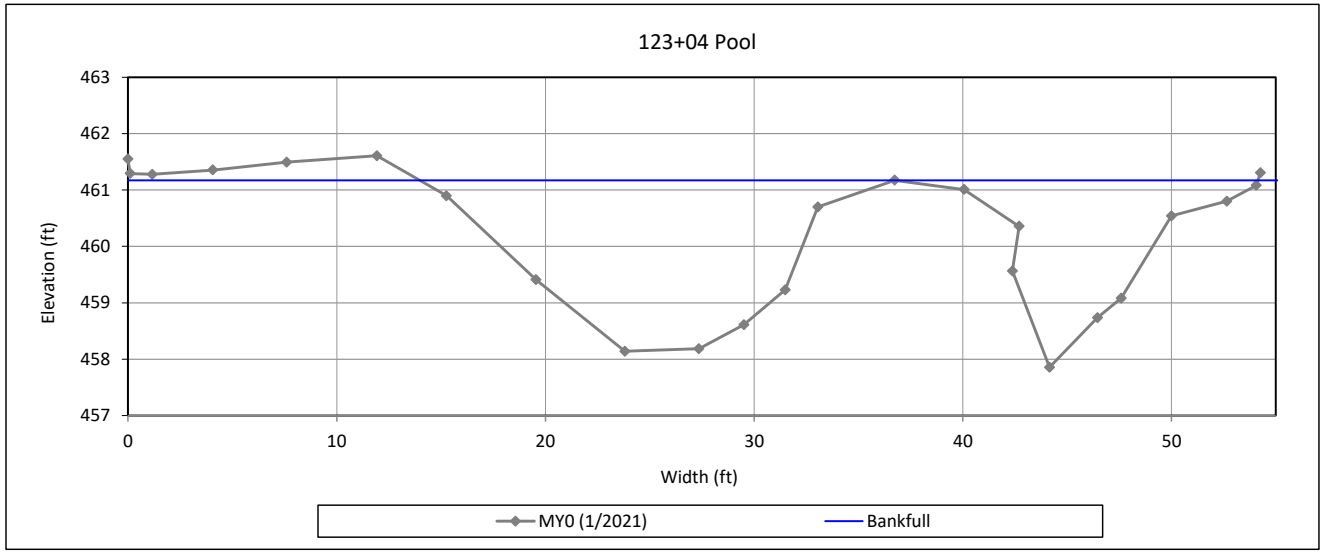
Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 6 - SandyBranch R2**




| Bankfull Dimensions | |
|---|---|
| 38.6 | x-section area (ft.sq.) |
| 22.7 | width (ft) |
| 1.7 | mean depth (ft) |
| 3.3 | max depth (ft) |
| 23.9 | wetted perimeter (ft) |
| 1.6 | hydraulic radius (ft) |
| 13.4 | width-depth ratio |

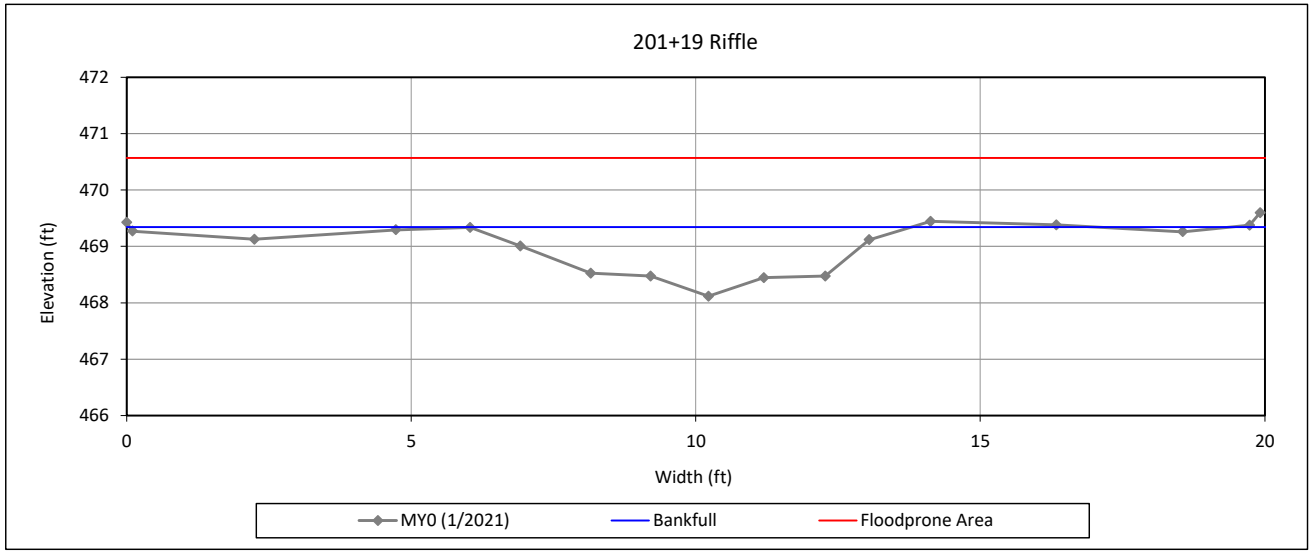
View Downstream

Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 7 - UT1**




Bankfull Dimensions

| | |
|---|---|
| 5.3 | x-section area (ft.sq.) |
| 7.7 | width (ft) |
| 0.7 | mean depth (ft) |
| 1.2 | max depth (ft) |
| 8.3 | wetted perimeter (ft) |
| 0.6 | hydraulic radius (ft) |
| 11.3 | width-depth ratio |
| 55.0 | W flood prone area (ft) |
| 7.1 | entrenchment ratio |
| 1.0 | low bank height ratio |

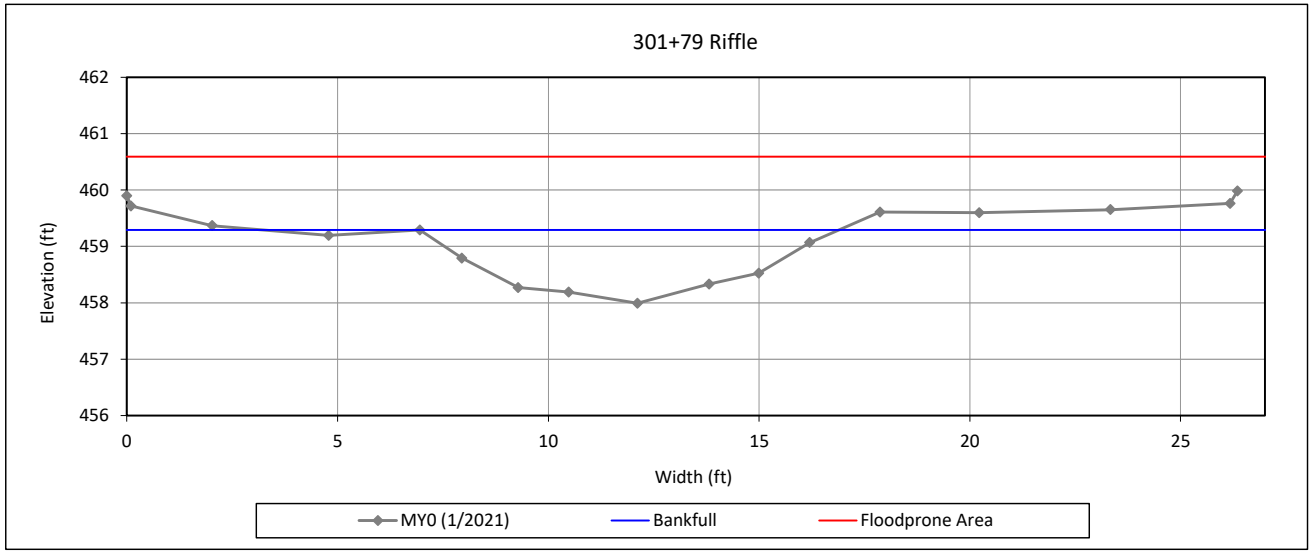
Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

## Cross-Section Plots

Sandy Branch Mitigation Site
DMS Project No. 100061
**Monitoring Year 0 - 2021**

**Cross-Section 8 - UT2**




Bankfull Dimensions

| | |
|---|---|
| 8.1 | x-section area (ft.sq.) |
| 9.9 | width (ft) |
| 0.8 | mean depth (ft) |
| 1.3 | max depth (ft) |
| 10.4 | wetted perimeter (ft) |
| 0.8 | hydraulic radius (ft) |
| 12.2 | width-depth ratio |
| 80.0 | W flood prone area (ft) |
| 8.1 | entrenchment ratio |
| 1.0 | low bank height ratio |

Survey Date: 1/2021
Field Crew: Summit Design & Engineering Services

View Downstream

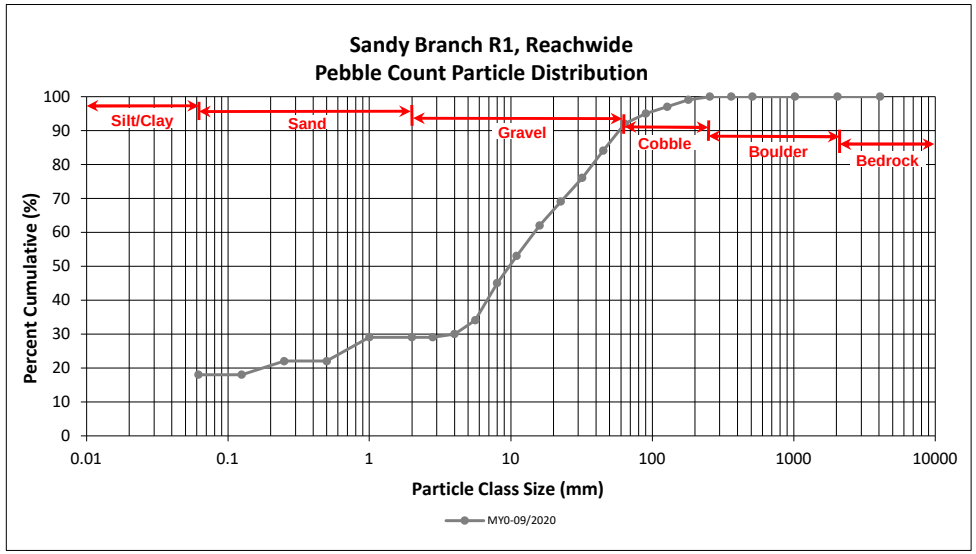
## Reachwide and Cross-Section Pebble Count Plots

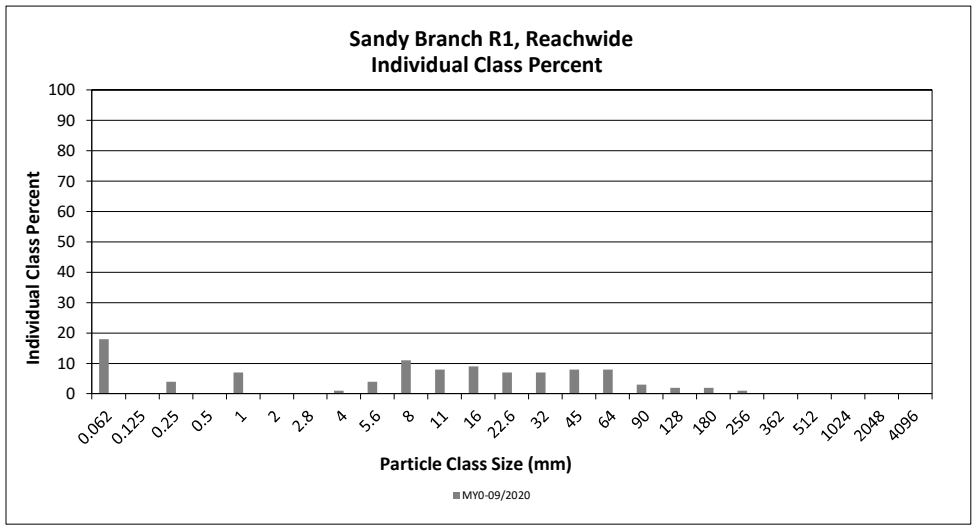
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

Sandy Branch R1, Reachwide

| Particle Class | | Diameter (mm) | | Particle Count | | | Reach Summary | |
|---|---|---|---|---|---|---|---|---|
| | | min | max | Riffle | Pool | Total | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 1 | 17 | 18 | 18 | 18 |
| *SAND* | Very fine | 0.062 | 0.125 | | | | | 18 |
| | Fine | 0.125 | 0.250 | | 4 | 4 | 4 | 22 |
| | Medium | 0.25 | 0.50 | | | | | 22 |
| | Coarse | 0.5 | 1.0 | 1 | 6 | 7 | 7 | 29 |
| | Very Coarse | 1.0 | 2.0 | | | | | 29 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | | | 29 |
| | Very Fine | 2.8 | 4.0 | | 1 | 1 | 1 | 30 |
| | Fine | 4.0 | 5.6 | | 4 | 4 | 4 | 34 |
| | Fine | 5.6 | 8.0 | 5 | 6 | 11 | 11 | 45 |
| | Medium | 8.0 | 11.0 | 5 | 3 | 8 | 8 | 53 |
| | Medium | 11.0 | 16.0 | 5 | 4 | 9 | 9 | 62 |
| | Coarse | 16.0 | 22.6 | 5 | 2 | 7 | 7 | 69 |
| | Coarse | 22.6 | 32 | 5 | 2 | 7 | 7 | 76 |
| | Very Coarse | 32 | 45 | 8 | | 8 | 8 | 84 |
| | Very Coarse | 45 | 64 | 7 | 1 | 8 | 8 | 92 |
| *COBBLE* | Small | 64 | 90 | 3 | | 3 | 3 | 95 |
| | Small | 90 | 128 | 2 | | 2 | 2 | 97 |
| | Large | 128 | 180 | 2 | | 2 | 2 | 99 |
| | Large | 180 | 256 | 1 | | 1 | 1 | 100 |
| *BOULDER* | Small | 256 | 362 | | | | | 100 |
| | Small | 362 | 512 | | | | | 100 |
| | Medium | 512 | 1024 | | | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | | | 100 |
| | | | **Total** | **50** | **50** | **100** | **100** | **100** |

| Reachwide | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | Silt/Clay |
| $D_{35}$ = | 5.78 |
| $D_{50}$ = | 9.8 |
| $D_{84}$ = | 45.0 |
| $D_{95}$ = | 90.0 |
| $D_{100}$ = | 256.0 |



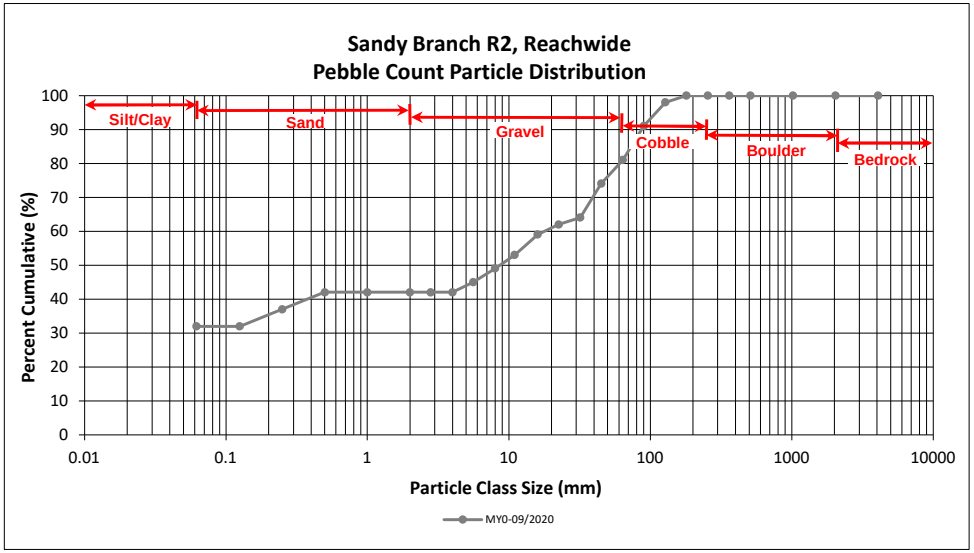
## Reachwide and Cross-Section Pebble Count Plots

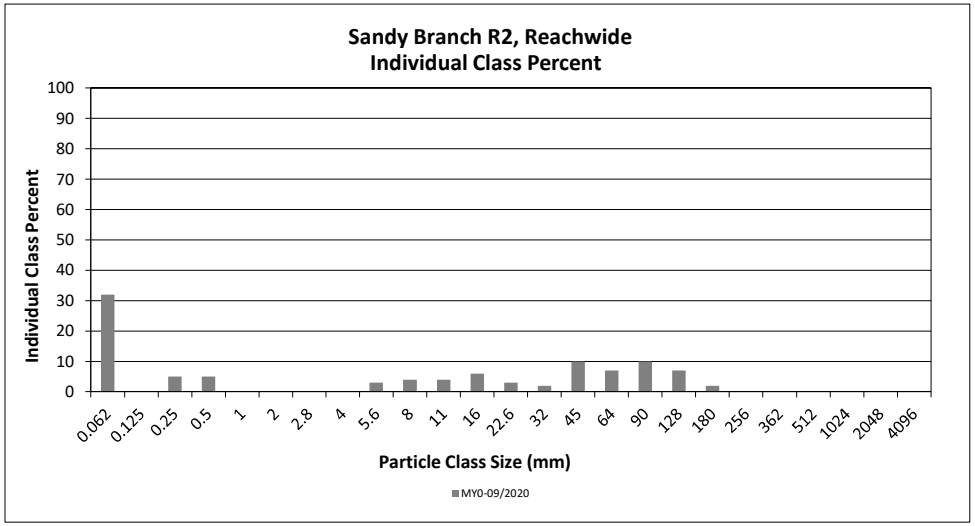
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

Sandy Branch R2, Reachwide

| Particle Class | | Diameter (mm) | | Particle Count | | | Reach Summary | |
|---|---|---|---|---|---|---|---|---|
| | | min | max | Riffle | Pool | Total | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 5 | 27 | 32 | 32 | 32 |
| *SAND* | Very fine | 0.062 | 0.125 | | | | | 32 |
| | Fine | 0.125 | 0.250 | | 5 | 5 | 5 | 37 |
| | Medium | 0.25 | 0.50 | 1 | 4 | 5 | 5 | 42 |
| | Coarse | 0.5 | 1.0 | | | | | 42 |
| | Very Coarse | 1.0 | 2.0 | | | | | 42 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | | | 42 |
| | Very Fine | 2.8 | 4.0 | | | | | 42 |
| | Fine | 4.0 | 5.6 | 1 | 2 | 3 | 3 | 45 |
| | Fine | 5.6 | 8.0 | 1 | 3 | 4 | 4 | 49 |
| | Medium | 8.0 | 11.0 | 3 | 1 | 4 | 4 | 53 |
| | Medium | 11.0 | 16.0 | 3 | 3 | 6 | 6 | 59 |
| | Coarse | 16.0 | 22.6 | 2 | 1 | 3 | 3 | 62 |
| | Coarse | 22.6 | 32 | 1 | 1 | 2 | 2 | 64 |
| | Very Coarse | 32 | 45 | 10 | | 10 | 10 | 74 |
| | Very Coarse | 45 | 64 | 6 | 1 | 7 | 7 | 81 |
| *COBBLE* | Small | 64 | 90 | 8 | 2 | 10 | 10 | 91 |
| | Small | 90 | 128 | 7 | | 7 | 7 | 98 |
| | Large | 128 | 180 | 2 | | 2 | 2 | 100 |
| | Large | 180 | 256 | | | | | 100 |
| *BOULDER* | Small | 256 | 362 | | | | | 100 |
| | Small | 362 | 512 | | | | | 100 |
| | Medium | 512 | 1024 | | | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | | | 100 |
| | | | **Total** | **50** | **50** | **100** | **100** | **100** |

| Reachwide | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | Silt/Clay |
| $D_{35}$ = | 0.19 |
| $D_{50}$ = | 8.7 |
| $D_{84}$ = | 70.9 |
| $D_{95}$ = | 110.1 |
| $D_{100}$ = | 180.0 |



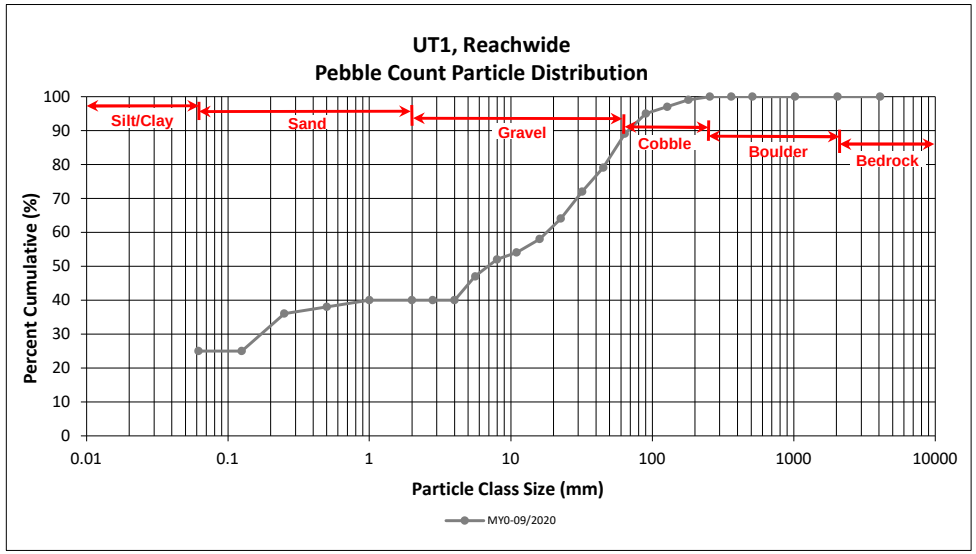
## Reachwide and Cross-Section Pebble Count Plots

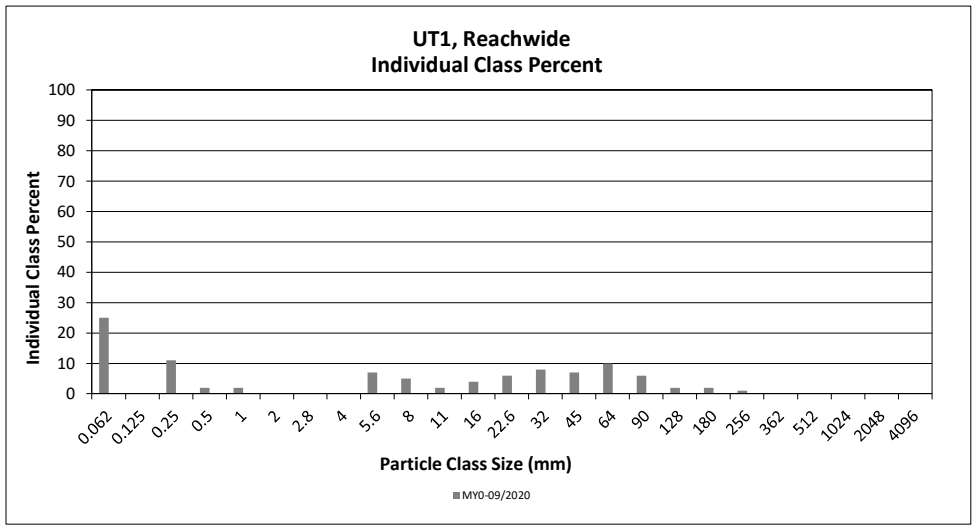
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

UT1, Reachwide

| Particle Class | | Diameter (mm) | | Particle Count | | | Reach Summary | |
|---|---|---|---|---|---|---|---|---|
| | | min | max | Riffle | Pool | Total | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 2 | 23 | 25 | 25 | 25 |
| *SAND* | Very fine | 0.062 | 0.125 | | | | | 25 |
| | Fine | 0.125 | 0.250 | 2 | 9 | 11 | 11 | 36 |
| | Medium | 0.25 | 0.50 | 1 | 1 | 2 | 2 | 38 |
| | Coarse | 0.5 | 1.0 | 1 | 1 | 2 | 2 | 40 |
| | Very Coarse | 1.0 | 2.0 | | | | | 40 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | | | 40 |
| | Very Fine | 2.8 | 4.0 | | | | | 40 |
| | Fine | 4.0 | 5.6 | 3 | 4 | 7 | 7 | 47 |
| | Fine | 5.6 | 8.0 | 2 | 3 | 5 | 5 | 52 |
| | Medium | 8.0 | 11.0 | 2 | | 2 | 2 | 54 |
| | Medium | 11.0 | 16.0 | 3 | 1 | 4 | 4 | 58 |
| | Coarse | 16.0 | 22.6 | 2 | 4 | 6 | 6 | 64 |
| | Coarse | 22.6 | 32 | 7 | 1 | 8 | 8 | 72 |
| | Very Coarse | 32 | 45 | 7 | | 7 | 7 | 79 |
| | Very Coarse | 45 | 64 | 8 | 2 | 10 | 10 | 89 |
| *COBBLE* | Small | 64 | 90 | 6 | | 6 | 6 | 95 |
| | Small | 90 | 128 | 1 | 1 | 2 | 2 | 97 |
| | Large | 128 | 180 | 2 | | 2 | 2 | 99 |
| | Large | 180 | 256 | 1 | | 1 | 1 | 100 |
| *BOULDER* | Small | 256 | 362 | | | | | 100 |
| | Small | 362 | 512 | | | | | 100 |
| | Medium | 512 | 1024 | | | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | | | 100 |
| | | | **Total** | **50** | **50** | **100** | **100** | **100** |

| Reachwide | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | Silt/Clay |
| $D_{35}$ = | 0.23 |
| $D_{50}$ = | 6.9 |
| $D_{84}$ = | 53.7 |
| $D_{95}$ = | 90.0 |
| $D_{100}$ = | 256.0 |



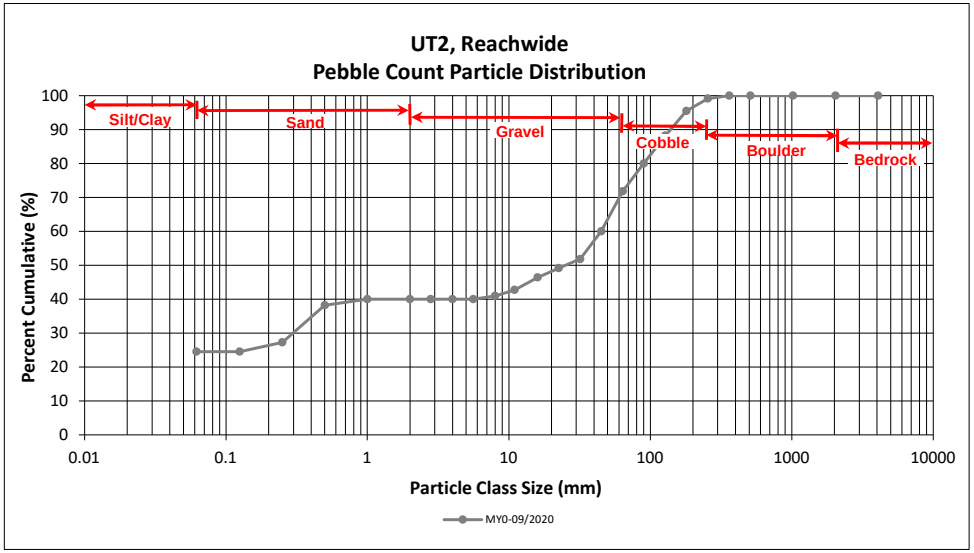
## Reachwide and Cross-Section Pebble Count Plots

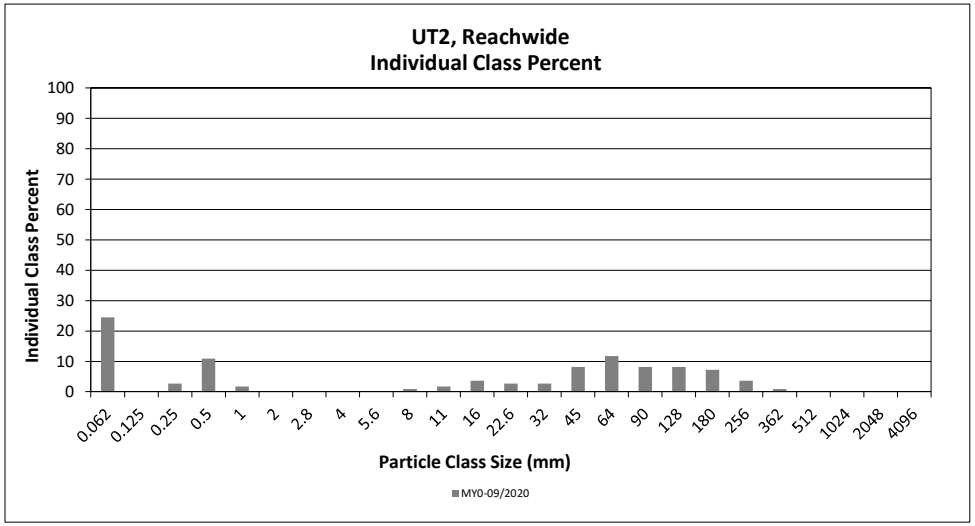
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

UT2, Reachwide

| Particle Class | | Diameter (mm) | | Particle Count | | | Reach Summary | |
|---|---|---|---|---|---|---|---|---|
| | | min | max | Riffle | Pool | Total | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 3 | 24 | 27 | 25 | 25 |
| *SAND* | Very fine | 0.062 | 0.125 | | | | | 25 |
| | Fine | 0.125 | 0.250 | | 3 | 3 | 3 | 27 |
| | Medium | 0.25 | 0.50 | 1 | 11 | 12 | 11 | 38 |
| | Coarse | 0.5 | 1.0 | | 2 | 2 | 2 | 40 |
| | Very Coarse | 1.0 | 2.0 | | | | | 40 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | | | 40 |
| | Very Fine | 2.8 | 4.0 | | | | | 40 |
| | Fine | 4.0 | 5.6 | | | | | 40 |
| | Fine | 5.6 | 8.0 | | 1 | 1 | 1 | 41 |
| | Medium | 8.0 | 11.0 | 1 | 1 | 2 | 2 | 43 |
| | Medium | 11.0 | 16.0 | 1 | 3 | 4 | 4 | 46 |
| | Coarse | 16.0 | 22.6 | 3 | | 3 | 3 | 49 |
| | Coarse | 22.6 | 32 | 2 | 1 | 3 | 3 | 52 |
| | Very Coarse | 32 | 45 | 6 | 3 | 9 | 8 | 60 |
| | Very Coarse | 45 | 64 | 12 | 1 | 13 | 12 | 72 |
| *COBBLE* | Small | 64 | 90 | 9 | | 9 | 8 | 80 |
| | Small | 90 | 128 | 9 | | 9 | 8 | 88 |
| | Large | 128 | 180 | 8 | | 8 | 7 | 95 |
| | Large | 180 | 256 | 4 | | 4 | 4 | 99 |
| *BOULDER* | Small | 256 | 362 | 1 | | 1 | 1 | 100 |
| | Small | 362 | 512 | | | | | 100 |
| | Medium | 512 | 1024 | | | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | | | 100 |
| | | | **Total** | **60** | **50** | **110** | **100** | **100** |

| Reachwide | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | Silt/Clay |
| $D_{35}$ = | 0.41 |
| $D_{50}$ = | 25.4 |
| $D_{84}$ = | 106.9 |
| $D_{95}$ = | 176.2 |
| $D_{100}$ = | 362.0 |



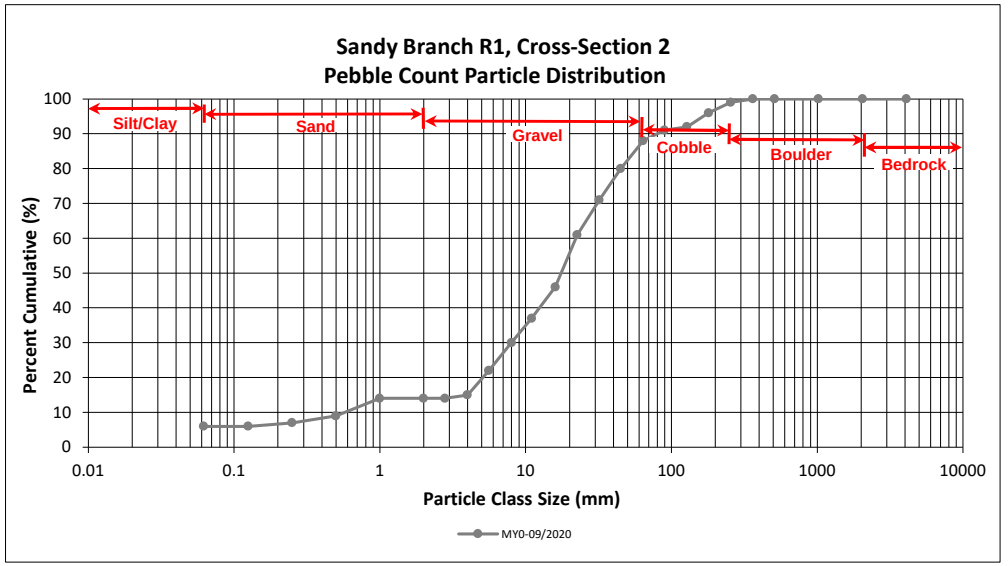
## Reachwide and Cross-Section Pebble Count Plots

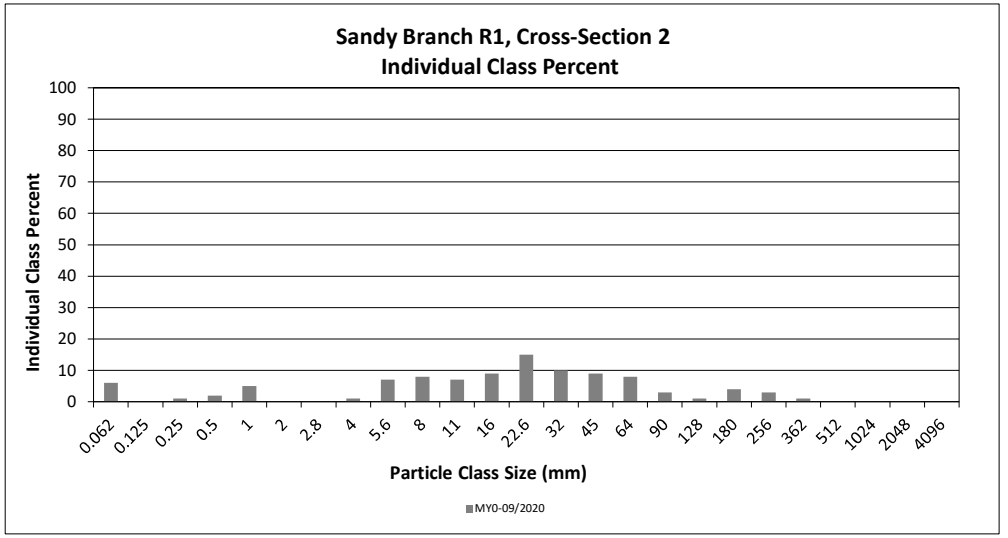
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

Sandy Branch R1, Cross-Section 2

| Particle Class | | Diameter (mm) | | Riffle 100-Count | Summary | |
|---|---|---|---|---|---|---|
| | | min | max | | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 6 | 6 | 6 |
| *SAND* | Very fine | 0.062 | 0.125 | | | 6 |
| | Fine | 0.125 | 0.250 | 1 | 1 | 7 |
| | Medium | 0.25 | 0.50 | 2 | 2 | 9 |
| | Coarse | 0.5 | 1.0 | 5 | 5 | 14 |
| | Very Coarse | 1.0 | 2.0 | | | 14 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | 14 |
| | Very Fine | 2.8 | 4.0 | 1 | 1 | 15 |
| | Fine | 4.0 | 5.6 | 7 | 7 | 22 |
| | Fine | 5.6 | 8.0 | 8 | 8 | 30 |
| | Medium | 8.0 | 11.0 | 7 | 7 | 37 |
| | Medium | 11.0 | 16.0 | 9 | 9 | 46 |
| | Coarse | 16.0 | 22.6 | 15 | 15 | 61 |
| | Coarse | 22.6 | 32 | 10 | 10 | 71 |
| | Very Coarse | 32 | 45 | 9 | 9 | 80 |
| | Very Coarse | 45 | 64 | 8 | 8 | 88 |
| *COBBLE* | Small | 64 | 90 | 3 | 3 | 91 |
| | Small | 90 | 128 | 1 | 1 | 92 |
| | Large | 128 | 180 | 4 | 4 | 96 |
| | Large | 180 | 256 | 3 | 3 | 99 |
| *BOULDER* | Small | 256 | 362 | 1 | 1 | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **100** | **100** | **100** |

| Cross-Section 2 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 4.20 |
| $D_{35}$ = | 10.04 |
| $D_{50}$ = | 17.5 |
| $D_{84}$ = | 53.7 |
| $D_{95}$ = | 165.3 |
| $D_{100}$ = | 362.0 |



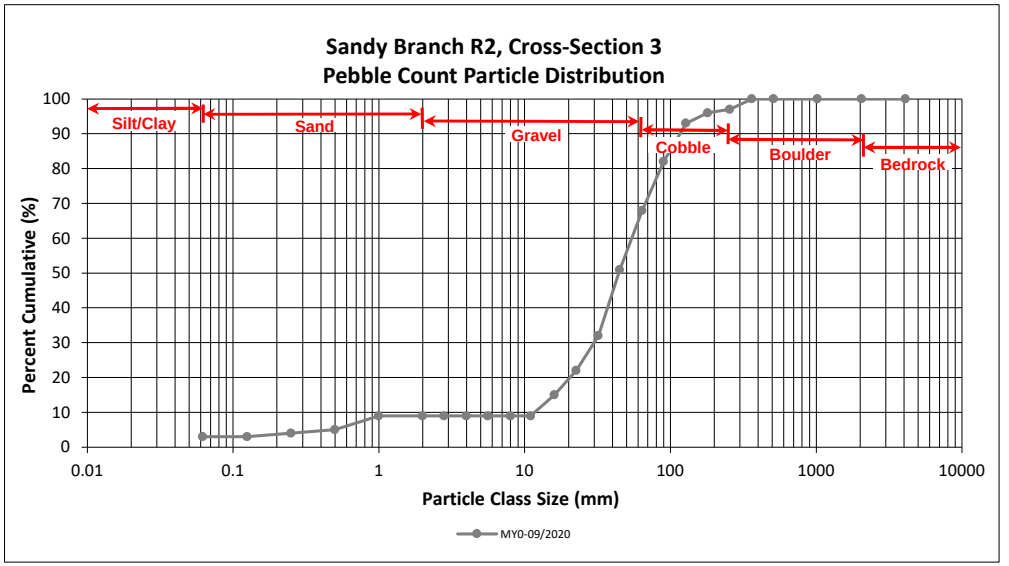
## Reachwide and Cross-Section Pebble Count Plots

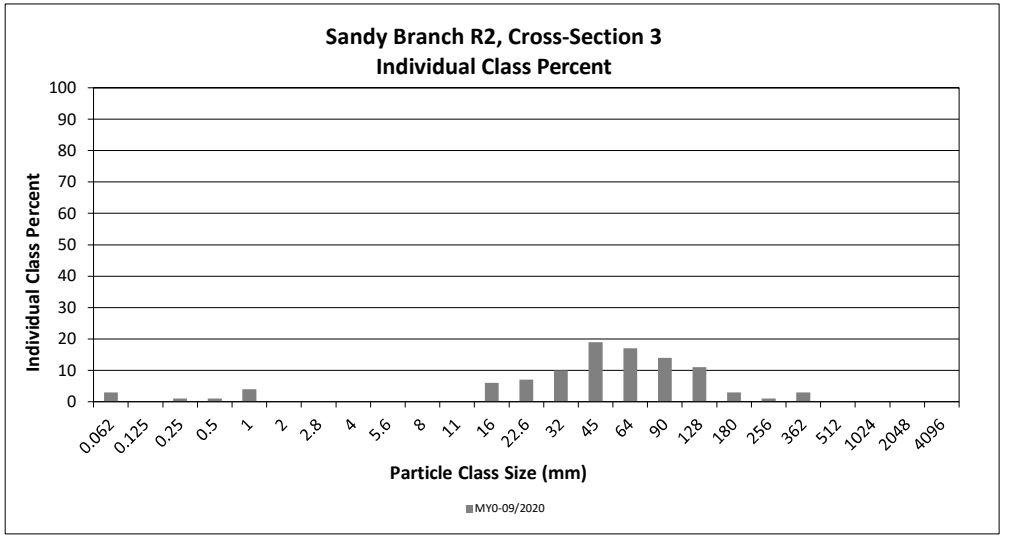
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

Sandy Branch R2, Cross-Section 3

| Particle Class | | Diameter (mm) | | Riffle 100-Count | Summary | |
|---|---|---|---|---|---|---|
| | | min | max | | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 3 | 3 | 3 |
| *SAND* | Very fine | 0.062 | 0.125 | | | 3 |
| | Fine | 0.125 | 0.250 | 1 | 1 | 4 |
| | Medium | 0.25 | 0.50 | 1 | 1 | 5 |
| | Coarse | 0.5 | 1.0 | 4 | 4 | 9 |
| | Very Coarse | 1.0 | 2.0 | | | 9 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | 9 |
| | Very Fine | 2.8 | 4.0 | | | 9 |
| | Fine | 4.0 | 5.6 | | | 9 |
| | Fine | 5.6 | 8.0 | | | 9 |
| | Medium | 8.0 | 11.0 | | | 9 |
| | Medium | 11.0 | 16.0 | 6 | 6 | 15 |
| | Coarse | 16.0 | 22.6 | 7 | 7 | 22 |
| | Coarse | 22.6 | 32 | 10 | 10 | 32 |
| | Very Coarse | 32 | 45 | 19 | 19 | 51 |
| | Very Coarse | 45 | 64 | 17 | 17 | 68 |
| *COBBLE* | Small | 64 | 90 | 14 | 14 | 82 |
| | Small | 90 | 128 | 11 | 11 | 93 |
| | Large | 128 | 180 | 3 | 3 | 96 |
| | Large | 180 | 256 | 1 | 1 | 97 |
| *BOULDER* | Small | 256 | 362 | 3 | 3 | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **100** | **100** | **100** |

| Cross-Section 3 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 16.81 |
| $D_{35}$ = | 33.77 |
| $D_{50}$ = | 44.2 |
| $D_{84}$ = | 96.0 |
| $D_{95}$ = | 160.7 |
| $D_{100}$ = | 362.0 |



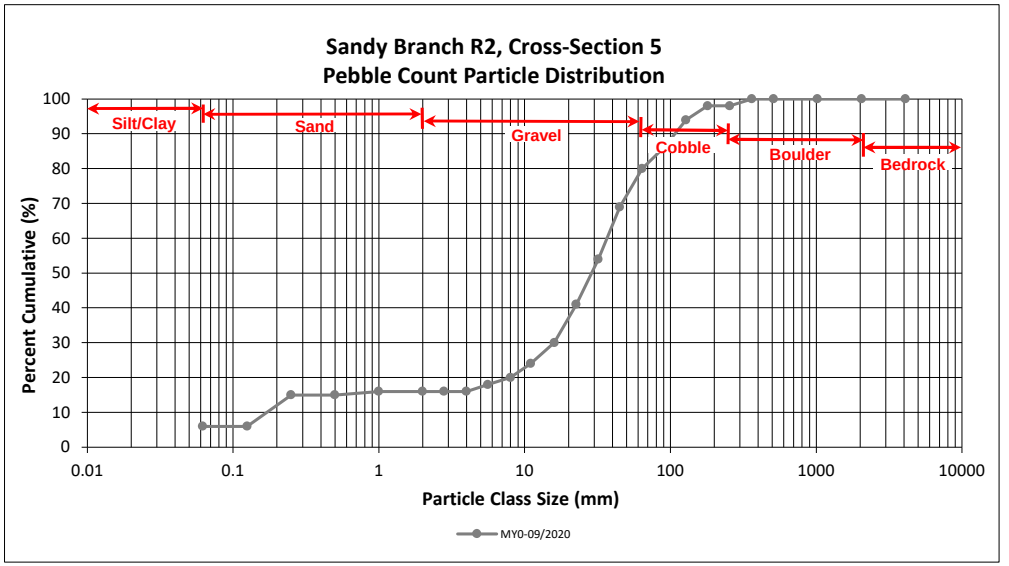
## Reachwide and Cross-Section Pebble Count Plots

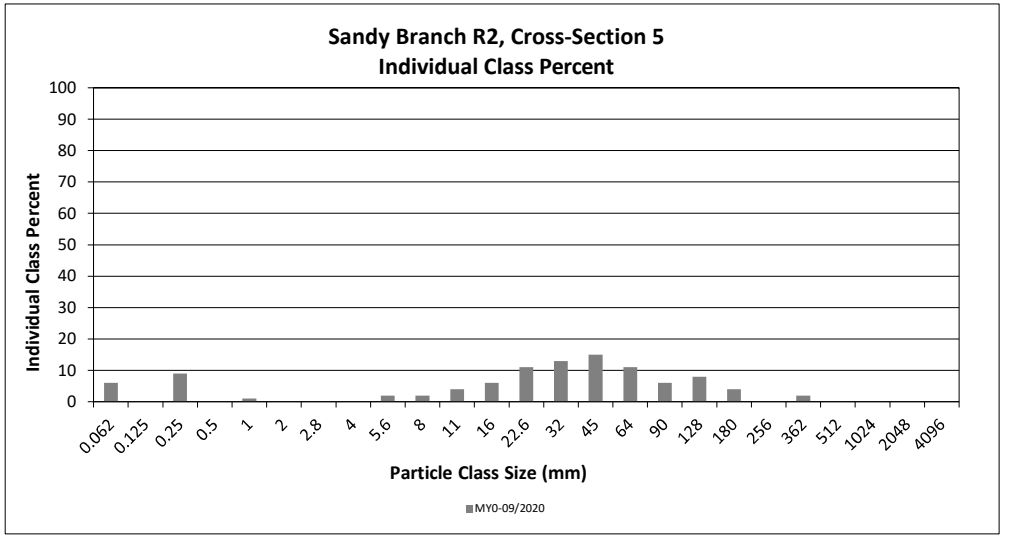
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

Sandy Branch R2, Cross-Section 5

| Particle Class | | Diameter (mm) | | Riffle 100-Count | Summary | |
|---|---|---|---|---|---|---|
| | | min | max | | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 6 | 6 | 6 |
| *SAND* | Very fine | 0.062 | 0.125 | | | 6 |
| | Fine | 0.125 | 0.250 | 9 | 9 | 15 |
| | Medium | 0.25 | 0.50 | | | 15 |
| | Coarse | 0.5 | 1.0 | 1 | 1 | 16 |
| | Very Coarse | 1.0 | 2.0 | | | 16 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | 16 |
| | Very Fine | 2.8 | 4.0 | | | 16 |
| | Fine | 4.0 | 5.6 | 2 | 2 | 18 |
| | Fine | 5.6 | 8.0 | 2 | 2 | 20 |
| | Medium | 8.0 | 11.0 | 4 | 4 | 24 |
| | Medium | 11.0 | 16.0 | 6 | 6 | 30 |
| | Coarse | 16.0 | 22.6 | 11 | 11 | 41 |
| | Coarse | 22.6 | 32 | 13 | 13 | 54 |
| | Very Coarse | 32 | 45 | 15 | 15 | 69 |
| | Very Coarse | 45 | 64 | 11 | 11 | 80 |
| *COBBLE* | Small | 64 | 90 | 6 | 6 | 86 |
| | Small | 90 | 128 | 8 | 8 | 94 |
| | Large | 128 | 180 | 4 | 4 | 98 |
| | Large | 180 | 256 | | | 98 |
| *BOULDER* | Small | 256 | 362 | 2 | 2 | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **100** | **100** | **100** |

| Cross-Section 5 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 1.00 |
| $D_{35}$ = | 18.72 |
| $D_{50}$ = | 28.8 |
| $D_{84}$ = | 80.3 |
| $D_{95}$ = | 139.4 |
| $D_{100}$ = | 362.0 |



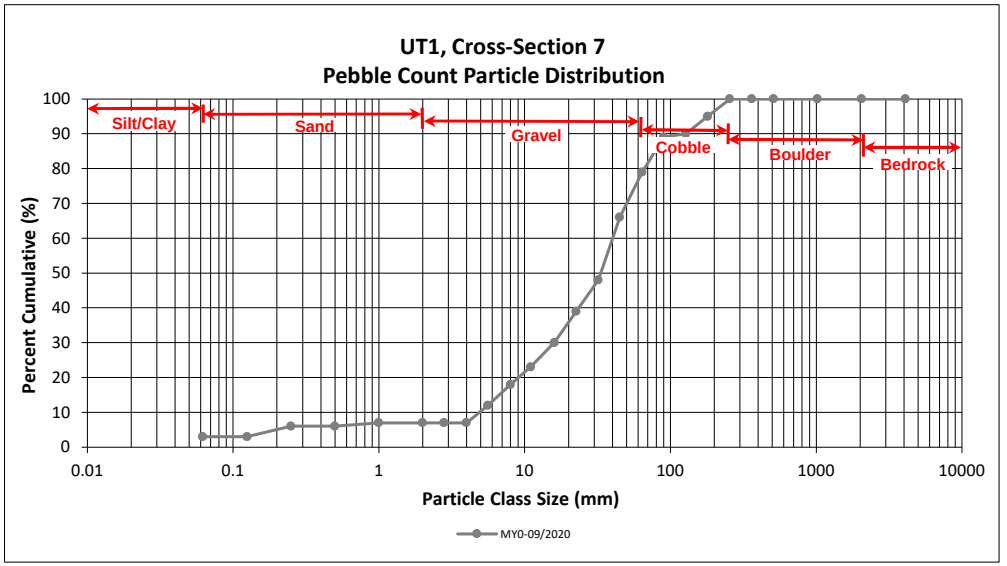
## Reachwide and Cross-Section Pebble Count Plots

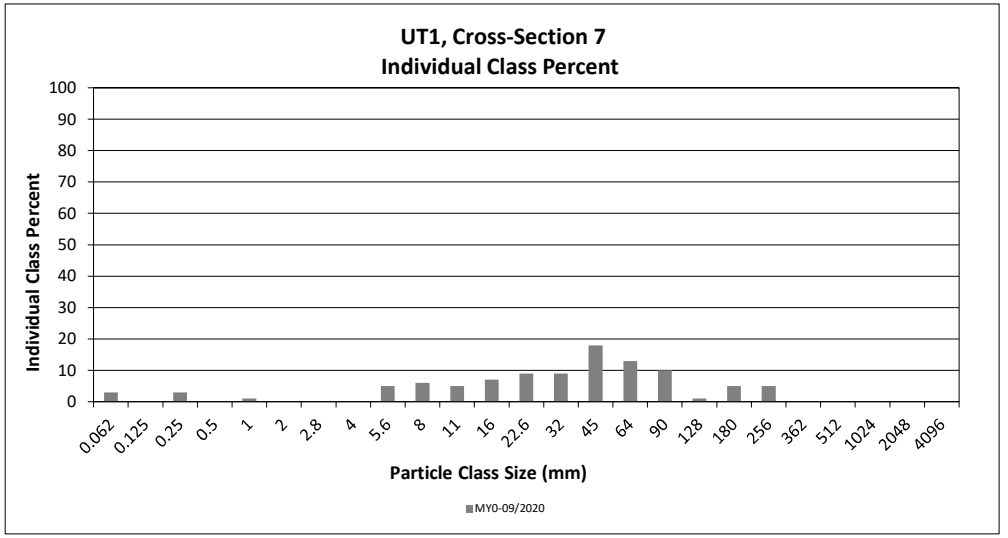
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

UT1, Cross-Section 7

| Particle Class | | Diameter (mm) | | Riffle 100-Count | Summary | |
|---|---|---|---|---|---|---|
| | | min | max | | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 3 | 3 | 3 |
| *SAND* | Very fine | 0.062 | 0.125 | | | 3 |
| | Fine | 0.125 | 0.250 | 3 | 3 | 6 |
| | Medium | 0.25 | 0.50 | | | 6 |
| | Coarse | 0.5 | 1.0 | 1 | 1 | 7 |
| | Very Coarse | 1.0 | 2.0 | | | 7 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | 7 |
| | Very Fine | 2.8 | 4.0 | | | 7 |
| | Fine | 4.0 | 5.6 | 5 | 5 | 12 |
| | Fine | 5.6 | 8.0 | 6 | 6 | 18 |
| | Medium | 8.0 | 11.0 | 5 | 5 | 23 |
| | Medium | 11.0 | 16.0 | 7 | 7 | 30 |
| | Coarse | 16.0 | 22.6 | 9 | 9 | 39 |
| | Coarse | 22.6 | 32 | 9 | 9 | 48 |
| | Very Coarse | 32 | 45 | 18 | 18 | 66 |
| | Very Coarse | 45 | 64 | 13 | 13 | 79 |
| *COBBLE* | Small | 64 | 90 | 10 | 10 | 89 |
| | Small | 90 | 128 | 1 | 1 | 90 |
| | Large | 128 | 180 | 5 | 5 | 95 |
| | Large | 180 | 256 | 5 | 5 | 100 |
| *BOULDER* | Small | 256 | 362 | | | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **100** | **100** | **100** |

| Cross-Section 7 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 7.10 |
| $D_{35}$ = | 19.38 |
| $D_{50}$ = | 33.2 |
| $D_{84}$ = | 75.9 |
| $D_{95}$ = | 180.0 |
| $D_{100}$ = | 256.0 |



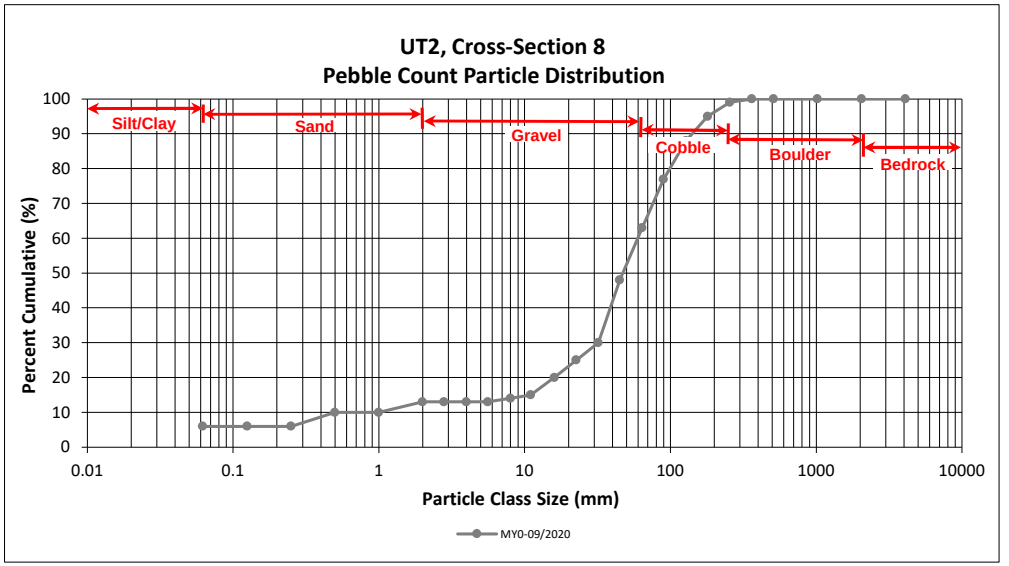
## Reachwide and Cross-Section Pebble Count Plots

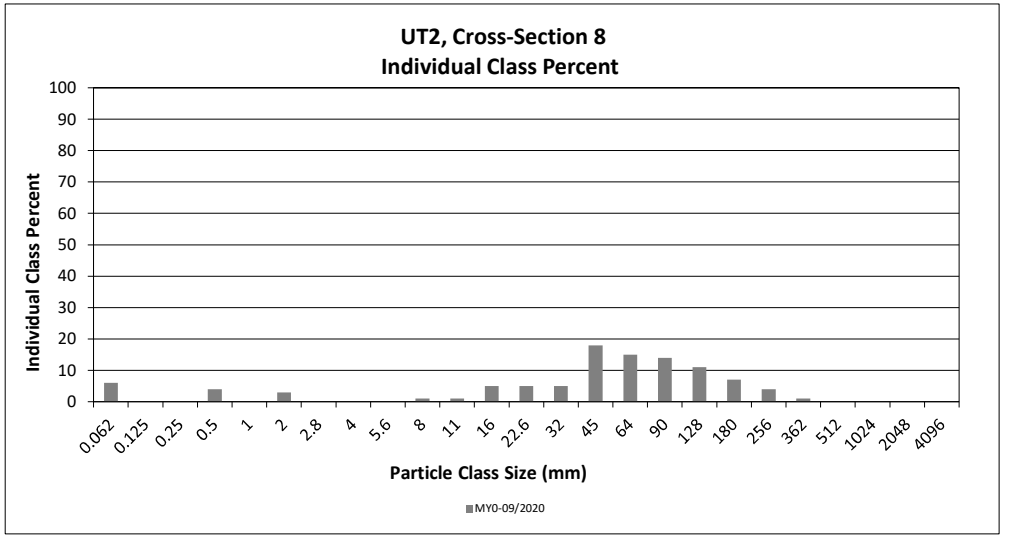
Sandy Branch Mitigation Site
DMS Project No. 100060
**Monitoring Year 0 - 2021**

UT2, Cross-Section 8

| Particle Class | | Diameter (mm) | | Riffle 100-Count | Summary | |
|---|---|---|---|---|---|---|
| | | min | max | | Class Percentage | Percent Cumulative |
| *SILT/CLAY* | Silt/Clay | 0.000 | 0.062 | 6 | 6 | 6 |
| *SAND* | Very fine | 0.062 | 0.125 | | | 6 |
| | Fine | 0.125 | 0.250 | | | 6 |
| | Medium | 0.25 | 0.50 | 4 | 4 | 10 |
| | Coarse | 0.5 | 1.0 | | | 10 |
| | Very Coarse | 1.0 | 2.0 | 3 | 3 | 13 |
| *GRAVEL* | Very Fine | 2.0 | 2.8 | | | 13 |
| | Very Fine | 2.8 | 4.0 | | | 13 |
| | Fine | 4.0 | 5.6 | | | 13 |
| | Fine | 5.6 | 8.0 | 1 | 1 | 14 |
| | Medium | 8.0 | 11.0 | 1 | 1 | 15 |
| | Medium | 11.0 | 16.0 | 5 | 5 | 20 |
| | Coarse | 16.0 | 22.6 | 5 | 5 | 25 |
| | Coarse | 22.6 | 32 | 5 | 5 | 30 |
| | Very Coarse | 32 | 45 | 18 | 18 | 48 |
| | Very Coarse | 45 | 64 | 15 | 15 | 63 |
| *COBBLE* | Small | 64 | 90 | 14 | 14 | 77 |
| | Small | 90 | 128 | 11 | 11 | 88 |
| | Large | 128 | 180 | 7 | 7 | 95 |
| | Large | 180 | 256 | 4 | 4 | 99 |
| *BOULDER* | Small | 256 | 362 | 1 | 1 | 100 |
| | Small | 362 | 512 | | | 100 |
| | Medium | 512 | 1024 | | | 100 |
| | Large/Very Large | 1024 | 2048 | | | 100 |
| *BEDROCK* | Bedrock | 2048 | >2048 | | | 100 |
| | | | **Total** | **100** | **100** | **100** |

| Cross-Section 8 | |
|---|---|
| Channel materials (mm) | |
| $D_{16}$ = | 11.86 |
| $D_{35}$ = | 35.18 |
| $D_{50}$ = | 47.2 |
| $D_{84}$ = | 112.6 |
| $D_{95}$ = | 180.0 |
| $D_{100}$ = | 362.0 |



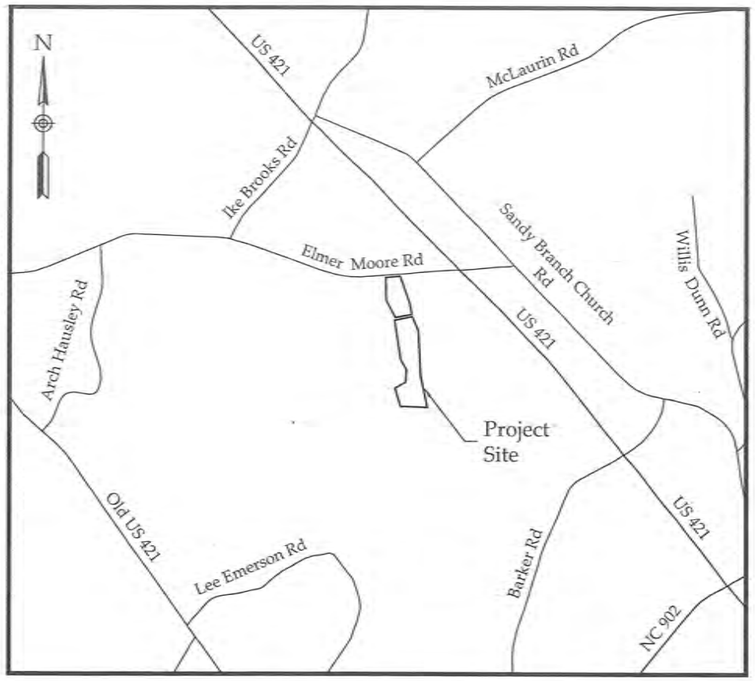



# APPENDIX 5. Record Drawings

# Sandy Branch Mitigation Site

## Cape Fear River Basin 03030003

## Chatham County, North Carolina




Vicinity Map
Not to Scale

CERTIFICATE OF SURVEY AND ACCURACY

I, BRANTLY W. WELLS, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY FOR THIS PROJECT WAS COMPLETED UNDER MY DIRECT SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY DIRECT SUPERVISION, THAT THE RECORD DRAWINGS WERE PREPARED BY WILDLANDS ENGINEERING, INC FROM DIGITAL FILES AND CONTOUR DATA PROVIDED BY SUMMIT DESIGN AND ENGINEERING SERVICES,PLLC AS SHOWN ON AN "ASBUILT SURVEY OF CONSERVATION EASEMENT FOR SANDY BRANCH", SUMMIT DESIGN PROJECT # 18-0409, SEALED DECEMBER 30TH 2020; THAT THIS SURVEY WAS PERFORMED AT THE 95% CONFIDENCE LEVEL TO MEET THE FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC SURVEY TO THE ACCURACY OF CLASS A HORIZONTAL AND CLASS C VERTICAL WHERE APPLICABLE; THAT THE ORIGINAL DATA WAS OBTAIN BETWEEN THE DATES OF 10/13/2020 AND 12/07/2020; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND THAT ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88; THAT THIS MAP MEETS THE SPECIFICATIONS FOR TOPOGRAPHIC SURVEYS AS STATED IN TITLE 21, CHAPTER 56, SECTION .1606; THAT THIS MAP WAS NOT PREPARED IN ACCORDANCE WITH G.S. 47-30, AS AMENDED AND DOES NOT REPRESENT AN OFFICIAL BOUNDARY SURVEY. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 20th DAY OF MARCH, 2021.

April

SUMMIT DESIGN AND ENGINEERING SERVICES, PLLC P-0339

NORTH CAROLINA PROFESSIONAL SEAL L-4544 LAND SURVEYOR BRANTLEY W. WELLS

AS-BUILT AND
RECORD DRAWINGS
APRIL 2021

### Stream Origins

| Stream | Latitude | Longitude |
|---|---|---|
| Sandy Branch | N35° 38' 45.69" | W79° 23' 18.26" |
| UT1 | N35° 38' 38.21" | W79° 23' 12.95" |
| UT2 | N35° 38' 26.81" | W79° 23' 16.34" |

### Sheet Index



### Project Directory


Engineering:
Wildlands Engineering, Inc.
License No. F-0831
312 West Millbrook Road
Suite 225
Raleigh, NC 27609
John Hutton, Project Manager
Greg Turner, PE, Project Engineer
919.851.9986

Surveying:
Summit Design and Engineering Services, PLLC
504 Meadowland Drive
Hillsborough, NC 27278
Brantly Wells, PLS
919.732.3883

Owner:
Attention: Jeremiah Dow
NCDEQ Division of
Mitigation Services
Raleigh, NC 27699
919.707.8976


DWR No. 18-0786
DMS ID No. 100060
DEQ Contract No. 007527
USACE Action ID No. SAW-2018-01167


WILDLANDS ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919.851.9986
License No. F-0831


NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038259 GREGORY A. TURNER 4-14-2021

Sandy Branch Mitigation Site
Chatham County, North Carolina

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

Title Sheet

Date: 04-2021
Job Number: 005-02173
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 0.1

X:\Shared\Projects\WI0173_Sandy_Branch\Monitoring\Baseline Monitoring\Plans\0173 - All Cover.dwg

JARED KYLE OLDHAM
PIN# 868800599033
PARCEL ID# 8510
D.B. 1979-562
P.B. 2018-16

JOHN L. FESMIRE ET AL.
PIN# 868800590000
PARCEL ID# 8566
D.B. 2004-361
P.B. 2002-441

BERTIS E. MOORE &
LU ANNE MOORE JOHNSON TRUSTEE
PIN# 868900502275
PARCEL ID# 80145
WILL BOOK E-8 12,13&14
D.B. 1255-894
P.B. 2002-441

JAMES & DONNA EMERSON
PIN# 868800476128
PARCEL ID# 8521
D.B. 317-180

ELMER MOORE RD (S.R. 2126)
60' R/W

BARN

40' EASEMENT BREAK
SANDY BRANCH
REACH 1
STA. 109+01

40' EASEMENT BREAK
SANDY BRANCH
REACH 1
STA. 108+61

BEGIN UT1 (RESTORATION)
STA. 200+61

SANDY BRANCH

SANDY BRANCH
REACH 2 (RESTORATION)
STA. 127+70
END UT2 (RESTORATION)
STA. 302+93

UT1

UT2

1.01
1.02
1.03
1.04
1.05
1.06
1.07
1.08
1.09

BEGIN UT2 (RESTORATION)
STA. 300+38

END SANDY BRANCH
REACH 1 (RESTORATION)
BEGIN SANDY BRANCH
REACH 2 (RESTORATION)
STA. 110+11
END UT1 (RESTORATION)
STA. 201+92

END SANDY BRANCH
REACH 2 (RESTORATION)
STA. 129+40

BEGIN SANDY BRANCH
REACH 1 (RESTORATION)
STA. 100+00

BERTIS E. MOORE &
LU ANNE MOORE JOHNSON TRUSTEE
PIN# 868800497016
PARCEL ID# 8507
WILL BOOK E-8 12,13&14
D.B. 741-714

N

0' 100' 200' 300'
HORIZONTAL & VERTICAL

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Raleigh, NC 27609
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License No. P-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043290 GREGORY A. NORRIS
4-19-2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Project Overview

Revisions:

Date: 04-2021
Job Number: 005-02173
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 0.2

X:\Shared\Projects\W02173 Sandy Branch\Monitoring\Baseline Monitoring\Plans\02173-AR Project Overview.dgn

## Existing Features

- Existing Property Boundary
- Existing NCDOT Right-of-Way
- Existing Storm Pipe
- Existing Top of Bank
- Existing Edge of Pavement
- Existing Fence
- Existing Evergreen Tree
- Existing Deciduous Tree
- Existing Optical Fiber Marker
- Existing Wetland
- Existing Bedrock

## Design Features

- CE CE CE — Design Conservation Easement
- 10+00 — Not For Credit
- 10+00 — Design Restoration Reach
- Design Bankfull/Top of Bank
- 540 — Design 5' Major Contour
- Design 1' Minor Contour
- Design Fence
- Design Riffle
- Design Log J-Hook
- Design Boulder Sill
- Design Angled Log Sill
- Design Lunker Log
- Design Log Vane
- Design Lunker Structure
- Design Transplanted Sod Mat
- Design Brush Toe
- Design Boulder Toe
- Design Rock Floodplain Outlet
- Design Culvert Crossing
- Design Gate

## As-Built Features

- As-Built Stream Alignment
- As-Built Bankfull
- 540 — As-Built 5' Major Contour
- 541 — As-Built 1' Minor Contour
- XS# — Cross Section
- As-Built Fence
- LOD LOD LOD — Limits of Disturbance
- PP ## — Photo Point
- GWG ## — Ground Water Gauge
- CG — Crest Gauge
- VEG / VEG / VP ## / VEG / VEG — Vegetation Plot
- As-Built Riffle
- As-Built Log J-Hook
- As-Built Boulder Sill
- As-Built Angled Log Sill
- As-Built Lunker Log
- As-Built Log Vane
- As-Built Lunker Structure
- As-Built Brush Toe
- As-Built Brush Toe
- As-Built Boulder Toe
- As-Built Rock Floodplain Outlet
- As-Built Gate

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 032960 GREGORY A. ANNE 4-19-2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

General Notes and Symbols

| | |
|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

Sheet 0.3

X:\Shared\Projects\SW02173_Sandy_Branch\Monitoring\Baseline Monitoring\Plans\02173 - All general Notes and Symbols.dwg

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.


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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 032190 GREGORY A. JENNINGS
4-19-2021

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL L-4544 STILES W. BRANTLEY III

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Sandy Branch
Stream Plan and Profile

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

Date: 04-2021
Job Number: 005-02173
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 1.01

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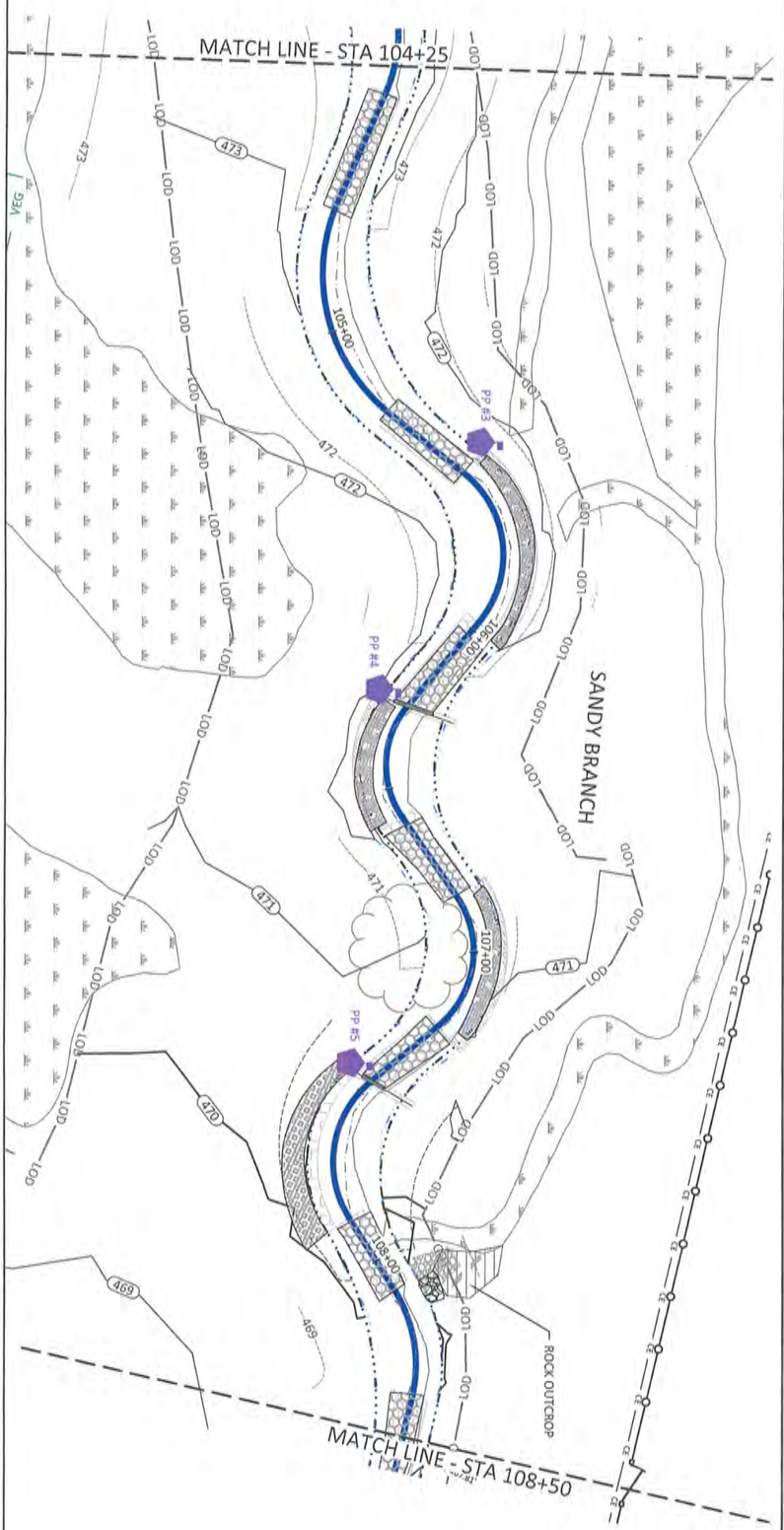
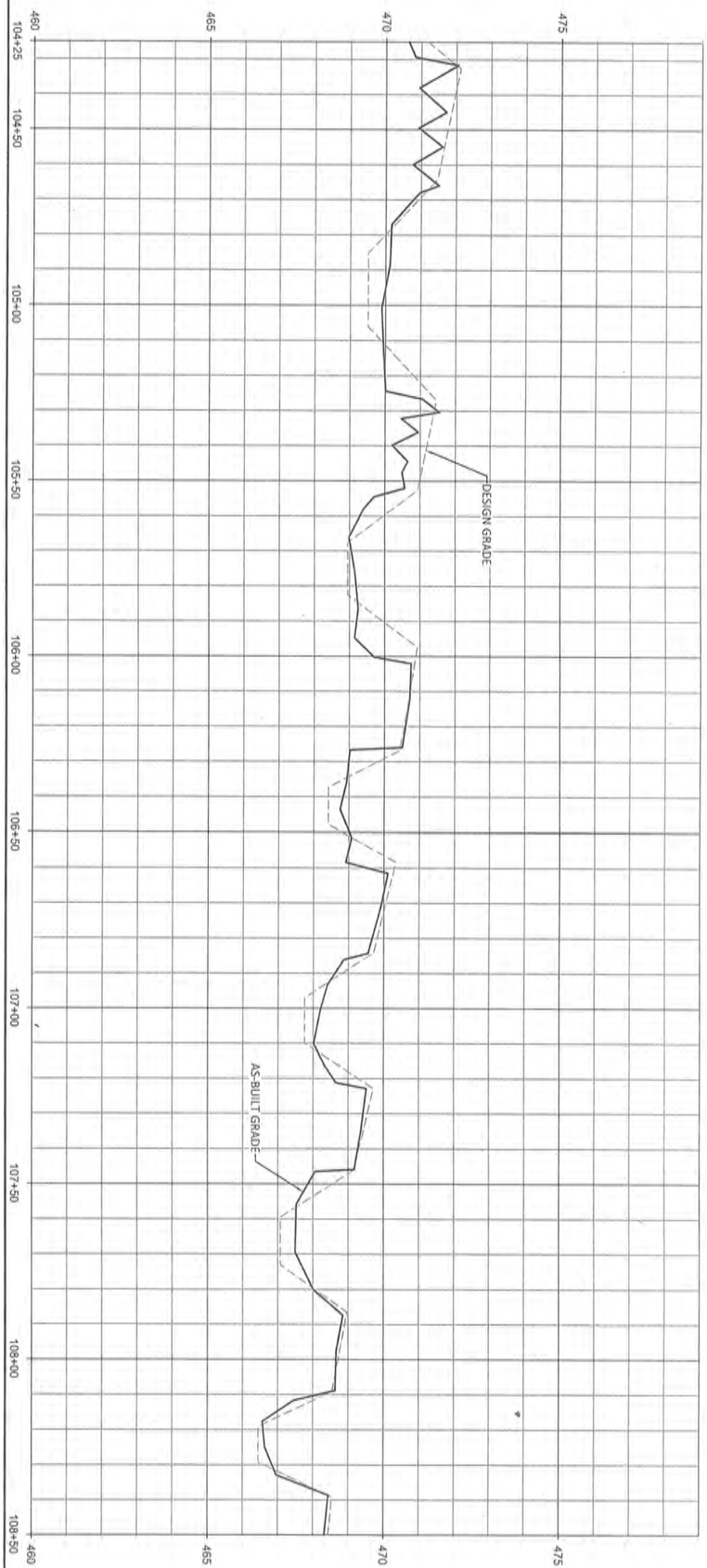
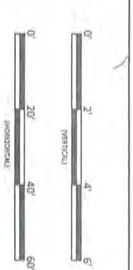
X:\Shared\Projects\WI02173 -Sandy Branch\Monitoring\Baseline Monitoring\Plans\02173 - AB Sandy Branch Plan and Profile.dwg

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.








| | |
|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

1.02
Sheet

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Sandy Branch
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL L-4544 LAND SURVEYOR BRANTLEY W. WELLS

NORTH CAROLINA PROFESSIONAL SEAL 043290 ENGINEER GREGORY A. TUPPER
4-19-2021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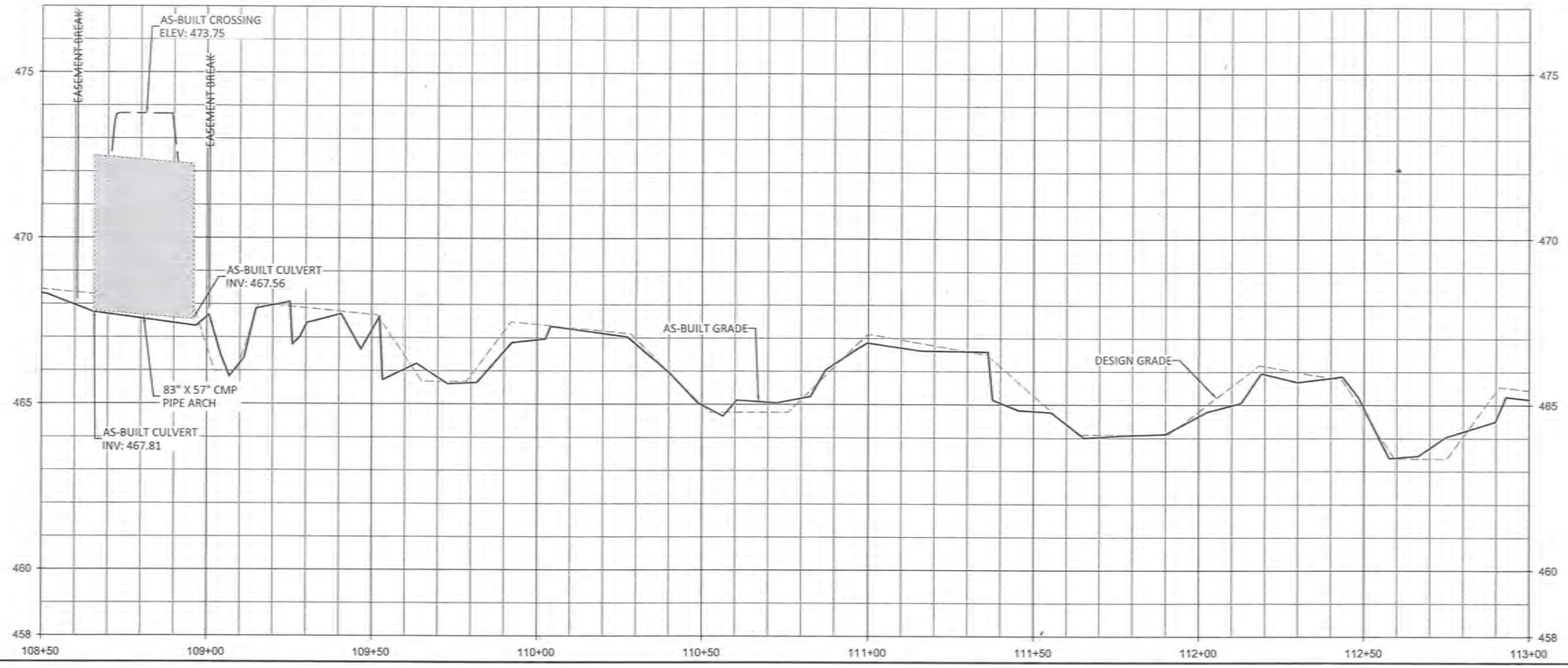


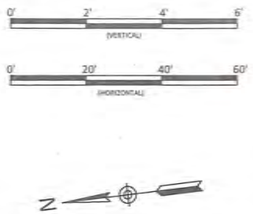


NOTE:

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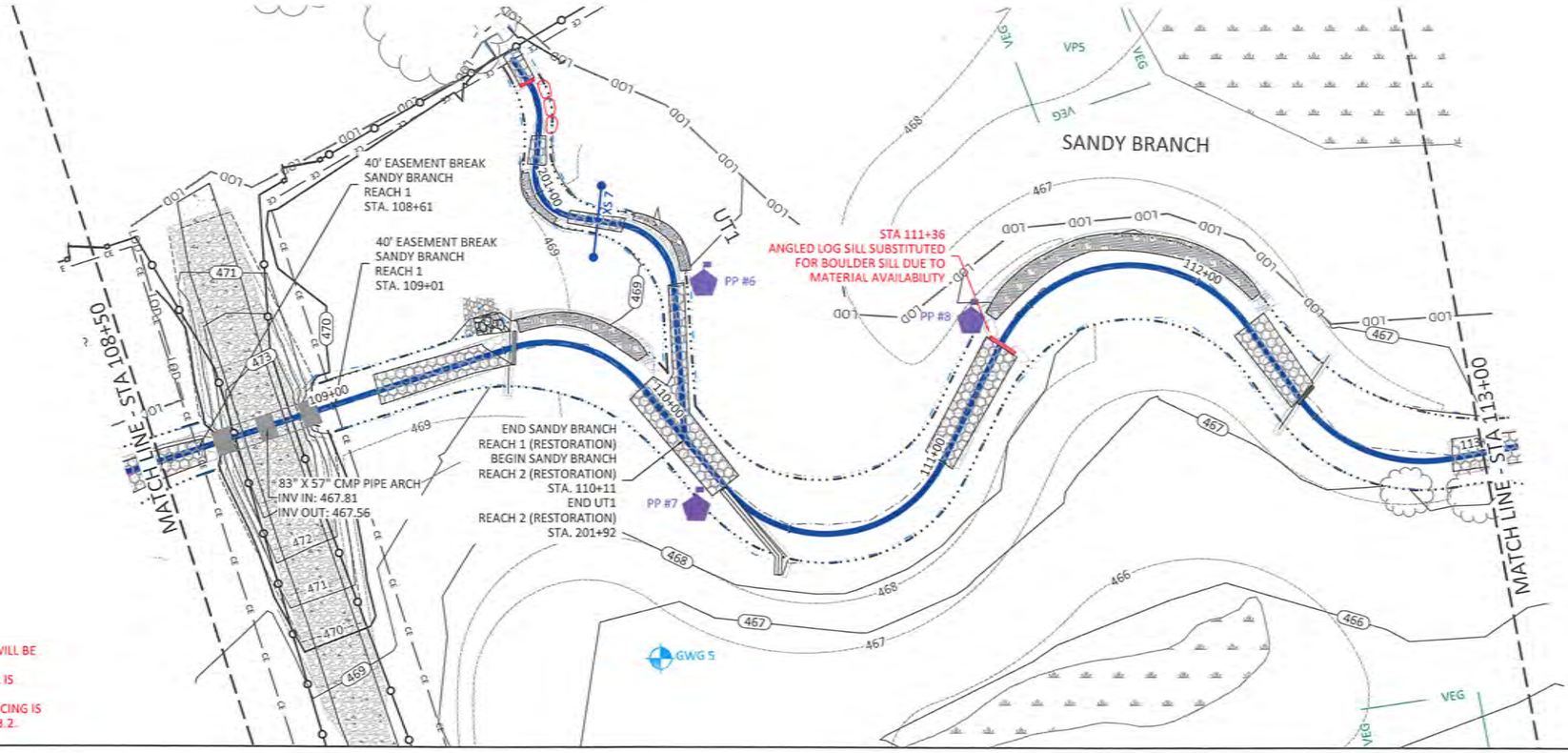


NOTES:

1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT1 IS ADDRESSED ON SHEET 1.08.
3. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.


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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 032980 CHRISTOPHER A. GREGORY

4-19-2021

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 51134 BRANTLEY W. HARRELL

Sandy Branch Mitigation Site
Chatham County, North Carolina

Sandy Branch
Stream Plan and Profile

| Revisions: |
|---|
| 1. Addressed DEQ Review Comments Dated April 5, 2021 |

| | |
|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

Sheet 1.03

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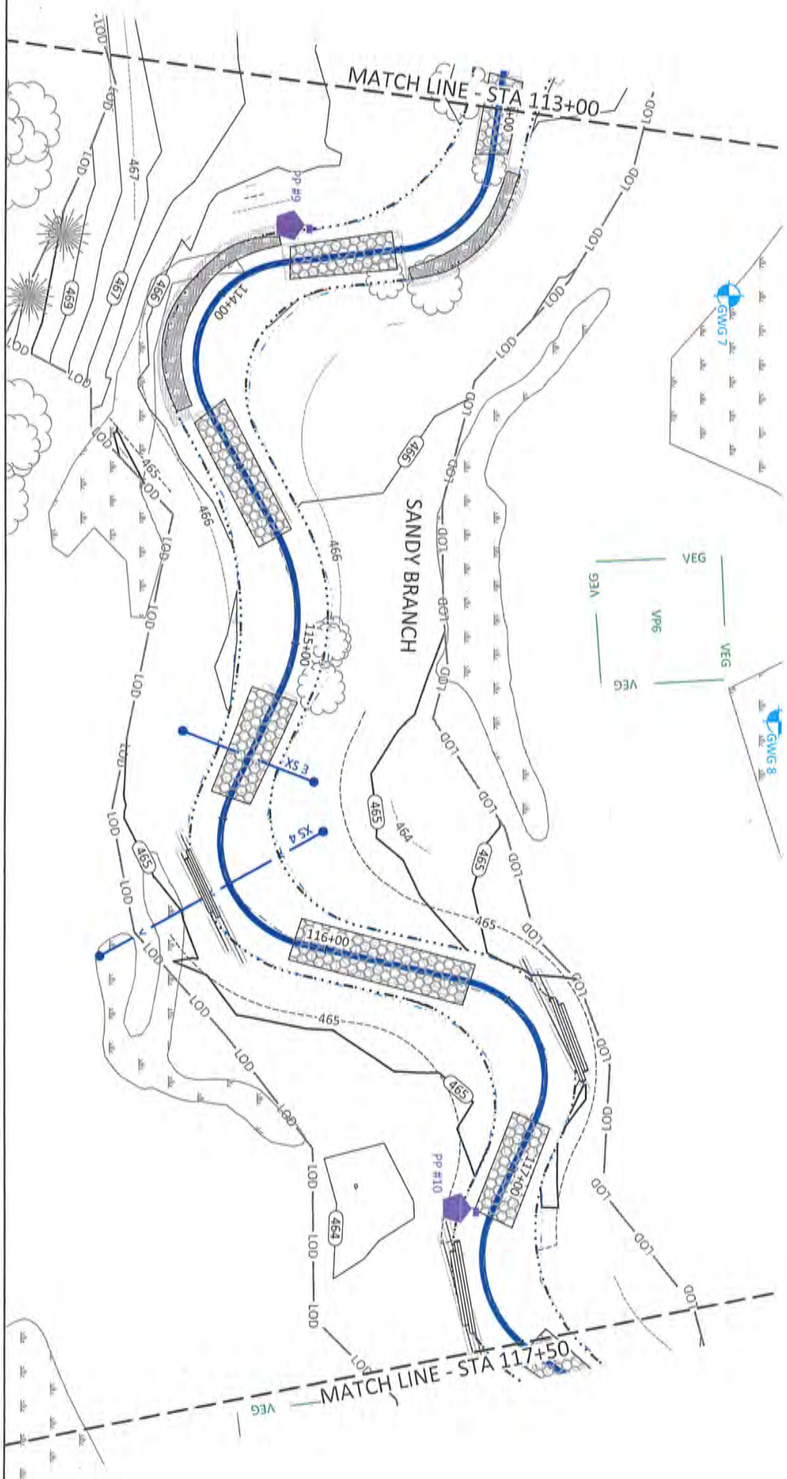
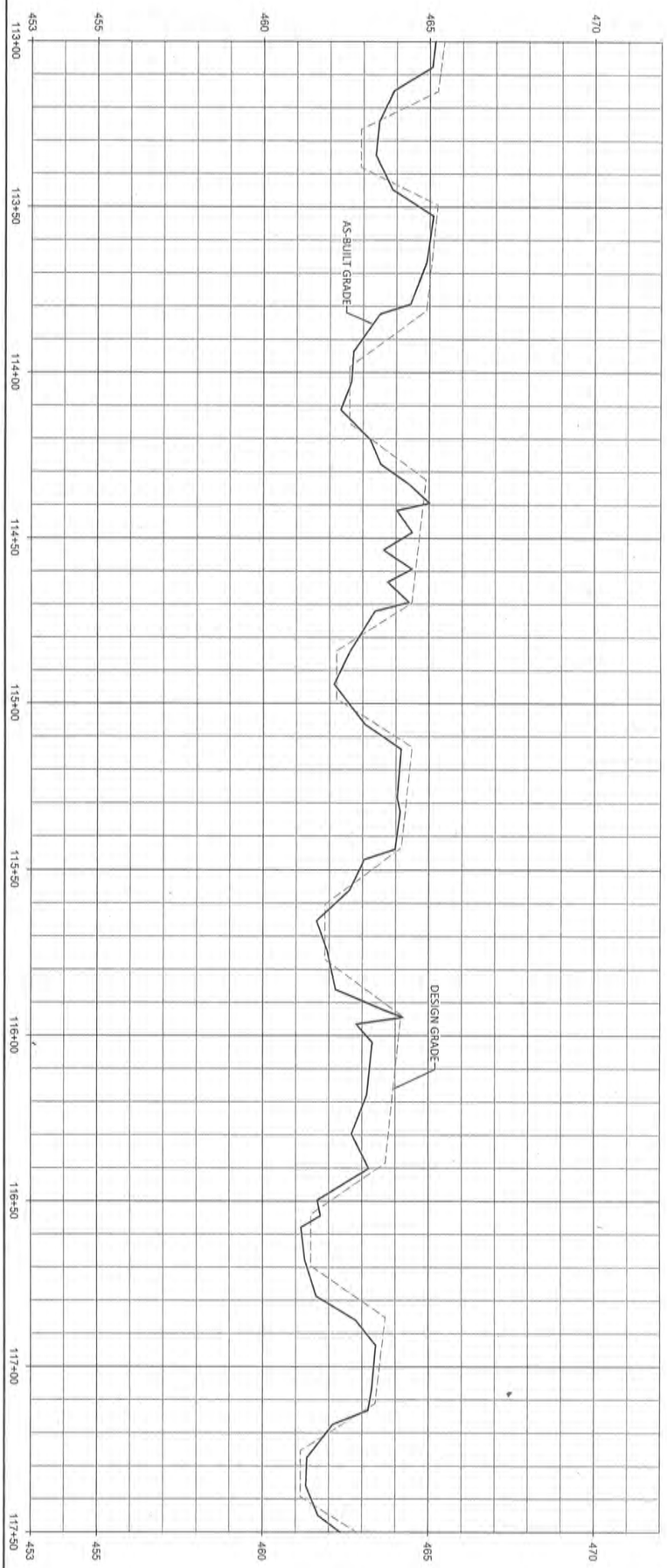
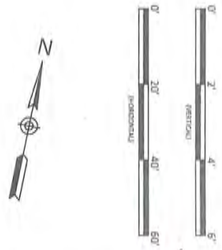
NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.

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| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

1.04
Sheet

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Sandy Branch
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL L-4534 LAND SURVEYOR BRANTLEY W. WELLS

NORTH CAROLINA PROFESSIONAL SEAL 033290 ENGINEER GREGORY A. TURNER
4-19-2021


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NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.


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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043290 GREGORY A. NORRIS
4-14-2021

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL 4544 BRANTLEY W. ELLIS
4-13-21

Sandy Branch Mitigation Site
Chatham County, North Carolina

Sandy Branch
Stream Plan and Profile

| Revisions: |
|---|
| 1. Addressed DEQ Review Comments Dated April 5, 2021 |

| | |
|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

Sheet 1.05

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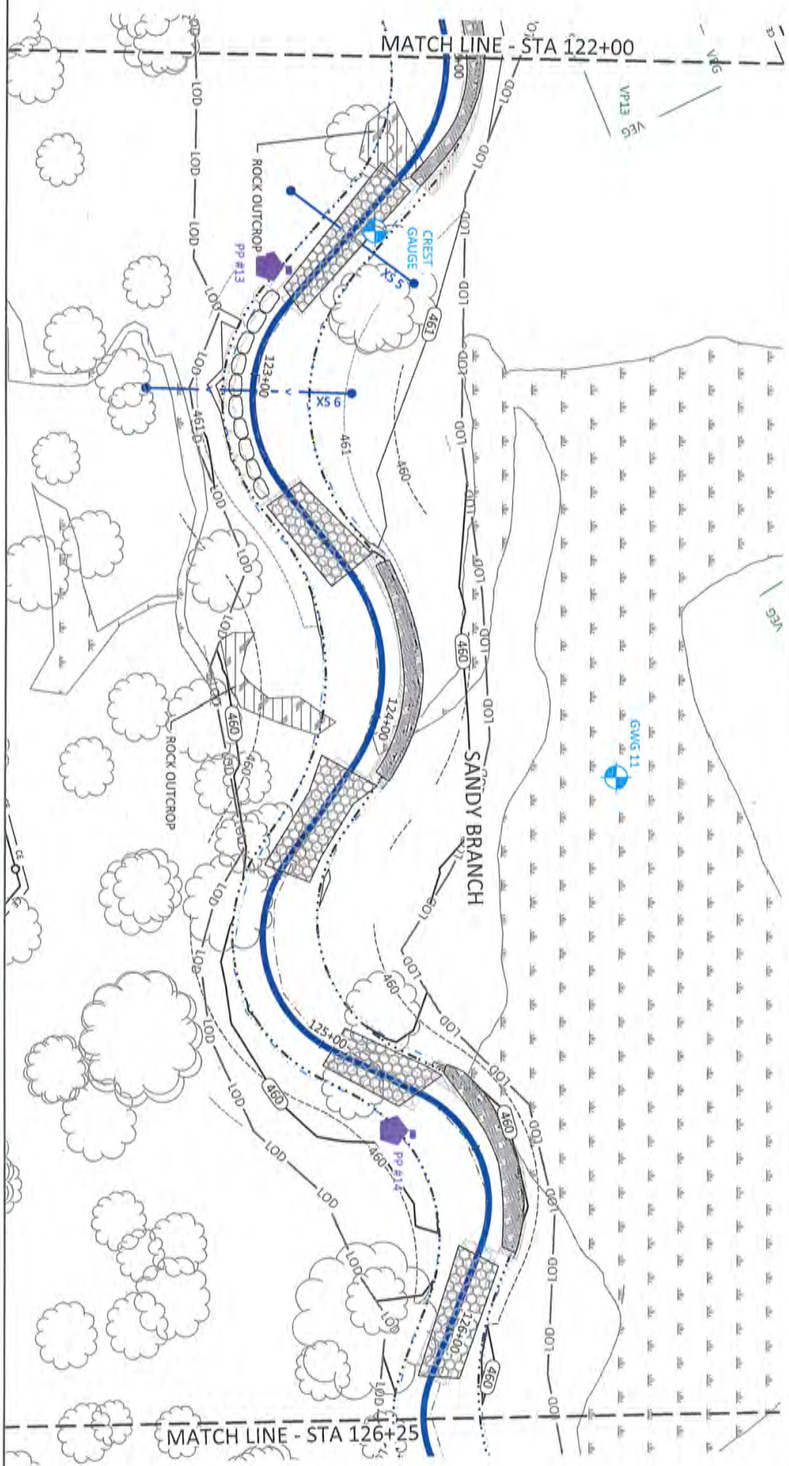
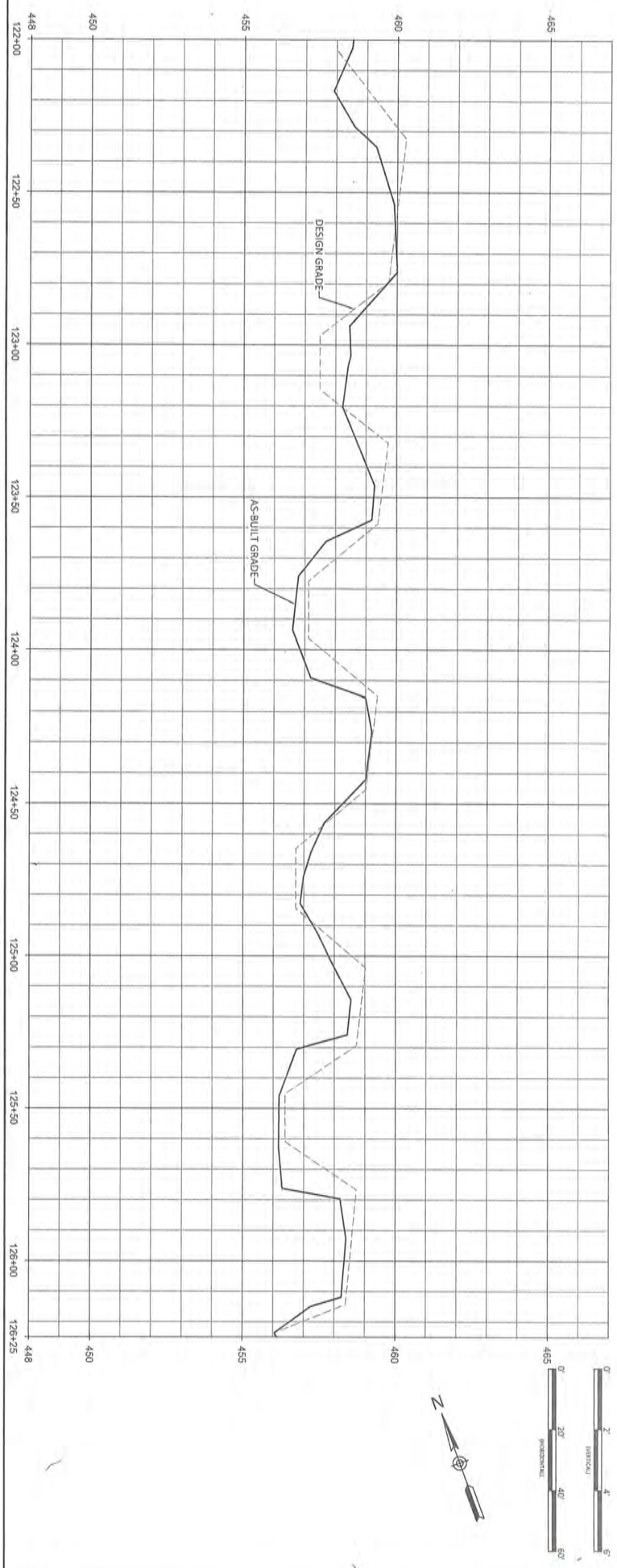
X:\Shared\Projects\WP2173_Sandy_Branch\Monitoring\Baseline Monitoring\Plans\02173 - All Sandy Branch Plan and Profile.dwg

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.

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|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

1.06
Sheet

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Sandy Branch
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL L-4544 LAND SURVEYOR BRANTLEY W. WELLS 4-22-21

NORTH CAROLINA PROFESSIONAL SEAL 013290 ENGINEER GREGORY A. TURNER 4-19-2021


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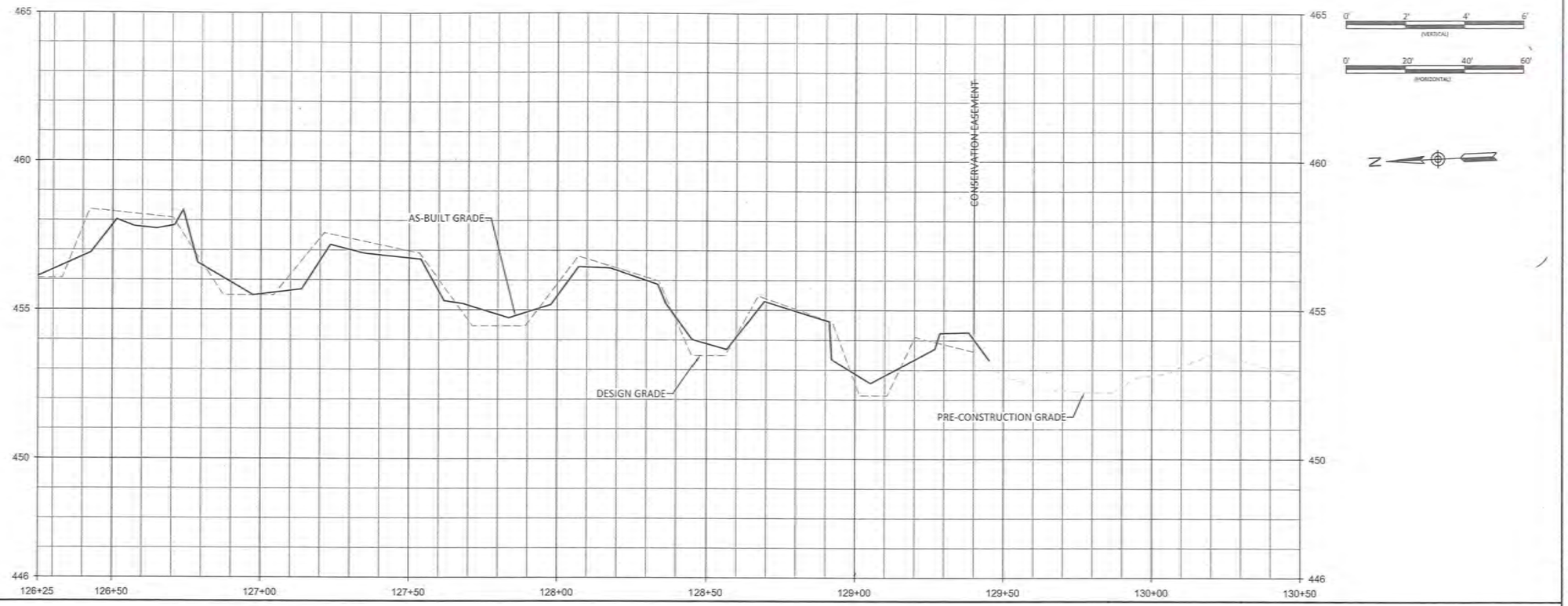
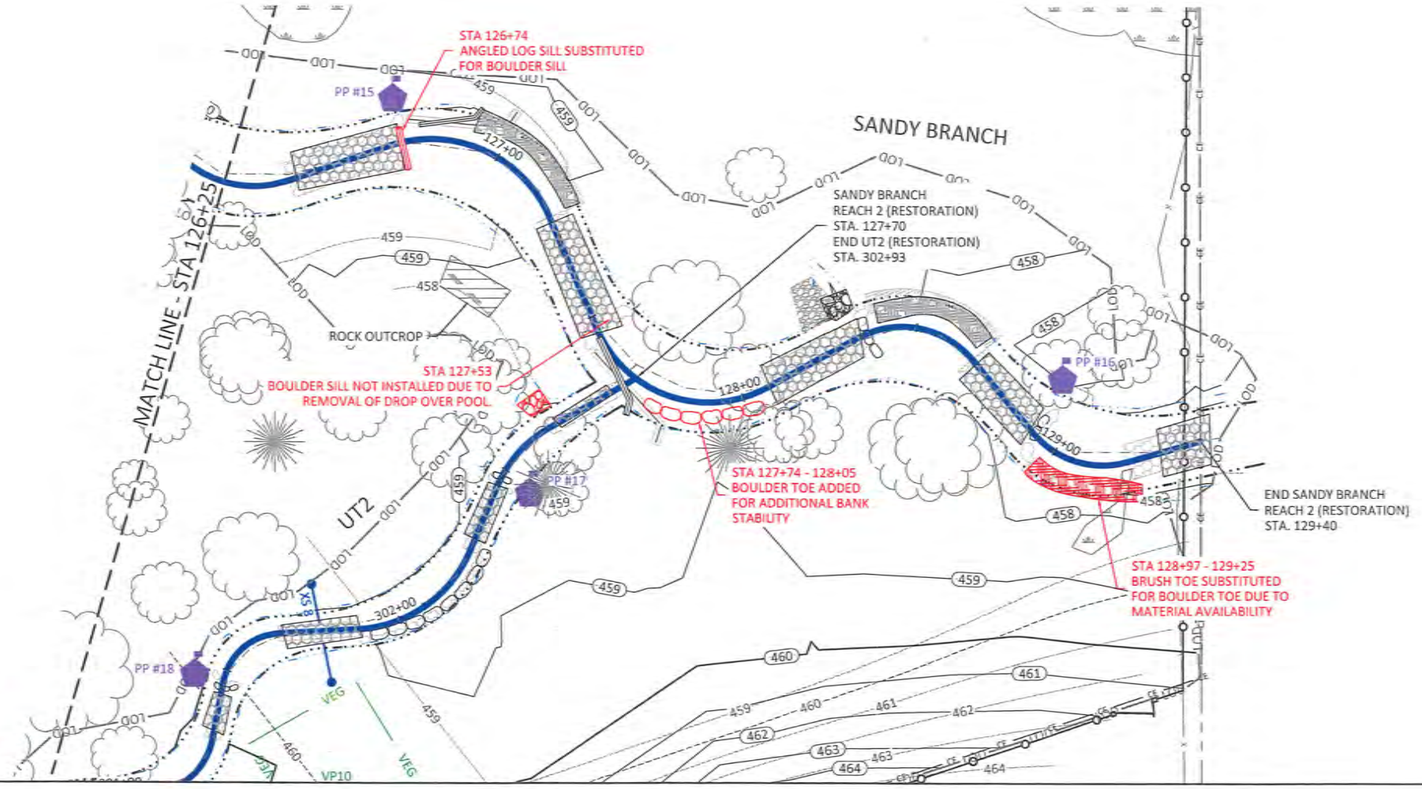



NOTE:

FULL GRADING FOR THIS AREA SHOWN ON SHEET 1.09.




NOTES:

1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR UT2 IS ADDRESSED ON SHEET 1.09.
3. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.

X:\Shared\Projects\W0173 Sandy Branch\Monitoring\Baseline Monitoring\Plans\0173 - All Sandy Branch Plan and Profile.dwg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Raleigh, NC 27609
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License No. P-0831


NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038290 GREGORY A. FLUHRER
4-19-2021

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL 5713 BRANTLEY W. THOMAS

# Sandy Branch Mitigation Site
# Chatham County, North Carolina

## Sandy Branch
## Stream Plan and Profile

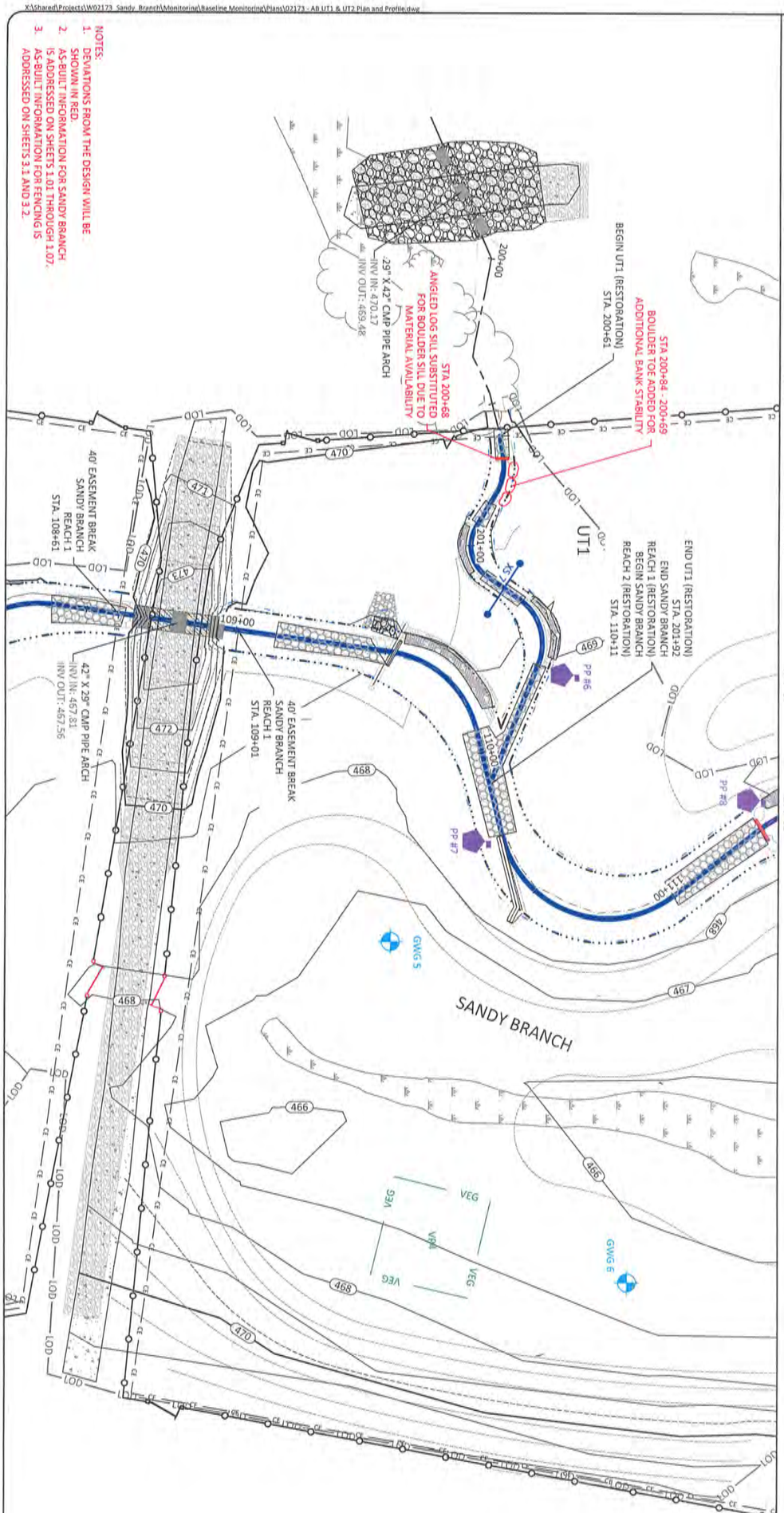
Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

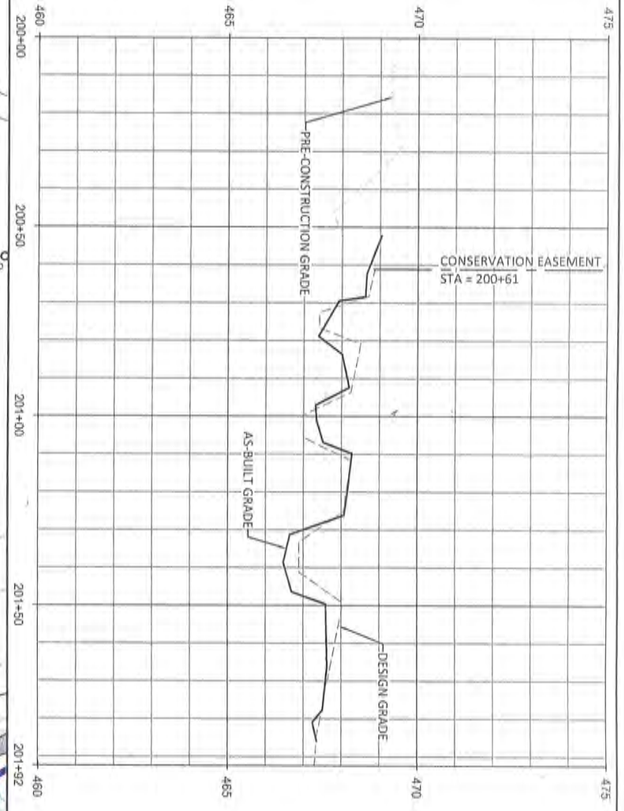
Date: 04-2021
Job Number: 005-02173
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 1.07

X:\Shared\Projects\W02173_Sandy_Branch\Monitoring\Baseline Monitoring\plans\02173 - AB UT1 & UT2 Plan and Profile.dwg

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR SANDY BRANCH IS ADDRESSED ON SHEETS 1.01 THROUGH 1.07.
3. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.





| | |
|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

1.08
Sheet

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

UT1
Stream Plan and Profile

NORTH CAROLINA PROFESSIONAL SEAL 043290 LAND SURVEYOR GRANTLEY W. WELLS

NORTH CAROLINA PROFESSIONAL SEAL 043290 ENGINEER GREGORY A. TURNER
4-19-2021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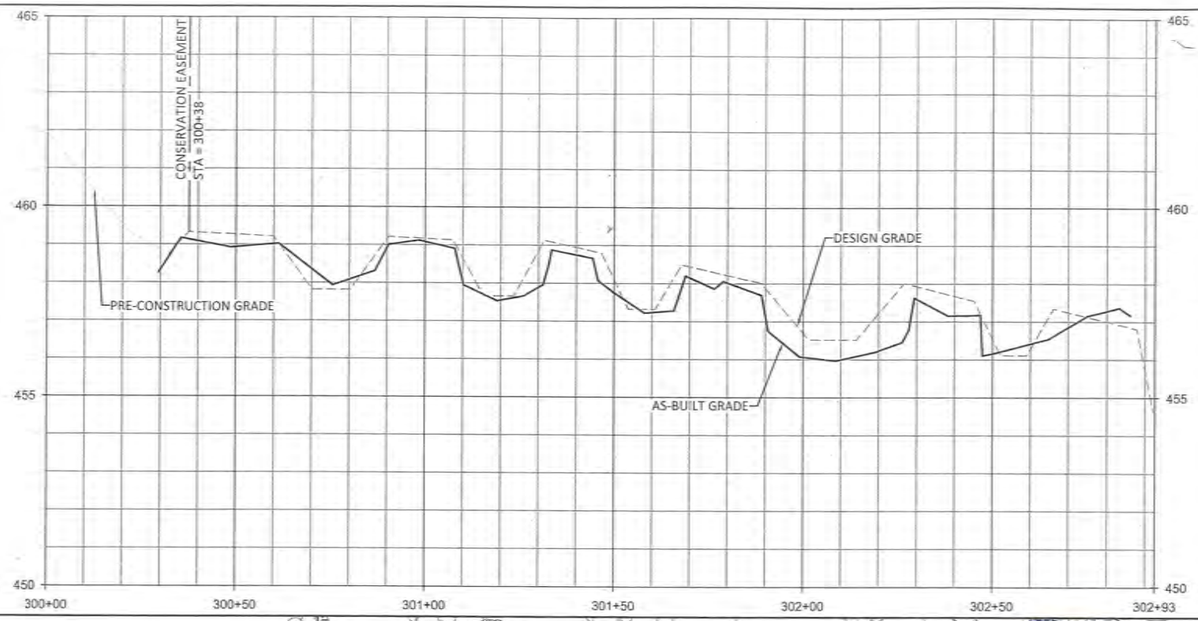


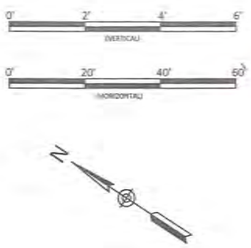


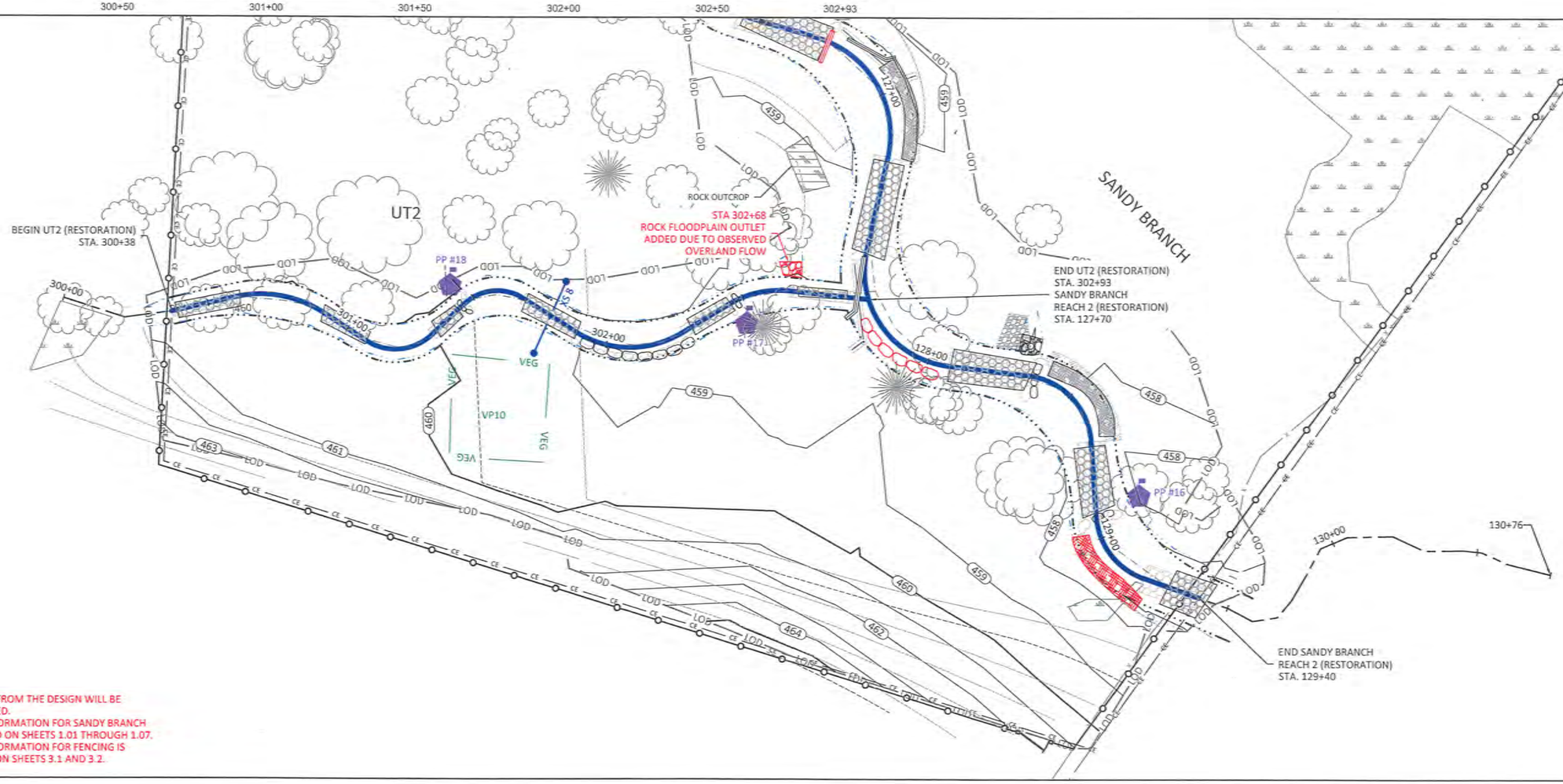


NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR SANDY BRANCH IS ADDRESSED ON SHEETS 1.01 THROUGH 1.07.
3. AS-BUILT INFORMATION FOR FENCING IS ADDRESSED ON SHEETS 3.1 AND 3.2.


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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 43290 GREGORY A. BENNETT
4-19-2021

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 45344 BRANTLEY W. GILES

Sandy Branch Mitigation Site
Chatham County, North Carolina

UT2
Stream Plan and Profile

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

Date: 04-2021
Job Number: 005-02173
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 1.09

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## Streambank Planting Zone

*Live Stakes*

| Species | Common Name | Indiv. Spacing | Min. Size | Stratum | % of Stems |
|---|---|---|---|---|---|
| *Salix nigra* | Black Willow | 4' - 8' | 0.5"-1.5" cal. | Shrub | 15% |
| *Cornus ammomum* | Silky Dogwood | | 0.5"-1.5" cal. | Shrub | 25% |
| *Salix sericea* | Silky Willow | | 0.5"-1.5" cal. | Shrub | 30% |
| *Cephalanhus occidentalis* | Buttonbush | | 0.5"-1.5" cal. | Shrub | 15% |
| *Sambus canadensis* | Elderberry | | 0.5"-1.5" cal. | Shrub | 15% |
| | | | | | 100% |

*Herbaceous Plugs*

| | | | | | |
|---|---|---|---|---|---|
| *Juncus effusus* | Common Rush | 4' - 6' | 1.0"- 2.0" plug | Herbaceous | 30% |
| *Carex alata* | Broadwing Sedge | | 1.0"- 2.0" plug | Herbaceous | 20% |
| *Panicum virgatum* | Switchgrass | | 1.0"- 2.0" plug | Herbaceous | 20% |
| *Scirpus cyperinus* | Woolgrass | | 1.0"- 2.0" plug | Herbaceous | 10% |
| *Carex lurida* | Lurid Sedge | | 1.0"- 2.0" plug | Herbaceous | 20% |
| | | | | | 100% |

## Buffer Planting Zone

*Bare Roots*

| Species | Common Name | Indiv. Spacing | Min. Caliper Size | Stratum | # of Stems |
|---|---|---|---|---|---|
| *Quercus phellos* | Willow Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 15% |
| *Platanus occidentalis* | Sycamore | 6-12 ft. | 0.25"-1.0" | Canopy | 20% |
| *Betula nigra* | River Birch | 6-12 ft. | 0.25"-1.0" | Canopy | 20% |
| *Quercus michauxii* | Swamp Chestnut Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 15% |
| *Quercus nigra* | Water Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 8% |
| *Acer negundo* | Boxelder | 6-12 ft. | 0.25"-1.0" | Subcanopy | 8% |
| *Ulmus rubra* | Slippery Elm | 6-12 ft. | 0.25"-1.0" | Canopy | 8% |
| *Quercus shumardii* | Shumard Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 6% |
| | | | | | 100% |

## Floodplain and Wetland Planting Zone

*Bare Roots*

| Species | Common Name | Indiv. Spacing | Min. Caliper Size | Stratum | # of Stems |
|---|---|---|---|---|---|
| *Betula nigra* | River Birch | 6-12 ft. | 0.25"-1.0" | Canopy | 20% |
| *Quercus pagoda* | Cherrybark Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 10% |
| *Platanus occidentalis* | Sycamore | 6-12 ft. | 0.25"-1.0" | Canopy | 15% |
| *Quercus michauxii* | Swamp Chestnut Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 15% |
| *Salix nigra* | Black Willow | 6-12 ft. | 0.25"-1.0" | Canopy | 5% |
| *Quercus phellos* | Willow Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 10% |
| *Quercus nigra* | Water Oak | 6-12 ft. | 0.25"-1.0" | Canopy | 5% |
| *Celtis laevigata* | Sugarberry | 6-12 ft. | 0.25"-1.0" | Canopy | 5% |
| *Acer negundo* | Boxelder | 6-12 ft. | 0.25"-1.0" | Subcanopy | 5% |
| *Ulmus rubra* | Slippery Elm | 6-12 ft. | 0.25"-1.0" | Canopy | 5% |
| *Diospyros virginiana* | Persimmon | 6-12 ft. | 0.25"-1.0" | Canopy | 5% |
| | | | | | 100% |

## Permanent Riparian Seeding

*Pure Live Seed (20 lbs/acre)*

| Approved Dates | Species Name | Common Name | Stratum | Density (lbs/acre) | Percentage |
|---|---|---|---|---|---|
| All Year | *Panicum rigidulum* | Redtop Panicgrass | Herbaceous | 1.0 | 5% |
| All Year | *Chasmanthium latifolium* | River Oats | Herbaceous | 2.0 | 10% |
| All Year | *Rudbeckia hirta* | Blackeyed Susan | Herbaceous | 1.0 | 5% |
| All Year | *Coreopsis lanceolata* | Lanceleaf Coreopsis | Herbaceous | 1.0 | 5% |
| All Year | *Carex vulpinoidea* | Fox Sedge | Herbaceous | 3.0 | 15% |
| All Year | *Carex lurida* | Lurid Sedge | Herbaceous | 1.0 | 5% |
| All Year | *Panicum clandestinum* | Deertongue | Herbaceous | 3.0 | 15% |
| All Year | *Elymus virginicus* | Virginia Wild Rye | Herbaceous | 3.0 | 15% |
| All Year | *Chamaecrista fasciculata var. fasciculata* | Partridge Pea | Herbaceous | 1.0 | 5% |
| All Year | *Asclepias incarnata* | Swamp Milkweed | Herbaceous | 0.2 | 1% |
| All Year | *Juncus effusus* | Soft Rush | Herbaceous | 2.0 | 10% |
| All Year | *Bidens aristosa* | Bur Marigold | Herbaceous | 0.8 | 4% |
| All Year | *Helianthus angustifolius* | Swamp Sunflower | Herbaceous | 1.0 | 5% |
| | | | | | 100% |

## Temporary Seeding

*Pure Live Seed*

| Approved Dates | Species Name | Common Name | Stratum | Density (lbs/acre) |
|---|---|---|---|---|
| Aug 15 - May 1 | *Secale cereale* | Rye Grain | Herbaceous | 140 |
| May 1 - Aug 15 | *Setaria italica* | German Millet | Herbaceous | 50 |

## Permanent Seeding Outside Easement

| Approved Dates | Species Name | Common Name | Stratum | Density (lbs/acre) | Percentage |
|---|---|---|---|---|---|
| All Year | *Festuca arundinacea* | Tall Fescue | Herbaceous | 40 | 70% |
| All Year | *Festuca rubra* | Creeping Red Fescue | Herbaceous | 40 | 10% |
| All Year | *Dactylis glomerata* | Orchardgrass | Herbaceous | 40 | 20% |
| | | | | | 100% |

Zone 1 - Streambank Planting Zone

Zone 2 - Buffer Planting Zone

Zone 3 - Wetland Planting Zone

Note: Non-hatched areas within the conservation easement are currently vegetated and were planted as needed to achieve target density. The remainder of the conservation easement was planted according to Sheets 2.0-2.01.

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043296 GREGORY A. JUDAY 4-19-2021

Sandy Branch Mitigation Site
Chatham County, North Carolina

Planting Tables

Date: 04-2021
Job Number: 005-02173
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Revisions:

Sheet 2.0

Zone 1 - Streambank Planting Zone

Zone 2 - Buffer Planting Zone

Zone 3 - Wetland Planting Zone

Note: Non-hatched areas within the conservation easement are currently vegetated and were planted as needed to achieve target density. The remainder of the conservation easement was planted according to Sheets 2.0-2.01.

ELMER MOORE RD (S.R. 2126)
60' R/W

SANDY BRANCH

UT1

UT2

BARN

EXISTING HARDWOOD CANOPY

EXISTING HARDWOOD CANOPY

EXISTING HARDWOOD CANOPY

EXISTING HARDWOOD CANOPY

N

0' 100' 200' 300'
HORIZONTAL & VERTICAL

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NORTH CAROLINA PROFESSIONAL ENGINEER 032960 GREGORY A. ANNE
4-19-2021

Sandy Branch Mitigation Site
Chatham County, North Carolina

Planting Plan

| | |
|---|---|
| Date | 04-2021 |
| Job Number | 005-02173 |
| Project Engineer | GAT |
| Drawn By | CAW |
| Checked By | ANA |

Revisions:

Sheet 2.01

June 12, 2020

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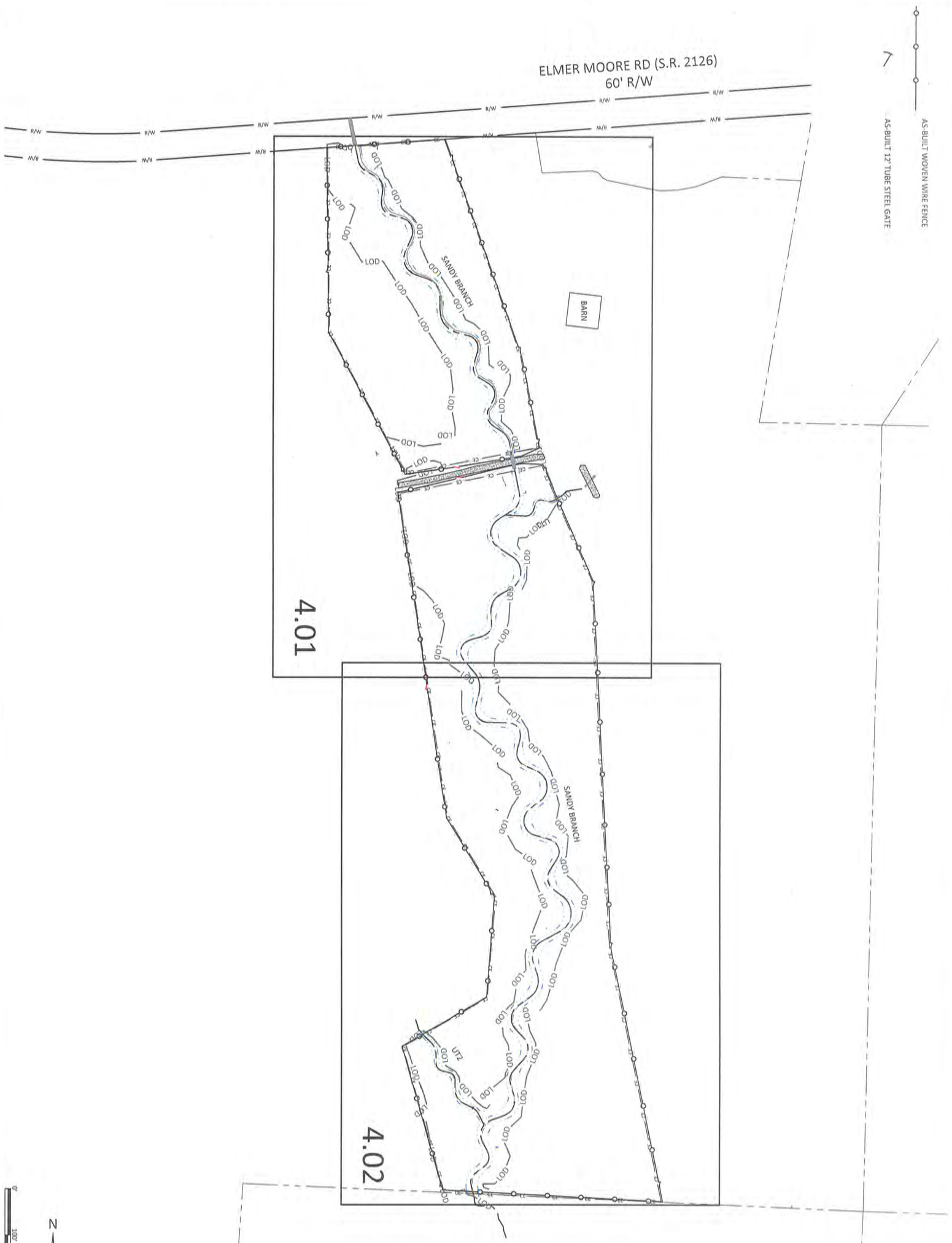


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|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

Revisions:

3.0
Sheet

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Fencing Plan Overview

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 043290 GREGORY A. TURNER
4-19-2021

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AS-BUILT WOVEN WIRE FENCE

AS-BUILT 12' TUBE STEEL GATE

BARN

12' STEEL GATE

WOVEN WIRE FENCE

CONSERVATION EASEMENT

12' STEEL GATE

12' STEEL GATE

12' STEEL GATE

PASSAGE WIDTH 16.2'

WOVEN WIRE FENCE

UT1

SANDY BRANCH

12' STEEL GATE

SANDY BRANCH

CONSERVATION EASEMENT

EXISTING FENCE REMOVED

12' STEEL GATE ADDED

12' STEEL GATE

12' STEEL GATE

12' STEEL GATE

MATCHLINE - SHEET 3.11

NOTES:
1. DEVIATIONS FROM THE DESIGN WILL BE SHOWN IN RED.
2. AS-BUILT INFORMATION FOR SANDY BRANCH, UT1 AND UT2 IS ADDRESSED ON SHEETS 1.01 THROUGH 1.09.

N

0' 40' 80' 120'

(H)ORIZONTAL)

X:\Shared\Projects\LW\02173 Sandy Branch\Monitoring\Baseline Monitoring\Plans\02173 - As Fencing Plan.dwg

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038980 GREGORY A. TOWN

4-12-2021

NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL 4844 BRANTLEY W. ELLIS

Sandy Branch Mitigation Site
Chatham County, North Carolina

Fencing Plan

| Revisions |
|---|
| 1. Addressed DEQ Review Comments Dated April 5, 2021 |

| | |
|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

Sheet 3.1

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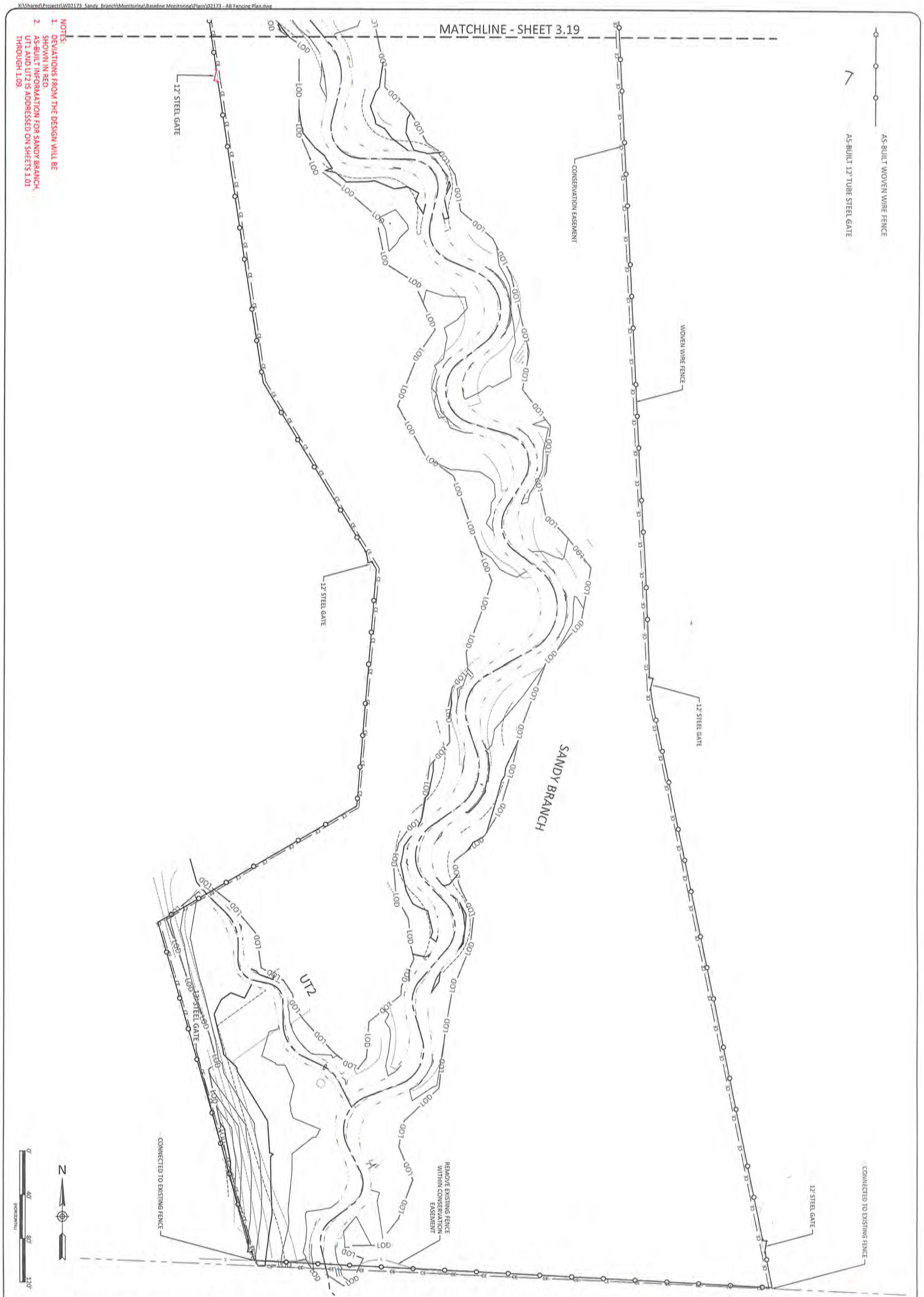


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|---|---|
| Date: | 04-2021 |
| Job Number: | 005-02173 |
| Project Engineer: | GAT |
| Drawn By: | CAW |
| Checked By: | ANA |

3.2
Sheet

Revisions:
1. Addressed DEQ Review Comments Dated April 5, 2021

# Sandy Branch Mitigation Site
## Chatham County, North Carolina

Fencing Plan

NORTH CAROLINA PROFESSIONAL SEAL C-4544 LAND SURVEYOR BRANTLEY W. WELLS

NORTH CAROLINA PROFESSIONAL SEAL 043290 ENGINEER GREGORY A. TURNER

4-19-2021


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