BASELINE MONITORING DOCUMENT AND AS-BUILT BASELINE REPORT

Final

MANEY FARM MITIGATION PROJECT

Chatham County, NC
NCDEQ Contract No. 005793
DMS ID No. 96314

Data Collection Period: January 2016 – February 2016
Draft Submission Date: April 1, 2016
Final Submission Date: May 12, 2016

PREPARED FOR:

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

PREPARED BY:

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

Jason Lorch
jlorch@wildlandseng.com
Phone: (919) 851-9986

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Many Farm Mitigation Project (Site) for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore and enhance a total of 6,112 linear feet (LF) of perennial and intermittent stream in Chatham County, NC. The Site is expected to generate 4,948 stream mitigation units (SMUs). The Site is located northwest of Pittsboro, NC and north of Silk Hope, NC (Figure 1) in the Cape Fear River Basin 8-Digit Hydrologic Unit Code (HUC) 03030002. The Site is also within the Cane Creek Targeted Local Watershed (HUC 03030002050050), which flows into Cane Creek and eventually into the Haw River. The streams are all unnamed tributaries (UT) to South Fork Cane Creek (SF) and are referred to herein as UTSF, UT1, UT2, UT3, UT4, and UT5.

The Site is located within the Cane Creek Targeted Local Watershed (TLW) which is discussed in DMS's 2009 Cape Fear River Basin Restoration Priorities (RBRP). This document identifies the need to improve aquatic conditions and habitats as well as promoting good riparian conditions in the Cane Creek watershed. The Site is currently maintained as cattle pasture and is one of the 51 animal operations referenced in the RBRP. The Site drains to the Haw River, which flows to B. Everett Jordan Lake (Jordan Lake). The 2005 NCDWR Cape Fear River Basinwide Water Quality Plan indicates that Jordan Lake is a drinking water supply (WS-IV), a primary area for recreation, and a designated Nutrient Sensitive Water which calls for reduction of non-point source pollution. The water supply watershed boundary for Jordan Lake is just six miles downstream from the Site. The Cape Fear watershed is also discussed in the 2005 North Carolina Wildlife Resource Commission's Wildlife Action Plan where sedimentation is noted as a major issue in the basin. Maps within the Wildlife Action Plan indicate that Priority Species are present along Cane Creek. Restoration at the Site will directly address non-point source stressors by removing cattle from the streams, creating stable stream banks, restoring a riparian corridor, and placing 16.69 acres of land under permanent conservation easement.

The project goals established in the mitigation plan (Wildlands, 2015) were completed with careful consideration of goals and objectives that were described in the Cape Fear RBRP plan. The following project goals established include:

- Exclude cattle from project streams resulting in reduced pollutant inputs including fecal coliform, nitrogen, and phosphorous;
- Stabilizing eroding stream banks resulting in reduced inputs of sediment into streams;
- Construct stream channels that are laterally and vertically stable resulting in a network of streams capable of supporting hydrologic, biologic, and water quality functions;
- Improve instream habitat resulting in improved aquatic communities within the streams;
- Reconnect channels with floodplains so that floodplains are inundated relatively frequently resulting in groundwater recharge, floodplain wetland and vernal pool inundation, and reduced shear stress on channels during larger flow events;
- Restore and enhance native floodplain forest resulting in stream shading, reduced thermal loads, woody input sources, and reduced flood flow velocities allowing for pollutants and sediments to settle; and
- Permanently protect the project site from harmful uses therefore ensuring that development and agricultural damage is prevented.

The project is helping meet the goals for the watershed and providing numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the project area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat; have farther-reaching effects. In addition, protected parcels downstream of this site promote cumulative project benefits within the watershed.

The Site construction and as-built surveys were completed between October 2015 and February 2016. Minimal adjustments were made during construction and specific changes are detailed in Section 5.1. 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.

TABLE OF CONTENTS

APPENDICES

Section 1: PROJECT GOALS, BACKGROUND AND ATTRIBUTES

1.1 Project Location and Setting

The Many Farm Mitigation Site (Site) is located in northwestern Chatham County (35.838333, -79.343889), northwest of Pittsboro and north of Silk Hope off of Center Church Road (Figure 1). The Site is located on a tract under the ownership of M. Darryl Lindley Revocable Trustee (PIN 8795-99-2158). A conservation easement was recorded on 16.69 acres of the parcel (Deed Book 1537, Page 876).

From Raleigh, NC, take I-40 West towards Durham. Take exit 293A for US-1 / US-64 / West toward Sanford/Asheboro. Travel approximately three miles and take exit 98B for US-64 West. Travel approximately 25 miles, take exit 381 for NC-87 towards Burlington. Travel approximately 1.8 miles on NC-87 North and turn left onto Silk Hope Gum Springs Road. Continue for 8.1 miles to Silk Hope Lindley Mill Road. Take Silk Hope-Lindley Mill Road north 3.6 miles. Turn right on Center Church Road and travel 0.9 miles. The Site is located north of Center Church Road.

The Site is located in the Cane Creek Watershed within the Jordan Lake Water Supply Watershed which has been designated a Nutrient Sensitive Water. The project streams drain to the Haw River and eventually into the Jordan Lake Reservoir. The Site's watershed is within Hydrologic Unit Code (HUC) 03030002050050 and is located within the Cane Creek Targeted Local Watershed (TLW) as identified in Division of Mitigation Services (DMS) 2009 Cape Fear River Basin Restoration Priorities (RBRP). This document identifies the need to improve aquatic conditions and habitats as well as promoting good riparian conditions in the Cane Creek watershed and notes that there are currently 51 active animal operations in the watershed, one of which was this Site.

Prior to construction activities, the streams and vegetative communities on the Site had been severely impacted due to livestock having direct access to the streams and riparian zones. Table 4 in Appendix 1 and Tables 6a-d in Appendix 2 present the pre-restoration conditions in more detail.

1.2 Project Goals and Objectives

The mitigation project is intended to provide numerous ecological benefits within the Cape Fear River Basin. While many of these benefits are limited to the Maney Farm Mitigation Site project area, others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals were established and completed with careful consideration of goals and objectives that were described in the RBRP and to meet the DMS mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following primary project goals established in the mitigation plan (Wildlands, 2015) include:

- Reduce fecal coliform, nitrogen, and phosphorous inputs through removing cattle from streams and establishing and augmenting a forested riparian corridor to intercept and process sediment and nutrients before they reach the channel during storm events;
- Reducing sediment loads by stabilizing eroding stream banks;
- Return a network of streams to a stable form that is capable of supporting biological functions;
- Install instream structures to improve bed and bank stability, create fish and macroinvertibrate habitat, and help oxygenate streamflows; and
- Restore and enhance a floodplain forested buffer.

Secondary project objectives include:

- Improving instream nutrient cycling by incorporating woody debris into constructed riffles and bank stabilization measures;
- Reducing thermal loadings through establishment of riparian shading;
- Reconnecting channels with floodplains to raise the local water table; and
- Create and implement a stream and riparian area restoration design that is both natural and aesthetically pleasing.

1.3 Project Structure, Restoration Type and Approach

The final mitigation plan was submitted and accepted by DMS in August 2015. Construction activities were completed by Land Mechanic Designs, Inc in January 2016. The baseline as-built survey was completed by Turner Land Surveying in February 2016. The planting was completed by Bruton Natural Systems, Inc. in February 2016. Minimal field adjustments were made during construction and are described in further detail in section 5.1. Refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

1.3.1 Project Structure

The project will provide 4,948 stream mitigation units (SMUs). While the mitigation plan indicated that the project would yield 4,922 SMUs, the as-built survey indicates that some of the reaches are slightly longer than expected. Refer to Figure 2 for the project component/asset map for the stream restoration feature exhibits and Table 1 for the project component and mitigation credit information 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 stream restoration and enhancement activities as described below.

The stream restoration portion of this project included three reaches:

- Unnamed Tributaries to South Fork Cane Creek (UTSF) – Reaches 1 and 2: This restoration reach begins at Center Church Road at the southern portion of the property and flows north to an adjoining protected property. Reach 1 includes one easement break for a culvert farm road crossing and the stream within this break is not included in the restoration credit total. The design included one reach upstream of the confluence with UT4 and one downstream of the confluence;
- UT5: This reach begins at a mature, forested riparian complex and extends to the confluence with UTSF – Reach 2.

The project also includes stream enhancement on nine reaches classified as either enhancement I (EI) or enhancement II (EII):

- UT1 (Reaches A, B, and C): UT1 is an intermittent system draining to the upper extent of UTSF Reach 1. An EII approach was utilized for UT1A and B to prevent cattle from accessing these tributaries and to support the reestablishment of functioning stream and riparian ecosystems. UT1C at the downstream extent was restored to support the construction of a stable confluence with the restored UTSF.
- UT2 (Reaches A and B): UT2 begins as an intermittent stream and develops into a perennial system prior to its confluence with UTSF. EII activities within UT2A included cattle exclusion and a supplemental planting effort to restore the understory and herbaceous layers within this reach. UT2B was restored to facilitate the tie in with UTSF, but the mitigation plan specified a credit ratio of 1.5:1 for this reach.

- UT3 (Reaches A and B): UT3 is an intermittent stream in which EII activities were primarily utilized along Reach A to exclude cattle and to restore the vegetative riparian zone. Reach B incorporated a restoration approach in order to facilitate the transition into the restored UTSF reach with a credit ratio of 1.5:1.
- UT4 (Reaches A and B): Similar EII approaches were employed for UT4A in order to facilitate the reestablishment of the intermittent stream and riparian ecosystem. A restoration approach (with a credit ratio of 1.5:1) was incorporated at the downstream extent to facilitate the transition from UT4B to the restored UTSF channel.

Design parameters were developed for restoration reaches based on the design bankfull discharge, dimensionless ratios from the reference reach data, and professional judgment of the designers. The restoration reaches were designed to be similar to type C streams according to the Rosgen classification system (Rosgen, 1996). Type C streams are slightly entrenched, meandering streams with access to the floodplain (entrenchment ratios >2.2), and channel slopes of 2% or less. They occur within a wide range of valley types and are appropriate for the project landscape.

The morphologic design parameters are shown in Appendix 2, Tables 6a through 6d for the restoration reaches, and fall within the ranges specified for C 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 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 Baseline Information and Attributes.

Section 2: PERFORMANCE STANDARDS

The stream performance criteria for the Site follow approved performance criteria presented in the Maney Farm Mitigation Plan (2015). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The stream restoration and enhancement reaches and the buffer restoration areas of the project were assigned specific performance criteria components for stream morphology, hydrology, and vegetation. Performance criteria will be evaluated throughout the seven-year post-construction monitoring. If all performance criteria have been met and two bankfull events have occurred during separate years, Wildlands may propose to terminate stream and/or vegetation monitoring after year five. An outline of the performance criteria components follows.

2.1 Streams

2.1.1 Dimension

Riffle cross sections on the restoration and enhancement level I reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per DMS 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. Reach riffle means should fall within the parameters defined for channels of the appropriate Rosgen stream type. 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 trend in vertical incision or eroding channel banks over the monitoring period. 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

Longitudinal profile surveys will not be conducted during the seven-year monitoring period unless other indicators during the annual monitoring indicate 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 (11/7/2011) and the 2003 USACE and NCDWR Stream Mitigation Guidance for the necessary reaches. Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability. A longitudinal profile was conducted as part of the as-built survey to provide a baseline for comparison should it become necessary to perform longitudinal profile surveys later during monitoring and to insure accordance with design plans.

2.1.3 Substrate

A reach-wide pebble count will be performed annually in each restoration and enhancement level I reach for classification purposes. A pebble count will be performed at each surveyed riffle to characterize the pavement. Substrate materials in the restoration and enhancement level I reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

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

Two bankfull flow events must be documented on the restoration reaches within the seven-year monitoring period. The two bankfull events must occur in separate years. Stream monitoring will continue until performance criteria in the form of two bankfull events in separate years have been documented. In addition, the presence of baseflow must be documented within the intermittent reach of UTSF Reach 1 for a minimum of 30 days during a normal precipitation year.

2.2 Vegetation

The final vegetative performance criteria will be the survival of 210 planted stems per acre in the planted riparian corridor at the end of the required monitoring period (MY7). The interim measure of vegetative performance will be the survival of at least 320 planted stems per acre at the end of the third monitoring year and at least 260 stems per acre at the end of the fifth year of monitoring. Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. If this performance standard is met by MY5 and stem density is trending towards success (i.e., no less than 260 five year old stems/acre), monitoring of vegetation on the Site may be terminated with written approval by the USACE in consultation with the NC Interagency Review Team. In addition, the supplemental planting areas of shade tolerant understory species will be monitored to determine survival rates of these species but the results will not be tied to project success. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

2.3 Schedule and Reporting

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to DMS. Based on the DMS Monitoring Report Template (version 1.5, 6/8/2012), 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;
- As-built topographic plans of major project elements including such items as grade control structures, vegetation plots, permanent cross sections, crest gages, and pressure transducers;
- 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 identification of any invasion by undesirable plant species;
- Stream flow gage attainment;
- A description of damage by animals or vandalism;
- Maintenance issues and recommended remediation measures will be detailed and documented; and
- Wildlife observations.

Section 3: MONITORING PLAN

Monitoring will consist of collecting morphological, vegetative, and hydrological data to assess the project performance based on the restoration goals and objectives on an annual basis or until performance criteria is met. The performance of the project will be assessed using measurements of the stream channel's dimension, pattern, substrate composition, permanent photographs, vegetation, and surface water hydrology. Any areas with identified 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 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 Appendix 4 for monitoring locations discussed below.

3.1.1 Dimension

A total of 17 cross sections were installed along the stream restoration and enhancement level I 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 trends in bank erosion. If moderate bank erosion is observed at 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 three feet. 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). Bank pins will be monitored by measuring exposed rebar and maintaining pins flush to bank to capture bank erosion progression. Annual cross section will be conducted in monitoring years one (MY1), two (MY2), three (MY3), five (MY5), and seven (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 (11/7/2011) 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 each restoration and enhancement level I reach each year for classification purposes. A pebble count will be performed at each surveyed riffle to characterize the pavement.

3.1.4 Photo Reference Points

A total of 32 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. The photographer will make every effort to consistently maintain the same area in each photo over time.

3.1.5 Hydrology Documentation

Bankfull events will be documented using crest gages, pressure transducers, photographs, and visual assessments such as debris lines. Three manual crest gages and three pressure transducer automated gages were installed on the Site. Crest gages and pressure transducers were installed on the restoration reaches at a surveyed riffle cross section. These gages will be checked during each site visit to determine if a bankfull event has occurred since the last visit. Photographs will be used to document the occurrence of debris lines and sediment deposition as evidence of bankfull events. Baseflow within the intermittent reach of UTSF Reach 1 will be confirmed with a pressure transducer automated gage installed at the thalweg elevation of the channel. The pressure transducer data will be plotted and included in the annual monitoring reports.

3.1.6 Visual Assessment

Visual assessments will be performed along all stream and buffer restoration areas 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 photographed 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 13 standard 10 meter by 10 meter vegetation plots and one non-standard 5 meter by 20 meter plot were established within the project easement area to monitor both the standard planting zones (11 plots) as well as the supplemental planting zones (3 plots).

Vegetation plots were randomly established within the planted corridor of the restoration areas to capture the heterogeneity of the designed vegetative communities. The 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 February 2016. Subsequent annual assessments following baseline survey will capture the same reference photograph locations. 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. Planted woody stems will be marked annually, as needed, based off of a known origin so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems.

Section 4: MAINTENANCE AND CONTINGENCY PLAN

Wildlands will perform maintenance as needed on the mitigation project. 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 site construction and may include one or more of the following components.

4.1 Stream

Stream problem areas will be mapped and included in the Current Condition Plan View (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 problems 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 (NCDA) 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 mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. 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 in February 2016. The survey included developing an as-built topographic surface, locating the channel boundaries, structures, and cross-sections. For comparison purposes, the baseline monitoring divided the reach assessments in the same way they were established for design parameters.

5.1 As-Built/Record Drawings

A sealed half-size set of record drawings are located in Appendix 4. These include redlines for any significant field adjustments made during construction that differ from the design plans. Minimal adjustments were made during construction, where needed, based on field evaluation.

5.1.1 UTSF – Reach 1

- Station 104+75 root wads replaced with brush toe due to availability of materials;
- Station 110+20 root wads replaced with brush toe due to availability of materials; and
- Station 111+25 brush toe not installed to avoid impact to nearby tree.

5.1.2 UTSF – Reach 2

- Station 131+75 brush toe added to provide additional bank stability and habitat.

5.1.3 UT1C

- No field adjustments were made during construction.

5.1.4 UT2B

- No field adjustments were made during construction.

5.1.5 UT3B

- No field adjustments were made during construction.

5.1.6 UT4B

- No field adjustments were made during construction.

5.1.7 UT5

- Station 604+30 brush toe not installed to avoid impact to nearby tree; and
- Station 607+90 brush toe replaced with sod mat due to availability of nearby sod.

5.2 Baseline Data Assessment

Baseline monitoring (MY0) was conducted between January and February 2016. The first annual monitoring assessment (MY1) will be completed in the fall of 2016. The streams will be monitored for a total of seven years, with the final monitoring activities concluding in 2022. The close-out for the Site will be conducted in 2023 given the performance criteria has been met. As part of the closeout process, DMS will evaluate the Site at the end of the fourth year monitoring period to determine whether or not the Site is eligible to closeout following MY5. If the Site is meeting performance criteria, DMS will propose to the Interagency Review Team (IRT) to proceed with the closeout process. If the Site is not meeting performance criteria, then an additional two years of monitoring will be conducted by Wildlands.

5.2.1 Morphological State of the Channel

Morphological data for the as-built profile was collected in January and February 2016. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The MY0 profiles closely match the profile design parameters. On the design profiles, riffles were depicted as straight lines with consistent slopes. However, at some locations the as-built survey riffle profiles are not consistent in slope due to natural deposition and scour within some riffle reaches. Additionally, maximum pool depths typically exceed design parameters and are expected to trend towards the design depths as a result of natural deposition over time. These variations in riffle slope and pool depths do not constitute a problem or indicate a need for remedial actions and will be assessed visually during the CCPV site walks.

Dimension

The MY0 dimension numbers fall within standard ranges as compared to the design parameters. Variations are primarily associated with a wider constructed bankfull width as reflected in the cross sections. It is expected that over time as vegetation is established, the channels may narrow more toward dimensions characteristic of an E channel. This narrowing over time would not be seen as an indicator of instability in and of itself. Summary data and cross section plots of each project reach can be found in Appendix 2.

Pattern

The MY0 pattern metrics fell within the design parameters for all seven reaches. No major design changes were made to alignments during construction. A minor pattern adjustment was made on UTSF station 111+50 in order to save a large tree. Pattern data will be evaluated in monitoring year five if there are any indicators through the profile or dimensions that indicate significant geomorphic adjustments have occurred.

Sediment Transport

As-built shear stresses and velocities are similar to design calculations and should reduce the risk of further erosion along the reaches. The as-built condition for each of these reaches indicates an overall increase in substrate particle size (Table 6a – 6d). 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 Vegetation

The MY0 planted density is 648 stems/acre for the standard and supplemental planting zones. The stems per/acre established within the standard planting zones exceeds the interim measure of vegetative performance of at least 320 planted stems per acre at the end of the third monitoring year. While there is not a performance criteria for the stems established within the supplemental planting zones, these areas will be monitored to determine survival rates of these species. Summary data and photographs of each plot can be found in Appendix 3.

5.2.3 Hydrology

Bankfull events recorded following completion of construction will be reported in the Year 1 monitoring report.

Section 6: REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E. 2003. Stream Restoration A Natural Channel Design Handbook.

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique.* Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://www.nceep.net/business/

monitoring/veg/datasheets.htm.

Multi-Resolution Land Characteristics Consortium (MRLC). 2001. National Land Cover Database. http://www.mrlc.gov/nlcd.php

North Carolina Division of Water Resources (NCDWR). 2011. Surface Water Classifications. http://portal.ncdenr.org/web/wq/ps/csu/classifications

North Carolina Division of Water Resources, 2005. Cape Fear River Basinwide Water Quality Plan. http://h20.enr.state.nc.us/basinwide/draftCPFApril2005.htm

North Carolina Wildlife Resources Commission. 2005. Wildlife Action Plan. Accessed online at:

http://www.ncwildlife.org/portals/0/Conserving/documents/ActionPlan/WAP_complete.pdf

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.

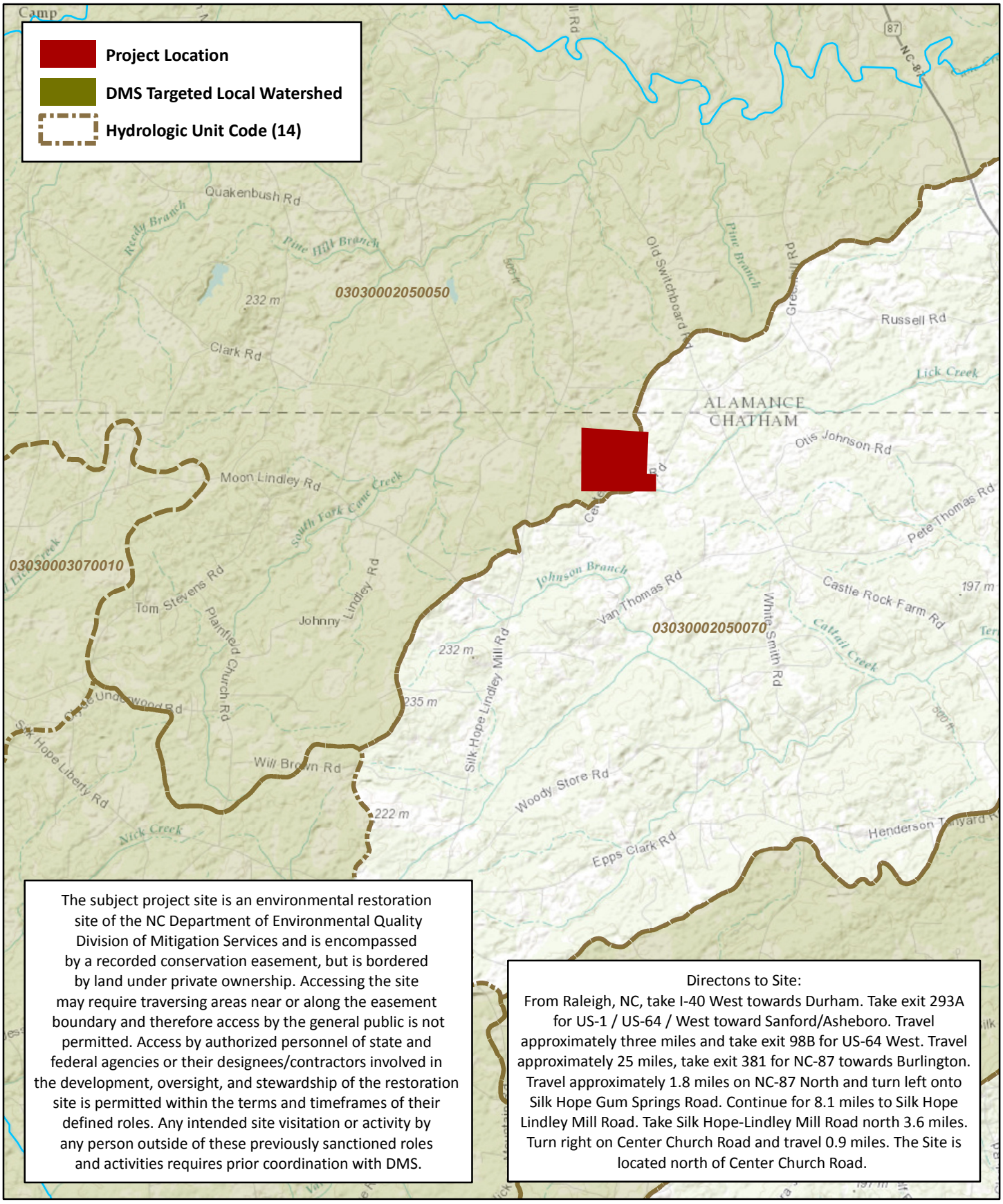
United States Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey (USGS), 1998. North Carolina Geology.

http://www.geology.enr.state.nc.us/usgs/carolina.htm

Wildlands Engineering, Inc. (2015). Maney Farm Mitigation Project Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables



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

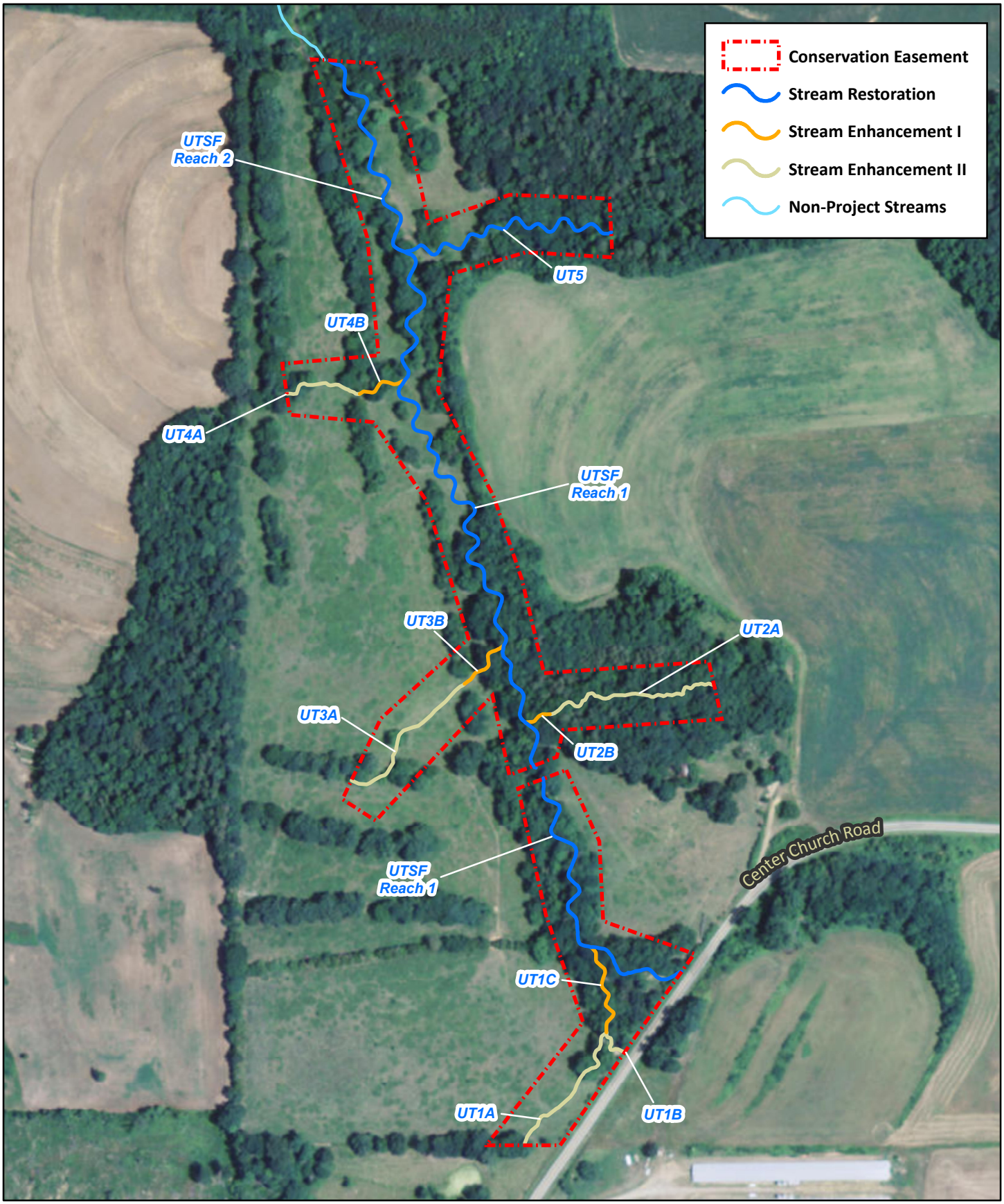
Directons to Site:
From Raleigh, NC, take I-40 West towards Durham. Take exit 293A for US-1 / US-64 / West toward Sanford/Asheboro. Travel approximately three miles and take exit 98B for US-64 West. Travel approximately 25 miles, take exit 381 for NC-87 towards Burlington. Travel approximately 1.8 miles on NC-87 North and turn left onto Silk Hope Gum Springs Road. Continue for 8.1 miles to Silk Hope Lindley Mill Road. Take Silk Hope-Lindley Mill Road north 3.6 miles. Turn right on Center Church Road and travel 0.9 miles. The Site is located north of Center Church Road.

WILDLANDS ENGINEERING

0 0.5 1 Miles

N

Figure 1 Project Vicinity Map
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016
Chatham County, NC



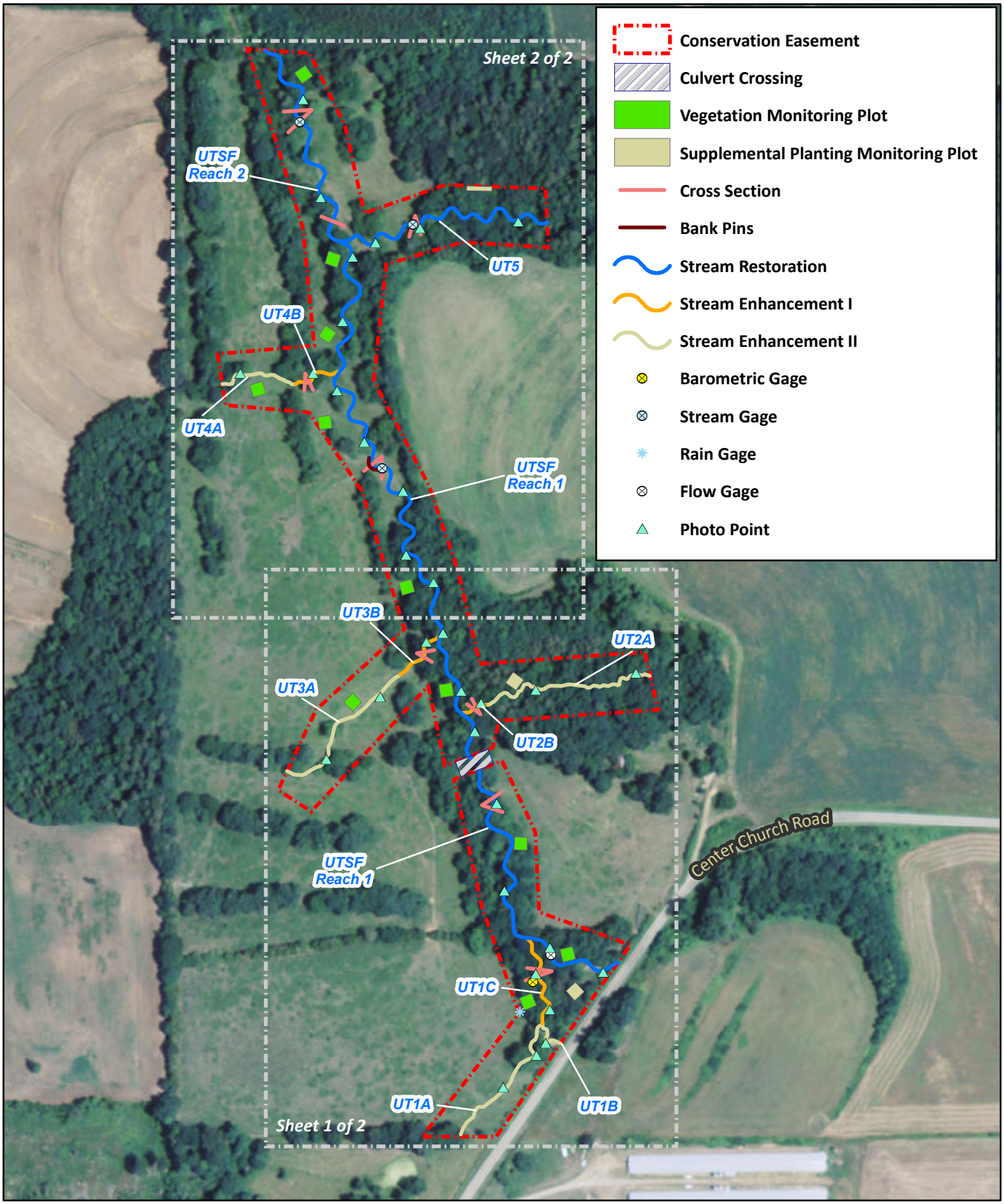
WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 2 Project Compoent/Asset Map
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

Chatham County, NC

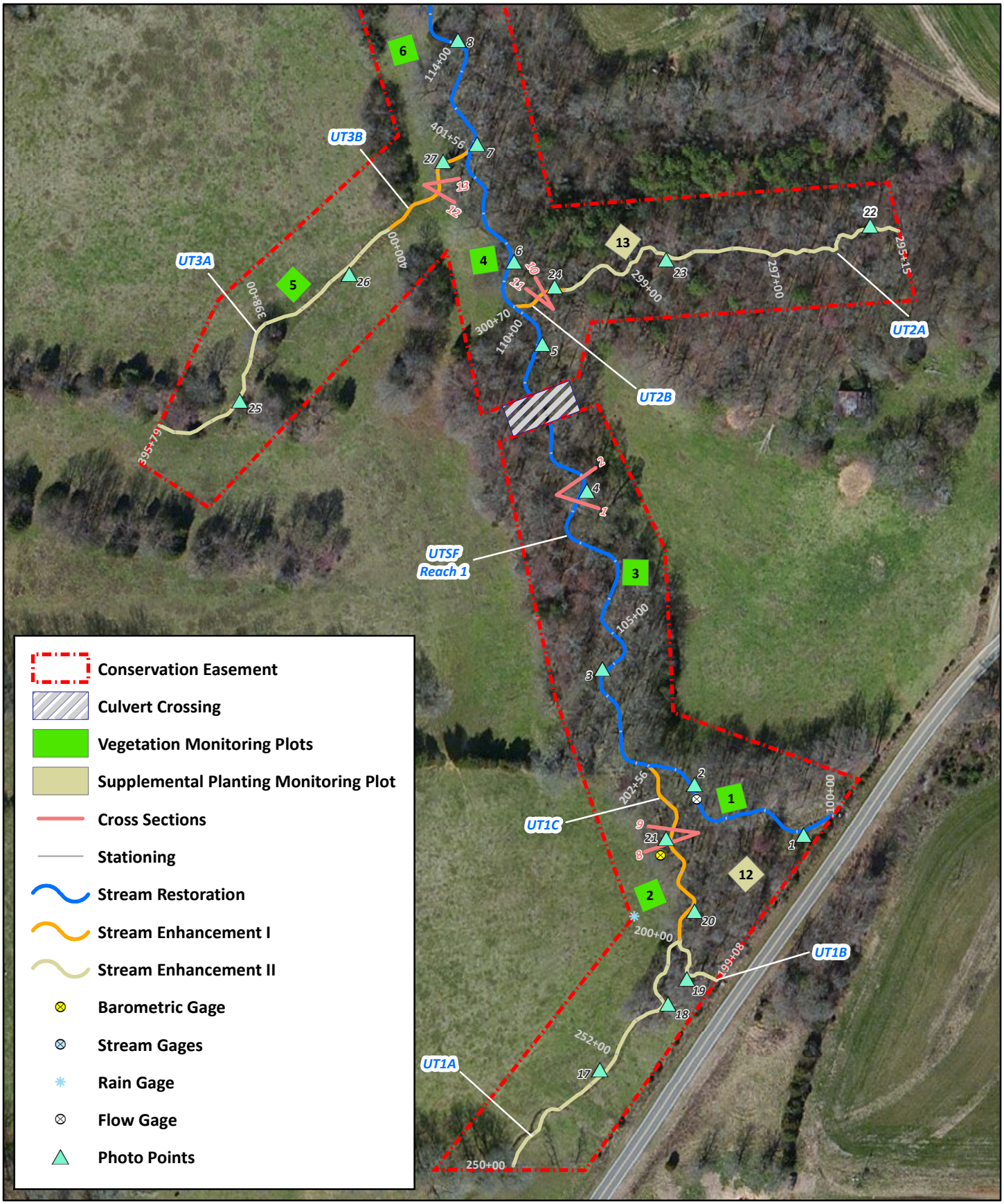


WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 3.0 Monitoring Plan View (Key)
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016
Chatham County, NC

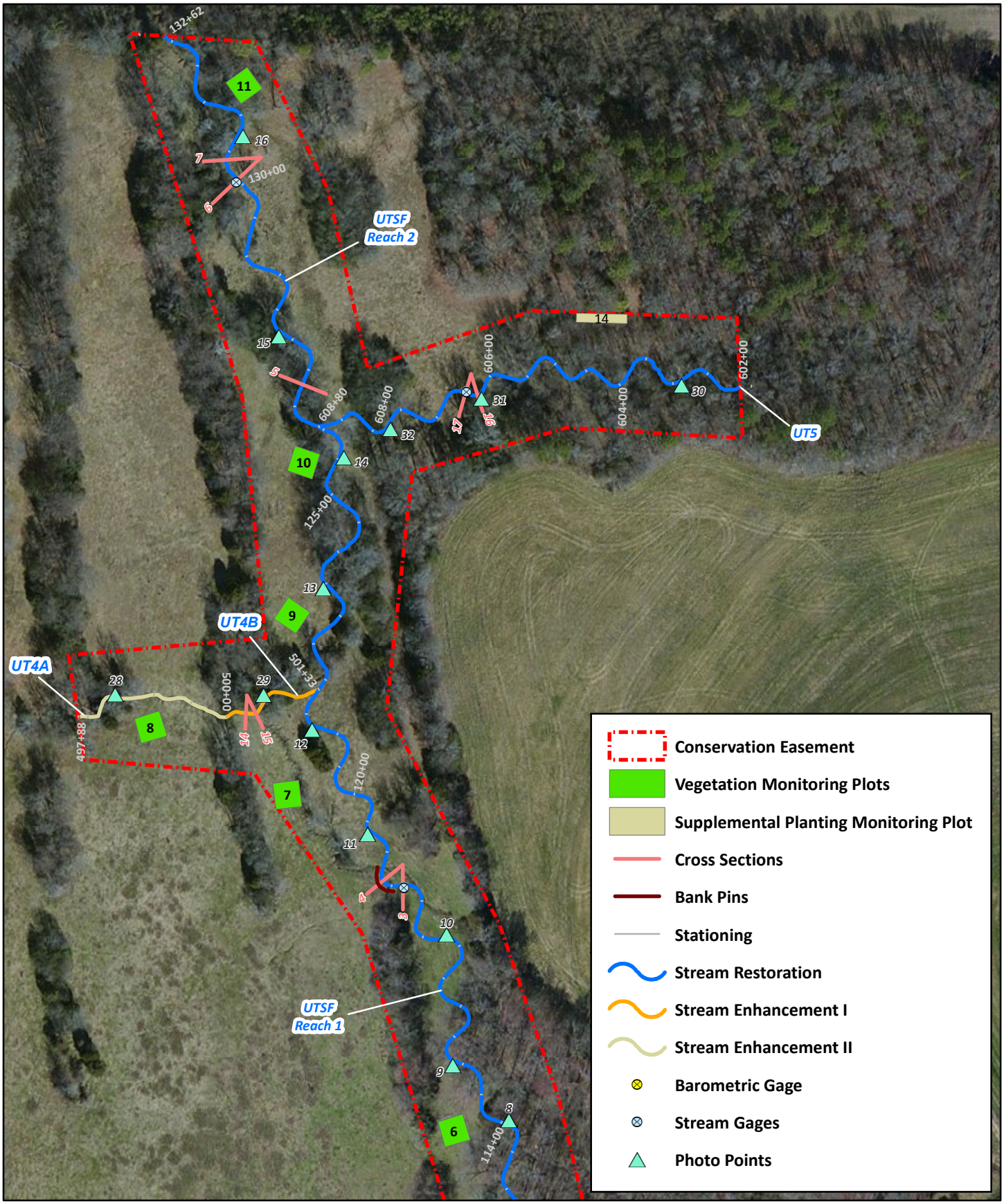


WILDLANDS ENGINEERING

0 50 100 Feet

Figure 3.1 Monitoring Plan View
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

Chatham County, NC



WILDLANDS ENGINEERING

0 50 100 Feet

N

Figure 3.2 Monitoring Plan View
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

Chatham County, NC

Table 1. Project Components and Mitigation Credits
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	4,948	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

PROJECT COMPONENTS							
Reach ID	As-Built Stationing / Location	Existing Footage / Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage / Acreage	Mitigation Ratio	Credits (SMU / WMU)
STREAMS							
UTSF - Reach 1	100+00 - 108+39 108+82 - 121+85	2,298	P1	Restoration	2,142	1:1	2,142
UTSF - Reach 2	121+85 - 132+62	1,209	P1	Restoration	1,077	1:1	1,077
UT1A*	250+00 - 253+89	390	EII	Restoration	389	2.5:1	156
UT1B*	199+08 - 200+00	102	EII	Restoration	92	2.5:1	37
UT1C	200+00 - 202+56	166	EI	Restoration	256	1.5:1	171
UT2A	295+15 - 300+00	485	EII	Restoration	485	2.5:1	194
UT2B	300+00 - 300+70	44	EI	Restoration	70	1.5:1	47
UT3A*	395+79 - 400+00	418	EII	Restoration	421	2.5:1	168
UT3B	400+00 - 401+55	84	EI	Restoration	155	1.5:1	103
UT4A*	497+88 - 500+00	217	EII	Restoration	212	2.5:1	85
UT4B	500+00 - 501+33	40	EI	Restoration	133	1.5:1	89
UT5	602+00 - 608+80	778	P1	Restoration	680	1:1	680

COMPONENT SUMMATION						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	3,899	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	614					
Enhancement II	1,599					
Creation		-	-	-		
Preservation	-	-	-	-		-
High Quality Preservation	-	-	-	-		-

*Differences in the EII stream lengths between the existing and as-built are the result of minor changes to insure proper tie in between the EI and EII reaches.

Table 2. Project Activity and Reporting History
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

Activity or Report	Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	July 2014	August 2015
Final Design - Construction Plans	July 2014	August 2015
Construction	October 2015 - January 2016	January 2016
Temporary S&E mix applied to entire project area [1]	October 2015 - January 2016	January 2016
Permanent seed mix applied to reach/segments [1]	October 2015 - January 2016	January 2016
Bare root and live stake plantings for reach/segments	February 2016	February 2016
Baseline Monitoring Document (Year 0)	January 2016 - February 2016	April 2016
Year 1 Monitoring	2016	December 2016
Year 2 Monitoring	2017	December 2017
Year 3 Monitoring	2018	December 2018
Year 4 Monitoring	2019	December 2019
Year 5 Monitoring	2020	December 2020
Year 6 Monitoring	2021	December 2021
Year 7 Monitoring	2022	December 2022

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

Table 3. Project Contact Table
Maney Farm Mitigation Site
DMS Project No.96314
Monitoring Year 0 - 2016

Designer Jeff Keaton, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes**	**Bruton Natural Systems, Inc**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Jason Lorch 919-851-9986

Table 4. Project Information and Attributes

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0 - 2016

PROJECT INFORMATION									
Project Name	Maney Farm Mitigation Site								
County	Chatham County								
Project Area (acres)	16.69								
Project Coordinates (latitude and longitude)	35°50'18.00" N, 79° 20'38.00" W								
PROJECT WATERSHED SUMMARY INFORMATION									
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province								
River Basin	Cape Fear								
USGS Hydrologic Unit 8-digit	03030002								
USGS Hydrologic Unit 14-digit	03030002050050								
DWR Sub-basin	03-06-04								
Project Drainiage Area (acres)	211								
Project Drainage Area Percentage of Impervious Area	3%								
CGIA Land Use Classification	69% – Agriculture/Managed Herbaceous; 28% – Forested/Scrubland; 3% - Developec								
REACH SUMMARY INFORMATION									
Parameters	**UTSF-R1**	**UTSF-R2**	**UT1A**	**UT1B**	**UT1C**	**UT2A/B**	**UT3A/B**	**UT4A/B**	**UT5**
Length of Reach (linear feet) - Post-Restoration	2,142	1,077	389	92	256	555	576	345	680
Drainage Area (acres)	115	211	16	4	19	11	10	20	76
NCDWR Stream Identification Score	27/37	37	21	25.5	28	26/30	20.75	22.5	32.5
NCDWR Water Quality Classification	N/A								
Morphological Desription (stream type)	I/P	P	I	I	I	I/P	I	I	P
Evolutionary Trend (Simon's Model) - Pre-Restoratior	II/IV	II/IV	III	V	II/IV	II/V	V/VI	II/V	II/III
Underlying Mapped Soils	Cid Silt Loam, Cid-Lignum Complex, Nanford-Badin Complex, Georgeville Silty Clay Loan								
Drainage Class	Well Drained - Moderately Well Drained								
Soil Hydric Status	Cid-Lignum Complex 2 to 6 percent slopes - Hydric								
Slope	0.0131	0.0086	0.0187	0.0396	0.0187	0.0366	0.0377	0.0232	0.0139
FEMA Classification	X								
Native Vegetation Community	Piedmont Bottomland Forest								
Percent Composition Exotic Invasive Vegetation - Post-Restoratior	0%								

REGULATORY CONSIDERATIONS			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	X	X	USACE Nationwide Permit No.27 and DWR 401 Water Quality Certification No. 3885.
Waters of the United States - Section 401	X	X	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	X	X	Maney Farm Mitigation Plan; Wildlands determined "no effect" on Chatham County listed endangered species. The USFWS responded on April 4, 2014 and concurred with NCWRC stating that "the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act."
Historic Preservation Act	X	X	Correspondence from SHPO on March 24, 2014 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 (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	X	X	Correspodence from Chatham County Public Works Director on January 12, 2015 stated that a floodplain development permit is not required since work is not occurring is not located in a Special Flood Hazard Area.
Essential Fisheries Habitat	N/A	N/A	N/A

Table 5. Monitoring Component Summary
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

Parameter	Monitoring Feature	Quantity / Length by Reach											Frequency
		UTSF-R1	UTSF-R2	UT1A	UT1B	UT1C	UT2A	UT2B	UT3A	UT3B	UT4A	UT4B	UT5	
Dimension	Riffle Cross Sections	2	2	N/A	N/A	1	N/A	1	N/A	1	N/A	1	1	Annual
	Pool Cross Sections	2	1	N/A	N/A	1	N/A	1	N/A	1	N/A	1	1	
Pattern	Pattern	N/A												N/A
Profile	Longitudinal Profile	N/A												N/A
Substrate	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	1 RW, 2 RF	1 RW, 2 RF	N/A	N/A	1 RW, 1 RF	N/A	1 RW, 1 RF	N/A	1 RW, 1 RF	N/A	1 RW, 1 RF	1 RW, 1 RF	Annual
Hydrology	Stream (SG) / Flow (FG) Gage	1 SG, 1 FG	1 SG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1 SG	Annual
Vegetation	Vegetation Plots	14												Annual
Visual Assessment	All Streams	Y												Bi-Annual
Exotic and nuisance vegetation														Annual
Project Boundary														Annual
Reference Photos	Photos	12	4	5			3		3		2		3	Annual

APPENDIX 2. Morphological Summary Data and Plots

Table 6a. Baseline Stream Data Summary

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0 - 2016

UT South Fork Reaches 1 and 2

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA				DESIGN				AS-BUILT/BASELINE			
Parameter	**Gage**	**UTSF Reach 1**		**UTSF Reach 2**		**Agony Acres UT1A-Reach 1**		**UT to Cane Creek**		**UTSF Reach 1**		**UTSF Reach 2**		**UTSF Reach 1**		**UTSF Reach 2**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																	
Bankfull Width (ft)		3.2	12.0	4.7	8.2	9.1	10.4	11.5	12.3	9.5		12.1		8.8	9.3	12.7	13.7
Floodprone Width (ft)		15	50	70	82	>36		31		21	48	27	61	85		150	
Bankfull Mean Depth		0.6	1.3	0.7	1.2	1.0	1.2	0.8	1.0	0.7		0.8		0.6	0.7	0.8	0.9
Bankfull Max Depth		1.2	2.0	1.5		1.8		1.2	1.6	1.0	1.2	1.2	1.5	1.0	1.2	1.3	1.4
Bankfull Cross Sectional Area (ft^2)	N/A	4.1	7.1	5.4	5.6	10.7	11.3	8.9	12.2	6.5		10.2		5.3	6.8	10.9	11.0
Width/Depth Ratio		2.5	20.4	4.0	12.3	7.3	10.1	12.3	14.4	14.0		14.0		9.1	9.7	14.5	17.3
Entrenchment Ratio		1.4	12.5	10.0	14.8	>3.9		2.5	2.7	2.2	5.0	2.2	5.0	6.2	9.5	10.9	11.8
Bank Height Ratio		1.3	2.2	1.4	1.9	---		---		0.9	1.1	0.9	1.1	1.0		1.0	
D50 (mm)		Medium Sand		Silt/Clay										8.4		10.4	
Riffle Length (ft)						---		---		---		---		9	50	9	40
Riffle Slope (ft/ft)		0.0036	0.0274	0.0062	0.0258	---		0.0188	0.0704	0.0120	0.0505	0.0106	0.0447	0.0058	0.0432	0.0055	0.0326
Pool Length (ft)	N/A					---		---		---		---		12	47	23	50
Pool Max Depth (ft)		1.5	1.8	1.8	2	2.5		1.8	2.3	1.1	2.1	1.3	2.6	2.4	2.6	2.1	
Pool Spacing (ft)		23	239	44	145	---		27	73	3	67	4	85	29	85	45	78
Pool Volume (ft^3)																	
Pattern																	
Channel Beltwidth (ft)		5	42	10	37	21	93	102		15	85	19	108	24	56	37	54
Radius of Curvature (ft)		4	25	5	13	14	60	23	38	17	55	22	70	9	36	17	28
Rc:Bankfull Width (ft/ft)	N/A	1.3	2.1	1.1	1.6	1.5	5.8	2.0	3.1	1.8	5.8	1.8	5.8	1.0	4.1	1.6	2.6
Meander Length (ft)		18	100	21	59	---		---		29	156	36	198	68	151	110	144
Meander Width Ratio		1.6	3.5	2.1	4.5	2.3	8.9	8.3	8.9	1.6	8.9	1.6	8.9	2.7	6.5	3.4	5.0
Substrate, Bed and Transport Parameters																	
Ri%/Ru%/P%/G%/S%																	
SC%/Sa%/G%/C%/B%/Be%														21/13/64/2/0/0		28/10/56/6/0/0	
d16/d35/d50/d84/d95/d100		SC/VFS/MS/11.1/15.4/22.6		SC/SC/SC/6.1/28.5/180		---		---						SC/2.37/8.4/34.5/55/180		SC/0.40/10.4/37.9/71.7/180	
Reach Shear Stress (Competency) lb/ft^2	N/A	0.39		0.45						0.42		0.44		0.32	0.34	0.35	0.37
Max part size (mm) mobilized at bankfull		28.9		34.2						31.7		33.0					
Stream Power (Capacity) W/m^2										---		---		---		---	
Additional Reach Parameters																	
Drainage Area (SM)		0.18		0.33		0.30		0.29		0.18		0.33		0.18		0.33	
Watershed Impervious Cover Estimate (%)		5%		3%		---		---		5%		3%		5%		3%	
Rosgen Classification		E5		E5		E4		E4		C		C		C		C	
Bankfull Velocity (fps)		2.8	4.8	3.4	3.6	2.2	2.4	3.8		3.0		2.8		2.8	3.6	2.6	2.7
Bankfull Discharge (cfs)		19.6		19.3		25.3		40.0		19.0		29.0		19.0		29.0	
Q-NFF regression (2-yr)										43		67					
Q-USGS extrapolation (1.2-yr)	N/A									22		34					
Q-Mannings										4.8	8.0	6.9	11.0				
Valley Length (ft)		1,720		910		---		---		1,720		910		1,720		910	
Channel Thalweg Length (ft)		2,298		1,209		---		---		2,163		1,061		2,185		1,077	
Sinuosity		1.34		1.33		1.35		1.40		1.20	1.40	1.20	1.40	1.27		1.18	
Water Surface Slope (ft/ft^2)		0.0084		0.0075		---		---		0.0095		0.0113		0.0103		0.0078	
Bankfull Slope (ft/ft)		---		---		---		---		0.0129		0.0114		0.0102	0.0104	0.0077	0.0078

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 6b. Baseline Stream Data Summary

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0 - 2016

UT1C and UT2B

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA		DESIGN				AS-BUILT/BASELINE			
Parameter	**Gage**	**UT1C**		**UT2B**		**UT to Varnals Creek**		**UT1C**		**UT2B**		**UT1C**		**UT2B**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle															
Bankfull Width (ft)		4.1		2.6		9.3	10.5	8.1		4.0		9.8		5.5	
Floodprone Width (ft)		5.3		4.4		20	64	18	41	9	20	60		60	
Bankfull Mean Depth		0.5		0.4		1.1	1.2	0.6		0.4		0.5		0.4	
Bankfull Max Depth		0.8		0.5		1.5	1.7	0.9	1.2	0.5	0.7	0.7		0.7	
Bankfull Cross Sectional Area (ft^2)	N/A	2.1		1.1		10.3	12.3	5.2		1.5		4.9		2.3	
Width/Depth Ratio		8.1		6.2		8.1	9.3	13.0		11.0		19.4		13.2	
Entrenchment Ratio		1.3		1.7		1.9	6.1	2.2	5.0	2.2	5.0	6.1		10.8	
Bank Height Ratio		2.3		5.4		0.9	1.0	0.9	1.1			1.0		1.0	
D50 (mm)		---		---								3.3		0.1	
Riffle Length (ft)						---		---		---		8	22	11	19
Riffle Slope (ft/ft)		---		---		0.0240	0.0570	0.0086	0.0355	0.0083	0.0342	0.0011	0.0110	0.0073	0.0106
Pool Length (ft)						---		---		---		6	22	13	19
Pool Max Depth (ft)	N/A	---		---		2.5	2.6	0.9	1.8	0.6	1.2	2.0		1.5	
Pool Spacing (ft)		34	44	---		8	82	2	44	1	24	22	38	22	
Pool Volume (ft^3)															
Channel Beltwidth (ft)		10	18	1	2	15	45	13	72	6	36	16	26	---	
Radius of Curvature (ft)		9	16	1	3	8	47	11	47	5	23	9	15	13	25
Rc:Bankfull Width (ft/ft)	N/A	2.2	3.9	0.4	1.2	0.6	3.2	1.3	5.8	1.3	5.8	1.0	1.6	1.8	3.3
Meander Length (ft)		54	63	12		---		24	133	12	66	55	73	---	
Meander Width Ratio		2.4	4.4	0.4	0.8	1.0	3.0	1.6	8.9	1.6	8.9	1.7	2.8	---	
Ri%/Ru%/P%/G%/S%															
SC%/Sa%/G%/C%/B%/Be%												24/17/58/1/0/0		47/13/37/3/0/0	
d16/d35/d50/d84/d95/d100	N/A	---		---		---						SC/0.21/3.3/22.6/34.8/128		SC/SC/0.1/22.6/50.6/128	
Reach Shear Stress (Competency) lb/ft^2		---		---				---		---		0.15		0.23	
Max part size (mm) mobilized at bankfull		---		---				---		---					
Stream Power (Capacity) W/m^2								---		---		---		---	
Additional Reach Parameters															
Drainage Area (SM)		0.03		0.02		0.41		0.03		0.02		0.03		0.02	
Watershed Impervious Cover Estimate (%)		13%		0%		---		13%		0%		13%		0%	
Rosgen Classification		B5		B5		E4		C		C		C		C	
Bankfull Velocity (fps)		3.0		3.4		4.4	5.2	1.1		3.1		1.1		1.6	
Bankfull Discharge (cfs)		---		---		54.0		5.6		3.6		5.6		3.6	
Q-NFF regression (2-yr)								13		8					
Q-USGS extrapolation (1.2-yr)	N/A							6		4					
Q-Mannings								4.1	5.7	6.9	7.3				
Valley Length (ft)		142		42		---		220		62		231		67	
Channel Thalweg Length (ft)		166		44		---		260		74		256		70	
Sinuosity		1.17		1.04		1.20		1.10	1.25	1.10	1.25	1.11		1.04	
Water Surface Slope ($ft/ft)^2$		---		---		---		---		---		0.0053		0.0101	
Bankfull Slope (ft/ft)		---		---		---		0.0083		0.0080		0.0078	0.0080	0.0070	0.0084

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 6c. Baseline Stream Data Summary
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

UT1C and UT2B

		PRE-RESTORATION CONDITION				REFERENCE REACH DATA		DESIGN				AS-BUILT/BASELINE			
Parameter	**Gage**	**UT3B**		**UT4B**		**UT to Varnals Creek**		**UT3B**		**UT4B**		**UT3B**		**UT4B**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle															
Bankfull Width (ft)		2.2		4.4		9.3	10.5	4.0		5.0		4.2		5.7	
Floodprone Width (ft)		11.4		23.3		20	64	9	20	11	25	60		25	
Bankfull Mean Depth		0.5		0.4		1.1	1.2	0.4		0.4		0.4		0.6	
Bankfull Max Depth		0.8		1.0		1.5	1.7	0.5	0.7	0.5	0.7	0.6		0.9	
Bankfull Cross Sectional Area (ft^2)	N/A	1.1		1.9		10.3	12.3	1.5		1.9		1.6		3.6	
Width/Depth Ratio		4.6		9.9		8.1	9.3	11.0		13.0		11.6		9.1	
Entrenchment Ratio		5.1		5.3		1.9	6.1	2.2	5.0	2.2	5.0	14.1		4.3	
Bank Height Ratio		2.2		1.4		0.9	1.0	0.9	1.1	0.9	1.1	1.0		1.0	
D50 (mm)		---		---								5.6		4.0	
Riffle Length (ft)						---		---		---		12	23	8	19
Riffle Slope (ft/ft)		---		---		0.0240	0.0570	0.0191	0.0786	0.0088	0.0312	0.0112	0.0419	0.0035	0.0113
Pool Length (ft)						---		---		---		10	22	10	21
Pool Max Depth (ft)	N/A	---		---		2.5	2.6	0.6	1.2	0.6	1.2	1.3		1.4	
Pool Spacing (ft)		56	157	---		8	82	1	24	3	31	30	36	31	
Pool Volume (ft^3)															
Channel Beltwidth (ft)		---		2	3	15	45	6	36	8	45	12	23	19	23
Radius of Curvature (ft)		---		2	3	8	47	5	23	7	29	11	47	10	20
Rc:Bankfull Width (ft/ft)	N/A	---		0.5	0.7	0.6	3.2	1.3	5.8	1.3	5.8	1.7	7.6	1.8	3.6
Meander Length (ft)		---		11	22	---		12	66	15	82	55	68	59	69
Meander Width Ratio		---		0.5	0.7	1.0	3.0	1.6	8.9	1.6	8.9	1.9	3.7	3.3	4.1
Ri%/Ru%/P%/G%/S%															
SC%/Sa%/G%/C%/B%/Be%												32/14/51/3/0/0		22/20/57/1/0/0	
d16/d35/d50/d84/d95/d100	N/A	---		---		---						SC/0.08/5.6/33.4/56.9/90		SC/0.25/4.0/20.1/45/90	
Reach Shear Stress (Competency) lb/ft^2		---		---				---		---		0.33		0.14	
Max part size (mm) mobilized at bankfull		---		---				---		---					
Stream Power (Capacity) W/m^2								---		---		---		---	
Additional Reach Parameters															
Drainage Area (SM)		0.02		0.03		0.41		0.02		0.03		0.02		0.03	
Watershed Impervious Cover Estimate (%)		0%		0%		---		0%		0%		0%		0%	
Rosgen Classification		E5b		E5b		E4		C		C		C		E	
Bankfull Velocity (fps)		3.2		3.0		4.4	5.2	3.3		3.3		2.2		1.5	
Bankfull Discharge (cfs)		---		---		54.0		3.5		5.3		3.5		5.3	
Q-NFF regression (2-yr)								8		12					
Q-USGS extrapolation (1.2-yr)	N/A							4		6					
Q-Mannings								7.8	12.0	4.1	5.5				
Valley Length (ft)		84		38		---		138		117		148		124	
Channel Thalweg Length (ft)		84		40		---		163		138		155		212	
Sinuosity		1.00		1.06		1.20		1.10	1.25	1.10	1.25	1.05		1.71	
Water Surface Slope $(ft/ft)^2$		---		---		---		---		---		0.0164		0.0043	
Bankfull Slope (ft/ft)		---		---		---		0.0170		0.0073		0.0127	0.0161	0.0059	0.0067

SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 6d. Baseline Stream Data Summary

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0 - 2016

UT South Fork Reaches 1 and 2

		PRE-RESTORATION		REFERENCE REACH DATA				DESIGN		AS-BUILT/BASELINE	
Parameter	**Gage**	**UT5**		**Agony Acres UT1A-Reach 1**		**UT to Cane Creek**		**UT5**		**UT5**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle											
Bankfull Width (ft)	N/A	5.7		9.1	10.4	11.5	12.3	7.2		8.1	
Floodprone Width (ft)		40		>36		31		16	36	100	
Bankfull Mean Depth		0.6		1.0	1.2	0.8	1.0	0.6		0.5	
Bankfull Max Depth		1.2		1.8		1.2	1.6	0.8	1.0	0.9	
Bankfull Cross Sectional Area (ft^2)		3.5		10.7	11.3	8.9	12.2	4.1		4.0	
Width/Depth Ratio		9.1		7.3	10.1	12.3	14.4	13.0		16.6	
Entrenchment Ratio		7.1		>3.9		2.5	2.7	2.2	5.0	12.3	
Bank Height Ratio		1.4		---		---		0.9	1.1	1.0	
D50 (mm)		Silt/Clay								5.9	
Riffle Length (ft)	N/A			---		---		---		5	21
Riffle Slope (ft/ft)		0.0028	0.0638	---		0.0188	0.0704	0.0128	0.0541	0.0081	0.0374
Pool Length (ft)				---		---		---		18	42
Pool Max Depth (ft)		1.4		2.5		1.8	2.3	0.9	1.8	1.7	
Pool Spacing (ft)		9	197	---		27	73	2	44	31	51
Pool Volume (ft^3)											
Pattern											
Channel Beltwidth (ft)	N/A	3	18	21	93	102		12	64	22	40
Radius of Curvature (ft)		3	14	14	60	23	38	13	42	10	37
Rc:Bankfull Width (ft/ft)		0.5	2.5	1.5	5.8	2.0	3.1	1.3	5.8	1.0	3.7
Meander Length (ft)		16	58	---		---		22	118	63	97
Meander Width Ratio		0.5	3.2	2.3	8.9	8.3	8.9	1.6	8.9	2.3	4.0
Substrate, Bed and Transport Parameters											
Ri%/Ru%/P%/G%/S%	N/A										
SC%/Sa%/G%/C%/B%/Be%										34/11/54/1/0/0	
d16/d35/d50/d84/d95/d100		SC/SC/SC/8.9/22.6/64		---		---				SC/0.08/5.9/29.8/53.7/90	
Reach Shear Stress (Competency) lb/ft^2		0.19						0.37		0.31	
Max part size (mm) mobilized at bankfull		14.0						27.5			
Stream Power (Capacity) W/m^2								---		---	
Additional Reach Parameters											
Drainage Area (SM)	N/A	0.12		0.30		0.29		0.12		0.12	
Watershed Impervious Cover Estimate (%)		0%		---		---		0%		0%	
Rosgen Classification		E5		E4		E4		C		C	
Bankfull Velocity (fps)		2.1		2.2	2.4	3.8		2.9		3.5	
Bankfull Discharge (cfs)		7.4		25.3		40.0		14.0		14.0	
Q-NFF regression (2-yr)								32			
Q-USGS extrapolation (1.2-yr)								16			
Q-Mannings								5.4	11.0		
Valley Length (ft)		580		---		---		520		515	
Channel Thalweg Length (ft)		778		---		---		677		680	
Sinuosity		1.34		1.35		1.40		1.20	1.40	1.3	
Water Surface Slope $(ft/ft)^2$		0.0111		---		---		---		0.0114	
Bankfull Slope (ft/ft)		---		---		---		0.0138		0.0110	0.0114

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 7a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross Section)
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

	Cross Section 1, UTSF Reach 1 (Riffle)								Cross Section 2, UTSF Reach 1 (Pool)								Cross Section 3, UTSF Reach 1 (Riffle)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	567.0								566.4								556.5							
Bankfull Width (ft)	8.8								11.1								9.3							
Floodprone Width (ft)	85								---								85							
Bankfull Mean Depth (ft)	0.6								1.2								0.7							
Bankfull Max Depth (ft)	1.0								2.6								1.2							
Bankfull Cross Sectional Area (ft^2)	5.3								13.6								6.8							
Bankfull Width/Depth Ratio	14.6								9.1								12.8							
Bankfull Entrenchment Ratio	9.7								---								9.1							
Bankfull Bank Height Ratio	1.0								1.0								1.0							
	Cross Section 4, UTSF Reach 1 (Pool)								**Cross Section 5, UTSF Reach 2 (Riffle)**								**Cross Section 6, UTSF Reach 2 (Riffle)**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	556.0								549.9								547.9							
Bankfull Width (ft)	14.8								12.7								13.7							
Floodprone Width (ft)	---								150								150							
Bankfull Mean Depth (ft)	1.2								0.9								0.8							
Bankfull Max Depth (ft)	2.4								1.4								1.3							
Bankfull Cross Sectional Area (ft^2)	17.5								11.0								10.9							
Bankfull Width/Depth Ratio	12.6								14.5								17.3							
Bankfull Entrenchment Ratio	---								11.8								10.9							
Bankfull Bank Height Ratio	1.0								1.0								1.0							
	Cross Section 7, UTSF Reach 2 (Pool)								**Cross Section 8, UT1C (Pool)**								**Cross Section 9, UT1C (Riffle)**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	547.0								572.5								572.4							
Bankfull Width (ft)	12.3								7.6								9.8							
Floodprone Width (ft)	---								---								60							
Bankfull Mean Depth (ft)	1.2								1.0								0.5							
Bankfull Max Depth (ft)	2.1								2.0								0.7							
Bankfull Cross Sectional Area (ft^2)	14.7								7.7								4.9							
Bankfull Width/Depth Ratio	10.3								7.6								19.4							
Bankfull Entrenchment Ratio	---								---								6.1							
Bankfull Bank Height Ratio	1.0								1.0								1.0							

Table 7b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross Section)
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

	Cross Section 10, UT2B (Pool)								Cross Section 11, UT2B (Riffle)								Cross Section 12, UT3B (Pool)							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	564.2								563.9								563.0							
Bankfull Width (ft)	10.7								5.5								6.2							
Floodprone Width (ft)	---								60								---							
Bankfull Mean Depth (ft)	0.8								0.4								0.6							
Bankfull Max Depth (ft)	1.5								0.7								1.3							
Bankfull Cross Sectional Area (ft^2)	8.6								2.3								3.8							
Bankfull Width/Depth Ratio	13.3								13.2								10.1							
Bankfull Entrenchment Ratio	---								10.8								---							
Bankfull Bank Height Ratio	1.0								1.0								1.0							
	Cross Section 13, UT3B (Riffle)								**Cross Section 14, UT4B (Riffle)**								**Cross Section 15, UT4B (Pool)**							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
based on fixed bankfull elevation	562.8								553.8								553.6							
Bankfull Width (ft)	4.2								5.7								6.3							
Floodprone Width (ft)	60								25								---							
Bankfull Mean Depth (ft)	0.4								0.6								0.7							
Bankfull Max Depth (ft)	0.6								0.9								1.4							
Bankfull Cross Sectional Area (ft^2)	1.6								3.6								4.5							
Bankfull Width/Depth Ratio	11.6								9.1								8.7							
Bankfull Entrenchment Ratio	14.1								4.3								---							
Bankfull Bank Height Ratio	1.0								1.0								1.0							
	Cross Section 16, UT5 (Pool)								**Cross Section 17, UT5 (Riffle)**															
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**								
based on fixed bankfull elevation	552.6								552.5															
Bankfull Width (ft)	8.0								8.1															
Floodprone Width (ft)	---								100															
Bankfull Mean Depth (ft)	1.0								0.5															
Bankfull Max Depth (ft)	1.7								0.9															
Bankfull Cross Sectional Area (ft^2)	7.9								4.0															
Bankfull Width/Depth Ratio	8.0								16.6															
Bankfull Entrenchment Ratio	---								12.3															
Bankfull Bank Height Ratio	1.0								1.0															

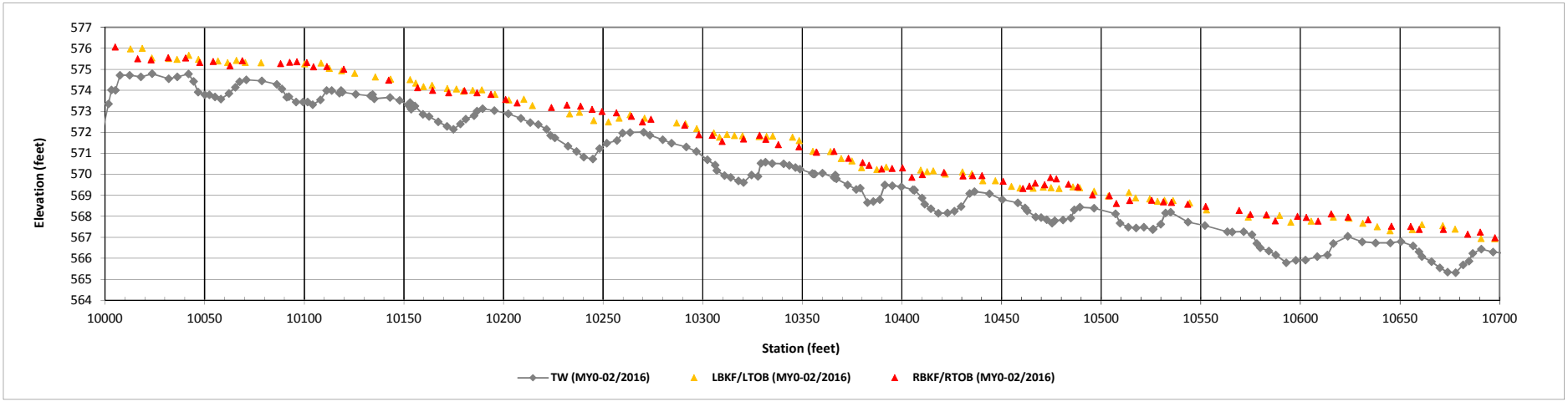
Longitudinal Profile Plots

Maney Farm Mitigation Project

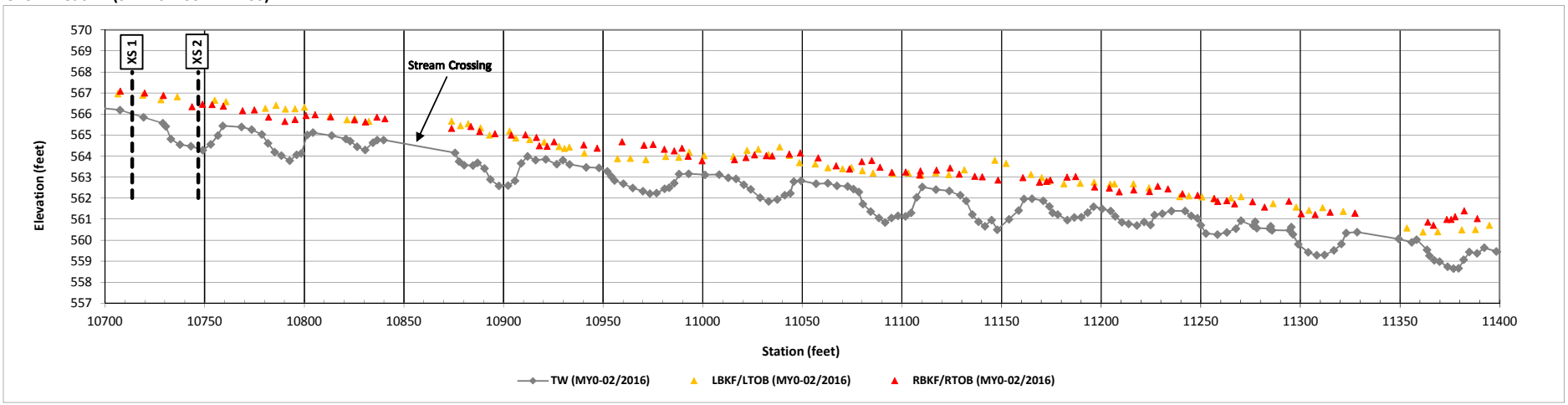
DMS Project No. 96314

Monitoring Year 0 - 2016

UTSF - Reach 1 (STA 100+00 - 107+00)



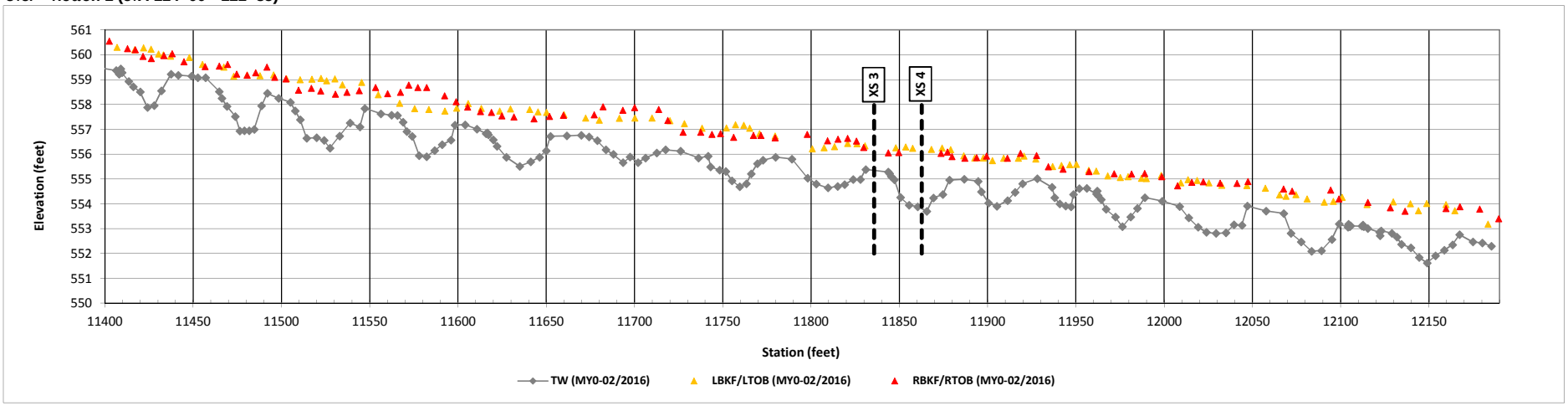
UTSF - Reach 1 (STA 107+00 - 114+00)



Longitudinal Profile Plots

Maney Farm Mitigation Project (DMS Project No. 96314)
Monitoring Year 0 - 2016

UTSF - Reach 1 (STA 114+00 - 121+85)



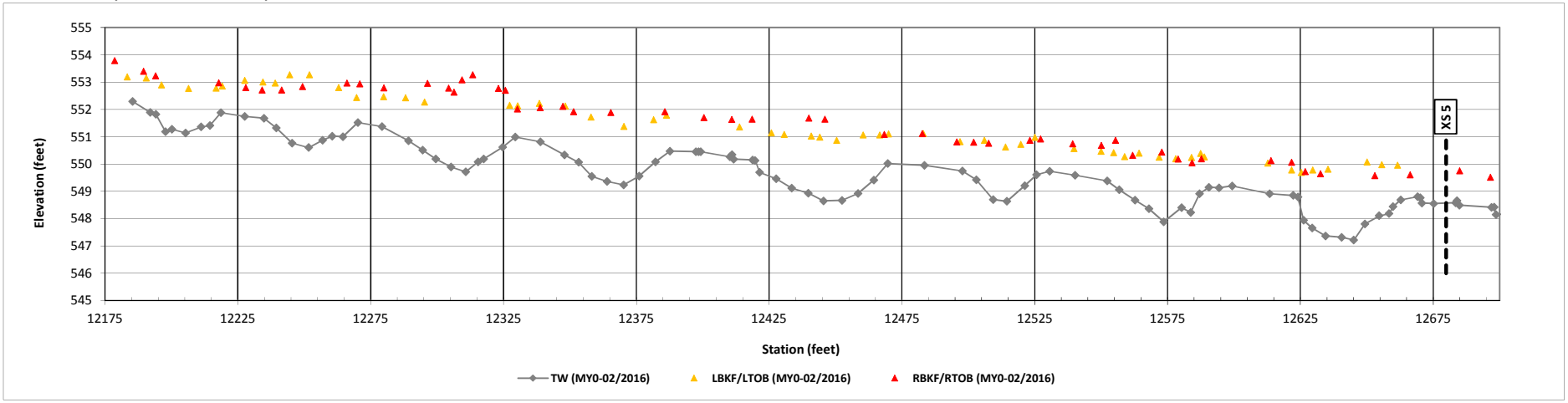
Longitudinal Profile Plots

Maney Farm Mitigation Project

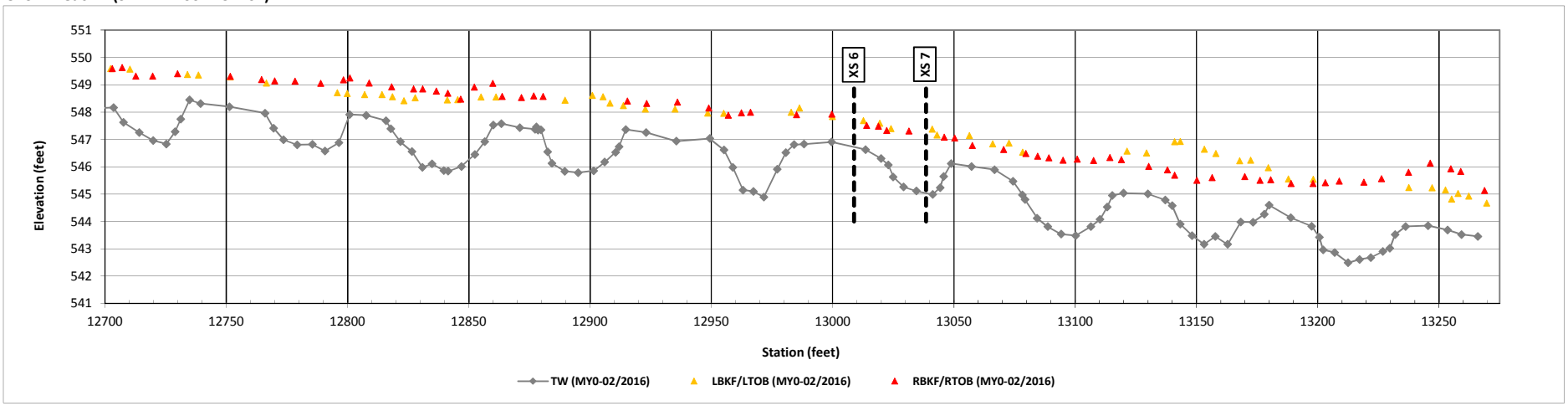
DMS Project No. 96314

Monitoring Year 0 - 2016

UTSF - Reach 2 (STA 121+85 - 127+00)



UTSF - Reach 2 (STA 127+00 - 132+62)



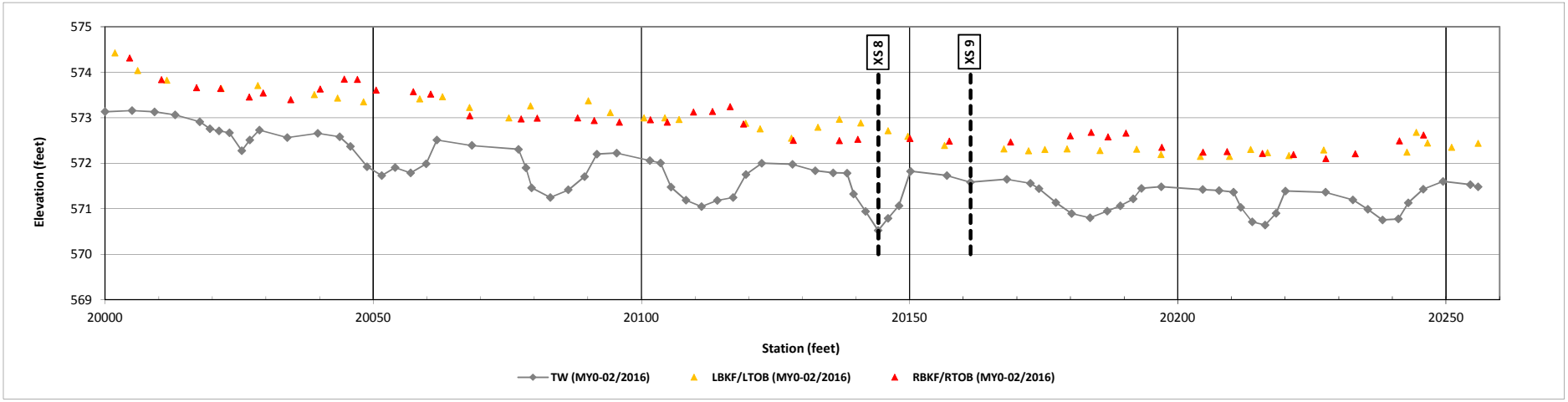
Longitudinal Profile Plots

Maney Farm Mitigation Project

DMS Project No. 96314

Monitoring Year 0 - 2016

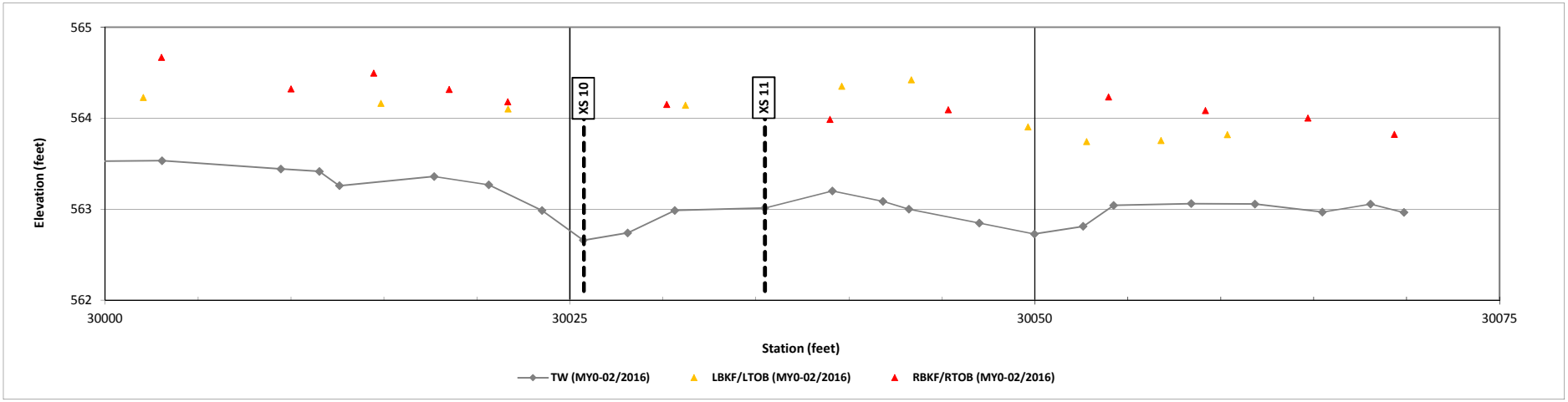
UT1C (STA 200+00 - 202+56)



Longitudinal Profile Plots

Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

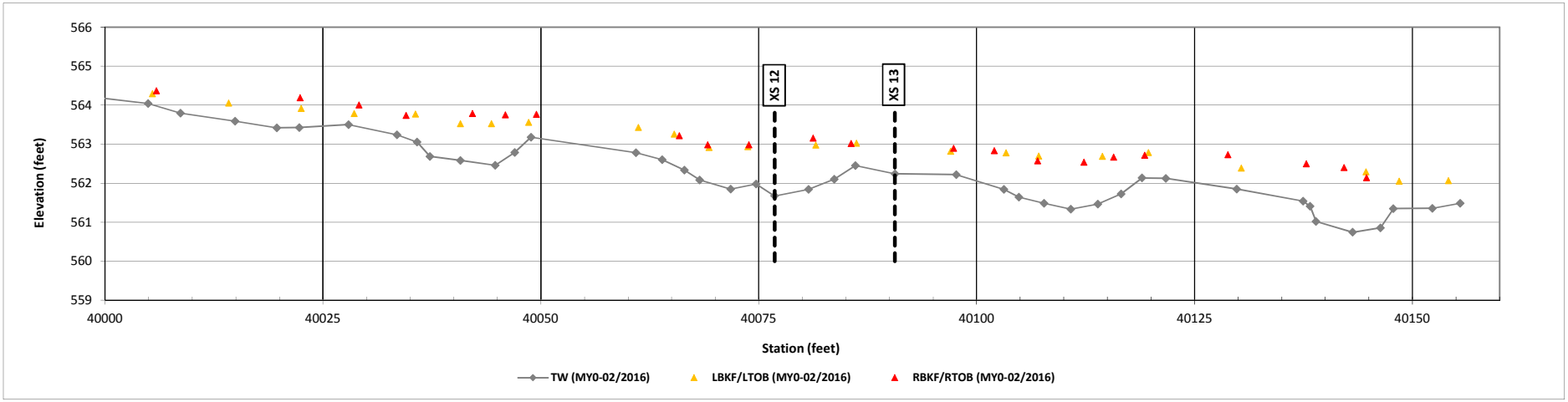
UT2B (STA 300+00 - 300+70)



Longitudinal Profile Plots

Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

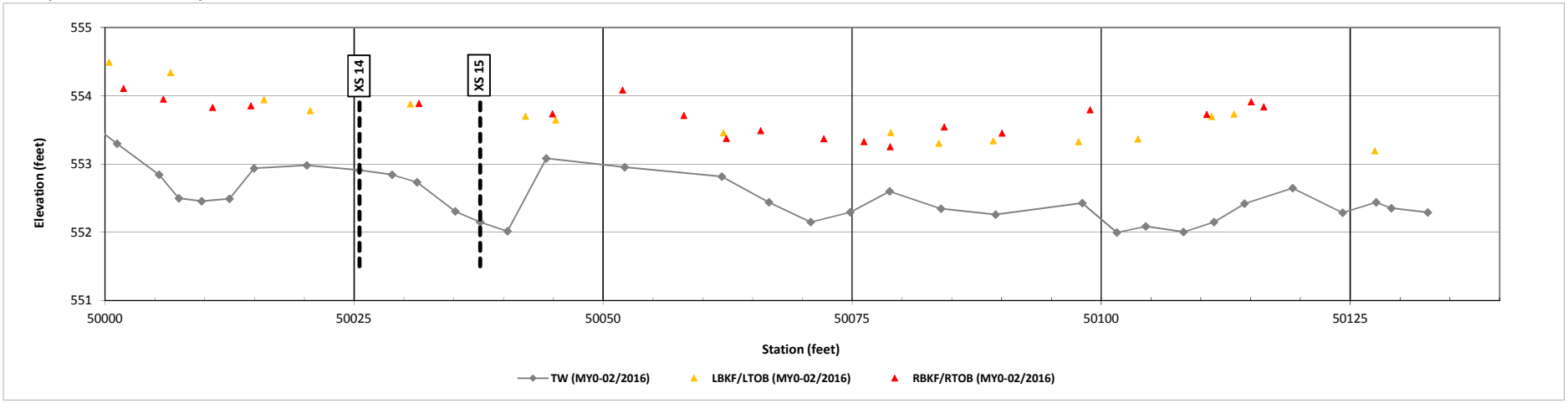
UT3B (STA 400+00 - 401+56)



Longitudinal Profile Plots

Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

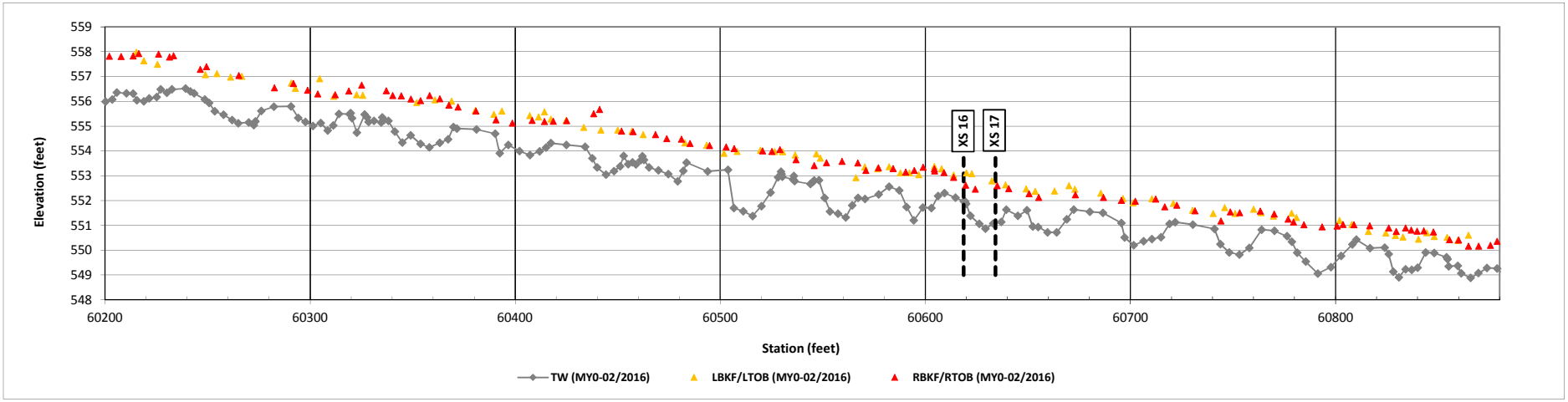
UT4B (STA 500+00 - 501+33)



Longitudinal Profile Plots

Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

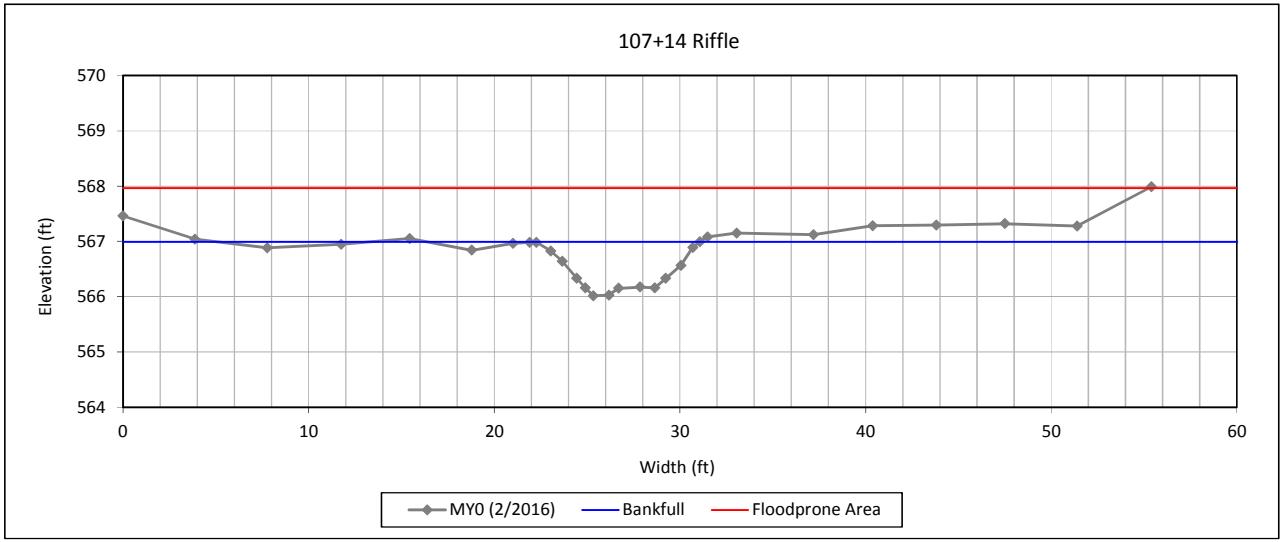
UT5 (STA 602+00 - 608+80)



Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 1, UTSF Reach 1



Bankfull Dimensions	
5.3	x-section area (ft.sq.)
8.8	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
9.1	wetted parameter (ft)
0.6	hydraulic radius (ft)
14.6	width-depth ratio
85.0	W flood prone area (ft)
9.7	entrenchment ratio
1.0	low bank height ratio

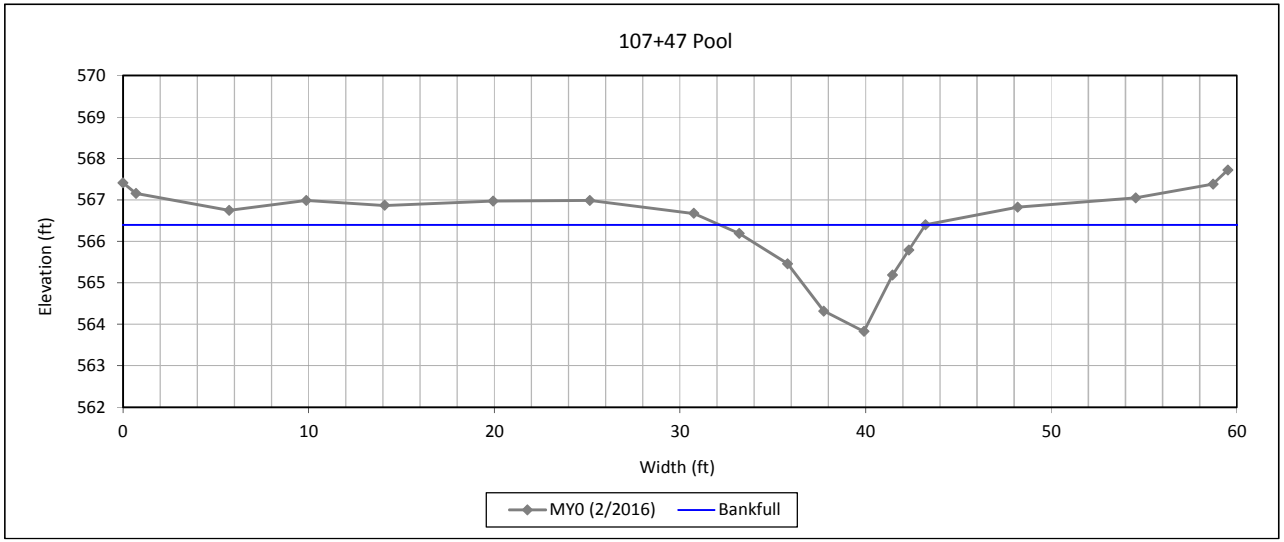
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 2, UTSF Reach 1



Bankfull Dimensions	
13.6	x-section area (ft.sq.)
11.1	width (ft)
1.2	mean depth (ft)
2.6	max depth (ft)
12.5	wetted parameter (ft)
1.1	hydraulic radius (ft)
9.1	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

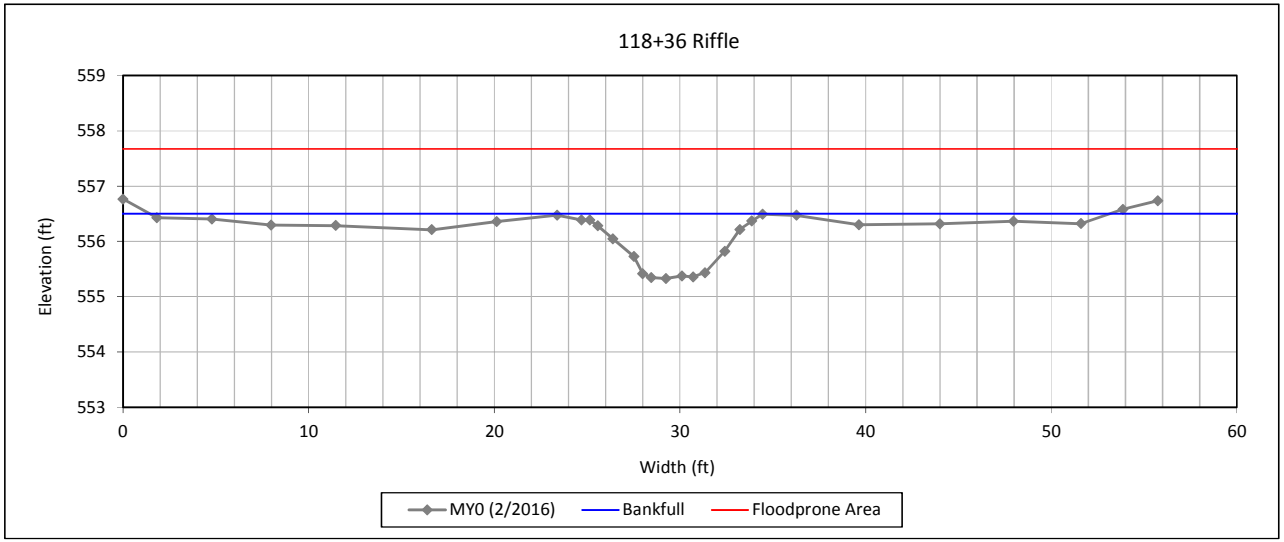
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 3, UTSF Reach 1



Bankfull Dimensions	
6.8	x-section area (ft.sq.)
9.3	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
9.7	wetted parameter (ft)
0.7	hydraulic radius (ft)
12.8	width-depth ratio
85.0	W flood prone area (ft)
9.1	entrenchment ratio
1.0	low bank height ratio

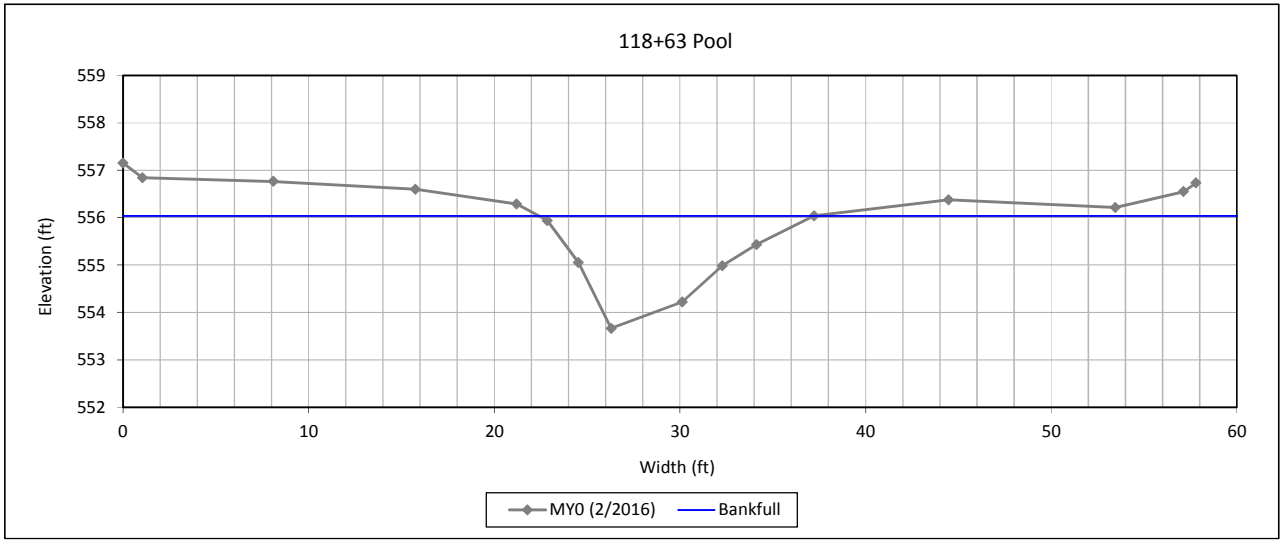
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 4, UTSF Reach 1



Bankfull Dimensions	
17.5	x-section area (ft.sq.)
14.8	width (ft)
1.2	mean depth (ft)
2.4	max depth (ft)
15.8	wetted parameter (ft)
1.1	hydraulic radius (ft)
12.6	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

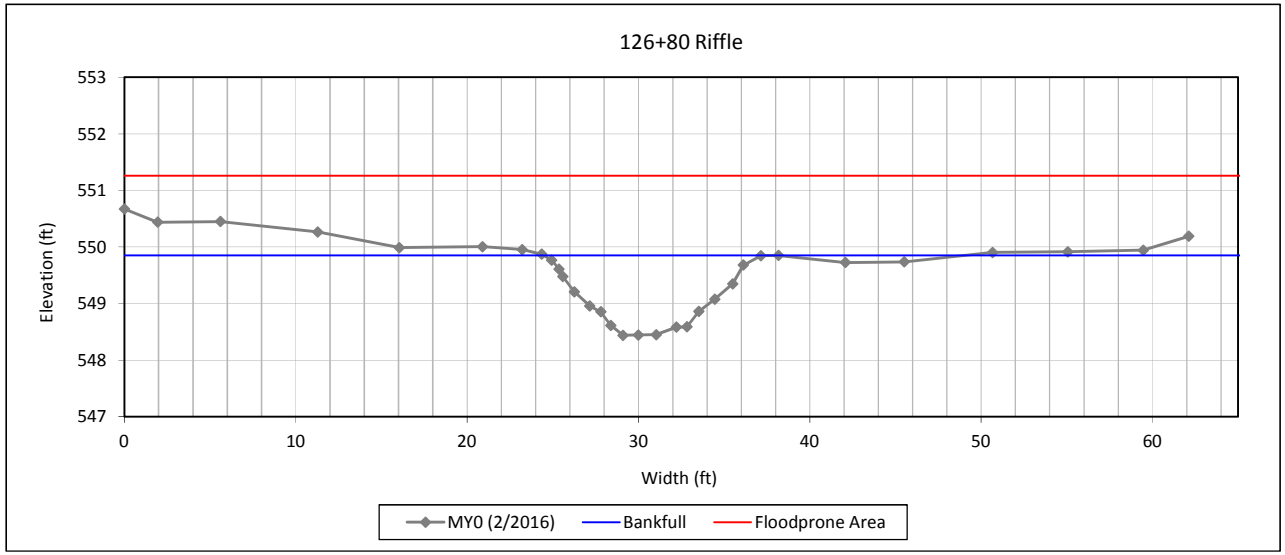
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 5, UTSF Reach 2



Bankfull Dimensions	
11.0	x-section area (ft.sq.)
12.7	width (ft)
0.9	mean depth (ft)
1.4	max depth (ft)
13.1	wetted parameter (ft)
0.8	hydraulic radius (ft)
14.5	width-depth ratio
150.0	W flood prone area (ft)
11.8	entrenchment ratio
1.0	low bank height ratio

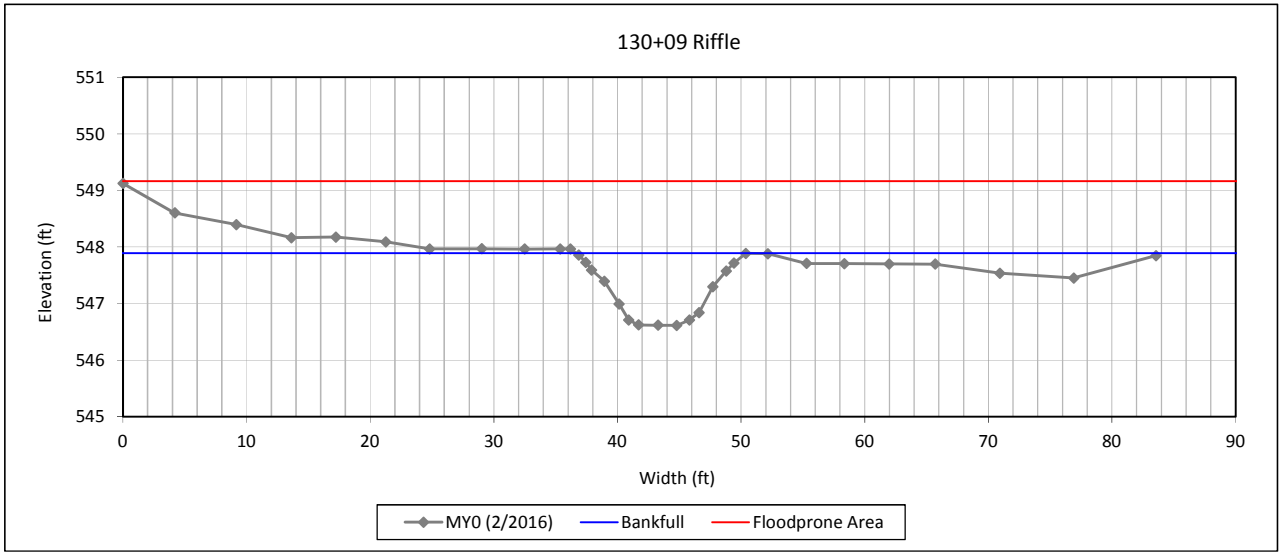
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 6, UTSF Reach 2



Bankfull Dimensions	
10.9	x-section area (ft.sq.)
13.7	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
14.1	wetted parameter (ft)
0.8	hydraulic radius (ft)
17.3	width-depth ratio
150.0	W flood prone area (ft)
10.9	entrenchment ratio
1.0	low bank height ratio

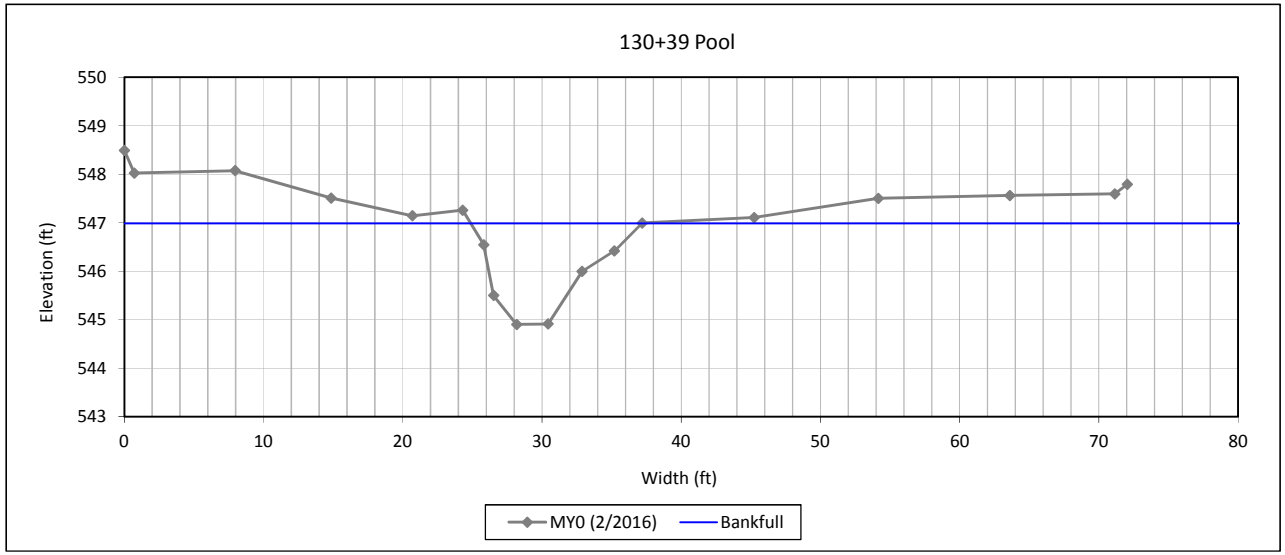
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 7, UTSF Reach 2



Bankfull Dimensions	
14.7	x-section area (ft.sq.)
12.3	width (ft)
1.2	mean depth (ft)
2.1	max depth (ft)
13.4	wetted parameter (ft)
1.1	hydraulic radius (ft)
10.3	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

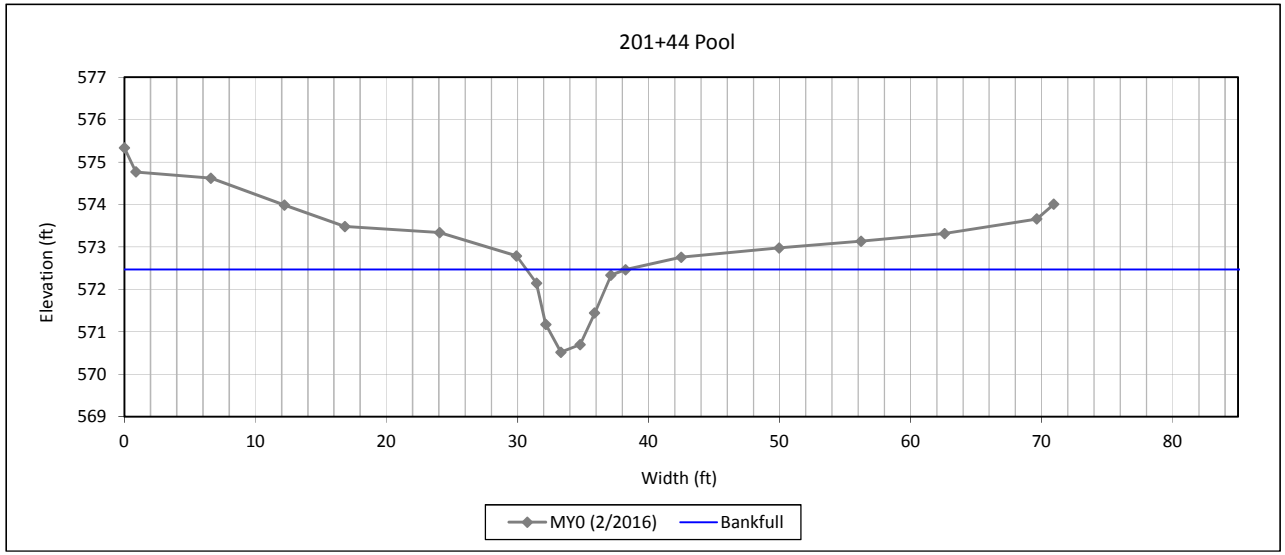
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 8, UT1C



Bankfull Dimensions	
7.7	x-section area (ft.sq.)
7.6	width (ft)
1.0	mean depth (ft)
2.0	max depth (ft)
8.9	wetted parameter (ft)
0.9	hydraulic radius (ft)
7.6	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

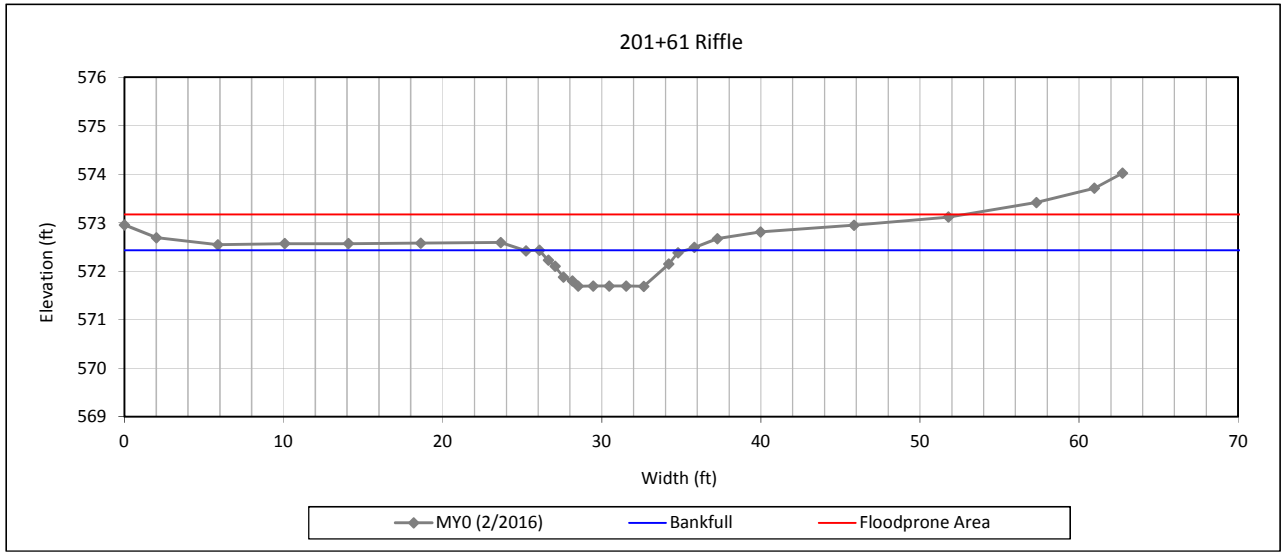
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 9, UT1C



Bankfull Dimensions	
4.9	x-section area (ft.sq.)
9.8	width (ft)
0.5	mean depth (ft)
0.7	max depth (ft)
10.0	wetted parameter (ft)
0.5	hydraulic radius (ft)
19.4	width-depth ratio
60.0	W flood prone area (ft)
6.1	entrenchment ratio
1.0	low bank height ratio

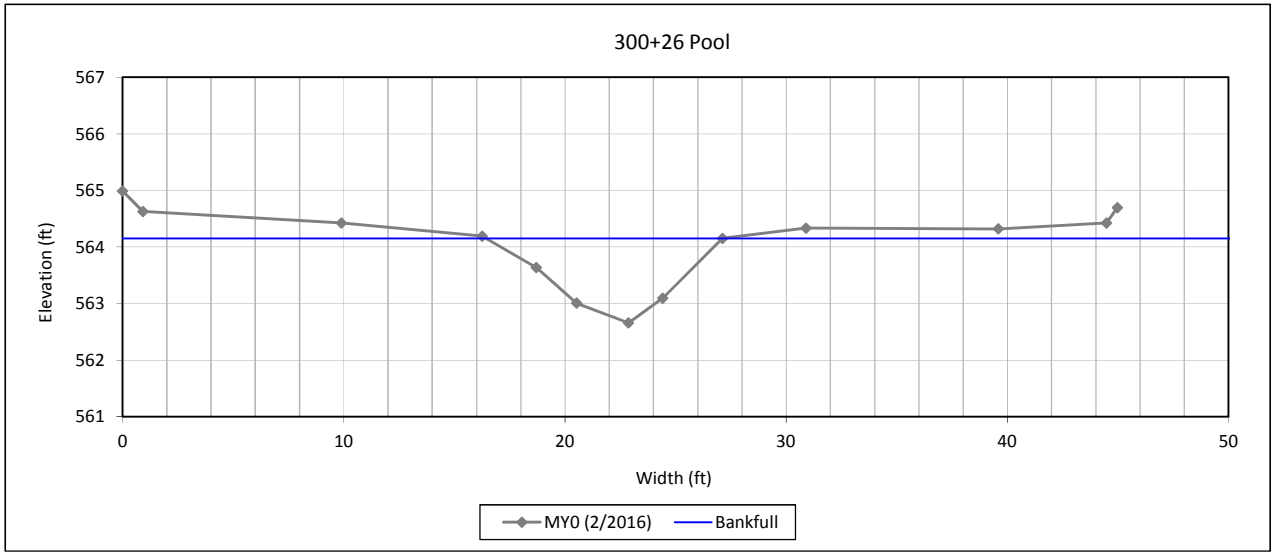
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 10, UT2B



Bankfull Dimensions	
8.6	x-section area (ft.sq.)
10.7	width (ft)
0.8	mean depth (ft)
1.5	max depth (ft)
11.1	wetted parameter (ft)
0.8	hydraulic radius (ft)
13.3	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

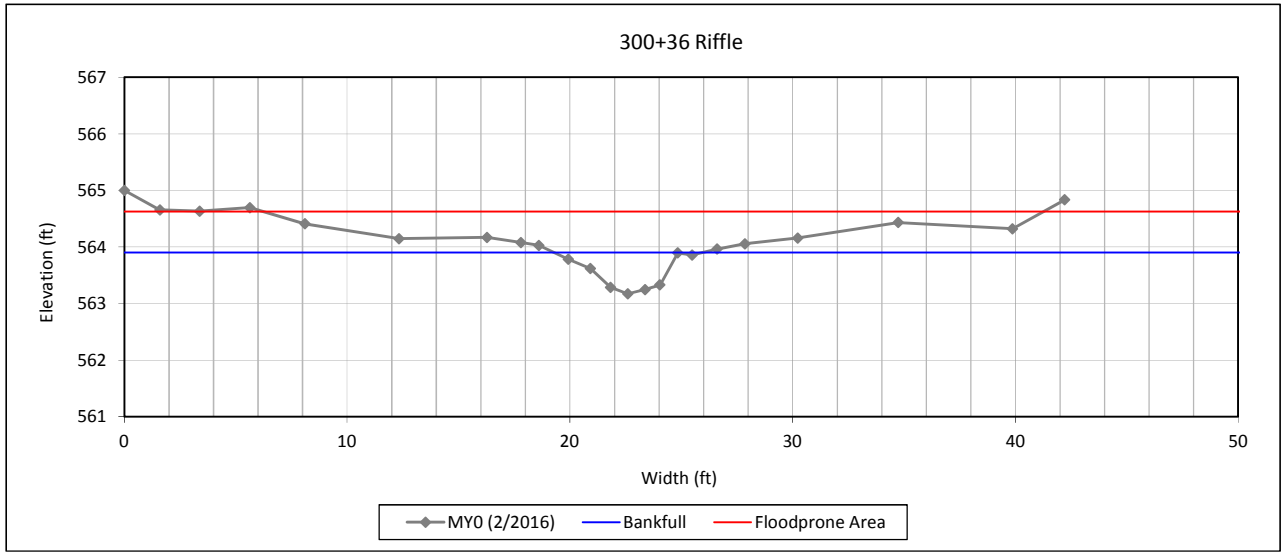
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 11, UT2B



Bankfull Dimensions	
2.3	x-section area (ft.sq.)
5.5	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
5.8	wetted parameter (ft)
0.4	hydraulic radius (ft)
13.2	width-depth ratio
60.0	W flood prone area (ft)
10.8	entrenchment ratio
1.0	low bank height ratio

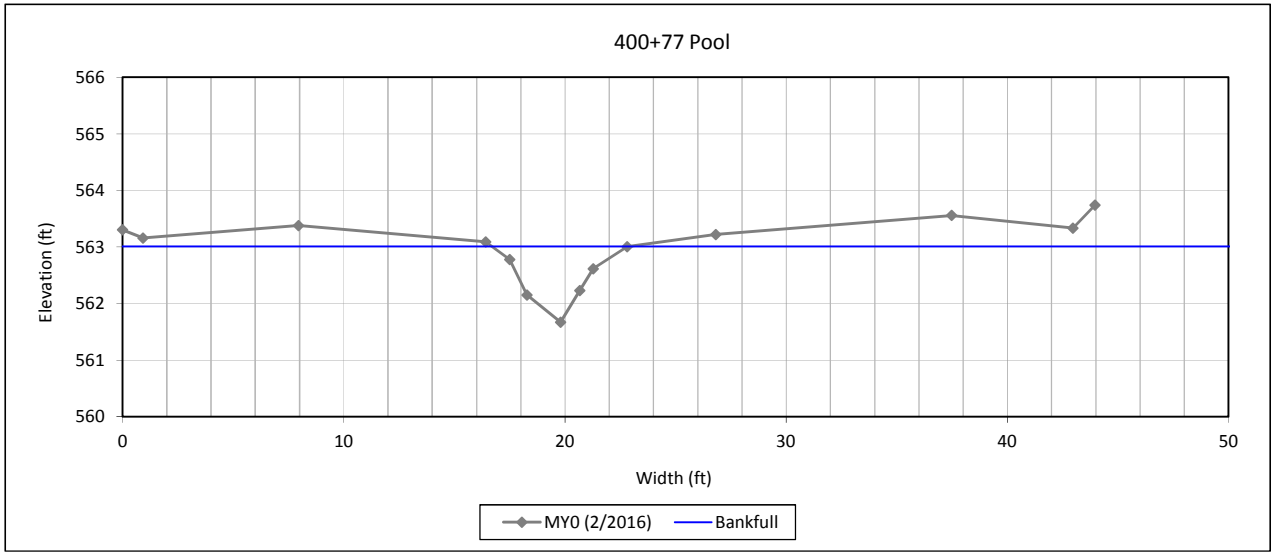
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 12, UT3B



Bankfull Dimensions	
3.8	x-section area (ft.sq.)
6.2	width (ft)
0.6	mean depth (ft)
1.3	max depth (ft)
6.8	wetted parameter (ft)
0.6	hydraulic radius (ft)
10.1	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

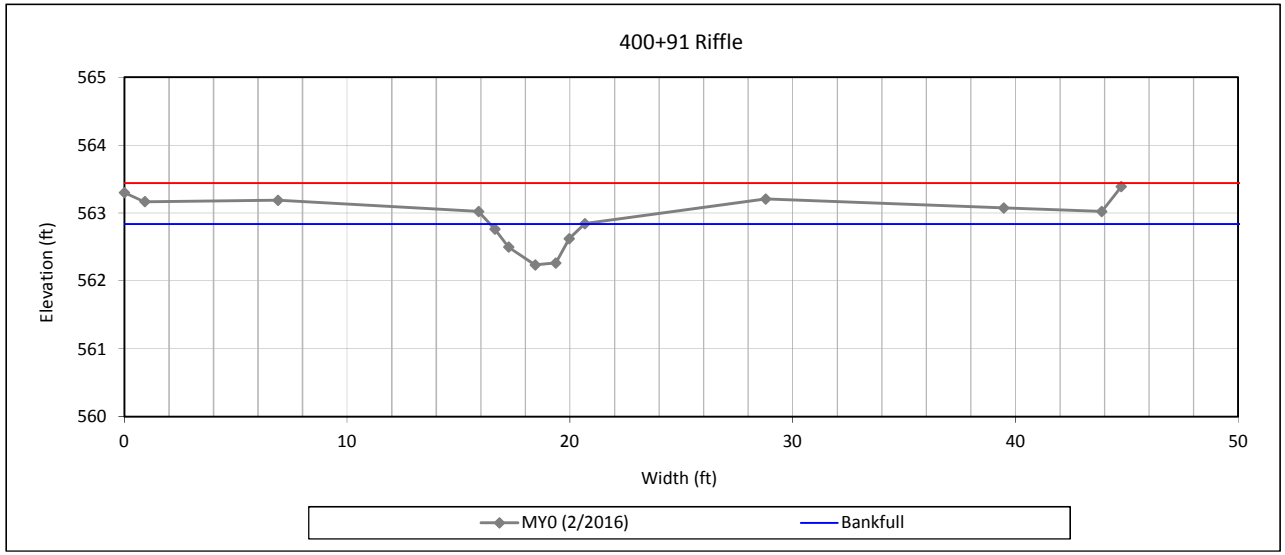
Cross Section Plots

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0

Cross Section 13, UT3B



Bankfull Dimensions	
1.6	x-section area (ft.sq.)
4.2	width (ft)
0.4	mean depth (ft)
0.6	max depth (ft)
4.5	wetted parameter (ft)
0.3	hydraulic radius (ft)
11.6	width-depth ratio
60.0	W flood prone area (ft)
14.1	entrenchment ratio
1.0	low bank height ratio

Survey Date: 2/2016

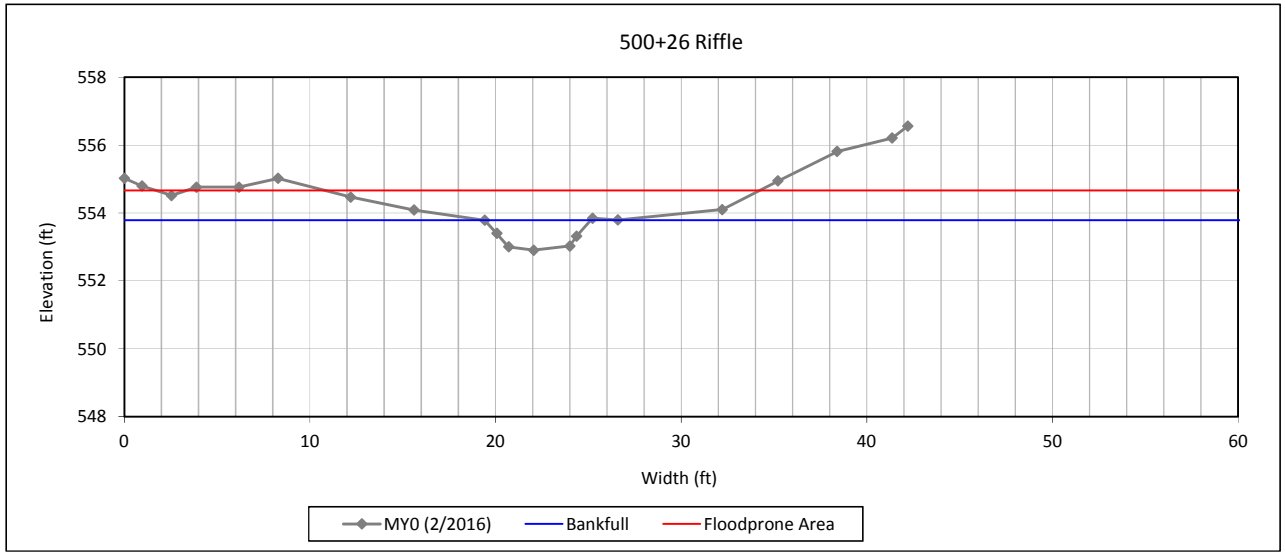
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 14, UT4B



Bankfull Dimensions	
3.6	x-section area (ft.sq.)
5.7	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
6.2	wetted parameter (ft)
0.6	hydraulic radius (ft)
9.1	width-depth ratio
25.0	W flood prone area (ft)
4.3	entrenchment ratio
1.0	low bank height ratio

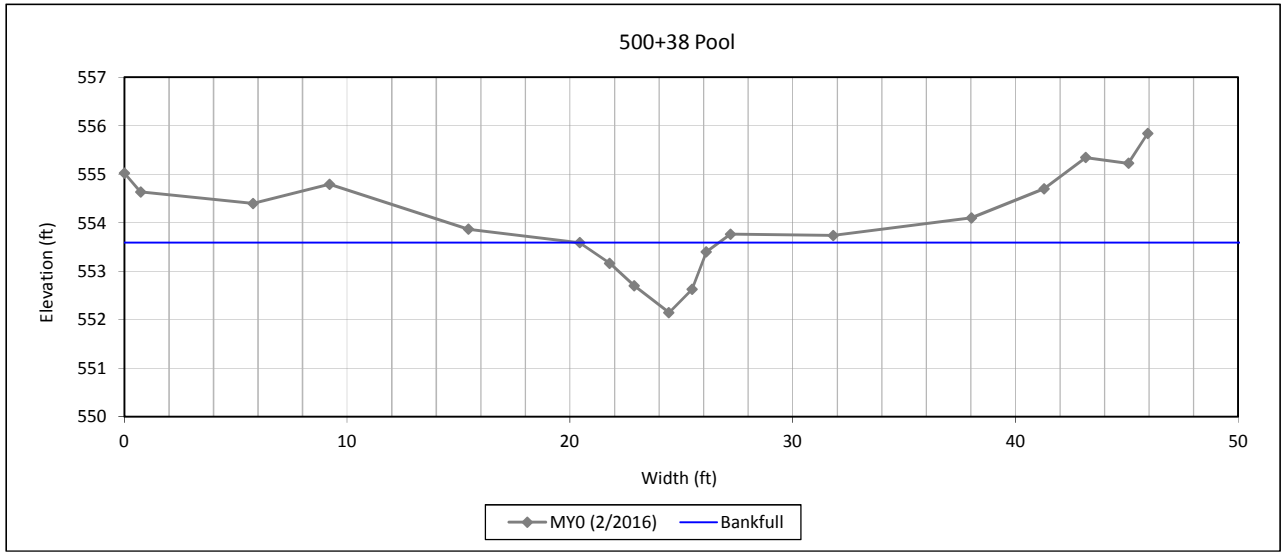
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 15, UT4B



Bankfull Dimensions	
4.5	x-section area (ft.sq.)
6.3	width (ft)
0.7	mean depth (ft)
1.4	max depth (ft)
7.0	wetted parameter (ft)
0.6	hydraulic radius (ft)
8.7	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

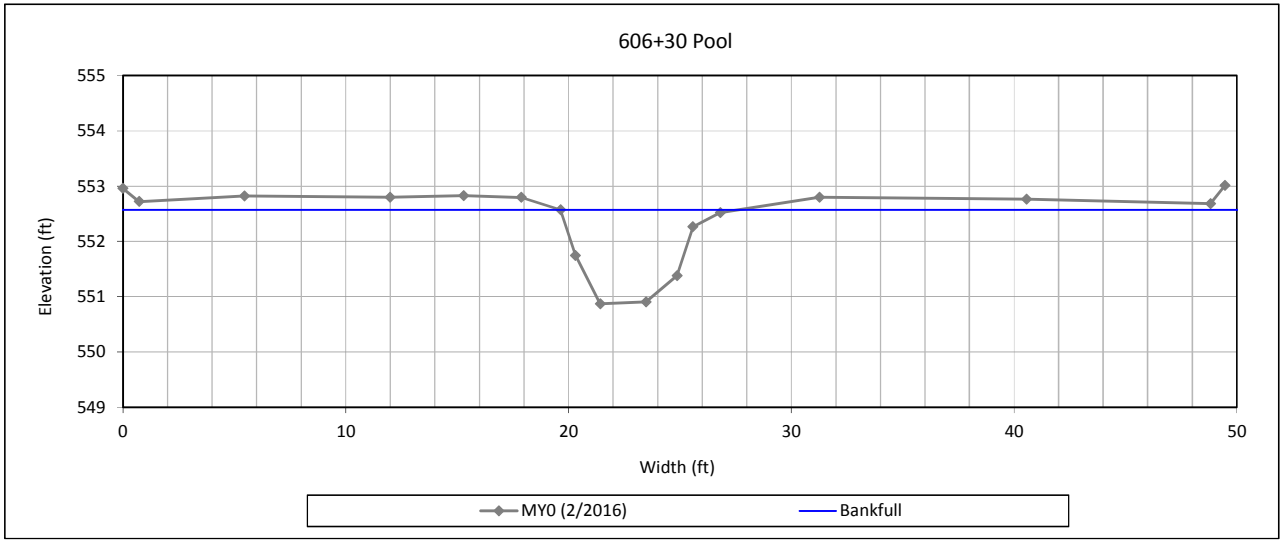
Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

Cross Section Plots

Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0

Cross Section 16, UT5



Bankfull Dimensions	
7.9	x-section area (ft.sq.)
8.0	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
9.2	wetted parameter (ft)
0.9	hydraulic radius (ft)
8.0	width-depth ratio
---	W flood prone area (ft)
---	entrenchment ratio
1.0	low bank height ratio

Survey Date: 2/2016
Field Crew: Turner Surveying

View Downstream

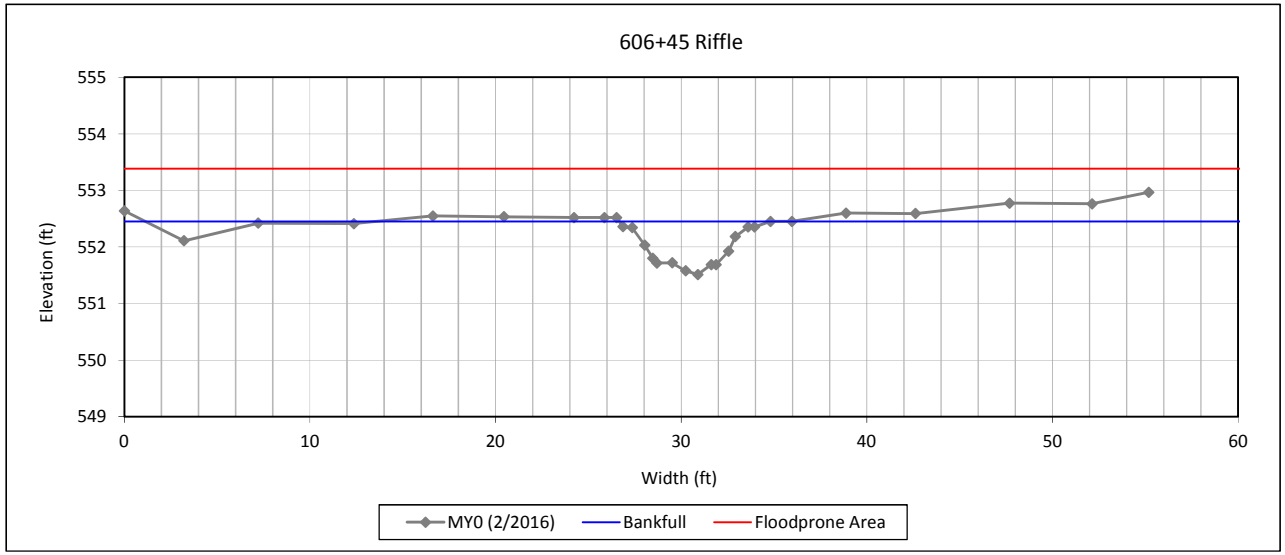
Cross Section Plots

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0

Cross Section 17, UT5



Bankfull Dimensions	
4.0	x-section area (ft.sq.)
8.1	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
8.5	wetted parameter (ft)
0.5	hydraulic radius (ft)
16.6	width-depth ratio
100.0	W flood prone area (ft)
12.3	entrenchment ratio
1.0	low bank height ratio

Survey Date: 2/2016

Field Crew: Turner Surveying

View Downstream

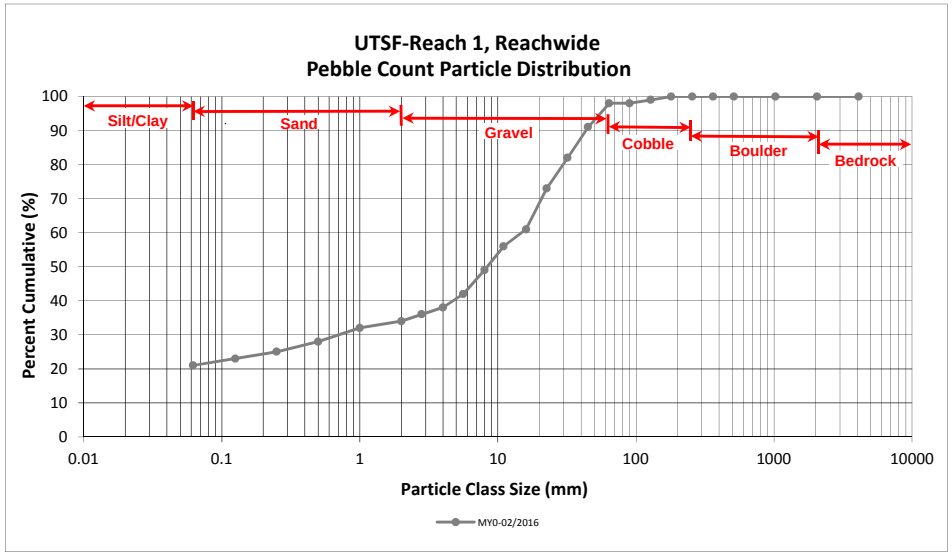
Reachwide and Cross Section Pebble Count Plots

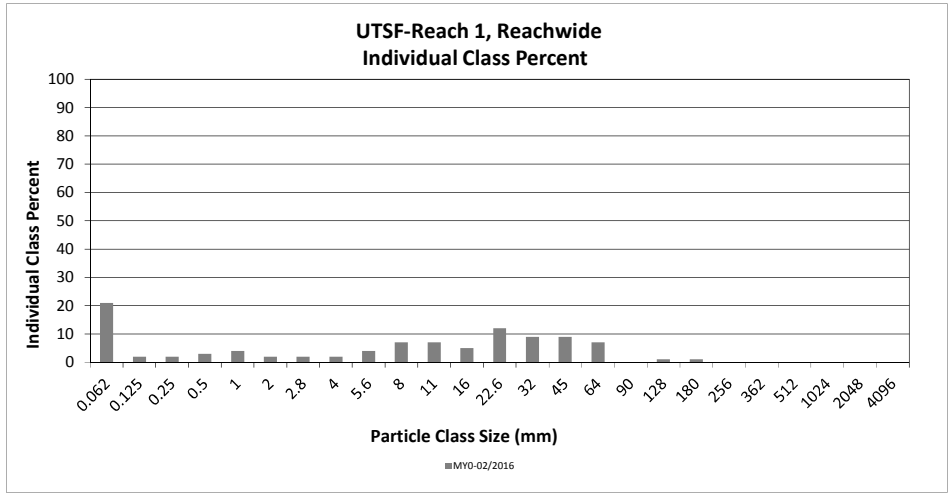
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UTSF-Reach 1, 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		21	21	21	21
SAND	Very fine	0.062	0.125		2	2	2	23
	Fine	0.125	0.250		2	2	2	25
	Medium	0.25	0.50		3	3	3	28
	Coarse	0.5	1.0		4	4	4	32
	Very Coarse	1.0	2.0		2	2	2	34
GRAVEL	Very Fine	2.0	2.8		2	2	2	36
	Very Fine	2.8	4.0		2	2	2	38
	Fine	4.0	5.6	1	3	4	4	42
	Fine	5.6	8.0	3	4	7	7	49
	Medium	8.0	11.0	4	3	7	7	56
	Medium	11.0	16.0	5		5	5	61
	Coarse	16.0	22.6	10	2	12	12	73
	Coarse	22.6	32	9		9	9	82
	Very Coarse	32	45	9		9	9	91
	Very Coarse	45	64	7		7	7	98
COBBLE	Small	64	90					98
	Small	90	128	1		1	1	99
	Large	128	180	1		1	1	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} =	2.37
D_{50} =	8.4
D_{84} =	34.5
D_{95} =	55.0
D_{100} =	180.0





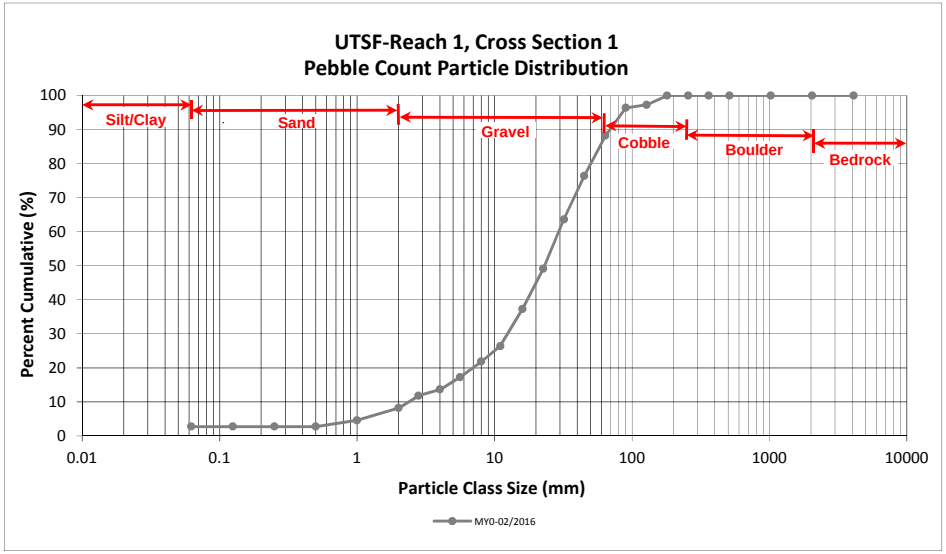
Reachwide and Cross Section Pebble Count Plots

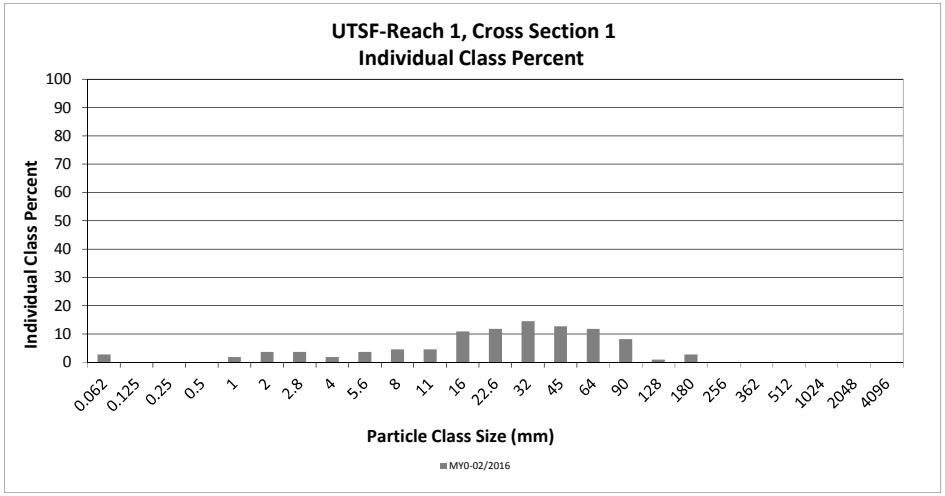
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UTSF-Reach 1, Cross Section 1

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
	Medium	0.25	0.50			3
	Coarse	0.5	1.0	2	2	5
	Very Coarse	1.0	2.0	4	4	8
GRAVEL	Very Fine	2.0	2.8	4	4	12
	Very Fine	2.8	4.0	2	2	14
	Fine	4.0	5.6	4	4	17
	Fine	5.6	8.0	5	5	22
	Medium	8.0	11.0	5	5	26
	Medium	11.0	16.0	12	11	37
	Coarse	16.0	22.6	13	12	49
	Coarse	22.6	32	16	15	64
	Very Coarse	32	45	14	13	76
	Very Coarse	45	64	13	12	88
COBBLE	Small	64	90	9	8	96
	Small	90	128	1	1	97
	Large	128	180	3	3	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	**110**	**100**	**100**

Cross Section 1	
Channel materials (mm)	
D_{16} =	4.98
D_{35} =	14.80
D_{50} =	23.1
D_{84} =	56.5
D_{95} =	85.0
D_{100} =	180.0





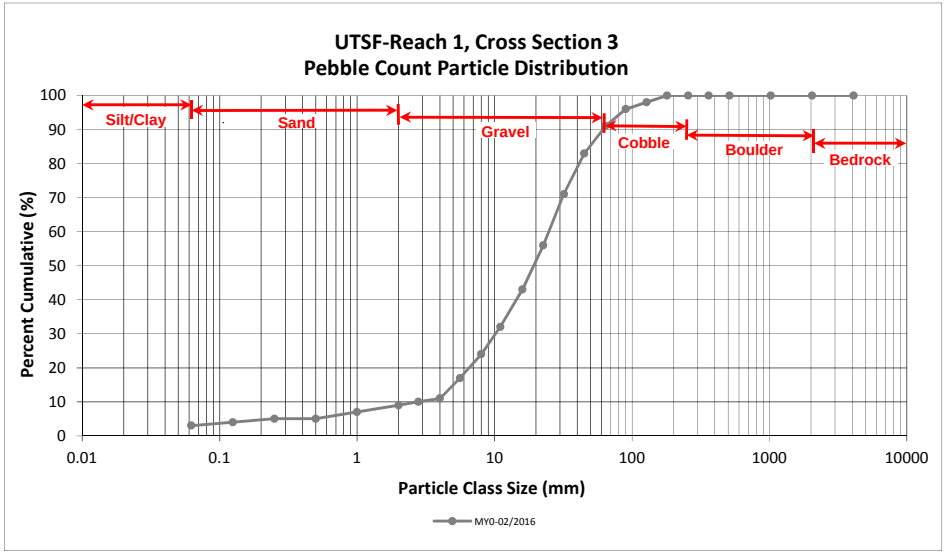
Reachwide and Cross Section Pebble Count Plots

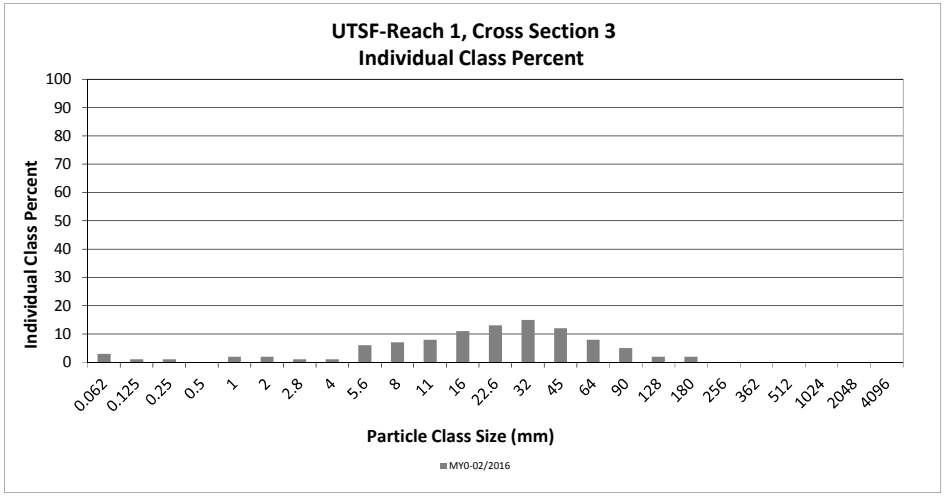
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UTSF-Reach 1, 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	1	1	4
	Fine	0.125	0.250	1	1	5
	Medium	0.25	0.50			5
	Coarse	0.5	1.0	2	2	7
	Very Coarse	1.0	2.0	2	2	9
GRAVEL	Very Fine	2.0	2.8	1	1	10
	Very Fine	2.8	4.0	1	1	11
	Fine	4.0	5.6	6	6	17
	Fine	5.6	8.0	7	7	24
	Medium	8.0	11.0	8	8	32
	Medium	11.0	16.0	11	11	43
	Coarse	16.0	22.6	13	13	56
	Coarse	22.6	32	15	15	71
	Very Coarse	32	45	12	12	83
	Very Coarse	45	64	8	8	91
COBBLE	Small	64	90	5	5	96
	Small	90	128	2	2	98
	Large	128	180	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	**100**	**100**	**100**

Cross Section 3	
Channel materials (mm)	
D_{16} =	5.29
D_{35} =	12.18
D_{50} =	19.3
D_{84} =	47.0
D_{95} =	84.1
D_{100} =	180.0





Reachwide and Cross Section Pebble Count Plots

Maney Farm Mitigation Project

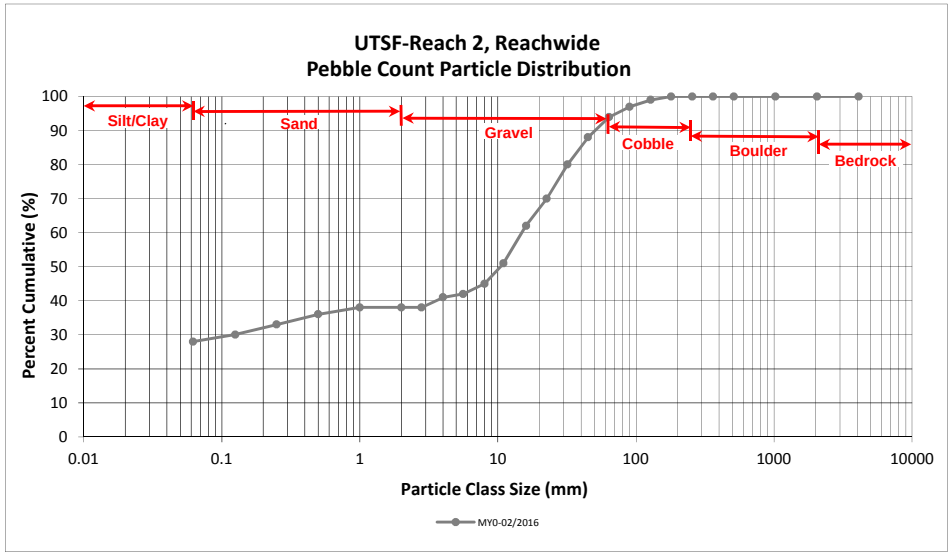
DMS Project No. 96314

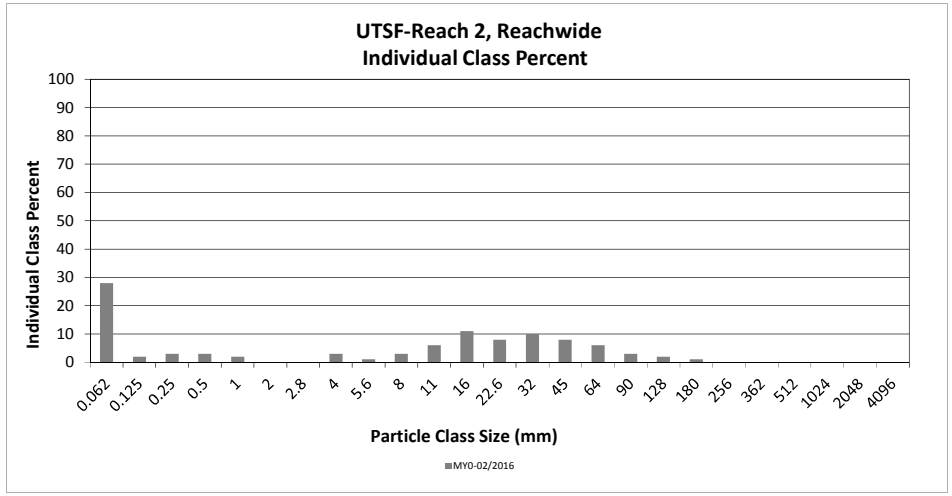
Monitoring Year 0 - 2016

UTSF-Reach 2, 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	27	28	28	28
SAND	Very fine	0.062	0.125	2		2	2	30
	Fine	0.125	0.250	3		3	3	33
	Medium	0.25	0.50	3		3	3	36
	Coarse	0.5	1.0	2		2	2	38
	Very Coarse	1.0	2.0					38
GRAVEL	Very Fine	2.0	2.8					38
	Very Fine	2.8	4.0	1	2	3	3	41
	Fine	4.0	5.6		1	1	1	42
	Fine	5.6	8.0		3	3	3	45
	Medium	8.0	11.0	3	3	6	6	51
	Medium	11.0	16.0	5	6	11	11	62
	Coarse	16.0	22.6	8		8	8	70
	Coarse	22.6	32	8	2	10	10	80
	Very Coarse	32	45	7	1	8	8	88
	Very Coarse	45	64	5	1	6	6	94
COBBLE	Small	64	90	1	2	3	3	97
	Small	90	128	1	1	2	2	99
	Large	128	180		1	1	1	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} =	0.40
D_{50} =	10.4
D_{84} =	37.9
D_{95} =	71.7
D_{100} =	180.0





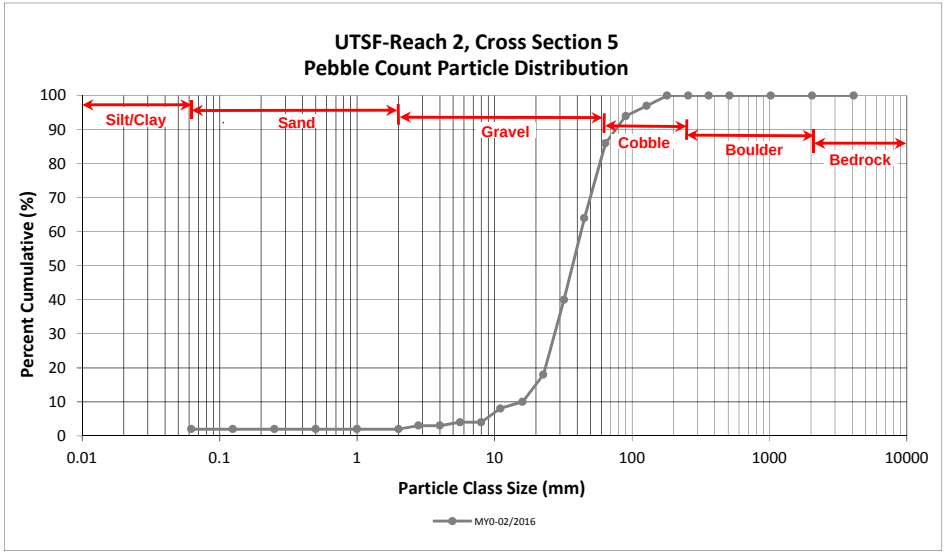
Reachwide and Cross Section Pebble Count Plots

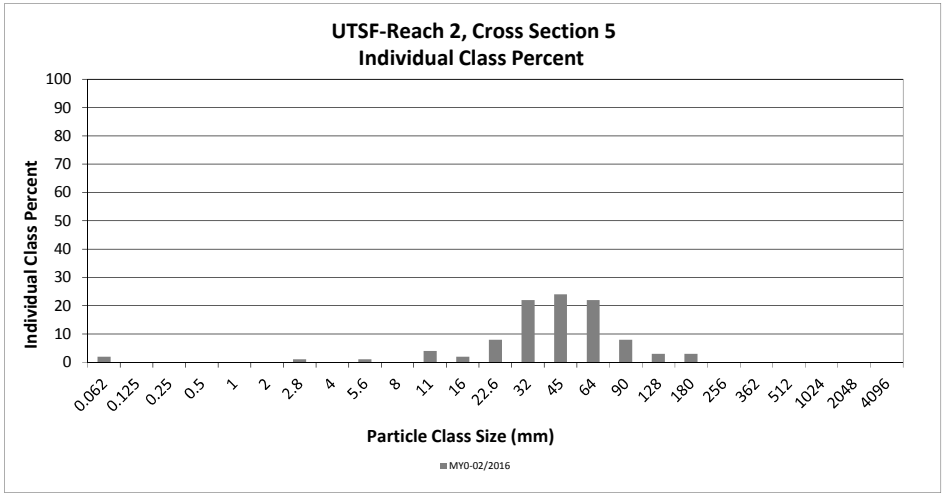
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UTSF-Reach 2, 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	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0			2
GRAVEL	Very Fine	2.0	2.8	1	1	3
	Very Fine	2.8	4.0			3
	Fine	4.0	5.6	1	1	4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	4	4	8
	Medium	11.0	16.0	2	2	10
	Coarse	16.0	22.6	8	8	18
	Coarse	22.6	32	22	22	40
	Very Coarse	32	45	24	24	64
	Very Coarse	45	64	22	22	86
COBBLE	Small	64	90	8	8	94
	Small	90	128	3	3	97
	Large	128	180	3	3	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	**100**	**100**	**100**

Cross Section 5	
Channel materials (mm)	
D_{16} =	20.73
D_{35} =	29.57
D_{50} =	36.9
D_{84} =	62.0
D_{95} =	101.2
D_{100} =	180.0





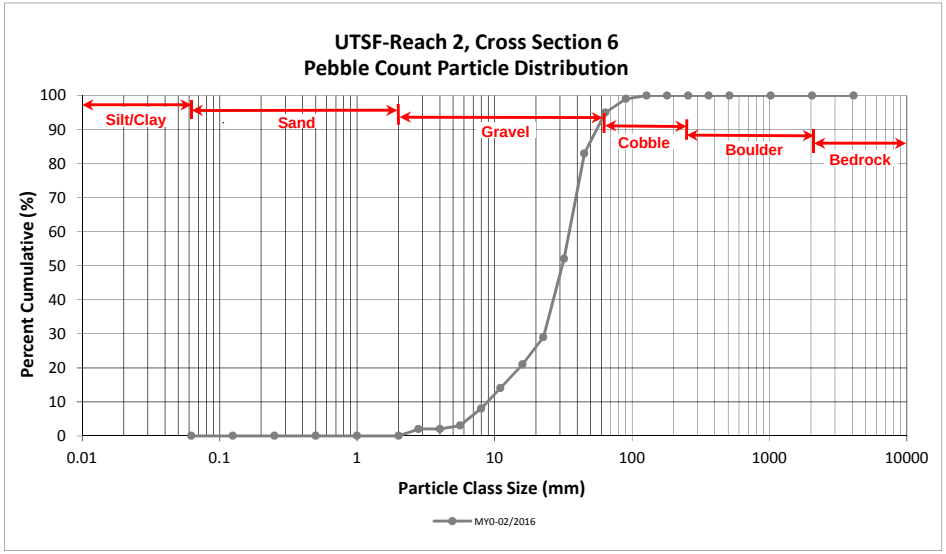
Reachwide and Cross Section Pebble Count Plots

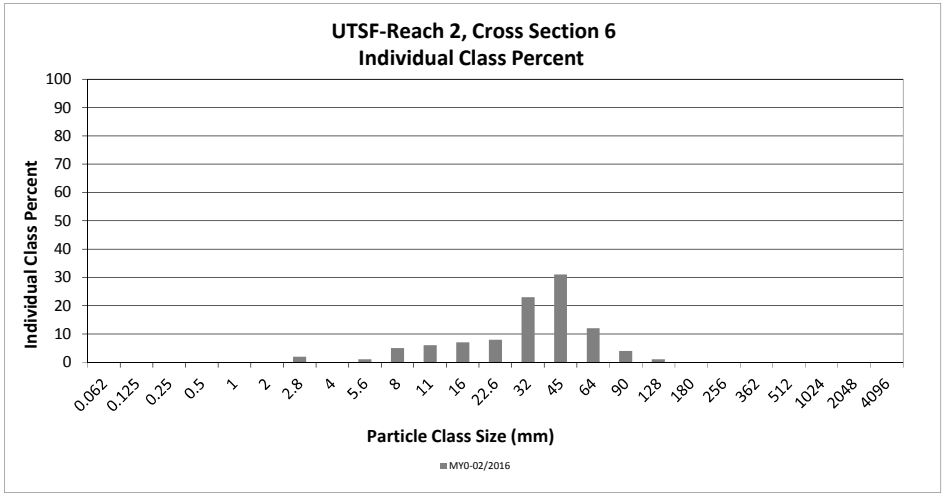
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UTSF-Reach 2, Cross Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8	2	2	2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6	1	1	3
	Fine	5.6	8.0	5	5	8
	Medium	8.0	11.0	6	6	14
	Medium	11.0	16.0	7	7	21
	Coarse	16.0	22.6	8	8	29
	Coarse	22.6	32	23	23	52
	Very Coarse	32	45	31	31	83
	Very Coarse	45	64	12	12	95
COBBLE	Small	64	90	4	4	99
	Small	90	128	1	1	100
	Large	128	180			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	**100**	**100**	**100**

Cross Section 6	
Channel materials (mm)	
D_{16} =	12.24
D_{35} =	24.75
D_{50} =	31.0
D_{84} =	46.3
D_{95} =	64.0
D_{100} =	128.0





Reachwide and Cross Section Pebble Count Plots

Maney Farm Mitigation Project

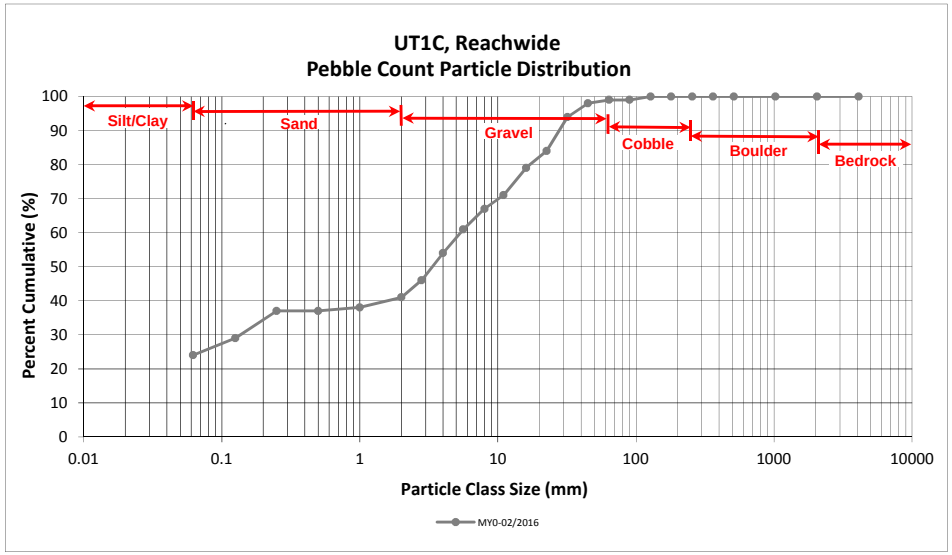
DMS Project No. 96314

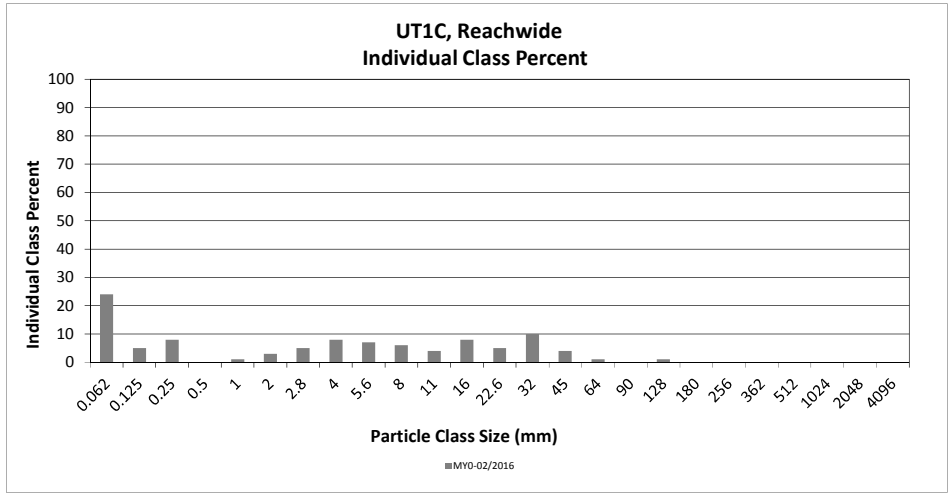
Monitoring Year 0 - 2016

UT1C, 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	19	24	24	24
SAND	Very fine	0.062	0.125	2	3	5	5	29
	Fine	0.125	0.250	4	4	8	8	37
	Medium	0.25	0.50					37
	Coarse	0.5	1.0		1	1	1	38
	Very Coarse	1.0	2.0	2	1	3	3	41
GRAVEL	Very Fine	2.0	2.8	3	2	5	5	46
	Very Fine	2.8	4.0	5	3	8	8	54
	Fine	4.0	5.6	4	3	7	7	61
	Fine	5.6	8.0	5	1	6	6	67
	Medium	8.0	11.0	3	1	4	4	71
	Medium	11.0	16.0	8		8	8	79
	Coarse	16.0	22.6	5		5	5	84
	Coarse	22.6	32	8	2	10	10	94
	Very Coarse	32	45	4		4	4	98
	Very Coarse	45	64	1		1	1	99
COBBLE	Small	64	90					99
	Small	90	128	1		1	1	100
	Large	128	180					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	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.21
D_{50} =	3.3
D_{84} =	22.6
D_{95} =	34.8
D_{100} =	128.0





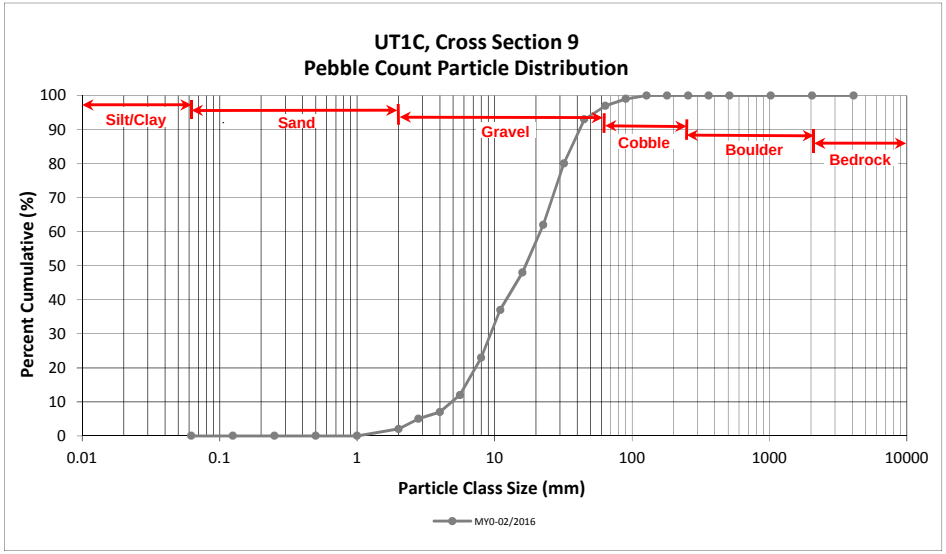
Reachwide and Cross Section Pebble Count Plots

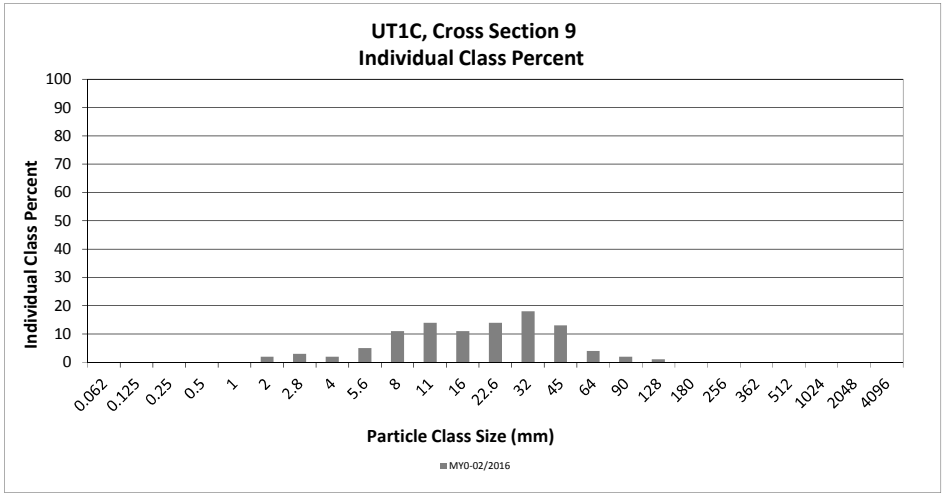
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UT1C, Cross Section 9

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
GRAVEL	Very Fine	2.0	2.8	3	3	5
	Very Fine	2.8	4.0	2	2	7
	Fine	4.0	5.6	5	5	12
	Fine	5.6	8.0	11	11	23
	Medium	8.0	11.0	14	14	37
	Medium	11.0	16.0	11	11	48
	Coarse	16.0	22.6	14	14	62
	Coarse	22.6	32	18	18	80
	Very Coarse	32	45	13	13	93
	Very Coarse	45	64	4	4	97
COBBLE	Small	64	90	2	2	99
	Small	90	128	1	1	100
	Large	128	180			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	**100**	**100**	**100**

Cross Section 9	
Channel materials (mm)	
D_{16} =	6.38
D_{35} =	10.51
D_{50} =	16.8
D_{84} =	35.5
D_{95} =	53.7
D_{100} =	128.0





Reachwide and Cross Section Pebble Count Plots

Maney Farm Mitigation Project

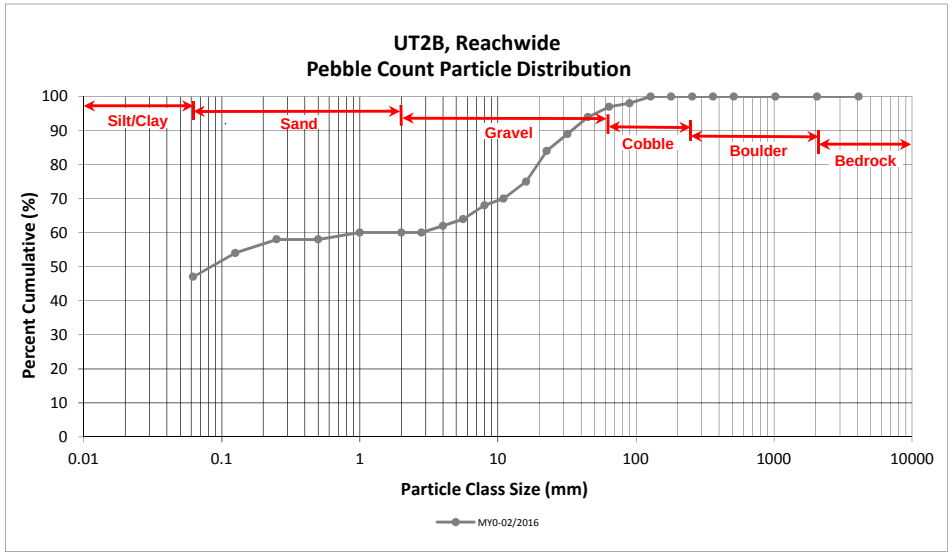
DMS Project No. 96314

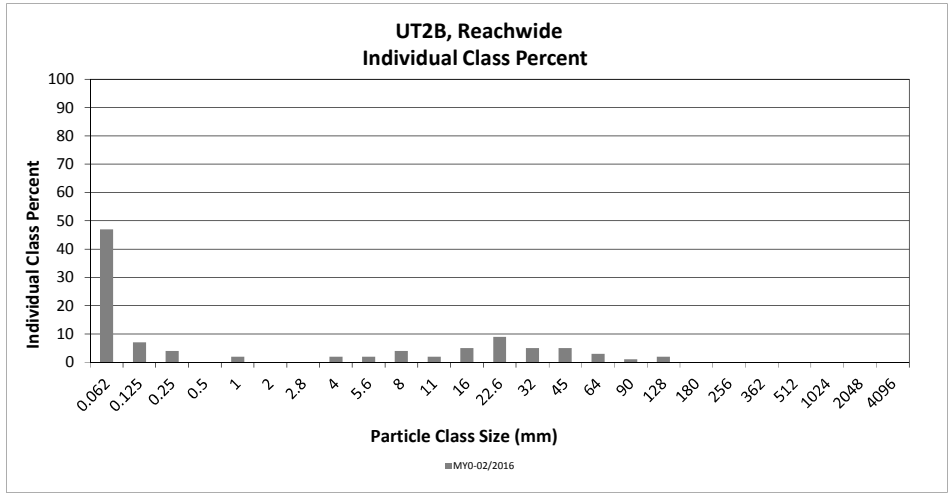
Monitoring Year 0 - 2016

UT2B, 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	4	43	47	47	47
SAND	Very fine	0.062	0.125	3	4	7	7	54
	Fine	0.125	0.250	4		4	4	58
	Medium	0.25	0.50					58
	Coarse	0.5	1.0	2		2	2	60
	Very Coarse	1.0	2.0					60
GRAVEL	Very Fine	2.0	2.8					60
	Very Fine	2.8	4.0	2		2	2	62
	Fine	4.0	5.6	1	1	2	2	64
	Fine	5.6	8.0	4		4	4	68
	Medium	8.0	11.0	2		2	2	70
	Medium	11.0	16.0	5		5	5	75
	Coarse	16.0	22.6	7	2	9	9	84
	Coarse	22.6	32	5		5	5	89
	Very Coarse	32	45	5		5	5	94
	Very Coarse	45	64	3		3	3	97
COBBLE	Small	64	90	1		1	1	98
	Small	90	128	2		2	2	100
	Large	128	180					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} =	Silt/Clay
D_{50} =	0.1
D_{84} =	22.6
D_{95} =	50.6
D_{100} =	128.0





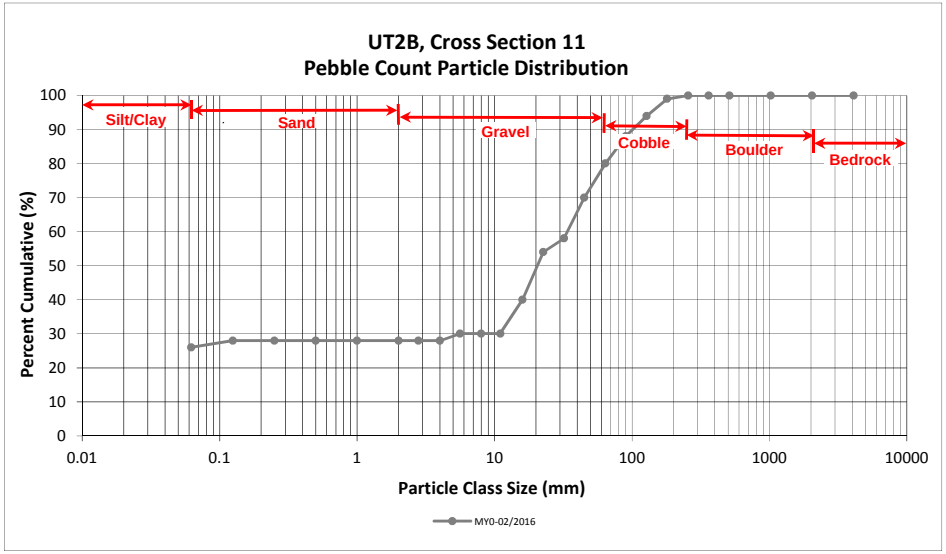
Reachwide and Cross Section Pebble Count Plots

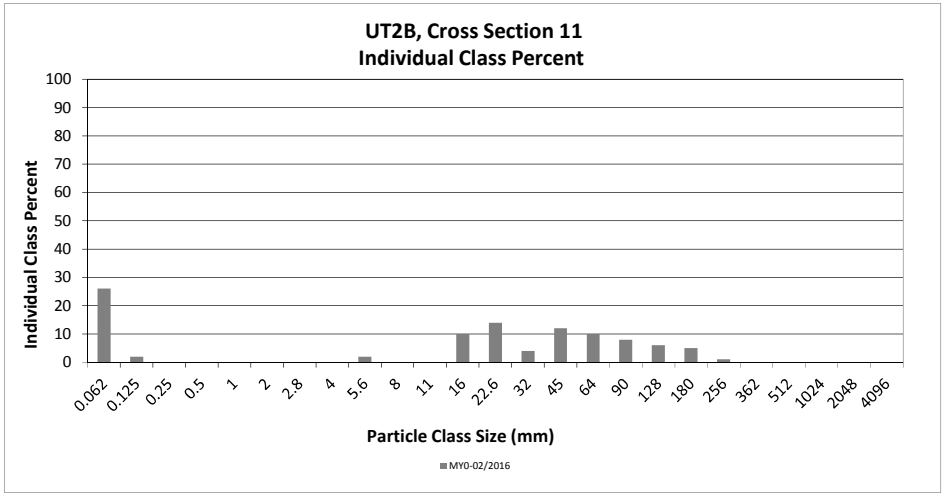
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UT2B, Cross Section 11

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	26	26	26
SAND	Very fine	0.062	0.125	2	2	28
	Fine	0.125	0.250			28
	Medium	0.25	0.50			28
	Coarse	0.5	1.0			28
	Very Coarse	1.0	2.0			28
GRAVEL	Very Fine	2.0	2.8			28
	Very Fine	2.8	4.0			28
	Fine	4.0	5.6	2	2	30
	Fine	5.6	8.0			30
	Medium	8.0	11.0			30
	Medium	11.0	16.0	10	10	40
	Coarse	16.0	22.6	14	14	54
	Coarse	22.6	32	4	4	58
	Very Coarse	32	45	12	12	70
	Very Coarse	45	64	10	10	80
COBBLE	Small	64	90	8	8	88
	Small	90	128	6	6	94
	Large	128	180	5	5	99
	Large	180	256	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	**100**	**100**	**100**

Cross Section 11	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	13.27
D_{50} =	20.5
D_{84} =	75.9
D_{95} =	137.0
D_{100} =	256.0





Reachwide and Cross Section Pebble Count Plots

Maney Farm Mitigation Project

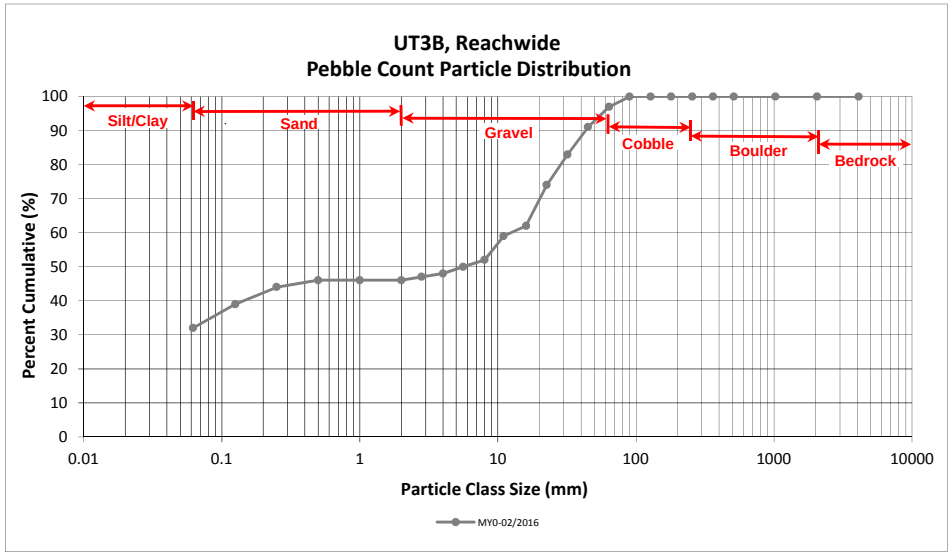
DMS Project No. 96314

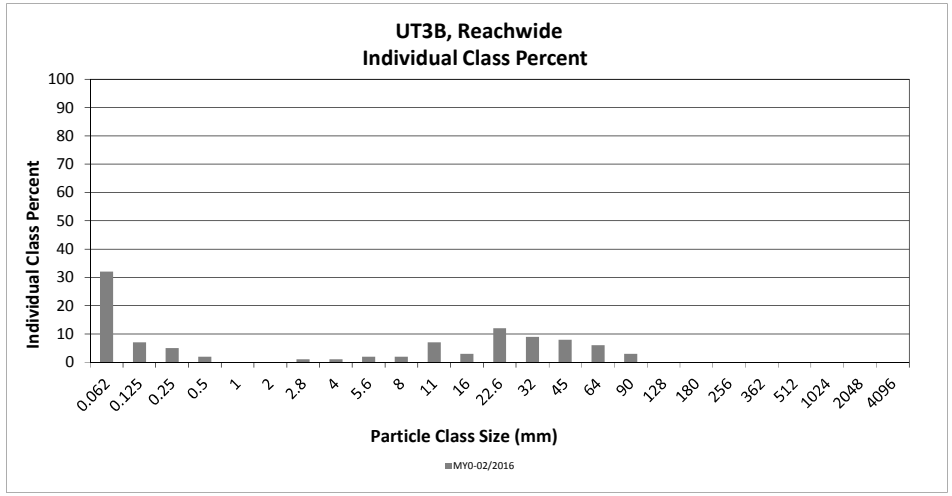
Monitoring Year 0 - 2016

UT3B, 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	30	32	32	32
SAND	Very fine	0.062	0.125	5	2	7	7	39
	Fine	0.125	0.250	4	1	5	5	44
	Medium	0.25	0.50		2	2	2	46
	Coarse	0.5	1.0					46
	Very Coarse	1.0	2.0					46
GRAVEL	Very Fine	2.0	2.8		1	1	1	47
	Very Fine	2.8	4.0		1	1	1	48
	Fine	4.0	5.6	1	1	2	2	50
	Fine	5.6	8.0	1	1	2	2	52
	Medium	8.0	11.0	6	1	7	7	59
	Medium	11.0	16.0	3		3	3	62
	Coarse	16.0	22.6	12		12	12	74
	Coarse	22.6	32	9		9	9	83
	Very Coarse	32	45	8		8	8	91
	Very Coarse	45	64	6		6	6	97
COBBLE	Small	64	90	3		3	3	100
	Small	90	128					100
	Large	128	180					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	**60**	**40**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	0.08
D_{50} =	5.6
D_{84} =	33.4
D_{95} =	56.9
D_{100} =	90.0





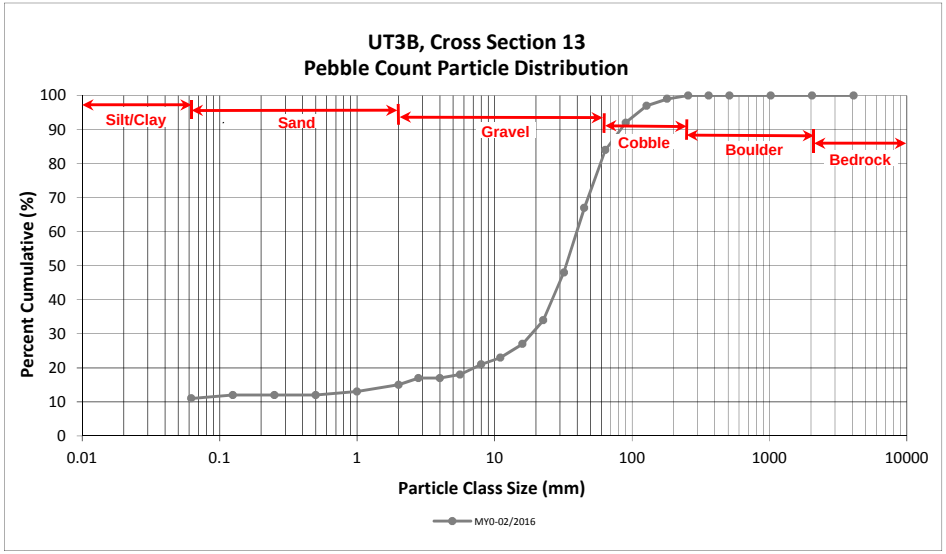
Reachwide and Cross Section Pebble Count Plots

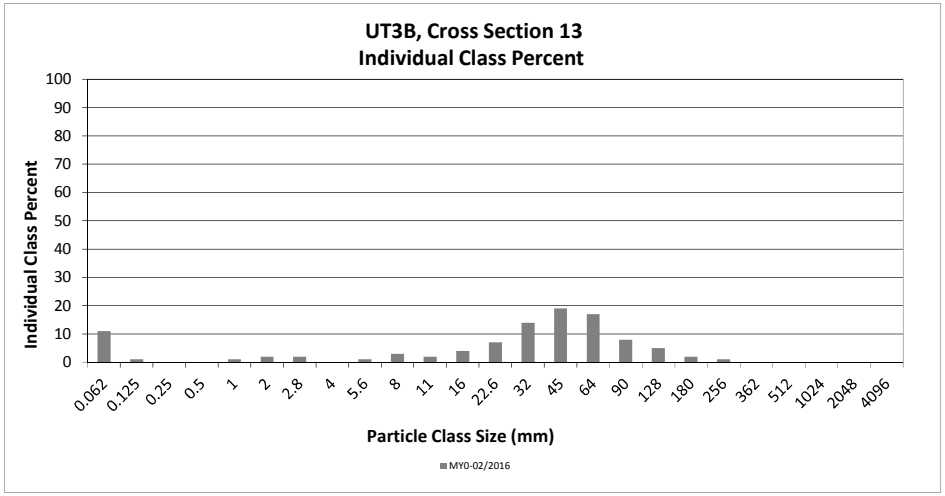
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UT3B, Cross Section 13

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	11	11	11
SAND	Very fine	0.062	0.125	1	1	12
	Fine	0.125	0.250			12
	Medium	0.25	0.50			12
	Coarse	0.5	1.0	1	1	13
	Very Coarse	1.0	2.0	2	2	15
GRAVEL	Very Fine	2.0	2.8	2	2	17
	Very Fine	2.8	4.0			17
	Fine	4.0	5.6	1	1	18
	Fine	5.6	8.0	3	3	21
	Medium	8.0	11.0	2	2	23
	Medium	11.0	16.0	4	4	27
	Coarse	16.0	22.6	7	7	34
	Coarse	22.6	32	14	14	48
	Very Coarse	32	45	19	19	67
	Very Coarse	45	64	17	17	84
COBBLE	Small	64	90	8	8	92
	Small	90	128	5	5	97
	Large	128	180	2	2	99
	Large	180	256	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	**100**	**100**	**100**

Cross Section 13	
Channel materials (mm)	
D_{16} =	2.37
D_{35} =	23.17
D_{50} =	33.2
D_{84} =	64.0
D_{95} =	111.2
D_{100} =	256.0





Reachwide and Cross Section Pebble Count Plots

Maney Farm Mitigation Project

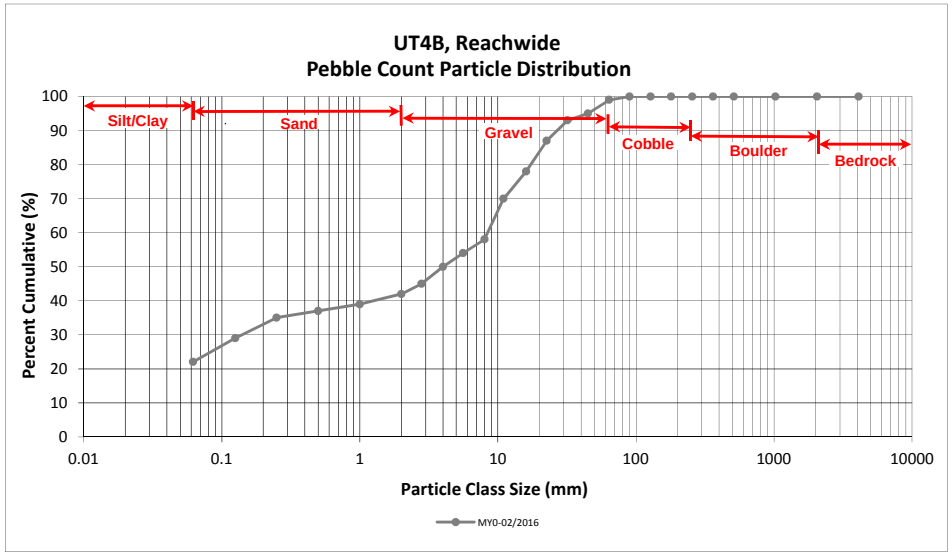
DMS Project No. 96314

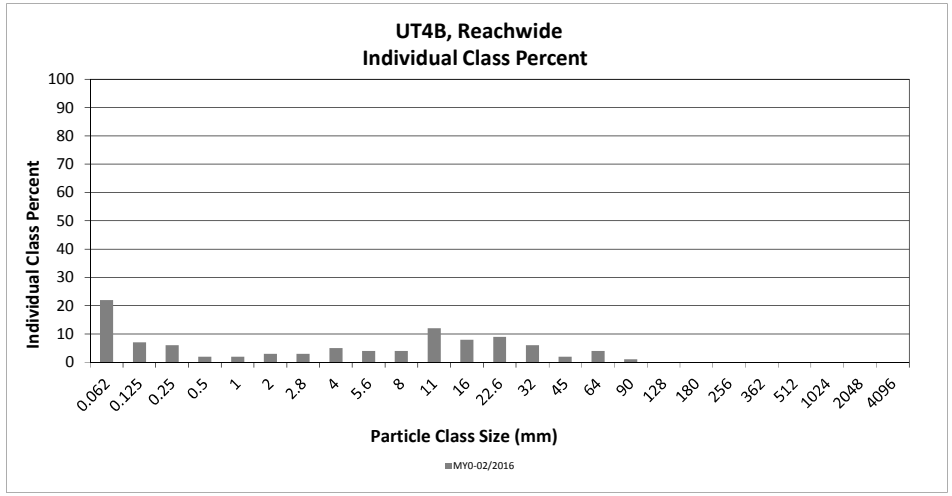
Monitoring Year 0 - 2016

UT4B, 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	4	18	22	22	22
SAND	Very fine	0.062	0.125		7	7	7	29
	Fine	0.125	0.250		6	6	6	35
	Medium	0.25	0.50		2	2	2	37
	Coarse	0.5	1.0		2	2	2	39
	Very Coarse	1.0	2.0	1	2	3	3	42
GRAVEL	Very Fine	2.0	2.8	1	2	3	3	45
	Very Fine	2.8	4.0	2	3	5	5	50
	Fine	4.0	5.6	2	2	4	4	54
	Fine	5.6	8.0	3	1	4	4	58
	Medium	8.0	11.0	9	3	12	12	70
	Medium	11.0	16.0	6	2	8	8	78
	Coarse	16.0	22.6	9		9	9	87
	Coarse	22.6	32	6		6	6	93
	Very Coarse	32	45	2		2	2	95
	Very Coarse	45	64	4		4	4	99
COBBLE	Small	64	90	1		1	1	100
	Small	90	128					100
	Large	128	180					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} =	0.25
D_{50} =	4.0
D_{84} =	20.1
D_{95} =	45.0
D_{100} =	90.0





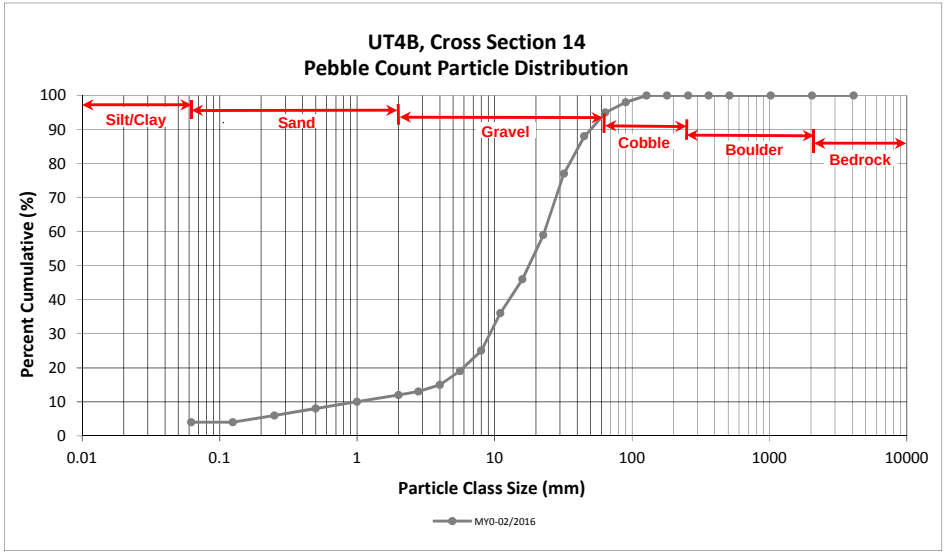
Reachwide and Cross Section Pebble Count Plots

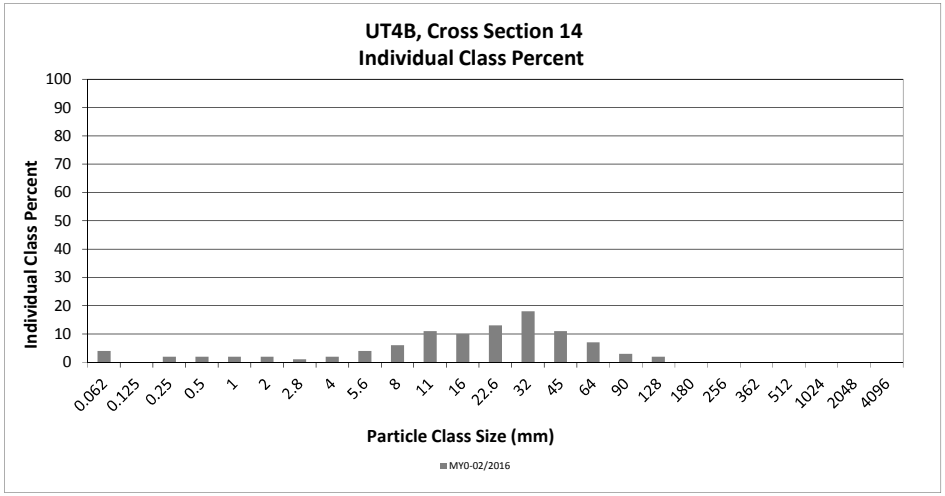
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UT4B, Cross Section 14

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	2	2	6
	Medium	0.25	0.50	2	2	8
	Coarse	0.5	1.0	2	2	10
	Very Coarse	1.0	2.0	2	2	12
GRAVEL	Very Fine	2.0	2.8	1	1	13
	Very Fine	2.8	4.0	2	2	15
	Fine	4.0	5.6	4	4	19
	Fine	5.6	8.0	6	6	25
	Medium	8.0	11.0	11	11	36
	Medium	11.0	16.0	10	10	46
	Coarse	16.0	22.6	13	13	59
	Coarse	22.6	32	18	18	77
	Very Coarse	32	45	11	11	88
	Very Coarse	45	64	7	7	95
COBBLE	Small	64	90	3	3	98
	Small	90	128	2	2	100
	Large	128	180			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	**100**	**100**	**100**

Cross Section 14	
Channel materials (mm)	
D_{16} =	4.35
D_{35} =	10.69
D_{50} =	17.8
D_{84} =	39.8
D_{95} =	64.0
D_{100} =	128.0





Reachwide and Cross Section Pebble Count Plots

Maney Farm Mitigation Project

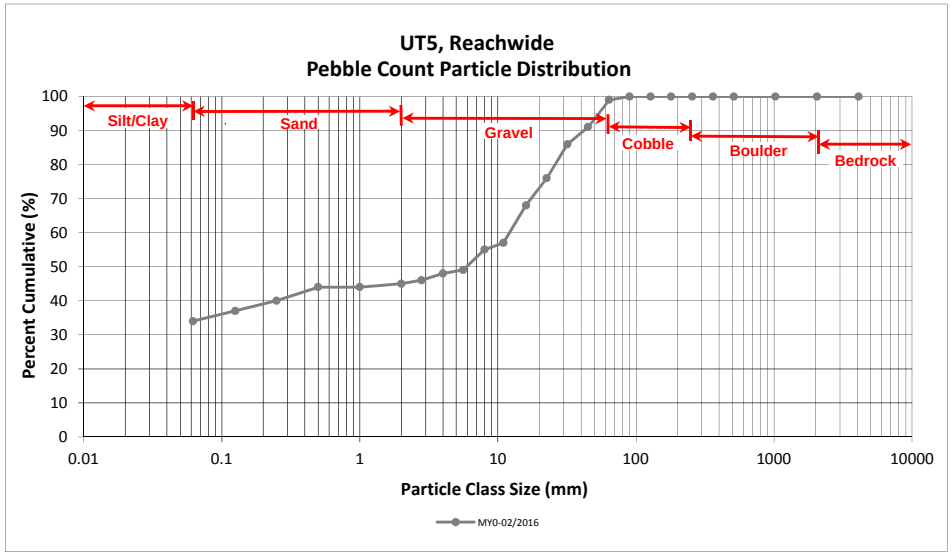
DMS Project No. 96314

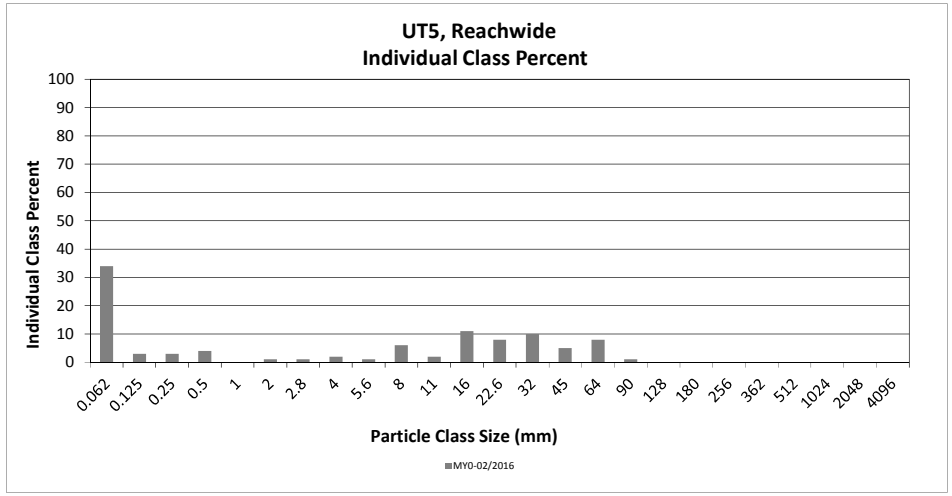
Monitoring Year 0 - 2016

UT5, 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		34	34	34	34
SAND	Very fine	0.062	0.125	3		3	3	37
	Fine	0.125	0.250	3		3	3	40
	Medium	0.25	0.50	3	1	4	4	44
	Coarse	0.5	1.0					44
	Very Coarse	1.0	2.0		1	1	1	45
GRAVEL	Very Fine	2.0	2.8		1	1	1	46
	Very Fine	2.8	4.0	1	1	2	2	48
	Fine	4.0	5.6		1	1	1	49
	Fine	5.6	8.0	2	4	6	6	55
	Medium	8.0	11.0	2		2	2	57
	Medium	11.0	16.0	8	3	11	11	68
	Coarse	16.0	22.6	6	2	8	8	76
	Coarse	22.6	32	9	1	10	10	86
	Very Coarse	32	45	5		5	5	91
	Very Coarse	45	64	7	1	8	8	99
COBBLE	Small	64	90	1		1	1	100
	Small	90	128					100
	Large	128	180					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} =	0.08
D_{50} =	5.9
D_{84} =	29.8
D_{95} =	53.7
D_{100} =	90.0





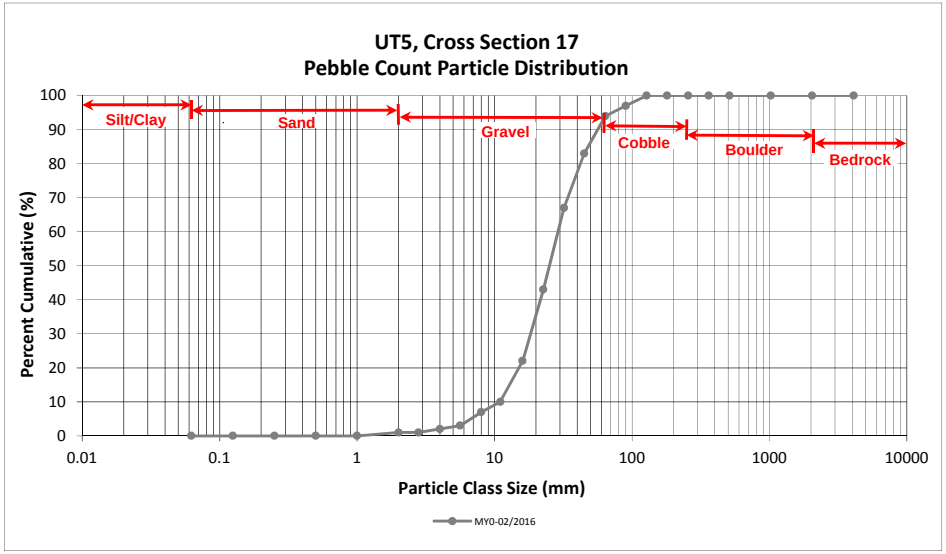
Reachwide and Cross Section Pebble Count Plots

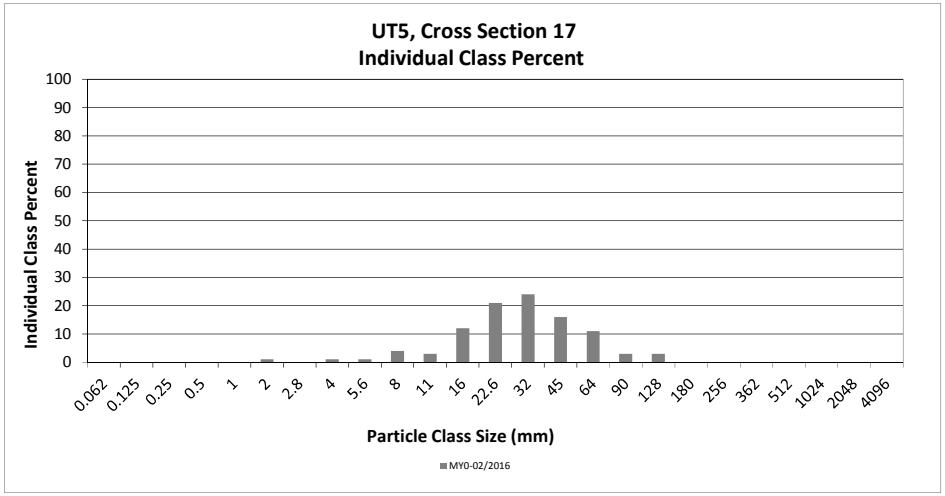
Maney Farm Mitigation Project
DMS Project No. 96314
Monitoring Year 0 - 2016

UT5, Cross Section 17

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	1	1	1
GRAVEL	Very Fine	2.0	2.8			1
	Very Fine	2.8	4.0	1	1	2
	Fine	4.0	5.6	1	1	3
	Fine	5.6	8.0	4	4	7
	Medium	8.0	11.0	3	3	10
	Medium	11.0	16.0	12	12	22
	Coarse	16.0	22.6	21	21	43
	Coarse	22.6	32	24	24	67
	Very Coarse	32	45	16	16	83
	Very Coarse	45	64	11	11	94
COBBLE	Small	64	90	3	3	97
	Small	90	128	3	3	100
	Large	128	180			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	**100**	**100**	**100**

Cross Section 17	
Channel materials (mm)	
D_{16} =	13.27
D_{35} =	19.81
D_{50} =	25.0
D_{84} =	46.5
D_{95} =	71.7
D_{100} =	128.0





Stream Photographs
UT to South Fork Reach 1

	
Photo Point 1 – looking upstream *(01/20/2016)*	Photo Point 1 – looking downstream *(01/20/2016)*
	
Photo Point 2 – looking upstream *(01/20/2016)*	Photo Point 2 – looking downstream *(01/20/2016)*
	
Photo Point 3 – looking upstream *(01/20/2016)*	Photo Point 3 – looking downstream *(01/20/2016)*

	
Photo Point 4 – looking upstream *(01/20/2016)*	Photo Point 4 – looking downstream *(01/20/2016)*
	
Photo Point 5 – looking upstream (*01/20/2016*)	Photo Point 5 – looking downstream (*01/20/2016*)
	
Photo Point 6 – looking upstream (*01/20/2016*)	Photo Point 6 – looking downstream (*01/20/2016*)

	
Photo Point 7 – looking upstream (*01/20/2016*)	Photo Point 7 – looking downstream (*01/20/2016*)
	
Photo Point 8 – looking upstream (*01/20/2016*)	Photo Point 8 – looking downstream (*01/20/2016*)
	
Photo Point 9 – looking upstream (*01/20/2016*)	Photo Point 9 – looking downstream (*01/20/2016*)

	
Photo Point 10 – looking upstream (*01/20/2016*)	Photo Point 10 – looking downstream (*01/20/2016*)
	
Photo Point 11 – looking upstream (*01/20/2016*)	Photo Point 11 – looking downstream (*01/20/2016*)
	
Photo Point 12 – looking upstream (*01/20/2016*)	Photo Point 12 – looking downstream (*01/20/2016*)

Stream Photographs
UT to South Fork Reach 2

	
Photo Point 13 – looking upstream *(01/20/2016)*	Photo Point 13 – looking downstream *(01/20/2016)*
	
Photo Point 14 – looking upstream *(01/20/2016)*	Photo Point 14 – looking downstream *(01/20/2016)*
	
Photo Point 15 – looking upstream *(01/20/2016)*	Photo Point 15 – looking downstream *(01/20/2016)*

	
Photo Point 16 – looking upstream (*01/20/2016*)	Photo Point 16 – looking downstream (*01/20/2016*)

Stream Photographs

UT1

	
Photo Point 17 – looking upstream *(01/20/2016)*	Photo Point 17 – looking downstream *(01/20/2016)*
	
Photo Point 18 – looking upstream *(01/20/2016)*	Photo Point 18 – looking downstream *(01/20/2016)*
	
Photo Point 19 – looking upstream *(01/20/2016)*	Photo Point 19 – looking downstream *(01/20/2016)*

	
Photo Point 20 – looking upstream *(01/20/2016)*	Photo Point 20 – looking downstream *(01/20/2016)*
	
Photo Point 21 – looking upstream (*01/20/2016*)	Photo Point 21 – looking downstream (*01/20/2016*)

Stream Photographs

UT2

Photo Point 22 – looking upstream *(01/20/2016)*

Photo Point 22 – looking downstream *(01/20/2016)*

Photo Point 23 – looking upstream *(01/20/2016)*

Photo Point 23 – looking downstream *(01/20/2016)*

Photo Point 24 – looking upstream *(01/20/2016)*

Photo Point 24 – looking downstream *(01/20/2016)*

Stream Photographs

UT3

	
Photo Point 25 – looking upstream *(01/20/2016)*	Photo Point 25 – looking downstream *(01/20/2016)*
	
Photo Point 26 – looking upstream *(01/20/2016)*	Photo Point 26 – looking downstream *(01/20/2016)*
	
Photo Point 27 – looking upstream *(01/20/2016)*	Photo Point 27 – looking downstream *(01/20/2016)*

Stream Photographs

UT4

	
Photo Point 28 – looking upstream *(01/20/2016)*	Photo Point 28 – looking downstream *(01/20/2016)*
	
Photo Point 29 – looking upstream *(01/20/2016)*	Photo Point 29 – looking downstream *(01/20/2016)*

Stream Photographs

UT5

	
Photo Point 30 – looking upstream *(01/20/2016)*	Photo Point 30 – looking downstream *(01/20/2016)*
	
Photo Point 31 – looking upstream *(01/20/2016)*	Photo Point 31 – looking downstream *(01/20/2016)*
	
Photo Point 32 – looking upstream *(01/20/2016)*	Photo Point 32 – looking downstream *(01/20/2016)*

APPENDIX 3. Vegetation Plot Data

Table 8a. Planted and Total Stems (Standard Planting Zones)

Maney Farm Mitigation Project

DMS Project No.96314

Monitoring Year 0 - 2016

			Current Plot Data (MY0 2016)																	
			Vegetation Plot 1			Vegetation Plot 2			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6		
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
Alnus serrulata	Tag alder	Shrub/Tree	1	1	1	3	3	3							2	2	2			
Betula nigra	River birch	Tree	2	2	2	4	4	4	2	2	2	4	4	4	2	2	2	3	3	3
Carpinus caroliniana	American hornbeam	Shrub/Tree	2	2	2				2	2	2							2	2	2
Fraxinus pennsylvanica	Green ash	Tree	3	3	3	2	2	2	6	6	6	1	1	1	3	3	3	2	2	2
Liriodendron tulipifera	Tulip poplar	Tree	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	2	2	2
Platanus occidentalis	American sycamore	Tree	2	2	2	1	1	1	1	1	1	5	5	5	1	1	1	2	2	2
Quercus palustris	Pin oak	Tree	1	1	1	1	1	1	2	2	2	3	3	3	2	2	2	1	1	1
Quercus phellos	Willow oak	Tree				3	3	3	1	1	1	1	1	1	5	5	5	4	4	4
Viburnum prunifolium	Black haw	Shrub/Tree	3	3	3							1	1	1						
Stem count			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Size (ares)			1			1			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Stems per ACRE			647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	647

			Current Plot Data (MY0 2016)															Annual Summary		
			Vegetation Plot 7			Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			MY0		
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
Alnus serrulata	Tag alder	Shrub/Tree				1	1	1	1	1	1	1	1	1	4	4	4	13	13	13
Betula nigra	River birch	Tree	3	3	3	3	3	3	1	1	1	1	1	1				25	25	25
Carpinus caroliniana	American hornbeam	Shrub/Tree	1	1	1	2	2	2	1	1	1	2	2	2	1	1	1	13	13	13
Fraxinus pennsylvanica	Green ash	Tree	4	4	4	5	5	5	3	3	3	4	4	4	3	3	3	36	36	36
Liriodendron tulipifera	Tulip poplar	Tree	1	1	1				2	2	2	1	1	1	2	2	2	16	16	16
Platanus occidentalis	American sycamore	Tree	3	3	3	3	3	3	7	7	7	6	6	6	6	6	6	37	37	37
Quercus palustris	Pin oak	Tree	3	3	3	1	1	1	1	1	1	1	1	1				16	16	16
Quercus phellos	Willow oak	Tree	1	1	1	1	1	1										16	16	16
Viburnum prunifolium	Black haw	Shrub/Tree																4	4	4
Stem count			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	176	176	176
Size (ares)			1			1			1			1			1			11		
Size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.27		
Species count			7	7	7	7	7	7	7	7	7	7	7	7	5	5	5	9	9	9
Stems per ACRE			647	647	647	647	647	647	647	647	647	647	647	647	647	647	647	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%

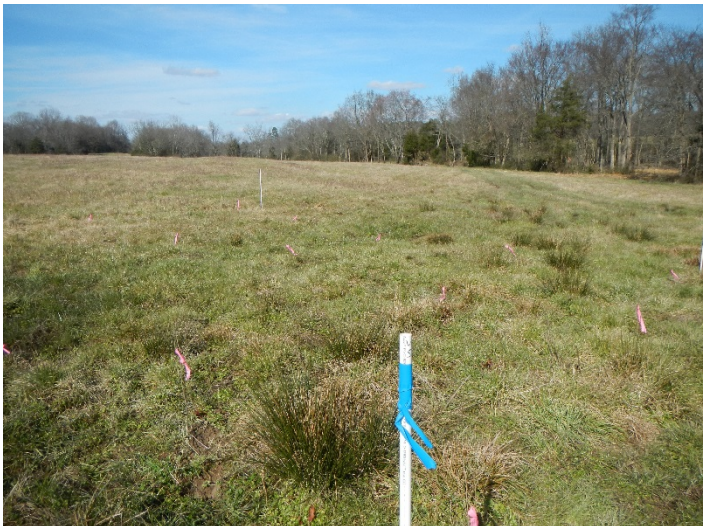
Fails to meet requirements by more than 10%

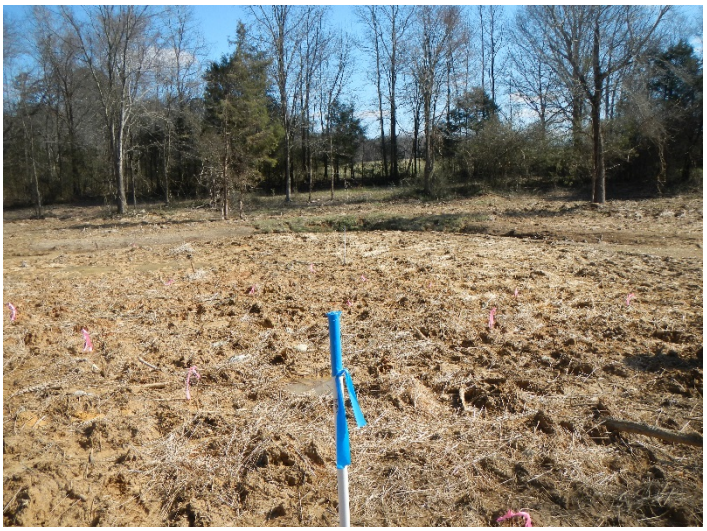
Table 8b. Planted and Total Stems (Supplemental Planting Zones)
Maney Farm Mitigation Project
DMS Project No.96314
Monitoring Year 0 - 2016

			Current Plot Data (MY0 2016)											
			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14			Annual Summary		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Aesculus pavia	Red buckeye	Shrub/Tree	2	2	2	1	1	1				3	3	3
Callicarpa americana	American beautyberry	Shrub	3	3	3	5	5	5	3	3	3	11	11	11
Calycanthus floridus	Sweet-shrub	Shrub	4	4	4	2	2	2				6	6	6
Carpinus caroliniana	American hornbeam	Shrub Tree	3	3	3	5	5	5	9	9	9	17	17	17
Symphoricarpos orbiculatus	Coralberry	Shrub	4	4	4	2	2	2	4	4	4	10	10	10
Viburnum prunifolium	Black haw	Shrub Tree				1	1	1				1	1	1
Stem count			16	16	16	16	16	16	16	16	16	48	48	48
Size (ares)			1			1			1			1		
Size (ACRES)			0.02			0.02			0.02			0.07		
Species count			5	5	5	6	6	6	3	3	3	6	6	6
Stems per ACRE			647	647	647	647	647	647	647	647	647	647	647	647

Supplemental planting zones are monitored to determine survival rates of these species but the results will not be tied to project success.

Vegetation Photographs

	
Vegetation Plot 1 – (*02/17/2016*)	Vegetation Plot 2 – (*02/17/2016*)
	
Vegetation Plot 3 – (*02/17/2016*)	Vegetation Plot 4 – (*02/17/2016*)
	
Vegetation Plot 5 – (*02/17/2016*)	Vegetation Plot 6 – (*02/17/2016*)

	
Vegetation Plot 7 – (*02/17/2016*)	Vegetation Plot 8 – (*02/17/2016*)
	
Vegetation Plot 9 – (*02/17/2016*)	Vegetation Plot 10 – (*02/17/2016*)
	
Vegetation Plot 11 – (*02/17/2016*)	Vegetation Plot 12 – (*02/17/2016*)

	
Vegetation Plot 13 – (*02/17/2016*)	Vegetation Plot 14 – (*02/17/2016*)

APPENDIX 4. Record Drawings

Maney Farm Mitigation Project Record Drawings

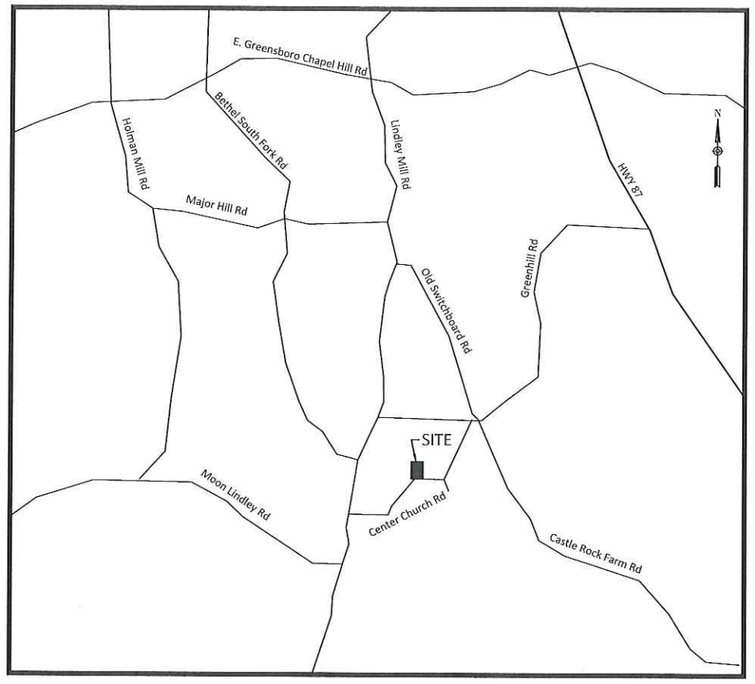
Cape Fear River Basin HUC 03030002

Chatham County, North Carolina

for

NCDEQ -

Division of Mitigation Services



Vicinity Map
Not to Scale

RECORD DRAWINGS
ISSUED May 13, 2016

CERTIFICATE OF SURVEY
AND
ACCURACY

I, DAVID S. TURNER, CERTIFY THAT THE GROUND TOPOGRAPHIC SURVEY PORTION OF 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 PROVIDED BY TURNER LAND SURVEYING,PLLC AS SHOWN ON AN AS-BUILT SURVEY FOR "THE STATE OF NC, DIVISION OF MITIGATION SERVICES" DATED FEBRUARY 22, 2016; 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 02/06/16 - 02/13/16 ; THAT THE CONTOURS SHOWN AS BROKEN LINES MAY NOT MEET THE STATED STANDARD AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASE 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 THE 13th DAY OF May, 2016.

OFFICIAL SEAL

NORTH CAROLINA PROFESSIONAL SEAL L-4551 LAND SURVEYOR DAVID S. TURNER
05-13-16

DAVID S. TURNER, PLS L-4551

Sheet Index

Project Directory

Surveying:
Turner Land Surveying, PLLC
P.O. Box 148
Swannanoa, NC 28778
David S. Turner, PLS
919-623-5095

Engineering:
Wildlands Engineering, Inc
License No. F-0831
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Jeff Keaton, P.E.
919-851-9986

Owner:
NCDEQ
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652
Jeff Jurek
919-707-8976

DMS Project ID 96314

NCDEQ Contract No. 005793

WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL SEAL L-4551 ENGINEER JEFFREY KEATON
05-13-16

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

Title Sheet

Revisions:

Date: May 13, 2016
Job Number: 005-02144
Project Engineer: JK
Drawn By: RCP
Checked By: JK

Sheet 0.1

May 13, 2016

T:\ACTIVE PROJECTS (NC)\005-02144 Maney Farm\Monitoring\Baseline Monitoring\Plans\02144-As-CoverNotes.dwg

Property Line

Conservation Easement (CE)

Design Thalweg Alignment (10+00)

Design Bankfull

Design Major Contour (100)

Design Minor Contour

Existing Wetland

As-Built Thalweg Alignment (10+00)

As-Built Bankfull

As-Built Major Contour (100)

As-Built Minor Contour

Tree Saved During Construction

Rip Rap

Design Log Sill

Design Root Wad

Design Cover Log

Design Constructed Riffle

Design Brush Toe

Design Sod Mats

As-Built Log Sill

As-Built Root Wad

As-Built Cover Log

As-Built Constructed Riffle

As-Built Brush Toe

As-Built Sod Mats

Monitoring Cross Section

Monitoring Bank Pin Array (BP)

Monitoring Vegetation Plot (VP1)

Monitoring Supplemental Vegetation Plot (SVP1)

Monitoring Photo Point (PP1)

Monitoring Flow Gauge (FG)

Monitoring Stream Gauge (SG1)

Monitoring Barometric Gauge (BG)

Monitoring Rain Gauge (RG)

*Deviation from design shown in red.

WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 037127 JAMES C. KANOY

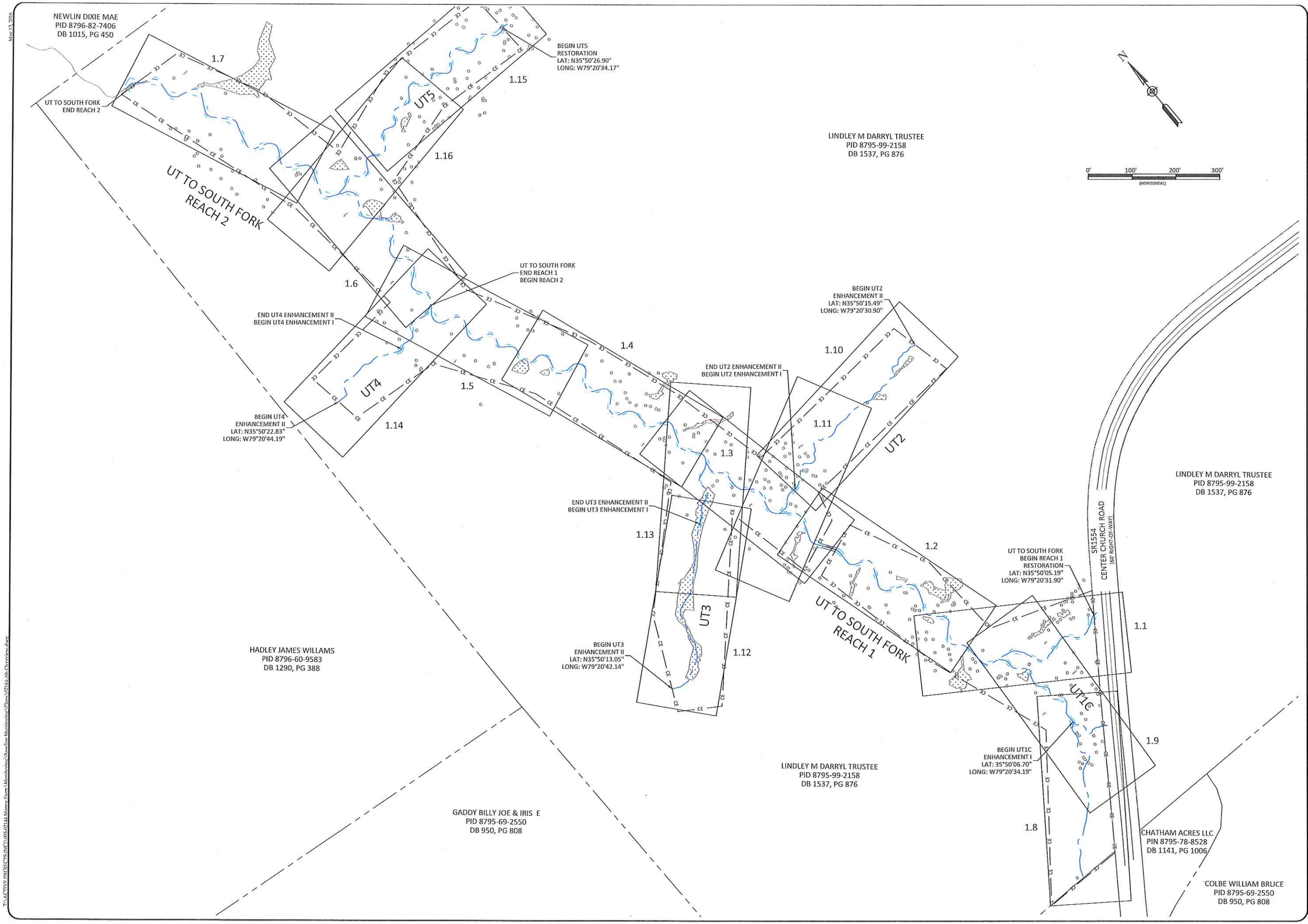
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

General Notes and Symbols

Revisions:

Date: May 13, 2016
Job Number: 005-02144
Project Engineer: JK
Drawn By: RCP
Checked By: JK

Sheet 0.2



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.1778
Firm License No.: P-0831

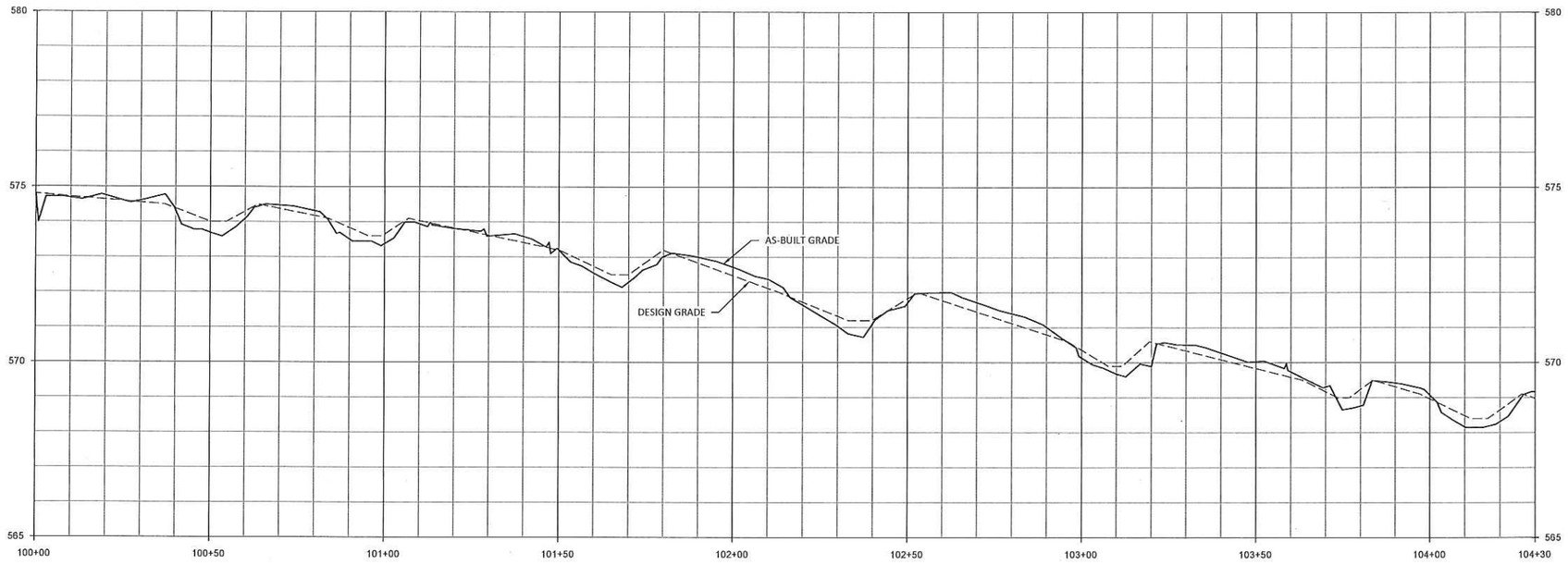
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038261 JAMES KEITH
5-13-16

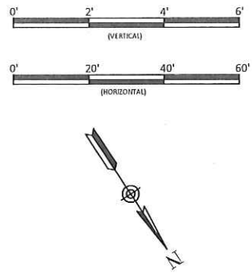
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina
Project Overview

Revisions:

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

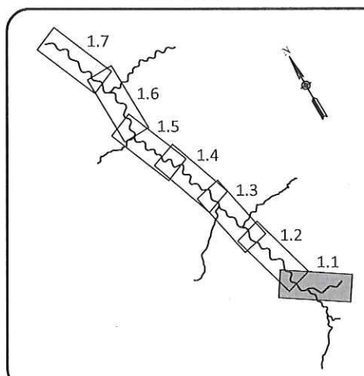
Sheet 0.3





Note: As-built profile stations and match lines based on design alignment.

Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9987
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 042324 KEVIN J. ERICKSON 5-13-16

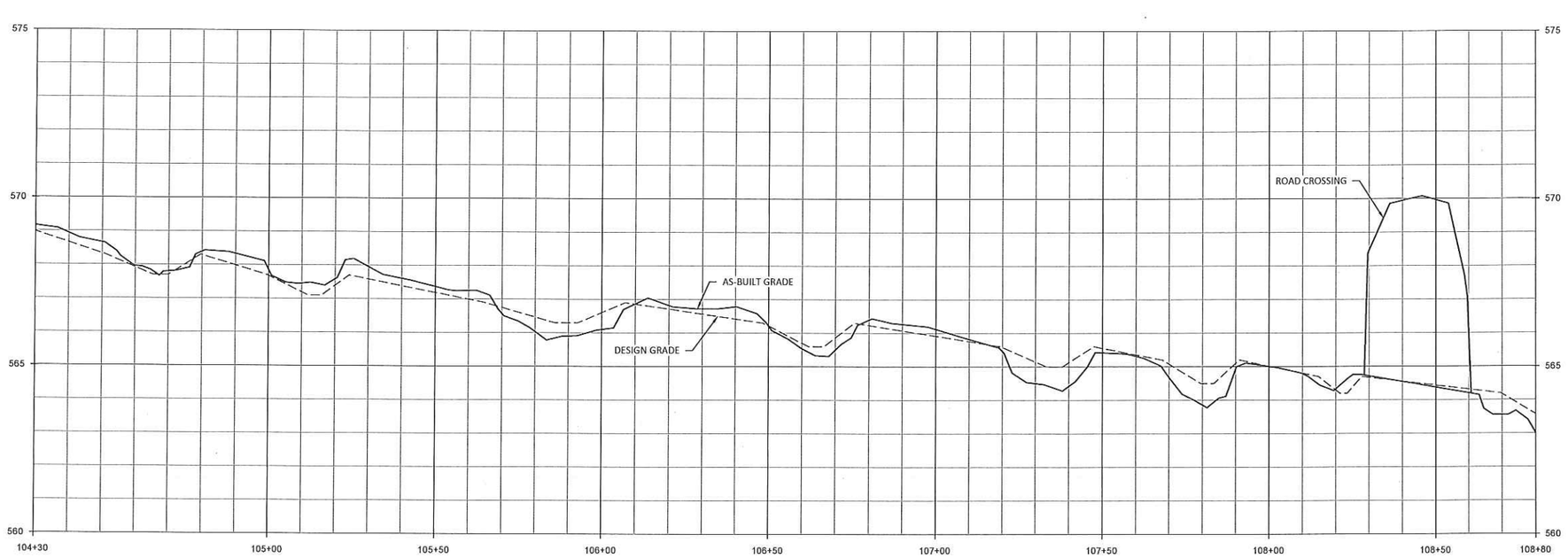
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UTSF Reach 1
Stream Plan and Profile

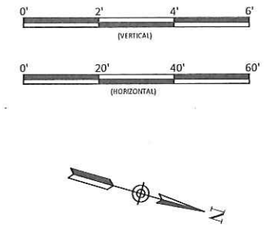
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

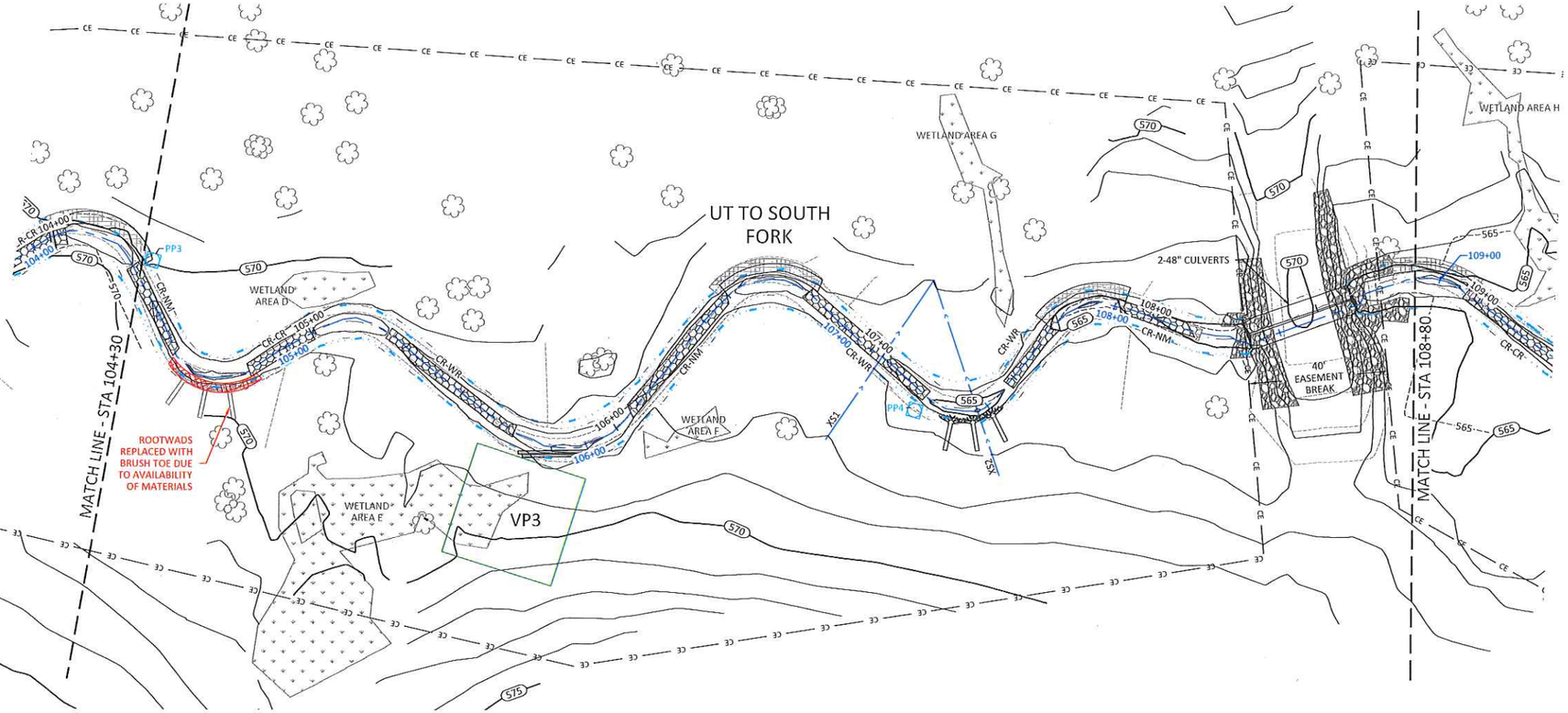
Revisions:

Sheet 1.1

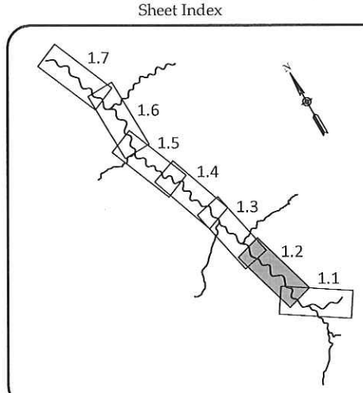


Note: As-built profile stations and match lines based on design alignment.





Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. P-0831

5-13-16

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UTSF Reach 1
Stream Plan and Profile

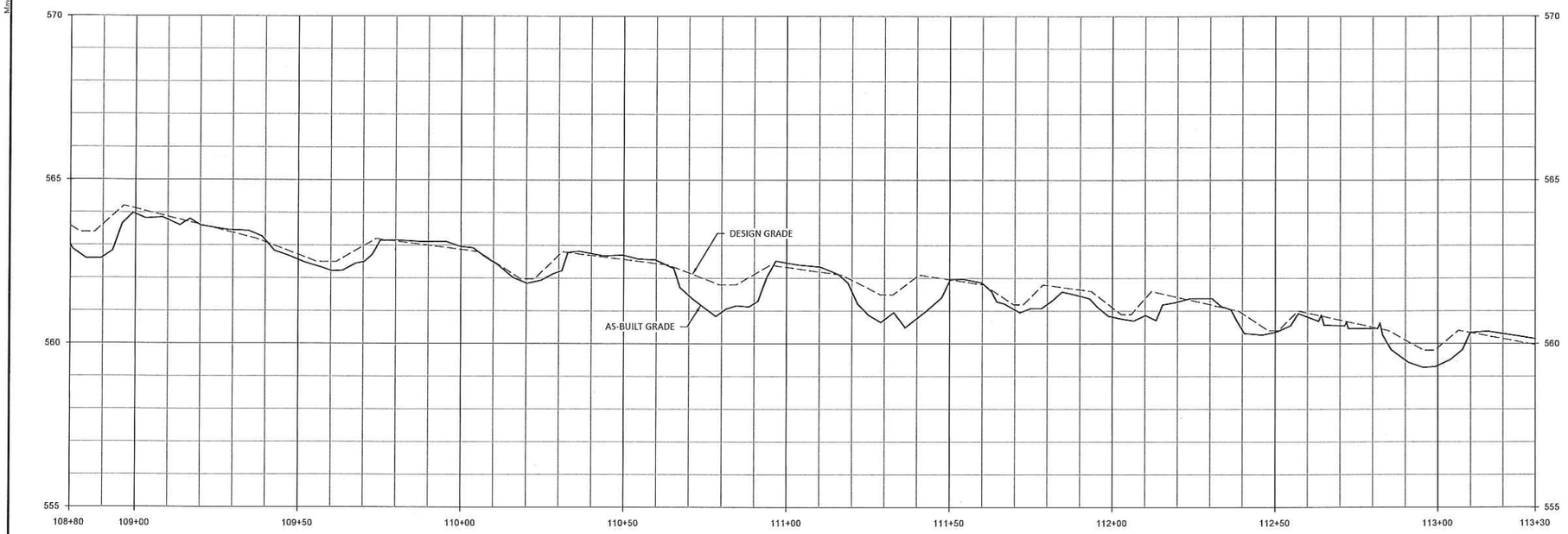
Revisions:

Date: May 13, 2016
Job Number: 005-02144
Project Engineer: JK
Drawn By: RCP
Checked By: JK

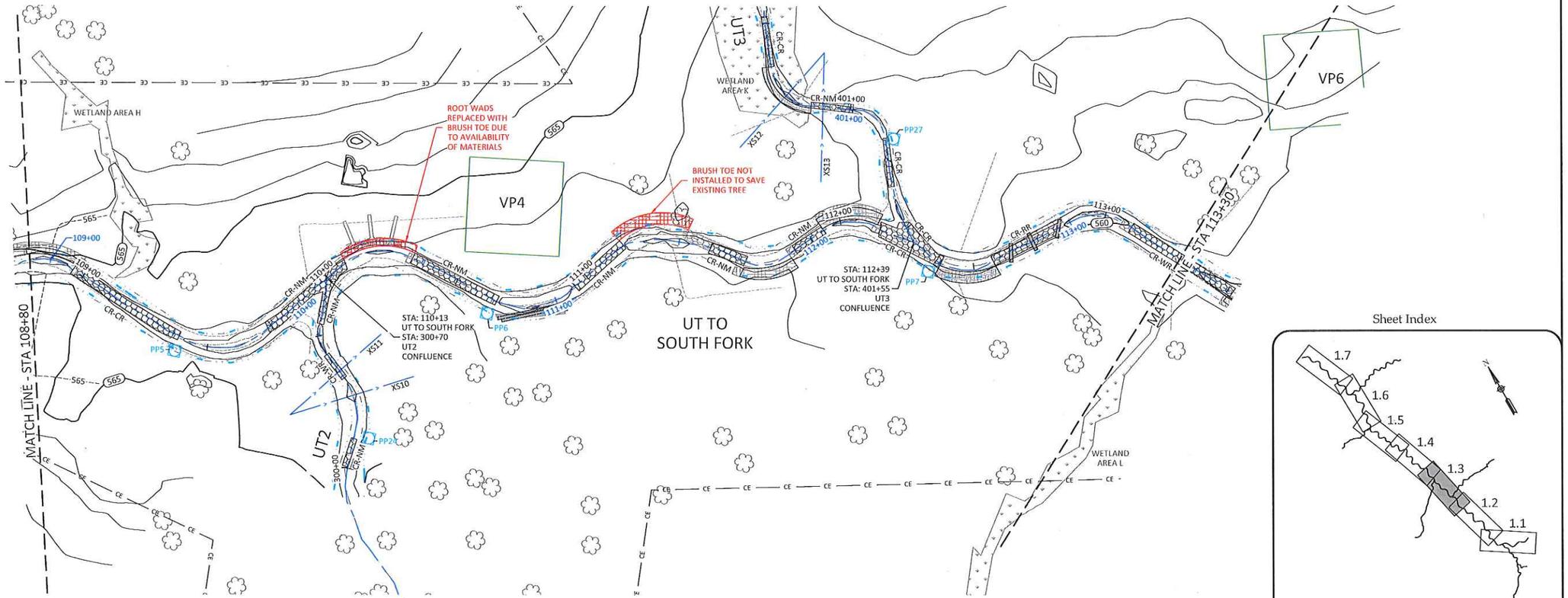
Sheet 1.2

May 13, 2016

T:\ACTIVE PROJECTS\NCS\Wilds\02144 Maney Farm\Monitoring\Baseline Monitoring\Plans\[02144_Ab-Profile.dwg]



Note: As-built profile stations and match lines based on design alignment.



0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

N

WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9987
Firm License No. P-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036161 JOSEPH E. KLEIN JEFFERSON NE

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UTSF Reach 1
Stream Plan and Profile

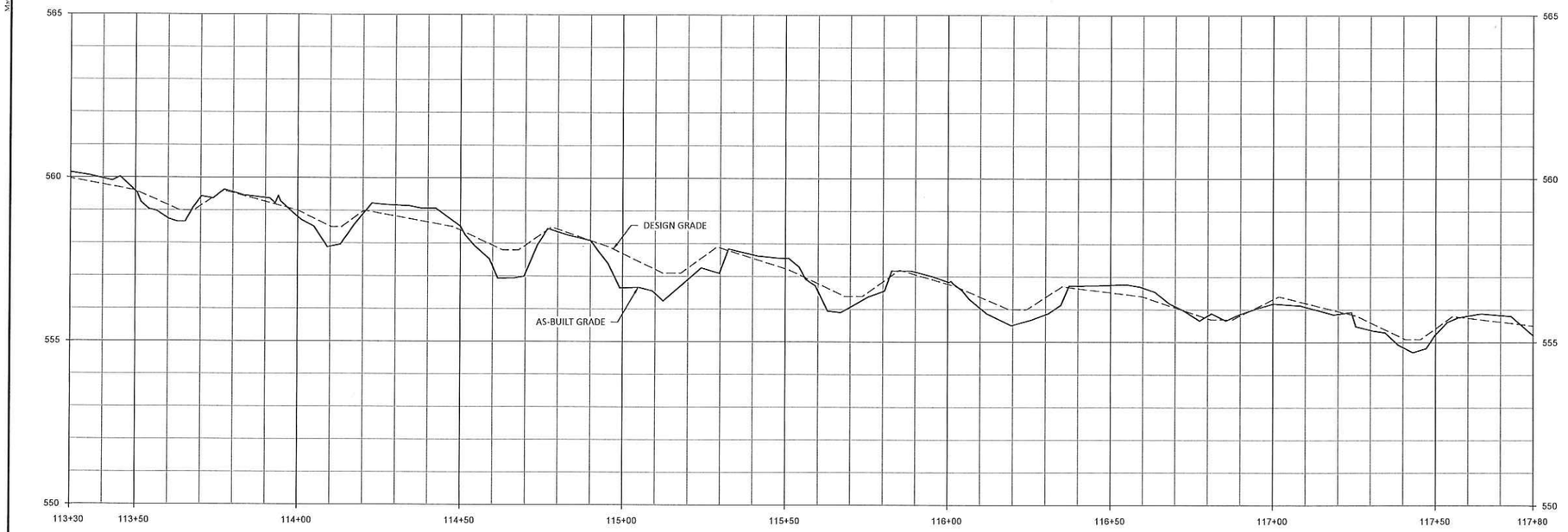
Revisions:

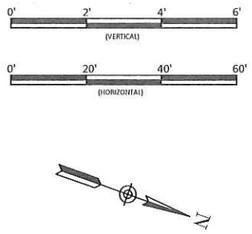
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Sheet: 1.3

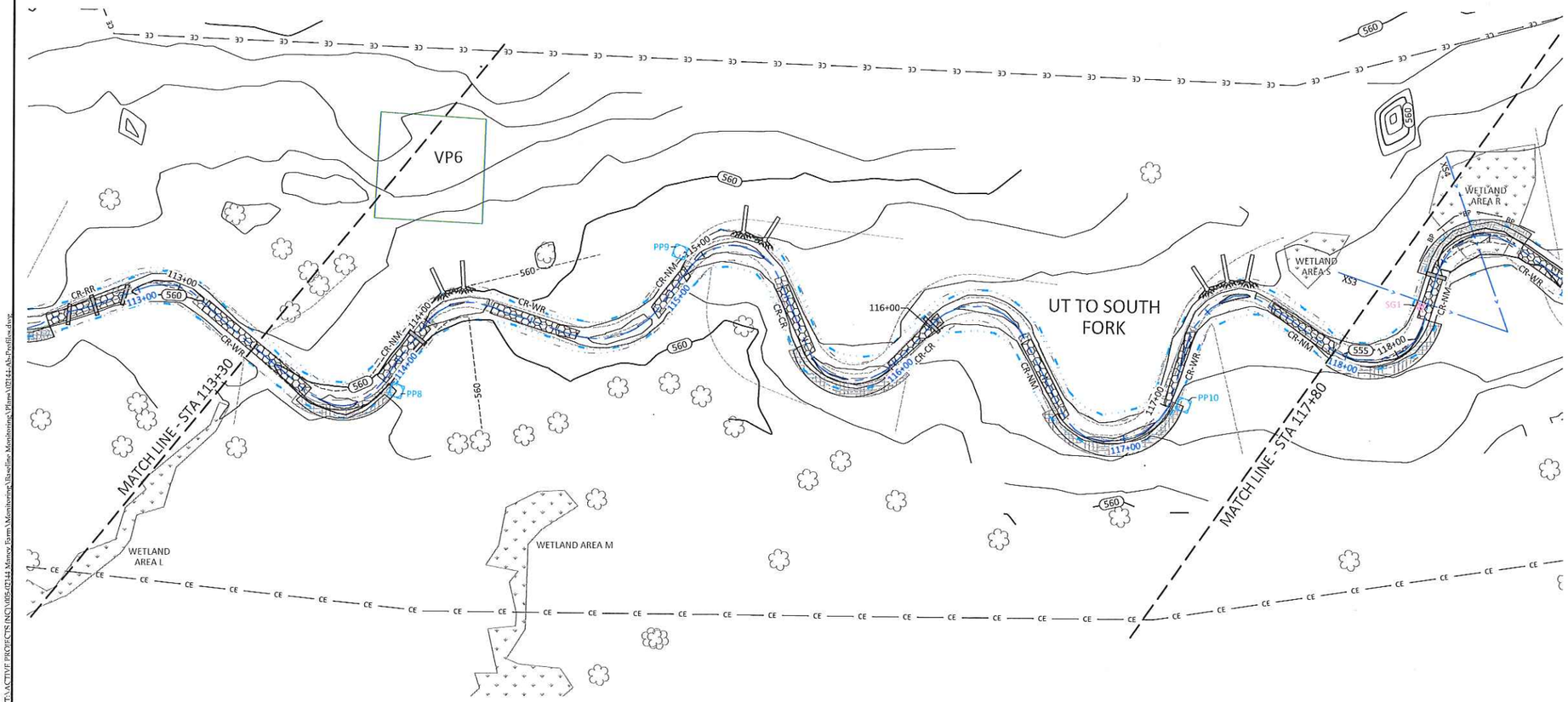
Mon 13, 2016

T:\ACTIVE PROJECTS (NC)\005\02144 Maney Farm \Monitoring\Baseline Monitoring\Plans\02144-Ab-Profile.dwg

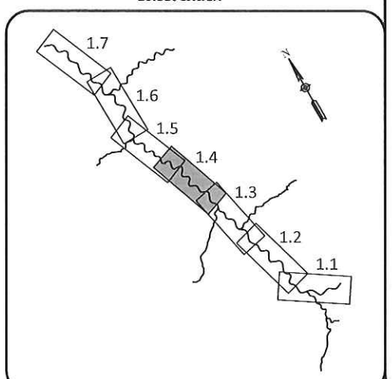




Note: As-built profile stations and match lines based on design alignment.



Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9987
Firm License No. P-0831

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UTSF Reach 1
Stream Plan and Profile

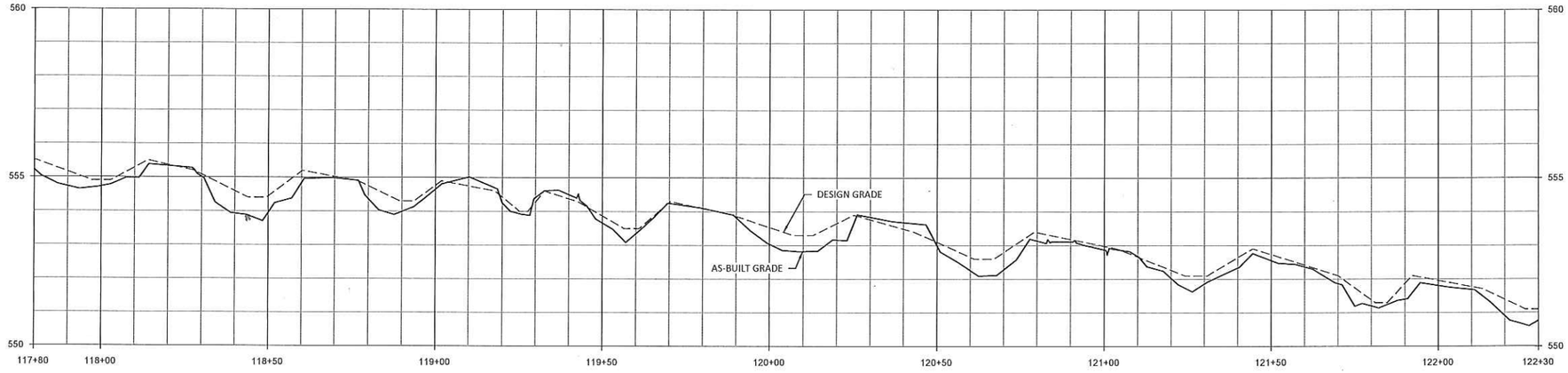
Revisions:

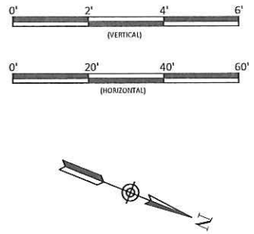
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Sheet 1.4

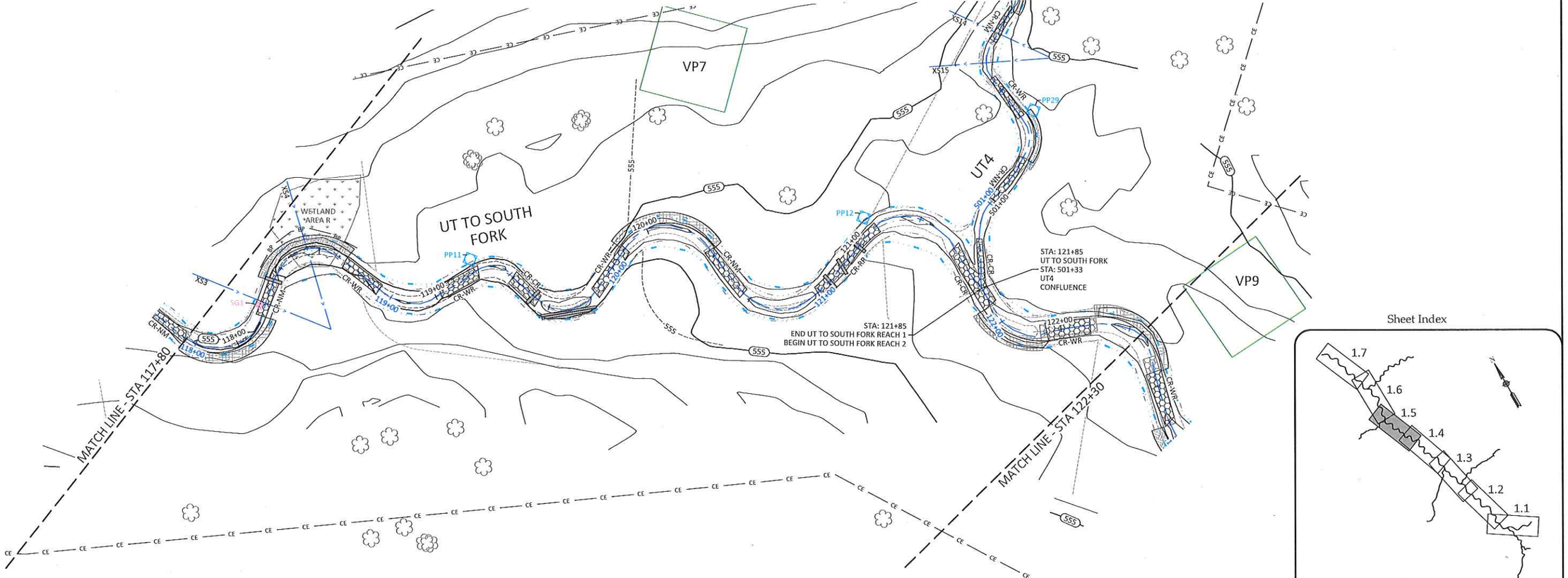
T:\ACTIVE PROJECTS (NC)\005-02144 Maney Farm\Monitoring\Baseline Monitoring\Plans\02144-Ab-Profile.dwg
May 13, 2016

May 13, 2016





Note: As-built profile stations and match lines based on design alignment.



Sheet Index

WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. F-0831

NORTH CAROLINA
SEAL
024722
ENGINEER
JEFFREY KEATON
5-13-16

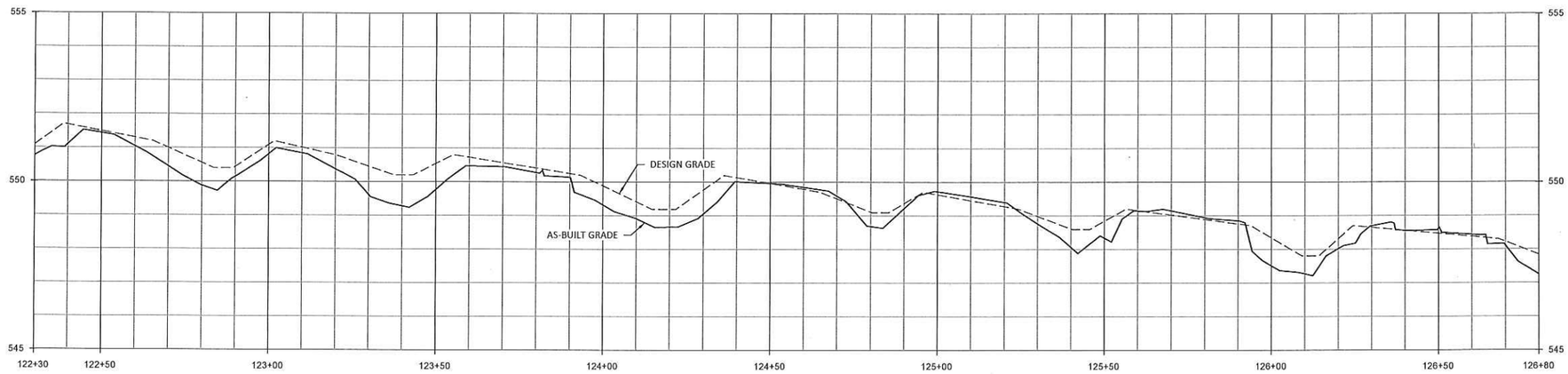
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

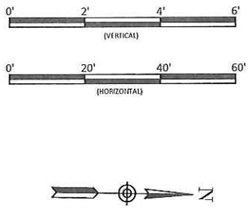
UTSF Reach 1 & 2
Stream Plan and Profile

Revisions:	
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

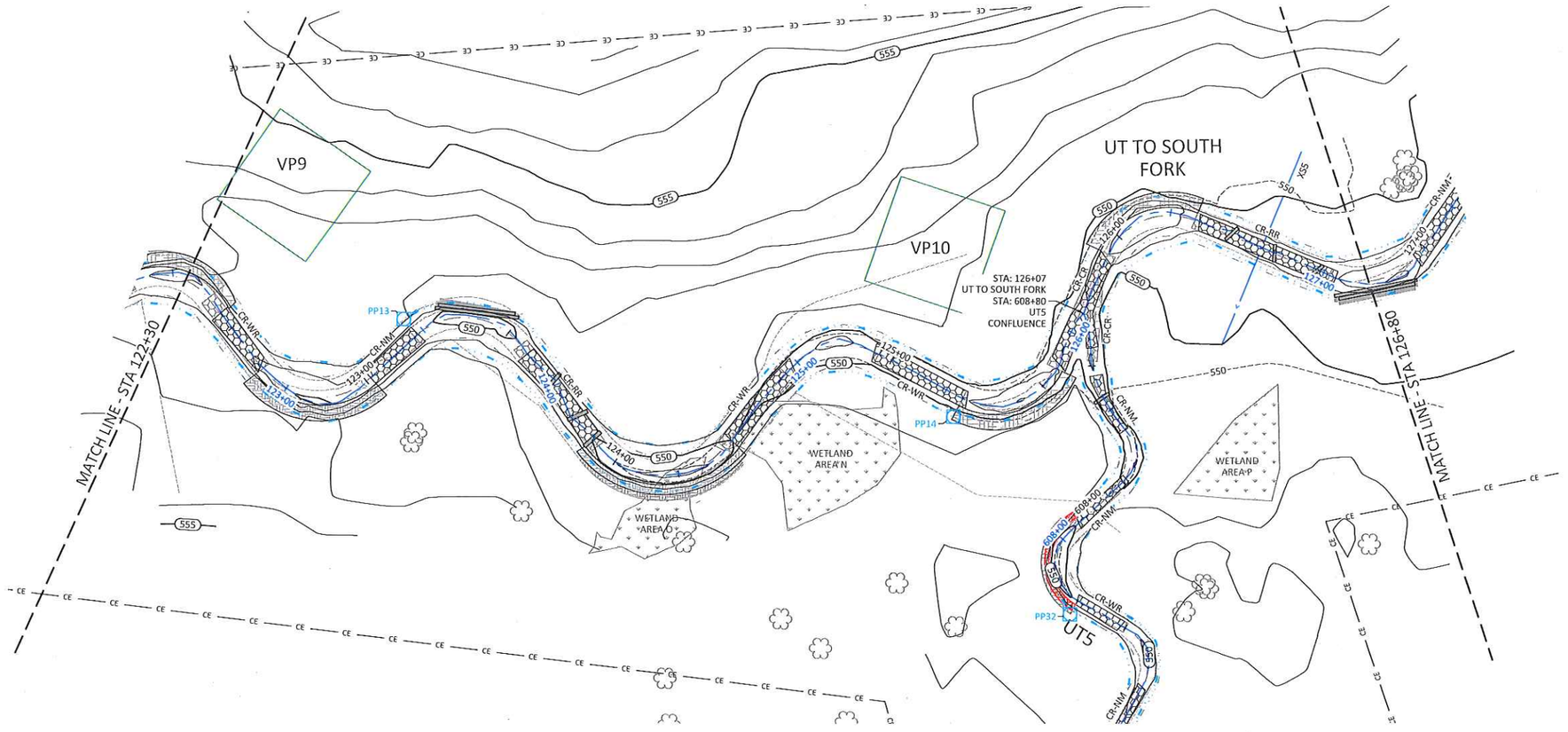
Sheet 1.5

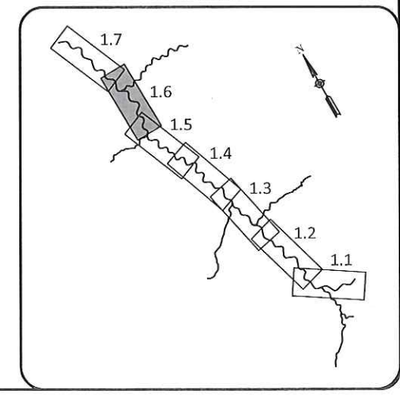
P:\ACTIVE PROJECTS (NC)\005-02144 Maney Farms\Monitoring\Wildlife Monitoring\Plans\02144-As-Profile.dwg





Note: As-built profile stations and match lines based on design alignment.





WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9585
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 040681 JOHN D. KNOX 5-13-16

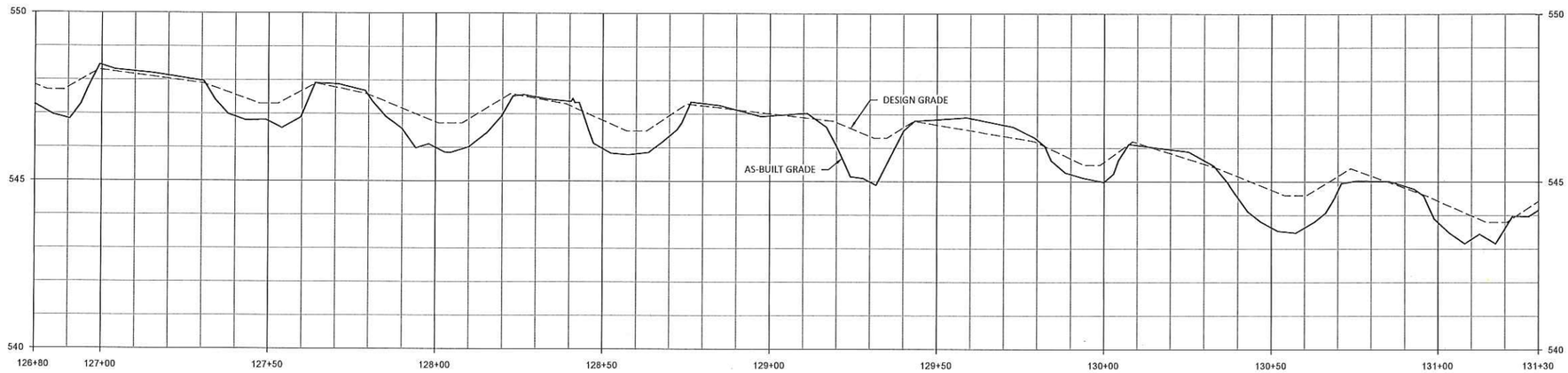
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

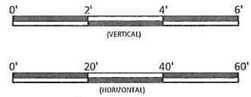
UTSF Reach 2
Stream Plan and Profile

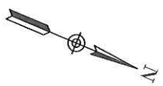
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Revisions:

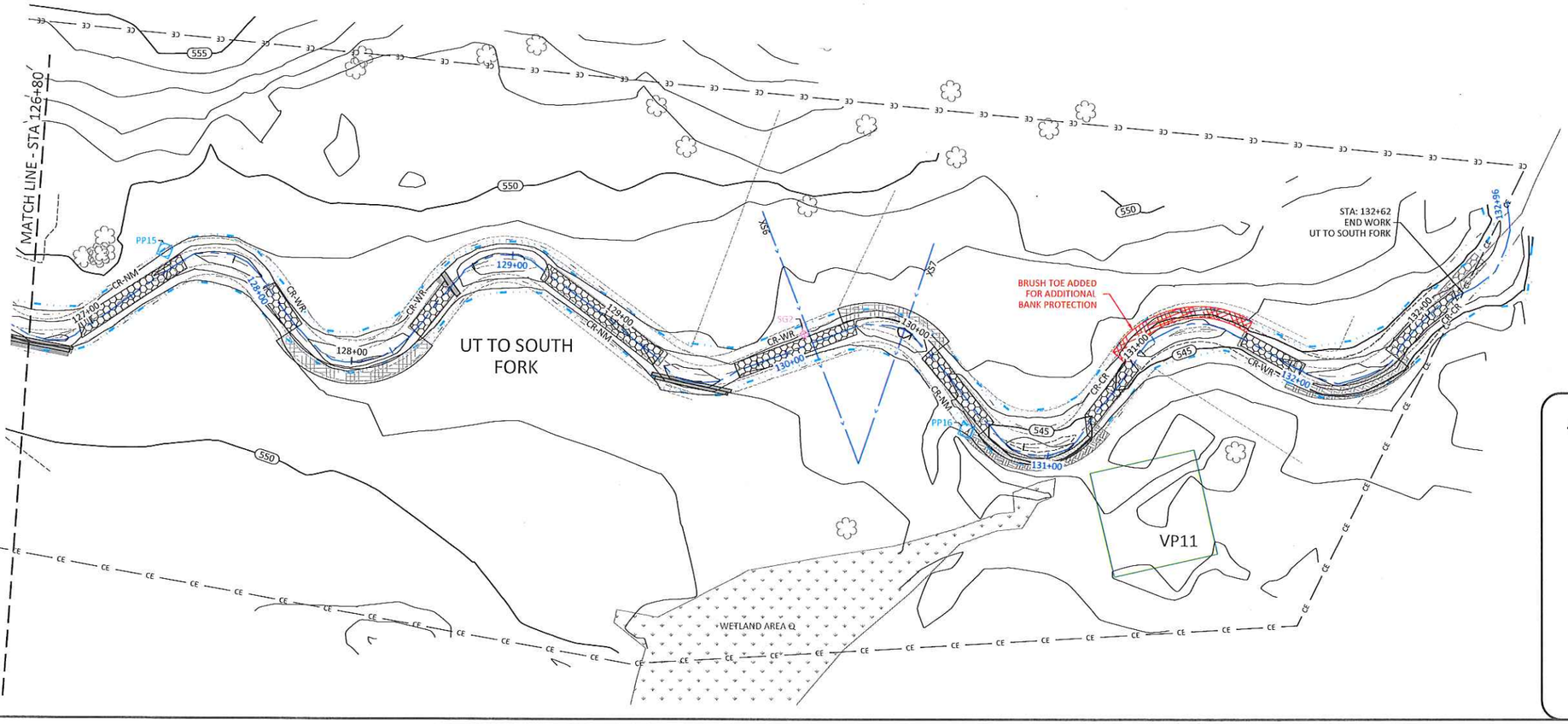
Sheet 1.6



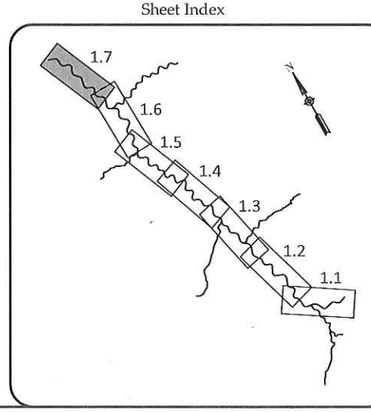




Note: As-built profile stations and match lines based on design alignment.



Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Phone: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0331

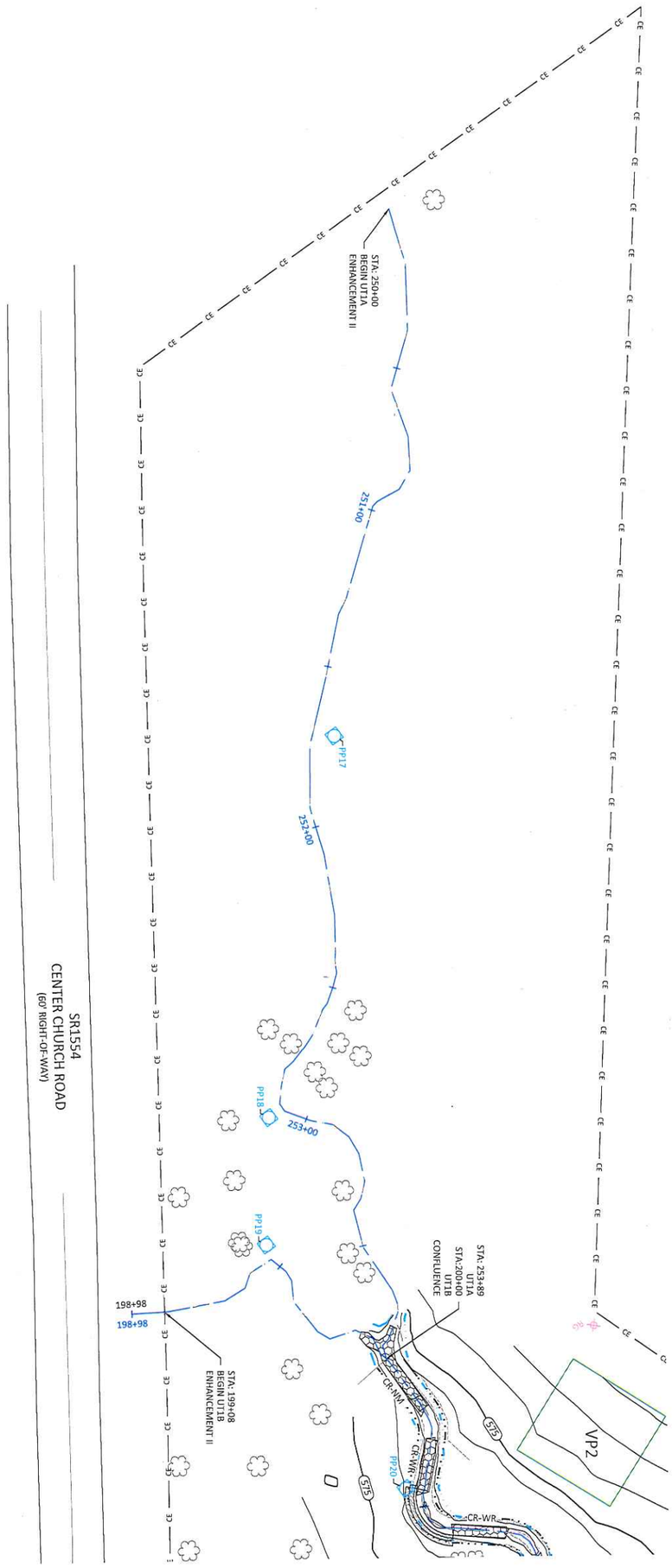
CAROLINA JEFFERSON N. 5-13-16

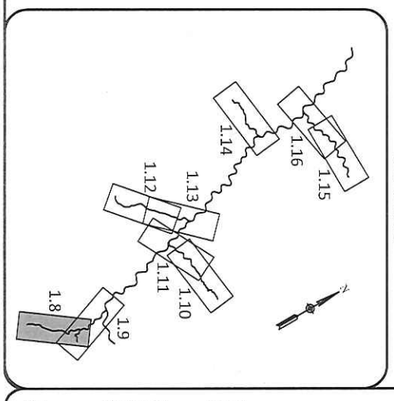
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UTSF Reach 2
Stream Plan and Profile

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK
Revisions:	

Sheet 1.7





Sheet Index

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Revisions:

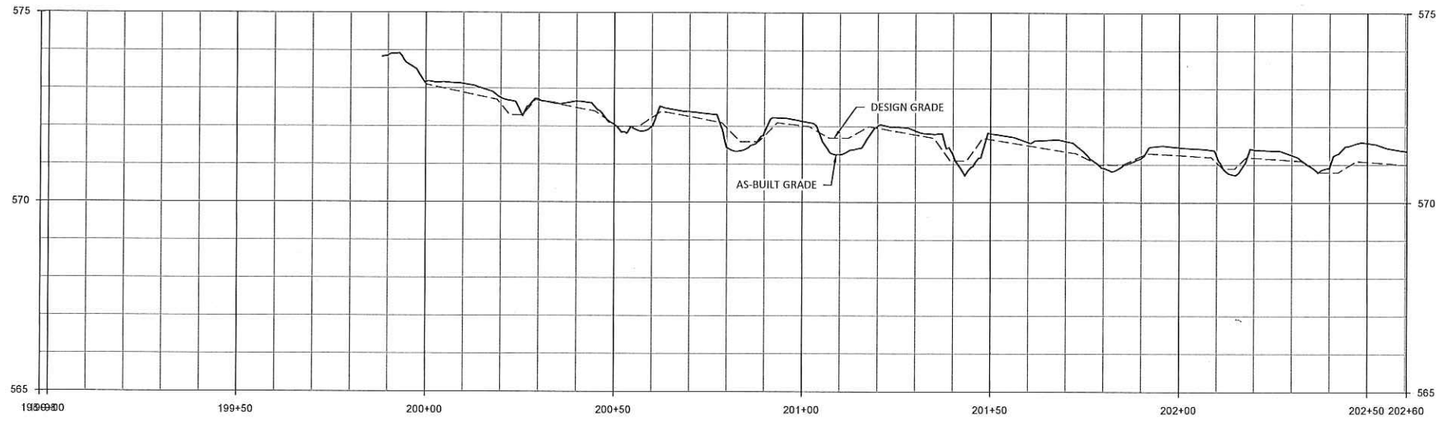
1.8
Sheet

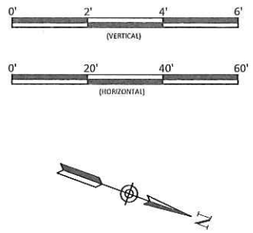
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT1A & UT1B
Stream Plan and Profile

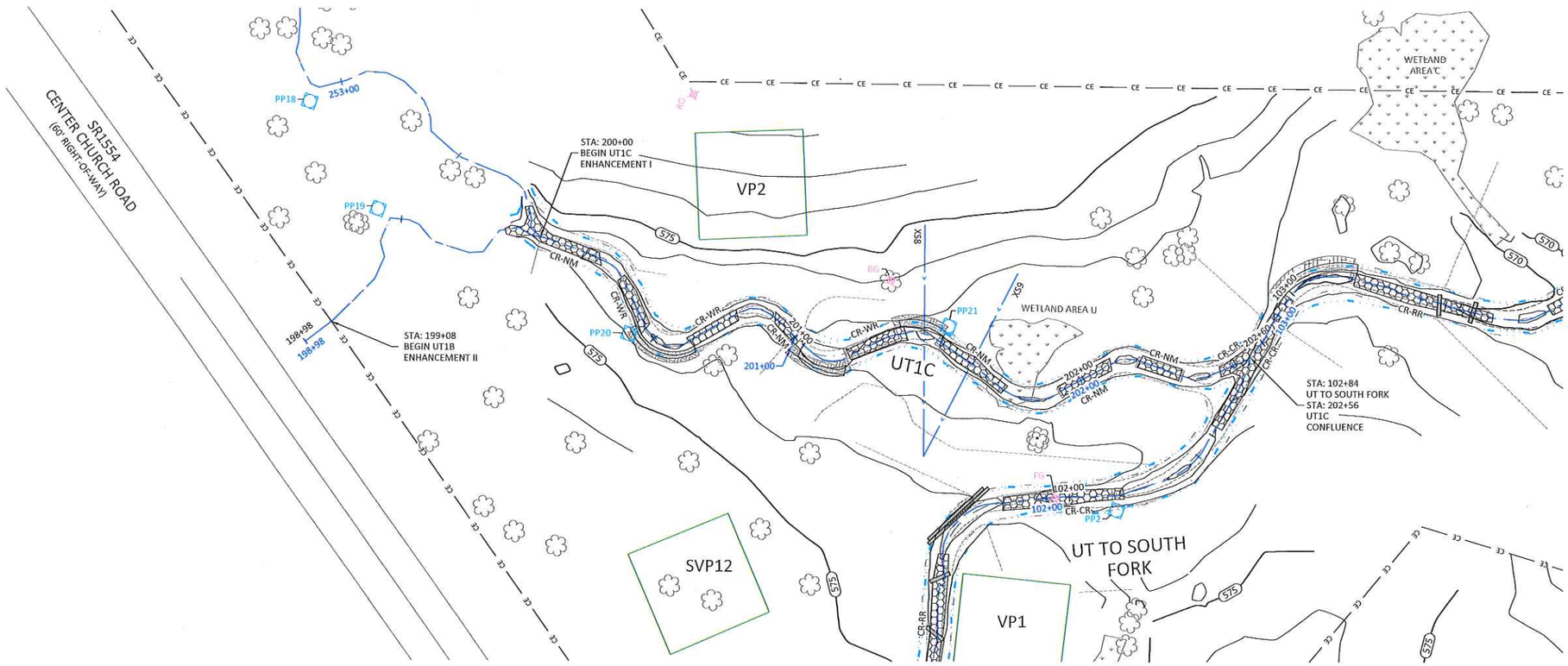
NORTH CAROLINA
SEAL
030107
ENGINEER
JEFFERSON N. KERTON
5-13-16

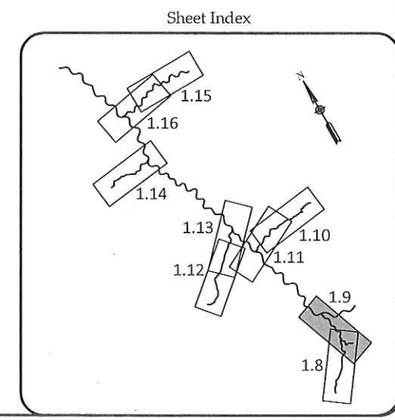
WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. P-0831





Note: As-built profile stations and match lines based on design alignment.





WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831

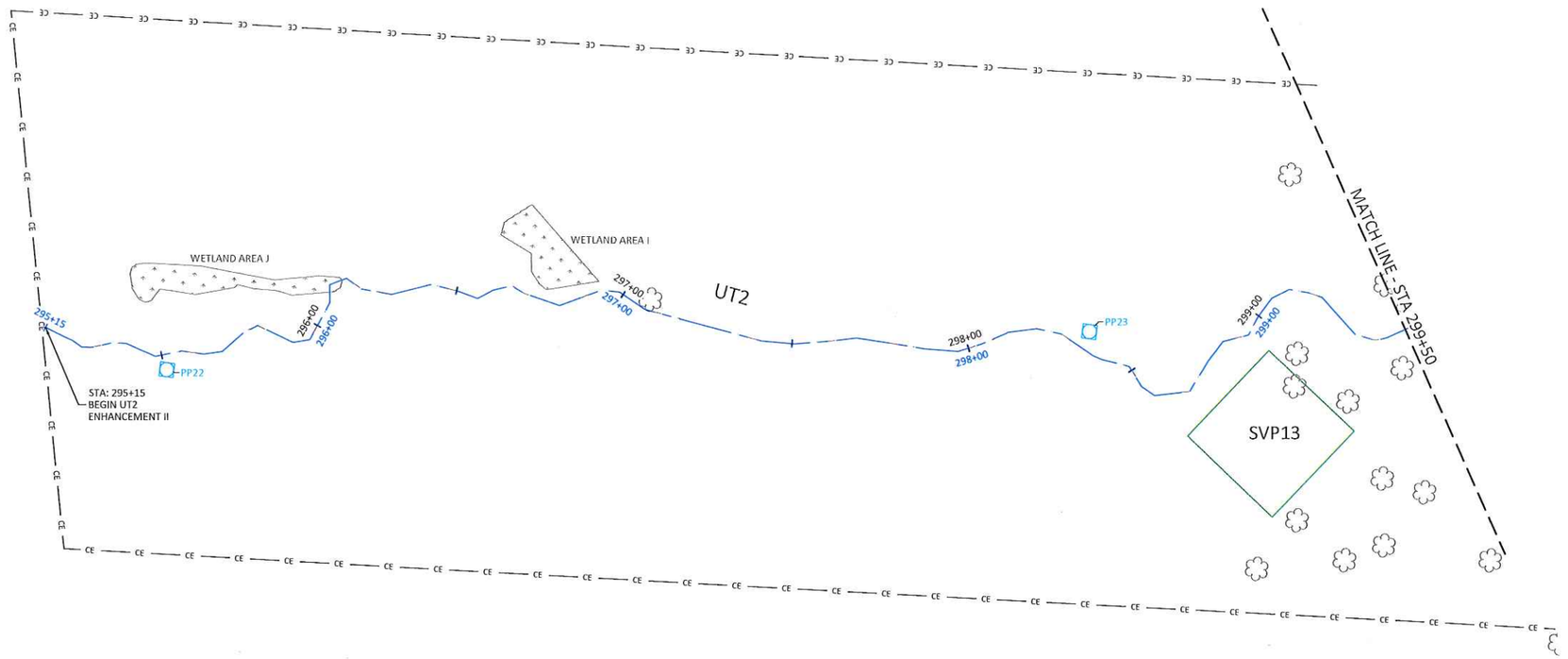
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036007 JOHN E. KLEIN 5-13-16

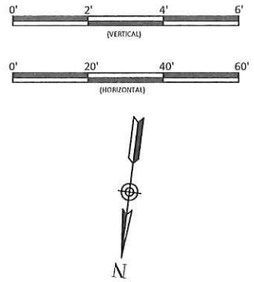
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT1C
Stream Plan and Profile

Revisions:	
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

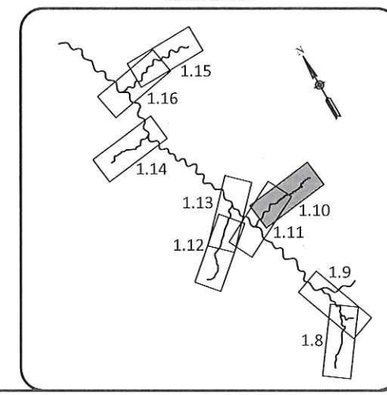
Sheet 1.9





Note: Match lines based on design alignment.

Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9958
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 042831 JAMES KEITH LENEAVE 5-13-16

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT2
Stream Plan and Profile

Revisions:

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Sheet 1.10

Note: As-built profile stations and match lines based on design alignment.

Sheet Index

WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No: F-0831

5-13-16

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT2
Stream Plan and Profile

Revisions:

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Sheet 1.11

May 13, 2016

T:\ACTIVE PROJECTS (NC)\005-02144 Maney Farm\Monitoring\Baseline Monitoring\Plans\UT2\44-ab-Profile-2.dwg

Note: Match lines based on design alignment.

Sheet Index

WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 042902 JOHN A. KLEINFELTER 5-13-16

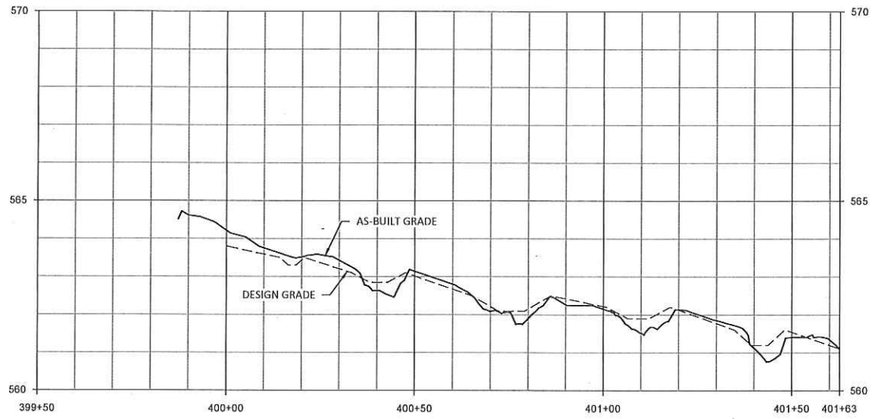
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

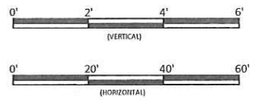
UT3
Stream Plan and Profile

Revisions:

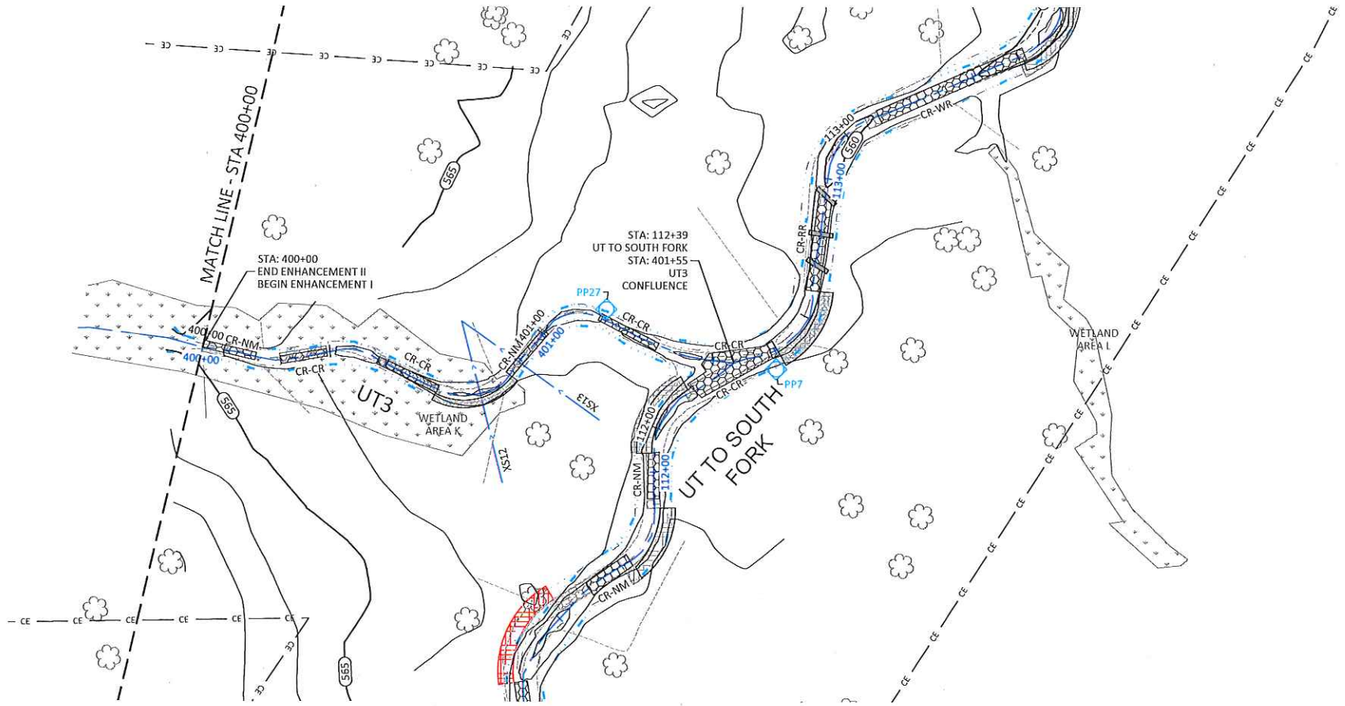
Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Sheet 1.12

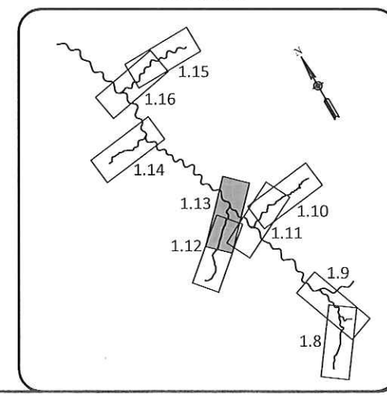




Note: As-built profile stations and match lines based on design alignment.



Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038707 JOSEPH KLEIN 5-13-16

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

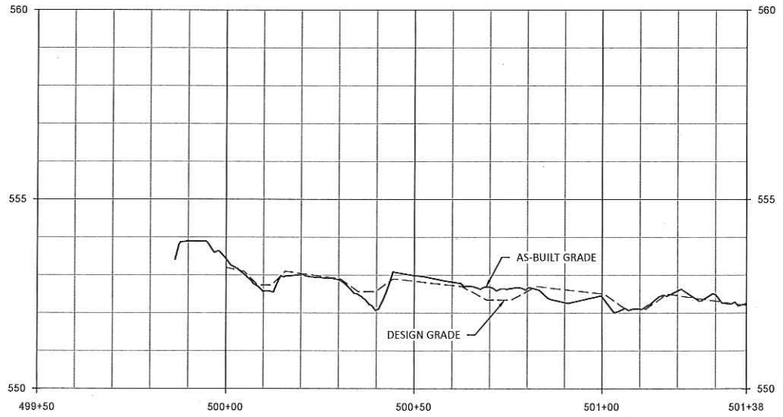
UT3
Stream Plan and Profile

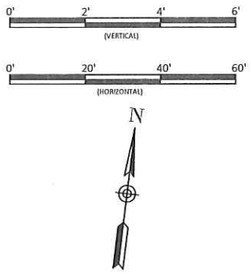
Revisions:

Date: May 13, 2016
Job Number: 005-02144
Project Engineer: JK
Drawn By: RCP
Checked By: JK

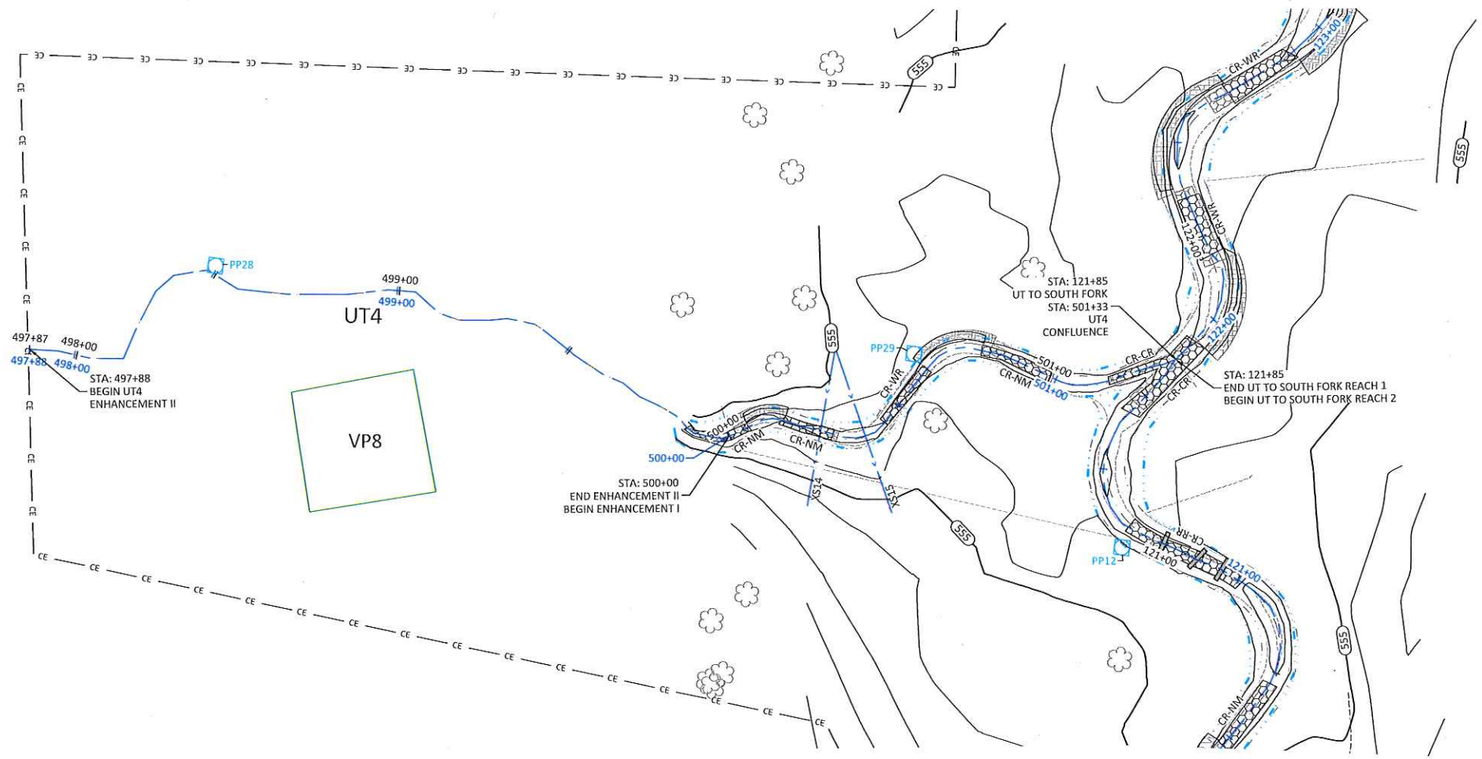
Sheet: 1.13

May 13, 2016

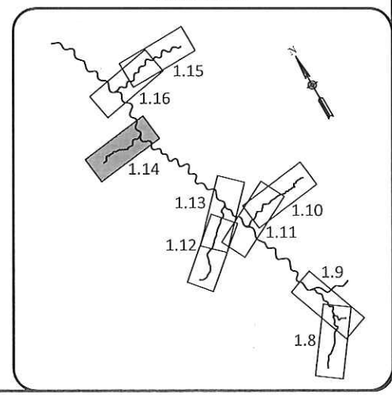




Note: As-built profile stations and match lines based on design alignment.



Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9987
Firm Licenses No. P-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 036811 REGISTERED JEFFERSON N. HOLLEY 5-13-16

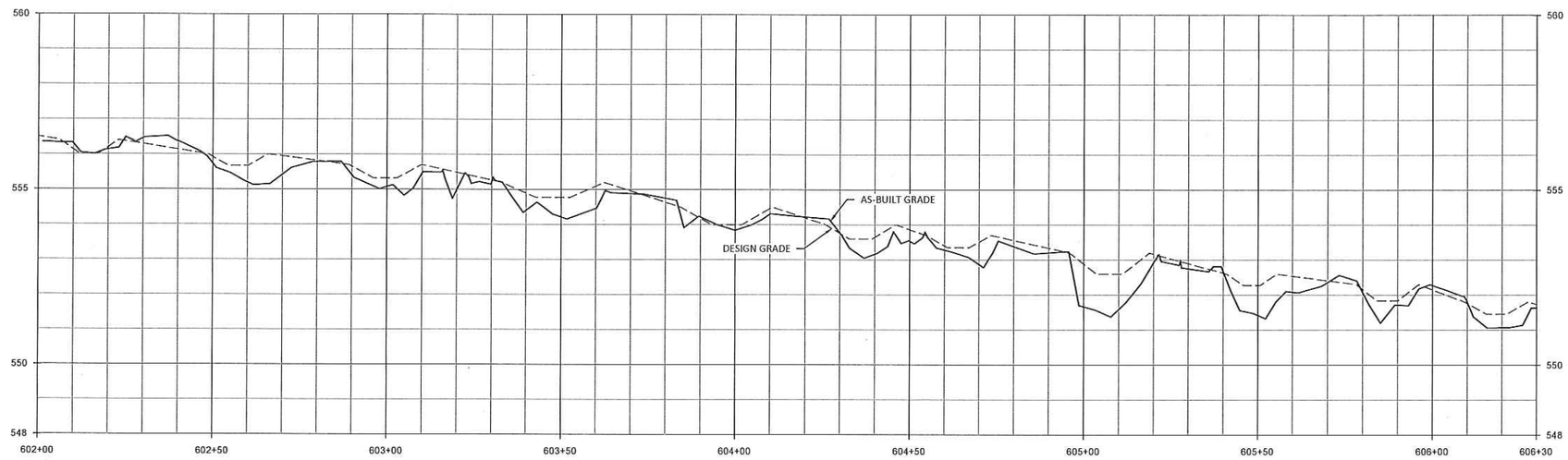
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

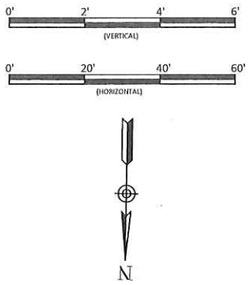
UT4
Stream Plan and Profile

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

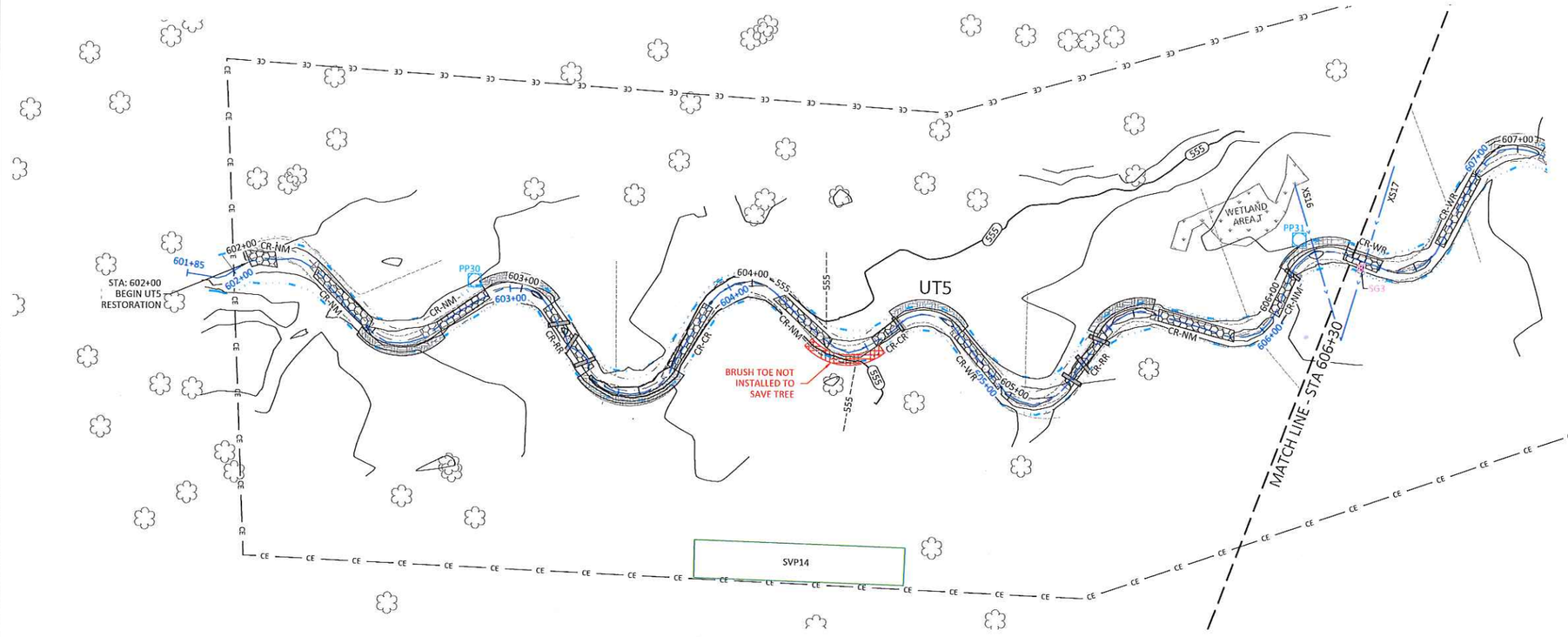
Revisions:

Sheet: 1.14

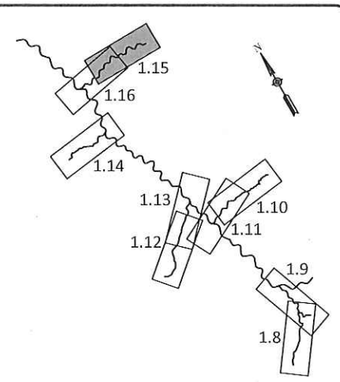




Note: As-built profile stations and match lines based on design alignment.



Sheet Index



WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No: F-0831

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT5
Stream Plan and Profile

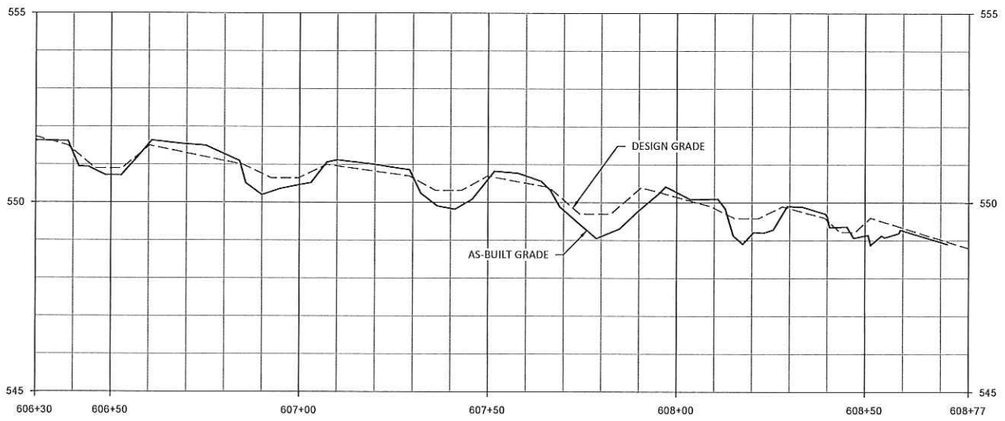
Revisions:

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

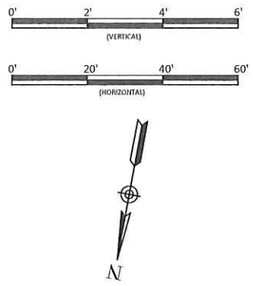
Sheet 1.15

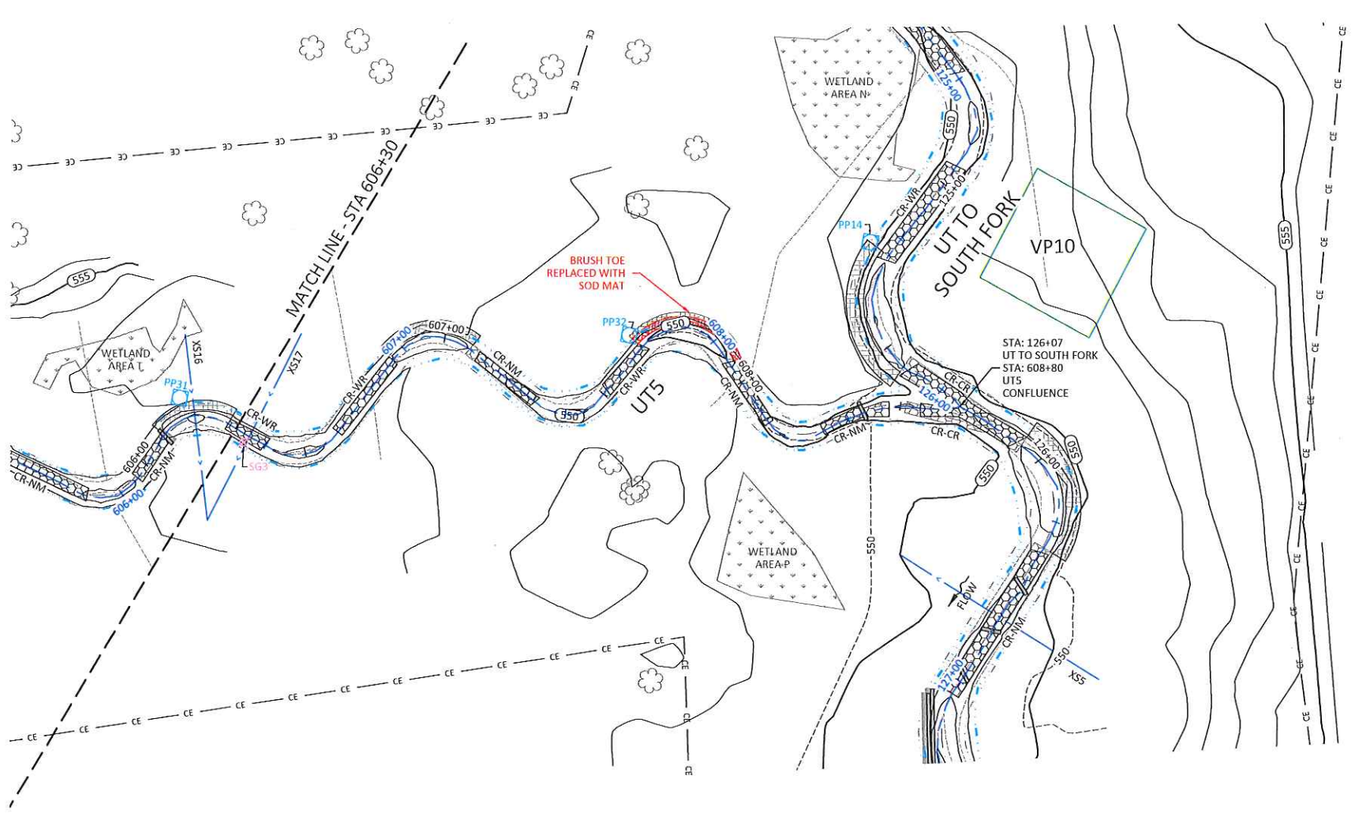
T:\ACTIVE PROJECTS (NC)\005\02144 Maney Farm \Monitoring \Baseline Monitoring \Plans \02144-As-Profile.dwg

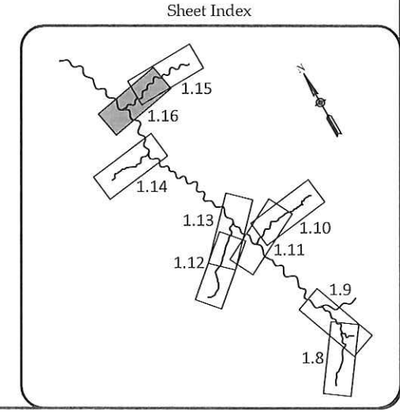
May 13, 2016



Note: As-built profile stations and match lines based on design alignment.







WILDLANDS
ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT5
Stream Plan and Profile

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Revisions:

Sheet 1.16

T:\ACTIVE PROJECTS (NC)\005-02144 Maney Farm\Monitoring\Baseline Monitoring\Plans\02144-As-Profiles.dwg

May 13, 2016

Streambank Planting Zone						
Live Stakes						
Species	**Common Name**	**Max Spacing**	**Indiv. Spacing**	**Min. Size**	**Stratum**	**% of Stems**
Cornus ammomum	Silky Dogwood	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
Salix sericea	Silky Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	35%
Salix nigra	Black Willow	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	15%
Physocarpos opulifolius	Ninebark	8 ft.	2-8 ft.	0.5"-1.5" cal.	Shrub	15%
Herbaceous Plugs						
**Juncus effusus*	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	40%
Carex alata	Broadwing Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	40%
Panicum virgatum	Switchgrass	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	20%

*Juncus effusus only to be used in channels within 100' of confluence with UT to South Fork Cane Creek.

Buffer Planting Zone						
Bare Root						
Species	**Common Name**	**Max Spacing**	**Indiv. Spacing**	**Min. Caliper Size**	**Stratum**	**% of Stems**
Fraxinus pennsylvanica	Green Ash	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Liriodendron tulipifera	Tulip Poplar	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Alnus serrulata	Tag Alder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	8%
Quercus palustris	Pin Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	5%
Carpinus caroliniana	American Hornbeam	12 ft.	6-12 ft.	0.25"-1.0"	Mid-Story	4%
Viburnum prunifolium	Blackhaw Viburnum	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	2%
Calycanthus floridus	Sweetshrub	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	2%
Callicarpa americana	American Beautyberry	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	2%
Symphoricarpos orbiculatus	Coralberry	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	2%

Supplemental Mid-Story / Shrub Planting Zone						
Bare Root						
Species	**Common Name**	**Max Spacing**	**Indiv. Spacing**	**Min. Caliper Size**	**Stratum**	**% of Stems**
Carpinus caroliniana	American Hornbeam	24 ft.	12-24 ft.	0.25"-1.0"	Mid-Story	40%
Callicarpa americana	American Beautyberry	24 ft.	12-24 ft.	0.25"-1.0"	Shrub	15%
Calycanthus floridus	Sweetshrub	24 ft.	12-24 ft.	0.25"-1.0"	Shrub	15%
Viburnum prunifolium	Blackhaw Viburnum	24 ft.	12-24 ft.	0.25"-1.0"	Shrub	10%
Symphoricarpos orbiculatus	Coralberry	24 ft.	12-24 ft.	0.25"-1.0"	Shrub	10%
Aesculus pavia	Red Buckeye	25 ft.	12-24 ft.	0.25"-1.0"	Mid-Story	10%

ZONE 1 - STREAM BANK PLANTING ZONE

ZONE 2 - BUFFER PLANTING ZONE

ZONE 3 - SUPPLEMENTAL MID-STORY/SHRUB PLANTING ZONE

Permanent Riparian Seeding				
Pure Live Seed (20 lbs/ acre)				
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.5
All Year	*Agrostis hyemalis*	Winter Bentgrass	Herb	4.0
All Year	*Chasmanthium latifolium*	River Oats	Herb	2.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	3.0
All Year	*Panicum clandestinum*	Deertongue	Herb	3.5
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	2.0
All Year	*Asclepias syrica*	Common Milkweed	Herb	0.2
All Year	*Baptisia australis*	Blue False Indigo	Herb	0.2
All Year	*Gaillardia pulchella*	Annual Gaillardia	Herb	1.0
All Year	*Echinacea purpurea*	Pale Purple Coneflower	Herb	0.6

Permanent Seeding Outside Easement				
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**
All Year	*Festuca arundinacea*	Tall Fescue	Herb	40

Temporary Seeding				
Pure Live Seed				
Approved Date	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**
Aug 15 - May 1	*Secale cereale*	Rye Grain	Herb	140
May 1 - Aug 15	*Setaria italica*	German Millet	Herb	50

WILDLANDS ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9985
Firm License No. F-0831

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049521 JAMES KEEVER 5-13-16

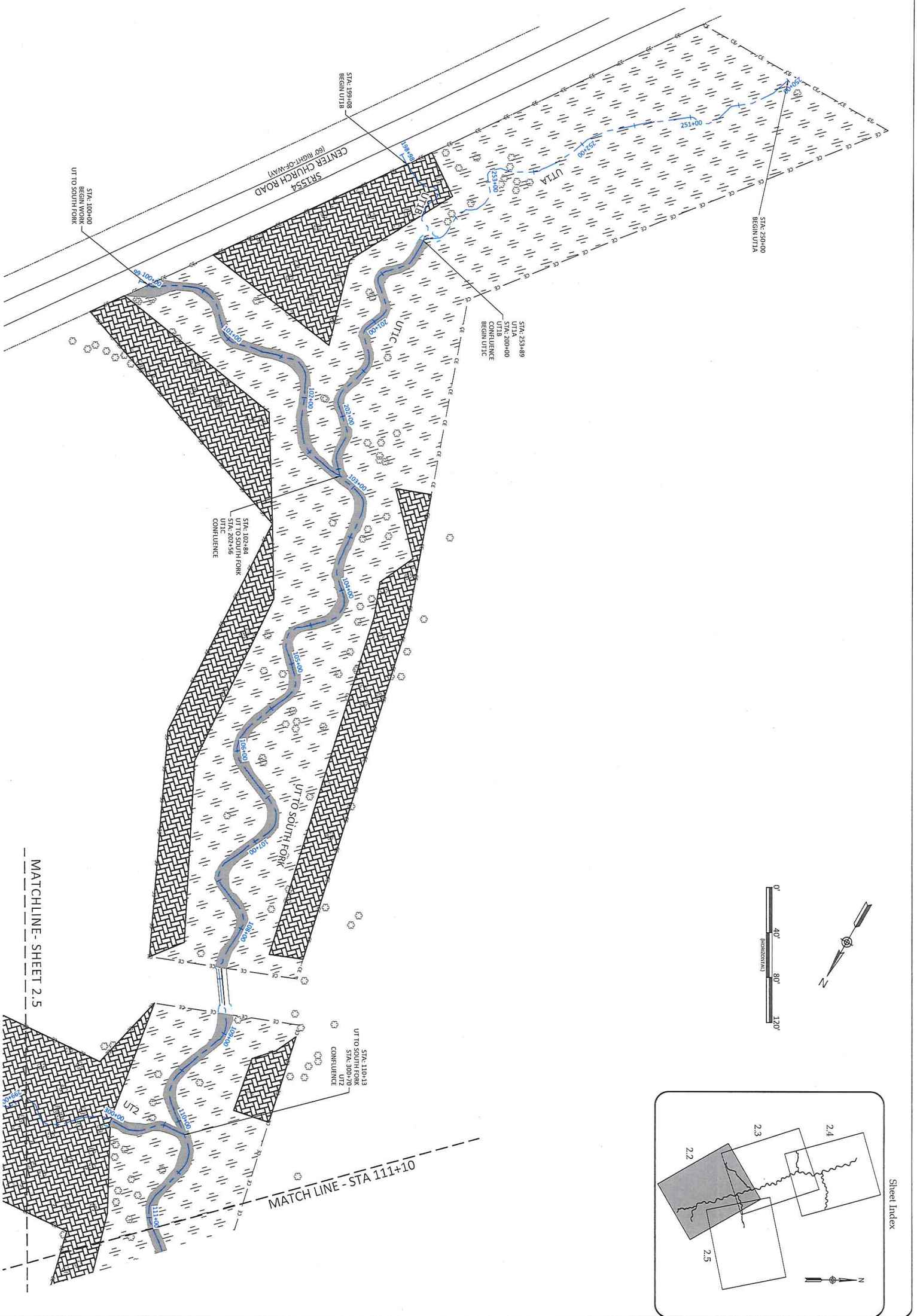
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

Planting List
Planting Plan

Revisions:

Date: May 13, 2016
Job Number: 005-02144
Project Engineer: JK
Drawn By: RCP
Checked By: JK

Sheet 2.1



Sheet Index

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Revisions:

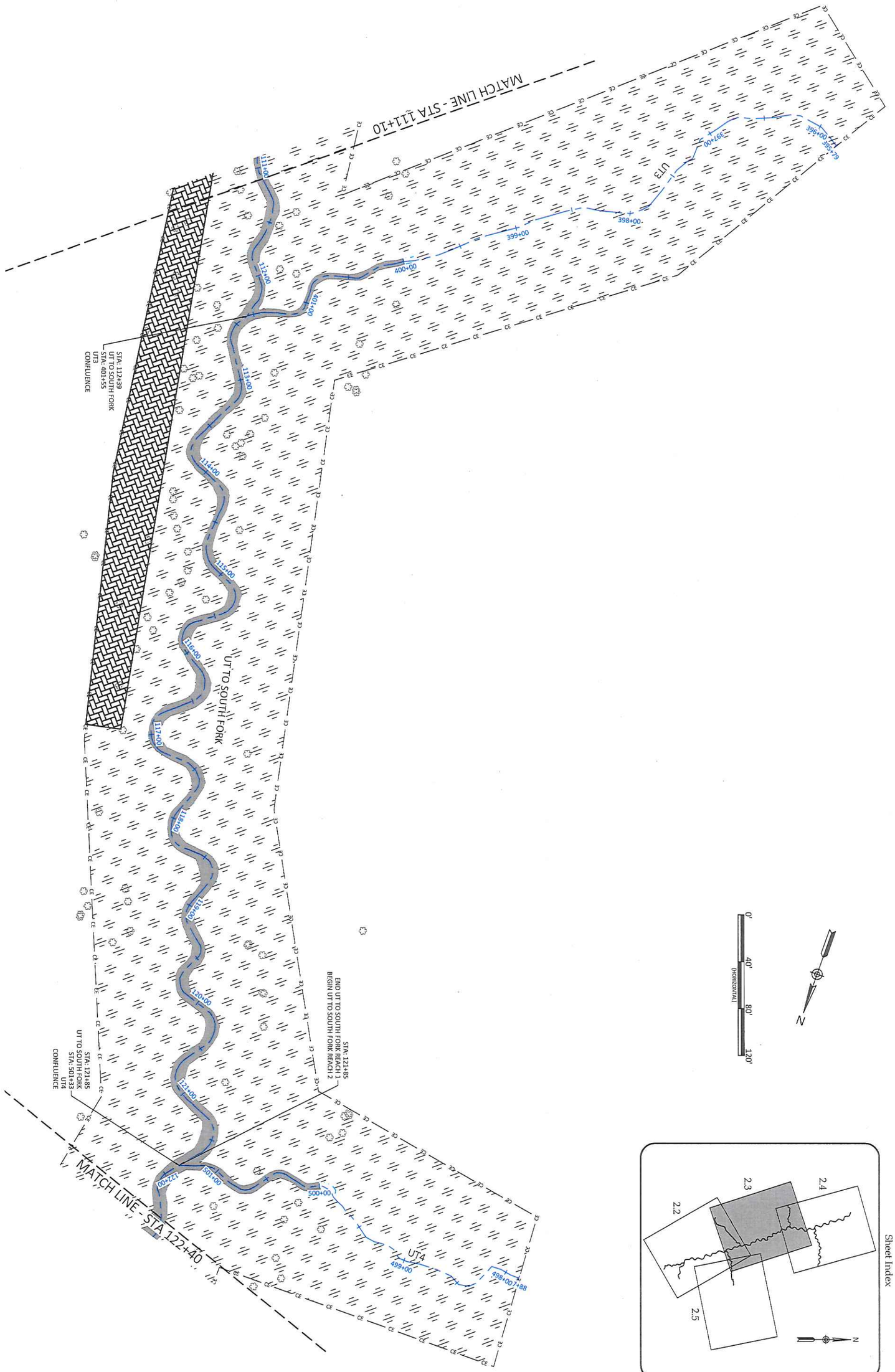
2.2
Sheet

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT to South Fork & UT1
Planting Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 038057 JOHN KLEIN
5-13-16

WILDLANDS ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831



Sheet Index

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

Revisions:

2.3
Sheet

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

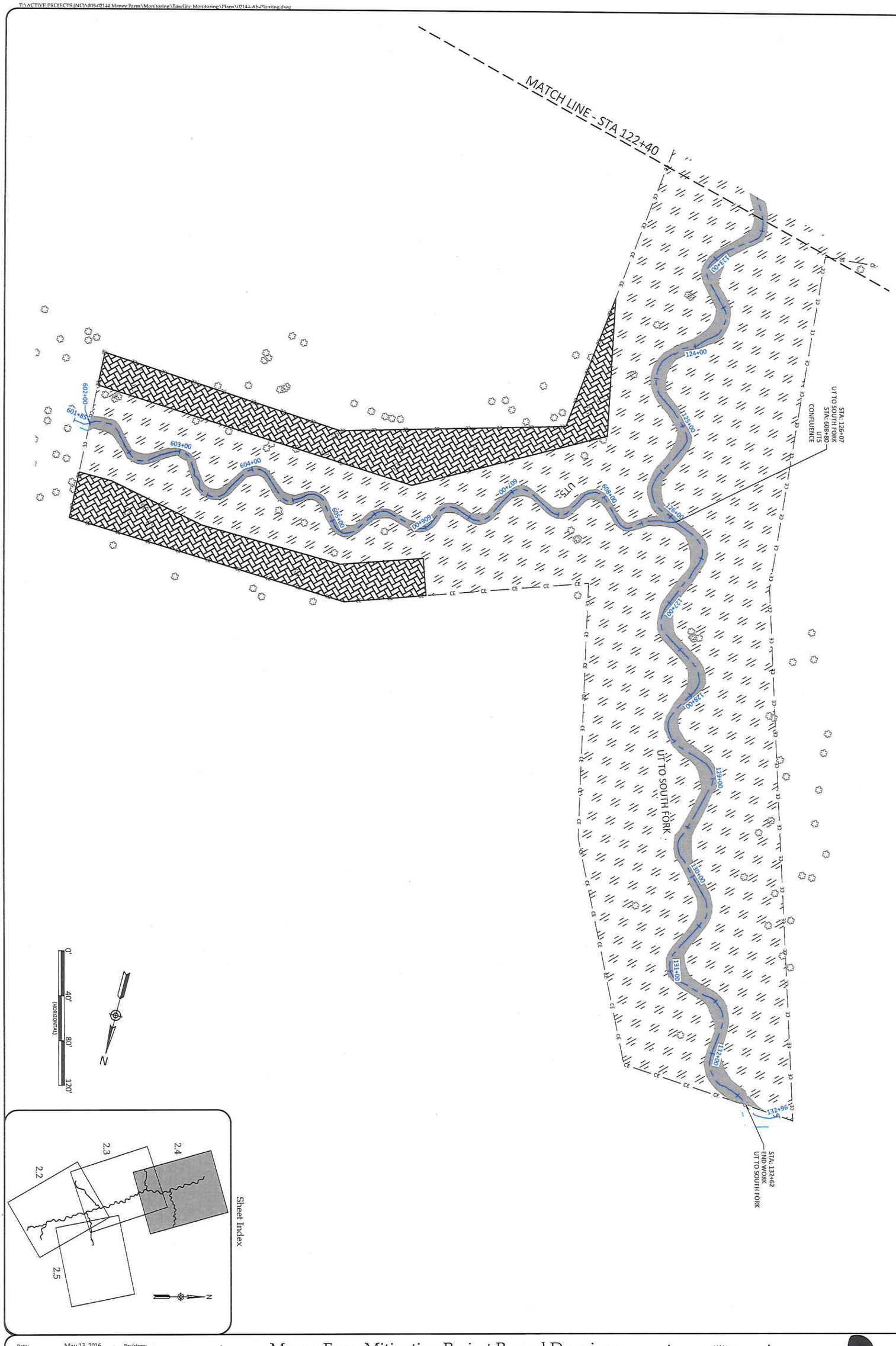
UT to South Fork, UT3, & UT4
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 040101 ENGINEER JEFFERSON N. KENTON
5-13-16

WILDLANDS ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831

T:\ACTIVE PROJECTS (NC)\005402144 Maney Farm\Monitoring\Baseline Monitoring\Plans\02144-Ab-Planting.dwg

May 13, 2016



Sheet Index

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

2.4
Sheet

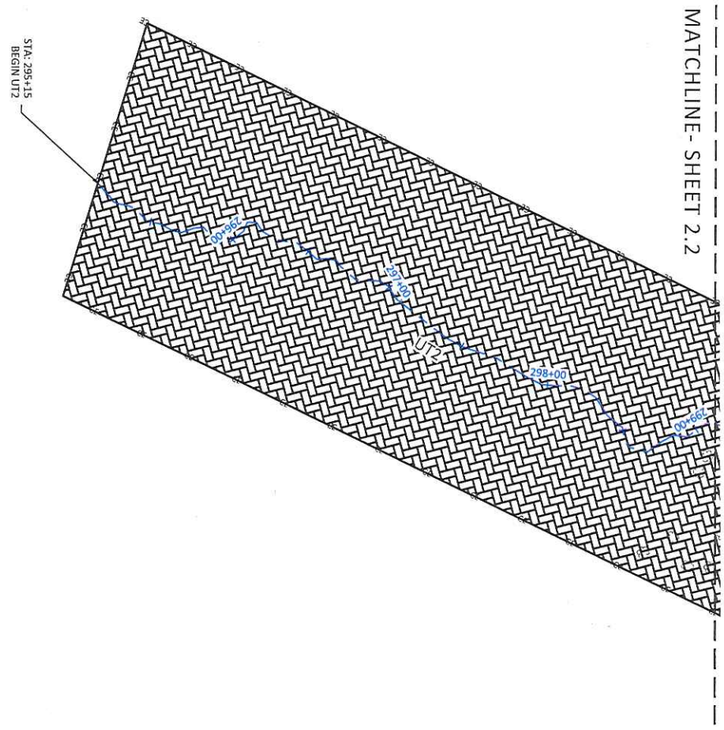
Revisions:

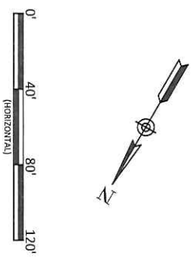
Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

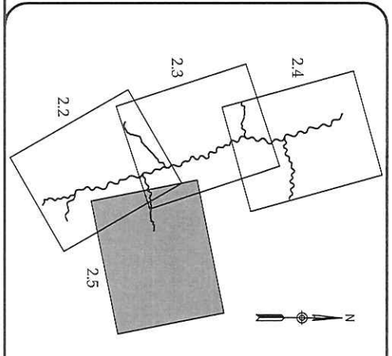
UT to South Fork & UT5
Planting Plan

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031027 JENNIFER M. KEATON
5-13-16

WILDLANDS ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831







Sheet Index

Date:	May 13, 2016
Job Number:	005-02144
Project Engineer:	JK
Drawn By:	RCP
Checked By:	JK

2.5
Sheet

Revisions:

Maney Farm Mitigation Project Record Drawings
Chatham County, North Carolina

UT2
Planting Plan

NORTH CAROLINA PROFESSIONAL SEAL 030107 ENGINEER JOSEPH KLUTSCH
5-13-16

WILDLANDS ENGINEERING
312 West Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Fax: 919.851.9986
Firm License No. F-0831