



# **MONITORING YEAR 2 ANNUAL REPORT**

Final

**NORKETT BRANCH STREAM MITIGATION SITE**  
Union County, NC  
NCDEQ Contract 004673  
NCDMS Project Number 95360

Data Collection Period: April - October 2015  
Draft Submission Date: November 13, 2015  
Final Submission Date: November 20, 2015

---

**PREPARED FOR:**



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

**PREPARED BY:**

---



**Wildlands Engineering, Inc.**  
1430 South Mint Street, Suite 104  
Charlotte, NC 28203

Kirsten Y. Gimbert  
kgimbert@wildlandseng.com  
Phone: 704.332.7754  
Fax: 704.332.3306

## EXECUTIVE SUMMARY

Wildlands Engineering (Wildlands) restored and enhanced a total of 10,706 linear feet (LF) of stream on a full-delivery mitigation site in Union County, NC. The project streams consist of Norkett Branch, a third order stream, two unnamed first order tributaries to Norkett Branch (UT1 and UT2), and two intermittent tributaries to Norkett Branch (UT2A and UT3). Water quality treatment Best Management Practices (BMPs) were installed to treat water quality on the non-jurisdictional headwaters of UT3 and an adjacent ephemeral drainage feature. The project will provide 10,098 stream mitigation units (SMUs).

The Norkett Branch Stream Mitigation Site (Site) is located in southeastern Union County, NC, approximately ten miles southeast of the City of Monroe and five miles north of the South Carolina state line. The Site is located in the Yadkin River Basin; eight-digit Cataloging Unit (CU) 03040105 and the 14-digit Hydrologic Unit Code (HUC) 03040105081020 (Figure 1). This CU was identified as a targeted local watershed in the 2009 *Lower Yadkin- Pee Dee River Basin Restoration Priority* (RBRP) plan. This RBRP plan identifies agricultural practices and runoff as the probable major sources of water quality impairment in the Middle Lanes Creek watershed. The 2008 North Carolina Division of Water Resources' (NCDWR) Basinwide Water Quality Plan (BWQP) lists turbidity and nutrient concentrations of nitrogen and phosphorus as specific concerns in the Rocky River watershed portion of the Yadkin- Pee Dee River basin. Other pollutants of concern cited in this report are fecal coliform bacteria, iron, and copper. The project reaches flow off-site, directly into Lanes Creek, which is included on the NCDWR 303d list of impaired streams. The section of Lanes Creek downstream of the project Site is listed as impaired due to turbidity (NCDWR, 2012). The project goals established in the Mitigation Plan (Wildlands, 2013) were completed with careful consideration of goals and objectives that were described in the RBRP and NCDWR BWQP and to meet the North Carolina Division of Mitigation Services (NCDMS) mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project goals were established to address the effects listed above in the executive summary from watershed and project Site stressors:

- Improve aquatic and terrestrial habitat within the riparian corridor and provide habitat corridor extension from adjacent downstream forested habitat;
- Improve additional water quality aspects within stream channels on Site;
- Decrease sediment inputs to the stream channels and decrease turbidity in receiving Lanes Creek; and
- Decrease phosphorus, nitrogen, and fecal coliform inputs to the stream channels.

Restoration and enhancement, planting, and water quality treatment BMP construction efforts were completed between November 2013 and April 2014. Baseline as-built monitoring activities were completed between April and May 2014. A conservation easement is in place on the 31.6 acres of riparian corridor and stream resources to protect them in perpetuity.

Monitoring Year 2 (MY2) assessment and Site visits were completed between April and October 2015 to assess the conditions of the Site. Overall, the Site has met the required hydrologic, vegetation, and stream success criteria for MY2. The Site's average planted stem density of 470 stems per acre meets the 320 stems per acre density required for MY2. All restored and enhanced streams are stable and functioning as designed. Maintenance performed during the MY2 assessment is successfully addressing the vegetation problem areas, and areas of bank and rill erosion. The restored streams have met both of the two bankfull events required for the Monitoring Year 5 (MY5) hydrology success criteria.



**NORKETT BRANCH STREAM MITIGATION SITE**  
Monitoring Year 2 Annual Report

**TABLE OF CONTENTS**

**Section 1: PROJECT OVERVIEW ..... 1-1**

    1.1 Project Goals and Objectives ..... 1-1

    1.2 Monitoring Year 2 Data Assessment ..... 1-3

        1.2.1 Vegetative Assessment..... 1-3

        1.2.2 Vegetation Problem Areas ..... 1-4

        1.2.3 Stream Assessment ..... 1-4

        1.2.4 Stream Areas of Concern..... 1-5

        1.2.5 Hydrology Assessment ..... 1-5

        1.2.6 Water Quality BMPs ..... 1-5

        1.2.7 Existing Wetland Monitoring..... 1-7

    1.3 Monitoring Year 2 Summary ..... 1-7

**Section 2: METHODOLOGY ..... 2-1**

**Section 3: REFERENCES ..... 3-1**

**APPENDICES**

<b>Appendix 1</b>	<b>General Tables and Figures</b>
Figure 1	Project Vicinity Map
Figure 2	Project Component/Asset Map
Table 1	Project Components and Mitigation Credits
Table 2	Project Activity and Reporting History
Table 3	Project Contacts Table
Table 4	Project Information and Attributes
<b>Appendix 2</b>	<b>Visual Assessment Data</b>
Figure 3.0-3.6	Integrated Current Condition Plan View
Table 5a-g	Visual Stream Morphology Stability Assessment Table
Table 6	Vegetation Condition Assessment Table
	Stream Photographs
	Vegetation Photographs
	Areas of Concern
<b>Appendix 3</b>	<b>Vegetation Plot Data</b>
Table 7	Vegetation Plot Criteria Attainment
Table 8	CVS Vegetation Plot Metadata
Table 9	Planted and Total Stem Counts (Species by Plot with Annual Means)
<b>Appendix 4</b>	<b>Morphological Summary Data and Plots</b>
Table 10a-c	Baseline Stream Data Summary
Table 11a-c	Monitoring Data – Dimensional Morphology Summary
Table 12a-g	Monitoring Data – Stream Reach Data Summary
	Cross-Section Plots
	Reachwide and Cross-Section Pebble Count Plots
<b>Appendix 5</b>	<b>Hydrology Data</b>
Table 13	Verification of Bankfull Events
	Stream Flow Gage Plots





**Appendix 6**

Table 14

Table 15

**Water Quality BMPs**

Water Quality Sampling Results

Pollutant Removal Results

Water Quality Data

Pollutant Removal Plot



## Section 1: PROJECT OVERVIEW

---

The Site is located in southeastern Union County, NC, approximately ten miles southeast of the City of Monroe and five miles north of the South Carolina state line. The Site is located in the Yadkin River Basin; eight-digit Cataloging Unit (CU) 03040105 and the 14-digit Hydrologic Unit Code (HUC) 03040105081020 (Figure 1). The Site is located in the Carolina Slate Belt of the Piedmont physiographic province (USGS, 1998). The project watershed consists primarily of agricultural land, pasture, and forest. The Site is located on agricultural tracts owned by Marie S. Autry (PIN 03060001A), Kay A. and Lane Haigler (PIN 03081007C; PIN 03081013; PIN 03081014), The Cox Farms Irrevocable Trust (PIN 03081010), John H. and Peggy S. Autry (3081007D), and Marion, Delano, Ruth, and John (Sr.) Cox (PIN 03081012), where the surrounding land is primarily used for pasture, and rotating soybean, corn and hay fields. A conservation easement was recorded on 31.6 acres within the seven parcels (Deed Book 06095, Pages 0530-0589).

The Site is located within the North Carolina Division of Water Resources (NCDWR) subbasin 03-07-14. The project streams consist of Norkett Branch, a third order stream, two unnamed first order tributaries to Norkett Branch (UT1 and UT2), and two intermittent tributaries to Norkett Branch (UT2A and UT3). Norkett Branch (DWQ Index No. 13-17-40-8) is the main tributary of the project and is classified as WS-V waters. Class WS-V waters are protected as water supplies draining to Class WS-IV waters or waters used by industry to supply drinking water or waters formerly used as water supply, and are protected for secondary recreation, fishing, wildlife and aquatic life, maintenance of biotic integrity, and agriculture. The drainage area for the project Site is 2,034 acres (3.18 sq mi) at the lower end of Norkett Branch Reach 2.

Mitigation work at the Site included restoration on Norkett Branch, UT1, and UT2. Enhancement II was implemented on UT2A and UT3. Water quality treatment BMPs were also implemented to treat agricultural drainage upstream of UT3 and agricultural drainage in the right floodplain of Norkett Branch Reach 2. All onsite riparian areas were planted with native species. Construction and planting activities were completed in April 2014. Directions and a map of the Site are provided in Figure 1 and project components are illustrated in Figure 2.

### 1.1 Project Goals and Objectives

Prior to construction activities, the streams were routinely maintained to provide drainage for agricultural purposes. Impacts to the stream included straightening and ditching, eroding banks, and a lack of stabilizing riparian vegetation. The stream was used as a water source for cattle in some areas, resulting in over-widened, unstable trampled banks. Algal blooms, presumably from agricultural nutrient loading, were observed during Site visits. Trampled stream banks, over-widened channels, and banks illustrating signs of instability were a common occurrence throughout the Site. The alterations of the Site to promote farming resulted in impairment of the ecological function of Site's streams. Specific functional losses at the Site include degraded aquatic habitat, altered hydrology, and reduction of quality of in-stream and riparian wetland habitats and related water quality benefits. Table 4 in Appendix 1 and Tables 10a-c in Appendix 4 present the Site's pre-restoration conditions in detail.

The mitigation project is intended to provide numerous ecological benefits such as pollutant removal and improved aquatic and terrestrial habitat. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. The agricultural stressors and pollutants have been specifically addressed by the Site design. The major goals of the stream mitigation project are to provide ecological and water quality enhancements to the Norkett Branch, Lane's Creek, Rocky River

and Yadkin River Basins while creating a functional riparian corridor at the Site level and restoring a Piedmont Bottomland Forest as described by Schafale and Weakley (1990). These project goals were established with careful consideration of goals and objectives that were described in the RBRP and to meet the North Carolina Division of Mitigation Services (NCDMS) mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project goals and objectives were established and listed in the Mitigation Plan (approved 2013) to address the effects listed above and in the executive summary from watershed and project Site stressors:

- *Improve aquatic and terrestrial habitat within the riparian corridor and provide habitat corridor extension from adjacent downstream forested habitat.* By restoring appropriate channel cross-section and profile, including riffle and pool sequences, coarse substrate zones for macroinvertebrates and deep pool habitat for fish will also be restored. Introduction of large woody debris, rock structures, brush toe, and native stream bank vegetation will provide additional habitat and cover for both fish and macroinvertebrates. Adjacent buffer areas will be restored by planting native vegetation which will provide habitat and forage for terrestrial species. These areas will be allowed to receive more regular inundating flows, and vernal pools may develop over time increasing habitat diversity. A watershed approach, restoring riparian corridor functions on multiple interconnected tributaries as well as treating agricultural drainage from headwater features with Best Management Practices (BMPs), will allow for large-scale riparian corridor connectivity.
- *Improve additional water quality aspects within stream channels on Site.* Riffle/pool sequences will be restored to provide re-aeration for oxygen levels to be maintained in the perennial reaches. Creation of deep pool zones will lower temperature, helping to maintain dissolved oxygen concentrations. Establishment and maintenance of riparian buffers will create long-term shading of the stream to minimize thermal heating. Water quality BMPs situated in the headwaters upstream of jurisdictional streams will treat agricultural runoff before it reaches project streams.
- *Decrease sediment inputs to the stream channels and decrease turbidity in receiving Lanes Creek.* Cattle will be fenced out of the riparian corridor, eliminating bank trampling. Sediment input from eroding stream banks will be reduced by installing bioengineering and in-stream structures while creating a stable channel form using geomorphic design principles. Sediment from off-site sources will be captured by deposition on restored floodplain areas where native vegetation will slow overland flow velocities. By allowing for more overbank flooding and by increasing channel roughness, in-channel velocities can be reduced. This will lower bank shear stress and decrease bank erosion.
- *Decrease phosphorus, nitrogen, and fecal coliform inputs to the stream channels.* Nitrogen and phosphorus chemical fertilizers, pesticides, and cattle waste will be decreased by buffering adjacent agricultural operations from the restored channels. Cattle will be fenced out to eliminate in-channel fecal pollution. Off-site nutrient input will be absorbed on-site by filtering flood flows through restored floodplain areas, water quality BMPs, and vernal pools positioned to treat concentrated overland flow. Flood flows will be allowed to disperse through native vegetation across the reconnected floodplain. Increased surface water residency time will provide contact treatment time and groundwater recharge potential.



## 1.2 Monitoring Year 2 Data Assessment

Annual monitoring was conducted between April and October 2015 to assess the condition of the project. The stream restoration success criteria for the Site follows the approved success criteria presented in the Mitigation Plan (Wildlands, 2013).

### 1.2.1 Vegetative Assessment

A total of 26 vegetation plots were established during the baseline monitoring within the project easement area using standard 10 meter by 10 meter vegetation monitoring plots. Plots were randomly established within planted portions of the stream restoration and enhancement areas to capture the heterogeneity of the designed vegetative communities. The plot corners were marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs were taken at the plot origin looking diagonally across the plot to the opposite corner to capture the same reference photograph locations as the as-built. The final vegetative success criteria will be the survival of 210 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of the seventh year of monitoring (MY7). Planted vegetation must average 10 feet in height in each plot by MY7. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of the third year of monitoring (MY3) and at least 260 stems per acre at the end of the fifth year of monitoring (MY5). 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 per acre), monitoring of vegetation on the Site may be terminated provided written approval is provided by the USACE in consultation with the NC Interagency Review Team.

The MY2 vegetation survey was completed in September 2015 and resulted in 24 out of 26 vegetation plots on track to meet the year three interim success criteria (320 stems/ac). Overall, the Site's average planted stem density resulted in 470 stems per acre which also exceeds the year three interim success criteria. Although the Site meets the overall stem density requirement, one vegetation plot (plot 5) has a stem density of 283 stems per acre and another vegetation plot (plot 7) has a stem density of 243 stems per acre. These two plots do not meet the interim success criteria for MY2 and plot 7 does not exceed the 260 stems per acre MY5 required stem density (260 stems/ac). The low stem survival in these plots is presumably due to a combination of drought stress, soil fertility, and scouring flows which uprooted several planted stems, which is described in further detail in section 1.2.2.

Additional planting was installed on all reaches east of Philadelphia Church Road in February 2015 prior to performing the MY2 vegetation survey due to low stem vigor in many plots and high mortality between as-built assessment and MY1 assessment. However many of the planted stems did not survive the growing season and the increase in stem density as a result of this supplemental planting was less than anticipated. The additional plantings consisted of red maple (*Acer rubrum*), river birch (*Betula nigra*), flowering dogwood (*Cornus florida*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), and willow oak (*Quercus phellos*). A few volunteers were observed in the vegetation plots, which included common buttonbush (*Cephalanthus occidentalis*), common persimmon (*Diospyros virginiana*), sweetgum (*Liquidambar styraciflua*), eastern cottonwood (*Populus deltoides*), silky willow (*Salix sericea*), and winged elm (*Ulmus alata*). The average woody stem density of the site with volunteers included is 500 stems per acre. Please refer to Appendix 3 for vegetation summary tables and raw data tables and Appendix 2 for vegetation plot photographs, the Current Condition Plan View (CCPV) maps, and the vegetation condition assessment table.

### 1.2.2 Vegetation Problem Areas

The MY2 vegetation monitoring and visual assessment resulted in Vegetation Problem Areas with “Bare/Poor Herbaceous Cover” which are noted in the Figures 3.0-3.6 and in Table 6. Areas identified with poor establishment of herbaceous cover in MY1 persist in MY2, but with some improvement. There are still areas where it has been difficult to establish vegetation on the floodplain, primarily downstream from culvert crossings. Surface soil continues to be washed out and herbaceous cover is either absent or sparse in these areas.

The total area designated as “Bare/Poor Herbaceous Cover” is approximately 1.8 acres or 6% of the planted area of the site, which is an improvement of 47% since the MY1 assessment. At this time, no vegetation problem areas of “Invasive Plants” have been designated for MY2, typically consisting primarily of a discrete dense patch of a single, undesired species of high concern for DMS-required monitoring. However several areas of undesirable species have been identified and will be watched in upcoming monitoring efforts. Groundsel tree (*Baccharis halimifolia*), cattail (*Typha latifolia*), and parrot feather (*Myriophyllum aquaticum*) were all identified in discrete dense patches, but these are not species of high concern. Few instances of Chinese privet (*Ligustrum sinense*) were noted and did not meet the mapping threshold in MY2, but will be closely watched in upcoming monitoring efforts.

Woody stem vigor continues to be weak in MY2, with only 38% of observed stems receiving a rating of three or more (indicating that the stem is healthy or more likely to survive), and 47% of observed stems receiving a rating of 1 or less (indicating that the stem is dead, missing, or unlikely to survive). The vigor of the planted stems appears to be species dependent. The best performing species were sycamore, green ash, and river birch. Less viable species were flowering dogwood, eastern redbud (*Cercis 1-4anadensis*), tuliptree (*Liriodendron tulipifera*), and common elderberry (*Sambucus 1-4anadensis*). The poor vigor of many of these trees appears linked to the dryness of the site during the MY2 growing season and associated stressors of insect damage and disease. If the vigor ratings do not improve in future monitoring years, Wildlands will prepare a plan to address these areas. Please refer to Appendix 2 for the vegetation condition assessment table (Table 6), and Figures 3.0-3.6 for the CCPV maps.

#### *Maintenance Plan*

Areas noted with poor herbaceous cover will be reseeded with native grasses in the spring of 2016, with additional seeding as necessary to establish vegetative cover. Visual assessment will be performed during MY3 to determine if any additional maintenance is necessary to promote survival of planted woody stems. We will continue to monitor problem areas identified in previous monitoring years and address as needed.

### 1.2.3 Stream Assessment

Morphological surveys for MY2 were conducted in April 2015. All streams within the Site appear stable and have met the success criteria for MY2. Riffle cross-sections surveyed along the restoration reaches appear stable and show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio. All surveyed riffle cross-section dimensions fell within the parameters defined for channels of the appropriate Rosgen stream type (Rosgen 1994). In-stream structures used to enhance channel habitat and stability on the outside bank of meander bends, such as brush toe, are providing stability and habitat as designed. Pattern data will only be completed in MY5 if there are indicators from the dimensions that significant geomorphic adjustments have occurred. No changes were observed that indicated a change in the radius of curvature or channel belt width; therefore, pattern data is not included in the MY2 report.

In general, substrate materials in the restoration reaches indicate maintenance of coarser materials in the riffle features and finer particles in the pool features. In most riffle cross-sections, the particle size

distribution for MY2 is coarser than MY1, with the exception of riffle cross-section 6, which shows an increase in the silt/clay and sand particle class sizes. The deposition of fine particles is likely due to a combination of increased wash load from floodplain rill erosion, and the hydraulic influence of a downstream culvert crossing which is backing up water in this location during larger flow events. Substrate materials are expected to coarsen in future monitoring years after vegetation establishes along the floodplain. Please refer to Appendix 2 for the stream visual assessment tables, the CCPV map, and stream reference photographs. Refer to Appendix 4 for the morphological data and plots.

#### **1.2.4 Stream Problem Areas**

There were no new stream problem areas identified in MY2. Bare banks observed in MY1 along UT2 Reach 3B near station 338+00 and along Norkett Branch Reach 1 near station 119+00 have naturally established vegetation on the streambanks and appear to be stable. Bare banks observed in MY1 along Norkett Branch Reach 2 near station 133+00 has vegetation beginning to establish on the left bank, but bank scour persists on the right bank for approximately 79 LF. Bare banks and loose matting were observed in MY1 along Norkett Branch Reach 1 near station 115+50 for approximately 50 LF. Repairs were made in MY2 to the bank with the re-installation of coir matting and application of native seed. The repairs are effectively stabilizing the bank in this area. Hay bales and coir logs were installed in MY1 in areas of concentrated flow on the floodplain, and they appear to be successfully stabilizing rill erosion.

Floodplain rill erosion on Norkett Branch Reach 1 near station 124+00 observed in MY1 was repaired in MY2 using coir logs, hay bales, and application of native seed. These repairs appear to be effectively reducing erosion, trapping sediment, and allowing vegetation to become established. Minor rill erosion continues to occur sporadically in Vegetation Problem Areas with “bare/poor herbaceous cover.” These areas will continue to receive occasional applications of native seed as needed and will be monitored for progression in MY3.

Please refer to Appendix 2 for the stream visual assessment tables, the CCPV map, reference photographs, and photographs of the stream problem areas.

#### **1.2.5 Hydrology Assessment**

Hydrologic monitoring was accomplished using both manual crest gauge readings and *in-situ* Rugged Troll100 pressure transducers installed at three surveyed cross-sections throughout the site (XS6 on Norkett Branch Reach 2, XS9 on UT1, and XS18 on UT2 Reach 3a). Rainfall amounts were measured by an Onset HOBO rain gauge located at the site, and supplemented with data from a nearby weather station at Long Run Farm in Marshville, NC (KNCMARSH13). To meet hydrological success criteria, two or more bankfull events must occur in separate years within the restored reaches by the end of MY5. During MY2, at least one bankfull or greater event was recorded in all reaches. This is the second year of a bankfull or greater event, as events have been recorded in both MY1, and MY2. Therefore the success criteria has been met for the five-year monitoring period. Please refer to Appendix 5 for hydrologic data.

#### **1.2.6 Water Quality BMPs**

Water quality grab samples were collected during the monitoring period to assess the functionality of the Step Pool Storm Conveyance BMP (SPSC BMP) and the Pocket Wetland BMP (PW BMP). Inflow and outflow was sampled at each BMP after a storm event on March 30, 2015, and on October 28, 2015. The monitoring plan calls for quarterly sampling, but due to drought conditions in 2Q and 3Q 2015, samples were unable to be obtained. Wildlands staff measured temperature, pH, and electrical conductivity *in-situ* using a calibrated YSI Model 63 Handheld Probe. Water grab samples were analyzed for nitrogen as total



nitrogen (TN) Nitrate/Nitrite (NO<sub>x</sub>), and Total Kjeldahl Nitrogen (TKN), phosphorus as total phosphorus (TP), total suspended solids (TSS) and fecal coliform (FC) by Prism Laboratories Inc. For the purpose of this analysis, only TN, TP, and TSS are considered. This sampling is not part of the success criteria for the project. Please refer to in Appendix 6 for water quality sampling results and pollutant removal rates.

The following goals for pollutant removal were established in the Mitigation Plan (2013) according to published rates of removal from similar BMP approaches. The SPSC BMP is expected to provide similar pollutant removal rates as the published removal rates of a bioretention area with internal water storage (NCDWQ, 2007), which are 85% TSS removal, 40% TN removal, and 40% TP removal. The PW BMP is expected to provide 60% TSS removal, 20% TN removal, and 45% TP removal, which is similar to extended detention wetlands (Center for Watershed Protection, 2000 and United States Environmental Protection Agency, 2012).

#### *Nitrogen species*

At the spring sampling, effective nitrogen removal was not achieved at either the SPSC BMP or the PW BMP. NO<sub>x</sub> at the SPSC BMP decreased by 0.04 mg/L, resulting in 25% removal, while both TKN and TN increased by 0.3 mg/L. Similarly, the PW BMP was a source of both TN and TKN, with outlet concentrations increasing by approximately 1.2 mg/L higher than inlet concentrations which was below detection limit. A negligible difference in NO<sub>x</sub> was observed. The results indicate marginal or insignificant organic uptake of free nitrate rather than removal by denitrification, and an export of either ammonia, or organically bound nitrogen.

#### *Total Phosphorus*

At the spring sampling, TP concentration was marginally elevated in the SPSC BMP effluent by 0.01 mg/L, a difference which is likely insignificant. However, the PW BMP provided a reduction of 0.07 mg/L, equivalent to 24% removal. No clear trend is apparent with phosphorus uptake, adsorption or release by the BMPs.

#### *Total Suspended Solids*

At the spring sampling, TSS removal was apparent at the both the SPSC BMP and the PW BMP. Influent concentrations of 6.2 mg/L was effectively reduced to below detection limits by the SPSC BMP. Influent concentrations of 16 mg/L was reduced by 44% to 9 mg/L at the PW BMP.

#### *Discussion of Monitoring Results*

The Water Quality BMPs did not meet the pollutant removal goals of TN, TP, or TSS, during spring sampling. However significant improvement in the capacity of TSS removal was noted in comparison to MY1. The establishment of vegetation within the features had the most significant effect on the TSS removal capacity of each BMP. All parameters of specific conductivity, temperature, and pH were elevated in both the SPSC BMP and the PW BMP effluent. Differences in these parameters along with dissolved oxygen in the sediment and surface water play a significant role in determining biological activity, and other physiochemical removal mechanisms in the BMPs. In MY1, influent concentrations of TN, TP and TSS were much higher in comparison to the influent concentrations observed in MY2. Lab results are still pending for the October 28, 2015 samples, and will be provided in the Final version of the MY2 Annual Report.



### **1.2.7 Existing Wetland Monitoring**

A permanent photo station (photo point) was established in the stream to wetland conversion area in Norkett Branch Reach 1 near station 104+00 on the left floodplain. The former channel area appears to be maintaining wetland hydrology and supports a dominant wetland plant community composition. The photo point (#16) is included in the Stream Photographs section of Appendix 2.

### **1.3 Monitoring Year 2 Summary**

The Site has met the required stream and vegetation mitigation success criteria for MY2. All restored reaches recorded at least one bankfull or greater event during MY2, and the MY5 hydrological success criteria for the Site has been met at this time. Geomorphically, the stability of each restored and enhanced stream remains in good standing. Visual assessment suggests the channels show little sign of instability within the bed, bank, or engineered structures and the stream survey shows little change in bankfull parameters. Visual assessment revealed vegetation problem areas with poor herbaceous cover and bare banks with some floodplain rill erosion, and planned maintenance includes reseeding with a native seed mix in the upcoming monitoring year. The average planted stem density for the site is 470 stems/ acre, and is on track to meet upcoming criteria.

Summary information/data related to various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting can be found in the Mitigation Plan documents available on the NCDMS website. All raw data supporting the tables and figures in the appendices is available upon request.



## Section 2: METHODOLOGY

---

Geomorphic data collected followed the standards outlined in *The Stream Channel Reference Site: An Illustrated Guide to Field Techniques* (Harrelson et al., 1994) and in the *Stream Restoration: A Natural Channel Design Handbook* (Doll et al., 2003). Longitudinal and cross-sectional data were collected using a total station and were georeferenced to established benchmarks and NC State Plane coordinates. Morphological surveys were conducted using a total station tied to these geo-referenced (control) points. Reachwide pebble counts were conducted along each restored reach for channel classification. Cross-section substrate analyses conducted in each surveyed riffle followed the 100 count wetted perimeter methodology to characterize pavement. All CCPV mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcView. Crest gauges were installed during the baseline monitoring period in surveyed riffle cross-sections and are monitored quarterly. Hydrology attainment installation and monitoring methods are in accordance with the USACE (2003) standards. Vegetation monitoring protocols followed the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2008).



## Section 3: REFERENCES

---

- Center for Watershed Protection, 2000. National Pollutant Removal Performance Database for Stormwater Treatment Practices, 2nd Edition. Elliot City, Maryland.
- 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, C.C., Rawlins, C.L., Potyondy, J.P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Techniques*. 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, M.T., Peet, R.K., S.D., Wentworth, T.R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Retrieved from <http://cvs.bio.unc.edu/protocol/cvs-eeep-protocol-v4.2-lev1-5.pdf>.
- North Carolina Division of Water Quality (NCDWQ), 2007. Stormwater Best Management Practices Manual. <http://portal.ncdenr.org/web/wq/ws/su/bmp-ch9>
- North Carolina Division of Water Resources (NCDWR) Basinwide Planning Program, 2008. Yadkin Pee-Dee River Basinwide Water Quality Plan. <http://portal.ncdenr.org/web/wq/ps/bpu/basin/yadkinpeedee/2008>
- North Carolina Division of Water Resources (NCDWR), 2012. North Carolina 303(d) List - Category 5. August 24, 2012. [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=9d45b3b4-d066-4619-82e6-ea8ea0e01930&groupId=38364](http://portal.ncdenr.org/c/document_library/get_file?uuid=9d45b3b4-d066-4619-82e6-ea8ea0e01930&groupId=38364)
- North Carolina Ecosystem Enhancement Program (NCEEP), 2009. Lower Yadkin-Pee Dee River Basin Restoration Priorities (RBRP). [http://www.nceep.net/services/restplans/Yadkin\\_Pee\\_Deer\\_RBRP\\_2009\\_Final.pdf](http://www.nceep.net/services/restplans/Yadkin_Pee_Deer_RBRP_2009_Final.pdf)
- Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.
- Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina, 3rd approx. North Carolina Natural Heritage Program, Raleigh, North Carolina.
- United States Army Corps of Engineers (USACE). 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC
- United States Environmental Protection Agency (EPA), 2012. Stormwater Wetland Factsheet, [http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=74](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=74)
- United States Geological Survey (USGS). 1998. North Carolina Geology. <http://www.geology.enr.state.nc.us/usgs/carolina.htm>
- Weakley, A.S. 2008. *Flora of the Carolinas, Virginia, Georgia, Northern Florida, and Surrounding Areas* (Draft April 2008). University of North Carolina at Chapel Hill: Chapel Hill, NC.

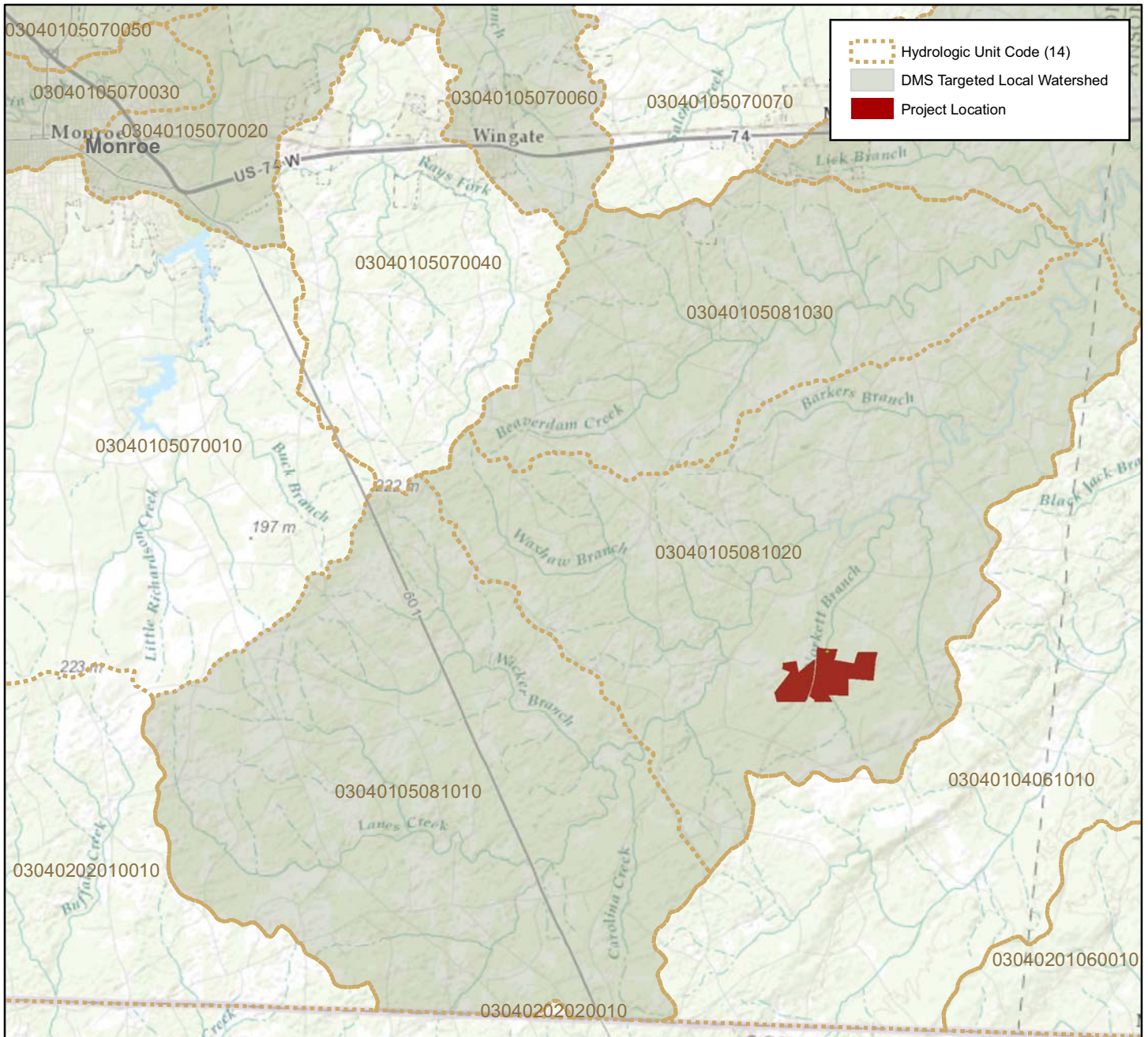
Wildlands Engineering, Inc. 2013. Norkett Branch Stream Mitigation Site Mitigation Plan. NCDMS, Raleigh, NC.

Wildlands Engineering, Inc. 2014. Norkett Branch Stream Mitigation Site Baseline Monitoring Document and As-Built Baseline Report. NCDMS, Raleigh, NC.



## **APPENDIX 1. General Tables and Figures**





	Hydrologic Unit Code (14)
	DMS Targeted Local Watershed
	Project Location

**Directions:**  
 The Norkett Branch Stream Mitigation Site is located in the southeastern portion of Union County, NC. From Charlotte, NC, take US-74 south approximately 25 miles to US-601 in Monroe, NC. Turn right on US-601 South and continue approximately 10.5 miles and then turn left onto Landsford Road. Travel approximately 3 miles and take a left onto Philadelphia Church Road. Travel 2 miles and cross over UT2 to Norkett Branch. The project site is located upstream and downstream of the Philadelphia Church Road stream crossing.

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



Figure 1 Project Vicinity Map  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



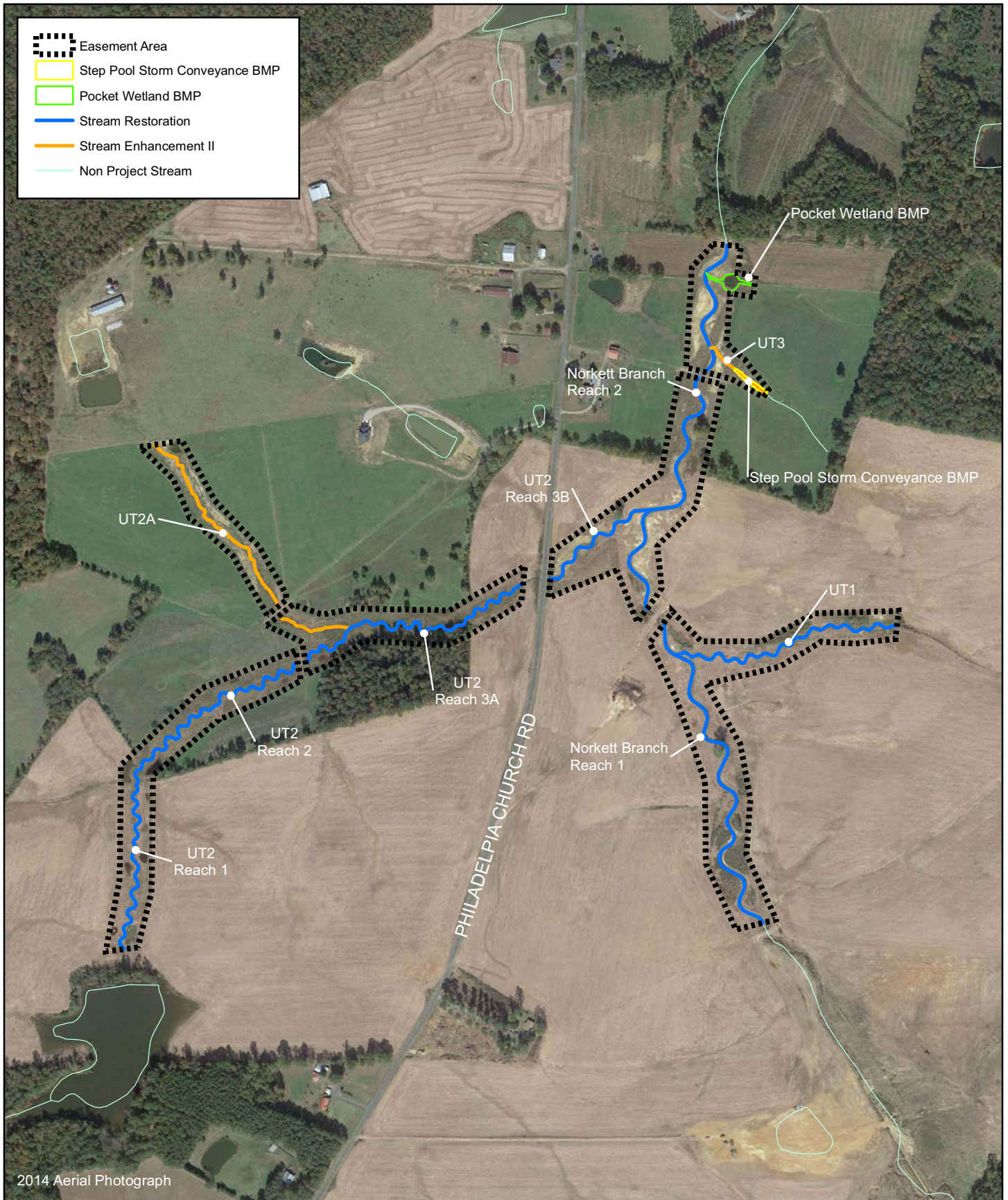


Figure 2 Project Component/Asset Map  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC

**Table 1. Project Components and Mitigation Credits**

**Norkett Branch Stream Mitigation Site (NCDMS Project No.95360)**

**Monitoring Year 2 - 2015**

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	9,196	902	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PROJECT COMPONENTS									
Reach ID	As-Built Stationing <sup>1</sup>	Existing Footage/Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage/Acreage <sup>2</sup>	Mitigation Ratio	Credits (SMU) <sup>2</sup>		
<b>STREAMS</b>									
Norkett Branch Reach 1	100+31-117+60 & 118+60-124+00	1,980 LF	P1	R	2,313	1:1	2,313		
Norkett Branch Reach 2	124+00-131+84 & 132+25-138+99	1,505 LF	P1	R	1,513	1:1	1,513		
UT1	200+00-211+98	840 LF	P1	R	1,212	1:1	1,212		
UT2 Reach 1	300+41-310+80	820 LF	P1	R	1,033	1:1	1,033		
UT2 Reach 2	310+80-321+71 & 322+06-325+20	1,272 LF	P1	R	1,416	1:1	1,416		
UT2 Reach 3A	325+20-335+58	923 LF	P1	R	1,041	1:1	1,041		
UT2 Reach 3B	336+90-343+48	380 LF	P1/2	R	668	1:1	668		
UT2A	401+53-411+46 & 411+84-415+31	1,296 LF	EII	EII	1,340	2.5:1	536		
UT3	505+42-507+12	163 LF	EII	EII	170	2.5:1	68		
SPSC BMP	Upstream of UT3 intermittent drainage		Step Pool Storm Conveyance	WQ BMP	29.7 ac treated	1:8	238 <sup>3</sup>		
PW BMP	non-jurisdictional drainage in eastern Norkett Branch floodplain		Pocket Wetland	WQ BMP	19.9 ac treated	1:3	60 <sup>3</sup>		

COMPONENT SUMMATION						
Restoration Level	Stream (LF)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	9,196	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I						
Enhancement II	1,510					
Creation		-	-	-		
Preservation		-	-	-		-
High Quality Preservation		-	-	-		-
Alternative Mitigation	49.6 ac treated					

N/A: not applicable

1. Stationing based off of centerline as-built alignment which matched with the design alignment.

2. Credits are based off of the as-built thalweg alignment.

3. Credits determined for the BMPs were established in the mitigation plan (2013).

**Table 2. Project Activity and Reporting History**  
**Norkett Branch Stream Mitigation Site (NCDMS Project No.95360)**  
**Monitoring Year 2 - 2015**

Activity or Report	Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan	July 2012-October 2012	July 2013
Final Design - Construction Plans	July 2013-November 2013	November 2013
Construction	December 2013- April 2014	April 2014
Temporary S&E mix applied to entire project area <sup>1</sup>	December 2013- April 2014	April 2014
Permanent seed mix applied to reach/segments	December 2013- April 2014	April 2014
Bare root and live stake plantings for reach/segments	March 2014 - April 2014	April 2014
Baseline Monitoring Document (Year 0)	April 2014 - May 2014	June 2014
Year 1 Monitoring	September 2014 - October 2014	December 2014
Maintenance and Replanting	October 2014-January 2014	February 2015
Year 2 Monitoring	April 2015 - October 2015	December 2015
Year 3 Monitoring	2016	December 2016
Year 4 Monitoring	2017	December 2017
Year 5 Monitoring	2018	December 2018
Year 6 Monitoring	2019	December 2019
Year 7 Monitoring	2020	December 2020

<sup>1</sup>Seed and mulch is added as each section of construction is completed.

**Table 3. Project Contact Table**  
**Norkett Branch Stream Mitigation Site (NCDMS Project No.95360)**  
**Monitoring Year 2 - 2015**

<b>Designer</b> Emily Reinicker, PE, CFM	<b>Wildlands Engineering, Inc.</b> 1403 S Mint St. Suite 104 Charlotte, NC 28203 704.332.7754
<b>Construction Contractor</b>	<b>Land Mechanic Designs, Inc.</b> 126 Circle G Lane Willow Spring, NC 27592
<b>Planting Contractor</b>	<b>Bruton Natural Systems, Inc</b> P.O. Box 1197 Fremont, NC 27830
<b>Seeding Contractor</b>	<b>Bruton Natural Systems, Inc</b> P.O. Box 1197 Fremont, NC 27830
<b>Seed Mix Sources</b> <b>Nursery Stock Suppliers</b> <b>Bare Roots</b> <b>Live Stakes</b>	<b>Green Resource, Colfax, NC</b> <b>Bruton Natural Systems, Inc</b> <b>Dykes and Son Nursery, McMinnville, TN</b> <b>Foggy Bottom Nursery, Lansing, NC</b>
<b>Monitoring Performers</b> Monitoring, POC	<b>Wildlands Engineering, Inc.</b> Kirsten Gimbert 704.332.7754, ext. 110

**Table 4. Project Information and Attributes**  
**Norkett Branch Stream Mitigation Site (NCDMS Project No.95360)**  
**Monitoring Year 2 - 2015**

PROJECT INFORMATION						
Project Name	Norkett Branch Stream Mitigation Site					
County	Union County					
Project Area (acres)	31.6					
Project Coordinates (latitude and longitude)	34°52'47.56"N, 80°22'9.19"W					
PROJECT WATERSHED SUMMARY INFORMATION						
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province					
River Basin	Yadkin					
USGS Hydrologic Unit 8-digit	03040105					
USGS Hydrologic Unit 14-digit	03040105081020					
DWQ Sub-basin	03-07-14					
Project Drainage Area (acres)	2,034					
Project Drainage Area Percentage of Impervious Area	<1%					
CGIA Land Use Classification	43% forested, 29% managed herbaceous cover, 28% cultivated land					
REACH SUMMARY INFORMATION						
Parameters	Norkett Branch Reach 1	Norkett Branch Reach 2	UT1	UT2	UT2A	UT3
Length of reach (linear feet) - Post-Restoration <sup>1</sup>	2,369	1,499	1,198	4,175	1,378	170
Drainage area (acres)	1490	2034	48	457	72	28
Drainage area (sqmi)	2.3	3.2	0.08	0.72	0.11	0.04
NCDWQ stream identification score	43.75	41.5	32.25	35.75	23;30.75	25.75
NCDWQ Water Quality Classification	WS-V					
Morphological Description (stream type)	P	P	P	P	I	I
Evolutionary trend (Simon's Model) - Pre- Restoration	III	III/IV	II/III	II, IV	IV	II/ III
Underlying mapped soils	Floodplain Soil Types for Site					
	Badin channery silt loam		Badin channery silt clay loam		Cid channery silt loam	Secrest-Cid complex
Drainage class	well-drained		well-drained		well-drained with moderate shrink-swell potential	well-drained
Soil Hydric status	N		N		N	Y
Slope	2-8%		2-8%		1-5%	0-3%
FEMA classification	AE	AE	N/A	N/A	N/A	N/A
Native vegetation community	Piedmont Bottomland Forest					
Percent composition exotic invasive vegetation -Post-Restoration	0%					
REGULATORY CONSIDERATIONS						
Regulation	Applicable?	Resolved?	Supporting Documentation			
Waters of the United States - Section 404	X	X	USACE Nationwide Permit No.27 and DWQ 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	Norkett Branch Mitigation Plan; Wildlands determined "no effect" on Union County listed endangered species.			
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO dated 8/20/2012).			
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A			
FEMA Floodplain Compliance	X	X	CLOMR and LOMR Approved			
Essential Fisheries Habitat	N/A	N/A	N/A			

1. Total stream length does not exclude easement crossings.



## **APPENDIX 2. Visual Assessment Data**



Table 5a. Visual Stream Morphology Stability Assessment Table  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

Norkett Branch Reach 1 - 2,313 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation	
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%				
		Degradation			0	0	100%				
	2. Riffle Condition	Texture/Substrate	17	17			100%				
		Depth Sufficient	16	16			100%				
	3. Meander Pool Condition	Length Appropriate	16	16			100%				
		Thalweg centering at upstream of meander bend (Run)	17	17			100%				
4. Thalweg Position	Thalweg centering at downstream of meander bend (Glide)	17	17			100%					
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	100%	
		Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	100%	100%	100%	
		Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%	
3. Engineered Structures <sup>1</sup>	<b>Totals</b>										
	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%				
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%				
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%				
4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rockwads/logs providing some cover at baseflow.	2	2			100%					

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

Table 5b. Visual Stream Morphology Stability Assessment Table  
 Norkeet Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

Norkeet Branch Reach 2 - 1.513 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
		Depth Sufficient	11	11			100%			
	3. Meander Pool Condition	Length Appropriate	11	11			100%			
Thalweg centering at upstream of meander bend (Run)		12	12			100%				
4. Thalweg Position	Thalweg centering at downstream of meander bend (Glide)	12	12			100%				
	<b>Totals</b>									
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion	1		1	79	100%	100%	100%	100%
		Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat	0		0	0	100%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse	0		0	0	100%	100%	100%	100%
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
		Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
		Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	1	1			100%				

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

Table 5c. Visual Stream Morphology Stability Assessment Table  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

UT1-1.212 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	27	27			100%			
		Depth Sufficient	26	26			100%			
	3. Meander Pool Condition	Length Appropriate	27	27			100%			
		Thalweg centering at upstream of meander bend (Run)	27	27			100%			
	4. Thalweg Position	Thalweg centering at downstream of meander bend (Glide)	27	27			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	100%
		Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
<b>Totals</b>										
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rockwads/logs providing some cover at baseflow.	1	1			100%			

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

Table 5d. Visual Stream Morphology Stability Assessment Table  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

UT2 Reach 1- 1,033 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	24	24			100%			
		Depth Sufficient	24	24			100%			
		Length Appropriate	24	24			100%			
	3. Meander Pool Condition	Thalweg centering at upstream of meander bend (Run)	25	25			100%			
		Thalweg centering at downstream of meander bend (Glide)	25	25			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	100%
		Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
		<b>Totals</b>			0	0	100%	100%	100%	100%
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
		Grade control structures exhibiting maintenance of grade across the sill	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
		Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rockwads/logs providing some cover at baseflow.	2	2			100%			

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

Table 5e. Visual Stream Morphology Stability Assessment Table  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

UT2 Reach 2 - 1,416 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation	
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%				
		Degradation			0	0	100%				
	2. Rifle Condition	Texture/Substrate	31	31				100%			
		Depth Sufficient	31	31				100%			
		Length Appropriate	33	33				100%			
	3. Meander Pool Condition	Thalweg centering at upstream of meander bend (Run)	34	34				100%			
		Thalweg centering at downstream of meander bend (Glide)	34	34				100%			
	2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	100%
			Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	100%	100%	100%
		3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
<b>Totals</b>					0	0	100%	100%	100%	100%	
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	4	4			100%				
		Grade control structures exhibiting maintenance of grade across the sill	4	4			100%				
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%				
		Bank erosion within the structures extent of influence does not exceed 15%.	4	4			100%				
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rockwads/logs providing some cover at baseflow.	4	4			100%				

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

Table 5f. Visual Stream Morphology Stability Assessment Table  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

UT2 Reach 3A- 1,041 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Rifle Condition	Texture/Substrate	25	25			100%			
		Depth Sufficient	24	24			100%			
	3. Meander Pool Condition	Length Appropriate	24	24			100%			
		Thalweg centering at upstream of meander bend (Run)	25	25			100%			
	4. Thalweg Position	Thalweg centering at downstream of meander bend (Glide)	25	25			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	100%
		Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	100%	100%	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
			<b>Totals</b>			0	0	100%	100%	100%
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	1	1			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	1	1			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	1			100%			
4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rockwads/logs providing some cover at baseflow.	1	1			100%				

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.

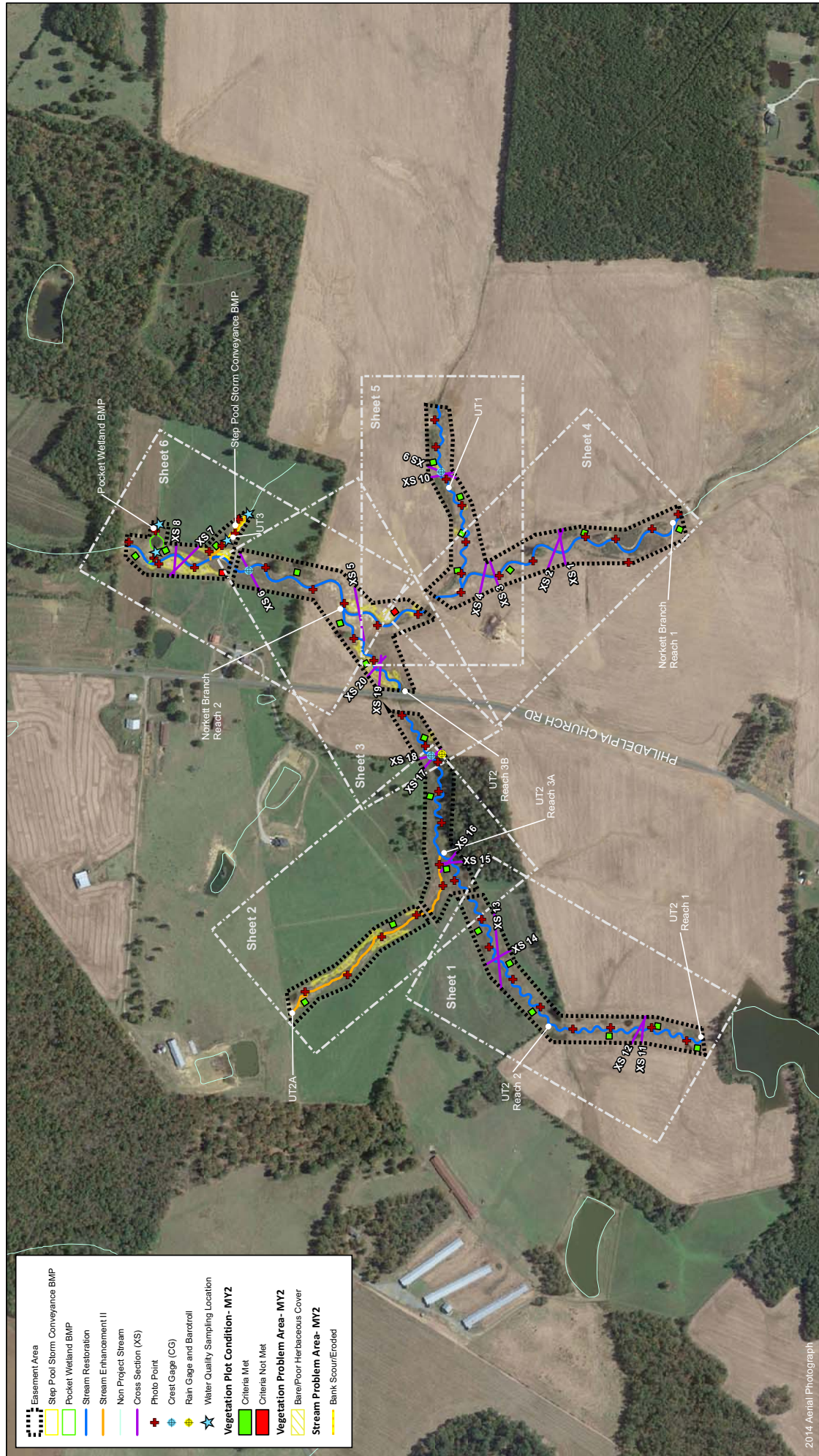


Table 5g. Visual Stream Morphology Stability Assessment Table  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

UT2 Reach 3B- 668 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation	
1. Bed	1. Vertical Stability (Rifle and Run units)	Aggradation			0	0	100%				
		Degradation			0	0	100%				
	2. Rifle Condition	Texture/Substrate	10	10			100%				
		Depth Sufficient	10	10			100%				
		Length Appropriate	10	10			100%				
	3. Meander Pool Condition	Thalweg centering at upstream of meander bend (Run)	11	11			100%				
		Thalweg centering at downstream of meander bend (Glide)	11	11			100%				
	2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	100%	100%	100%
			Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat			0	0	100%	100%	100%	100%
		3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	100%	100%	100%
<b>Totals</b>					0	0	100%	100%	100%	100%	
3. Engineered Structures <sup>1</sup>	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%				
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%				
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%				
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%				
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rockwads/logs providing some cover at baseflow.	2	2			100%				

<sup>1</sup>Excludes constructed riffles since they are evaluated in section 1.



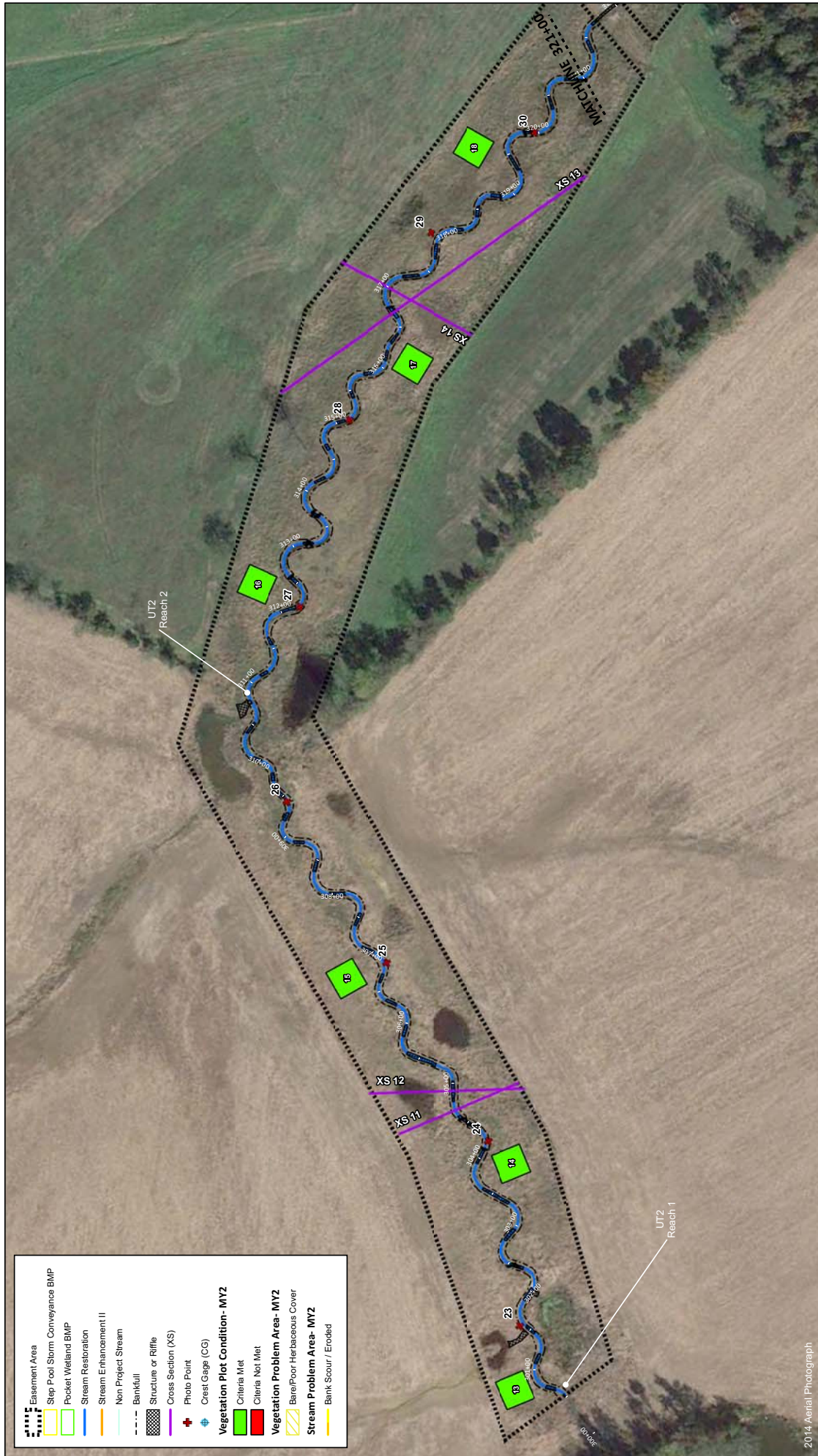
- Easement Area
- Step Pool Storm Conveyance BMP
- Pocket Wetland BMP
- Stream Restoration
- Stream Enhancement II
- Non Project Stream
- Cross Section (XS)
- Photo Point
- Crest Gage (CG)
- Rain Gage and Barotroll
- Water Quality Sampling Location
- Vegetation Plot Condition - MY2**
- Criteria Met
- Criteria Not Met
- Vegetation Problem Area- MY2**
- Bare/Poor Herbaceous Cover
- Stream Problem Area- MY2**
- Bank Scour/Eroded

Figure 3.0 Integrated Current Condition Plan View (Key)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



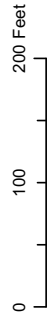
2014 Aerial Photograph





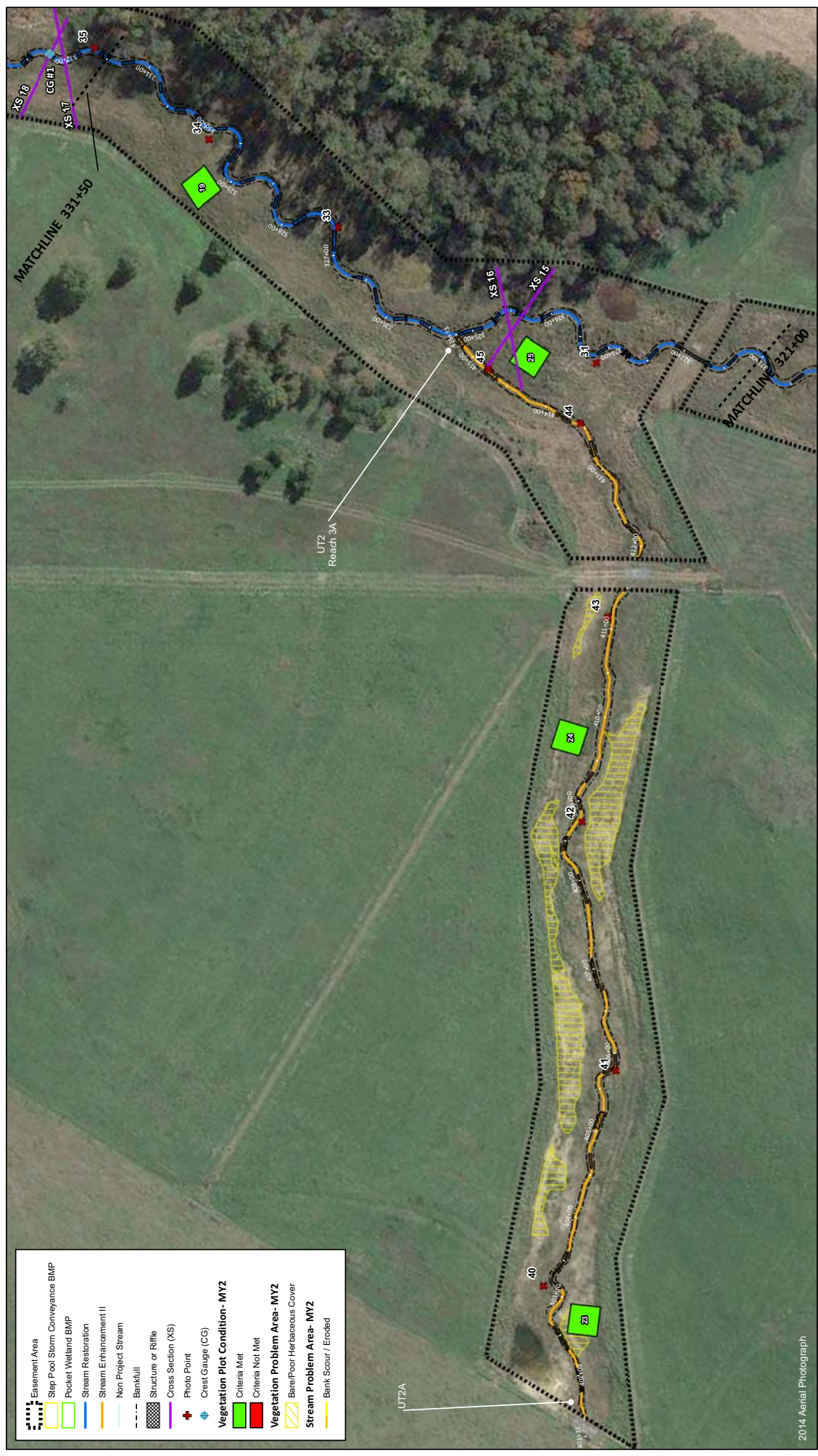
	Easement Area
	Step Pool Storm Conveyance BMP
	Pocket Wetland BMP
	Stream Restoration
	Stream Enhancement II
	Non Project Stream
	Bankfull
	Structure or Riffle
	Cross Section (XS)
	Photo Point
	Crest Gauge (CG)
	<b>Vegetation Plot Condition- MY2</b>
	Criteria Met
	Criteria Not Met
	<b>Vegetation Problem Area- MY2</b>
	Bare/Poor Herbaceous Cover
	<b>Stream Problem Area- MY2</b>
	Bank Scour / Eroded

Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



2014 Aerial Photograph





	Easement Area
	Step Pool Storm Conveyance BMP
	Pocket Wetland BMP
	Stream Restoration
	Stream Enhancement II
	Non Project Stream
	Bankfull
	Structure or Riffle
	Cross Section (XS)
	Photo Point
	Crest Gauge (CG)
	<b>Vegetation Plot Condition- MY2</b>
	Criteria Met
	Criteria Not Met
	<b>Vegetation Problem Area- MY2</b>
	Bare/Poor Herbaceous Cover
	<b>Stream Problem Area- MY2</b>
	Bank Scour / Eroded

Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



2014 Aerial Photograph



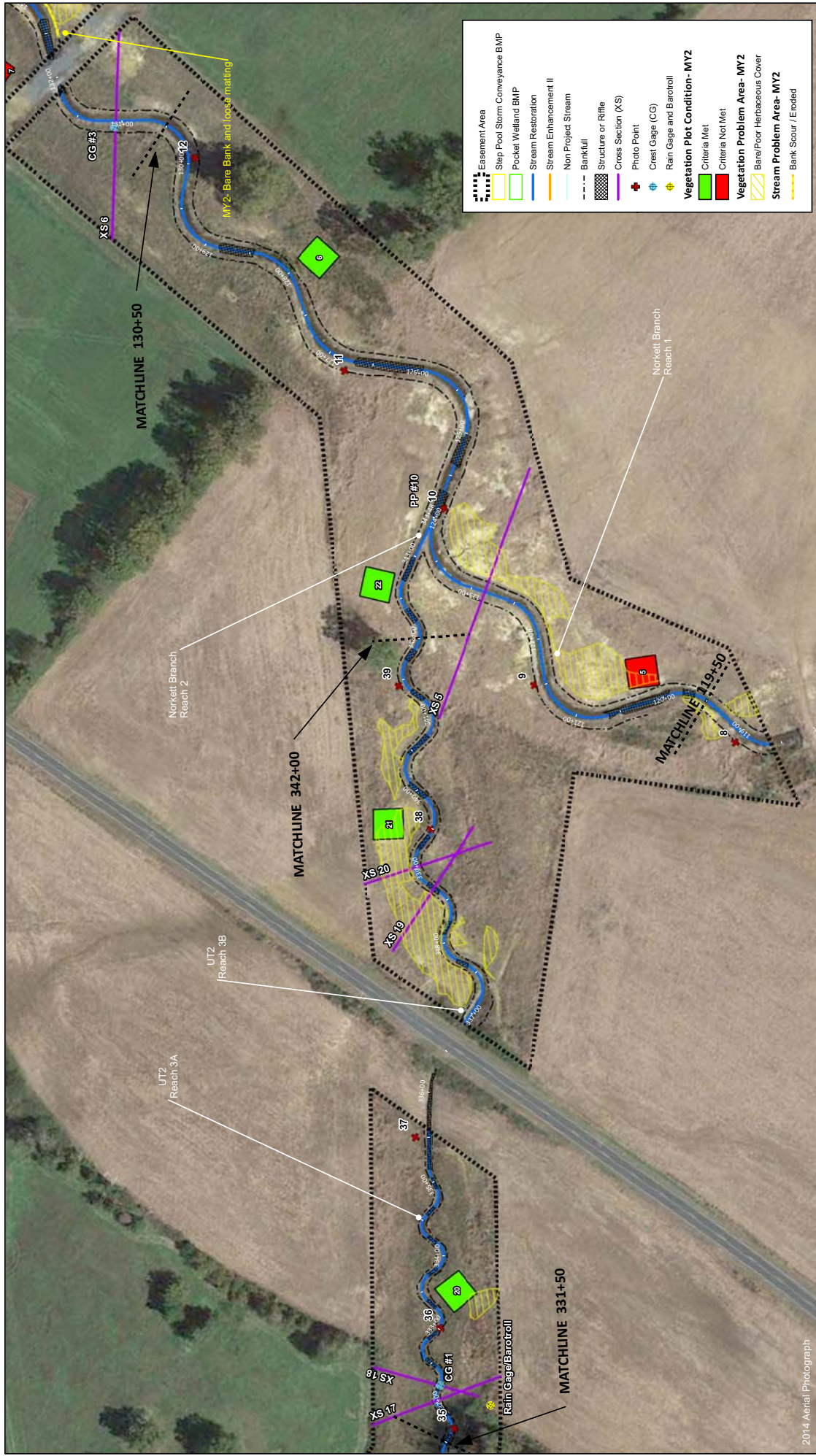
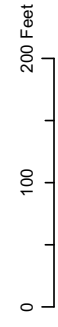


Figure 3.3 Integrated Current Condition Plan View (Sheet 3 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



2014 Aerial Photograph



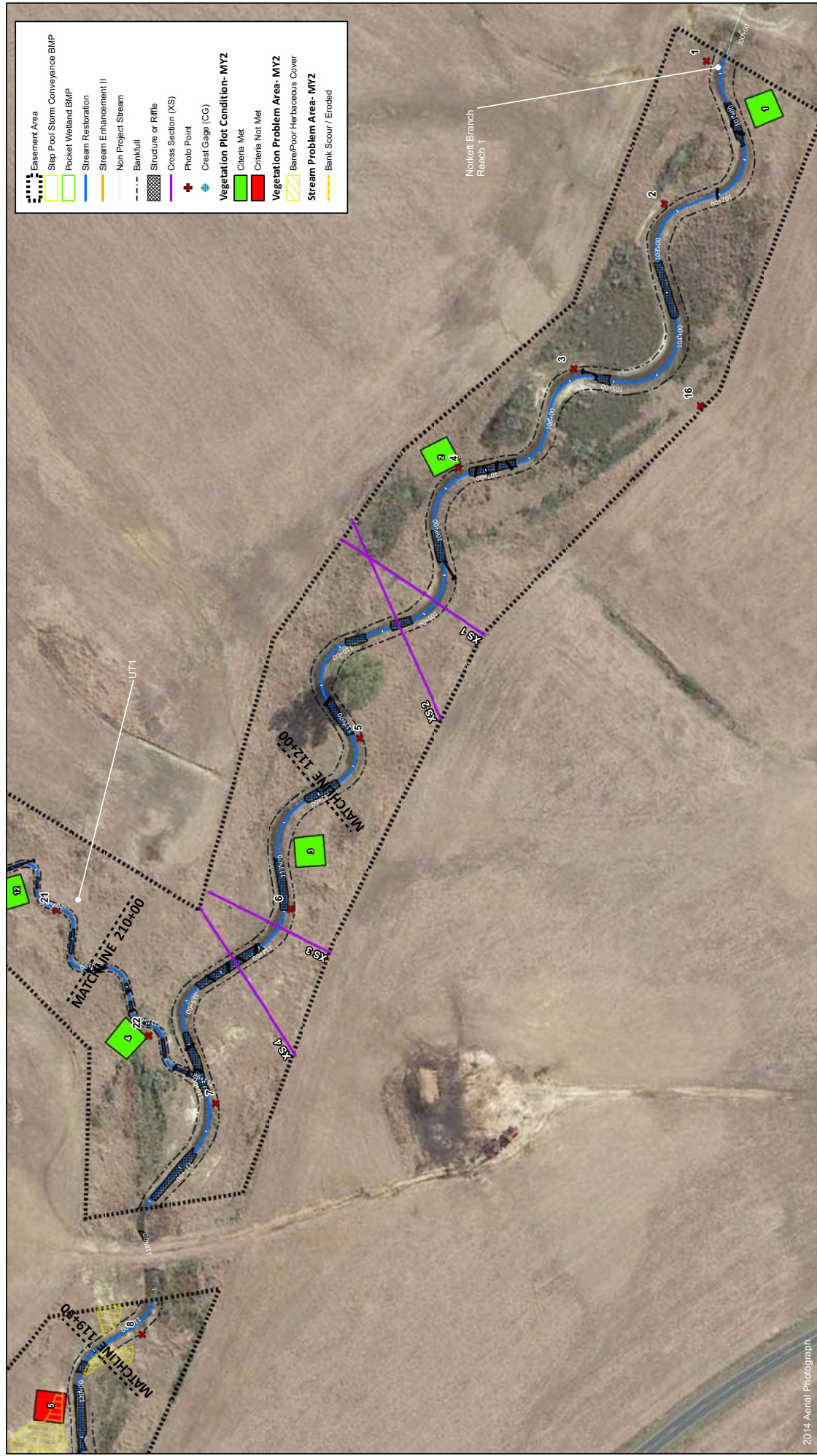


Figure 3.4 Integrated Current Condition Plan View (Sheet 4 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



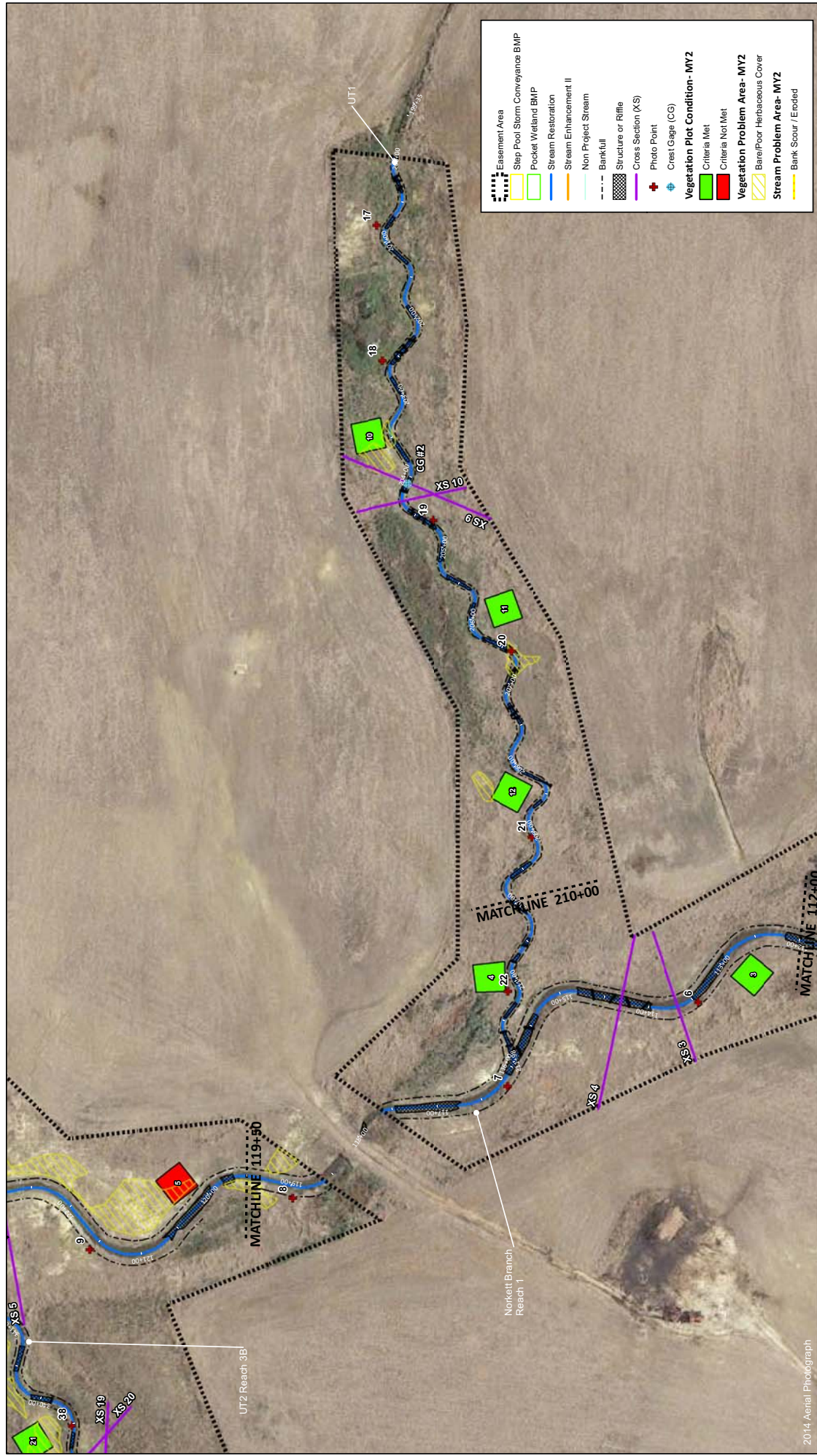


Figure 3.5 Integrated Current Condition Plan View (Sheet 5 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No.95360  
 Monitoring Year 2 - 2015  
 Union County, NC



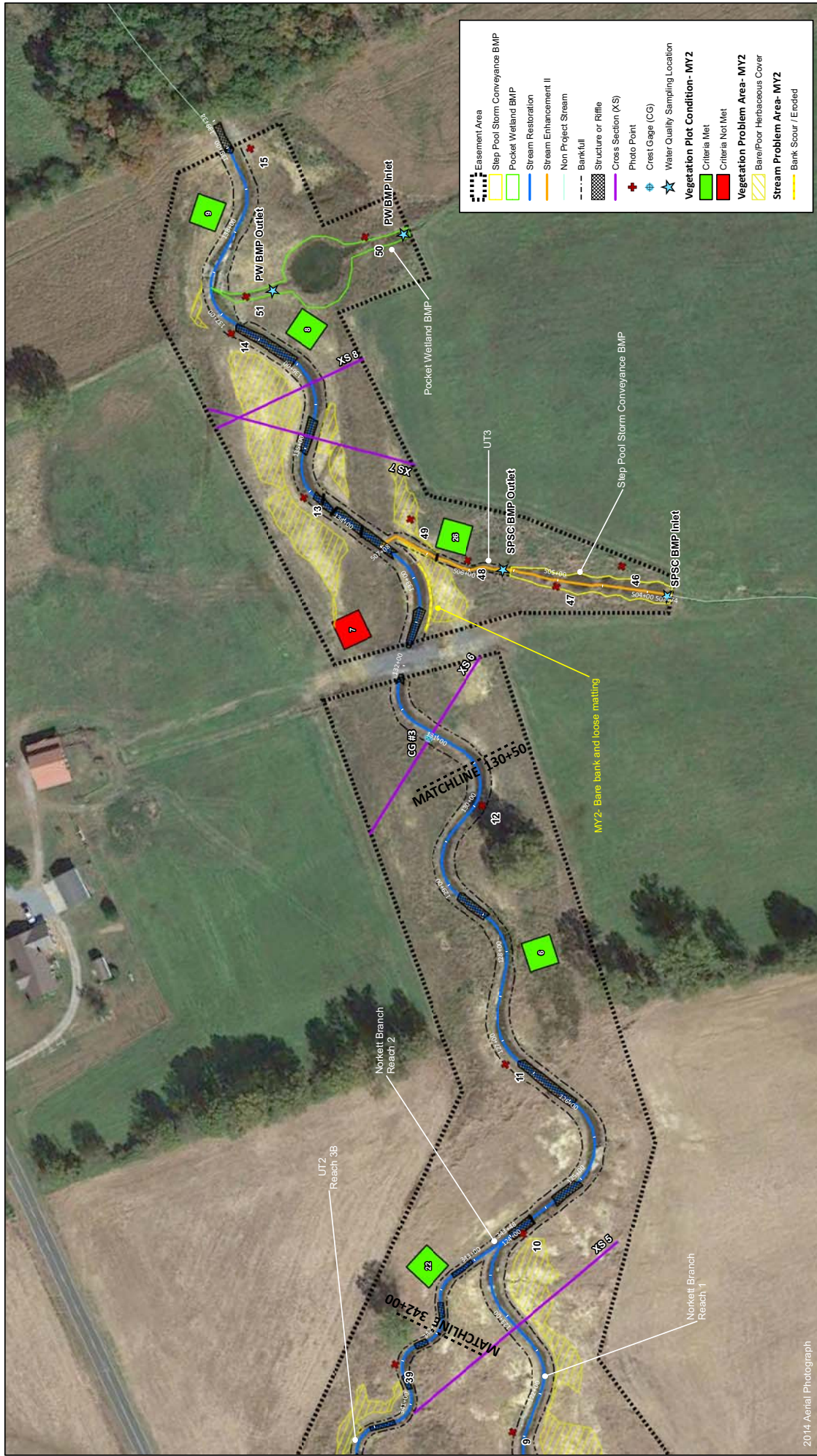


Figure 3.6 Integrated Current Condition Plan View (Sheet 6 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 2 - 2015  
 Union County, NC

Table 6. Vegetation Condition Assessment Table  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

Planted Acreage						
29.9						
Vegetation Category	Definitions	Mapping Threshold (acres)	Number of Polygons	Combined Acreage	% of Planted Acreage	
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	22	1.8	6%	
Low Stem Density Areas <sup>1</sup>	Woody stem densities clearly below target levels based on MY3, 4, 5, or 7 stem count criteria.	0.1	2	0.1	0%	
			<b>Total</b>	<b>1.9</b>	<b>6%</b>	
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0	0	0.0	0%	
			<b>Cumulative Total</b>	<b>1.9</b>	<b>6%</b>	

Easement Acreage						
31.6						
Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Planted Acreage	
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	0	0.0	0%	
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	0	0	0%	

<sup>1</sup>Acreage calculated from vegetation plots monitored for site.

## Stream Photographs





Photo Point 1 – looking upstream (4/21/2015)



Photo Point 1 – looking downstream (4/21/2015)



Photo Point 2 – looking upstream (4/21/2015)



Photo Point 2 – looking downstream (4/21/2015)



Photo Point 3 – looking upstream (4/21/2015)



Photo Point 3 – looking downstream (4/21/2015)







Photo Point 4 – looking upstream (4/21/2015)



Photo Point 4 – looking downstream (4/21/2015)



Photo Point 5 – looking upstream (4/21/2015)



Photo Point 5 – looking downstream (4/21/2015)



Photo Point 6 – looking upstream (4/21/2015)



Photo Point 6 – looking downstream (4/21/2015)







Photo Point 7 – looking upstream (4/21/2015)



Photo Point 7 – looking downstream (4/21/2015)



Photo Point 8 – looking upstream (4/21/2015)



Photo Point 8 – looking downstream (4/21/2015)



Photo Point 9 – looking upstream (4/21/2015)



Photo Point 9 – looking downstream (4/21/2015)







Photo Point 10 – looking upstream (4/21/2015)



Photo Point 10 – looking downstream (4/21/2015)



Photo Point 11 – looking upstream (4/21/2015)



Photo Point 11 – looking downstream (4/21/2015)



Photo Point 12 – looking upstream (4/21/2015)



Photo Point 12 – looking downstream (4/21/2015)







Photo Point 13 – looking upstream (4/21/2015)



Photo Point 13 – looking downstream (4/21/2015)



Photo Point 14 – looking upstream (4/21/2015)



Photo Point 14 – looking downstream (4/21/2015)



Photo Point 15 – looking upstream (4/21/2015)



Photo Point 15 – looking downstream (4/21/2015)







Photo Point 16 – looking upstream (4/21/2015)



Photo Point 16 – looking downstream (4/21/2015)



Photo Point 17 – looking upstream (4/21/2015)



Photo Point 17 – looking downstream (4/21/2015)



Photo Point 18 – looking upstream (4/21/2015)



Photo Point 18 – looking downstream (4/21/2015)







Photo Point 19 – looking upstream (4/21/2015)



Photo Point 19 – looking downstream (4/21/2015)



Photo Point 20 – looking upstream (4/21/2015)



Photo Point 20 – looking downstream (4/21/2015)



Photo Point 21 – looking upstream (4/21/2015)



Photo Point 21 – looking downstream (4/21/2015)







Photo Point 22 – looking upstream (4/21/2015)



Photo Point 22 – looking downstream (4/21/2015)



Photo Point 23 – looking upstream (4/21/2015)



Photo Point 23 – looking downstream (4/21/2015)



Photo Point 24 – looking upstream (4/21/2015)



Photo Point 24 – looking downstream (4/21/2015)







Photo Point 25 – looking upstream (4/21/2015)



Photo Point 25 – looking downstream (4/21/2015)



Photo Point 26 – looking upstream (4/21/2015)



Photo Point 26 – looking downstream (4/21/2015)



Photo Point 27 – looking upstream (4/21/2015)



Photo Point 27 – looking downstream (4/21/2015)







Photo Point 28 – looking upstream (4/21/2015)



Photo Point 28 – looking downstream (4/21/2015)



Photo Point 29 – looking upstream (4/21/2015)



Photo Point 29 – looking downstream (4/21/2015)



Photo Point 30 – looking upstream (4/21/2015)



Photo Point 30 – looking downstream (4/21/2015)







Photo Point 31 – looking upstream (4/21/2015)



Photo Point 31 – looking downstream (4/21/2015)



Photo Point 32 – looking upstream (4/21/2015)



Photo Point 32 – looking downstream (4/21/2015)



Photo Point 33 – looking upstream (4/21/2015)



Photo Point 33 – looking downstream (4/21/2015)







Photo Point 34 – looking upstream (4/21/2015)



Photo Point 34 – looking downstream (4/21/2015)



Photo Point 35 – looking upstream (4/21/2015)



Photo Point 35 – looking downstream (4/21/2015)



Photo Point 36 – looking upstream (4/21/2015)



Photo Point 36 – looking downstream (4/21/2015)







Photo Point 37 – looking upstream (4/21/2015)



Photo Point 37 – looking downstream (4/21/2015)



Photo Point 38 – looking upstream (4/21/2015)



Photo Point 38 – looking downstream (4/21/2015)



Photo Point 39 – looking upstream (4/21/2015)



Photo Point 39 – looking downstream (4/21/2015)







Photo Point 40 – looking upstream (4/21/2015)



Photo Point 40 – looking downstream (4/21/2015)



Photo Point 41 – looking upstream (4/21/2015)



Photo Point 41 – looking downstream (4/21/2015)



Photo Point 42 – looking upstream (4/21/2015)



Photo Point 42 – looking downstream (4/21/2015)







Photo Point 43 – looking upstream (4/21/2015)



Photo Point 43 – looking downstream (4/21/2015)



Photo Point 44 – looking upstream (4/21/2015)



Photo Point 44 – looking downstream (4/21/2015)



Photo Point 45 – looking upstream (4/21/2015)



Photo Point 45 – looking downstream (4/21/2015)







Photo Point 46 – looking upstream (4/21/2015)



Photo Point 46 – looking downstream (4/21/2015)



Photo Point 47 – looking upstream (4/21/2015)



Photo Point 47 – looking downstream (4/21/2015)



Photo Point 48 – looking upstream (4/21/2015)



Photo Point 48 – looking downstream (4/21/2015)







Photo Point 49 – looking upstream (4/21/2015)



Photo Point 49 – looking downstream (4/21/2015)



Photo Point 50 – looking downstream at Pocket Wetland WQ BMP (4/21/2015)



Photo Point 51 – looking upstream at Pocket Wetland WQ BMP (4/21/2015)



## Vegetation Photographs





Vegetation Plot 1 – (09/21/2015)



Vegetation Plot 2 – (09/21/2015)



Vegetation Plot 3 – (09/21/2015)



Vegetation Plot 4 – (09/21/2015)



Vegetation Plot 5 – (09/21/2015)



Vegetation Plot 6 – (09/21/2015)







Vegetation Plot 7 – (09/21/2015)



Vegetation Plot 8 – (09/21/2015)



Vegetation Plot 9 – (09/21/2015)



Vegetation Plot 10 – (09/21/2015)



Vegetation Plot 11 – (09/21/2015)



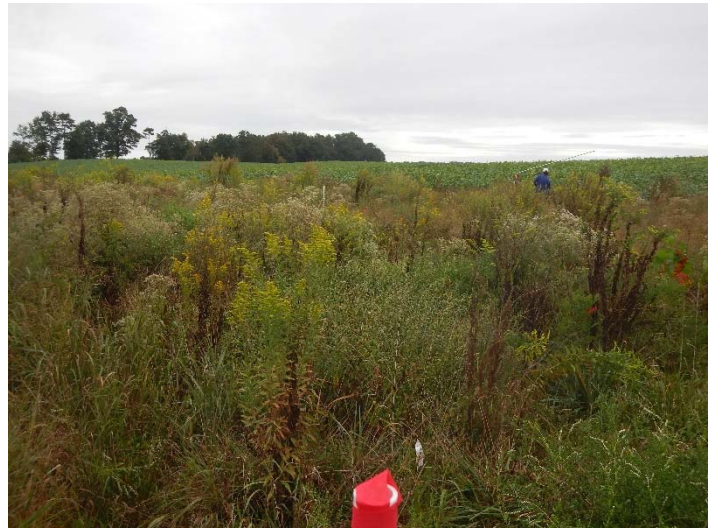
Vegetation Plot 12 – (09/21/2015)







Vegetation Plot 13 – (09/21/2015)



Vegetation Plot 14 – (09/21/2015)



Vegetation Plot 15 – (09/21/2015)



Vegetation Plot 16 – (09/21/2015)



Vegetation Plot 17 – (09/21/2015)



Vegetation Plot 18 – (09/21/2015)







Vegetation Plot 19 – (09/21/2015)



Vegetation Plot 20 – (09/21/2015)



Vegetation Plot 21 – (09/21/2015)



Vegetation Plot 22 – (09/21/2015)



Vegetation Plot 23 – (09/21/2015)



Vegetation Plot 24– (09/21/2015)







Vegetation Plot 25 – (09/21/2015)



Vegetation Plot 26 – (09/21/2015)



## Stream Problem Areas





Bare bank Norkett Branch Reach 2 right bank, continuing to erode. 9-21-2015



## **APPENDIX 3. Vegetation Plot Data**



Table 7. Vegetation Plot Criteria Attainment  
 Morkett Branch Stream Mitigation Site (NCDIMS Project No. 95360)  
 Monitoring Monitoring Year 2 -2015

Plot	MY2 Success Criteria Met (Y/N)	Tract Mean
1	Y	92%
2	Y	
3	Y	
4	Y	
5	N	
6	Y	
7	N	
8	Y	
9	Y	
10	Y	
11	Y	
12	Y	
13	Y	
14	Y	
15	Y	
16	Y	
17	Y	
18	Y	
19	Y	
20	Y	
21	Y	
22	Y	
23	Y	
24	Y	
25	Y	
26	Y	

Table 8. CVS Vegetation Plot Metadata  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 -2015

Report Prepared By	Ruby Davis
Date Prepared	9/29/2015 10:39
database name	Norkett MY2 cvs-eep-entrytool-v2.3.1.mdb
database location	Q:\ActiveProjects\005-02134 Norkett Branch FDP\Monitoring\Monitoring Year 2\Vegetation Assessment
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT</b> -----	
Metadata	<i>This worksheet, which is a summary of the project and the project data.</i>
Plots	<i>List of plots surveyed.</i>
Stem Count by Plot and Spp	<i>Unknown</i>
<b>PROJECT SUMMARY</b> -----	
Project Code	95360
Project Name	Norkett Branch
Description	Norkett Branch Stream Mitigation Site
length (ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	26



Table 9. Planted and Total Stem Counts  
 Norsett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 2015

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2015)																									
			95360-WEI-0001		95360-WEI-0002		95360-WEI-0003		95360-WEI-0004		95360-WEI-0005		95360-WEI-0006		95360-WEI-0007		95360-WEI-0008		95360-WEI-0009		95360-WEI-0010		95360-WEI-0011		95360-WEI-0012			
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T		
Acer rubrum	red maple	Tree	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	1	1	1	2	2	2	2	1	1	1	1
Betula nigra	river birch	Tree	3	3	1	1	1	1																				
Celtis laevigata	sugarberry	Tree																										
Cephalanthus occidentalis	common buttonbush	Shrub	1	1																								
Cercis canadensis	eastern redbud	Tree							2	2																		
Cornus florida	flowering dogwood	Tree			1	1	1	1																				
Diospyros virginiana	common persimmon	Tree			3	3																						
Fraxinus pennsylvanica	green ash	Tree	2	2	5	5	5	5																				
Hamamelis virginiana	American witchhazel	Tree																										
Liquidambar styraciflua	sweetgum	Tree																										
Liriodendron tulipifera	Tuliptree	Tree	6	6	6	6	7	7	8	8	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Populus deltoides	American sycamore	Tree																										
Platanus occidentalis	eastern cottonwood	Tree																										
Quercus michauxii	swamp chestnut oak	Tree																										
Quercus phellos	willow oak	Tree			1	1	1	1																				
Quercus rubra	northern red oak	Tree	2	2			3	3	3	3	1	1	1	1														
Salix sericea	silky willow	Shrub																										
Sambucus canadensis	Common Elderberry	Shrub																										
Taxodium distichum	bald cypress	Tree																										
Ulmus alata	winged elm	Tree																										
	<b>Stem count</b>		14	14	14	14	13	13	14	14	12	12	12	12	7	7	7	7	8	8	8	8	9	9	6	6	6	6
	<b>size (ares)</b>		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	<b>size (ACRES)</b>		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	<b>Stems count</b>		5	5	5	5	5	5	6	6	4	4	4	4	4	4	4	4	4	4	4	4	5	5	6	6	6	6
	<b>Stems per ACRE</b>		567	567	567	567	688	526	526	567	486	486	486	486	283	283	283	283	324	324	324	324	364	364	243	243	243	243

**Color for Density**  
 Exceeds requirements by 10%  
 Exceeds requirements, but by less than 10%  
 Falls to meet requirements, by less than 10%  
 Falls to meet requirements by more than 10%

Table 9. Planted and Total Stem Counts  
 Norsett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 2015

Scientific Name	Common Name	Species Type	Current Plot Data (MY2 2015)																					
			95360-WEI-0013		95360-WEI-0014		95360-WEI-0015		95360-WEI-0016		95360-WEI-0017		95360-WEI-0019		95360-WEI-0020		95360-WEI-0021		95360-WEI-0022		95360-WEI-0023		95360-WEI-0024	
			P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Acer rubrum	red maple	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Betula nigra	river birch	Tree																						
Celtis laevigata	sugarberry	Tree																						
Cephalanthus occidentalis	common buttonbush	Shrub																						
Cercis canadensis	eastern redbud	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Cornus florida	flowering dogwood	Tree																						
Diospyros virginiana	common persimmon	Tree																						
Fraxinus pennsylvanica	green ash	Tree	2	2	3	3	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Hamamelis virginiana	American witchhazel	Tree																						
Liquidambar styraciflua	sweetgum	Tree																						
Liriodendron tulipifera	tuliptree	Tree	4	4	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
Platanus occidentalis	American sycamore	Tree																						
Populus deltoides	eastern cottonwood	Tree																						
Quercus michauxii	swamp chestnut oak	Tree																						
Quercus phellos	willow oak	Tree	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Quercus rubra	northern red oak	Tree	2	2	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Salix sericea	silky willow	Shrub																						
Sambucus canadensis	Common Elderberry	Shrub																						
Taxodium distichum	bald cypress	Tree																						
Ulmus alata	winged elm	Tree																						
	<b>Stem count</b>		11	11	13	9	9	10	10	10	10	11	11	13	12	12	18	12	12	12	12	12	12	
	<b>size (ares)</b>		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	<b>size (ACRES)</b>		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
	<b>Stems per ACRE</b>		445	445	526	364	364	405	405	405	445	445	526	486	486	728	364	486	486	486	486	486	486	
	<b>Stems per ACRE</b>		445	445	526	364	364	405	405	405	445	445	526	486	486	728	364	486	486	486	486	486	486	
	<b>Stems per ACRE</b>		445	445	526	364	364	405	405	405	445	445	526	486	486	728	364	486	486	486	486	486	486	

**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%





## **APPENDIX 4. Morphological Summary Data and Plots**



Table 10b. Baseline Stream Data Summary  
 Norkett Branch Stream Mitigation Site (NDMS Project No. 95360)  
 Monitoring Year 2 - 2015

Parameter	PRE-RESTORATION CONDITION						REFERENCE REACHES						DESIGN						AS-BUILT/BASELINE					
	Norkett Branch Reach 1		Norkett Branch Reach 2		Spencer Creek		UT's Spenser Creek		UT Richard Creek Reach 2		Norkett Branch Reach 1		Norkett Branch Reach 2		Norkett Branch Reach 1		Norkett Branch Reach 2		Norkett Branch Reach 1		Norkett Branch Reach 2			
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
<b>Dimension and Substrate - Rifle</b>																								
Bankfull Width (ft)	12.8	21.5	22	29.5	10.7	11.2	7.0	15.2	13.3	15.2	48.4	22.0	23.0	22.5	26.6	25.6	22.5	26.6	26.6	25.6	25.6	25.7		
Floodprone Width (ft)	35	58	72	85	60.0	114*	98.1	154*	50	154*	1.8	1.8	1.9	1.6	>200	>200	>200	>200	>200	>200	>200	>200		
Bankfull Mean Depth (ft)	1.7	1.8	2.3	2.4	1.6	1.8	2.0	2.1	1.1	1.3	2.75	2.8	2.75	2.6	3.3	3.3	2.75	3.3	3.3	3.3	3.3	3.3		
Bankfull Max Depth (ft)	3.1	3.2	3.2	3.3	2.1	2.6	3.1	3.2	1.8	2.1	40.6	40.6	43.2	38.8	46.6	46.7	38.8	46.6	46.6	46.7	46.7	50.8		
Bankfull Cross-sectional Area (ft <sup>2</sup> )	28.1	35.6	40.6	52.8	17.8	19.7	7.7	17.5	16.5	17.5	11.9	11.9	12.2	13.1	16.7	16.7	13.1	16.7	16.7	16.7	16.7	16.7		
Width/Depth Ratio	5.9	13	9.2	21.4	5.8	7.1	6.4	13.9	10.1	13.9	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2		
Entrenchment Ratio	2.1	4.5	2.9	3.3	5.5	10.2	>11.6	10.2	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Bank Height Ratio	1.0	1.4	1.3	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Bank Height (mm)	8.6	0.4	0.4	0.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
<b>Profile</b>																								
Rifle Length (ft)	0.036	0.039	0.032	0.120	0.030	0.040	0.040	0.040	0.033	0.035	0.0018	0.0120	0.0023	0.0000	0.0152	0.0009	0.0000	0.0152	0.0152	0.0009	0.0009	0.0163		
Rifle Slope (ft/ft)	4.0	4.0	2.9	4.0	3.3	2.5	2.5	2.5	1.8	1.8	2.8	2.8	2.8	3.3	5.1	5.1	3.3	5.1	5.1	5.1	5.1	5.1		
Pool Length (ft)	62	300	60	300	71.0	42	19	42	33.0	93.0	29	163	30	67	170	183	67	170	170	183	183	172		
Pool Max Depth (ft)																								
Pool Spacing (ft)																								
Pool Volume (ft <sup>3</sup> )																								
<b>Pattern</b>																								
Channel Bedwidth (ft)	N/A	N/A	N/A	N/A	38	41	11	27	N/A	N/A	35	161	37	38	147	38	38	147	147	38	38	155		
Radius of Curvature (ft)	N/A	N/A	N/A	N/A	11	15	6	16	N/A	N/A	40	66	41	38	65	40	38	65	65	40	40	64		
Re-Bankfull Width (ft)	N/A	N/A	N/A	N/A	1.0	1.3	2.3	2.3	N/A	N/A	2.8	7.8	2.8	1.7	2.4	1.8	1.7	2.4	2.4	1.8	1.8	2.5		
Resistor Length (ft)	N/A	N/A	N/A	N/A	46	46	37.7	45	N/A	N/A	66	264	69	197	263	81	197	263	263	81	81	277		
Resistor Width Ratio	N/A	N/A	N/A	N/A	3.8	3.7	1.8	3.8	N/A	N/A	1.8	7.3	1.8	1.7	3.3	1.3	1.7	3.3	3.3	1.3	1.3	6.0		
<b>Substrate, Bed and Transport</b>																								
SC% (S <sub>90</sub> /S <sub>50</sub> /S <sub>25</sub> /S <sub>10</sub> /S <sub>5</sub> )																								
416/635/450/184/105/41/00																								
Reach Shear Stress (Compliance) lb/ft <sup>2</sup>																								
Max part size (mm) mobilized at bankfull	0.41	0.44	0.17	0.38							0.28	15-25	0.4	0.27	0.29	0.32	0.27	0.29	0.29	0.32	0.32	0.32		
Stream Power (Capacity) W/m																								
<b>Additional Reach Parameters</b>																								
Drainage Area (SQ)	2.3	3.2	3.2	3.2	0.96	0.01	0.01	0.28	0.28	0.28	2.3	2.3	3.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	3.2		
Watershed Impervious Cover Estimate (%)	<1%	<1%	<1%	<1%							<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%		
Resistor Classification	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4		
Bankfull Velocity (ft/s)	3.5	4	2.5	3.5	4.9	5.4	3.2	4.1	3.5	4.1	2.8	2.8	3.3	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9		
Bankfull Discharge (cfs)	110	140	140	140	97	25	25	32.0	23.1	32.0	110	140	140	105	124	130	105	124	124	130	130	148		
Q-UBS's exponent																								
Q-UBS's exponent																								
Channel Length (ft)	1,980	1,905	1,905	1,905	2,300	2,500	2,500	2,500	2,500	2,500	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910	1,910		
Channel Thalweg Length (ft)	1.1	1.1	1.1	1.1	2.30	2.30	2.30	2.30	2.30	2.30	2,369	2,369	2,369	2,369	2,369	2,369	2,369	2,369	2,369	2,369	2,369	2,369		
Sinuosity (ft)	0.004	0.001	0.001	0.005							0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025		
Bankfull Slope (ft/ft)																								

\*No impervious land is present within the project watershed per the CGA Land Use Classification data set.  
 †Channel length represented does not include easement breaks.  
 ‡Channel length represented does not include easement breaks.  
 N/A: Not Applicable  
 SC: S<sub>90</sub>/S<sub>50</sub>/S<sub>25</sub>/S<sub>10</sub>/S<sub>5</sub>





Table 10c. Baseline Stream Data Summary  
 Norsett Branch Stream Mitigation Site (NCDMs Project No. 95360)  
 Monitoring Year 2 - 2015

Parameter	RE-RESTORATION CONDITION		REFERENCE REACHES		DESIGN						AS BUILT BASELINE	
	UTZ Reach 3	Gage	UTZ Reach 3A	UTZ Reach 3B	UTZ Reach 3A	UTZ Reach 3B	UTZ Reach 3A	UTZ Reach 3B	UTZ Reach 3A	UTZ Reach 3B	UTZ Reach 3A	UTZ Reach 3B
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Profile</b>												
Bankfull Width (ft)	7.5		9.0	11.0	10.5							
Floodplain Width (ft)	24		45+	55+	>200							
Bankfull Mean Depth	1.1		0.8	1.0	0.7							
Bankfull Max Depth	1.6		1.2	1.5	1.2							
Bankfull Cross-sectional Area (ft <sup>2</sup> )	8.3		6.9	10.8	7.2							
Width/Depth Ratio	6.7		11.7	11.2	15.3							
Entrenchment Ratio	3.2		5.0+	5.0+	>2.2							
Bank Height Ratio	1.3	1.8	1.0	1.0	1.0							
GSD (mm)	732				32.0							33.4
<b>Profile</b>												
Riffle Length (ft)												
Riffle Slope (ft/ft)	0.014	0.025	0.011	0.032	0.008	0.017	8	25	13	28		
Pool Length (ft)												
Pool Max Depth (ft)												
Pool Spacing (ft) <sup>a</sup>	2		1.20	3.20	1.50	4.10	10	42	32	45		
Pool Volume (ft <sup>3</sup> )	26	53	12	63	14	77	26	66	38	72		
<b>Pattern</b>												
Channel Bankwidth (ft)	N/A	N/A	14	50	18	61	8	37	20	61		
Radius of Curvature (ft)	15	63.4	14	27	20	33	14	27	24	31		
Rc:Bankfull Width (ft/ft)	2	8.45	1.6	3.0	1.8	3.0	1.3	2.6	1.7	2.2		
Meander Length (ft)	N/A	N/A	27	108	33	132	56	88	87	105		
Meander Width Ratio	N/A	N/A	1.6	5.5	1.6	5.5	0.8	3.5	1.4	4.4		
<b>Substrate, Bed and Transport Parameters</b>												
R% /Ru% /P% /C% /S% /SC% /SN% /GN% /CV /BS% /BS%												
d16 /d35 /d50 /d85 /d95 /d100												
Reach Shear Stress (Competency) lb/ft <sup>2</sup>												
Max part size (mm) mobilized at bankfull												
Stream Power (Capacity) W/m <sup>2</sup>			15	25	12	20	0.23	0.23	0.23	0.14		
<b>Additional Reach Parameters</b>												
Drainage Area (Sqft)	0.71		0.46	0.46	0.46							
Watershed Impervious Cover Estimate (%)	<1% <sup>1</sup>		<1% <sup>1</sup>	<1% <sup>1</sup>	<1% <sup>1</sup>							
Rosgen Classification	E4		C/E4	C/E4	E4							
Bankfull Velocity (fps)	3.7		3.7	3.0	2.1							
Bankfull Discharge (cfs)	26	33	26	33	15							
Q-NFF regression												
Q-USGS extrapolation												
Q-Mannings												
Valley Length (ft)	1184		830	548	830							
Channel Thalweg Length (ft)	1,303		1,038	658	1,038							
Sinuosity (ft)	1.1		1.25	1.20	1.25							
Water Surface Slope (ft/ft)	0.009		0.006	0.004	0.006							
Bankfull Slope (ft/ft)												

<sup>1</sup> No impervious land use is present within the project watershed per the CGM Land Use Classification data set.

<sup>2</sup> Channel length represented does not include estuarine breaks.

(-): Data was not provided

N/A: Not Applicable

SC: 5/10/2015

Table 11a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

Dimension	Cross-Section 1 (Pool)					Cross-Section 2 (Riffle)					Cross-Section 3 (Pool)					Cross-Section 4 (Riffle)									
	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	
<i>based on fixed bankfull elevation</i>																									
Bankfull Width (ft)	33.2	34.1	34.3				26.6	23.2	23.4				26.7	29.2	25.8				25.1	23.1	26.2				
Floodprone Width (ft)	N/A	N/A	N/A				>200	>200	>200				N/A	N/A	N/A				>200	>200	>200				
Bankfull Mean Depth (ft)	1.8	2.0	2.0				1.6	2.0	2.0				2.3	2.3	2.4				1.8	2.1	1.9				
Bankfull Max Depth (ft)	3.6	3.7	3.8				2.9	3.0	3.0				3.9	4.4	4.6				3.3	3.4	3.4				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	58.4	68.3	68.7				42.6	45.5	48.0				60.3	67.5	62.9				44.6	47.7	48.8				
Bankfull Width/Depth Ratio	18.9	17.1	17.1				16.7	11.9	11.4				11.8	12.7	10.6				14.1	11.1	14.1				
Bankfull Entrenchment Ratio	N/A	N/A	N/A				>7.5	>12	>8.5				N/A	N/A	N/A				>8	>9	>7.6				
Bankfull Bank Height Ratio	N/A	N/A	N/A				1.0	1.0	1.0				N/A	N/A	N/A				1.0	1.0	1.0				
<i>based on fixed bankfull elevation</i>																									
<b>Dimension</b>																									
<i>based on fixed bankfull elevation</i>																									
Bankfull Width (ft)	22.5	23.5	23.3				25.7	26.0	25.6				25.6	24.9	25.6				30.1	26.8	29.1				
Floodprone Width (ft)	>200	>200	>200				>200	>200	>200				>200	>200	>200				N/A	N/A	N/A				
Bankfull Mean Depth (ft)	1.7	1.8	1.7				2.0	2.0	2.1				1.8	2.0	1.9				2.4	2.7	2.5				
Bankfull Max Depth (ft)	2.6	3.0	2.9				3.3	3.3	3.6				3.0	3.2	3.1				4.5	4.4	4.5				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	38.8	42.3	40.5				50.8	52.0	53.4				46.7	48.7	48.5				72.5	71.0	73.2				
Bankfull Width/Depth Ratio	13.1	13.1	13.3				13.0	13.0	12.3				14.1	12.7	13.6				12.5	10.1	11.6				
Bankfull Entrenchment Ratio	>9	>9	>8.6				>8	>8	>7.8				>8	>8	>7.8				N/A	N/A	N/A				
Bankfull Bank Height Ratio	1.0	1.0	1.0				1.0	1.0	1.0				1.0	1.0	1.0				N/A	N/A	N/A				

N/A: Not Applicable



Table 11b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)  
 Norket Branch Stream Mitigation Site (MCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT1 and UT2 Reaches 1 and 2

Dimension	Cross-Section 9 (Riffle)					Cross-Section 10 (Pool)					Cross-Section 11 (Pool)					Cross-Section 12 (Riffle)									
	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	
<i>based on fixed bankfull elevation</i>																									
Bankfull Width (ft)	10.5	11.6	11.1				18.1	15.9	17.3				10.6	11.1	11.3				9.4	11.1	9.5				
Floodprone Width (ft)	136	136	138				N/A	N/A	N/A				N/A	N/A	N/A				144	151	155				
Bankfull Mean Depth (ft)	0.4	0.5	0.6				0.5	0.9	0.9				0.7	0.8	0.8				0.5	0.5	0.6				
Bankfull Max Depth (ft)	0.8	1.1	0.9				1.8	2.0	2.1				1.9	2.0	0.8				1.2	1.1	1.2				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	4.5	6.2	6.7				9.8	14.0	12.7				7.5	9.4	8.8				4.5	5.6	5.5				
Bankfull Width/Depth Ratio	24.5	21.7	18.5				33.3	18.0	23.5				15.2	13.2	14.6				19.8	22.0	16.4				
Bankfull Entrenchment Ratio	13.0	11.7	12.4				N/A	N/A	N/A				N/A	N/A	N/A				15.2	13.6	16.3				
Bankfull Bank Height Ratio	1.0	1.0	1.0				N/A	N/A	N/A				N/A	N/A	N/A				1.0	1.0	1.0				
<i>based on fixed bankfull elevation</i>																									
<b>Dimension</b>																									
<i>based on fixed bankfull elevation</i>																									
Bankfull Width (ft)	9.0	9.5	9.1				13.9	13.7	14.8				9.6	10.5	11.5				9.6	9.4	7.9				
Floodprone Width (ft)	>200	>200	>200				N/A	N/A	N/A				>200	>200	>200				N/A	N/A	N/A				
Bankfull Mean Depth (ft)	0.6	0.7	0.7				0.8	1.0	0.8				0.5	0.7	0.8				0.7	0.9	1.0				
Bankfull Max Depth (ft)	1.2	1.2	1.2				2.1	2.2	2.0				1.1	1.4	1.3				1.8	1.9	1.0				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	5.3	7.1	6.4				11.7	14.1	12.0				5.2	7.6	8.7				7.0	8.1	8.1				
Bankfull Width/Depth Ratio	15.3	12.8	13.0				16.4	13.2	18.2				17.6	14.5	15.4				13.3	10.9	7.7				
Bankfull Entrenchment Ratio	>21	>21	>22				N/A	N/A	N/A				>15	>19	>17.3				N/A	N/A	N/A				
Bankfull Bank Height Ratio	1.0	1.0	1.0				N/A	N/A	N/A				1.0	1.0	1.0				N/A	N/A	N/A				

N/A: Not Applicable

Table 11c. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

Dimension <i>based on fixed bankfull elevation</i>	Cross-Section 17 (Pool)					Cross-Section 18 (Riffle)					Cross-Section 19 (Riffle)					Cross-Section 20 (Pool)								
	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
	Bankfull Width (ft)	10.5	10.9	11.3				10.5	11.1	10.1				13.9	12.6	14.3				14.7	15.0	15.5		
Floodprone Width (ft)	N/A	N/A	N/A				>200	>200	>200				130	130	146				N/A	N/A	N/A			
Bankfull Mean Depth (ft)	1.0	1.2	1.1				0.7	0.7	0.7				0.8	1.2	1.0				1.4	1.5	1.5			
Bankfull Max Depth (ft)	2.0	2.0	2.2				1.2	1.3	1.4				1.6	1.8	1.8				2.6	2.7	2.7			
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	10.7	12.9	12.1				7.2	7.6	7.6				11.8	14.9	14.3				21.2	22.7	23.0			
Bankfull Width/Depth Ratio	10.2	9.2	10.5				15.3	16.2	13.6				16.5	10.6	14.4				10.2	9.9	10.4			
Bankfull Entrenchment Ratio	N/A	N/A	N/A				>19	>18	>9.3				9.3	10.3	10.2				N/A	N/A	N/A			
Bankfull Bank Height Ratio	N/A	N/A	N/A				1.0	1.0	1.0				1.0	1.0	1.0				N/A	N/A	N/A			

N/A: Not Applicable

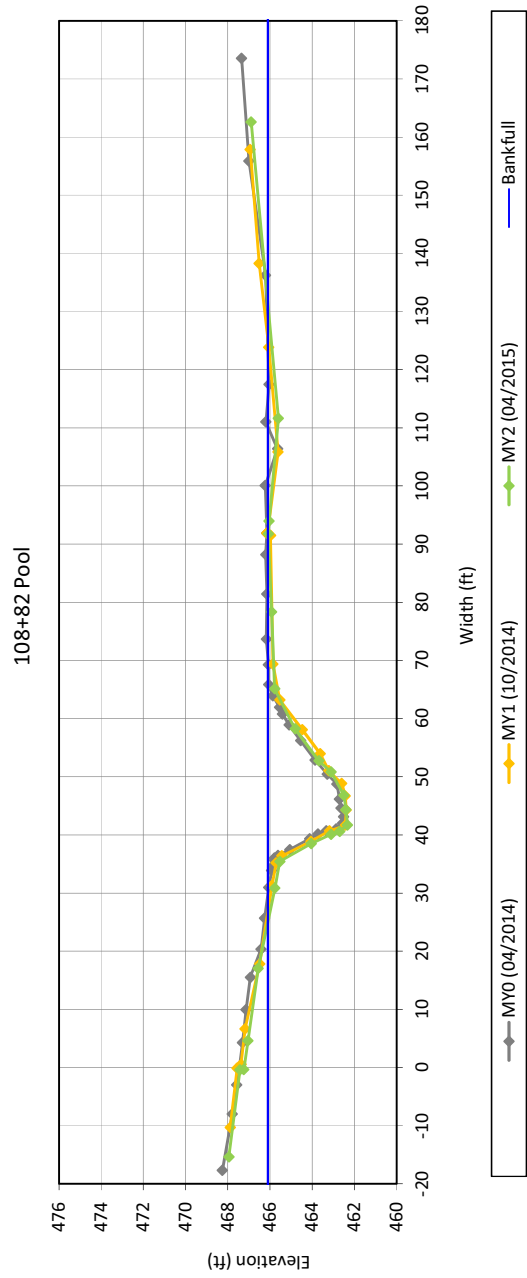


Table 12a. Monitoring Data - Stream Reach Data Summary  
 Norkett Branch Stream Mitigation Site (NCDIMS Project No. 95360)  
 Monitoring Year 2 - 2015

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>												
Bankfull Width (ft)	22.5	26.6	23.1	23.5	23.3	26.2						
Floodprone Width (ft)	>200		>200			>200						
Bankfull Mean Depth	1.6	1.8	1.8	2.1	1.7	2.0						
Bankfull Max Depth	2.6	3.3	3.0	3.4	2.9	3.4						
Bankfull Cross-sectional Area (ft <sup>2</sup> )	38.8	44.6	42.3	47.7	40.5	48.8						
Width/Depth Ratio	13.1	16.7	11.1	13.1	11.4	14.1						
Entrenchment Ratio	>2.2		>2.2			>2.2						
Bank Height Ratio	1.0		1.0			1.0						
D50 (mm)	18.4	59.6	13.3	26.9	24.7	90.0						
<b>Profile</b>												
Riffle Length (ft)	14	84										
Riffle Slope (ft/ft)	0.0000	0.0152										
Pool Length (ft)	12	88										
Pool Max Depth (ft)	3.3	5.1										
Pool Spacing (ft)	67	183										
Pool Volume (ft <sup>3</sup> )												
<b>Pattern</b>												
Channel Beltwidth (ft)	38	147										
Radius of Curvature (ft)	38	65										
Rc:Bankfull Width (ft/ft)	1.7	2.4										
Meander Wave Length (ft)	167	263										
Meander Width Ratio	1.7	5.5										
<b>Additional Reach Parameters</b>												
Rosgen Classification	C4		C4		C4							
Channel Thalweg Length (ft)	2,369											
Sinuosity (ft)	1.24											
Water Surface Slope (ft/ft)	0.003											
Bankfull Slope (ft/ft)	0.003											
R <sub>10</sub> /R <sub>50</sub> /P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	0.4/3.6/7.4/52.3/139.4/362		1.0/8.0/16.7/50.6/90/1024		0.3/11.0/29.3/121.7/180/1024							
% of Reach with Eroding Banks			6%		0%							

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 1-Norkett Branch Reach 1**



**Bankfull Dimensions**

68.7	x-section area (ft.sq.)
34.3	width (ft)
2.0	mean depth (ft)
3.8	max depth (ft)
35.4	wetted perimeter (ft)
1.9	hyd radi (ft)
17.1	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.

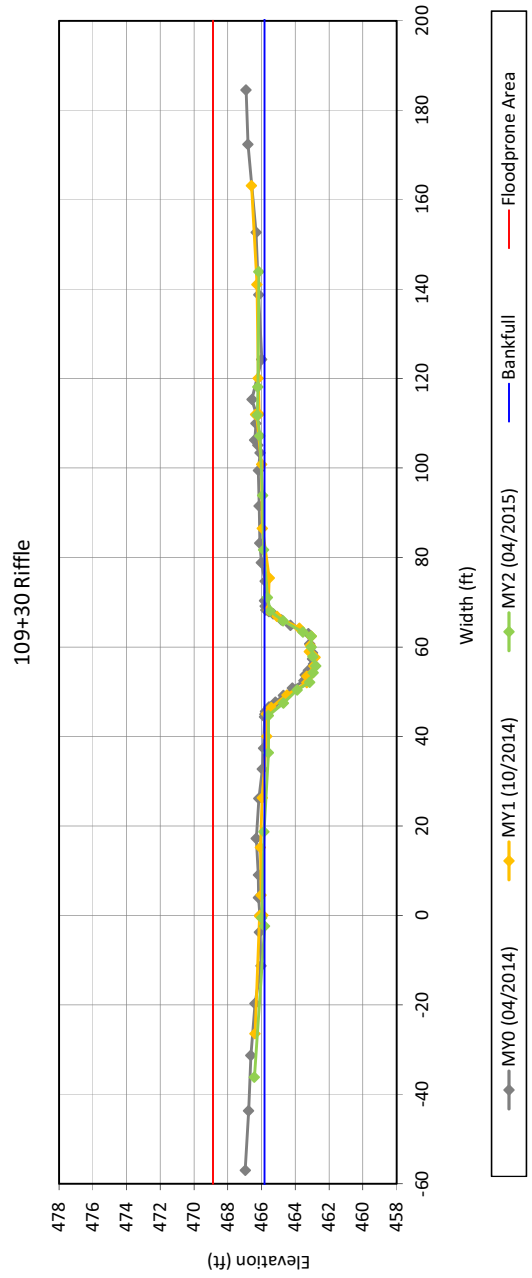


View Downstream



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS P Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 2-Norkett Branch Reach 1**



**Bankfull Dimensions**

- 48.0 x-section area (ft.sq.)
- 23.4 width (ft)
- 2.0 mean depth (ft)
- 3.0 max depth (ft)
- 24.4 wetted perimeter (ft)
- 2.0 hyd radi (ft)
- 11.4 width-depth ratio
- >200 W flood prone area (ft)
- >8.5 entrenchment ratio
- 1.0 low bank height ratio

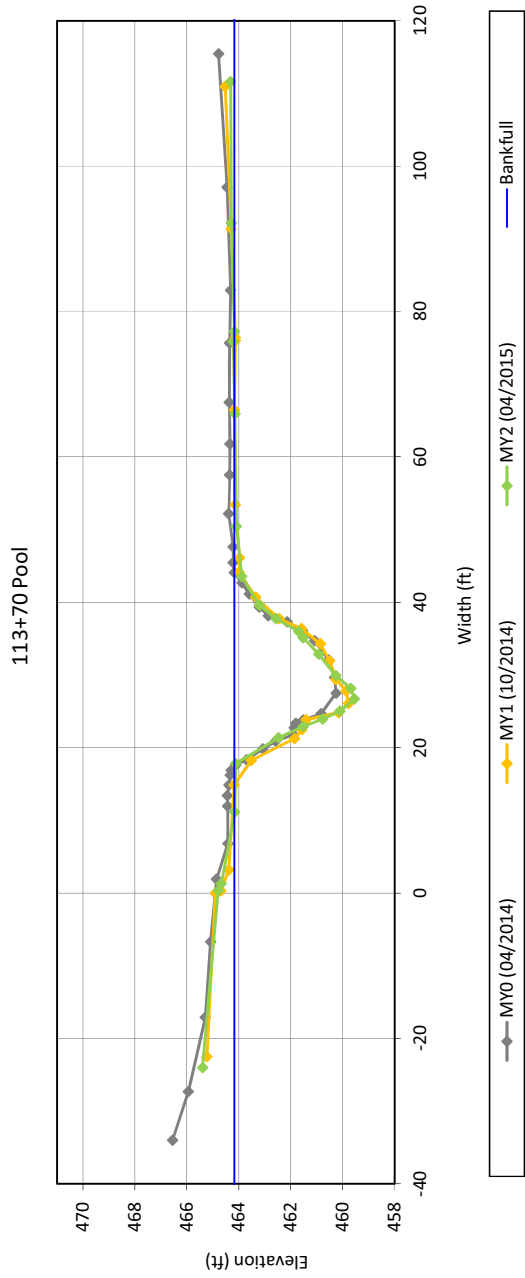
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 3--Norkett Branch Reach 1**



**Bankfull Dimensions**

62.9	x-section area (ft.sq.)
25.8	width (ft)
2.4	mean depth (ft)
4.6	max depth (ft)
27.6	wetted perimeter (ft)
2.3	hyd radi (ft)
10.6	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.

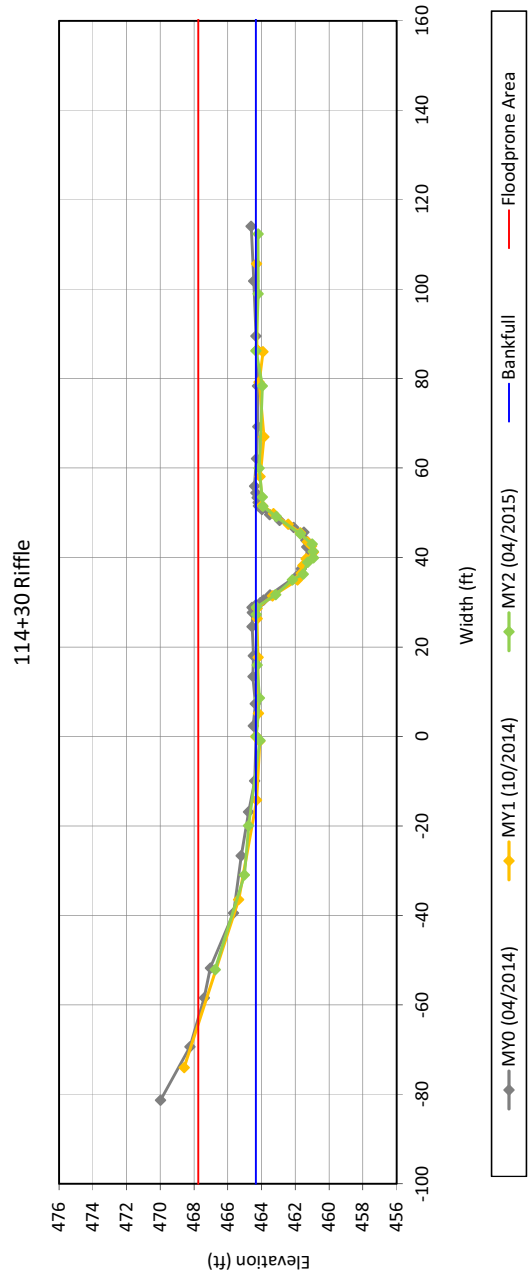


View Downstream



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS P Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 4-Norkett Branch Reach 1**



**Bankfull Dimensions**

48.8	x-section area (ft.sq.)
26.2	width (ft)
1.9	mean depth (ft)
3.4	max depth (ft)
27.3	wetted perimeter (ft)
1.8	hyd radi (ft)
14.1	width-depth ratio
>200	W flood prone area (ft)
>7.6	entrenchment ratio
1.0	low bank height ratio

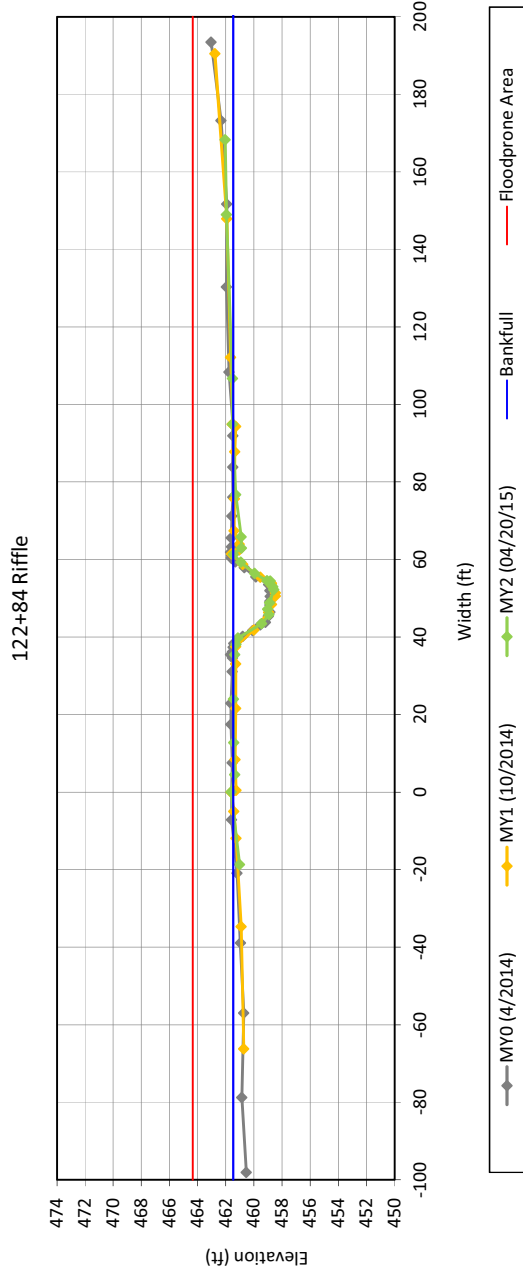
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 5-Norkett Branch Reach 1**



**Bankfull Dimensions**

- 40.5 x-section area (ft.sq.)
- 23.3 width (ft)
- 1.7 mean depth (ft)
- 2.9 max depth (ft)
- 24.3 wetted perimeter (ft)
- 1.7 hyd radi (ft)
- 13.3 width-depth ratio
- >200 W flood prone area (ft)
- >8.6 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

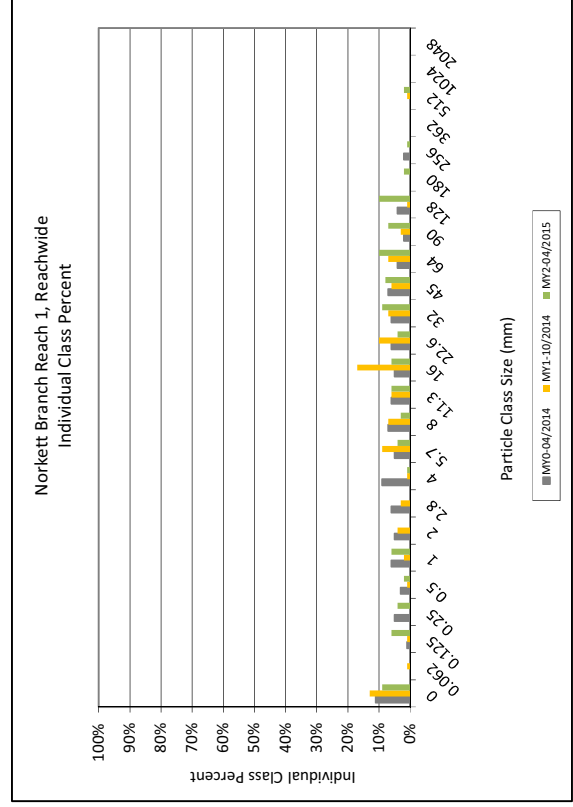
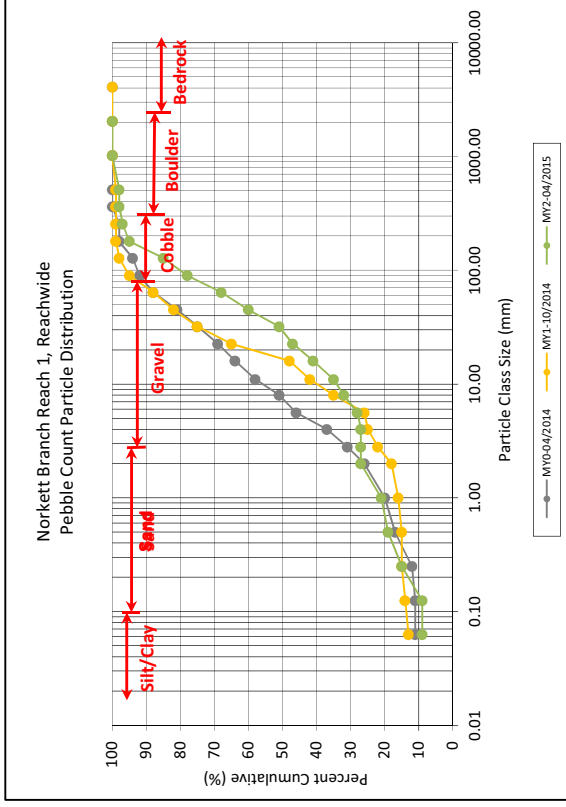


Reachwide and Cross-Section Pebble Count Plots  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

Norkett Branch Reach 1, Reachwide

Particle Class	Diameter (mm)		Particle Count			Norkett Branch Reach 1 Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	0.000	0.062	2	7	9	9	9
	0.062	0.125					9
SAND	0.125	0.250	2	4	6	6	15
	0.250	0.500	3	1	4	4	19
	0.5	1.0	1	1	2	2	21
	1.0	2.0	2	4	6	6	27
	2.0	2.8					27
GRAVEL	2.8	4.0					27
	4.0	5.7	1		1	1	28
	5.7	8.0	2	2	4	4	32
	8.0	11.3	1	2	3	3	35
	11.3	16.0	1	5	6	6	41
	16.0	22.6	3	3	6	6	47
	22.6	32	3	1	4	4	51
	32	45	6	3	9	9	60
	45	64	5	3	8	8	68
	64	90	3	7	10	10	78
COBBLE	90	128	6	1	7	7	85
	128	180	5	5	10	10	95
	180	256	2		2	2	97
	256	362	1		1	1	98
BOULDER	362	512					98
	512	1024	1	1	2	2	100
BEDROCK	1024	2048					
	2048	>2048					
		<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

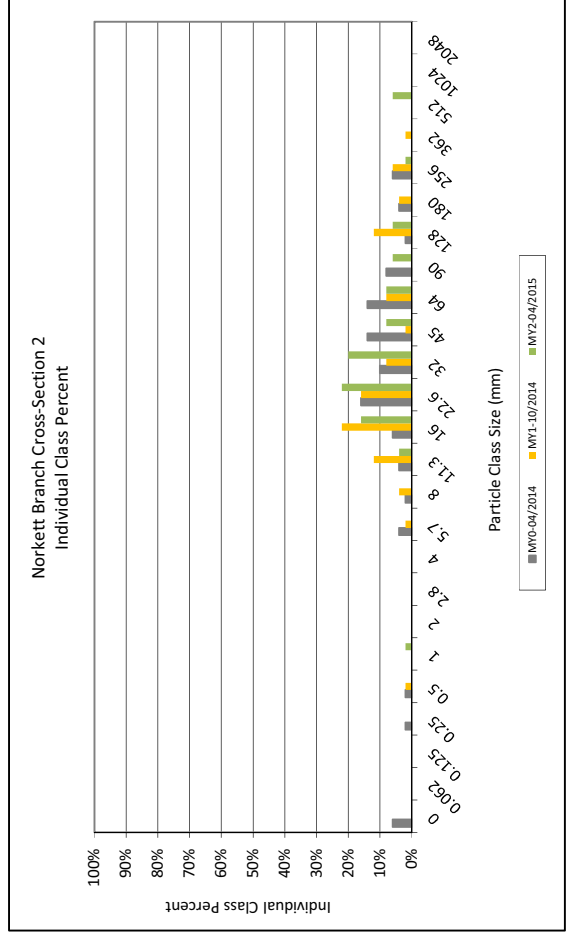
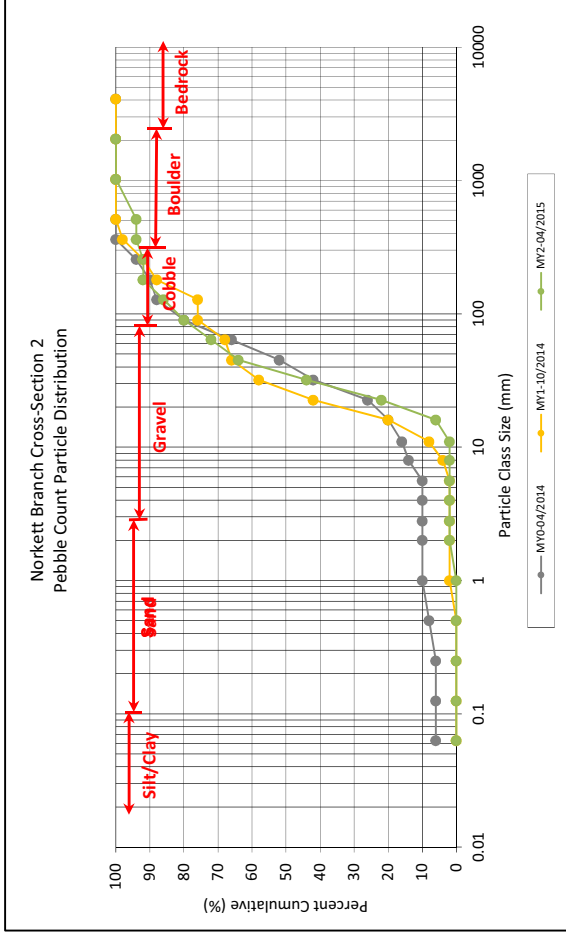
Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	0.3
D <sub>35</sub> =	11.0
D <sub>50</sub> =	29.3
D <sub>84</sub> =	121.7
D <sub>95</sub> =	180.0
D <sub>100</sub> =	1024.0



Norkett Branch Reach 1, Cross-Section 2

Particle Class	Diameter (mm)		Particle Count	Cross-Section 2 Summary	
	min	max		Total	Class Percentage
SILT/CLAY	0.000	0.062			0
	0.062	0.125			0
SAND	0.125	0.250			0
	0.250	0.500			0
GRAVEL	0.5	1.0			0
	1.0	2.0	2	2	2
GRAVEL	2.0	2.8			2
	2.8	4.0			2
GRAVEL	4.0	5.7			2
	5.7	8.0			2
GRAVEL	8.0	11.3			2
	11.3	16.0	4	4	6
GRAVEL	16.0	22.6	16	16	22
	22.6	32	22	22	44
COBBLE	32	45	20	20	64
	45	64	8	8	72
COBBLE	64	90	8	8	80
	90	128	6	6	86
COBBLE	128	180	6	6	92
	180	256			92
BOULDER	256	362	2	2	94
	362	512			94
BOULDER	512	1024	6	6	100
	1024	2048			
BEDROCK	2048	>2048			
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 2	
Channel materials (mm)	
D <sub>16</sub> =	19.9
D <sub>35</sub> =	27.8
D <sub>50</sub> =	35.4
D <sub>84</sub> =	113.8
D <sub>95</sub> =	574.7
D <sub>100</sub> =	1024.0

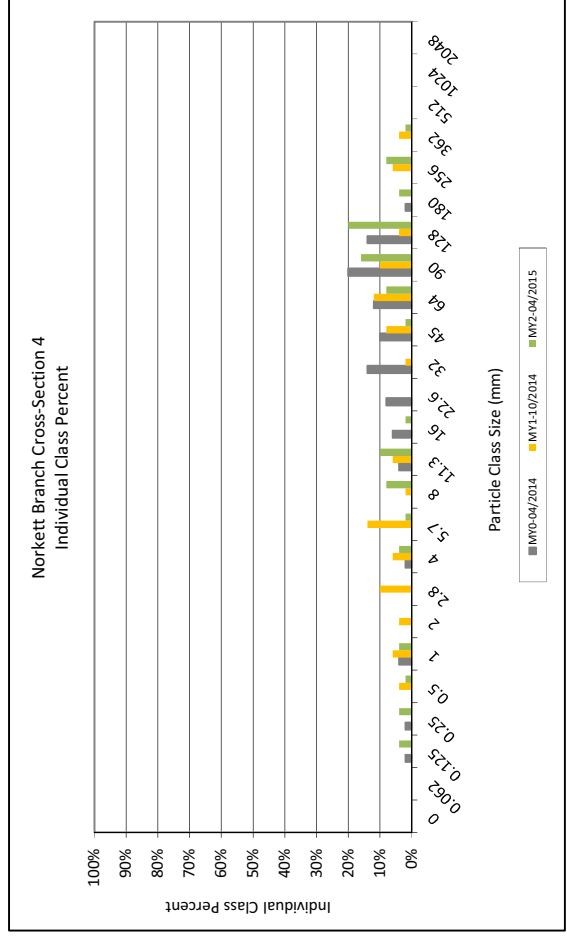
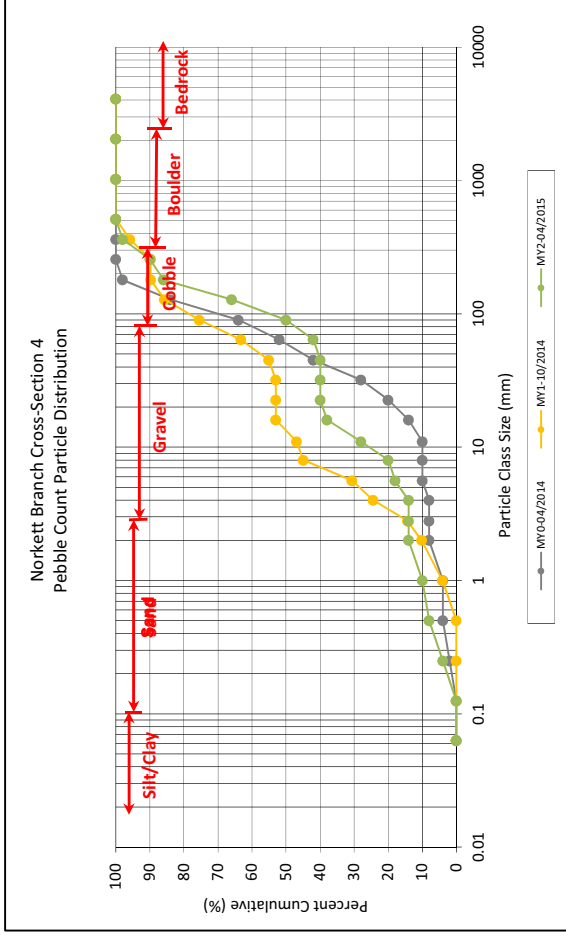




Norkett Branch Reach 1, Cross-Section 4

Particle Class	Diameter (mm)		Particle Count	Cross-Section 4 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	Total		0
	0.062	0.125			0
	0.125	0.250	4	4	4
	0.250	0.500	4	4	8
	0.5	1.0	2	2	10
	1.0	2.0	4	4	14
	2.0	2.8			14
	2.8	4.0			14
	4.0	5.7	4	4	18
	5.7	8.0	2	2	20
	8.0	11.3	8	8	28
	11.3	16.0	10	10	38
	16.0	22.6	2	2	40
	22.6	32			40
	32	45			40
	45	64	2	2	42
	64	90	8	8	50
	90	128	16	16	66
	128	180	20	20	86
	180	256	4	4	90
	256	362	8	8	98
	362	512	2	2	100
	512	1024			
	1024	2048			
	2048	>2048			
<b>TOTAL</b>			<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 4	
Channel materials (mm)	
D <sub>16</sub> =	4.7
D <sub>35</sub> =	14.3
D <sub>50</sub> =	90.0
D <sub>84</sub> =	174.0
D <sub>95</sub> =	317.9
D <sub>100</sub> =	512.0



Norkett Branch Reach 1, Cross-Section 5

Particle Class	Diameter (mm)		Particle Count	Cross-Section 5 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>					
Silt/Clay	0.062	0.062	8	8	8
Very fine	0.062	0.125			8
Fine	0.125	0.250	4	4	12
Medium	0.250	0.500			12
Coarse	0.5	1.0			12
Very Coarse	1.0	2.0	8	8	20
Very Fine	2.0	2.8			20
Very Fine	2.8	4.0			20
Fine	4.0	5.7	2	2	22
Fine	5.7	8.0	2	2	24
Medium	8.0	11.3	6	6	30
Medium	11.3	16.0	10	10	40
Coarse	16.0	22.6	8	8	48
Coarse	22.6	32	8	8	56
Very Coarse	32	45	10	10	66
Very Coarse	45	64	10	10	76
Small	64	90	8	8	84
Small	90	128	8	8	92
Large	128	180	8	8	100
Large	180	256			
Small	256	362			
Small	362	512			
Medium	512	1024			
Large/Very Large	1024	2048			
Bedrock	2048	>2048			
<b>TOTAL</b>			<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 5	
Channel materials (mm)	
D <sub>16</sub> =	1.4
D <sub>35</sub> =	13.3
D <sub>50</sub> =	24.7
D <sub>84</sub> =	90.0
D <sub>95</sub> =	145.5
D <sub>100</sub> =	180.0

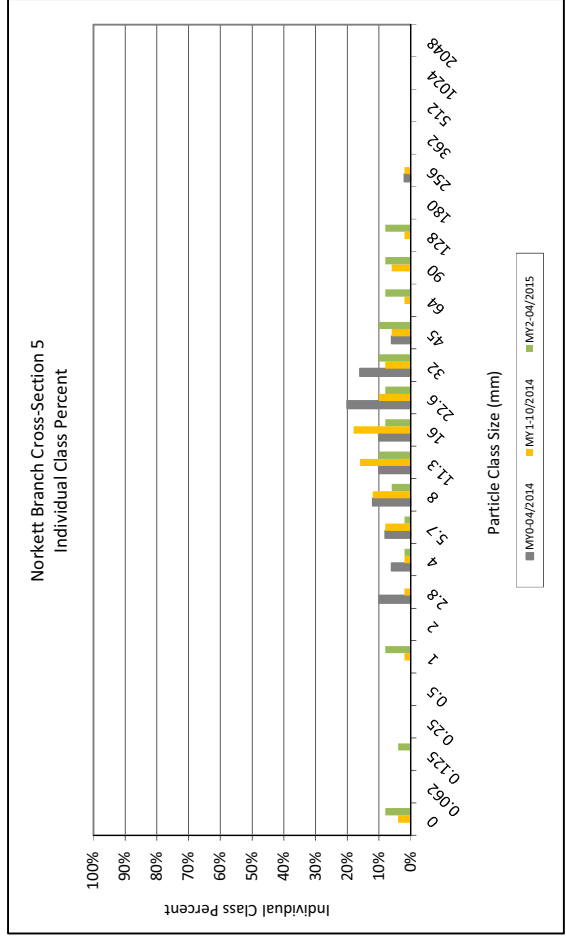
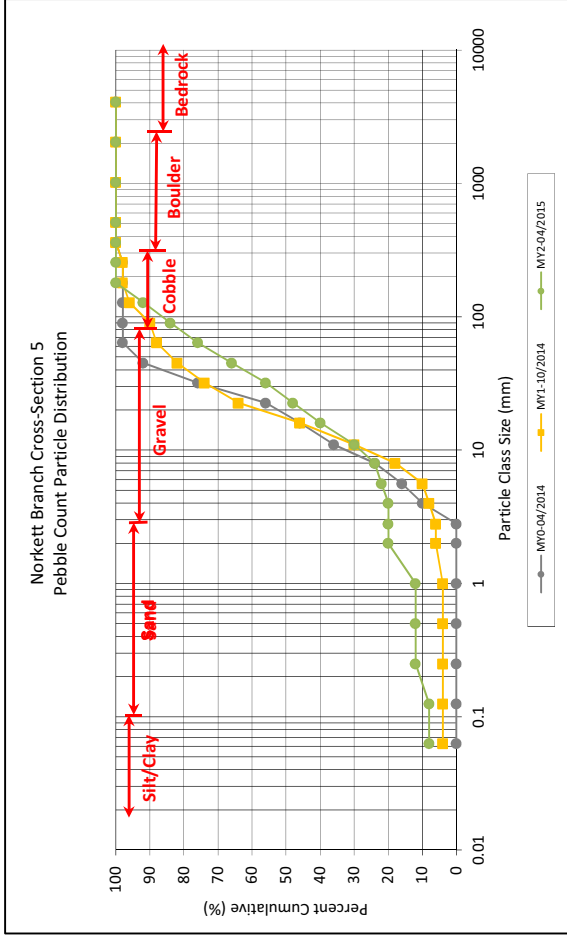


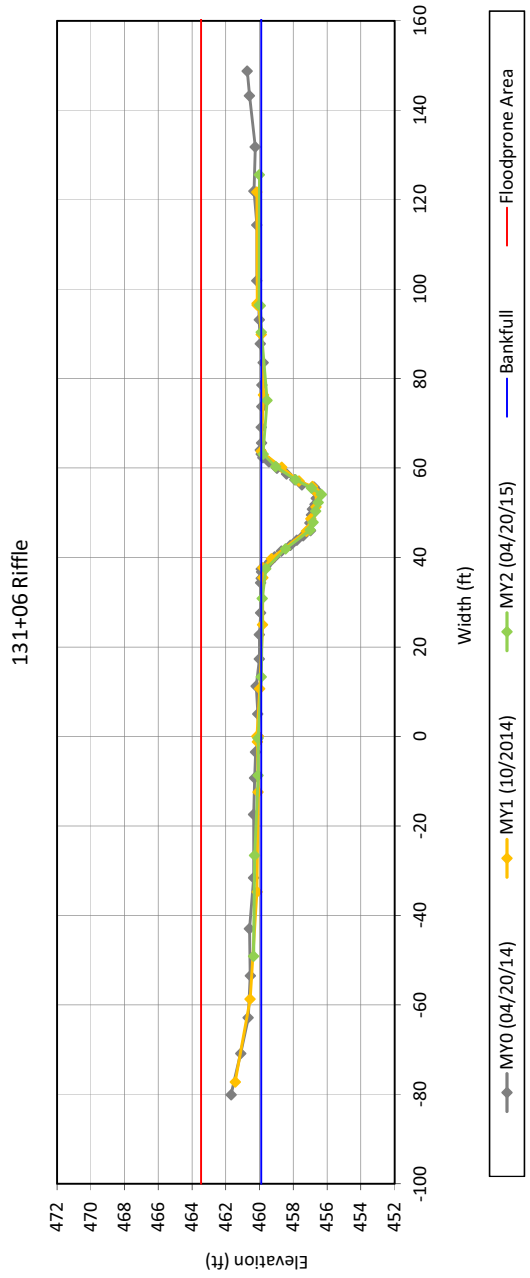


Table 12b. Monitoring Data - Stream Reach Data Summary  
 Norkett Branch Stream Mitigation Site (NCDIMS Project No. 95360)  
 Monitoring Year 2 - 2015

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>												
Bankfull Width (ft)	25.6	25.7	24.9	26.0	25.6	25.6						
Floodprone Width (ft)	>200		>200			>200						
Bankfull Mean Depth	1.8	2.0	2.0	2.0	1.9	2.1						
Bankfull Max Depth	3.0	3.3	3.2	3.3	3.1	3.6						
Bankfull Cross-sectional Area (ft <sup>2</sup> )	46.7	50.8	48.7	52.0	48.5	53.4						
Width/Depth Ratio	13.0	14.1	12.7	13.0	12.3	13.6						
Entrenchment Ratio	>2.2		>2.2			>2.2						
Bank Height Ratio	1.0		1.0			1.0						
D50 (mm)	7.3	9.9	3.6	12.1	1.0	27.8						
<b>Profile</b>												
Riffle Length (ft)	19	111										
Riffle Slope (ft/ft)	0.0009	0.0163										
Pool Length (ft)	51	102										
Pool Max Depth (ft)	3.5	4.8										
Pool Spacing (ft)	98	172										
Pool Volume (ft <sup>3</sup> )												
<b>Pattern</b>												
Channel Beltwidth (ft)	38	155										
Radius of Curvature (ft)	40	64										
Rc:Bankfull Width (ft/ft)	1.6	2.5										
Meander Wave Length (ft)	181	277										
Meander Width Ratio	1.5	6.0										
<b>Additional Reach Parameters</b>												
Rosgen Classification	C4/E4		C4/E4			C4/E4						
Channel Thalweg Length (ft)	1,499											
Sinuosity (ft)	1.20											
Water Surface Slope (ft/ft)	0.003											
Bankfull Slope (ft/ft)	0.003											
R%/Rw%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	2.6/6.7/13.0/62.6/210.9/>2048		0.3/10.4/15.3/49.1/90/362		4.2/16/24.9/83.4/151.8/362							
% of Reach with Eroding Banks			7%		5%							

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 6--Norkett Branch Reach 2**



**Bankfull Dimensions**

53.4	x-section area (ft.sq.)
25.6	width (ft)
2.1	mean depth (ft)
3.6	max depth (ft)
26.7	wetted perimeter (ft)
2.0	hyd radi (ft)
12.3	width-depth ratio
>200	W flood prone area (ft)
>7.8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.

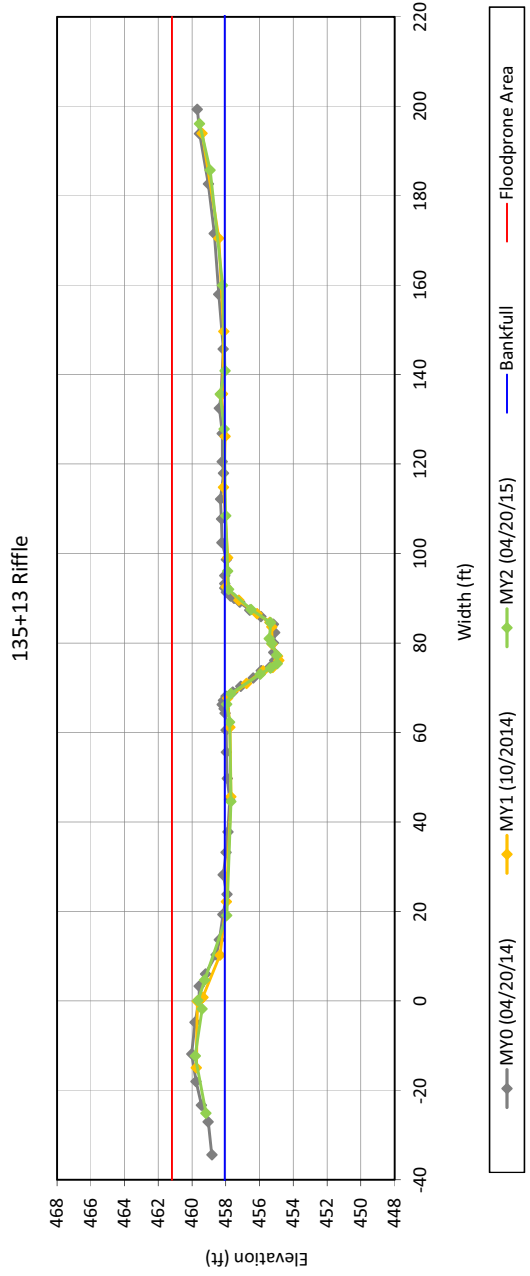


View Downstream



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

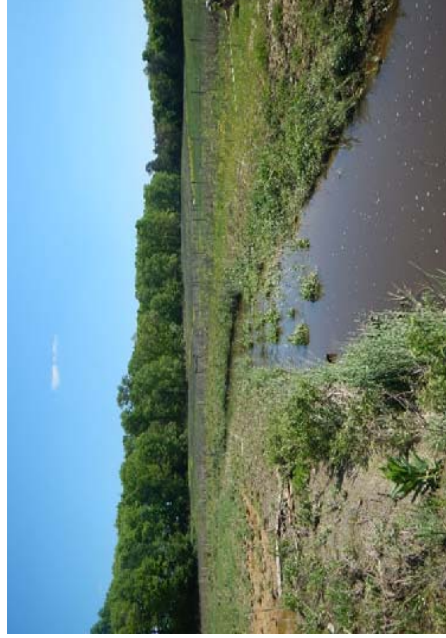
**Cross Section 7-Norkett Branch Reach 2**



**Bankfull Dimensions**

48.5	x-section area (ft.sq.)
25.6	width (ft)
1.9	mean depth (ft)
3.1	max depth (ft)
26.6	wetted perimeter (ft)
1.8	hyd radi (ft)
13.6	width-depth ratio
>200	W flood prone area (ft)
>7.8	entrenchment ratio
1.0	low bank height ratio

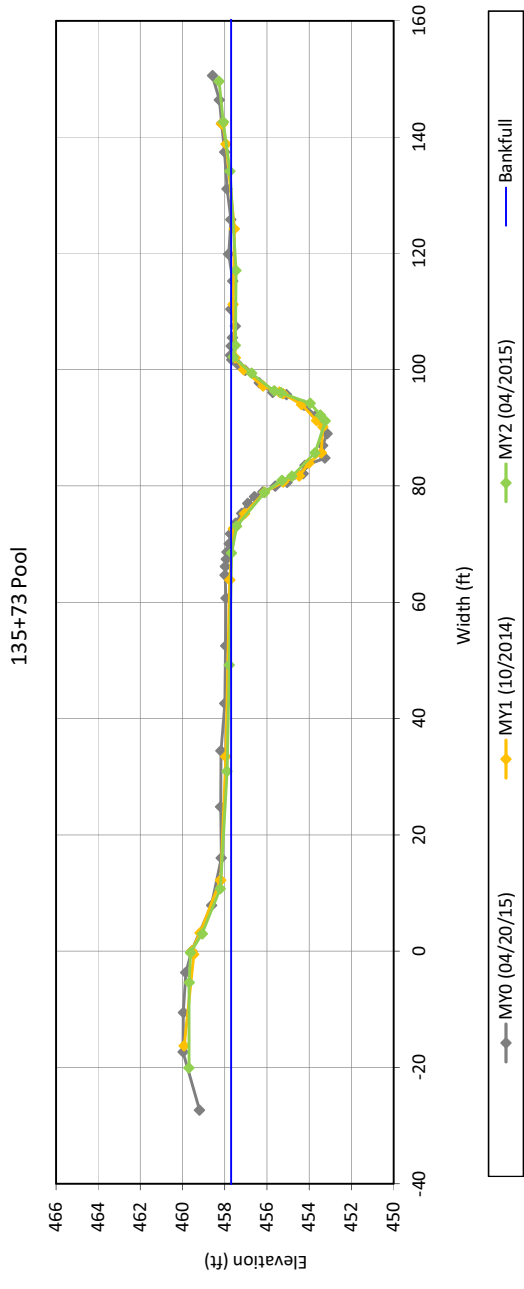
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 8--Norkett Branch Reach 2**



**Bankfull Dimensions**

73.2	x-section area (ft.sq.)
29.1	width (ft)
2.5	mean depth (ft)
4.5	max depth (ft)
30.8	wetted perimeter (ft)
2.4	hyd radi (ft)
11.6	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

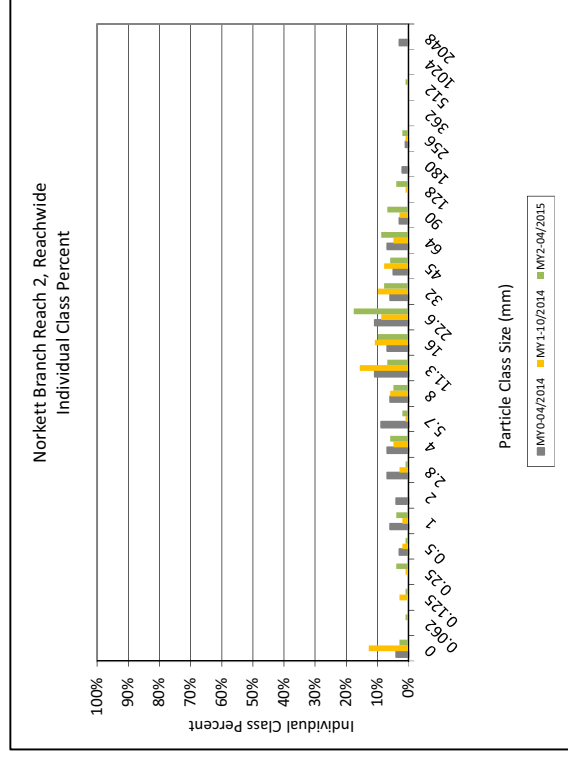
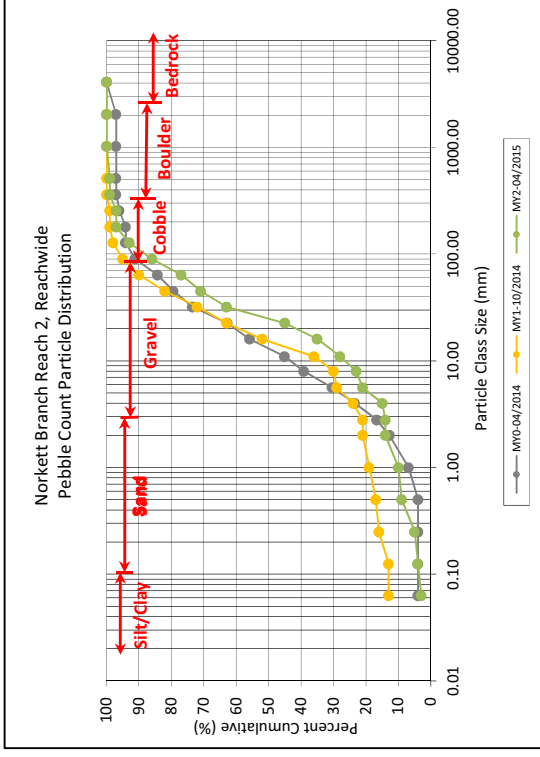


Reachwide and Cross-Section Pebble Count Plots  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

Norkett Branch Reach 2, Reachwide

Particle Class	Diameter (mm)		Particle Count			Norkett Branch Reach 2 Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	0.000	0.062	1	2	3	3	3
	0.062	0.125	1	1	2	1	4
SAND	0.125	0.250	1	1	2	1	5
	0.250	0.500	1	3	4	4	9
GRAVEL	0.5	1.0	1	1	2	1	10
	1.0	2.0	1	3	4	4	14
COBBLE	2.0	2.8					14
	2.8	4.0		1	1	1	15
BEDROCK	4.0	5.7	1	5	6	6	21
	5.7	8.0	1	1	2	2	23
BEDROCK	8.0	11.3	3	2	5	5	28
	11.3	16.0	2	5	7	7	35
BEDROCK	16.0	22.6	7	3	10	10	45
	22.6	32	8	10	18	18	63
BEDROCK	32	45	3	5	8	8	71
	45	64	3	3	6	6	77
BEDROCK	64	90	7	2	9	9	86
	90	128	5	2	7	7	93
BEDROCK	128	180	1	3	4	4	97
	180	256					97
BEDROCK	256	362	2		2	2	99
	362	512					99
BEDROCK	512	1024	1		1	1	100
	1024	2048					
BEDROCK	2048	>2048					
	Total		50	50	100	99	100

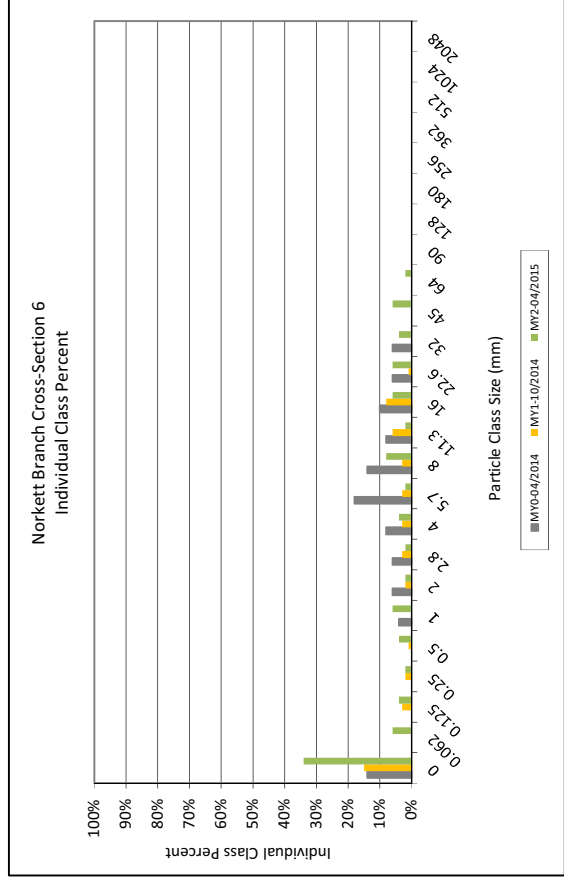
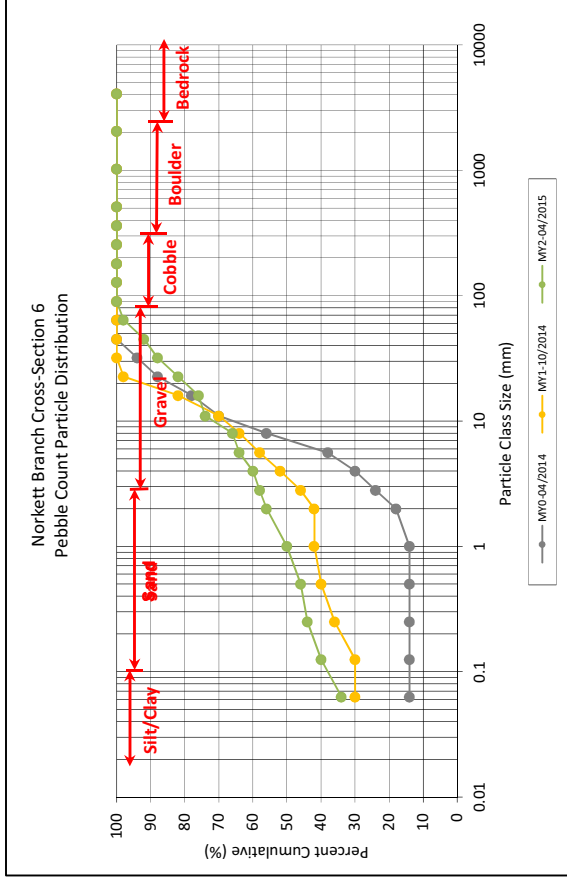
Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	4.2
D <sub>35</sub> =	16.0
D <sub>50</sub> =	24.9
D <sub>84</sub> =	83.4
D <sub>95</sub> =	151.8
D <sub>100</sub> =	362.0



Norkett Branch Reach 2, Cross-Section 6

Particle Class	Diameter (mm)		Particle Count	Cross-Section 6 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	34	34	34
<b>SAND</b>	0.062	0.125	6	6	40
	0.125	0.250	4	4	44
	0.250	0.500	2	2	46
	0.5	1.0	4	4	50
	1.0	2.0	6	6	56
	2.0	2.8	2	2	58
	2.8	4.0	2	2	60
	4.0	5.7	4	4	64
	5.7	8.0	2	2	66
	8.0	11.3	8	8	74
<b>GRAVEL</b>	11.3	16.0	2	2	76
	16.0	22.6	6	6	82
	22.6	32	6	6	88
	32	45	4	4	92
	45	64	6	6	98
	64	90	2	2	100
<b>COBBLE</b>	90	128			
	128	180			
	180	256			
	256	362			
<b>BOULDER</b>	362	512			
	512	1024			
<b>BEDROCK</b>	1024	2048			
	2048	>2048			
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 6	
Channel materials (mm)	
D <sub>16</sub> =	Silt / Clay
D <sub>35</sub> =	0.1
D <sub>50</sub> =	1.0
D <sub>84</sub> =	25.4
D <sub>95</sub> =	53.7
D <sub>100</sub> =	90.0





Norkett Branch Reach 2, Cross-Section 7

Particle Class	Diameter (mm)		Particle Count	Cross-Section 7 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	2	2	2
<b>SAND</b>	0.062	0.125			2
	0.125	0.250			2
	0.250	0.500			2
	0.5	1.0			2
	1.0	2.0	4	4	6
	2.0	2.8	2	2	8
	2.8	4.0	2	2	10
	4.0	5.7			10
	5.7	8.0	4	4	14
	8.0	11.3	4	4	18
<b>GRAVEL</b>	11.3	16.0	10	10	28
	16.0	22.6	10	10	38
	22.6	32	20	20	58
	32	45	20	20	78
	45	64	10	10	88
	64	90	6	6	94
	90	128	2	2	96
	128	180	2	2	98
<b>BOULDER</b>	180	256			98
	256	362			98
	362	512	2	2	100
	512	1024			
<b>BEDROCK</b>	1024	2048			
	2048	>2048			
<b>Total</b>			<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 7	
Channel materials (mm)	
D <sub>16</sub> =	9.4
D <sub>35</sub> =	20.4
D <sub>50</sub> =	27.8
D <sub>84</sub> =	55.6
D <sub>95</sub> =	107.3
D <sub>100</sub> =	512.0

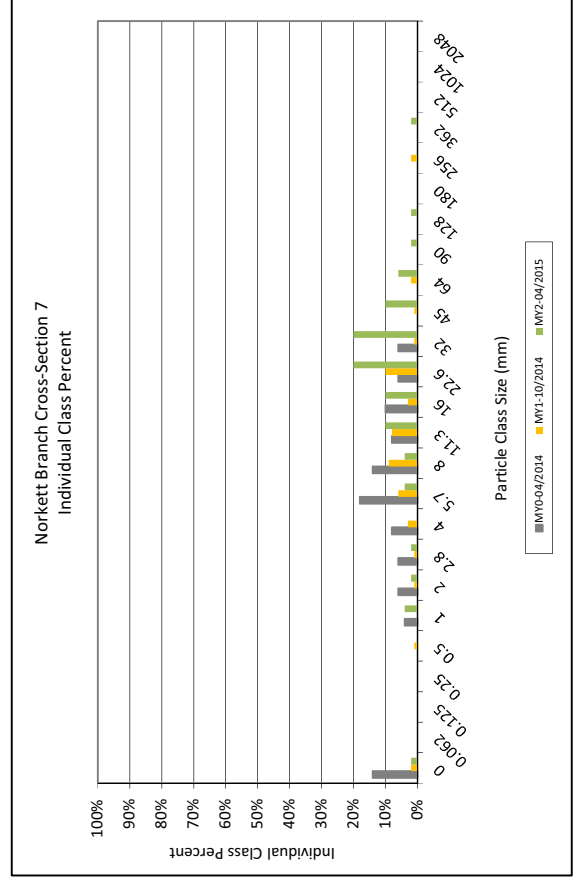
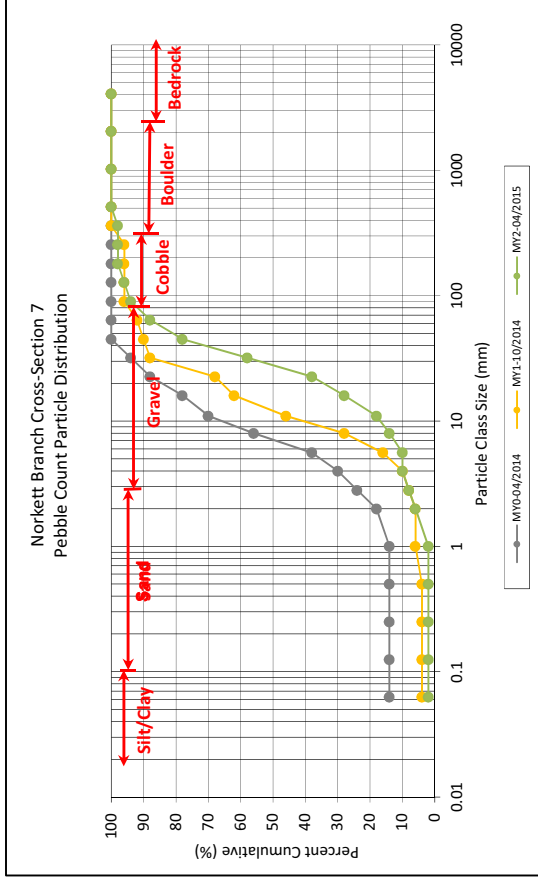


Table 12c. Monitoring Data - Stream Reach Data Summary  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

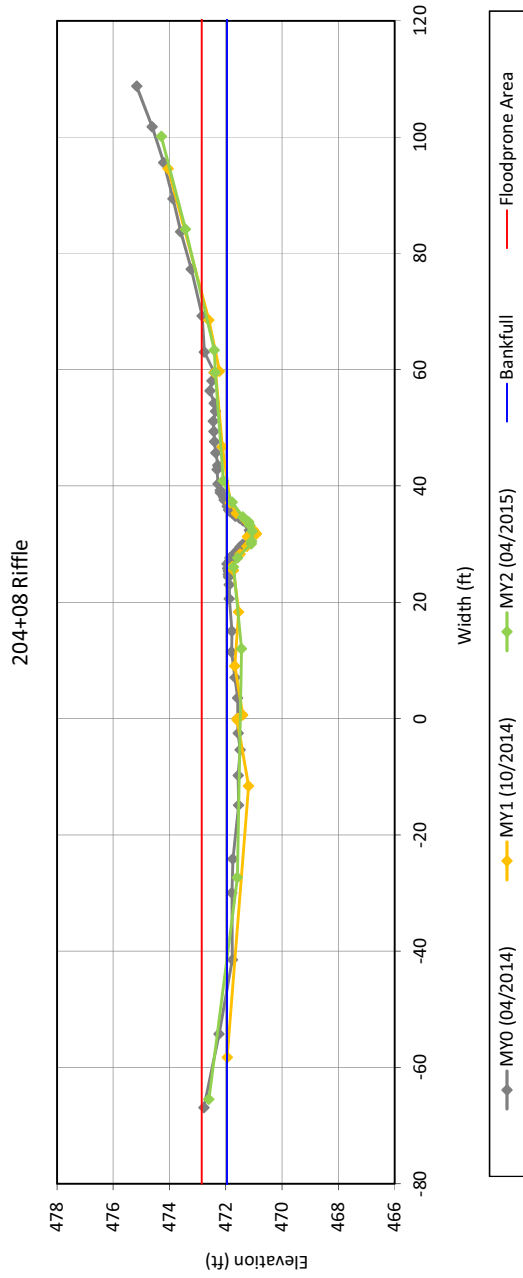
UT1

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>												
Bankfull Width (ft)	10.5		11.6		11.1							
Floodprone Width (ft)	136		136.0		137.8							
Bankfull Mean Depth	0.4		0.5		0.6							
Bankfull Max Depth	0.8		1.1		0.9							
Bankfull Cross-sectional Area (ft <sup>2</sup> )	4.5		6.2		6.7							
Width/Depth Ratio	24.5		21.7		18.5							
Entrenchment Ratio	13.0		11.7		12.4							
Bank Height Ratio	1.0		1.0		1.0							
D50 (mm)	20.9		48.3		21.9							
<b>Profile</b>												
Riffle Length (ft)	7											
Riffle Slope (ft/ft)	0.007											
Pool Length (ft)	12											
Pool Max Depth (ft)	1.2											
Pool Spacing (ft)	30											
Pool Volume (ft <sup>3</sup> )												
<b>Pattern</b>												
Channel Beltwidth (ft)	13											
Radius of Curvature (ft)	14											
Rc:Bankfull Width (ft/ft)	1.3											
Meander Wave Length (ft)	61											
Meander Width Ratio	1.2											
<b>Additional Reach Parameters</b>												
Rosgen Classification	C4		C4		C4							
Channel Thalweg Length (ft)	1,198											
Sinuosity (ft)	1.20											
Water Surface Slope (ft/ft)	0.011											
Bankfull Slope (ft/ft)	0.011											
R <sup>2</sup> /Ru <sup>2</sup> /P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100												
% of Reach with Eroding Banks	SC/1.0/12.7/55.3/90/256		SC/2.4/9.4/61.2/139.4/256.0		SC/0.1/8.6/82.6/139.4/256							
	0%		0%		0%							



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 9-UT1**



**Bankfull Dimensions**

6.7	x-section area (ft.sq.)
11.1	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
11.3	wetted perimeter (ft)
0.6	hyd radi (ft)
18.5	width-depth ratio
137.8	W flood prone area (ft)
12.4	entrenchment ratio
1.0	low bank height ratio

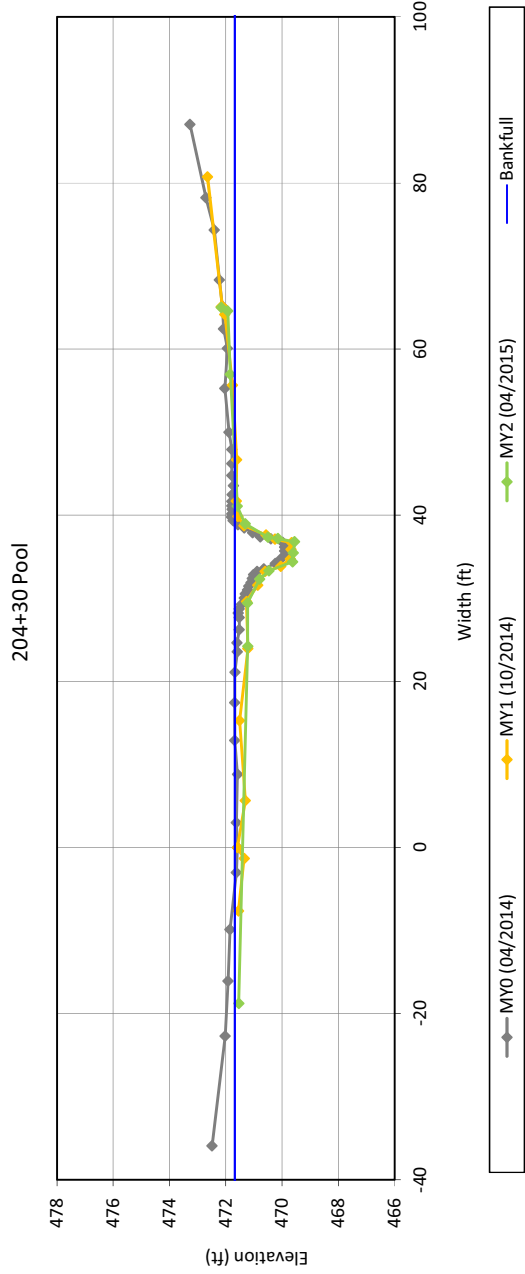
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 10-UT1**



**Bankfull Dimensions**

12.7	x-section area (ft.sq.)
17.3	width (ft)
0.7	mean depth (ft)
2.1	max depth (ft)
18.4	wetted perimeter (ft)
0.7	hyd radi (ft)
23.5	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



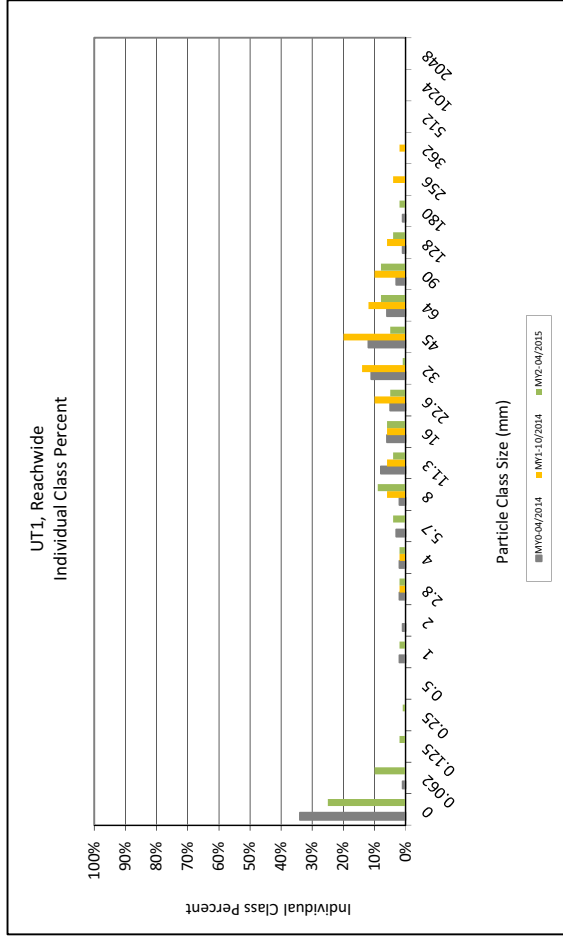
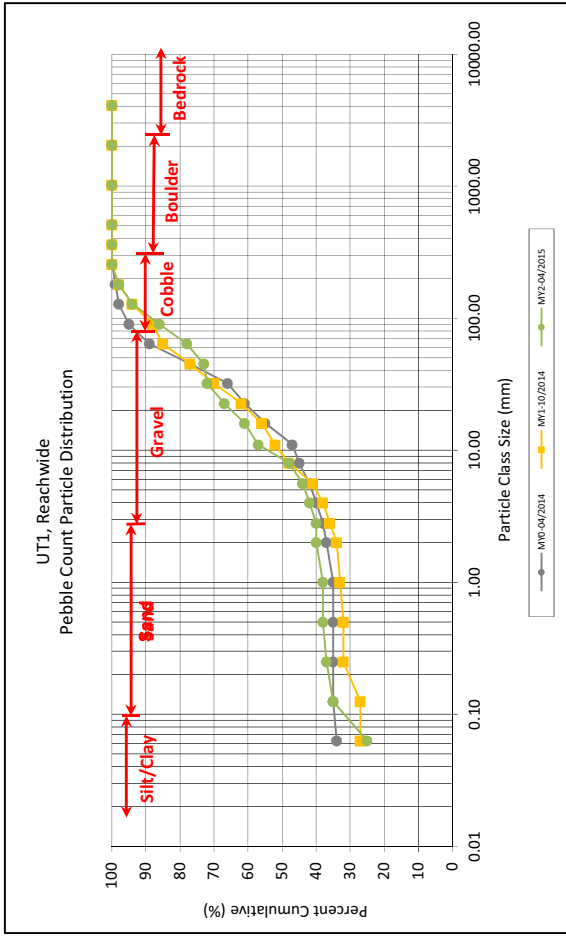
View Downstream

Reachwide and Cross-Section Pebble Count Plots  
 Norckett Branch Stream Mitigation Site (NCDSMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT1, Reachwide

Particle Class	Diameter (mm)		Particle Count			UT1 Reach Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	0.000	0.062	2	23	25	25	25
	0.062	0.125	1	9	10	10	35
	0.125	0.250	2	2	2	2	37
SAND	0.250	0.500	1	1	1	1	38
	0.5	1.0			0	0	38
	1.0	2.0	2	2	2	2	40
GRAVEL	2.0	2.8			0	0	40
	2.8	4.0	1	1	2	2	42
	4.0	5.7	1	1	2	2	44
COBBLE	5.7	8.0	1	3	4	4	48
	8.0	11.3	4	5	9	9	57
	11.3	16.0	3	1	4	4	61
BOULDER	16.0	22.6	5	1	6	6	67
	22.6	32	4	1	5	5	72
	32	45	1	1	1	1	73
BEDROCK	45	64	4	1	5	5	78
	64	90	8	8	8	8	86
	90	128	7	1	8	8	94
BEDROCK	128	180	4	4	4	4	98
	180	256	1	1	2	2	100
	256	362					
BEDROCK	362	512					
	512	1024					
	1024	2048					
BEDROCK	2048	>2048					
	<b>Total</b>		<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	Silt/Clay
D <sub>16</sub> =	0.1
D <sub>35</sub> =	8.6
D <sub>50</sub> =	82.6
D <sub>84</sub> =	139.4
D <sub>95</sub> =	256.0



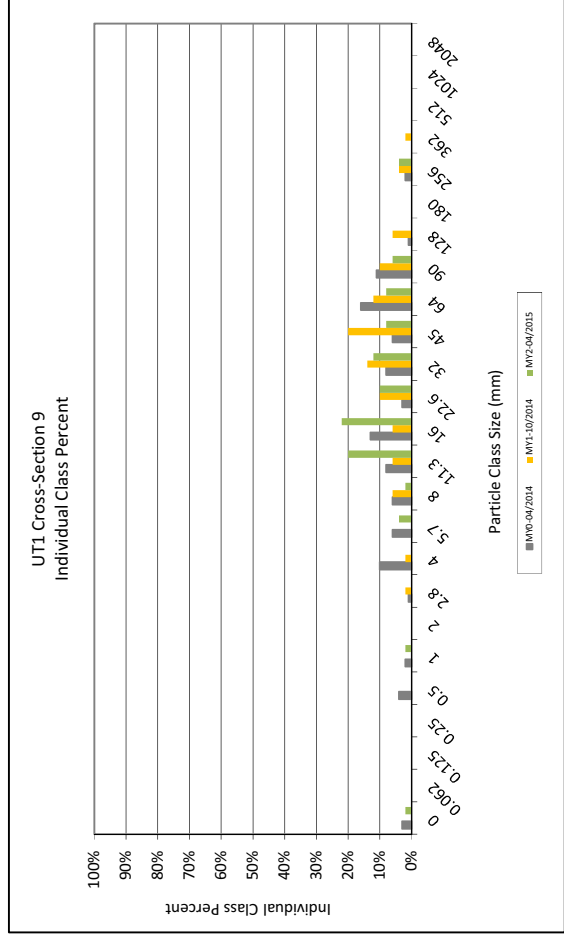
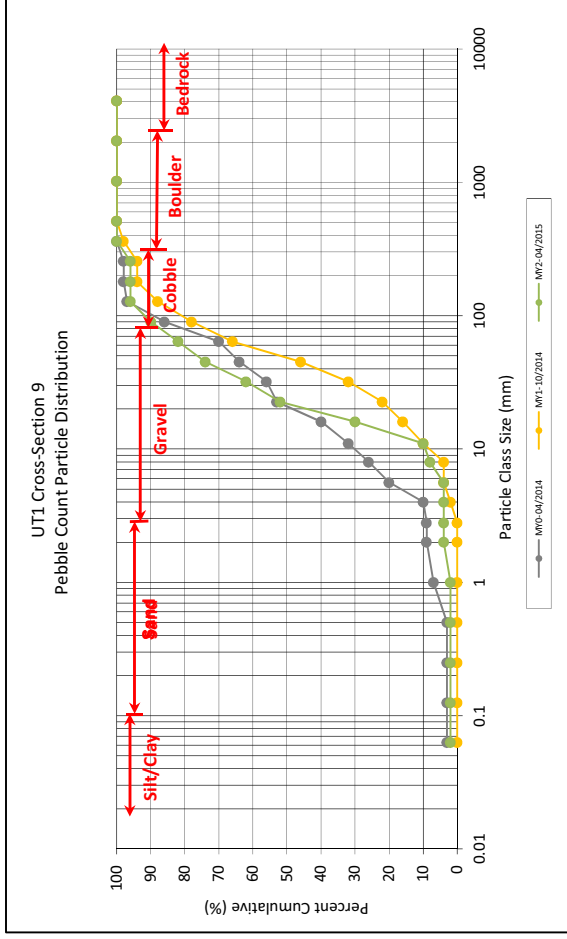


Reachwide and Cross-Section Substrate Plots  
 Norgett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT1, Cross-Section 9

Particle Class	Diameter (mm)		Particle Count	Cross-Section 9 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	2	2	2
<b>SAND</b>	Very fine	0.062			2
	Fine	0.125			2
	Medium	0.250			2
	Coarse	0.5	1.0		2
	Very Coarse	1.0	2.0	2	4
<b>GRAVEL</b>	Very Fine	2.0	2.8	4	4
	Very Fine	2.8	4.0	4	4
	Fine	4.0	5.7	4	4
	Fine	5.7	8.0	4	8
<b>COBBLE</b>	Medium	8.0	11.3	2	10
	Medium	11.3	16.0	20	30
	Coarse	16.0	22.6	22	52
	Coarse	22.6	32	10	62
<b>BOULDER</b>	Very Coarse	32	45	12	74
	Very Coarse	45	64	8	82
	Small	64	90	8	90
	Small	90	128	6	96
<b>BEDROCK</b>	Large	128	180		96
	Large	180	256		96
	Small	256	362	4	100
	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
	Bedrock	2048	>2048		
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

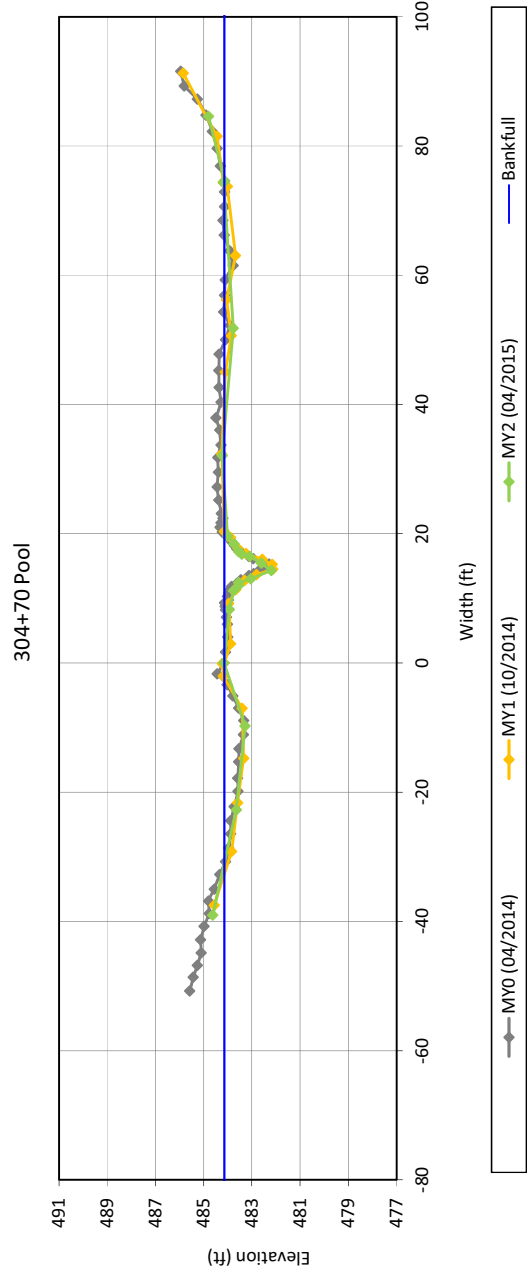
Cross-Section 9	
Channel materials (mm)	
D <sub>16</sub> =	12.3
D <sub>35</sub> =	17.3
D <sub>50</sub> =	21.9
D <sub>84</sub> =	69.7
D <sub>95</sub> =	120.7
D <sub>100</sub> =	362.0





**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 11-UT2 Reach 1**



**Bankfull Dimensions**

8.8	x-section area (ft.sq.)
11.3	width (ft)
0.8	mean depth (ft)
19.8	max depth (ft)
12.2	wetted perimeter (ft)
0.7	hyd radi (ft)
14.6	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.

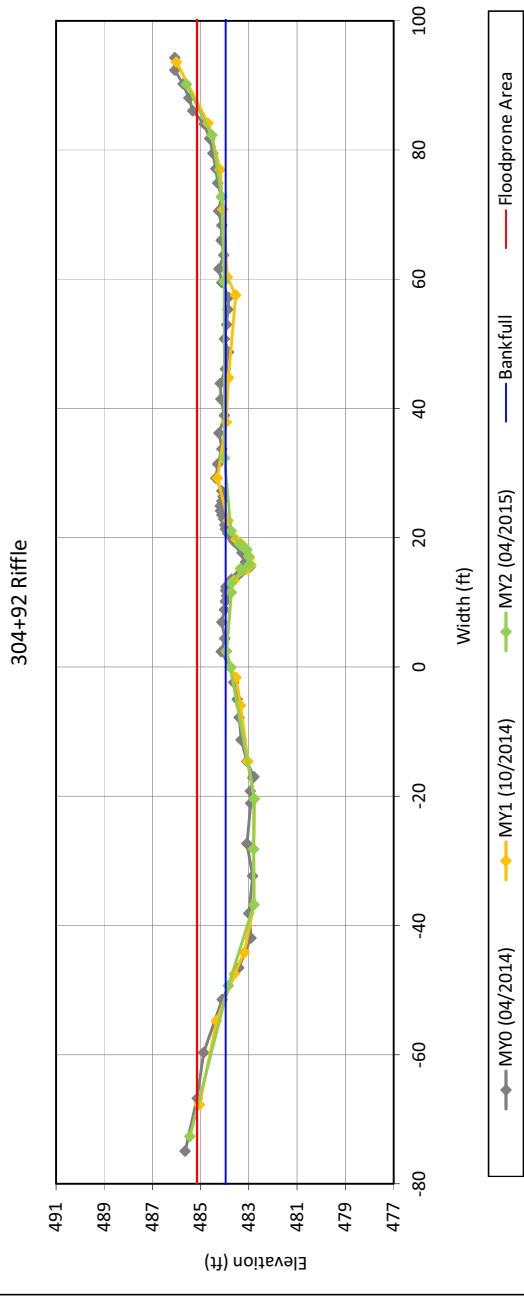


View Downstream



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

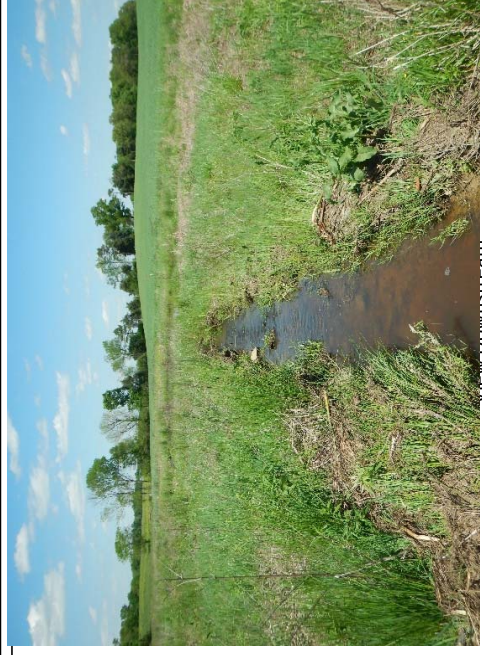
**Cross Section 12-UT2 Reach 1**



**Bankfull Dimensions**

5.5	x-section area (ft.sq.)
9.5	width (ft)
0.6	mean depth (ft)
1.2	max depth (ft)
9.8	wetted perimeter (ft)
0.6	hyd radi (ft)
16.4	width-depth ratio
155.1	W flood prone area (ft)
16.3	entrenchment ratio
1.0	low bank height ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.

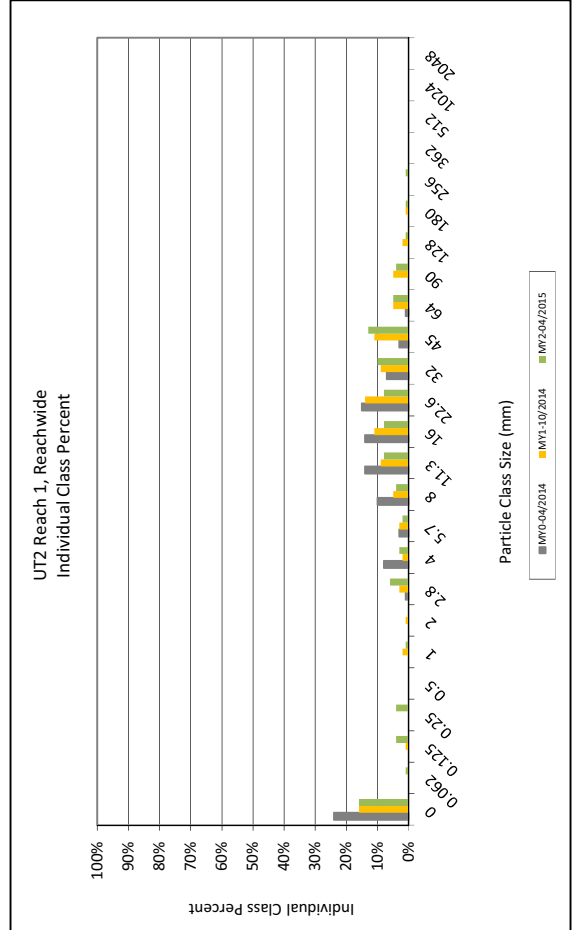
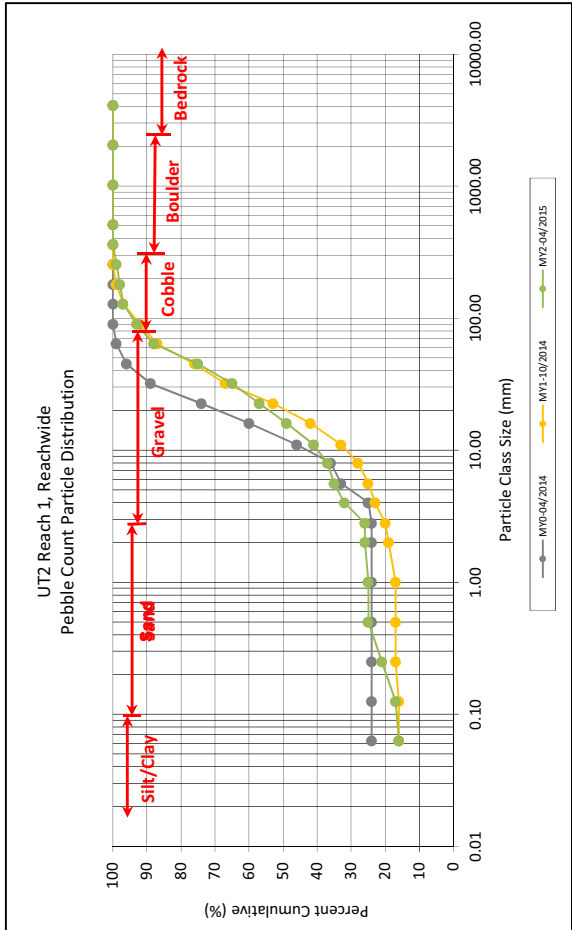


Reachwide and Cross-Section Pebble Count Plots  
 Norckett Branch Stream Mitigation Site (NCNMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 1, Reachwide

Particle Class	Diameter (mm)		Particle Count			UT2 Reach 1 Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.062	1	15	16	16	16
	Very fine	0.125		1	1	1	17
<b>SAND</b>	Fine	0.250	1	3	4	4	21
	Medium	0.500		4	4	4	25
	Coarse	1.0					25
	Very Coarse	2.0	1		1	1	26
<b>GRAVEL</b>	Very Fine	2.8					26
	Very Fine	4.0		6	6	6	32
	Fine	5.7		3	3	3	35
	Fine	8.0	1	1	2	2	37
<b>COBBLE</b>	Medium	11.3	1	3	4	4	41
	Medium	16.0	8		8	8	49
<b>BOULDER</b>	Coarse	22.6	3	5	8	8	57
	Coarse	32	6	2	8	8	65
<b>BEDROCK</b>	Very Coarse	45	6	4	10	10	75
	Very Coarse	64	12	1	13	13	88
	Small	90	4	1	5	5	93
	Small	128	4		4	4	97
	Large	180	1		1	1	98
	Large	256		1	1	1	99
	Small	256	1		1	1	100
	Small	362					
	Medium	512					
	Medium	1024					
	Large/Very Large	1024					
	Bedrock	2048					
		>2048					
		<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	Silt/Clay
D <sub>16</sub> =	5.6
D <sub>35</sub> =	16.7
D <sub>50</sub> =	57.4
D <sub>84</sub> =	107.3
D <sub>95</sub> =	362.0



UT2 Reach 1, Cross-Section 12

Particle Class	Diameter (mm)		Particle Count	Cross-Section 12 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	6	6	6
<b>SAND</b>	Very fine	0.062	0	0	6
	Fine	0.125	0	0	6
	Medium	0.250	0	0	6
	Coarse	0.5	0	0	6
	Very Coarse	1.0	2	2	8
<b>GRAVEL</b>	Very Fine	2.0	0	0	8
	Very Fine	2.8	0	0	8
	Fine	4.0	4	4	12
	Fine	5.7	2	2	14
	Medium	8.0	4	4	18
<b>COBBLE</b>	Medium	11.3	4	4	22
	Coarse	16.0	10	10	32
	Coarse	22.6	10	10	42
	Very Coarse	32	16	16	58
	Very Coarse	45	12	12	70
<b>Boulder</b>	Small	64	14	14	84
	Small	90	8	8	92
	Large	128	6	6	98
	Large	180	2	2	100
	Small	256	2	2	100
<b>Bedrock</b>	Small	362			
	Medium	512			
<b>Bedrock</b>	Large/Very Large	1024			
	Bedrock	2048			
		2048			
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 12	
Channel materials (mm)	
D <sub>16</sub> =	9.4
D <sub>35</sub> =	25.1
D <sub>50</sub> =	37.9
D <sub>84</sub> =	90.0
D <sub>95</sub> =	151.8
D <sub>100</sub> =	256.0

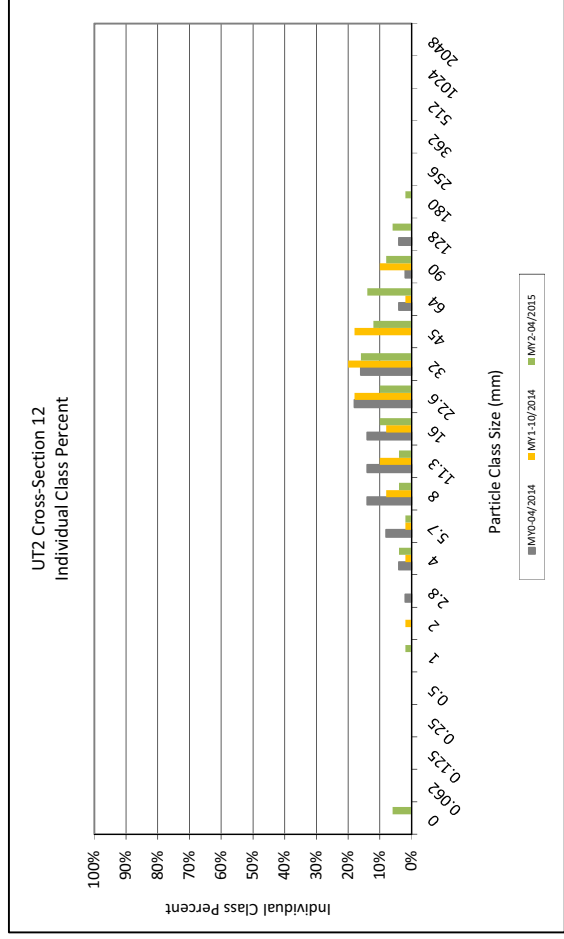
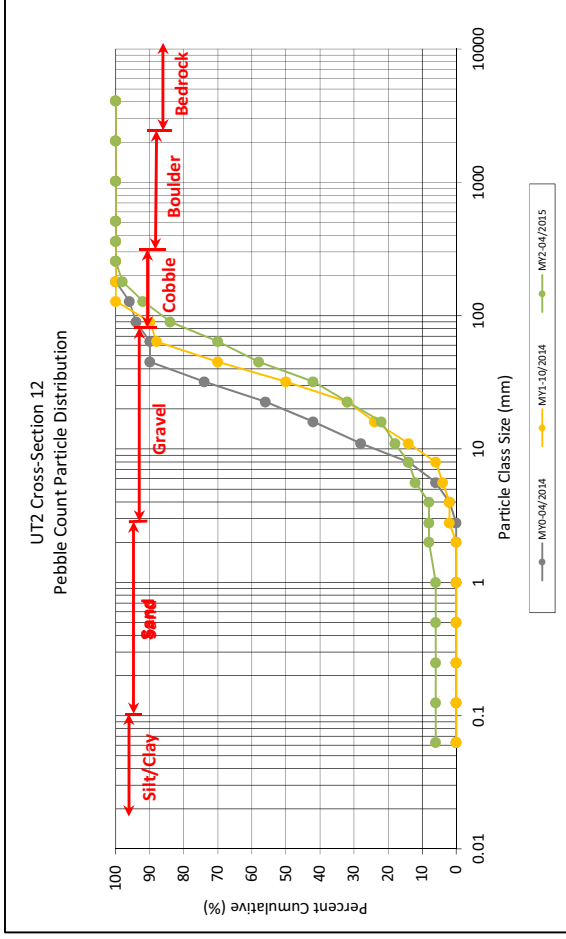




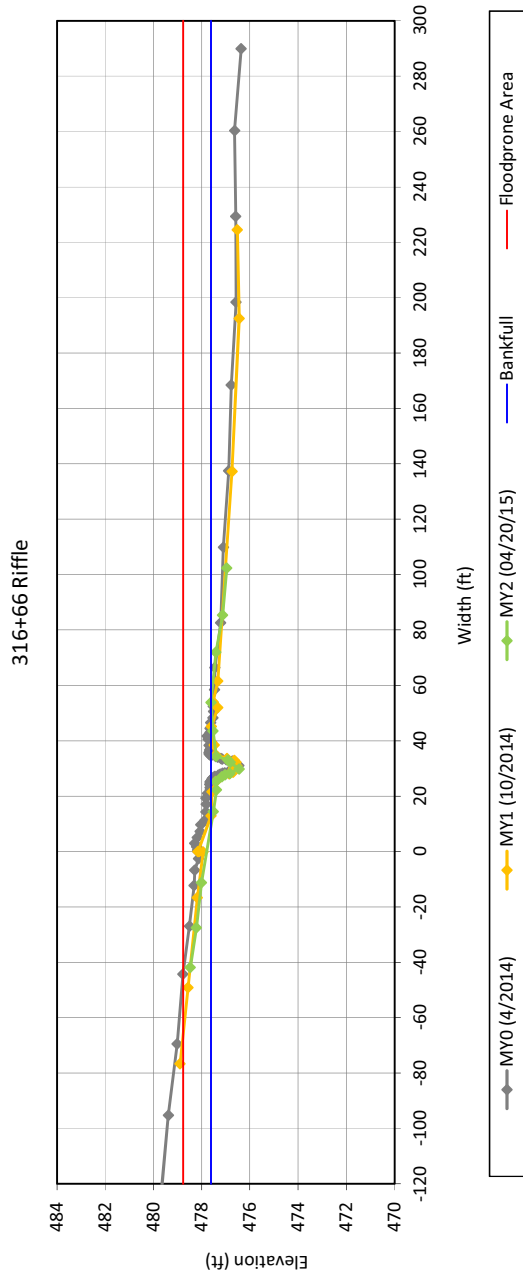
Table 1.2e. Monitoring Data - Stream Reach Data Summary  
 Norkett Branch Stream Mitigation Site (NCDIMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 2

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>												
Bankfull Width (ft)	9.0	9.6	9.5	10.5	9.1	11.5						
Floodprone Width (ft)	>200		>200									
Bankfull Mean Depth	0.5	0.6	0.7	0.7	0.7	0.8						
Bankfull Max Depth	1.1	1.2	1.2	1.4	1.2	1.3						
Bankfull Cross-sectional Area (ft <sup>2</sup> )	5.2	5.3	7.1	7.6	6.4	8.7						
Width/Depth Ratio	15.3	17.6	12.8	14.5	13.0	15.4						
Entrenchment Ratio	>2.2		>2.2									
Bank Height Ratio	1.0		1.0									
D50 (mm)	20.1	27.4	41.3	50.6	39.0	39.3						
<b>Profile</b>												
Riffle Length (ft)	6	27										
Riffle Slope (ft/ft)	0.009	0.039										
Pool Length (ft)	11	45										
Pool Max Depth (ft)	1.5	2.5										
Pool Spacing (ft)	22	71										
Pool Volume (ft <sup>3</sup> )												
<b>Pattern</b>												
Channel Beltwidth (ft)	12	52										
Radius of Curvature (ft)	14	22										
Rc:Bankfull Width (ft/ft)	1.6	2.3										
Meander Wave Length (ft)	44	83										
Meander Width Ratio	1.3	5.4										
<b>Additional Reach Parameters</b>												
Rosgen Classification	C4		C4		C4							
Channel Thalweg Length (ft)	1,440											
Sinuosity (ft)	1.30											
Water Surface Slope (ft/ft)	0.007											
Bankfull Slope (ft/ft)	0.007											
Rf%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	2.4/11.6/20.7/56.1/86.7/180		8.5/20.1/32/90/160.7/512		0.3/18.4/45/119.3/196.6/1024							
% of Reach with Eroding Banks	0%		0%		0%							

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

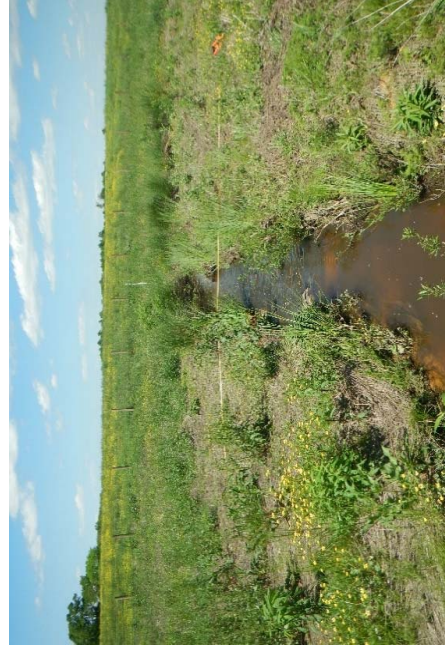
**Cross Section 13-UT2 Reach 2**



**Bankfull Dimensions**

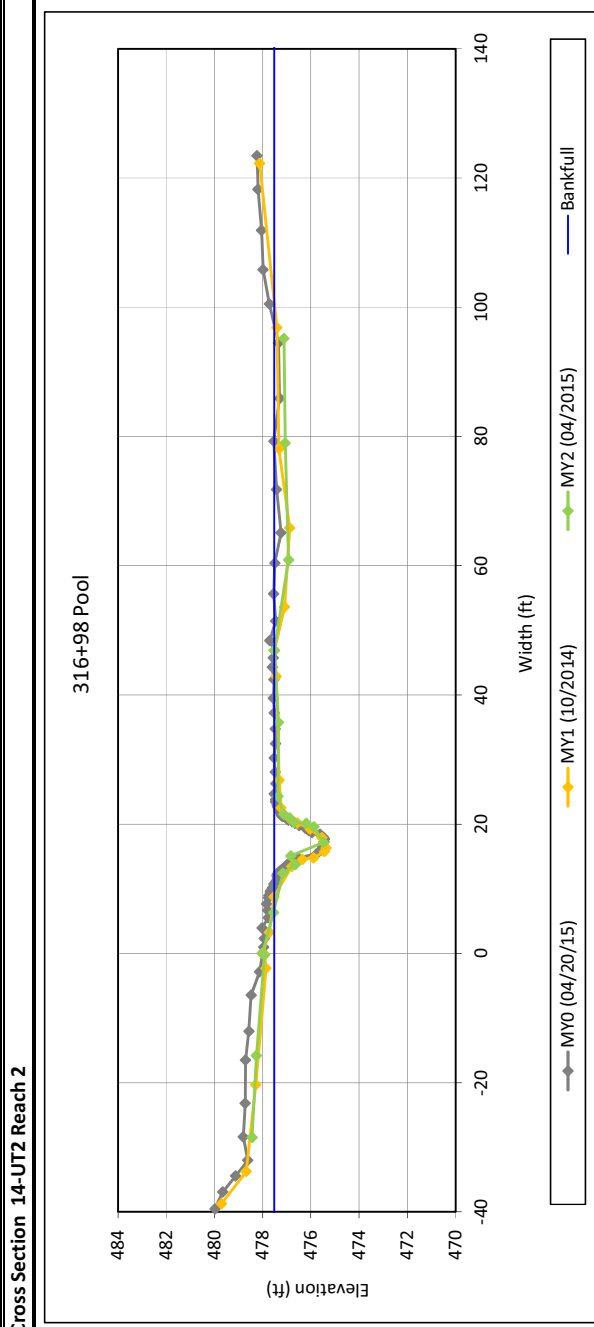
- 6.4 x-section area (ft.sq.)
- 9.1 width (ft)
- 0.7 mean depth (ft)
- 1.2 max depth (ft)
- 9.3 wetted perimeter (ft)
- 0.7 hyd radi (ft)
- 13.0 width-depth ratio
- >200 W flood prone area (ft)
- >22 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015



**Bankfull Dimensions**

12.0	x-section area (ft.sq.)
14.8	width (ft)
0.8	mean depth (ft)
2.0	max depth (ft)
15.9	wetted perimeter (ft)
0.8	hyd radi (ft)
18.2	width-depth ratio

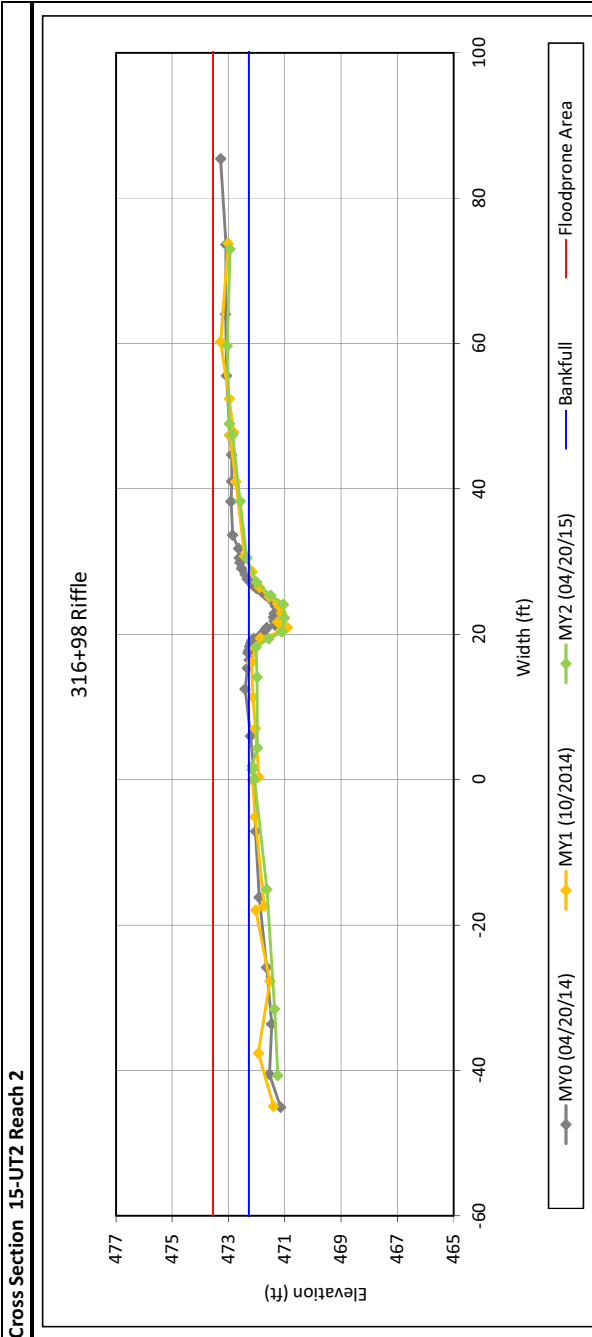
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015



**Bankfull Dimensions**

8.7	x-section area (ft.sq.)
11.5	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
11.9	wetted perimeter (ft)
0.7	hyd radi (ft)
15.4	width-depth ratio
>200	W flood prone area (ft)
>17.3	entrenchment ratio
1.0	low bank height ratio

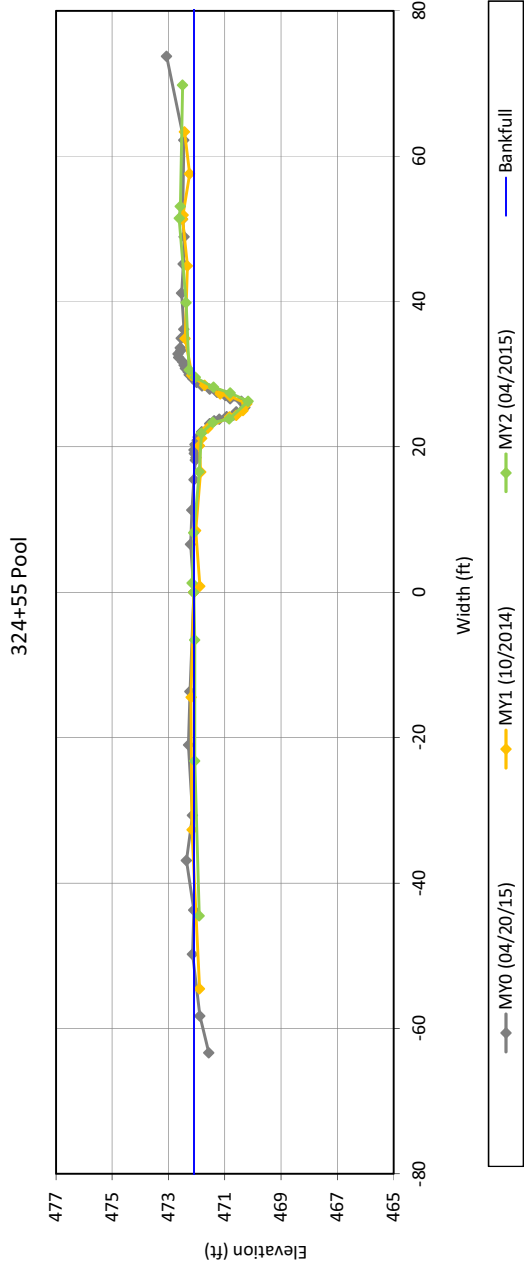
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



View Downstream

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 16-UT2 Reach 2**



**Bankfull Dimensions**

8.1	x-section area (ft.sq.)
7.9	width (ft)
1.0	mean depth (ft)
1.9	max depth (ft)
8.8	wetted perimeter (ft)
0.9	hyd radi (ft)
7.7	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



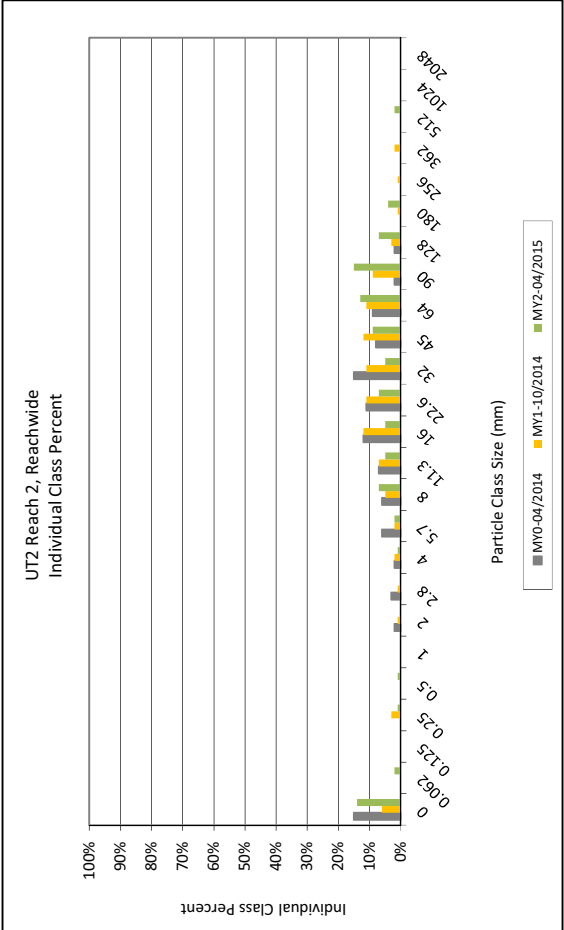
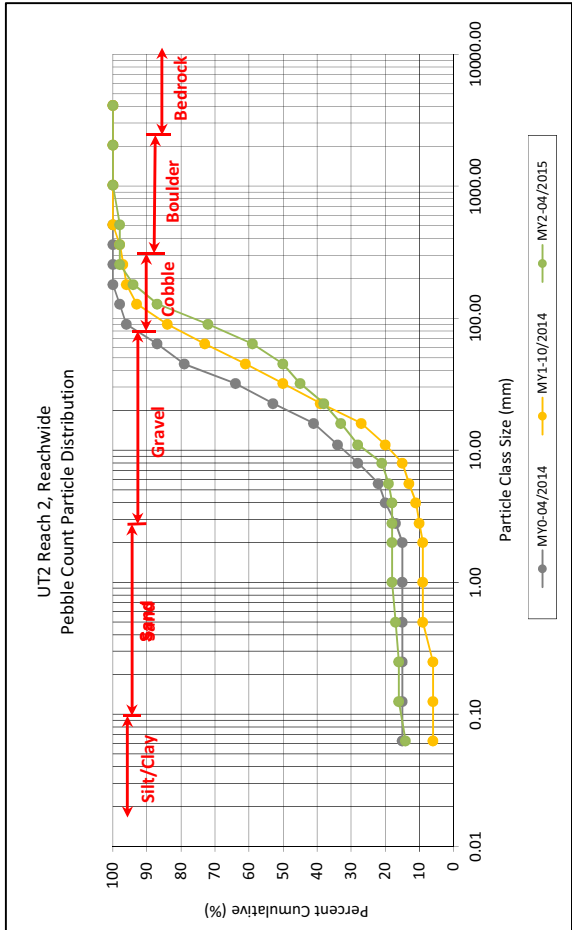
View Downstream

Reachwide and Cross-Section Pebble Count Plots  
 Norckett Branch Stream Mitigation Site (NCDEMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 2, Reachwide

Particle Class	Diameter (mm)		Particle Count			UT2 Reach 2 Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	0.000	0.062	1	13	14	14	14
	0.062	0.125		2	2	2	16
	0.125	0.250					16
SAND	0.250	0.500		1	1	1	17
	0.5	1.0		1	1	1	18
	1.0	2.0					18
	2.0	2.8					18
	2.8	4.0					18
GRAVEL	4.0	5.7		1	1	1	19
	5.7	8.0	1	1	2	2	21
	8.0	11.3		7	7	7	28
	11.3	16.0		5	5	5	33
	16.0	22.6	2	3	5	5	38
	22.6	32	4	3	7	7	45
	32	45	4	1	5	5	50
	45	64	8	1	9	9	59
	64	90	10	3	13	13	72
	90	128	11	4	15	15	87
COBBLE	128	180	5	2	7	7	94
	180	256	4		4	4	98
	256	362					98
BOULDER	362	512					98
	512	1024		2	2		100
BEDROCK	1024	2048					
	2048	>2048					
		<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>98</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	0.3
D <sub>35</sub> =	18.4
D <sub>50</sub> =	45.0
D <sub>84</sub> =	119.3
D <sub>95</sub> =	196.6
D <sub>100</sub> =	1024.0

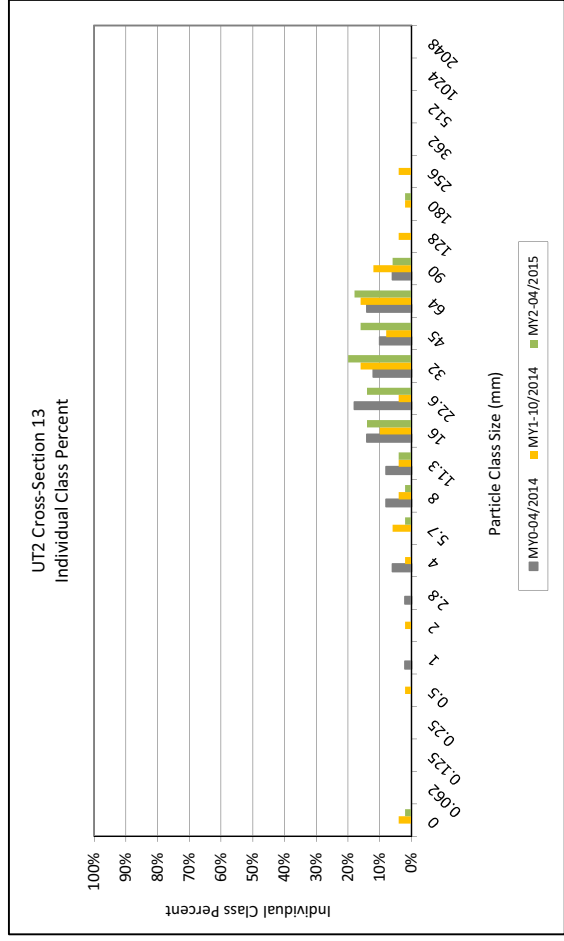
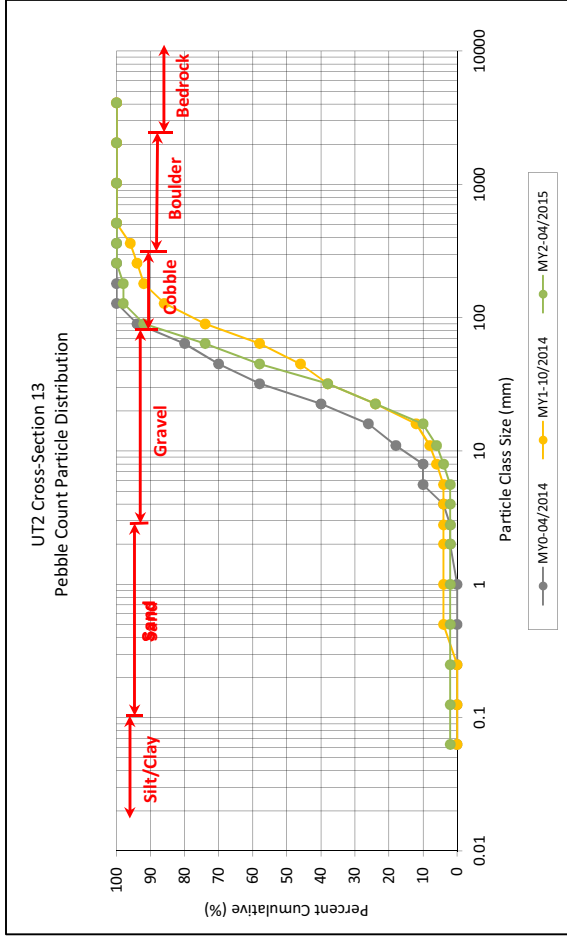




UT2 Reach 2, Cross-Section 13

Particle Class	Diameter (mm)		Particle Count	Cross-Section 13 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	2	2	2
<b>SAND</b>	Very fine	0.062			2
	Fine	0.125			2
	Medium	0.250			2
	Coarse	0.500			2
	Very Coarse	1.0			2
	Very Fine	2.0			2
	Very Fine	2.8			2
	Fine	4.0			2
	Fine	5.7			2
	Fine	8.0		2	4
<b>GRAVEL</b>	Medium	11.3			6
	Medium	16.0			10
	Coarse	22.6			24
	Coarse	32			38
	Very Coarse	45			58
	Very Coarse	64			74
<b>COBBLE</b>	Small	90			92
	Small	128			98
	Large	180			98
	Large	256			100
	Small	256		2	100
	Small	362			
<b>BEDROCK</b>	Medium	512			
	Large/Very Large	1024			
	Bedrock	2048			
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 13 Channel materials (mm)	
D <sub>16</sub> =	18.6
D <sub>35</sub> =	29.7
D <sub>50</sub> =	39.3
D <sub>84</sub> =	77.3
D <sub>95</sub> =	107.3
D <sub>100</sub> =	256.0



Reachwide and Cross-Section Substrate Plots  
 Norgett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 2, Cross-Section 15

Particle Class	Diameter (mm)		Particle Count	Cross-Section 15 Summary	
	min	max		Total	Class Percentage
<b>SILT/CLAY</b>	0.000	0.062			0
<b>SAND</b>	Very fine	0.062			0
	Fine	0.125			0
	Medium	0.250			0
	Coarse	0.5			0
	Very Coarse	1.0			0
<b>GRAVEL</b>	Very Fine	2.0			0
	Very Fine	2.8			0
	Fine	4.0			0
	Fine	5.7			0
	Fine	8.0			0
<b>COBBLE</b>	Medium	8.0	2	2	2
	Medium	11.3	4	4	6
	Coarse	16.0	10	10	16
	Coarse	22.6	20	20	36
	Very Coarse	32	24	24	60
<b>BOULDER</b>	Very Coarse	45	14	14	74
	Small	64	12	12	86
	Small	90	6	6	92
	Large	128	4	4	96
	Large	180	0	0	96
<b>BEDROCK</b>	Small	256	4	4	100
	Small	362			
	Medium	512			
	Large/Very Large	1024			
	Bedrock	2048			
		>2048			
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 15	
Channel materials (mm)	
D <sub>16</sub> =	22.6
D <sub>35</sub> =	31.4
D <sub>50</sub> =	39.0
D <sub>84</sub> =	85.0
D <sub>95</sub> =	165.3
D <sub>100</sub> =	362.0

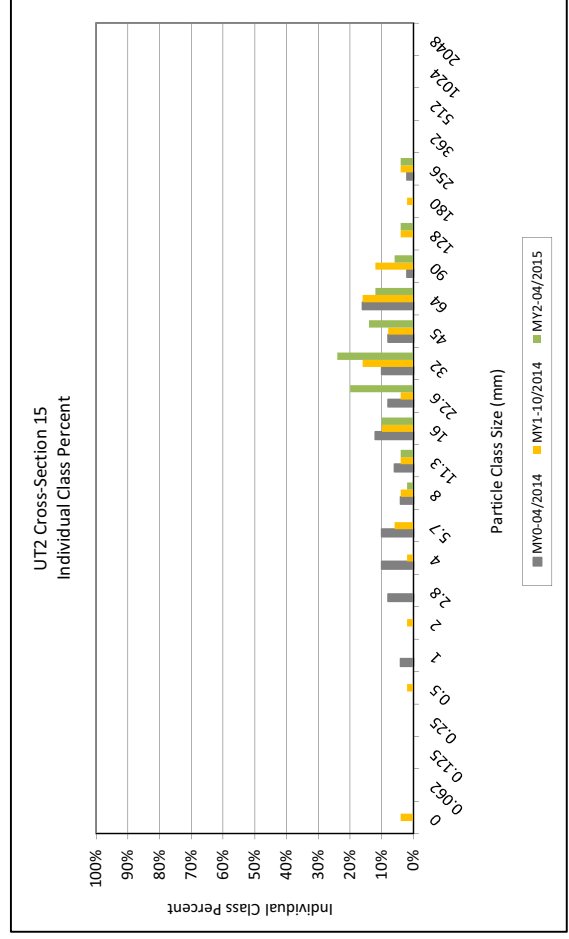
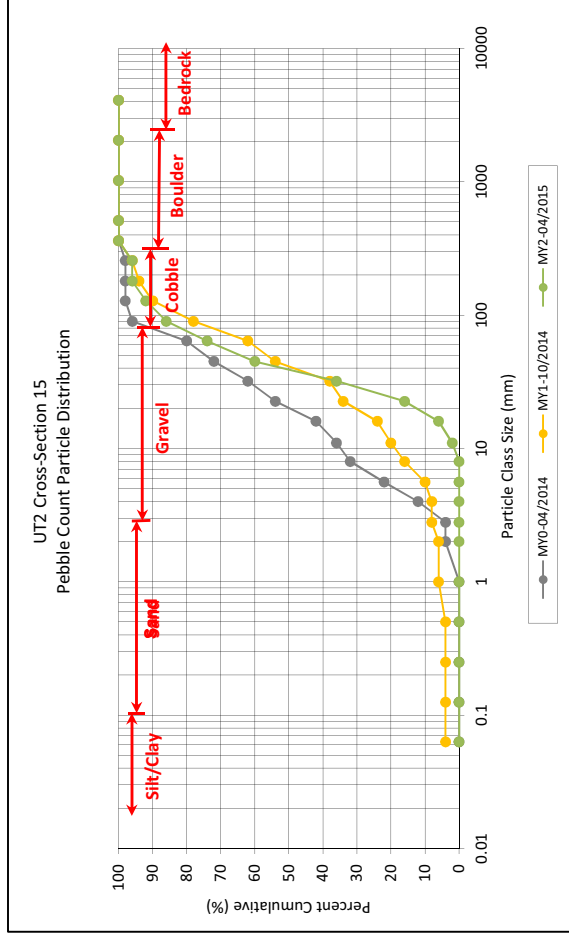


Table 12f. Monitoring Data - Stream Reach Data Summary  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

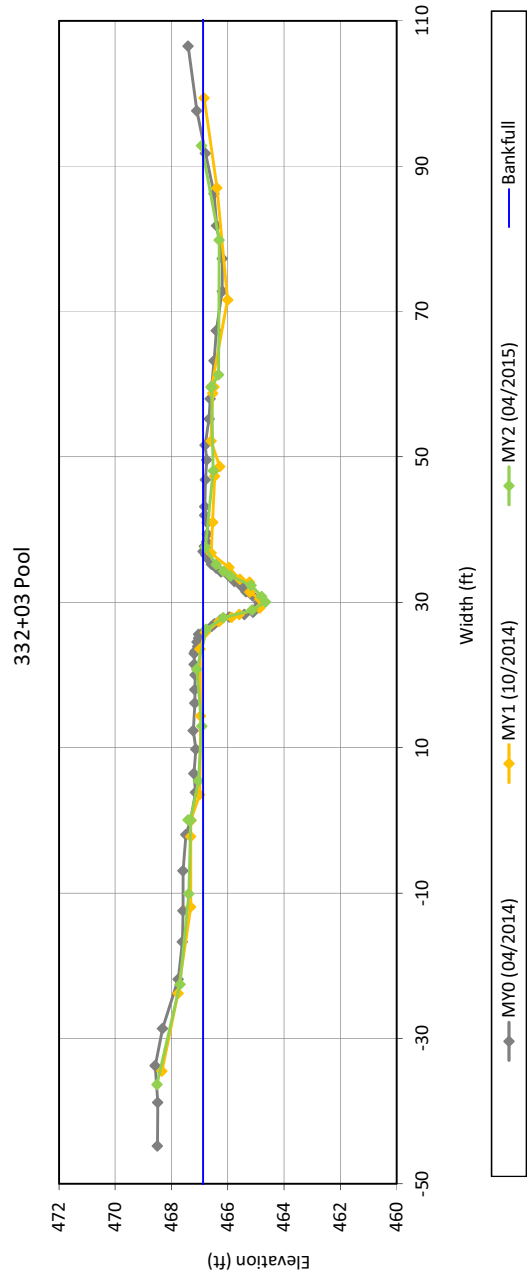
UT2 Reach 3A

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>												
Bankfull Width (ft)	10.5		11.1		10.1							
Floodprone Width (ft)	>200		>200		>200							
Bankfull Mean Depth	0.7		0.7		0.7							
Bankfull Max Depth	1.2		1.3		1.4							
Bankfull Cross-sectional Area (ft <sup>2</sup> )	7.2		7.6		7.6							
Width/Depth Ratio	15.3		16.2		13.6							
Entrenchment Ratio	>2.2		>2.2		>2.2							
Bank Height Ratio	1.0		1.0		1.0							
D50 (mm)	32.0		45.0		25.7							
<b>Profile</b>												
Riffle Length (ft)	8	25										
Riffle Slope (ft/ft)	0.010	0.046										
Pool Length (ft)	10	42										
Pool Max Depth (ft)	1.77	2.98										
Pool Spacing (ft)	26	66										
Pool Volume (ft <sup>3</sup> )												
<b>Pattern</b>												
Channel Beltwidth (ft)	8	37										
Radius of Curvature (ft)	14	27										
Rc:Bankfull Width (ft/ft)	1.3	2.6										
Meander Wave Length (ft)	58	88										
Meander Width Ratio	0.8	3.5										
<b>Additional Reach Parameters</b>												
Rosgen Classification	C4		C4		C4		C4		C4		C4	
Channel Thalweg Length (ft)	658											
Sinuosity (ft)	1.20											
Water Surface Slope (ft/ft)	0.003											
Bankfull Slope (ft/ft)	0.002											
R%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100												
% of Reach with Eroding Banks			0%		0%		0%		0%		0%	



**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 17-UT2 Reach 3A**



**Bankfull Dimensions**

- 12.1 x-section area (ft.sq.)
- 11.3 width (ft)
- 1.1 mean depth (ft)
- 2.2 max depth (ft)
- 12.3 wetted perimeter (ft)
- 1.0 hyd radi (ft)
- 10.5 width-depth ratio

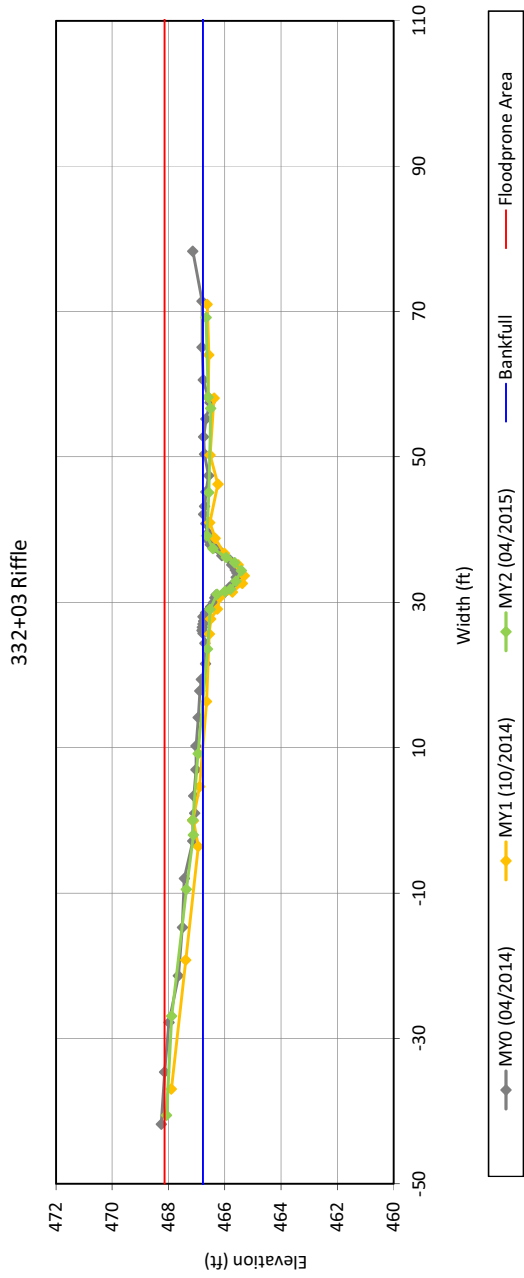


View Downstream

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

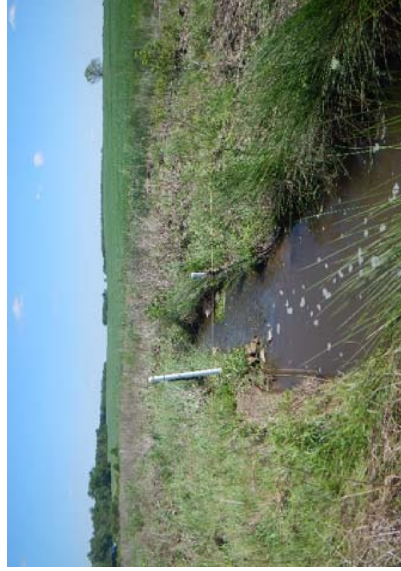
**Cross Section 18-UT2 Reach 3A**



**Bankfull Dimensions**

- 7.6 x-section area (ft.sq.)
- 10.1 width (ft)
- 0.7 mean depth (ft)
- 1.4 max depth (ft)
- 10.5 wetted perimeter (ft)
- 0.7 hyd radi (ft)
- 13.6 width-depth ratio
- >200 W flood prone area (ft)
- >9.3 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



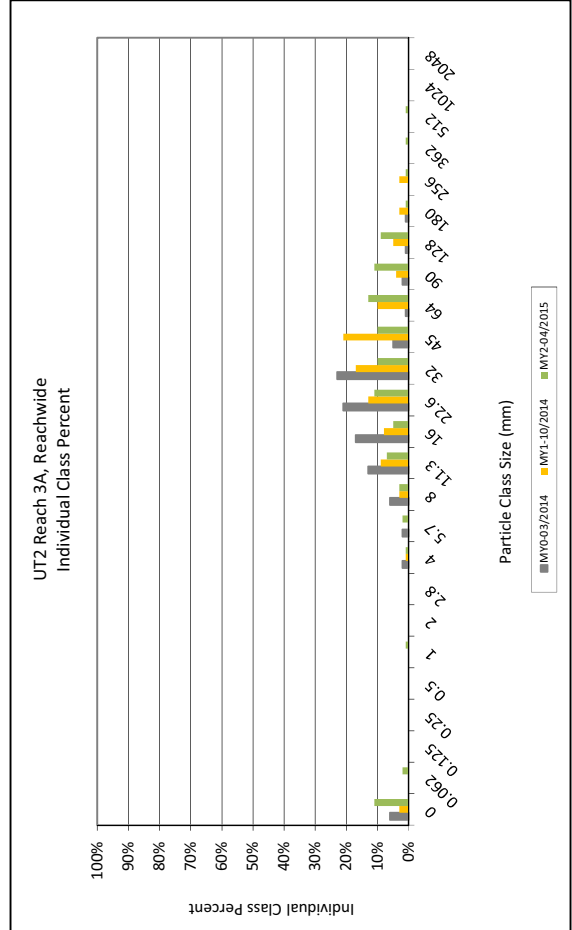
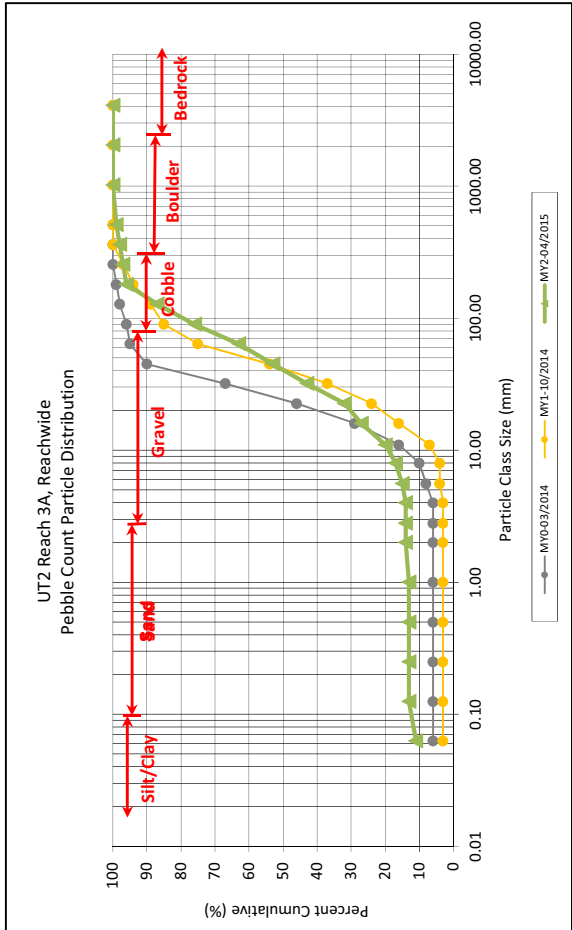
View Downstream

Reachwide and Cross-Section Pebble Count Plots  
 Norckett Branch Stream Mitigation Site (NCNMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 3A, Reachwide

Particle Class	Diameter (mm)		Particle Count			UT2 Reach 3A Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>							
Silt/Clay	0.000	0.062	1	10	11	11	11
Very fine	0.062	0.125		2	2	2	13
Fine	0.125	0.250			0	0	13
Medium	0.250	0.500			0	0	13
Coarse	0.5	1.0			0	0	13
Very Coarse	1.0	2.0		1	1	1	14
Very Fine	2.0	2.8			0	0	14
Very Fine	2.8	4.0			0	0	14
Fine	4.0	5.7	1		1	1	15
Fine	5.7	8.0	1	1	2	2	17
Medium	8.0	11.3	2	1	3	3	20
Medium	11.3	16.0	4	3	7	7	27
Coarse	16.0	22.6	2	3	5	5	32
Coarse	22.6	32	5	6	11	11	43
Very Coarse	32	45	6	4	10	10	53
Very Coarse	45	64	8	2	10	10	63
Small	64	90	9	4	13	13	76
Small	90	128	4	7	11	11	87
Large	128	180	5	4	9	9	96
Large	180	256	1	1	2	2	98
Small	256	362	1		1	1	99
Small	362	512		1	1	1	100
Medium	512	1024					
Large/Very Large	1024	2048					
Bedrock	2048	>2048					
<b>TOTAL</b>			<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	6.7
D <sub>35</sub> =	24.8
D <sub>50</sub> =	40.6
D <sub>84</sub> =	116.3
D <sub>95</sub> =	173.3
D <sub>100</sub> =	1024.0





Reachwide and Cross-Section Substrate Plots  
 Norgett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 3A, Cross Section 18

Particle Class	Diameter (mm)		Particle Count	Cross-Section 18 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.000	0.062	4	4	4
<b>SAND</b>	Very fine	0.062			4
	Fine	0.125			4
	Medium	0.250			4
	Coarse	0.5	1.0		4
	Very Coarse	1.0	2.0	2	6
	Very Fine	2.0	2.8		6
<b>GRAVEL</b>	Very Fine	2.8	4.0		6
	Fine	4.0	5.7		6
	Fine	5.7	8.0	2	8
	Medium	8.0	11.3	10	18
	Medium	11.3	16.0	12	30
	Coarse	16.0	22.6	14	44
	Coarse	22.6	32	16	60
	Very Coarse	32	45	12	72
	Very Coarse	45	64	6	78
	Small	64	90	4	82
	Small	90	128	12	94
	Large	128	180	2	96
<b>BOULDER</b>	Large	180	256	2	98
	Small	256	362		98
<b>BEDROCK</b>	Small	362	512	2	100
	Medium	512	1024		
	Large/Very Large	1024	2048		
	Bedrock	2048	>2048		
<b>Total</b>			<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 18	
Channel materials (mm)	
D <sub>16</sub> =	10.3
D <sub>35</sub> =	18.1
D <sub>50</sub> =	25.7
D <sub>84</sub> =	95.4
D <sub>95</sub> =	151.8
D <sub>100</sub> =	512.0

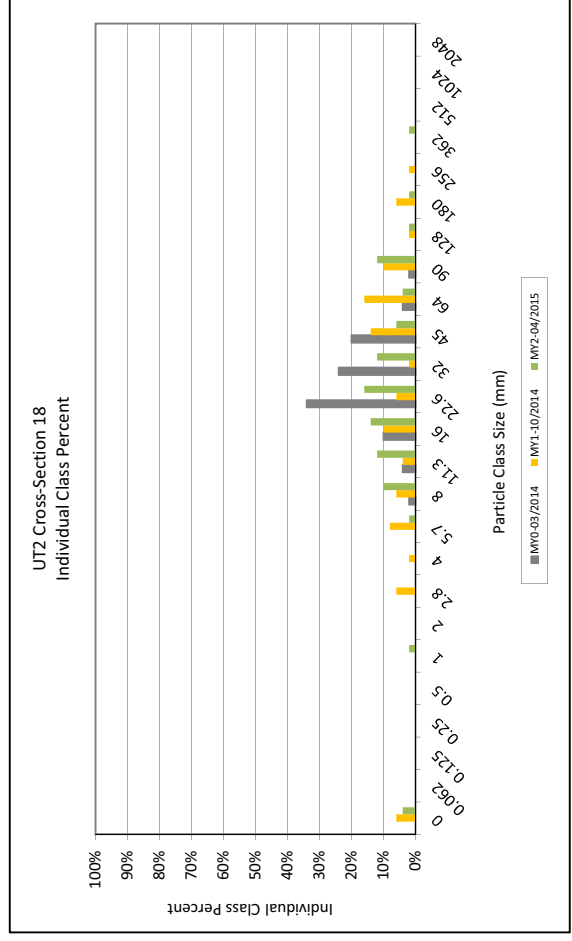
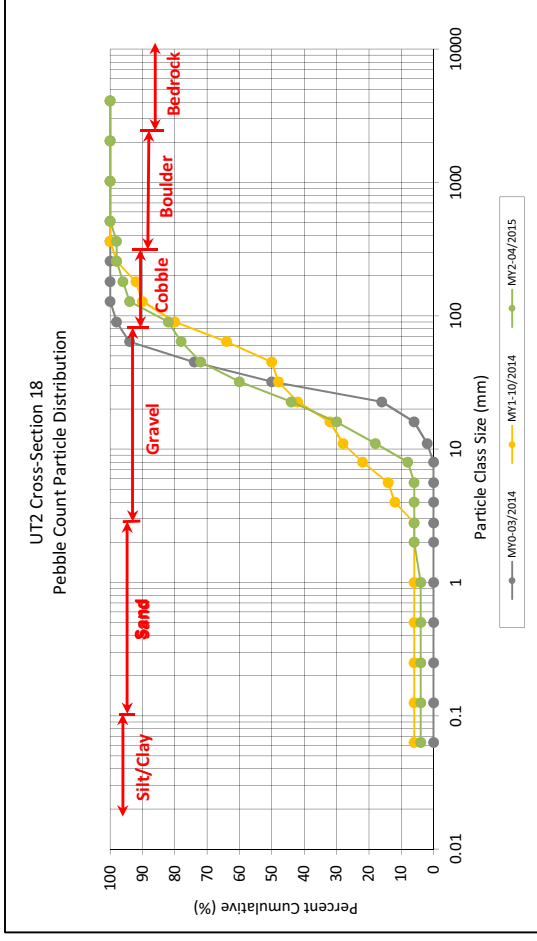


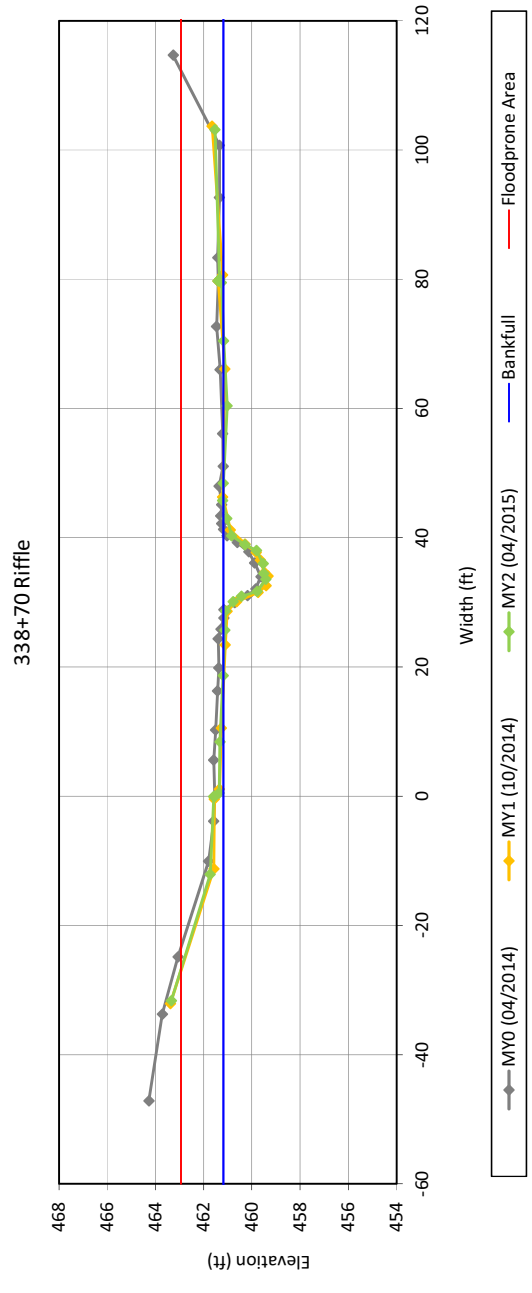
Table 12g. Monitoring Data - Stream Reach Data Summary  
 Norkett Branch Stream Mitigation Site (NCDIMS Project No. 95360)  
 Monitoring Year 2 -2015

UT2 Reach 3B

Parameter	As-Built/Baseline		MY-1		MY-2		MY-3		MY-4		MY-5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>												
Bankfull Width (ft)	13.9		12.6		14.3							
Floodprone Width (ft)	130		130		146							
Bankfull Mean Depth	0.8		1.2		1.0							
Bankfull Max Depth	1.6		1.8		1.8							
Bankfull Cross-sectional Area (ft <sup>2</sup> )	11.8		14.9		14.3							
Width/Depth Ratio	16.5		10.6		14.4							
Entrenchment Ratio	9.3		10.3		10.2							
Bank Height Ratio	1.0		1.0		1.0							
D50 (mm)	33.4		30.6		68.5							
<b>Profile</b>												
Riffle Length (ft)	13											
Riffle Slope (ft/ft)	0.001											
Pool Length (ft)	32											
Pool Max Depth (ft)	2.45				3.32							
Pool Spacing (ft)	38				72							
Pool Volume (ft <sup>3</sup> )												
<b>Pattern</b>												
Channel Beltwidth (ft)	20											
Radius of Curvature (ft)	24											
Rc:Bankfull Width (ft/ft)	1.7											
Meander Wave Length (ft)	87				105							
Meander Width Ratio	1.4				4.4							
<b>Additional Reach Parameters</b>												
Rosgen Classification	C4		C4		C4							
Channel Thalweg Length (ft)	658											
Sinuosity (ft)	1.20											
Water Surface Slope (ft/ft)	0.003											
Bankfull Slope (ft/ft)	0.002											
R%/Ru%/P%/G%/S%												
SC%/Sa%/G%/C%/B%/Be%												
d16/d35/d50/d84/d95/d100	SC/4.9/13.3/67.2/89.9/128		SC/4.5/14.8/60.0/98.3/180.0		SC/0.7/12.7/71.7/128/362							
% of Reach with Eroding Banks	0%		3%		0%							

**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 19-UT2 Reach 3B**



**Bankfull Dimensions**

14.3	x-section area (ft.sq.)
14.3	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
15.0	wetted perimeter (ft)
1.0	hyd radi (ft)
14.4	width-depth ratio
146.0	W flood prone area (ft)
10.2	entrenchment ratio
1.0	low bank height ratio

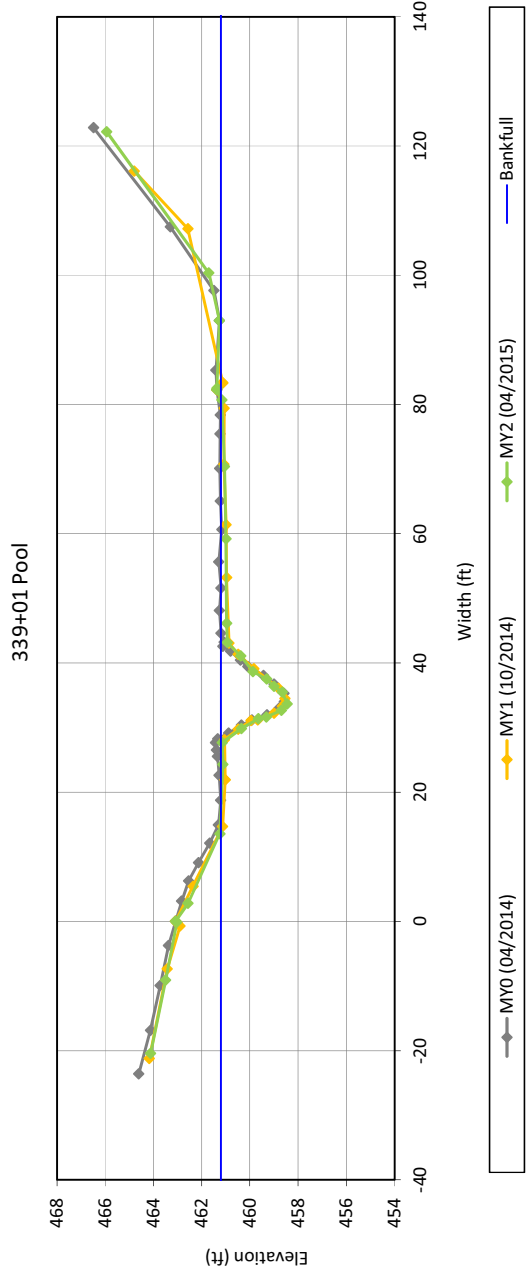
Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.





**Cross Section Plots**  
 Norkett Branch Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

**Cross Section 20-UT2 Reach 3B**



**Bankfull Dimensions**

23.0	x-section area (ft.sq.)
15.5	width (ft)
1.5	mean depth (ft)
2.7	max depth (ft)
16.5	wetted perimeter (ft)
1.4	hyd radi (ft)
10.4	width-depth ratio

Survey Date: 4/2015  
 Field Crew: Wildlands Engineering, Inc.



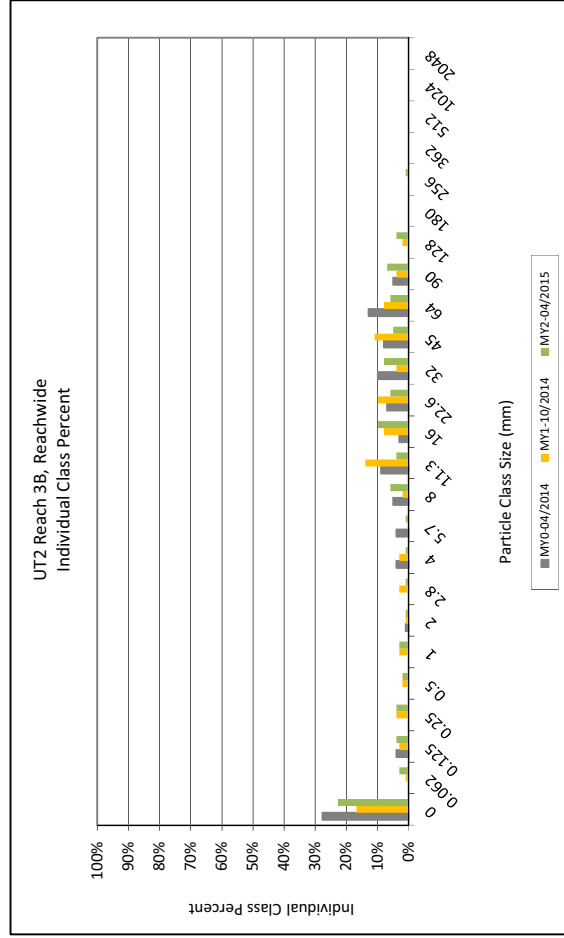
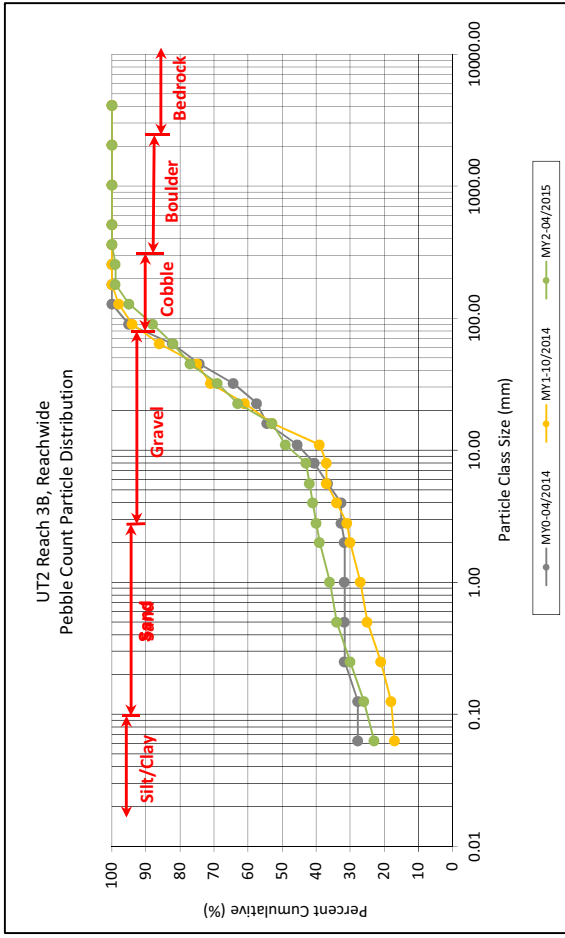
View Downstream

Reachwide and Cross-Section Pebble Count Plots  
 Norckett Branch Stream Mitigation Site (NCDSMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 3B, Reachwide

Particle Class	Diameter (mm)		Particle Count			UT2 Reach 3B Reach Summary	
	min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	0.000	0.062	6	17	23	23	23
	0.062	0.125		3	3	3	26
SAND	0.125	0.250	1	3	4	4	30
	0.250	0.500	2	2	4	4	34
GRAVEL	0.5	1.0	1	1	2	2	36
	1.0	2.0	1	2	3	3	39
COBBLE	2.0	2.8	1	1	1	1	40
	2.8	4.0	1		1	1	41
BOULDER	4.0	5.7		1	1	1	42
	5.7	8.0		1	1	1	43
BEDROCK	8.0	11.3	4	2	6	6	49
	11.3	16.0	3	1	4	4	53
GRAVEL	16.0	22.6	5	5	10	10	63
	22.6	32	3	3	6	6	69
COBBLE	32	45	5	3	8	8	77
	45	64	3	2	5	5	82
BOULDER	64	90	6		6	6	88
	90	128	7		7	7	95
BEDROCK	128	180	2	2	4	4	99
	180	256					99
GRAVEL	256	362		1	1	1	100
	362	512					
COBBLE	512	1024					
	1024	2048					
BEDROCK	2048	>2048					
			<b>Total</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	Silt/Clay
D <sub>16</sub> =	0.7
D <sub>35</sub> =	12.1
D <sub>50</sub> =	71.7
D <sub>84</sub> =	128.0
D <sub>95</sub> =	362.0

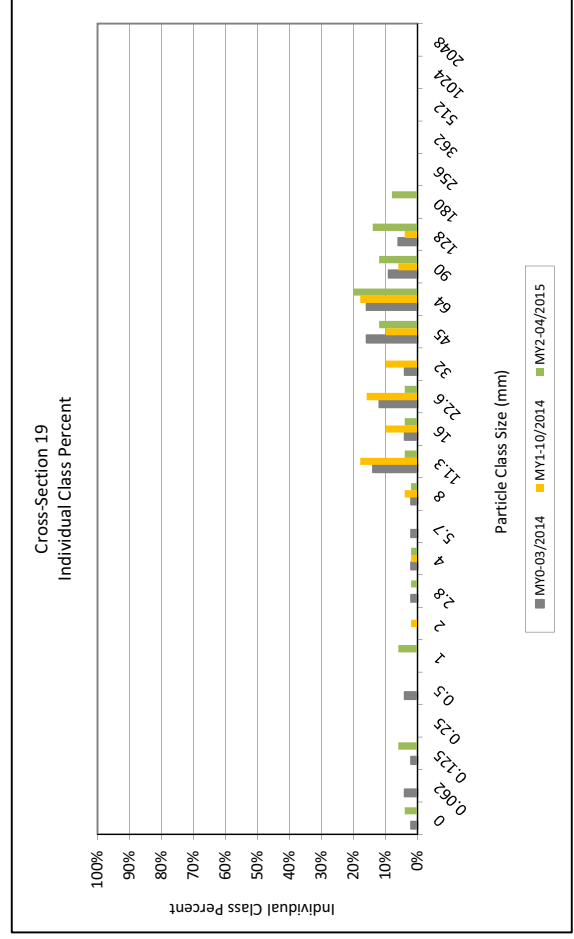
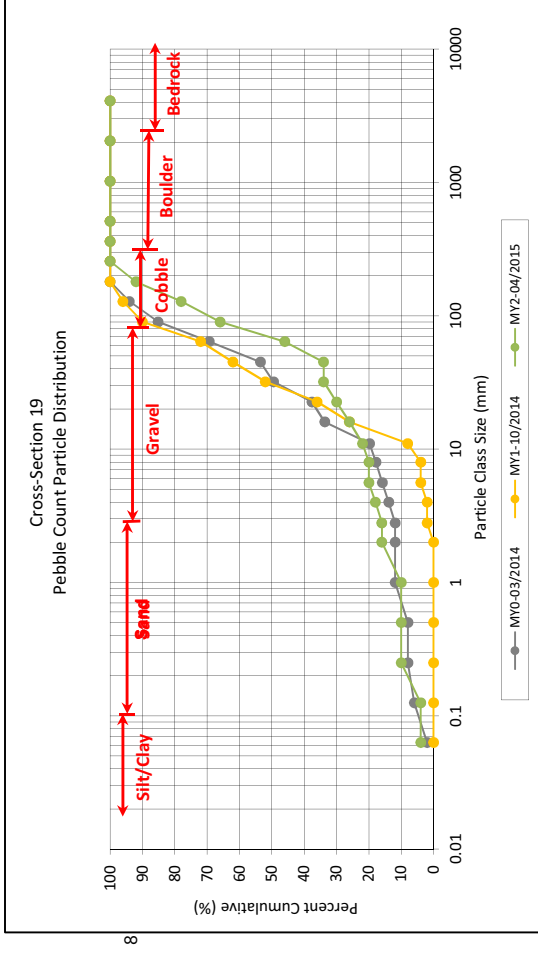


Reachwide and Cross-Section Substrate Plots  
 Norgett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

UT2 Reach 3B, Cross Section 19

Particle Class	Diameter (mm)		Particle Count	Cross-Section 19 Summary	
	min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	0.062	0.062	4	4	8
<b>SAND</b>	Very fine	0.062	0.125	6	4
	Fine	0.125	0.250	6	10
	Medium	0.250	0.500	6	10
	Coarse	0.5	1.0	6	10
	Very Coarse	1.0	2.0	6	16
	Very Fine	2.0	2.8	2	16
	Very Fine	2.8	4.0	2	18
	Fine	4.0	5.7	2	20
	Fine	5.7	8.0	2	20
	Medium	8.0	11.3	2	22
<b>GRAVEL</b>	Medium	11.3	16.0	4	26
	Coarse	16.0	22.6	4	30
	Coarse	22.6	32	4	34
	Very Coarse	32	45	4	34
	Very Coarse	45	64	12	46
	Small	64	90	20	66
	Small	90	128	12	78
	Large	128	180	14	92
	Large	180	256	8	100
	Small	256	362	8	100
<b>BOULDER</b>	Small	362	512		
	Medium	512	1024		
	Large/Very Large	1024	2048		
<b>BEDROCK</b>	2048	>2048			
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 19	
Channel materials (mm)	
D <sub>16</sub> =	2.8
D <sub>35</sub> =	46.3
D <sub>50</sub> =	68.5
D <sub>84</sub> =	148.1
D <sub>95</sub> =	205.4
D <sub>100</sub> =	256.0



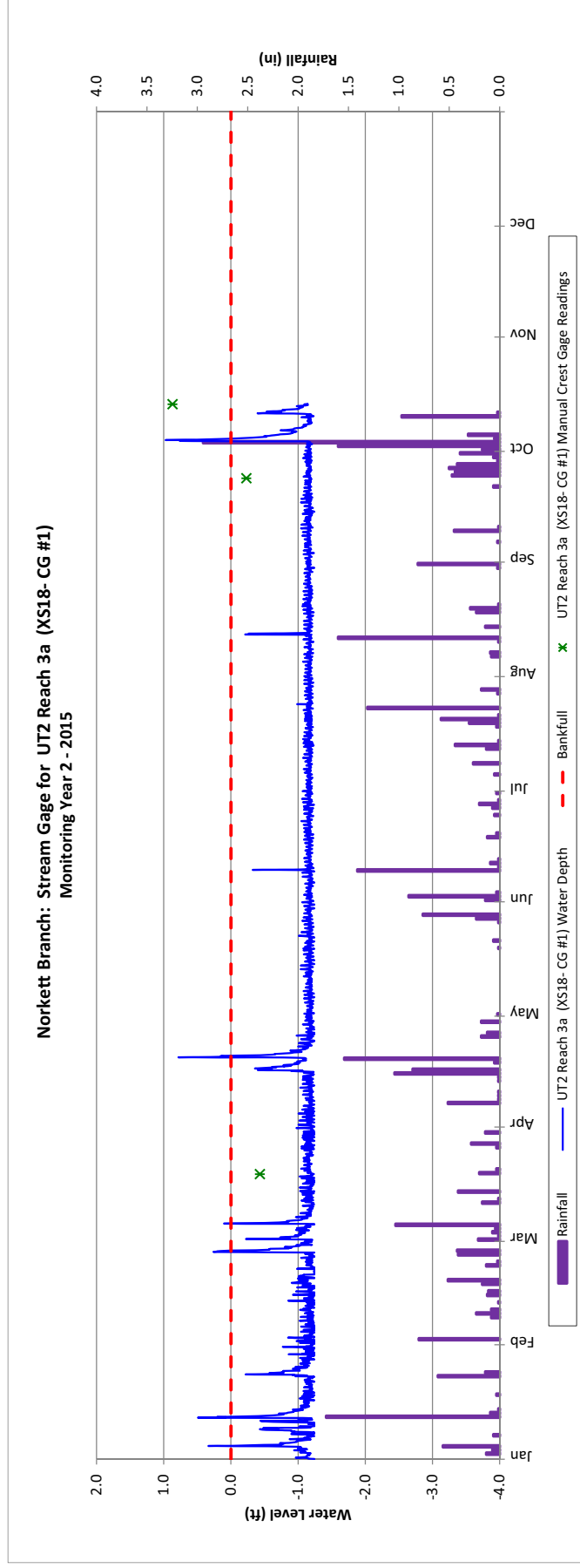


## **APPENDIX 5. Hydrology Data**

**Table 13. Verification of Bankfull Events**  
 Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015

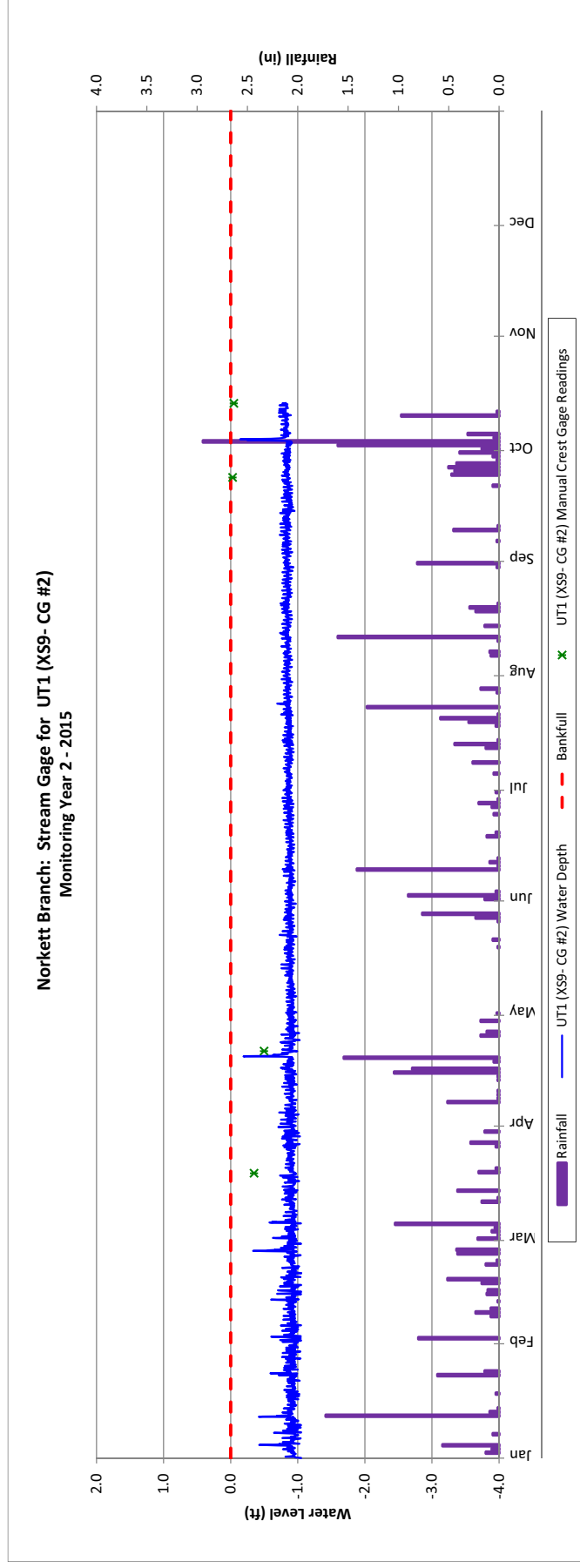
Monitoring Year	Reach	Date of Data Collection	Date of Occurrence	Method	
MY1	UT2 Reach 3a (CG #1 XS 18)	6/3/2014	5/30/2014	Stream Gage	
		9/4/2014	7/21/2014	Stream Gage	
		10/17/2014	9/16/2014	W/rack Line	
	UT1 (CG #2 XS9)	6/3/2014	5/30/2014	Stream Gage	
		9/4/2014	7/21/2014	Stream Gage	
		6/3/2014	5/30/2014	Stream Gage	
		9/4/2014	7/21/2014	Stream Gage	
	Norkett Branch Reach 2 (CG #3 XS6)	Norkett Branch Reach 2 (CG #3 XS6)	9/4/2014	7/21/2014	Stream Gage
			10/17/2014	9/16/2014	Stream Gage
			1/4/2015	1/4/2015	Stream Gage
1/12/2015			1/12/2015	Stream Gage	
2/26/2015			2/26/2015	Stream Gage	
3/5/2015			3/5/2015	Stream Gage	
4/19/2015			4/19/2015	Stream Gage	
MY2	UT2 Reach 3a (CG #1 XS 18)	10/3/2015	10/3/2015	Stream Gage, Crest Gage	
		1/4/2015	1/4/2015	Stream Gage	
		1/12/2015	1/12/2015	Stream Gage	
		2/26/2015	2/26/2015	Stream Gage	
		3/5/2015	3/5/2015	Stream Gage, Crest Gage	
	Norkett Branch Reach 2 (CG #3 XS6)	Norkett Branch Reach 2 (CG #3 XS6)	4/19/2015	4/19/2015	Stream Gage, Crest Gage
			10/3/2015	10/3/2015	Stream Gage, Crest Gage
			1/4/2015	1/4/2015	Stream Gage
			1/12/2015	1/12/2015	Stream Gage
			2/26/2015	2/26/2015	Stream Gage

Stream Flow Gage Plots  
Norkett Branch Mitigation Project (NCDMS Project No. 95360)  
Monitoring Year 2 - 2015

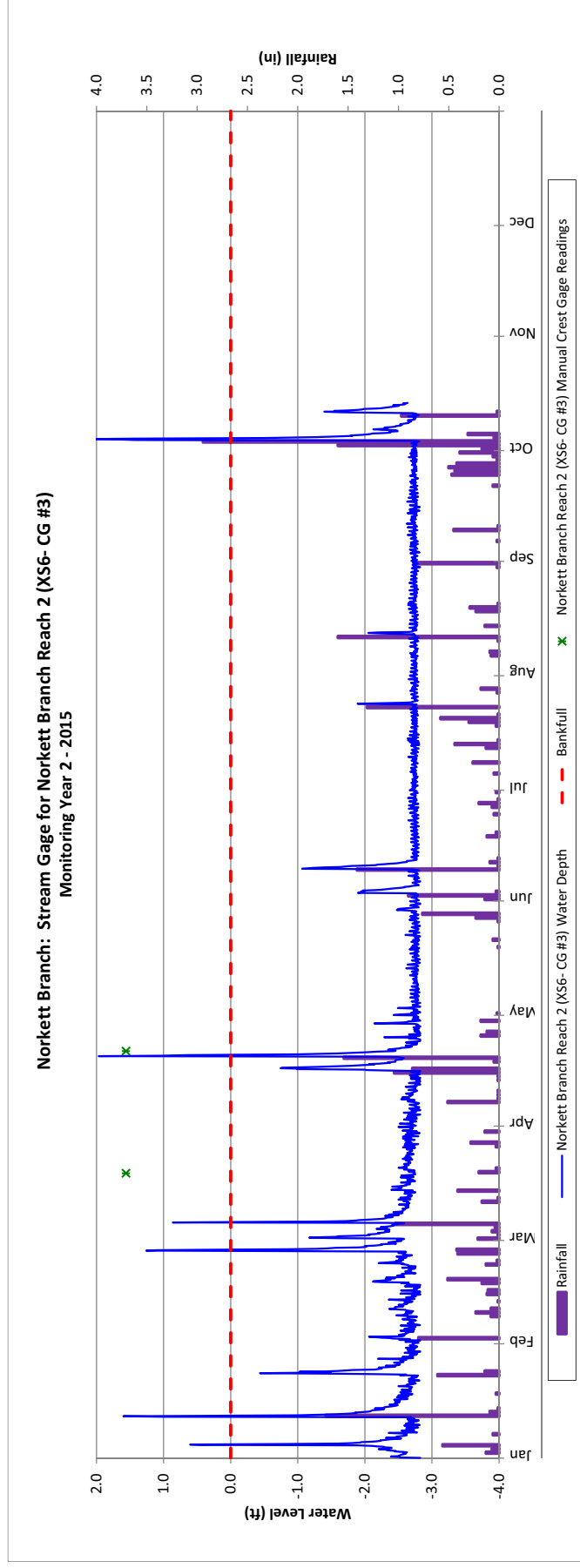




**Stream Flow Gage Plots**  
Norkett Branch Mitigation Project (NCDMS Project No. 95360)  
**Monitoring Year 2 - 2015**



**Stream Flow Gage Plots**  
Norkett Branch Mitigation Project (NCDMS Project No. 95360)  
**Monitoring Year 2 - 2015**



## **APPENDIX 6. Water Quality BMPs**



Table 14 Water Quality Sampling Results

Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)

Monitoring Year 2 -2015

Monitoring Year	Location	Sample Collection Date	TN (mg/L)	NO <sub>x</sub> (mg/L)	TKN (mg/L)	TP (mg/L)	TSS (mg/L)	FC (CFU/100mL)	Conductivity (µS/cm)	Temp °C	pH
MY1	SPSC BMP Inlet	4/22/2014 (Baseflow)	1.1	0.2	0.9	0.4	16.0	31	151.0	21.4	7.0
	SPSC BMP Outlet		0.9	DL	0.9	0.5	25.0	11	127.6	23.5	7.3
	PW BMP Inlet		DL	DL	0.5	0.2	11.0	68	65.0	25.3	7.4
	PW BMP Outlet		DL	0.1	DL	0.3	39.0	110	69.8	26.2	7.0
	SPSC BMP Inlet	5/15/2014	100.0	50.0	50.0	19.0	970.0	20000	1230.0	21.0	6.8
	SPSC BMP Outlet		47.0	18.0	29.0	7.0	410.0	20000	1185.0	21.0	6.9
	PW BMP Inlet		2.5	0.2	2.3	0.6	15.0	5600	95.5	22.9	6.9
	PW BMP Outlet		1.8	0.2	1.6	0.5	150.0	2100	11.3	23.8	6.9
	SPSC BMP Inlet	10/15/2014	5.5	1.3	4.2	5.4	27.0	490	437.0	19.8	7.1
	SPSC BMP Outlet		1.8	0.2	1.7	0.7	1.7	2300	333.0	21.0	7.1
	PW BMP Inlet		NF								
	PW BMP Outlet		NF								
	SPSC BMP Inlet	11/26/2014	7.2	2.2	5.0	5.0	30.0	HT	201.1	10.1	7.2
	SPSC BMP Outlet		6.5	2.0	4.6	4.9	32.0		196.2	10.0	7.2
PW BMP Inlet	2.8		1.1	1.7	0.6	6.6	57.8		11.2	6.7	
PW BMP Outlet	2.6		1.0	1.7	1.0	6.3	82.0		11.1	6.8	
MY2	SPSC BMP Inlet	3/30/2015	1.2	0.16	1.0	0.32	6.2	120	277.8	10.0	7.1
	SPSC BMP Outlet		1.5	0.12	1.3	0.33	DL	DL	329.9	10.5	7.2
	PW BMP Inlet		DL	0.12	DL	0.29	16.0	120	180.0	9.5	7.3
	PW BMP Outlet		1.2	0.12	1.1	0.22	9.0	64	184.0	11.8	8.1
	SPSC BMP Inlet	10/28/2015	3.8	1.3	2.5	1.2	16.0	150.0	141.9	17.5	6.6
	SPSC BMP Outlet		4.5	2.4	2.1	1.0	20.0	140.0	154.8	17.0	6.4
	PW BMP Inlet		2.9	1.1	1.8	0.8	48.0	DL	97.7	17.1	4.2
	PW BMP Outlet		1.7	DL	1.7	0.3	7.6	DL	92.7	18.7	7.2

DL: Parameter was below the detection limit

NF: No flow was available for sample collection

HT: Laboratory analysis was not available due to the short holding time for this parameter

Table 15 Pollutant Removal Rates

Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)

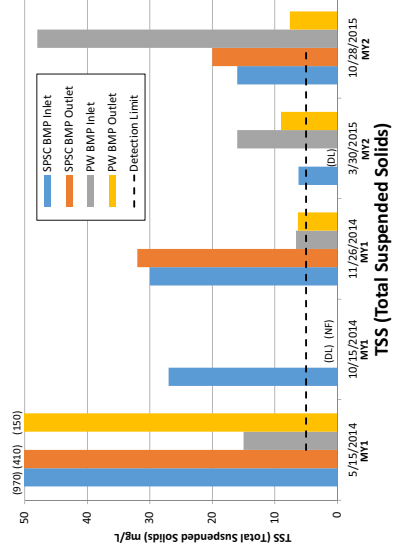
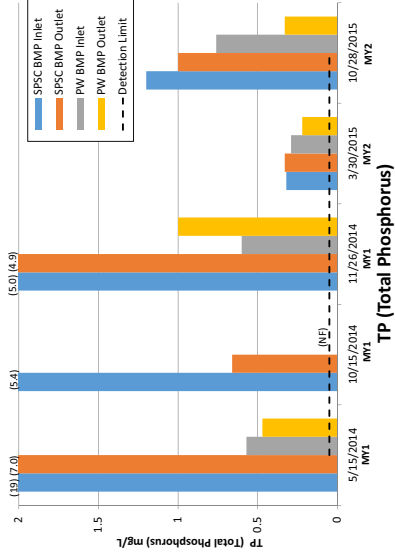
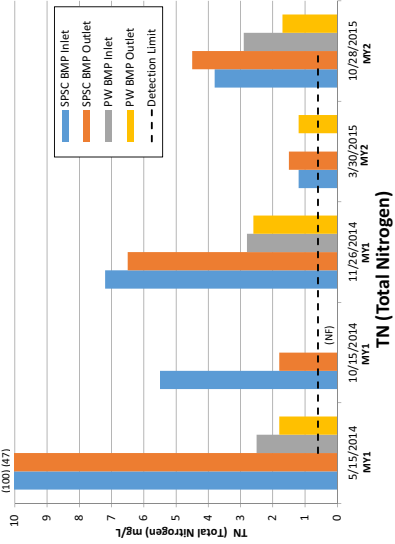
Monitoring Year 2 -2015

Monitoring Year	Location	Sample Collection Date	TN	NO <sub>x</sub>	TKN	TP *	TSS *	FC *
MY1	SPSC BMP	4/22/2014 (Baseflow)	18%	57%	1%	-29%	-56%	65%
	PW BMP		N/A	N/A	0%	-74%	-255%	-62%
	SPSC BMP	5/15/2014	53%	64%	42%	63%	58%	0%
	PW BMP		28%	27%	30%	18%	-900%	63%
	SPSC BMP	10/15/2014	67%	88%	60%	88%	94%	-369%
	PW BMP		N/A					
	SPSC BMP	11/26/2014	10%	9%	8%	2%	-7%	N/A
PW BMP	7%		14%	0%	-67%	5%		
MY2	SPSC BMP	3/30/2015	-25%	25%	-30%	-3%	N/A	N/A
	PW BMP		N/A	0%	N/A	24%	44%	47%
	SPSC BMP	10/28/2015	-18%	-85%	16%	17%	-25%	7%
	PW BMP		41%	N/A	6%	57%	84%	N/A

\*Negative values indicate that outlet concentrations were elevated from inlet concentrations

N/A: Not applicable

Water Quality Data  
 Norckett Branch Stream Mitigation Site (NCDMS Project No. 95360)  
 Monitoring Year 2 - 2015



**Pollutant Removal Plot**  
**Norkett Branch Stream Mitigation Site (NCDMS Project No. 95360)**  
**Monitoring Year 2 - 2015**

