



# **MONITORING YEAR 6 ANNUAL REPORT Final**

## **NORKETT BRANCH STREAM MITIGATION SITE**

Union County, NC

DEQ Contract 004673

DMS Project Number 95360

USACE Action ID Number 2012-01082

NCDWR Project Number 13-0250

Data Collection Period: April - October 2019

Final Submission Date: January 15, 2020

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### **PREPARED FOR:**



**North Carolina Department of Environmental Quality  
Division of Mitigation Services**

1652 Mail Service Center

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Mitigation Project Name Norkett Branch  
 DMS ID 95360  
 River Basin Yadkin  
 Cataloging Unit 03040105

County Union  
 Date Project Instituted 7/5/2012  
 Date Prepared 6/18/2019

USACE Action ID 2012-01082  
 NCDWR Permit No 2013-0250

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)		9,929.600												
Potential Credits (As-Built Survey)		10,098.000												
1 (Site Establishment)	N/A				N/A	N/A	N/A				N/A		N/A	N/A
2 (Year 0 / As-Built)	30%	3,029.400			2014	7/24/2014	N/A				N/A		N/A	N/A
3 (Year 1 Monitoring)	10%	1,009.800			2015	4/23/2015	N/A				N/A		N/A	N/A
4 (Year 2 Monitoring)	10%	1,009.800			2016	4/25/2016	N/A				N/A		N/A	N/A
5 (Year 3 Monitoring)	10%	1,009.800			2017	8/8/2017	N/A				N/A		N/A	N/A
6 (Year 4 Monitoring)	5%	504.900			2018	4/25/2018	N/A				N/A		N/A	N/A
7 (Year 5 Monitoring)	10%	1,009.800			2019	4/26/2019	N/A				N/A		N/A	N/A
8 (Year 6 Monitoring)	5%				2020		N/A				N/A		N/A	N/A
9 (Year 7 Monitoring)	10%				2021		N/A				N/A		N/A	N/A
Stream Bankfull Standard	10%	1,009.800			2016	4/25/2016	N/A				N/A		N/A	N/A
Total Credits Released to Date		8,583.300												

NOTES:

CONTINGENCIES:

  
 Signature of Wilmington District Official Approving Credit Release

27 Sept 2019

Date

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



**PREPARED BY:**

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## 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 is expected to 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 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 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 BWQR and to meet the North Carolina Division of Mitigation Services (DMS) mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project goals were established to address the 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.

Stream restoration and enhancement, water quality treatment BMP construction, and planting efforts were completed between December 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.

Overall, the Site has met the required stream and vegetation mitigation success criteria for MY6. The average planted stem density for the Site is 409 stems per acre and is on track to meet final density criteria. Visual assessment revealed good herbaceous cover across the Site with only isolated spots of invasive plant populations. Approximately 10% of the planted woody vegetation primarily along Norkett Branch Reaches 1 and 2 are shorter than expected for six-year-old trees. Woody vegetation across the remainder of the Site is on track to meet the MY7 height requirement. Geomorphically, the stability of each restored and enhanced stream remains in good standing, with cross-section dimensions falling within the range of parameters for the appropriate Rosgen (1996) stream type. Visual assessment indicates channel beds, bank, and engineered structures are functioning as designed with little to no sign of instability. The Site met final hydrological success criteria after MY3. During MY6, all three of the restored reaches (Norkett Branch, UT1, and UT2) recorded at least one bankfull or greater event. Water



quality results continues to indicate an overall trend of pollutant removal capacity of both storm water BMPs. During MY6, project streams are stable, vegetation continues to grow, and the Site is tracking towards final success criteria.



**NORKETT BRANCH STREAM MITIGATION SITE**  
Monitoring Year 6 Annual Report

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## Section 1: PROJECT OVERVIEW

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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 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. 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 streams were 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 11 a-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 (DMS) 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 (Wildlands, 2013) to address the effects listed above:



- *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 allowing 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 bioengineering and installing 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 6 Data Assessment

Annual monitoring was conducted between April and October 2019 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 260 stems per acre at the end of the fifth year of monitoring (MY5).

The MY6 vegetation survey was completed in August 2019 and resulted in all 26 vegetation plots meeting the year seven success criteria (210 stems per acre). Overall, the Site's average planted stem density resulted in 409 stems per acre which is on track to meet the year seven success criteria. In addition, the average woody stem density of the Site with volunteers included is 640 stems per acre. In MY6, planted stems heights averaged 8.8 feet which is a 33% increase in height compared to the MY5 stem height average of 6.6 feet. A majority of woody stems (87%) had a vigor rating of 3 or more indicating that the stem is healthy and likely to survive to MY7. Approximately 10% of the planted woody vegetation primarily along Norkett Branch Reaches 1 and 2 are shorter than expected for six-year-old trees. The lower than expected woody growth is likely due to soil fertility and generally correlates to previously mapped bare areas.

In February 2015 during MY2, supplemental planting added 6,000 stems (37% of the MY1 stem total) on reaches east of Philadelphia Church Road. The supplemental planting was in response to low stem vigor of many plots and high bare root mortality between the as-built and MY1 which was attributed to dry site conditions, soil fertility, scouring flows shortly after installation, insects, and disease. An additional supplemental planting in MY5 added 400 stems (3% of the MY5 stem total) on portions of Norkett Branch and UT1 in response to low stem density. In MY6, 50 stems (less than 1% of the MY6 stem total) were added in areas of poor woody growth documented in MY5. Some of the monitoring plots showed an increase in planted stem densities in MY2 and MY5 because of the supplemental planting.

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

Vegetation within the Site continues to grow as the native riparian buffer develops along project streams during MY6. In the late winter/early spring of MY4, several areas previously identified as "Bare/Poor Herbaceous Cover" were addressed through a combination of reseeding and the installation of hügelkultur (hugel) beds. The hugel beds provided additional organic matter and aid in moisture retention to encourage herbaceous and woody vegetation growth. Hugel bed installation involved the excavation of small floodplain trenches that were backfilled with organic matter, covered in a mixture of soil and brush, and planted with live whips, live stakes and seeded. The live stakes and whips were planted to anchor the beds. As the woody species establish, they help diffuse the energy of out of bank



events and trap additional organic matter. During MY6, several hugel beds have slightly subsided which is likely a result of backfilled organic matter breaking down and/or compacting. Planted whips and lives stakes on the hugel beds were also not as vibrant as previous years.

Isolated pockets of invasive species including cattail (*Typha latifolia*), Chinaberry tree (*Melia azedarach*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), and parrot feather (*Myriophyllum aquaticum*) were observed during MY6, however most pockets are too small to map (less than 1,000 square feet) and are not impacting planted vegetation. Pockets of parrot feather along Norkett Branch Reaches 1 and 2 were treated with glyphosate, however this aquatic invasive may persist in pockets until the streambed becomes fully shaded. Areas of dense groundsel tree (*Baccharis halimifolia*); an aggressive coastal plain native evergreen shrub, were mechanically and chemically treated during MY4. This species is not typically considered a species of high concern for DMS-required monitoring; however, portions of the Site were infested with dense thickets of this shrub that were competing with planted woody and herbaceous vegetation. Therefore, a cut/spray treatment was applied to these areas with only minor pockets of groundsel re-sprouts observed in MY5 and MY6. The cut/spray treatment has been successful with only minor pockets of groundsel re-sprouts observed during MY5 and MY6. Re-sprouts were treated along Norkett Branch Reach 1 during MY6.

#### Adaptive Management - Vegetation

As warranted, future adaptive management activities may be employed to continue to improve herbaceous vegetative cover and improve the growth rates of planted woody stems in targeted areas. Soil amendments will be applied to areas with poor woody growth in early 2020. Areas noted with invasive plant populations will be treated with herbicide as necessary. If necessary, cut/spray techniques and/or application of a broadleaf-selective herbicide may be used to control groundsel tree re-sprouts.

#### **1.2.3 Stream Assessment**

A total of 20 cross-sections were installed along the stream restoration reaches. One permanent cross-section was installed per 20 bankfull widths along stream restoration reaches, with riffle and pool sections in proportion to DMS guidance. Each cross-section was permanently marked with pins to establish its location. Annual cross-section survey includes points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg. Photographs were taken looking upstream and downstream at each cross-section. Stream photographs were also taken at 51 permanent photograph reference points throughout the project area. A reach-wide pebble count was conducted in all restoration reaches (Norkett Branch Reach 1, Norkett Branch Reach 2, UT1, UT2 Reach 1, UT2 Reach 2, UT2 Reach 3A, and UT2 Reach 3B) for classification purposes. A wetted perimeter pebble count was conducted at each permanent riffle cross-section to characterize the pavement.

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for channels of the appropriate Rosgen stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Substrate materials in the restoration reaches should indicate a progression towards or the maintenance of coarser materials in the riffle features and smaller particles in the pool features.

Morphological surveys for MY6 were conducted in April 2019. All streams within the Site appear stable and have met the success criteria for MY6. Riffle cross-section dimensions fell within the parameters defined for channels of the appropriate Rosgen stream type (Rosgen 1996) and generally show little change in the bankfull area, maximum depth ratio, or width-to-depth ratio. During MY6 a decrease in



bankfull width and area occurred at pool cross-section 10 on UT1. The decrease appears the result of deposition and continued growth of streambank vegetation. The cross-section will be closely monitored in subsequent monitoring years. Slight downcutting observed during MY3 on the left channel edge of riffle cross-section 15 on UT2 Reach 2 exhibited no progression in MY4 through MY6 and appears stable. 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. Per the Mitigation Plan (Wildlands 2013), pattern data will only be completed if there are indicators from the dimensions that significant geomorphic adjustments indicating a trend toward vertical or lateral instability. No changes were observed that indicated a change in the radius of curvature or channel belt width; therefore, pattern data was not collected or included in the MY6 report. Visual assessment during MY6 revealed little to no eroding banks.

In general, substrate materials in the restoration reaches indicate maintenance of coarser materials in the riffle features and finer particles in the pool features. Increases in the silt/clay particle size class observed during MY5 in reachwide counts for Norkett Branch Reach 1, Norkett Branch Reach 2, UT1, and UT2 Reach 3B as well as riffle 100-counts conducted on Norkett Branch Reach 1 (Cross-sections 5 and 6), Norkett Branch Reach 2 (Cross-section 7), and UT1 (Cross-section 9) have decreased and shifted toward previous particle size distributions. The decrease appears to be a cyclic fluctuation indicative of stable streams capable of transporting their sediment load.

Please refer to Appendix 2 for the stream visual assessment tables, the CCPV maps, and stream reference photographs. Refer to Appendix 4 for the morphological data and plots.

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

In MY5, two isolated areas of bare and scoured stream bank were noted at Stations 103+00 and 132+75 of Norkett Branch. These areas remained stable during MY6 with woody and herbaceous vegetation regeneration and are currently not considered areas of concern. Trappers with the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Services (APHIS) addressed two beaver dams noted on UT2 Reaches 1 and 2 in March 2019. One additional beaver dam was observed in October 2019 along Norkett Branch Reach. Trappers are in the process of removing beaver at that location. The Site will be monitored for future beaver activity during subsequent monitoring years.

#### **Adaptive Management - Stream**

Wildlands will continue to monitor the streams for potential areas of concern in the upcoming monitoring year and if necessary, repairs may be implemented. Refer to Appendix 2 for the stream visual assessment tables, the CCPV maps, reference photographs, and photographs of the stream problem areas.

#### **1.2.5 Hydrology Assessment**

Hydrologic monitoring was accomplished using both manual crest gage readings and In-situ Rugged Troll 100 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). The Onset HOB0 rain gage located onsite malfunctioned throughout 2019. Rainfall data was used from a nearby weather station at the Monroe Airport (KEQY) (NCCRONOS, 2019). To meet hydrological success criteria, two or more bankfull events must occur in separate years within the restored reaches by the end of MY7. The success criteria were met for the project after MY3. During MY6, at least one bankfull or greater event was recorded along Norkett Branch, UT1, and UT2. Please refer to Appendix 5 for hydrology data.

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

Water quality 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). This sampling is



not part of the success criteria for the project. However, the following expected rates for pollutant removal were established in the Mitigation Plan (Wildlands, 2013) and in accordance with 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).

The monitoring plan calls for quarterly sampling; however, samples were unable to be obtained during Q2 due to the timing and intensity of rain events. Inflow and outflow points were sampled at each BMP after storm events on 3/26/2019 (Q1) and 8/5/2019 (Q3). First flush style sample bottles were used to capture stormflow, which filled during the rain event at a pre-determined stage height and were retrieved within 24 hours. Samples were analyzed for total suspended solids (TSS), phosphorus as total phosphorus (TP), nitrogen as total nitrogen (TN), Nitrate/Nitrite (NO<sub>x</sub>), and Total Kjeldahl Nitrogen (TKN), by Prism Laboratories Inc. Refer to in Appendix 6 for water quality sampling results and pollutant removal rates.

The SPSC BMP provided pollutant removal of TN in both sampling events with removal ranging from 35% to 93%. TP removal ranged from 16% to 94%. TSS was reduced by 84% and 96% in MY6 samples.

A slight increase of 6% in TN was captured during the Q1 sample in the PW BMP and a reduction of 33% in the Q3 sample. The PW BMP provided pollutant removal of TP in both sampling events ranging from 19% to 31%. TSS was reduced by 94% and 95%.

#### **1.2.7 Wetland Monitoring**

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

### **1.3 Monitoring Year 6 Summary**

Overall, the Site has met the required stream, vegetation, and hydrology mitigation success criteria for MY6. The average planted stem density for the Site is 409 stems per acre and is on track to meet final density criteria. The MY6 average stem height was 8.8 feet which is a 33% increase from the MY5 average stem height of 6.6 feet. Most vegetation plots already exceed or are on track to meet the 10-foot average stem height per plot final success criteria. Morphological surveys indicate that the channel dimensions are stable and functioning as designed. Visual assessment indicates the channels show no sign of instability within the bed, bank, or engineered structures. All restored channels (Norkett Branch, UT1, and UT2) each recorded at least one bankfull event during MY6. The hydrological success criteria for the Site was achieved after MY3. Water quality monitoring results indicate continued pollutant removal capacity of both storm water BMPs.

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 data can be found in the Mitigation Plan documents available on the DMS website. All raw data supporting the tables and figures in the appendices are available upon request.



## Section 2: METHODOLOGY

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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

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- Center for Watershed Protection, 2000. National Pollutant Removal Performance Database for Stormwater Treatment Practices, 2nd Edition. Elliot City, Maryland.
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## **APPENDIX 1. General Figures and Tables**

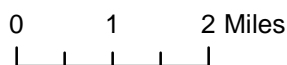
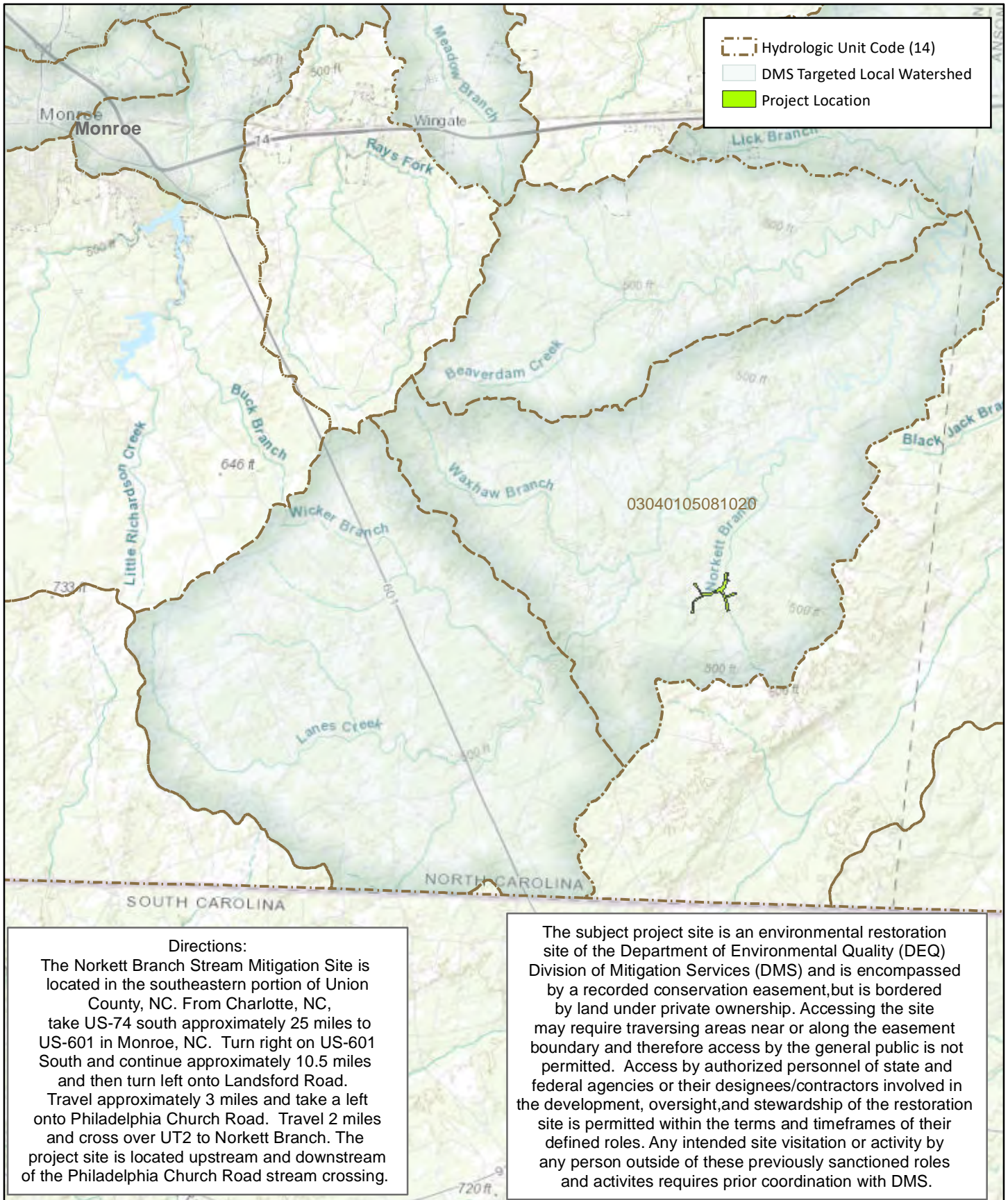


Figure 1 Project Vicinity Map  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019  
 Union County, NC



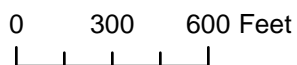
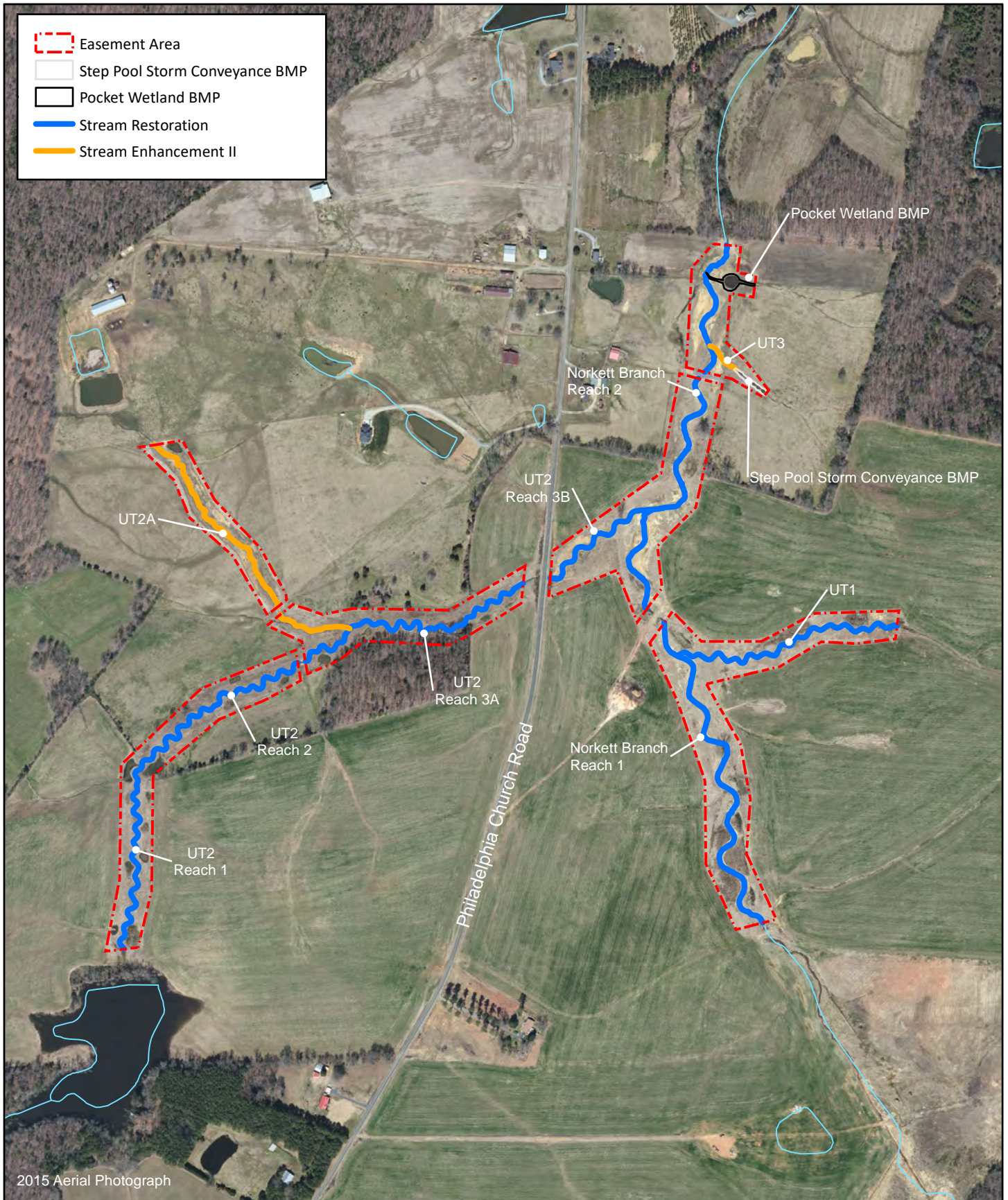


Figure 2 Project Component/Asset Map  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019  
 Union County, NC



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

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	9,196.000	902.000	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	2313.000		
Norkett Branch Reach 2	124+00-131+84 & 132+25-138+99	1,505 LF	P1	R	1,513	1:1	1513.000		
UT1	200+00-211+98	840 LF	P1	R	1,212	1:1	1212.000		
UT2 Reach 1	300+41-310+80	820 LF	P1	R	1,033	1:1	1033.000		
UT2 Reach 2	310+80-321+71 & 322+06-325+20	1,272 LF	P1	R	1,416	1:1	1416.000		
UT2 Reach 3A	325+20-335+58	923 LF	P1	R	1,041	1:1	1041.000		
UT2 Reach 3B	336+90-343+48	380 LF	P1/2	R	668	1:1	668.000		
UT2A	401+53-411+46 & 411+84-415+31	1,296 LF	EII	EII	1,340	2.5:1	536.000		
UT3	505+42-507+12	163 LF	EII	EII	170	2.5:1	68.000		
SPSC BMP	Upstream of UT3 intermittent drainage		Step Pool Storm Conveyance	WQ BMP	29.7 ac treated	1:8	238.000 <sup>3</sup>		
PW BMP	non-jurisdictional drainage in eastern Norkett Branch floodplain		Pocket Wetland	WQ BMP	19.9 ac treated	1:3	60.000 <sup>3</sup>		
Component Summation									
Restoration Level	Stream (LF)	Riparian Wetland (acres)	Non-Riparian Wetland	Buffer (square feet)	Upland (acres)				
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

DMS Project No. 95360

Monitoring Year 6 - 2019

Activity or Report		Data Collection Complete	Completion or Scheduled
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	Stream Assessment	October 2014	December 2014
	Vegetation Assessment	September 2014	
Maintenance and Replanting		October 2014 - February 2015	February 2015
Year 2 Monitoring	Stream Assessment	April 2015	December 2015
	Vegetation Assessment	September 2015	
Year 3 Monitoring	Stream Assessment	April 2016	December 2016
	Vegetation Assessment	June 2016	
Invasive Treatment		July 2016	December 2016
Bank repairs and hugel bed installation in bare areas		March 2017	Spring 2017
Year 4 Monitoring	Stream Assessment	August 2017	December 2017
	Vegetation Assessment	August 2017	
Invasive Treatment		June - July, November 2017	N/A
Supplemental planting		January - March 2018	Spring 2018
Invasive Treatment		June 2018	N/A
Year 5 Monitoring	Stream Assessment	June-August 2018	December 2018
	Vegetation Assessment	August 2018	
Invasive Treatment		March 2019	N/A
Supplemental seeding and planting		February - March 2019	Spring 2019
Year 6 Monitoring	Stream Assessment	April-October 2019	December 2019
	Vegetation Assessment	August 2019	
Beaver Removal		N/A	March - December 2019
Invasive Treatment		October 2019	October 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

DMS Project No.95360

Monitoring Year 6 - 2019

<b>Designer</b> Emily Reinicker, PE, CFM	<b>Wildlands Engineering, Inc.</b> 1430 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>Green Resource, Colfax, NC</b>
<b>Nursery Stock Suppliers</b>	<b>Bruton Natural Systems, Inc</b>
<b>Bare Roots</b>	<b>Dykes and Son Nursery, McMinnville, TN</b>
<b>Live Stakes</b>	<b>Foggy Bottom Nursery, Lansing, NC</b>
<b>Monitoring Performers</b>	<b>Wildlands Engineering, Inc.</b>
Monitoring, POC	Kristi Suggs 704.332.7754, ext. 110

**Table 4. Project Information and Attributes**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

**Monitoring Year 6 - 2019**

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	Secret-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.

**Table 5. Monitoring Component Summary**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Parameter	Monitoring Feature	Quantity/ Length by Reach						Frequency
		Norkett Branch Reach 1	Norkett Branch Reach 2	UT1	UT2 Reach 1	UT2 Reach 2	UT2 Reach 3A	
	Riffle Cross Section	3	2	1	1	2	1	Annual
	Pool Cross Section	2	1	1	1	2	1	
<b>Pattern</b>	Pattern	N/A						N/A
<b>Profile</b>	Longitudinal Profile	N/A						N/A
<b>Substrate</b>	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	RW-1, RF-3	RW-1, RF-2	RW-1, RF-1	RW-1, RF-1	RW-1, RF-2	RW-1, RF-1	Annual
<b>Stream Hydrology</b>	Crest Gage	1		1	1			Quarterly
<b>Wetland Hydrology</b>	Groundwater Gages	N/A						N/A
<b>Vegetation<sup>1</sup></b>	CVS Level 2	26 (Total)						Annual
<b>Visual Assessment</b>	All Streams	Y	Y	Y	Y	Y	Y	Annual
Exotic and nuisance vegetation								
<b>Project Boundary</b>								
<b>Reference Photos<sup>2</sup></b>	Photographs	51 (Total)						Annual
Parameter	Monitoring Feature	Quantity/ Length by Reach			Frequency			
		UT2 Reach 3B	UT3	Storm Water BMPs				
	Riffle Cross Section	1	N/A	N/A	Annual			
	Pool Cross Section	1	N/A	N/A				
<b>Pattern</b>	Pattern				N/A			
<b>Profile</b>	Longitudinal Profile				N/A			
<b>Substrate</b>	Reach Wide (RW) / Riffle (RF) 100 Pebble Count	RW-1, RF-1	N/A	N/A	Annual			
<b>Stream Hydrology</b>	Crest Gage	N/A	N/A	N/A	Quarterly			
<b>Wetland Hydrology</b>	Groundwater Gages	N/A			N/A			
<b>Vegetation<sup>1</sup></b>	CVS Level 2	26 (Total)			Annual			
<b>Visual Assessment</b>	All Streams	Y	Y	Y	Annual			
Exotic and nuisance vegetation								
<b>Project Boundary</b>								
<b>Reference Photos<sup>2</sup></b>	Photographs	51 (Total)			Annual			

<sup>1</sup>A deviation from the vegetation plot quantity indicated in the Mitigation Plan is due to a smaller than expected planted area.

<sup>2</sup>Additional reference photo locations were added for site documentation to exceed quantity indicated in the Mitigation Plan.

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

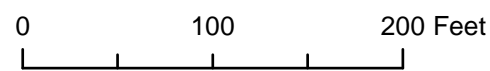








Figure 3.1 Integrated Current Condition Plan View (Sheet 1 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019  
 Union County, NC







2015 Aerial Photograph

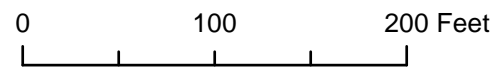
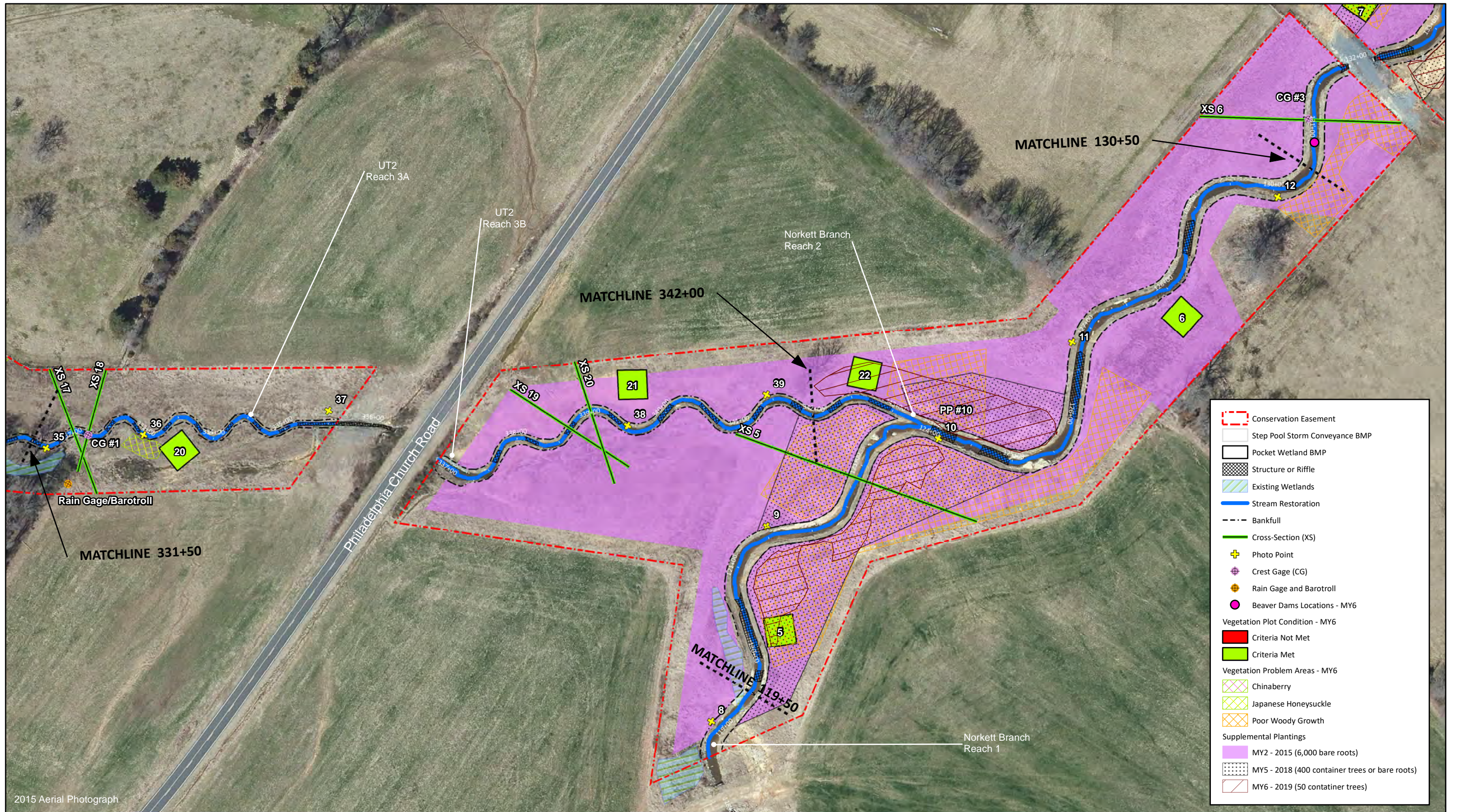


Figure 3.2 Integrated Current Condition Plan View (Sheet 2 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019  
 Union County, NC







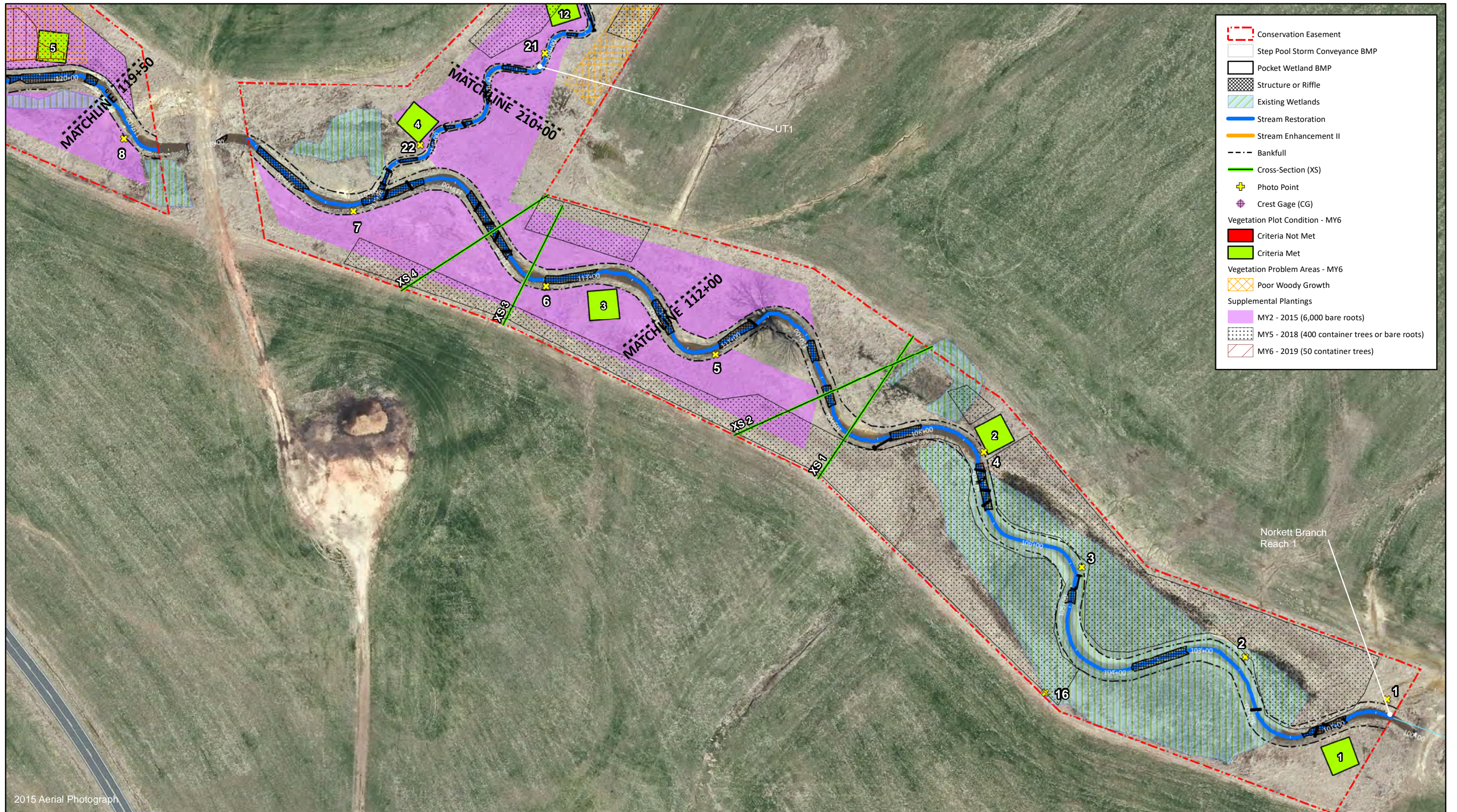
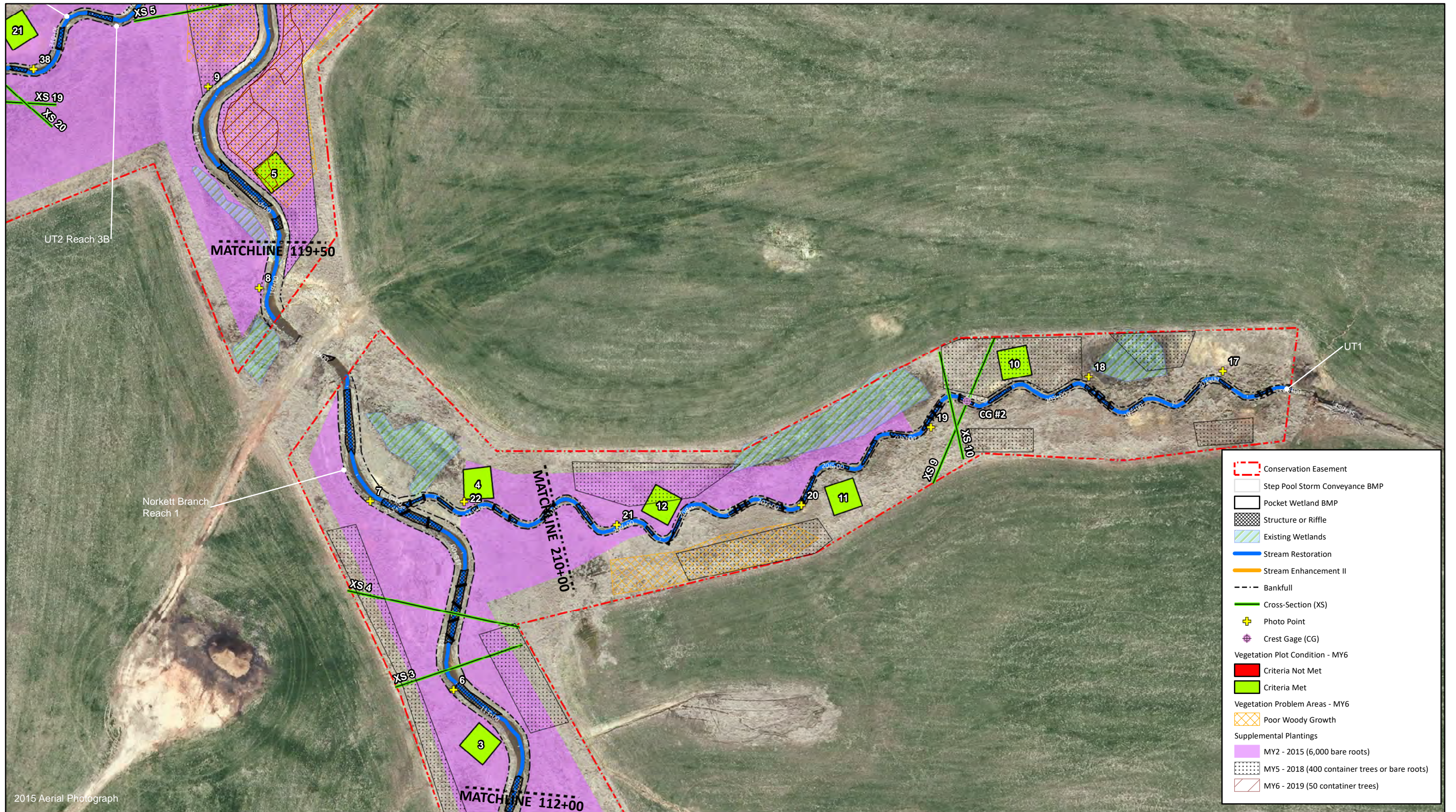


Figure 3.4 Integrated Current Condition Plan View (Sheet 4 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019  
 Union County, NC









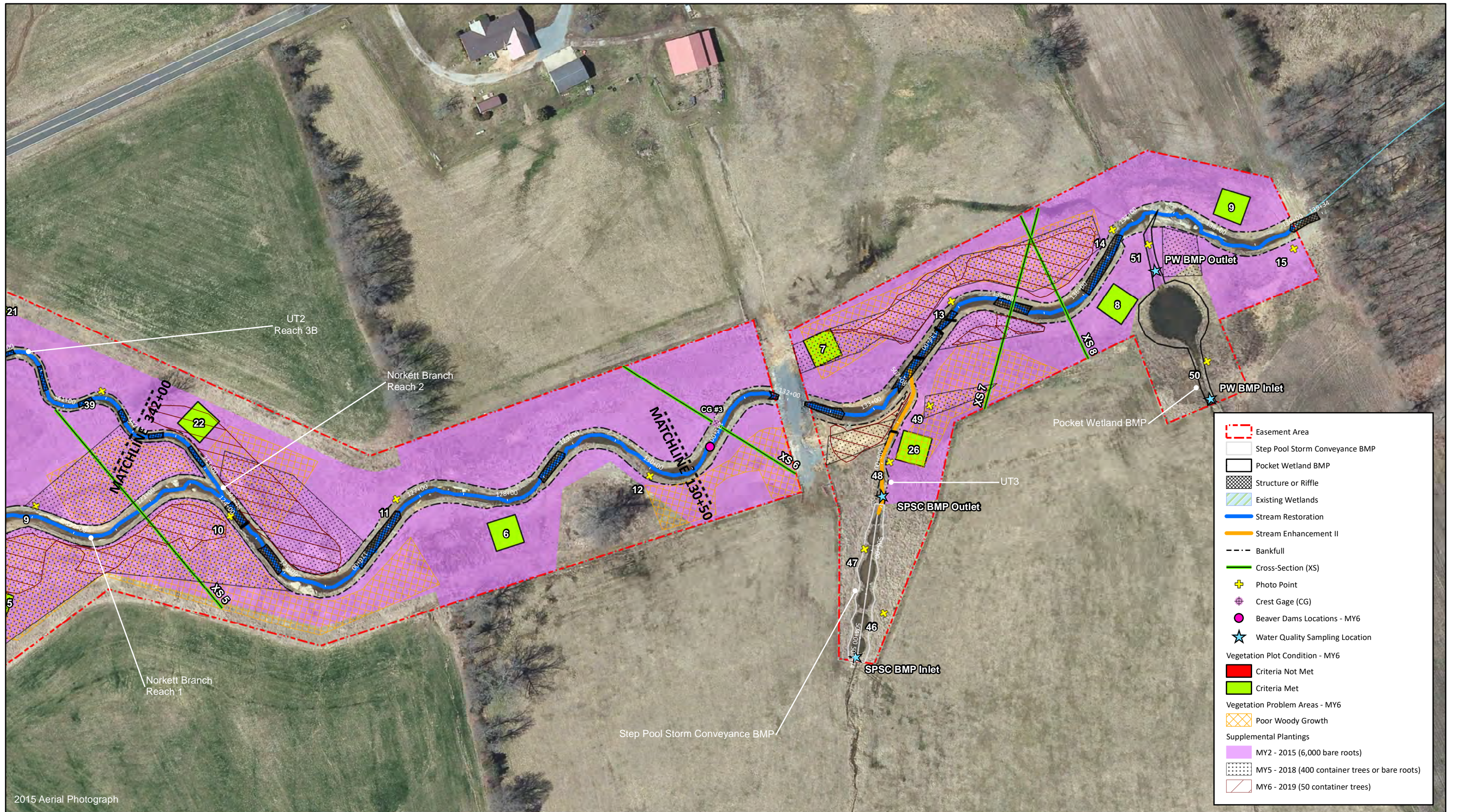


Figure 3.6 Integrated Current Condition Plan View (Sheet 6 of 6)  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019  
 Union County, NC





**Table 6a. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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 (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	17	17		100%				
	3. Meander Pool Condition	Depth Sufficient	16	16		100%				
		Length Appropriate	16	16		100%				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	17	17		100%				
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%
	2. Undercut	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 Rootwads/logs providing some cover at baseflow.	2	2			100%			

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

**Table 6b. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**Norkett 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 (Riffle and Run units)	Aggradation			0	0	100%					
		Degradation			0	0	100%					
	2. Riffle Condition	Texture/Substrate	10	10			100%					
		3. Meander Pool Condition	Depth Sufficient	11			11				100%	
	Length Appropriate		11	11			100%					
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	12	12			100%					
		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					0	0	100%	100%	100%	100%
	2. Undercut	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 Rootwads/logs providing some cover at baseflow.	1	1			100%					

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

**Table 6c. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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 (Riffle and Run units)	Aggradation			0	0	100%						
		Degradation			0	0	100%						
	2. Riffle Condition	Texture/Substrate	27	27			100%						
		3. Meander Pool Condition	Depth Sufficient	26			26				100%		
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	Length Appropriate	27			27				100%		
			Thalweg centering at downstream of meander bend (Glide)	27			27				100%		
<b>Totals</b>													
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%
	2. Undercut	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%			
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 Rootwads/logs providing some cover at baseflow.	1	1			100%						

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

**Table 6d. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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 (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	24	24			100%			
		3. Meander Pool Condition	Depth Sufficient	24			24			
	Length Appropriate		24	24			100%			
	4. Thalweg Position	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%
	2. Undercut	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 Rootwads/logs providing some cover at baseflow.	2	2			100%			

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



**Table 6e. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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 (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	31	31			100%			
	3. Meander Pool Condition	Depth Sufficient	31	31			100%			
		Length Appropriate	33	33			100%			
	4. Thalweg Position	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%
	2. Undercut	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%			
	2. Grade Control	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%			
	3. Bank Protection	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 Rootwads/logs providing some cover at baseflow.	4	4			100%			

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

**Table 6f. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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 (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	25	25			100%			
	3. Meander Pool Condition	Depth Sufficient	24	24			100%			
		Length Appropriate	24	24			100%			
	4. Thalweg Position	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%
	2. Undercut	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.	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 Rootwads/logs providing some cover at baseflow.	1	1			100%			

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

**Table 6g. Visual Stream Morphology Stability Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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 (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	10	10			100%			
		Depth Sufficient	10	10			100%			
	3. Meander Pool Condition	Length Appropriate	10	10			100%			
		Thalweg centering at upstream of meander bend (Run)	11	11			100%			
4. Thalweg Position	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%
	2. Undercut	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 Rootwads/logs providing some cover at baseflow.	2	2			100%			

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

**Table 7. Vegetation Condition Assessment Table**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**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	0	0.0	0%
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	0	0.0	0%
<b>Total</b>			<b>0</b>	<b>0.0</b>	<b>0%</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	7	3.1	10%
<b>Cumulative Total</b>			<b>7</b>	<b>3.1</b>	<b>10%</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	4	0.1	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**

**Norkett Branch Reach 1  
Monitoring Year 6**





**Photo Point 1** – looking upstream (06/03/2019)



**Photo Point 1** – looking downstream (06/03/2019)



**Photo Point 2** – looking upstream (06/03/2019)



**Photo Point 2** – looking downstream (06/03/2019)



**Photo Point 3** – looking upstream (06/03/2019)



**Photo Point 3** – looking downstream (06/03/2019)





**Photo Point 4** – looking upstream (06/03/2019)



**Photo Point 4** – looking downstream (06/03/2019)



**Photo Point 5** – looking upstream (06/03/2019)



**Photo Point 5** – looking downstream (06/03/2019)



**Photo Point 6** – looking upstream (06/03/2019)



**Photo Point 6** – looking downstream (06/03/2019)





**Photo Point 7** – looking upstream (06/03/2019)



**Photo Point 7** – looking downstream (06/03/2019)



**Photo Point 8** – looking upstream (06/03/2019)



**Photo Point 8** – looking downstream (06/03/2019)



**Photo Point 9** – looking upstream (06/03/2019)



**Photo Point 9** – looking downstream (06/03/2019)





**Photo Point 10** – looking upstream (06/03/2019)



**Photo Point 10** – looking downstream (06/03/2019)

**Stream Photographs**

**Norkett Branch Reach 2  
Monitoring Year 6**





**Photo Point 11** – looking upstream (06/03/2019)



**Photo Point 11** – looking downstream (06/03/2019)



**Photo Point 12** – looking upstream (06/03/2019)



**Photo Point 12** – looking downstream (06/03/2019)



**Photo Point 13** – looking upstream (06/03/2019)



**Photo Point 13** – looking downstream (06/03/2019)





**Photo Point 14 – looking upstream (06/03/2019)**



**Photo Point 14 – looking downstream (06/03/2019)**



**Photo Point 15 – looking upstream (06/17/2019)**



**Photo Point 15 – looking downstream (06/17/2019)**



**Photo Point 16 –Wetland looking upstream (10/14/2019)**



**Photo Point 16 – Wetland looking downstream (10/14/2019)**



## **Stream Photographs**

**UT1  
Monitoring Year 6**





**Photo Point 17** – looking upstream (06/03/2019)



**Photo Point 17** – looking downstream (06/03/2019)



**Photo Point 18** – looking upstream (06/03/2019)



**Photo Point 18** – looking downstream (06/03/2019)



**Photo Point 19** – looking upstream (06/03/2019)



**Photo Point 19** – looking downstream (06/03/2019)





**Photo Point 20** – looking upstream (06/03/2019)



**Photo Point 20** – looking downstream (06/03/2019)



**Photo Point 21** – looking upstream (06/03/2019)



**Photo Point 21** – looking downstream (06/03/2019)



**Photo Point 22** – looking upstream (06/03/2019)



**Photo Point 22** – looking downstream (06/03/2019)



## **Stream Photographs**

**UT2 Reach 1  
Monitoring Year 6**





**Photo Point 23** – looking upstream (06/17/2019)



**Photo Point 23** – looking downstream (06/17/2019)



**Photo Point 24** – looking upstream (06/17/2019)



**Photo Point 24** – looking downstream (06/17/2019)



**Photo Point 25** – looking upstream (06/17/2019)



**Photo Point 25** – looking downstream (06/17/2019)





**Photo Point 26** – looking upstream (06/17/2019)



**Photo Point 26** – looking downstream (06/17/2019)

**Stream Photographs**

**UT2 Reach 2  
Monitoring Year 6**





**Photo Point 27** – looking upstream (06/17/2019)



**Photo Point 27** – looking downstream (06/17/2019)



**Photo Point 28** – looking upstream (06/17/2019)



**Photo Point 28** – looking downstream (06/17/2019)



**Photo Point 29** – looking upstream (06/17/2019)



**Photo Point 29** – looking downstream (06/17/2019)





**Photo Point 30** – looking upstream (06/20/2019)



**Photo Point 30** – looking downstream (06/20/2019)



**Photo Point 31** – looking upstream (06/20/2019)



**Photo Point 31** – looking downstream (06/20/2019)



**Stream Photographs**

**UT2 Reach 3A & UT2 Reach 3B  
Monitoring Year 6**





**Photo Point 32** – looking upstream (06/20/2019)



**Photo Point 32** – looking downstream (06/20/2019)



**Photo Point 33** – looking upstream (06/20/2019)



**Photo Point 33** – looking downstream (06/20/2019)



**Photo Point 34** – looking upstream (06/20/2019)



**Photo Point 34** – looking downstream (06/20/2019)





**Photo Point 35** – looking upstream (06/20/2019)



**Photo Point 35** – looking downstream (06/20/2019)



**Photo Point 36** – looking upstream (06/03/2019)



**Photo Point 36** – looking downstream (06/03/2019)



**Photo Point 37** – looking upstream (06/03/2019)



**Photo Point 37** – looking downstream (06/03/2019)





**Photo Point 38** – looking upstream (06/03/2019)



**Photo Point 38** – looking downstream (06/03/2019)



**Photo Point 39** – looking upstream (06/03/2019)



**Photo Point 39** – looking downstream (06/03/2019)



**Stream Photographs**

**UT2A  
Monitoring Year 6**





**Photo Point 40** – looking upstream (06/20/2019)



**Photo Point 40** – looking downstream (06/20/2019)



**Photo Point 41** – looking upstream (06/20/2019)



**Photo Point 41** – looking downstream (06/20/2019)



**Photo Point 42** – looking upstream (06/20/2019)



**Photo Point 42** – looking downstream (06/20/2019)





**Photo Point 43** – looking upstream (06/20/2019)



**Photo Point 43** – looking downstream (06/20/2019)



**Photo Point 44** – looking upstream (06/20/2019)



**Photo Point 44** – looking downstream (06/20/2019)



**Photo Point 45** – looking upstream (06/20/2019)



**Photo Point 45** – looking downstream (06/20/2019)



## **Stream Photographs**

**UT3**

**Monitoring Year 6**





**Photo Point 46** – looking upstream (06/03/2019)



**Photo Point 46** – looking downstream (06/03/2019)



**Photo Point 47** – looking upstream (06/03/2019)



**Photo Point 47** – looking downstream (06/03/2019)



**Photo Point 48** – looking upstream (06/03/2019)



**Photo Point 48** – looking downstream (06/03/2019)





**Photo Point 49** – looking upstream (06/03/2019)



**Photo Point 49** – looking downstream (06/03/2019)



**Stream Photographs**

**BMP Inlet & BMP Outlet  
Monitoring Year 6**





**Photo Point 50** – looking downstream (06/03/2019)



**Photo Point 51** – looking upstream (06/03/2019)



**Vegetation Photographs  
Monitoring Year 6**





Vegetation Plot 1 – (08/06/2019)



Vegetation Plot 2 – (08/06/2019)



Vegetation Plot 3 – (08/06/2019)



Vegetation Plot 4 – (08/07/2019)



Vegetation Plot 5 – (08/05/2019)



Vegetation Plot 6 – (08/05/2019)





Vegetation Plot 7 – (08/05/2019)



Vegetation Plot 8 – (08/05/2019)



Vegetation Plot 9 – (08/05/2019)



Vegetation Plot 10 – (08/06/2019)



Vegetation Plot 11 – (08/06/2019)



Vegetation Plot 12 – (08/06/2019)





Vegetation Plot 13 – (08/08/2019)



Vegetation Plot 14 – (08/08/2019)



Vegetation Plot 15 – (08/08/2019)



Vegetation Plot 16 – (08/08/2019)



Vegetation Plot 17 – (08/08/2019)



Vegetation Plot 18 – (08/08/2019)





Vegetation Plot 19 – (08/07/2019)



Vegetation Plot 20 – (08/07/2019)



Vegetation Plot 21 – (08/05/2019)



Vegetation Plot 22 – (08/05/2019)



Vegetation Plot 23 – (08/07/2019)



Vegetation Plot 24 – (08/07/2019)





Vegetation Plot 25 – (08/07/2019)



Vegetation Plot 26 – (08/05/2019)



## **Areas of Concern**





Invasive Plant Population (Chinese Privet) – 10/15/2019



Invasive Plant Population (Chinaberry) – 10/15/2019



Poor Woody Growth Norkett Branch Reach 1 – 10/14/2019



Poor Woody Growth Norkett Branch Reach 2 – 10/15/2019



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



**Table 8. Vegetation Plot Criteria Attainment**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

**Monitoring Year 6 - 2019**

Plot	MY5 Success Criteria Met (Y/N)	Tract Mean
1	Y	100%
2	Y	
3	Y	
4	Y	
5	Y	
6	Y	
7	Y	
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 9. CVS Vegetation Plot Metadata**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

<b>Report Prepared By</b>	Ian Eckardt	
<b>Date Prepared</b>		9/20/2019 10:10
<b>database name</b>	cvs-eep-entrytool-v2.3.1 MY6.mdb	
<b>database location</b>	Q:\ActiveProjects\005-02134 Norkett Branch FDP\Monitoring\Monitoring Year 6 (2019)\Vegetation Assessment	
<b>computer name</b>	IAN-PC	
<b>file size</b>		52637696
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>		
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.	
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.	
<b>Proj, total stems</b>	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems	
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.)	
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.	
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.	
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.	
<b>Damage by Spp</b>	Damage values tallied by type for each species.	
<b>Damage by Plot</b>	Damage values tallied by type for each plot.	
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.	
<b>ALL Stems by Plot and spp</b>	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.	
<b>PROJECT SUMMARY-----</b>		
<b>Project Code</b>		95360
<b>project Name</b>	Norkett Branch Stream Mitigation Site	
<b>Description</b>		
<b>River Basin</b>		
<b>length(ft)</b>		10706
<b>stream-to-edge width (ft)</b>		50
<b>area (sq m)</b>		127880.66
<b>Required Plots (calculated)</b>		22
<b>Sampled Plots</b>		26



Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Scientific Name	Common Name	Species Type	Current Plot Data (MY6 2019)																							
			95360-WEI-0001			95360-WEI-0002			95360-WEI-0003			95360-WEI-0004			95360-WEI-0005			95360-WEI-0006			95360-WEI-0007					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Acer rubrum	red maple	Tree				1	1	1	1	1	1	2	2	2												
Baccharis halimifolia	eastern baccharis	Shrub																								
Betula nigra	river birch	Tree	3	3	4	1	1	1	1	1	1				3	3	3	2	2	3	2	2	2			
Carya illinoensis	pecan	Tree																								
Celtis laevigata	sugarberry	Tree																								
Cephalanthus occidentalis	common buttonbush	Shrub																								
Cercis canadensis	eastern redbud	Tree												1	1	1										
Cornus amomum	silky dogwood	Shrub			1																					
Cornus florida	flowering dogwood	Tree																								
Diospyros virginiana	common persimmon	Tree						4																		
Fraxinus pennsylvanica	green ash	Tree	2	2	2	5	5	5		1				1	1	1	4	4	5	3	3	3				
Hamamelis virginiana	American witchhazel	Tree																								
Juniperus virginiana	eastern redcedar	Tree																								
Liquidambar styraciflua	sweetgum	Tree																		1						
Liriodendron tulipifera	tuliptree	Tree																								
Pinus rigida	pitch pine	Tree																								
Pinus strobus	eastern white pine	Tree																								
Pinus taeda	loblolly pine	Tree								1																
Platanus occidentalis	American sycamore	Tree	5	5	5	6	6	6	7	7	8	8	8	9	2	2	2	3	3	3	1	1	1			
Populus deltoides	eastern cottonwood	Tree								1																
Quercus michauxii	swamp chestnut oak	Tree																								
Quercus phellos	willow oak	Tree												1	1	1	1	1	2							
Quercus rubra	northern red oak	Tree	2	2	2				3	3	3									2						
Salix nigra	black willow	Tree											1							2						
Salix sericea	silky willow	Shrub																								
Sambucus canadensis	common elderberry	Shrub										1	1	1												
Sambucus nigra	European black elderberry	Shrub																								
Taxodium distichum	bald cypress	Tree																								
Ulmus alata	winged elm	Tree																								
Ulmus americana	American elm	Tree											1													
Ulmus rubra	slippery elm	Tree																								
Unknown		Shrub or Tree																								
<b>Stem count</b>			12	12	14	13	13	17	12	12	16	11	11	14	8	8	8	10	10	16	6	6	6			
<b>size (ares)</b>			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					
<b>Species count</b>			4	4	5	4	4	5	4	4	7	3	3	5	5	5	5	4	4	6	3	3	3			
<b>Stems per ACRE</b>			486	486	567	526	526	688	486	486	647	445	445	567	324	324	324	405	405	647	243	243	243			

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%
Volunteer species included in total

PnoLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

\* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Supplemental planting performed in MY5 (January 2018) included 400 stems or approximately 3% of MY5 stem total. In MY6, (March 2019) 50 stems or less than 1% of the MY6 stem total were planted in areas of poor woody growth.



Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Scientific Name	Common Name	Species Type	Current Plot Data (MY6 2019)																							
			95360-WEI-0008			95360-WEI-0009			95360-WEI-0010			95360-WEI-0011			95360-WEI-0012			95360-WEI-0013			95360-WEI-0014					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Acer rubrum	red maple	Tree			1																					
Baccharis halimifolia	eastern baccharis	Shrub																								
Betula nigra	river birch	Tree	3	3	3				1	1	1			1	1	1	1	1	1	1	1	1				
Carya illinoensis	pecan	Tree																								
Celtis laevigata	sugarberry	Tree																								
Cephalanthus occidentalis	common buttonbush	Shrub																								
Cercis canadensis	eastern redbud	Tree							1	1	1															
Cornus amomum	silky dogwood	Shrub																								
Cornus florida	flowering dogwood	Tree																								
Diospyros virginiana	common persimmon	Tree			1																					
Fraxinus pennsylvanica	green ash	Tree	5	5	6	2	2	5	2	2	3	6	6	8	1	1	1	2	2	5	3	3	3			
Hamamelis virginiana	American witchhazel	Tree																								
Juniperus virginiana	eastern redcedar	Tree																								
Liquidambar styraciflua	sweetgum	Tree																								
Liriodendron tulipifera	tuliptree	Tree	1	1	1				1	1	1															
Pinus rigida	pitch pine	Tree																								
Pinus strobus	eastern white pine	Tree																								
Pinus taeda	loblolly pine	Tree			2			1																		
Platanus occidentalis	American sycamore	Tree	4	4	4	6	6	7	1	1	1	2	2	2	7	7	7	3	3	3	2	2	2			
Populus deltoides	eastern cottonwood	Tree																								
Quercus michauxii	swamp chestnut oak	Tree	1	1	1																					
Quercus phellos	willow oak	Tree			2	2	2	2												1	1	2				
Quercus rubra	northern red oak	Tree	1	1	1									1	1	1										
Salix nigra	black willow	Tree												8					1							
Salix sericea	silky willow	Shrub												3												
Sambucus canadensis	common elderberry	Shrub																								
Sambucus nigra	European black elderberry	Shrub																								
Taxodium distichum	bald cypress	Tree	2	2	2																					
Ulmus alata	winged elm	Tree						16																		
Ulmus americana	American elm	Tree																	2							
Ulmus rubra	slippery elm	Tree																	11							
Unknown		Shrub or Tree																								
<b>Stem count</b>			17	17	24	10	10	31	6	6	7	8	8	22	10	10	10	6	6	23	7	7	8			
<b>size (ares)</b>			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					
<b>Species count</b>			7	7	11	3	3	5	5	5	5	2	2	5	4	4	4	3	3	6	4	4	4			
<b>Stems per ACRE</b>			688	688	971	405	405	1255	243	243	283	324	324	890	405	405	405	243	243	931	283	283	324			

**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%
Volunteer species included in total

PnoLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

\* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Supplemental planting performed in MY5 (January 2018) included 400 stems or approximately 3% of MY5 stem total. In MY6, (March 2019) 50 stems or less than 1% of the MY6 stem total were planted in areas of poor woody growth.



Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Scientific Name	Common Name	Species Type	Current Plot Data (MY6 2019)																				
			95360-WEI-0015			95360-WEI-0016			95360-WEI-0017			95360-WEI-0018			95360-WEI-0019			95360-WEI-0020			95360-WEI-0021		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																				2	
Baccharis halimifolia	eastern baccharis	Shrub																					
Betula nigra	river birch	Tree	1	1	1				1	1	1				1	1	1	1	1	1			
Carya illinoensis	pecan	Tree														2							
Celtis laevigata	sugarberry	Tree																					
Cephalanthus occidentalis	common buttonbush	Shrub																					
Cercis canadensis	eastern redbud	Tree				1	1	1												3	3	3	
Cornus amomum	silky dogwood	Shrub																					
Cornus florida	flowering dogwood	Tree																					
Diospyros virginiana	common persimmon	Tree																					
Fraxinus pennsylvanica	green ash	Tree	4	4	4	3	3	3	4	4	5	3	3	3	3	3	4	3	3	3		3	
Hamamelis virginiana	American witchhazel	Tree																		2	2	2	
Juniperus virginiana	eastern redcedar	Tree													5								
Liquidambar styraciflua	sweetgum	Tree								4						3			1				
Liriodendron tulipifera	tuliptree	Tree												1	1	1							
Pinus rigida	pitch pine	Tree																					
Pinus strobus	eastern white pine	Tree																					
Pinus taeda	loblolly pine	Tree																				3	
Platanus occidentalis	American sycamore	Tree	3	3	3	1	1	1	4	4	4	4	4	4	4	4	4	4	4	6	6	6	
Populus deltoides	eastern cottonwood	Tree																					
Quercus michauxii	swamp chestnut oak	Tree												1	1	1	1	1	1				
Quercus phellos	willow oak	Tree	1	1	1				2	2	2	1	1	1	1	1	1	2	2	2	1	1	1
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	2	2	2	1	1	1	1	1				1	1	1	
Salix nigra	black willow	Tree																					
Salix sericea	silky willow	Shrub																					
Sambucus canadensis	common elderberry	Shrub																					
Sambucus nigra	European black elderberry	Shrub														1							
Taxodium distichum	bald cypress	Tree																					
Ulmus alata	winged elm	Tree						8			8					6			3				
Ulmus americana	American elm	Tree																					
Ulmus rubra	slippery elm	Tree														5			3				
Unknown		Shrub or Tree																					
<b>Stem count</b>			10	10	10	6	6	14	13	13	26	9	9	9	12	12	35	11	11	18	13	13	21
<b>size (ares)</b>			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		
<b>Species count</b>			5	5	5	4	4	5	5	5	7	4	4	4	7	7	13	5	5	8	5	5	8
<b>Stems per ACRE</b>			405	405	405	243	243	567	526	526	1052	364	364	364	486	486	1416	445	445	728	526	526	850

**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%
- Volunteer species included in total

PnoLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

\* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total.

Supplemental planting performed in MY5 (January 2018) included 400 stems or approximately 3% of MY5 stem total. In MY6, (March 2019) 50 stems or less than 1% of the MY6 stem total were planted in areas of poor woody growth.



**Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Scientific Name	Common Name	Species Type	Current Plot Data (MY6 2019)														
			95360-WEI-0022			95360-WEI-0023			95360-WEI-0024			95360-WEI-0025			95360-WEI-0026		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree															
Baccharis halimifolia	eastern baccharis	Shrub															
Betula nigra	river birch	Tree	1	1	1	1	1	1	1	1	1	1	1			2	
Carya illinoensis	pecan	Tree															
Celtis laevigata	sugarberry	Tree															
Cephalanthus occidentalis	common buttonbush	Shrub															
Cercis canadensis	eastern redbud	Tree															
Cornus amomum	silky dogwood	Shrub															
Cornus florida	flowering dogwood	Tree															
Diospyros virginiana	common persimmon	Tree															
Fraxinus pennsylvanica	green ash	Tree	6	6	7	3	3	3	3	3	3	3	3	4	4	4	
Hamamelis virginiana	American witchhazel	Tree															
Juniperus virginiana	eastern redcedar	Tree															
Liquidambar styraciflua	sweetgum	Tree			1												
Liriodendron tulipifera	tuliptree	Tree									1	1	1				
Pinus rigida	pitch pine	Tree															
Pinus strobus	eastern white pine	Tree															
Pinus taeda	loblolly pine	Tree						2									
Platanus occidentalis	American sycamore	Tree	5	5	5	3	3	3	4	4	4	2	2	2	2	2	
Populus deltoides	eastern cottonwood	Tree															
Quercus michauxii	swamp chestnut oak	Tree									1	1	1				
Quercus phellos	willow oak	Tree	2	2	2	2	2	2	1	1	1	1	1	1		1	
Quercus rubra	northern red oak	Tree				2	2	2	1	1	1	1	1	1	2	2	
Salix nigra	black willow	Tree															
Salix sericea	silky willow	Shrub															
Sambucus canadensis	common elderberry	Shrub															
Sambucus nigra	European black elderberry	Shrub															
Taxodium distichum	bald cypress	Tree															
Ulmus alata	winged elm	Tree						1									
Ulmus americana	American elm	Tree											1				
Ulmus rubra	slippery elm	Tree															
Unknown		Shrub or Tree															
	<b>Stem count</b>		14	14	16	11	11	14	10	10	10	10	10	11	8	8	11
	<b>size (ares)</b>		1			1			1			1			1		
	<b>size (ACRES)</b>		0.02			0.02			0.02			0.02			0.02		
	<b>Species count</b>		4	4	5	5	5	7	5	5	5	7	7	8	3	3	5
	<b>Stems per ACRE</b>		567	567	647	445	445	567	405	405	405	405	405	445	324	324	445

**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%
- Volunteer species included in total

PnoLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

\* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total. Supplemental planting performed in MY5 (January 2018) included 400 stems or approximately 3% of MY5 stem total. In MY6, (March 2019) 50 stems or less than 1% of the MY6 stem total were planted in areas of poor woody growth.



**Table 10. Planted and Total Stem Counts (Species by Plot with Annual Means)**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Scientific Name	Common Name	Species Type	Annual Summary																							
			MY6 (2019)			MY5 (8/2018)			MY4 (8/2017)			MY3 (6/2016)			MY2 (9/2015)			MY1 (9/2014)			MY0 (4/2014)					
			P-noLS	P-all	T	P-noLS	P-all	T	P-noLS	P-all	T	P-noLS	P-all	T	P-noLS	P-all	T	P-noLS	P-all	T	P-noLS	P-all	T			
Acer rubrum	red maple	Tree	4	4	7	4	4	5	4	4	7	4	4	6	4	4	4									
Baccharis halimifolia	eastern baccharis	Shrub			4			4																		
Betula nigra	river birch	Tree	27	27	32	29	29	32	27	27	27	27	27	27	27	27	25	25	25	32	32	32				
Carya illinoensis	pecan	Tree			2									6												
Celtis laevigata	sugarberry	Tree									6						1	1	1	7	7	7				
Cephalanthus occidentalis	common buttonbush	Shrub									2	1	1	1	1	1	2									
Cercis canadensis	eastern redbud	Tree	6	6	6	11	11	12	10	10	10	12	12	12	14	14	14	25	25	25	42	42	42			
Cornus amomum	silky dogwood	Shrub			1																					
Cornus florida	flowering dogwood	Tree				1	1	1					8	8	8	10	10	10	48	48	48	75	75	75		
Diospyros virginiana	common persimmon	Tree			5			5			3			2			3									
Fraxinus pennsylvanica	green ash	Tree	75	75	93	74	74	83	75	75	83	76	76	82	73	73	75	63	63	63	67	67	67			
Hamamelis virginiana	American witchhazel	Tree	2	2	2	3	3	3	3	3	3	3	3	3	3	3	7	7	7	7	8	8	8			
Juniperus virginiana	eastern redcedar	Tree			5																					
Liquidambar styraciflua	sweetgum	Tree			10			10			9						5									
Liriodendron tulipifera	tuliptree	Tree	4	4	4	7	7	7	6	6	6	9	9	16	11	11	11	24	24	24	59	59	59			
Pinus rigida	pitch pine	Tree						7			2															
Pinus strobus	eastern white pine	Tree									1															
Pinus taeda	loblolly pine	Tree			9																					
Platanus occidentalis	American sycamore	Tree	99	99	102	105	105	107	102	102	102	105	105	106	106	106	106	67	67	67	57	57	57			
Populus deltoides	eastern cottonwood	Tree			1						1			1			1									
Quercus michauxii	swamp chestnut oak	Tree	4	4	4	4	4	4	7	7	7	7	7	7	7	7	18	18	18	36	36	36				
Quercus phellos	willow oak	Tree	19	19	24	20	20	20	17	17	17	19	19	19	20	20	20	34	34	34	27	27	27			
Quercus rubra	northern red oak	Tree	20	20	20	23	23	23	19	19	19	20	20	20	23	23	23	24	24	24	24	24	24			
Salix nigra	black willow	Tree			12			9			5			7			1									
Salix sericea	silky willow	Shrub			3																					
Sambucus canadensis	common elderberry	Shrub	1	1	1	1	1	3	1	1	1	2	2	3	2	2	2	10	10	11	13	13	13			
Sambucus nigra	European black elderberry	Shrub			1																					
Taxodium distichum	bald cypress	Tree	2	2	2	2	2	3							1	1	1									
Ulmus alata	winged elm	Tree			42			19			15			17			6									
Ulmus americana	American elm	Tree			4			6																		
Ulmus rubra	slippery elm	Tree			19																					
Unknown		Shrub or Tree									1															
<b>Stem count</b>			263	263	411	284	284	363	271	271	327	293	293	343	302	302	321	346	346	347	447	447	447			
<b>size (ares)</b>			26			26			26			26			26			26			26					
<b>size (ACRES)</b>			0.64			0.64			0.64			0.64			0.64			0.64			0.64					
<b>Species count</b>			12	12	25	13	13	20	11	11	21	13	13	18	14	14	19	12	12	12	12	12	12			
<b>Stems per ACRE</b>			409	409	640	442	442	565	422	422	509	456	456	534	470	470	500	539	539	540	696	696	696			

**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%
- Volunteer species included in total

P-noLS: Planted Stems excluding live stakes

P-all: All planted stems

T: Total stems including volunteers

\* Supplemental planting was performed in MY2 (February 2015) included 6,000 stems or approximately 37% of MY1 stem total. Supplemental planting performed in MY5 (January 2018) included 400 stems or approximately 3% of MY5 stem total. In MY6, (March 2019) 50 stems or less than 1% of the MY6 stem total were planted in areas of poor woody growth.



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



**Table 11a. Baseline Stream Data Summary**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**Norkett Branch Reaches 1 and 2**

Parameter	Gage	PRE-RESTORATION CONDITION				REFERENCE REACHES						DESIGN				AS-BUILT/BASELINE			
		Norkett Branch Reach 1		Norkett Branch Reach 2		Spencer Creek		UT to Spencer Creek		UT Richland Creek 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
<b>Dimension and Substrate - Riffle</b>																			
Bankfull Width (ft)	n/a	12.8	21.5	22.0	29.5	10.7	11.2	7.0		13.3	15.2	22.0		23.0		22.5	26.6	25.6	25.7
Floodprone Width (ft)		35	58	72	85	60	114+	>81		>50		48	>110	61	>115	>200	>200	>200	>200
Bankfull Mean Depth		1.7	1.8	1.4	2.4	1.6	1.8	2.0		1.1	1.3	1.8		1.9		1.6	1.8	1.8	2.0
Bankfull Max Depth		3.1	3.2	2.3	2.9	2.1	2.6	1.1		1.8	2.1	2.8		2.8		2.6	3.3	3.0	3.3
Bankfull Cross-sectional Area (ft <sup>2</sup> )		28.1	35.6	40.6	52.8	17.8	19.7	7.7		16.5	17.5	40.6		43.2		38.8	44.6	46.7	50.8
Width/Depth Ratio		5.9	13.0	9.2	21.4	5.8	7.1	6.4		10.1	13.9	11.9		12.2		13.1	16.7	13.0	14.1
Entrenchment Ratio		2.1	4.5	2.9	3.3	5.5	10.2	>11.6		>2.5		2.2	>5.0	2.2	>5.0	>2.2		>2.2	
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	
D50 (mm)		8.6		0.4								---		---		18.4	59.6	7.3	9.9
<b>Profile</b>																			
Riffle Length (ft)	n/a					---		---		---		---		---		14	84	19	111
Riffle Slope (ft/ft)		0.0036	0.0039	0.0032	0.0120	0.0130		0.0140		0.0183	0.0355	0.0018	0.0120	0.0023	0.0180	0.0000	0.0152	0.0009	0.0163
Pool Length (ft)						---		---		---		---		---		12	88	51	102
Pool Max Depth (ft)		4.0	4.0	2.9	4.0	3.3		2.5		1.8		2.8	7.8	2.8	7.9	3.3	5.1	3.5	4.8
Pool Spacing (ft) <sup>^</sup>		62	300	60	300	71.0		19		42	33.0	93.0	29	163	30	170	67	183	98
Pool Volume (ft <sup>3</sup> )																			
<b>Pattern</b>																			
Channel Beltwidth (ft)	n/a	N/A		N/A		38	41	11	27	N/A		35	161	37	168	38	147	38	155
Radius of Curvature (ft)		N/A		N/A		11	15	6	16	N/A		40	66	41	69	38	65	40	64
Rc:Bankfull Width (ft/ft)		N/A		N/A		1.0	1.3	0.8	2.3	N/A		1.8	3.0	1.8	3.0	1.7	2.4	1.6	2.5
Meander Length (ft)		N/A		N/A		46	48	37.7	43	N/A		66	264	69	276	167	263	181	277
Meander Width Ratio		N/A		N/A		3.6	3.7	1.6	3.8	N/A		1.6	7.3	1.6	7.3	1.7	5.5	1.5	6.0
<b>Substrate, Bed and Transport Parameters</b>																			
Ri%/Ru%/P%/G%/S%	n/a																		
SC%/Sa%/G%/C%/B%/Be%																			
d16/d35/d50/d84/d95/d100		SC/4.6/8.7/28.5/64/2048		SC/SC/0.4/21.1/>2048/>2048		---		---		---						0.4/3.6/7.4/52.3/139.4/362		2.6/6.7/13.0/62.6/210.9/>2048	
Reach Shear Stress (Competency) lb/ft <sup>2</sup>		0.41	0.44	0.17	0.38							0.28		0.40		0.27	0.29	0.30	0.32
Max part size (mm) mobilized at bankfull												15-25		20-35		15-25		20-35	
Stream Power (Capacity) W/m <sup>2</sup>																			
<b>Additional Reach Parameters</b>																			
Drainage Area (SM)	n/a	2.3		3.2		0.96		0.01		0.28		2.3		3.2		2.3		3.2	
Watershed Impervious Cover Estimate (%)		<1% <sup>1</sup>		<1% <sup>1</sup>		---		---		---		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>	
Rosgen Classification		E4		C/E5		E4		E5		C4/E4		C4		C5		C4		C4/E4	
Bankfull Velocity (fps)		3.5	4.0	2.5	3.5	4.9	5.4	3.2	3.5	4.1	2.8	2.8	3.3	2.6	2.8	2.8	2.8	2.8	2.9
Bankfull Discharge (cfs)		110		140		97		25		29	32	110		140		105	124	130	148
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		1,910		1,249		1,910		1,249	
Channel Thalweg Length (ft) <sup>2</sup>		1,980		1,505		---		---		---		2,369		1,499		2,369		1,499	
Sinuosity (ft) <sup>3</sup>		1.10		1.10		2.30		2.50		1.00		1.24		1.20		1.24		1.20	
Water Surface Slope (ft/ft) <sup>2</sup>		0.0039		0.0013		0.0046		---		---		0.0025		0.0036		0.0031		0.0033	
Bankfull Slope (ft/ft)	---		---		---		---		---		---		---		0.0029		0.0034		

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

<sup>2</sup> Channel Length represented does not include easement breaks.

(---): Data was not provided

N/A: Not Applicable

SC: Silt/Clay



Table 11b. Baseline Stream Data Summary

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

UT1 and UT2 Reaches 1 and 2

Parameter	Gage	PRE-RESTORATION CONDITION						REFERENCE REACHES	DESIGN						AS BUILT/ BASELINE																					
		UT1		UT2 Reach 1		UT2 Reach 2		See Table 11a	UT1		UT2 Reach 1		UT2 Reach 2		UT1		UT2 Reach 1		UT2 Reach 2																	
		Min	Max	Min	Max	Min	Max	Min	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max																
<b>Dimension and Substrate - Riffle</b>																																				
Bankfull Width (ft)	n/a	2.9	8.2	13.6		7.1		See Table 11a	7.5		8.0		8.0		10.5		9.4		9.0		9.6															
Floodprone Width (ft)		6	40	29		53			16.5	>38	>40		>40		136		144		>200		>200															
Bankfull Mean Depth		0.9	1	0.6		0.7			0.6		0.6		0.7		0.4		0.5		0.5		0.6															
Bankfull Max Depth		1.2	2	1		1.5			0.9		0.9		1.0		0.8		1.2		1.1		1.2															
Bankfull Cross-sectional Area (ft <sup>2</sup> )		2.6	8.6	7.9		5.1			4.6		4.6		5.3		4.5		4.5		5.2		5.3															
Width/Depth Ratio		2.6	8.6	23.4		9.8			12.2		13.9		12.1		24.5		19.8		15.3		17.6															
Entrenchment Ratio		2.2	4.9	>7		>8			2.2	>5	>5		>5		>2.2		>2.2		>2.2		>2.2															
Bank Height Ratio		1.5	2.4	1		1			1.0		1.0		1.0		1.0		1.0		1.0		1.0															
D50 (mm)		SC		7.3		7.3									20.9		19.5		20.1		27.4															
<b>Profile</b>																																				
Riffle Length (ft)	n/a							See Table 11a	---		---		---		7		39		7		34		6		27											
Riffle Slope (ft/ft)		0.017	0.054	0.009		0.032			0.013		0.045		0.01		0.032		0.013		0.028		0.007		0.044		0.006		0.037		0.009		0.039					
Pool Length (ft)									---		---		---		12		69		11		35		11		45											
Pool Max Depth (ft)		1.4	1.7	1.3		2.5			0.9		2.6		0.9		2.4		1.0		2.8		1.2		2.5		1.5		2.6		1.5		2.5					
Pool Spacing (ft) <sup>A</sup>		61	295	190		51			10		56		10		56		10		56		30		58		21		64		22		71					
Pool Volume (ft <sup>3</sup> )																																				
<b>Pattern</b>																																				
Channel Beltwidth (ft)	n/a	N/A		N/A		N/A		26.9		49.5		See Table 11a	12		55		13		44		13		44		13		49		10		42		12		52	
Radius of Curvature (ft)		N/A		N/A		N/A		6.92		33.39			12		23		13.0		24.0		13		24		14		23		15		21		14		22	
Rc:Bankfull Width (ft/ft)		N/A		N/A		N/A		0.98		4.73			1.6		3		1.6		3.0		1.6		3		1.3		2.2		1.6		2.2		1.6		2.3	
Meander Length (ft)		N/A		N/A		N/A		83.5		141.4			23		90		24.0		96.0		24		96		61		88		45		92		44		83	
Meander Width Ratio		N/A		N/A		N/A		3.8		7.01			1.6		7.3		1.6		5.5		1.6		5.5		1.2		4.7		1.0		4.4		1.3		5.4	
<b>Substrate, Bed and Transport Parameters</b>																																				
Ri%/Ru%/P%/G%/S%	n/a																																			
SC%/Sa%/G%/C%/B%/Be%																																				
d16/d35/d50/d84/d95/d100		SC/SC/SC/SC/0.77/9.38/>2048		SC/SC/7.3/47.7/85.7/>2048		SC/SC/7.3/47.7/85.7/>2048				See Table 11a								SC/1.0/12.7/55.3/90/256		SC/7.1/12.2/28.5/42.9/90		2.4/11.6/20.7/56.1/86.7/180														
Reach Shear Stress (Competency) lb/ft <sup>2</sup>		0.57	0.82	0.14		0.42						0.38		0.18		0.27		0.27		0.16		0.21		0.23												
Max part size (mm) mobilized at bankfull												20-35		10-20		15-25		15-25		10-20		15-25														
Stream Power (Capacity) W/m <sup>2</sup>																																				
<b>Additional Reach Parameters</b>																																				
Drainage Area (SM)	n/a	0.08		0.40		0.48		See Table 5a	0.08		0.15		0.22		0.08		0.15		0.22																	
Watershed Impervious Cover Estimate (%)		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>			<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>		<1% <sup>1</sup>					
Rosgen Classification		E6		C/E4		E4			C/E6		C/E4		C/E4		C4		C4		C4		C4		C4		C4		C4		C4		C4					
Bankfull Velocity (fps)		3.3	4.2	1.4		3.4			2.6		2.4		3.2		2.1		1.6		1.9		2.0															
Bankfull Discharge (cfs)		12		11		17			12		11		17		10		7		10		11															
Q-NFF regression																																				
Q-USGS extrapolation																																				
Q-Mannings																																				
Valley Length (ft)		840		820		1156			998		866		1108		998		866		1108																	
Channel Thalweg Length (ft) <sup>2</sup>		840		820		1,272			1,198		1,039		1,440		1,198		1,039		1,440																	
Sinuosity (ft) <sup>3</sup>	1.0		1.0		1.1		1.20		1.20		1.30		1.20		1.20		1.30																			
Water Surface Slope (ft/ft) <sup>2</sup>	0.15		0.004		0.012		0.010		0.005		0.007		0.011		0.006		0.007																			
Bankfull Slope (ft/ft)							---		---		---		0.011		0.006		0.007																			

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

<sup>2</sup> Channel Length represented does not include easement breaks.

(---): Data was not provided

N/A: Not Applicable

SC: Silt/Clay



**Table 11c. Baseline Stream Data Summary**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**UT2 Reaches 3A and 3B**

Parameter	Gage	RE-RESTORATION CONDITION		REFERENCE REACHES		DESIGN				AS BUILT/BASELINE					
		UT2 Reach 3		See Table 11a		UT2 Reach 3A		UT2 Reach 3B		UT2 Reach 3A		UT2 Reach 3B			
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
<b>Dimension and Substrate - Riffle</b>															
Bankfull Width (ft)	n/a	7.5		See Table 11a		9.0		11.0		10.5		13.9			
Floodprone Width (ft)		24				45+		55+		>200		130			
Bankfull Mean Depth		1.1				0.8		1.0		0.7		0.8			
Bankfull Max Depth		1.6				1.2		1.5		1.2		1.6			
Bankfull Cross-sectional Area (ft <sup>2</sup> )		8.3				6.9		10.8		7.2		11.8			
Width/Depth Ratio		6.7				11.7		11.2		15.3		16.5			
Entrenchment Ratio		3.2				5.0+		5.0+		>2.2		>2.2			
Bank Height Ratio		1.3	1.8			1.0		1.0		1.0		1.0			
D50 (mm)		7.32								32.0		33.4			
<b>Profile</b>															
Riffle Length (ft)	n/a			See Table 11a		---		---		8	25	13	28		
Riffle Slope (ft/ft)		0.014	0.025			0.011	0.032	0.008	0.017	0.010	0.046	0.001	0.024		
Pool Length (ft)		2				1.20		3.20	1.50	4.10	1.77	2.98	2.45	3.32	
Pool Max Depth (ft)		26				12		63	14	77	26	66	38	72	
Pool Spacing (ft) <sup>^</sup>		53													
Pool Volume (ft <sup>3</sup> )															
<b>Pattern</b>															
Channel Beltwidth (ft)	n/a	N/A	N/A	See Table 11a		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	58	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>															
Ri%/Ru%/P%/G%/S%	n/a														
SC%/Sa%/G%/C%/B%/Be%															
d16/d35/d50/d84/d95/d100		SC/SC/7.3/47.7/85.7/>2048		See Table 11a						22.6/27.4/32/53.7/69.7/128		SC/4.9/13.3/67.2/89.9/128			
Reach Shear Stress (Competency) lb/ft <sup>2</sup>						0.29		0.23		0.23		0.14			
Max part size (mm) mobilized at bankfull						15	25	12	20	17		10			
Stream Power (Capacity) W/m <sup>2</sup>															
<b>Additional Reach Parameters</b>															
Drainage Area (SM)	n/a	0.71		See Table 5a		0.46		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>		<1% <sup>1</sup>		<1% <sup>1</sup>	
Rosgen Classification		E4				C/E4		C/E4		E4		C4		C4	
Bankfull Velocity (fps)		3.7				3.7		3.0		2.1		1.7		1.7	
Bankfull Discharge (cfs)		26	33			26		33		15		20		20	
Q-NFF regression															
Q-USGS extrapolation															
Q-Mannings															
Valley Length (ft)		1184				830		548		830		548		548	
Channel Thalweg Length (ft) <sup>2</sup>		1,303				1,038		658		1,038		658		658	
Sinuosity (ft) <sup>3</sup>	1.1		1.25		1.20		1.25		1.20		1.20				
Water Surface Slope (ft/ft) <sup>2</sup>	0.009		0.006		0.004		0.006		0.003		0.003				
Bankfull Slope (ft/ft)			---		---		0.007		0.002		0.002				

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

<sup>2</sup> Channel Length represented does not include easement breaks.

(---): Data was not provided

N/A: Not Applicable

SC: Silt/Clay



**Table 12a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**Norkett Branch Reach 1 and 2**

Dimension	Cross-Section 1, Norkett Branch Reach 1 (Pool)								Cross-Section 2, Norkett Branch Reach 1, (Riffle)								Cross-Section 3, Norkett Branch Reach 1, (Pool)								Cross-Section 4, Norkett Branch Reach 1, (Riffle)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft)	466.1	466.1	466.1	466.1	466.1	466.0	465.7	465.8	465.8	465.8	465.8	465.8	465.6	465.6	464.2	464.2	464.2	464.2	464.2	463.9	464.0	464.3	464.3	464.3	464.3	464.3	464.3	464.3	464.1			
Low Bank Elevation (ft)	466.1	466.1	466.1	466.1	466.1	466.0	465.7	465.8	465.8	465.8	465.8	465.8	465.6	465.6	464.2	464.2	464.2	464.2	464.2	463.9	464.0	464.3	464.3	464.3	464.3	464.3	464.3	464.3	464.1			
Bankfull Width (ft)	33.2	34.1	34.3	29.1	31.3	28.5	27.4	26.6	23.2	23.4	22.8	21.8	21.7	23.1	26.7	29.2	25.8	24.3	24.8	24.0	26.8	25.1	23.1	26.2	22.4	23.4	23.1	23.5				
Floodprone Width (ft)	---	---	---	---	---	---	---	>200	>200	>200	>200	>200	>200	>200	---	---	---	---	---	---	---	>200	>200	>200	>200	>200	>183	>173				
Bankfull Mean Depth (ft)	1.8	2.0	2.0	2.2	2.0	2.0	1.8	1.6	2.0	2.0	1.9	2.0	1.7	1.7	2.3	2.3	2.4	2.7	3.0	2.5	2.6	1.8	2.1	1.9	2.0	1.9	2.0	1.7				
Bankfull Max Depth (ft)	3.6	3.7	3.8	3.7	3.6	3.6	3.3	2.9	3.0	3.0	2.9	2.9	2.7	2.7	3.9	4.4	4.6	5.0	5.6	4.8	5.2	3.3	3.4	3.4	3.3	3.3	3.2	3.1				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	58.4	68.3	68.7	64.3	61.7	58.4	49.1	42.6	45.5	48.0	44.1	42.6	36.7	38.6	60.3	67.5	62.9	64.9	74.4	60.3	69.4	44.6	47.7	48.8	44.0	45.2	45.0	41.0				
Bankfull Width/Depth Ratio	18.9	17.1	17.1	13.2	15.9	13.9	15.3	16.7	11.9	11.4	11.8	11.1	12.8	13.8	11.8	12.7	10.6	9.1	8.2	9.5	10.3	14.1	11.1	14.1	11.4	12.1	11.8	13.4				
Bankfull Entrenchment Ratio	---	---	---	---	---	---	---	>8	>12	>9	>9	>12	>9	>9	---	---	---	---	---	---	---	>8	>9	>8	>9	>9	>8	>7				
Bankfull Bank Height Ratio <sup>1,2</sup>	---	---	---	---	---	---	---	1.0	1.0	1.0	1.0	1.0	0.9	0.9	---	---	---	---	---	---	---	1.0	1.0	1.0	1.0	1.0	1.0	1.0				
Dimension	Cross-Section 5, Norkett Branch Reach 1 (Riffle)								Cross-Section 6, Norkett Branch Reach 2, (Riffle)								Cross-Section 7, Norkett Branch Reach 2, (Riffle)								Cross-Section 8, Norkett Branch Reach 2, (Pool)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3 <sup>3</sup>	MY4	MY5	MY6	MY7
Bankfull Elevation (ft)	461.5	461.5	461.5	461.5	461.5	461.5	461.6	459.9	459.9	459.9	459.9	459.9	459.9	459.9	458.1	458.1	458.1	458.1	458.1	458.1	458.1	457.7	457.7	457.7	457.7	457.7	457.7	457.9	457.9			
Low Bank Elevation (ft)	461.5	461.5	461.5	461.5	461.5	461.5	461.6	459.9	459.9	459.9	459.9	459.9	459.9	459.9	458.1	458.1	458.1	458.1	458.1	458.1	458.1	457.7	457.7	457.7	457.7	457.7	457.7	457.9	457.9			
Bankfull Width (ft)	22.5	23.5	23.3	22.3	24.1	22.8	26.8	25.7	26.0	25.6	25.0	24.3	26.5	25.9	25.6	24.9	25.6	23.2	23.0	24.0	23.8	30.1	26.8	29.1	28.7	30.1	30.8	33.1				
Floodprone Width (ft)	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	>200	---	---	---	---	---	---	---				
Bankfull Mean Depth (ft)	1.7	1.8	1.7	1.7	1.6	1.6	1.4	2.0	2.0	2.1	2.0	2.0	1.8	1.8	1.8	2.0	1.9	1.9	1.9	1.7	1.7	2.4	2.7	2.5	2.5	2.4	2.4	2.2				
Bankfull Max Depth (ft)	2.6	3.0	2.9	2.7	2.9	2.7	2.8	3.3	3.3	3.6	3.2	3.1	3.2	3.0	3.0	3.2	3.1	3.1	3.1	3.1	2.9	4.5	4.4	4.5	4.6	4.7	4.8	4.6				
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	38.8	42.3	40.5	37.4	39.5	36.5	38.4	50.8	52.0	53.4	49.6	48.5	48.5	46.0	46.7	48.7	48.5	44.6	43.3	40.6	40.3	72.5	71.0	73.2	71.5	71.9	72.5	73.3				
Bankfull Width/Depth Ratio	13.1	13.1	13.3	13.2	14.7	14.2	18.7	13.0	13.0	12.3	12.6	12.2	14.5	14.6	14.1	12.7	13.6	12.1	12.3	14.2	14.1	12.5	10.1	11.6	11.5	12.6	13.1	15.0				
Bankfull Entrenchment Ratio	>9	>9	>9	>9	>8	>9	>8	>8	>8	>8	>8	>9	>8	>8	>8	>8	>8	>9	>9	>8	>8	---	---	---	---	---	---	---				
Bankfull Bank Height Ratio <sup>1,2</sup>	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	0.9	1.0	1.0	1.0	1.0	1.0	0.9	0.9	---	---	---	---	---	---	---				

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

<sup>3</sup> MY3 calculations were adjusted on Cross-section 8 because they were found to omit a portion of the bankfull area.

--- : Not Applicable

**Table 12b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019

**UT1 and UT2 Reaches 1 and 2**

Dimension	Cross-Section 9, UT1, (Riffle)								Cross-Section 10, UT1, (Pool)								Cross-Section 11, UT2 Reach 1, (Pool)								Cross-Section 12, UT2 Reach 1, (Riffle)								
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	
Bankfull Elevation (ft)	472.0	472.0	472.0	472.0	472.0	472.0	471.9		471.7	471.7	471.7	471.7	471.7	471.5	471.1		484.1	484.1	484.1	484.1	484.1	484.1	484.0	484.0		484.0	484.0	484.0	484.0	484.0	483.7	483.8	
Low Bank Elevation (ft)	472.0	472.0	472.0	472.0	472.0	472.0	471.9		471.7	471.7	471.7	471.7	471.7	471.7	471.1		484.1	484.1	484.1	484.1	484.1	484.1	484.0	484.0		484.0	484.0	484.0	484.0	484.0	483.7	483.8	
Bankfull Width (ft)	10.5	11.6	11.1	10.2	10.2	9.3	10.9		18.1	15.9	17.3	13.5	11.7	10.4	5.0		10.6	11.1	11.3	12.1	9.1	9.5	7.4		9.4	11.1	9.5	10.8	9.9	7.1	8.4		
Floodprone Width (ft)	136	136	138	131	107	130	126		---	---	---	---	---	---	---		---	---	---	---	---	---	---		144	151	155	147	153	145	147		
Bankfull Mean Depth (ft)	0.4	0.5	0.6	0.4	0.4	0.5	0.4		0.5	0.9	0.9	0.8	1.0	0.9	0.9		0.7	0.8	0.8	0.6	1.0	0.8	0.9		0.5	0.5	0.6	0.4	0.6	0.4	0.4		
Bankfull Max Depth (ft)	0.8	1.1	0.9	0.6	0.9	0.8	0.9		1.8	2.0	2.1	1.9	2.1	1.9	1.5		1.9	2.0	0.8	1.7	1.9	1.7	1.6		1.2	1.1	1.2	1.0	1.1	0.9	0.9		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	4.5	6.2	6.7	4.0	4.4	4.5	4.6		9.8	14.0	12.7	10.3	12.2	9.8	4.4		7.5	9.4	8.8	6.7	9.1	7.5	6.4		4.5	5.6	5.5	3.9	5.8	2.9	3.4		
Bankfull Width/Depth Ratio	24.5	21.7	18.5	25.7	23.6	19.1	25.9		33.3	18.0	23.5	17.7	11.2	11.0	5.8		15.2	13.2	14.6	21.9	9.0	12.0	8.4		19.8	22.0	16.4	29.6	17.1	17.6	20.4		
Bankfull Entrenchment Ratio	13.0	11.7	12.4	12.9	10.6	14.0	11.5		---	---	---	---	---	---	---		---	---	---	---	---	---	---		15.2	13.6	16.3	13.6	15.4	20.3	17.5		
Bankfull Bank Height Ratio <sup>1,2</sup>	1.0	1.0	1.0	1.0	1.0	1.0	1.0		---	---	---	---	---	---	---		---	---	---	---	---	---	---		1.0	1.0	1.0	1.0	1.0	0.8	0.9		
Dimension	Cross-Section 13, UT2 Reach 2, (Riffle)								Cross-Section 14, UT2 Reach 2, (Pool)								Cross-Section 15, UT2 Reach 2, (Riffle)								Cross-Section 16, UT2 Reach 2, (Pool)								
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	
Bankfull Elevation (ft)	477.6	477.6	477.6	477.6	477.6	477.6	477.6		477.5	477.5	477.5	477.5	477.5	477.6	477.4		472.3	472.3	472.3	472.3	472.3	471.9	471.9		472.1	472.1	472.1	472.1	472.1	471.9	471.9		
Low Bank Elevation (ft)	477.6	477.6	477.6	477.6	477.6	477.6	477.6		477.5	477.5	477.5	477.5	477.5	477.6	477.4		472.3	472.3	472.3	472.3	472.3	471.9	471.9		472.1	472.1	472.1	472.1	472.1	472.1	471.9		
Bankfull Width (ft)	9.0	9.5	9.1	8.9	8.2	8.0	8.8		13.9	13.7	14.8	12.9	15.3	12.5	10.3		9.6	10.5	11.5	11.9	11.2	7.6	8.1		9.6	9.4	7.9	9.6	8.6	8.1	9.0		
Floodprone Width (ft)	>200	>200	>200	>200	>200	>200	>200		---	---	---	---	---	---	---		>200	>200	>200	>200	>200	>103 <sup>3</sup>	>108 <sup>3</sup>		---	---	---	---	---	---	---		
Bankfull Mean Depth (ft)	0.6	0.7	0.7	0.6	0.7	0.6	0.6		0.8	1.0	0.8	0.9	0.8	0.9	1.0		0.5	0.7	0.8	0.7	0.8	0.7	0.8		0.7	0.9	1.0	1.0	1.0	0.9	0.8		
Bankfull Max Depth (ft)	1.2	1.2	1.2	1.1	1.0	0.9	1.2		2.1	2.2	2.0	2.0	1.9	2.0	1.8		1.1	1.4	1.3	1.6	1.5	1.1	1.3		1.8	1.9	1.9	2.0	1.9	1.8	1.8		
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	5.3	7.1	6.4	5.6	5.5	4.8	5.6		11.7	14.1	12.0	11.3	11.6	11.7	9.9		5.2	7.6	8.7	8.8	8.7	5.2	6.4		7.0	8.1	8.1	9.2	8.8	7.0	7.5		
Bankfull Width/Depth Ratio	15.3	12.8	13.0	14.1	12.4	13.3	13.8		16.4	13.2	18.2	14.7	20.1	13.4	10.8		17.6	14.5	15.4	15.9	14.5	11.0	10.2		13.3	10.9	7.7	10.1	8.4	8.6	10.7		
Bankfull Entrenchment Ratio	>22	>21	>22	>23	>24	>25	>22		---	---	---	---	---	---	---		>15	>19	>17	>17	>18	>14	>13		---	---	---	---	---	---	---		
Bankfull Bank Height Ratio <sup>1,2</sup>	1.0	1.0	1.0	1.0	1.0	0.9	1.0		---	---	---	---	---	---	---		1.0	1.0	1.0	1.0	1.0	1.1	1.0		---	---	---	---	---	---	---		

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

<sup>3</sup> Entrenchment Ratio (ER) is the floodprone width divided by the bankfull width. ER in MY5 and MY6 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in MY0 - MY4.

---: Not Applicable



**Table 12c. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**UT2 Reaches 3A and 3B**

Dimension	Cross-Section 17, UT2 Reach 3A, (Pool)								Cross-Section 18, UT2 Reach 3A, (Riffle)								Cross-Section 19, UT2 Reach 3B, (Riffle)								Cross-Section 20, UT2 Reach 3B, (Pool)							
	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7	Base	MY1	MY2	MY3	MY4	MY5	MY6	MY7
Bankfull Elevation (ft)	466.9	466.9	466.9	466.9	466.9	466.6	466.9		466.8	466.8	466.8	466.8	466.8	466.4	466.5		461.2	461.2	461.2	461.2	461.2	461.0	461.0		461.2	461.2	461.2	461.2	461.2	461.2	461.2	461.0
Low Bank Elevation (ft)	466.9	466.9	466.9	466.9	466.9	466.9	466.9		466.8	466.8	466.8	466.8	466.8	466.4	466.5		461.2	461.2	461.2	461.2	461.2	461.0	461.0		461.2	461.2	461.2	461.2	461.2	461.2	461.2	461.0
Bankfull Width (ft)	10.5	10.9	11.3	10.1	10.2	10.1	11.7		10.5	11.1	10.1	10.5	10.2	9.1	9.5		13.9	12.6	14.3	13.6	13.2	12.9	11.4		14.7	15.0	15.5	14.5	14.5	14.5	13.9	
Floodprone Width (ft)	---	---	---	---	---	---	---		>200	>200	>200	>200	>200	>200	>200		130	130	146	132	135	143	132		---	---	---	---	---	---	---	
Bankfull Mean Depth (ft)	1.0	1.2	1.1	1.3	1.3	1.1	1.1		0.7	0.7	0.7	0.9	0.9	0.6	0.7		0.8	1.2	1.0	0.9	1.0	0.9	1.0		1.4	1.5	1.5	1.5	1.5	1.5	1.2	
Bankfull Max Depth (ft)	2.0	2.0	2.2	2.1	2.3	1.9	2.1		1.2	1.3	1.4	1.5	1.5	1.1	1.2		1.6	1.8	1.8	1.7	1.6	1.7	1.6		2.6	2.7	2.7	2.8	2.6	2.6	2.4	
Bankfull Cross-Sectional Area (ft <sup>2</sup> )	10.7	12.9	12.1	13.0	13.7	10.7	13.4		7.2	7.6	7.6	9.3	9.5	5.7	6.5		11.8	14.9	14.3	12.6	12.6	11.4	10.9		21.2	22.7	23.0	21.3	21.5	21.2	17.2	
Bankfull Width/Depth Ratio	10.2	9.2	10.5	7.8	7.6	9.5	10.2		15.3	16.2	13.6	11.9	11.1	14.7	13.9		16.5	10.6	14.4	14.7	13.7	14.6	11.8		10.2	9.9	10.4	9.8	9.8	10.0	11.3	
Bankfull Entrenchment Ratio	---	---	---	---	---	---	---		>19	>18	>9	>19	>16	>22	>21		9.3	10.3	10.2	9.7	10.3	11.0	11.6		---	---	---	---	---	---	---	
Bankfull Bank Height Ratio <sup>1,2</sup>	---	---	---	---	---	---	---		1.0	1.0	1.0	1.0	1.0	0.9	0.9		1.0	1.0	1.0	1.0	1.0	1.0	1.0		---	---	---	---	---	---	---	

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

---: Not Applicable

**Table 13a. Monitoring Data - Stream Reach Data Summary**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**Norkett Branch Reach 1**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	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	22.3	22.8	21.8	24.1	21.7	23.1	23.1	26.8		
Floodprone Width (ft)	>200		>200		>200		>200		>200		>183	>200	>173	>200		
Bankfull Mean Depth	1.6	1.8	1.8	2.1	1.7	2.0	1.7	2.0	1.6	2.0	1.6	2.0	1.4	1.7		
Bankfull Max Depth	2.6	3.3	3.0	3.4	2.9	3.4	2.7	3.3	2.9	3.3	2.7	3.2	2.7	3.1		
Bankfull Cross-sectional Area (ft <sup>2</sup> )	38.8	44.6	42.3	47.7	40.5	48.8	37.4	44.1	39.5	45.2	36.5	45.0	38.4	41.0		
Width/Depth Ratio	13.1	16.7	11.1	13.1	11.4	14.1	11.4	13.2	11.1	14.7	11.8	14.2	13.4	18.7		
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2		>2.2		>2.2			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		0.9	1.0	0.9	1.0		
D50 (mm)	18.4	59.6	13.3	26.9	24.7	90.0	20.9	51.8	4.0	34.3	Silt/Clay	68.0	9.7	37.9		
<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		C4		C4		C5		C4			
Channel Thalweg Length (ft)	2,369															
Sinuosity (ft)	1.24															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.003															
Ri%/Ru%/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		SC/0.79/18.4/132.0/214.7/>2048		SC/6.40/11.8/39.8/89.6/180		SC/SC/1.0/56.9/119.3/180		0.3/5.7/9.7/44.7/95.2/128.0			
% of Reach with Eroding Banks			6%		0%		6%		3%		2%		0%			

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5- MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.



**Table 13b. Monitoring Data - Stream Reach Data Summary**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**Norkett Branch Reach 2**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	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	23.2	25.0	23.0	24.3	24.0	26.5	23.8	25.9		
Floodprone Width (ft)	>200		>200		>200		>200		>200		>200		>200			
Bankfull Mean Depth	1.8	2.0	2.0	2.0	1.9	2.1	1.9	2.0	1.9	2.0	1.7	1.8	1.7	1.8		
Bankfull Max Depth	3.0	3.3	3.2	3.3	3.1	3.6	3.1	3.2	3.1	3.1	3.2	3.0	2.9	3.0		
Bankfull Cross-sectional Area (ft <sup>2</sup> )	46.7	50.8	48.7	52.0	48.5	53.4	44.6	49.6	43.3	48.5	40.6	48.5	40.3	46.0		
Width/Depth Ratio	13.0	14.1	12.7	13.0	12.3	13.6	12.1	12.6	12.2	12.3	14.2	14.5	14.1	14.6		
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2		>2.2		>2.2			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		0.9	1.0	0.9			
D50 (mm)	7.3	9.9	3.6	12.1	1.0	27.8	4.4	11.0	1.7	5.6	1.7	16.0	11.2	20.0		
<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		C4/E4		C4/E4		C5/E5		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															
Ri%/Ru%/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		SC/6.7/17.6/52.6/101.2/256.0		SC/2.95/11.9/56.9/90.8/180		SC/SC/0.6/64/151.8/>2048		SC/6.7/14.9/49.1/81.6/362			
% of Reach with Eroding Banks			7%		5%		12%		2%		1%		0%			

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

**Table 13c. Monitoring Data - Stream Reach Data Summary**

Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019

**UT1**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	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		10.2		10.2		9.3		10.9			
Floodprone Width (ft)	136		136		138		131		107		130		126			
Bankfull Mean Depth	0.4		0.5		0.6		0.4		0.4		0.5		0.4			
Bankfull Max Depth	0.8		1.1		0.9		0.6		0.9		0.8		0.9			
Bankfull Cross-sectional Area (ft <sup>2</sup> )	4.5		6.2		6.7		4.0		4.4		4.5		4.6			
Width/Depth Ratio	24.5		21.7		18.5		20.8		23.6		19.1		25.9			
Entrenchment Ratio	13.0		11.7		12.4		14.4		10.6		14		11.5			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		1.0		1.0			
D50 (mm)	20.9		48.3		21.9		68.2		8.3		34.5		19.3			
<b>Profile</b>																
Riffle Length (ft)	7	39														
Riffle Slope (ft/ft)	0.007	0.044														
Pool Length (ft)	12	69														
Pool Max Depth (ft)	1.2	2.5														
Pool Spacing (ft)	30	58														
Pool Volume (ft <sup>3</sup> )																
<b>Pattern</b>																
Channel Beltwidth (ft)	13	49														
Radius of Curvature (ft)	14	23														
Rc:Bankfull Width (ft/ft)	1.3	2.2														
Meander Wave Length (ft)	61	88														
Meander Width Ratio	1.2	4.7														
<b>Additional Reach Parameters</b>																
Rosgen Classification	C4		C4		C4		C4		C4		C6		C4			
Channel Thalweg Length (ft)	1,198															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.011															
Bankfull Slope (ft/ft)	0.011															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	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		SC/SC/5.6/49.8/107.3/>2048		SC/1.04/8.3/69.2/143/256		SC/SC/SC/61.5/101.2/180		SC/0.5/12.2/43.6/90.0/256.0			
% of Reach with Eroding Banks			0%		0%		0%		0%		0%		0%			

<sup>1</sup> Prior to MYS, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MYS– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.



**Table 13d. Monitoring Data - Stream Reach Data Summary**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

**UT2 Reach 1**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
<b>Dimension and Substrate - Riffle</b>																
Bankfull Width (ft)	9.4		11.1		9.5		10.8		9.9		7.1		8.4			
Floodprone Width (ft)	144		151		155		147		152.9		144.7		147.3			
Bankfull Mean Depth	0.5		0.5		0.6		0.4		0.6		0.4		0.4			
Bankfull Max Depth	1.2		1.1		1.2		1.0		1.1		0.9		0.9			
Bankfull Cross-sectional Area (ft <sup>2</sup> )	4.5		5.6		5.5		3.9		5.8		2.9		3.4			
Width/Depth Ratio	19.8		22.0		16.4		29.6		17.1		17.6		20.4			
Entrenchment Ratio	15.2		13.6		16.3		13.6		15.4		20.3		17.5			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		0.8		0.9			
D50 (mm)	19.5		32.0		37.9		49.8		53.7		39.4		42.9			
<b>Profile</b>																
Riffle Length (ft)	7	34														
Riffle Slope (ft/ft)	0.006	0.037														
Pool Length (ft)	11	35														
Pool Max Depth (ft)	1.5	2.6														
Pool Spacing (ft)	21	64														
Pool Volume (ft <sup>3</sup> )																
<b>Pattern</b>																
Channel Beltwidth (ft)	10	42														
Radius of Curvature (ft)	15	21														
Rc:Bankfull Width (ft/ft)	1.6	2.2														
Meander Wave Length (ft)	45	92														
Meander Width Ratio	1.0	4.4														
<b>Additional Reach Parameters</b>																
Rosgen Classification	C4		C4		C4		C4		C4		C6		C5			
Channel Thalweg Length (ft)	1,039															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.006															
Bankfull Slope (ft/ft)	0.006															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	SC/7.1/12.2/28.5/42.9/90		SC/12/20.6/58.1/111.2/256		SC/5.6/16.7/57.4/107.3/362		SC/0.25/12.9/69.7/120.7/362.0		SC/SC/SC/52.8/96.6/180		SC/SC/SC/45/103.6/180		SC/SC/1.3/62.0/95.4/128.0			
% of Reach with Eroding Banks			0%		0%		0%		0%		0%		0%			

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

**Table 13e. Monitoring Data - Stream Reach Data Summary**

Norkett Branch Stream Mitigation Site  
DMS Project No. 95360

Monitoring Year 6 - 2019

**UT2 Reach 2**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	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	8.9	11.9	8.2	11.2	7.6	8.0	8.1	8.8		
Floodprone Width (ft)	>200		>200		>200		>200		>200		>103 <sup>3</sup>	>200	>108 <sup>3</sup>	>200		
Bankfull Mean Depth	0.5	0.6	0.7	0.7	0.7	0.8	0.6	0.7	0.7	0.8	0.6	0.7	0.6	0.8		
Bankfull Max Depth	1.1	1.2	1.2	1.4	1.2	1.3	1.1	1.6	1.0	1.5	0.9	1.1	1.2	1.3		
Bankfull Cross-sectional Area (ft <sup>2</sup> )	5.2	5.3	7.1	7.6	6.4	8.7	5.6	8.8	5.5	8.7	4.8	5.2	5.6	6.4		
Width/Depth Ratio	15.3	17.6	12.8	14.5	13.0	15.4	14.1	15.9	12.4	14.5	11.0	13.3	10.2	13.8		
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2		>2.2		>2.2			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		0.9	1.1	1.0			
D50 (mm)	20.1	27.4	41.3	50.6	39.0	39.3	35.4	51.4	53.7	68.5	49.3	69.0	54.1	68.0		
<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		C4		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															
Ri%/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		SC/SC/SC/73.4/118.9/180.0		SC/SC/12.5/71.7/112.2/180		SC/SC/13.3/67.2/120.7/180		SC/0.56/10.6/66.6/99.8/128.0			
% of Reach with Eroding Banks			0%		0%		0%		0%		0%		0%			

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

<sup>3</sup> Entrenchment Ratio (ER) is the floodprone width divided by the bankfull width. ER in MY5 and MY6 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in MY0 - MY4.



**Table 13f. Monitoring Data - Stream Reach Data Summary**

Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019

**UTZ Reach 3A**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	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		10.5		10.2		9.1		9.5			
Floodprone Width (ft)	>200		>200		>200		>200		>200		>200		>200			
Bankfull Mean Depth	0.7		0.7		0.7		0.9		0.9		0.6		0.7			
Bankfull Max Depth	1.2		1.3		1.4		1.5		1.5		1.1		1.2			
Bankfull Cross-sectional Area (ft <sup>2</sup> )	7.2		7.6		7.6		9.3		9.5		5.7		6.5			
Width/Depth Ratio	15.3		16.2		13.6		11.9		11.1		14.7		13.9			
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		>2.2		>2.2		>2.2			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		0.9		0.9			
D50 (mm)	32.0		45.0		25.7		40.8		53.7		28.6		41.0			
<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		C4			
Channel Thalweg Length (ft)	658															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.002															
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100	22.6/27.4/32/53.7/69.7/128		16.0/30.3/41.5/87.0/202.4/362.0		6.7/24.8/40.6/116.3/173.3/1024		12.8/27.8/41.3/85.7/128.0/180.0		SC/11/42.5/112.6/>2048/>2048		SC/14.9/28.6/62.6/90/180		2.0/30.4/43.1/96.6/90.0/180			
% of Reach with Eroding Banks			0%		0%		0%		0%		0%		0%			

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.

**Table 13g. Monitoring Data - Stream Reach Data Summary**  
 Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019

ZZZZZ

**UT2 Reach 3B**

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	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		13.6		13.2		12.9		11.4			
Floodprone Width (ft)	130		130		146		132		135		143		132			
Bankfull Mean Depth	0.8		1.2		1.0		0.9		1		0.9		1.0			
Bankfull Max Depth	1.6		1.8		1.8		1.7		1.6		1.7		1.6			
Bankfull Cross-sectional Area (ft <sup>2</sup> )	11.8		14.9		14.3		12.6		13.2		11.4		10.9			
Width/Depth Ratio	16.5		10.6		14.4		14.7		13.7		14.6		11.8			
Entrenchment Ratio	9.3		10.3		10.2		9.7		10.3		11		11.6			
Bank Height Ratio <sup>1,2</sup>	1.0		1.0		1.0		1.0		1.0		1.0		1.0			
D50 (mm)	33.4		30.6		68.5		48.3		45		24.2		36			
<b>Profile</b>																
Riffle Length (ft)	13	28														
Riffle Slope (ft/ft)	0.001	0.024														
Pool Length (ft)	32	45														
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	61														
Radius of Curvature (ft)	24	31														
Rc:Bankfull Width (ft/ft)	1.7	2.2														
Meander Wave Length (ft)	87	105														
Meander Width Ratio	1.4	4.4														
<b>Additional Reach Parameters</b>																
Rosgen Classification	C4		C4		C4		C4		C4		C6		C4			
Channel Thalweg Length (ft)	658															
Sinuosity (ft)	1.20															
Water Surface Slope (ft/ft)	0.003															
Bankfull Slope (ft/ft)	0.002															
Ri%/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		SC/0.7/12.7/71.7/128/362		SC/SC/SC/60.4/107.3/180		SC/6.12/19/82.6/151.8/>2048		SC/SC/SC/90/151.8/>2048		SC/11.9/24.9/53.7/107.3/180			
% of Reach with Eroding Banks			3%		0%		0%		0%		0%		0%			

<sup>1</sup> Prior to MY5, bankfull dimensions were calculated using a fixed bankfull elevation.

<sup>2</sup> MY5– MY6 Bank Height Ratio are calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current year's low bank height.



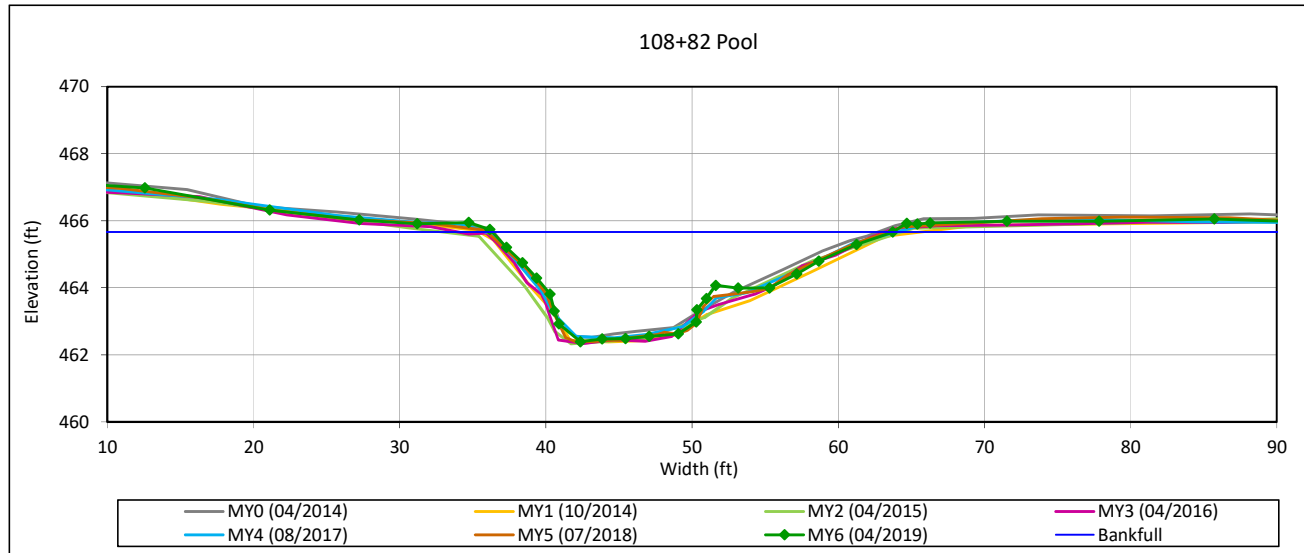
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

#### Cross-Section 1-Norkett Branch Reach 1



#### Bankfull Dimensions

- 49.1 x-section area (ft.sq.)
- 27.4 width (ft)
- 1.8 mean depth (ft)
- 3.3 max depth (ft)
- 29.1 wetted perimeter (ft)
- 1.7 hyd radi (ft)
- 15.3 width-depth ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

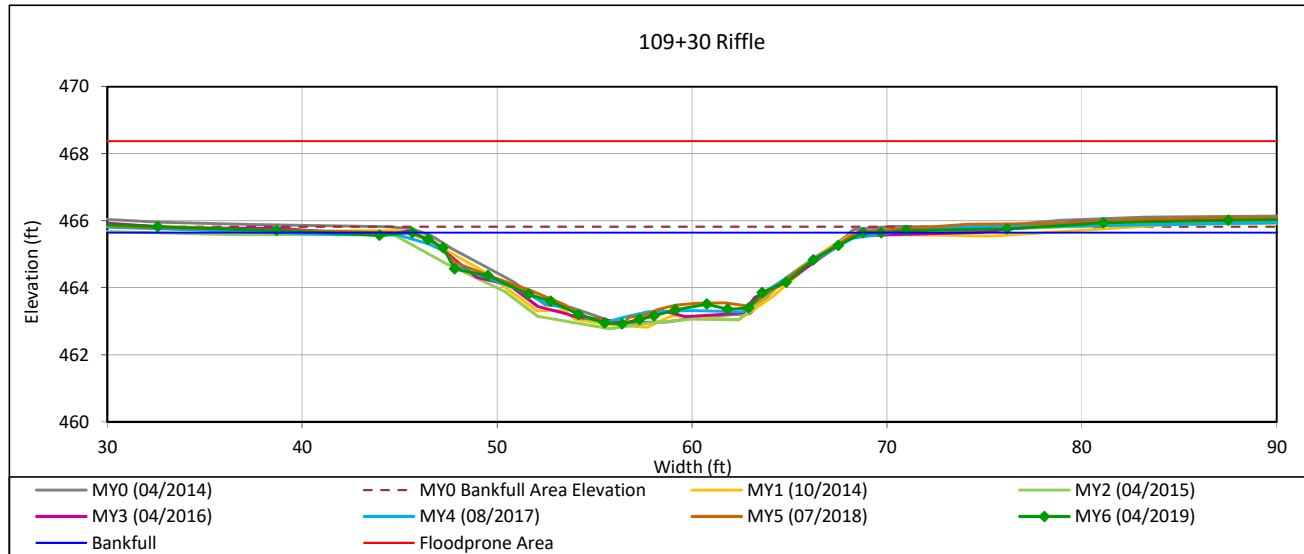
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

38.6	x-section area (ft.sq.)
23.1	width (ft)
1.7	mean depth (ft)
2.7	max depth (ft)
24.1	wetted perimeter (ft)
1.6	hyd radi (ft)
13.8	width-depth ratio
>200	W flood prone area (ft)
>8.7	entrenchment ratio
0.9	low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream



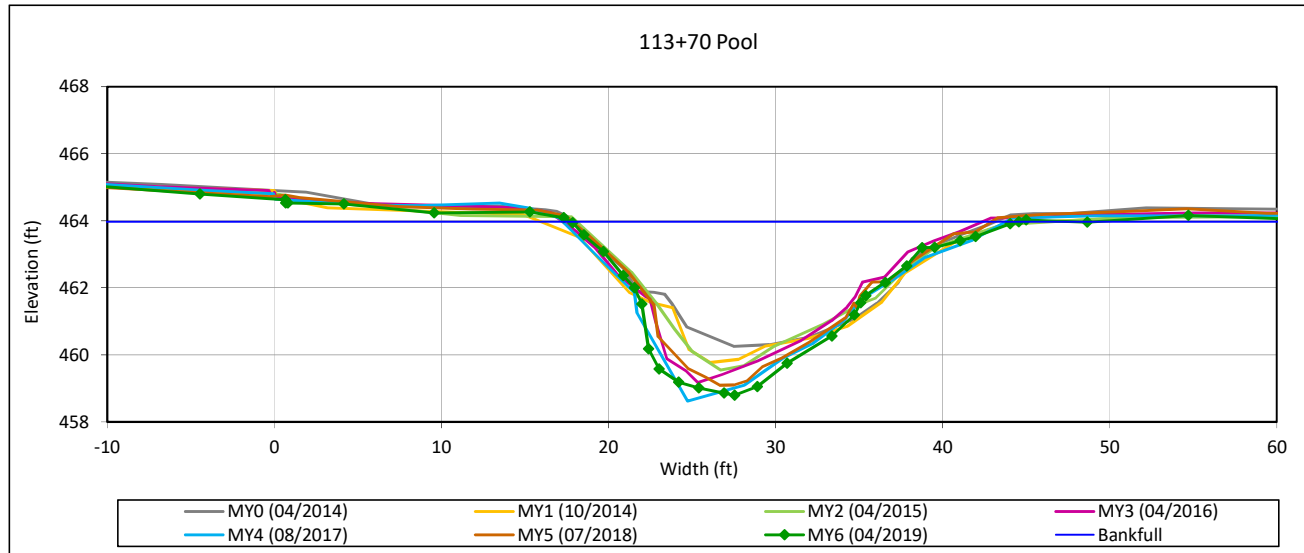
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

69.4 x-section area (ft.sq.)  
26.8 width (ft)  
2.6 mean depth (ft)  
5.2 max depth (ft)  
29.8 wetted perimeter (ft)  
2.3 hyd radi (ft)  
10.3 width-depth ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

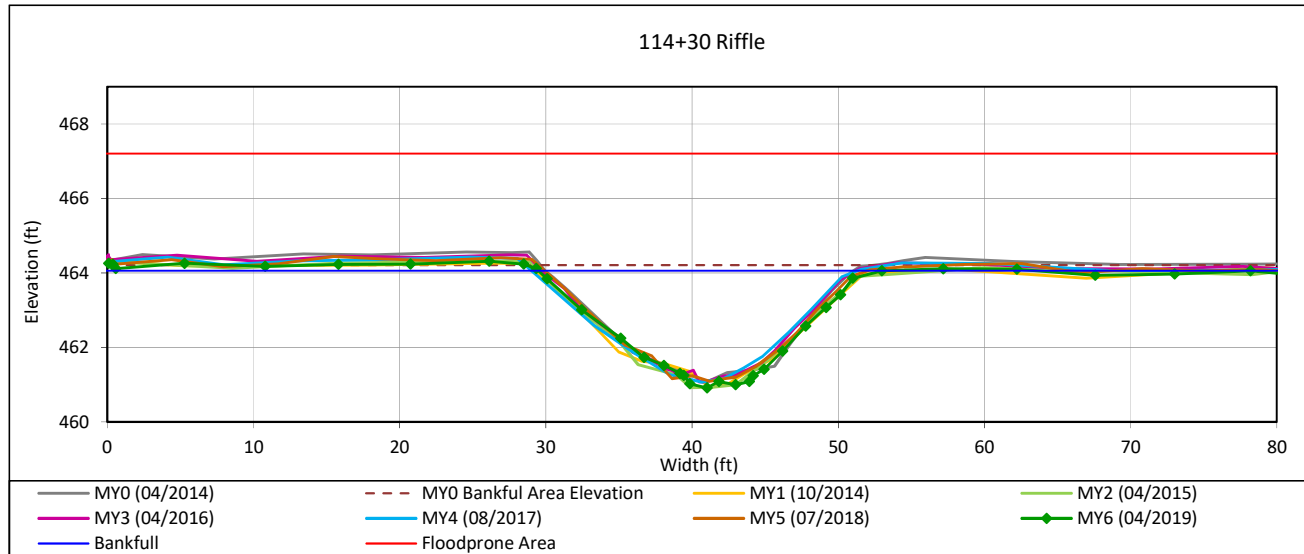
**Cross-Section Plots**

Norkett Branch Mitigation Site

DMS Project No. 95360

**Monitoring Year 6 - 2019**

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



**Bankfull Dimensions**

- 41.0 x-section area (ft.sq.)
- 23.5 width (ft)
- 1.7 mean depth (ft)
- 3.1 max depth (ft)
- 24.5 wetted parimeter (ft)
- 1.7 hyd radi (ft)
- 13.4 width-depth ratio
- >173 W flood prone area (ft)
- >7.4 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream



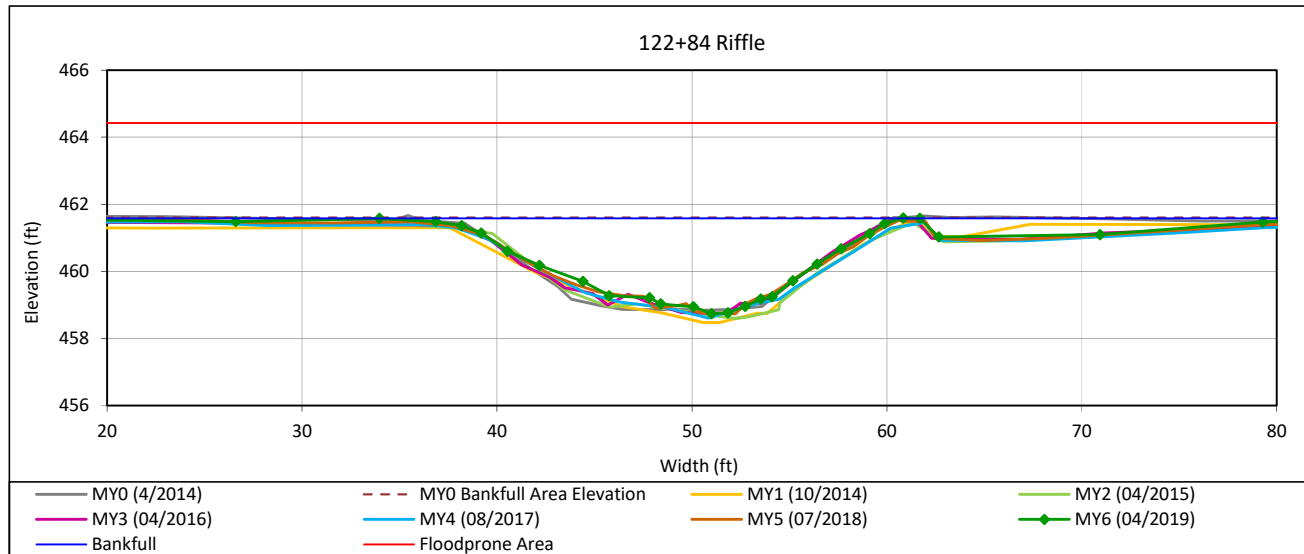
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

38.4	x-section area (ft.sq.)
26.8	width (ft)
1.4	mean depth (ft)
2.8	max depth (ft)
27.7	wetted perimeter (ft)
1.4	hyd radi (ft)
18.7	width-depth ratio
>200	W flood prone area (ft)
>8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

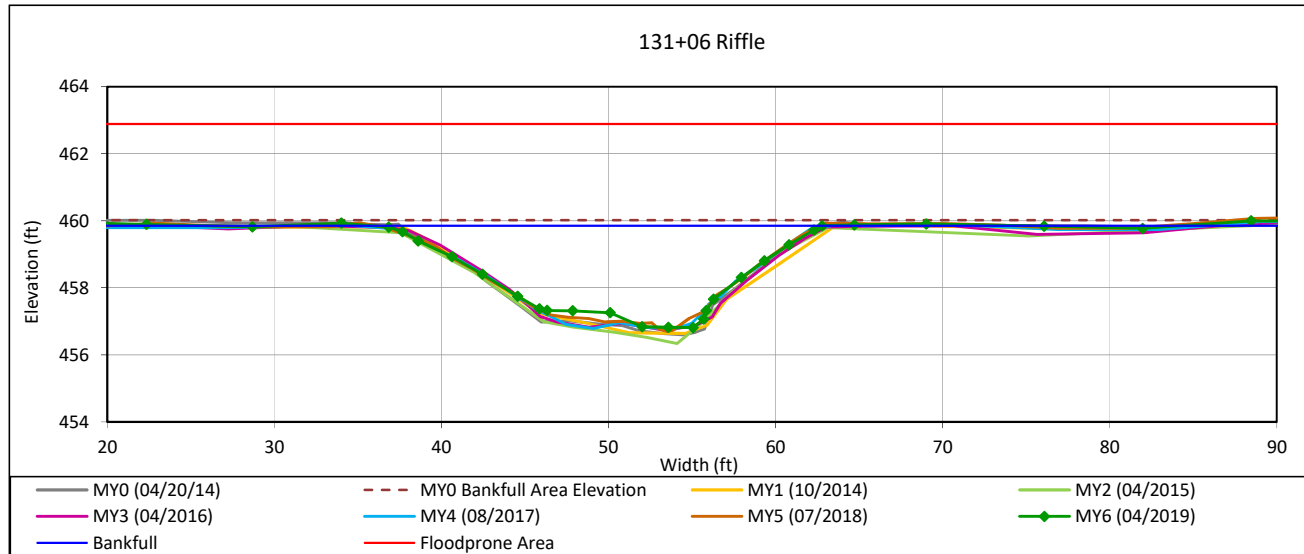
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

46.0	x-section area (ft.sq.)
25.9	width (ft)
1.8	mean depth (ft)
3.0	max depth (ft)
27.0	wetted parimeter (ft)
1.7	hyd radi (ft)
14.6	width-depth ratio
>200	W flood prone area (ft)
>8	entrenchment ratio
0.9	low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream



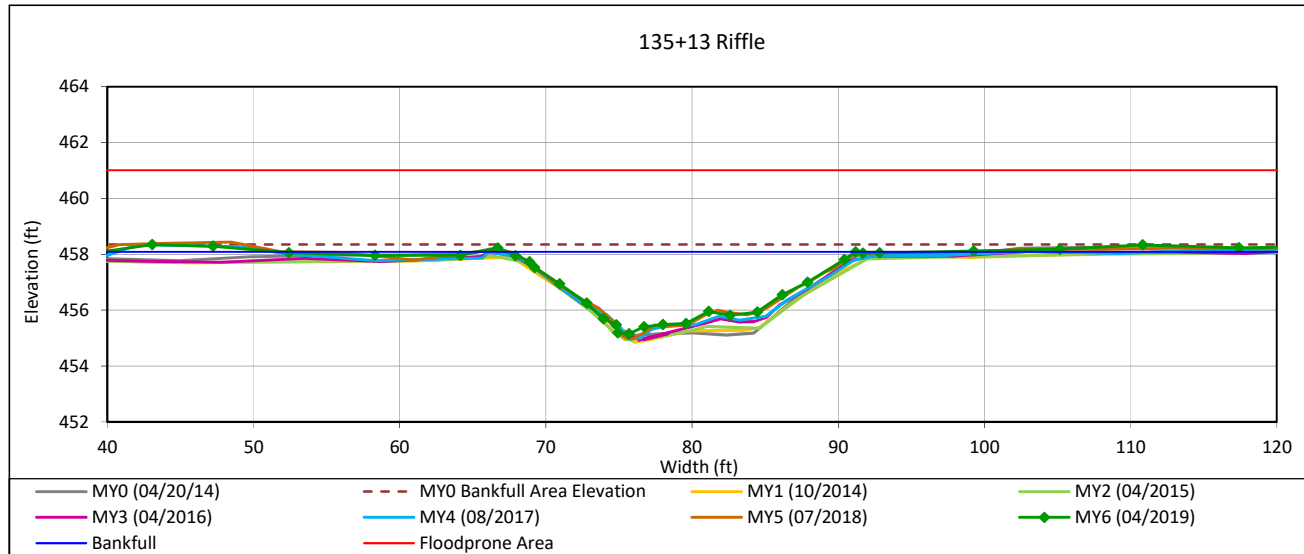
**Cross-Section Plots**

Norkett Branch Mitigation Site

DMS Project No. 95360

**Monitoring Year 6 - 2019**

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



- Bankfull Dimensions**
- 40.3 x-section area (ft.sq.)
  - 23.8 width (ft)
  - 1.7 mean depth (ft)
  - 2.9 max depth (ft)
  - 24.9 wetted parimeter (ft)
  - 1.6 hyd radi (ft)
  - 14.1 width-depth ratio
  - >200 W flood prone area (ft)
  - >8 entrenchment ratio
  - 0.9 low bank height ratio

Survey Date: 04/2019  
Field Crew: Wildlands Engineering



View Downstream

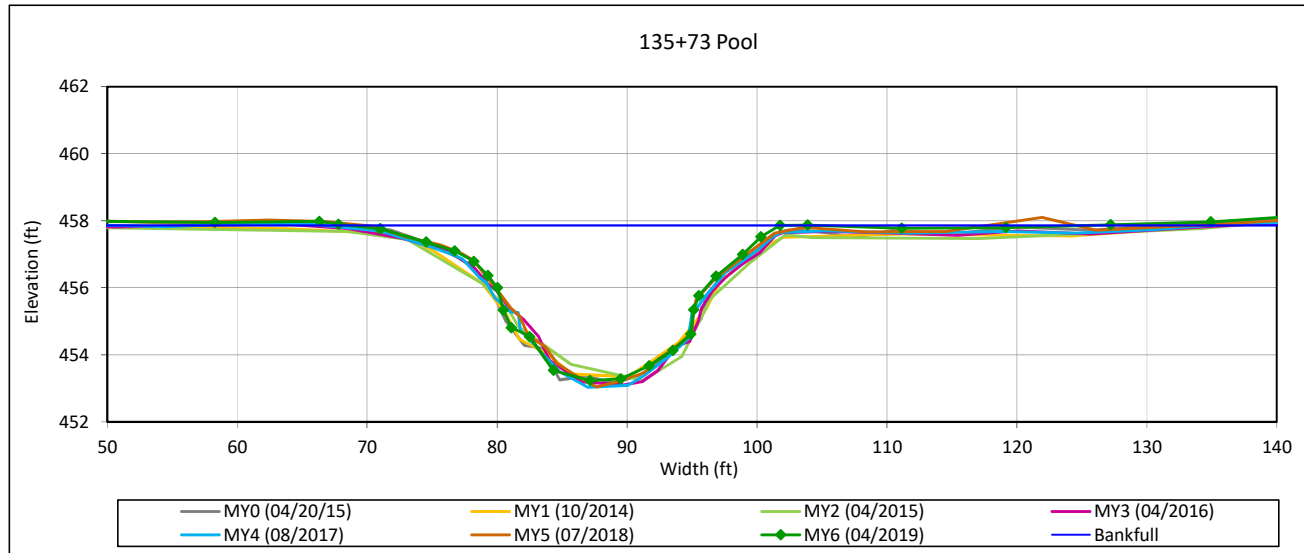
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

73.3 x-section area (ft.sq.)  
33.1 width (ft)  
2.2 mean depth (ft)  
4.6 max depth (ft)  
35.4 wetted perimeter (ft)  
2.1 hyd radi (ft)  
15.0 width-depth ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

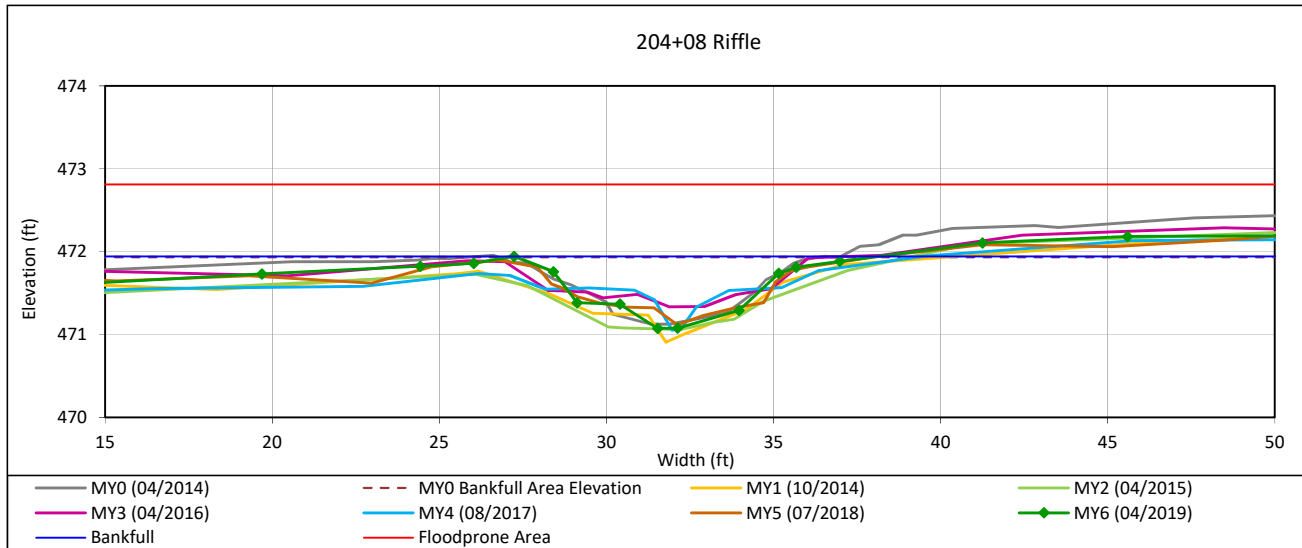


### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

Monitoring Year 6 - 2019

#### Cross-Section 9-UT1



#### Bankfull Dimensions

4.6	x-section area (ft.sq.)
10.9	width (ft)
0.4	mean depth (ft)
0.9	max depth (ft)
11.2	wetted perimeter (ft)
0.4	hyd radi (ft)
25.9	width-depth ratio
126.1	W flood prone area (ft)
11.5	entrenchment ratio
1.0	low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



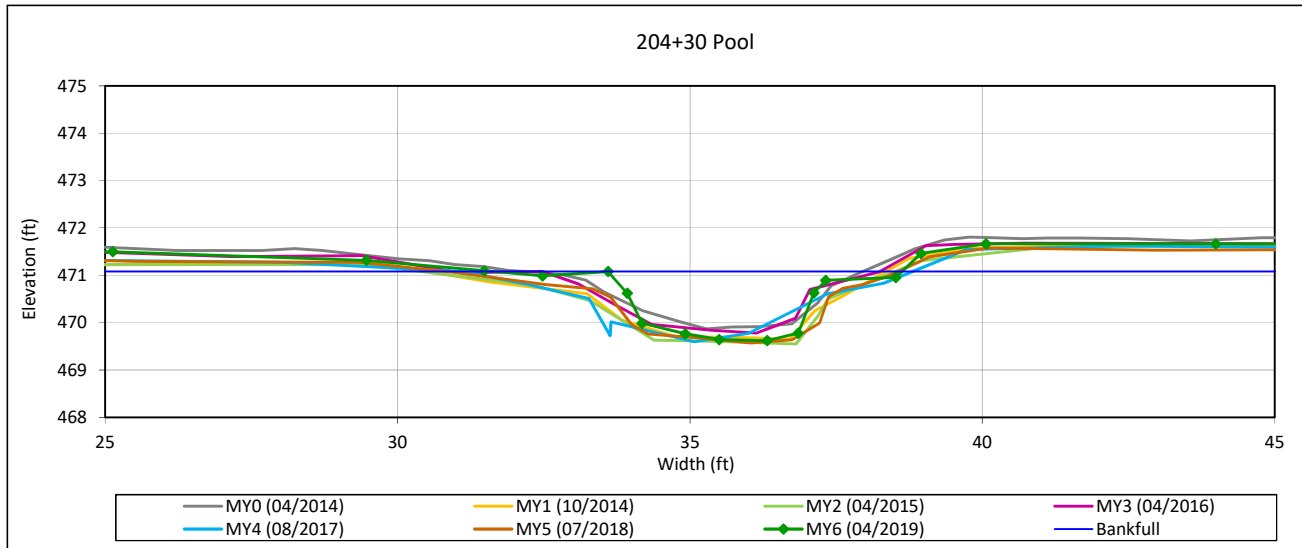
View Downstream

### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

**Monitoring Year 6 - 2019**

#### Cross-Section 10-UT1



#### Bankfull Dimensions

- 4.4 x-section area (ft.sq.)
- 5.0 width (ft)
- 0.9 mean depth (ft)
- 1.5 max depth (ft)
- 6.6 wetted perimeter (ft)
- 0.7 hyd radi (ft)
- 5.8 width-depth ratio

Survey Date: 04/2019  
Field Crew: Wildlands Engineering



View Downstream

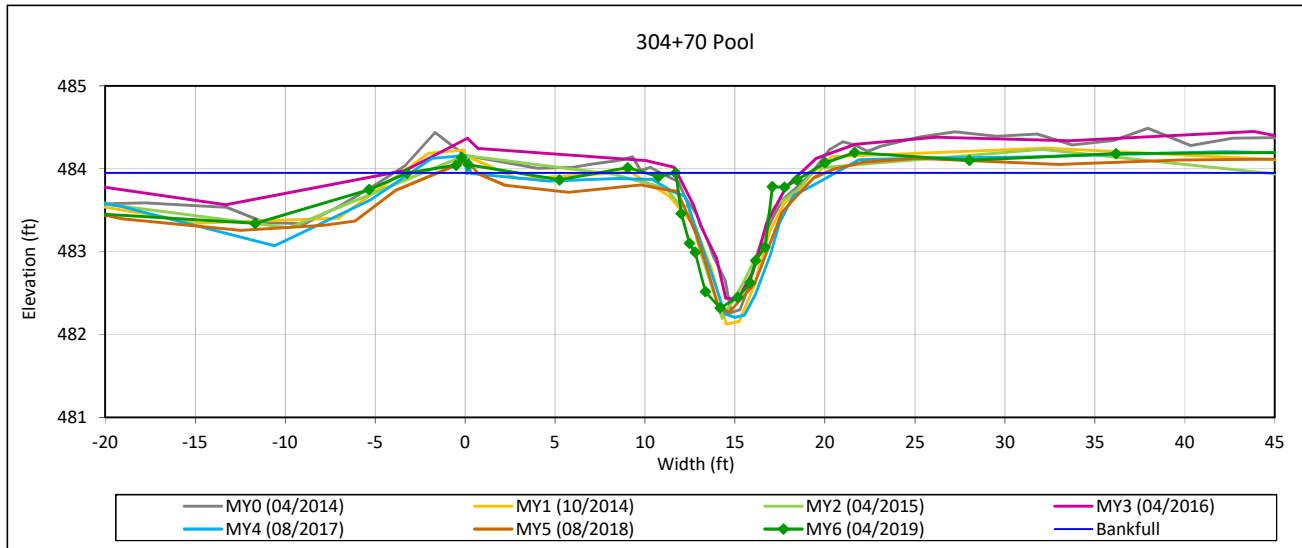


### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

**Monitoring Year 6 - 2019**

#### Cross-Section 11-UT2 Reach 1



#### Bankfull Dimensions

- 6.4 x-section area (ft.sq.)
- 7.4 width (ft)
- 0.9 mean depth (ft)
- 1.6 max depth (ft)
- 8.6 wetted perimeter (ft)
- 0.8 hyd radi (ft)
- 8.4 width-depth ratio

Survey Date: 04/2019  
Field Crew: Wildlands Engineering



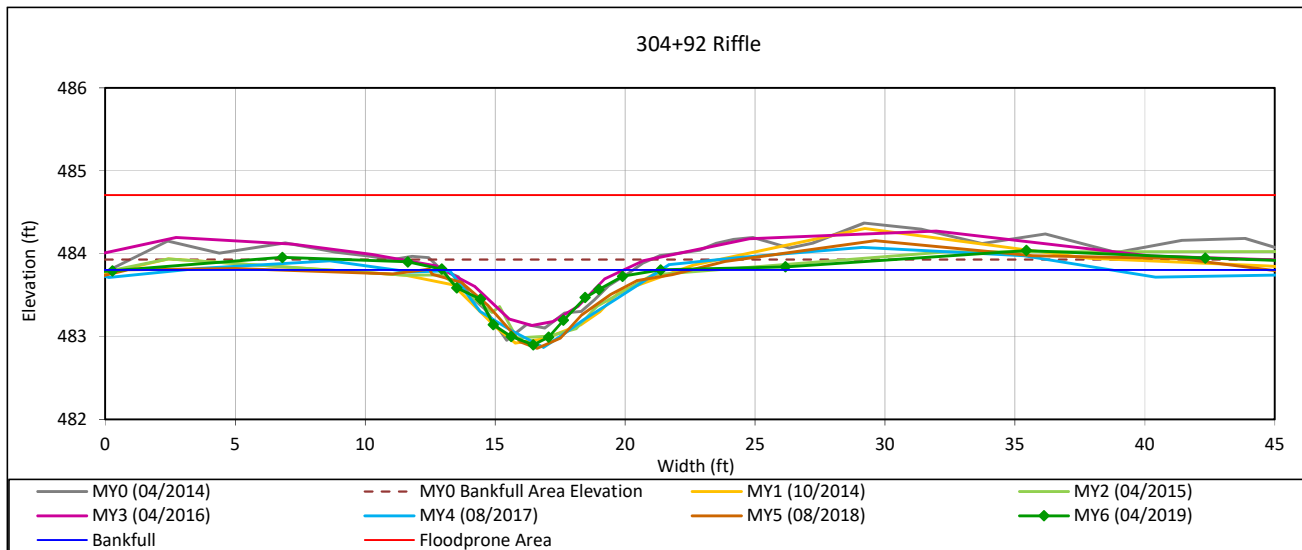
View Downstream

### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

Monitoring Year 6 - 2019

#### Cross-Section 12-UT2 Reach 1



#### Bankfull Dimensions

- 3.4 x-section area (ft.sq.)
- 8.4 width (ft)
- 0.4 mean depth (ft)
- 0.9 max depth (ft)
- 8.7 wetted perimeter (ft)
- 0.4 hyd radi (ft)
- 20.4 width-depth ratio
- 147.3 W flood prone area (ft)
- 17.5 entrenchment ratio
- 0.9 low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

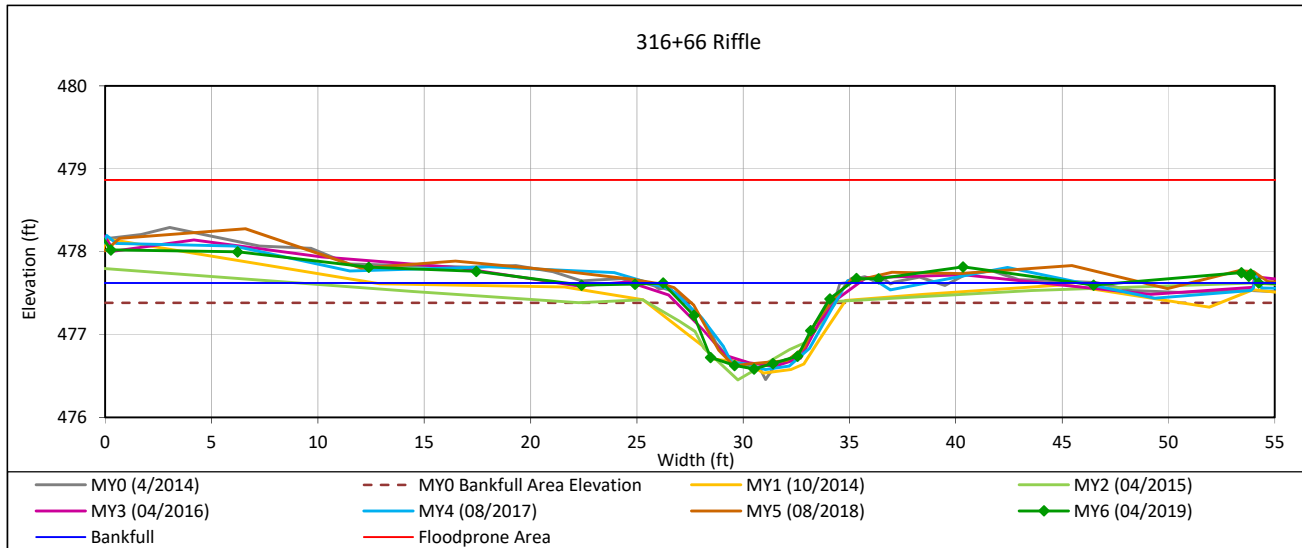


### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

Monitoring Year 6 - 2019

#### Cross-Section 13-UT2 Reach 2



#### Bankfull Dimensions

- 5.6 x-section area (ft.sq.)
- 8.8 width (ft)
- 0.6 mean depth (ft)
- 1.2 max depth (ft)
- 9.2 wetted perimeter (ft)
- 0.6 hyd radi (ft)
- 13.8 width-depth ratio
- >200 W flood prone area (ft)
- >22.7 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



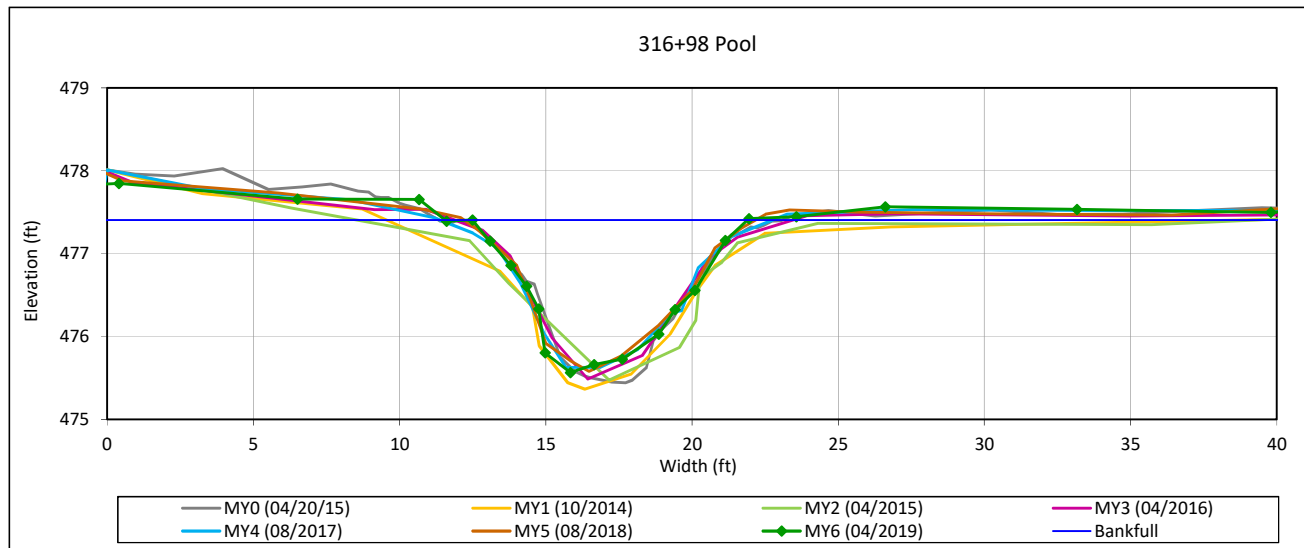
View Downstream

### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

Monitoring Year 6 - 2019

#### Cross-Section 14-UT2 Reach 2



#### Bankfull Dimensions

- 9.9 x-section area (ft.sq.)
- 10.3 width (ft)
- 1.0 mean depth (ft)
- 1.8 max depth (ft)
- 11.3 wetted perimeter (ft)
- 0.9 hyd radi (ft)
- 10.8 width-depth ratio



Survey Date: 04/2019  
Field Crew: Wildlands Engineering

View Downstream

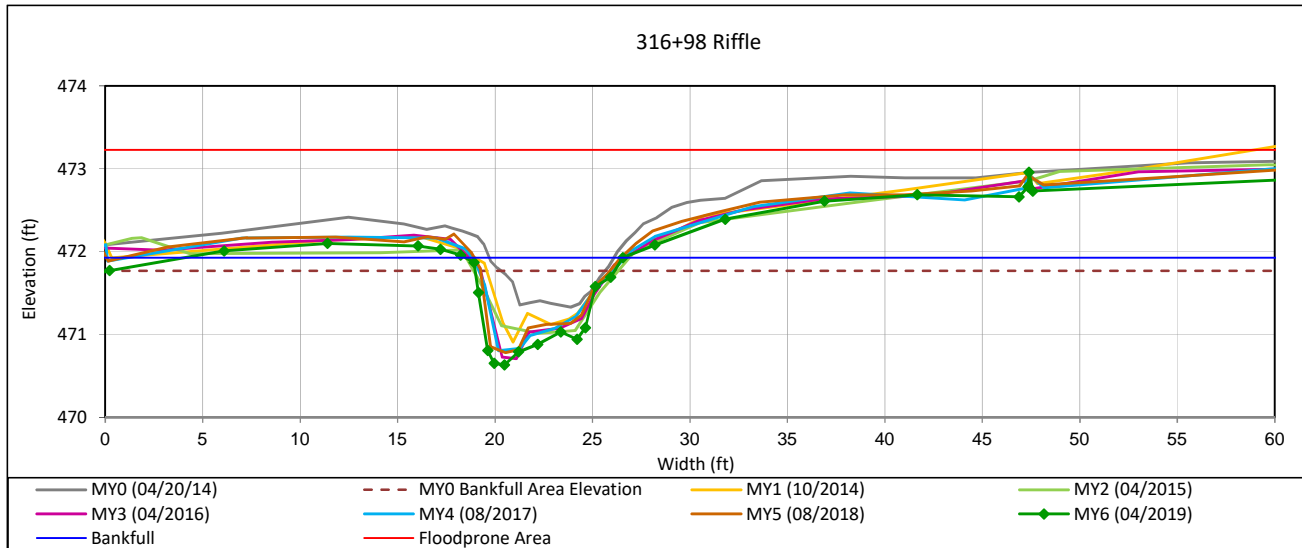


### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

**Monitoring Year 6 - 2019**

#### Cross-Section 15-UT2 Reach 2



#### Bankfull Dimensions

- 6.4 x-section area (ft.sq.)
- 8.1 width (ft)
- 0.8 mean depth (ft)
- 1.3 max depth (ft)
- 9.0 wetted perimeter (ft)
- 0.7 hyd radi (ft)
- 10.2 width-depth ratio
- >108 W flood prone area (ft)
- >13.3 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



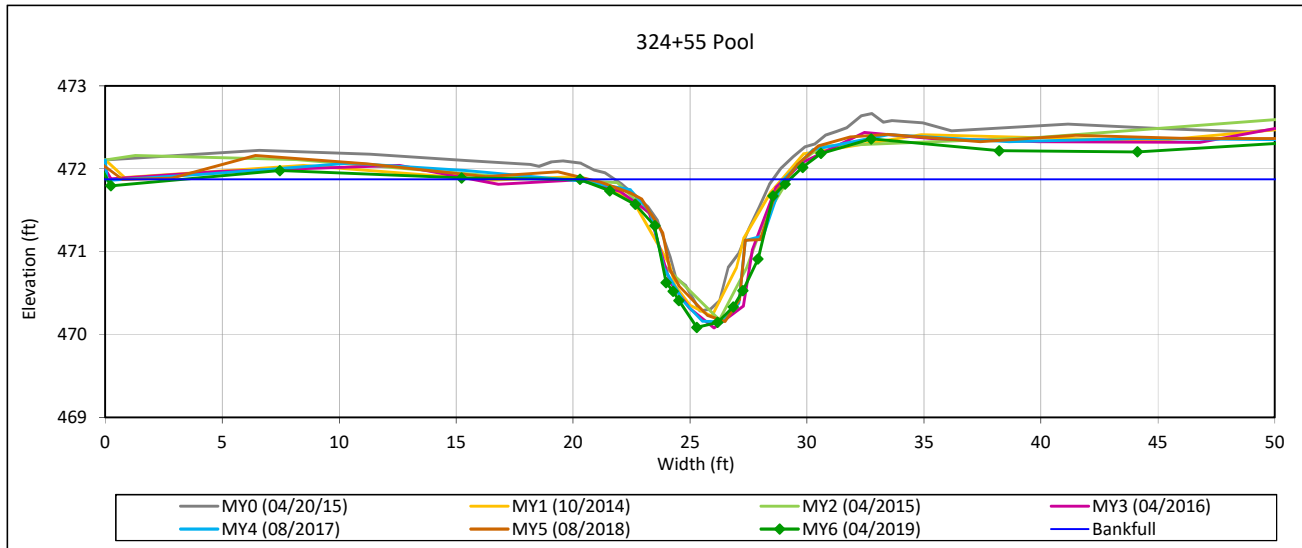
View Downstream

### Cross-Section Plots

Norkett Branch Mitigation Site  
DMS Project No. 95360

**Monitoring Year 6 - 2019**

#### Cross-Section 16-UT2 Reach 2



#### Bankfull Dimensions

- 7.5 x-section area (ft.sq.)
- 9.0 width (ft)
- 0.8 mean depth (ft)
- 1.8 max depth (ft)
- 10.1 wetted perimeter (ft)
- 0.7 hyd radi (ft)
- 10.7 width-depth ratio

Survey Date: 04/2019  
Field Crew: Wildlands Engineering



View Downstream



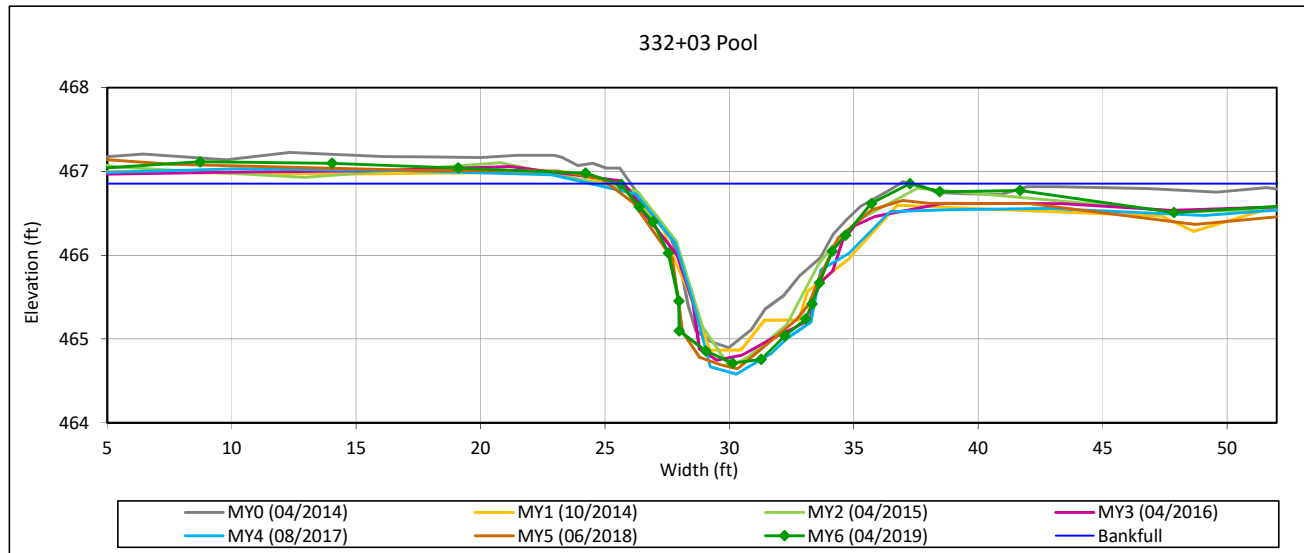
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

- 13.4 x-section area (ft.sq.)
- 11.7 width (ft)
- 1.1 mean depth (ft)
- 2.1 max depth (ft)
- 13.0 wetted perimeter (ft)
- 1.0 hyd radi (ft)
- 10.2 width-depth ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

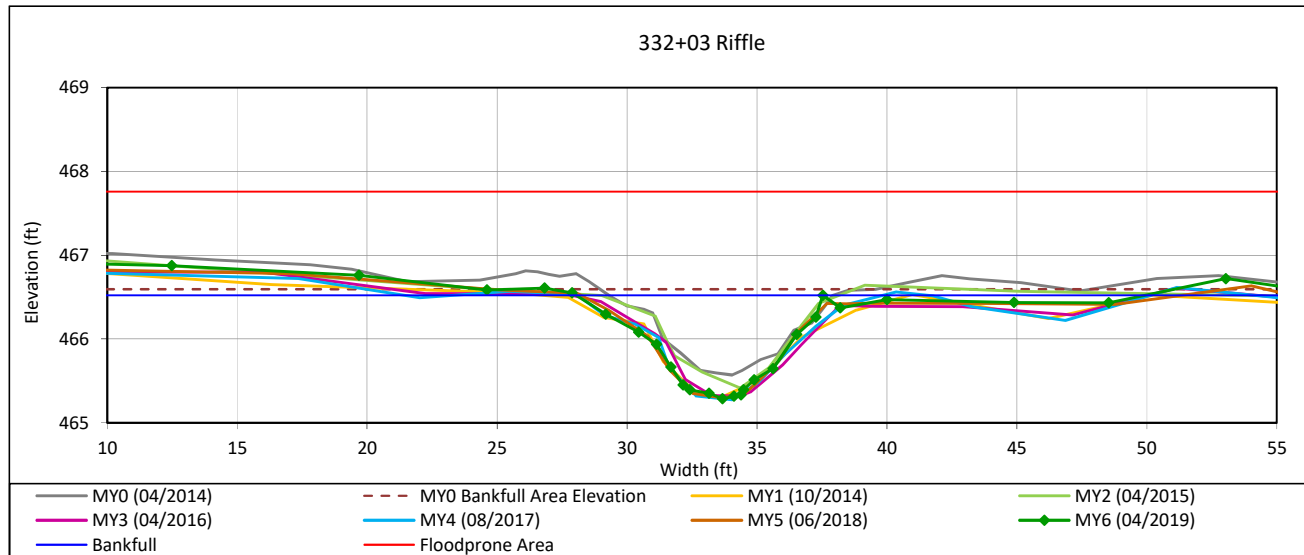
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

6.5	x-section area (ft.sq.)
9.5	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
10.0	wetted perimeter (ft)
0.7	hyd radi (ft)
13.9	width-depth ratio
>200	W flood prone area (ft)
>21	entrenchment ratio
0.9	low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream



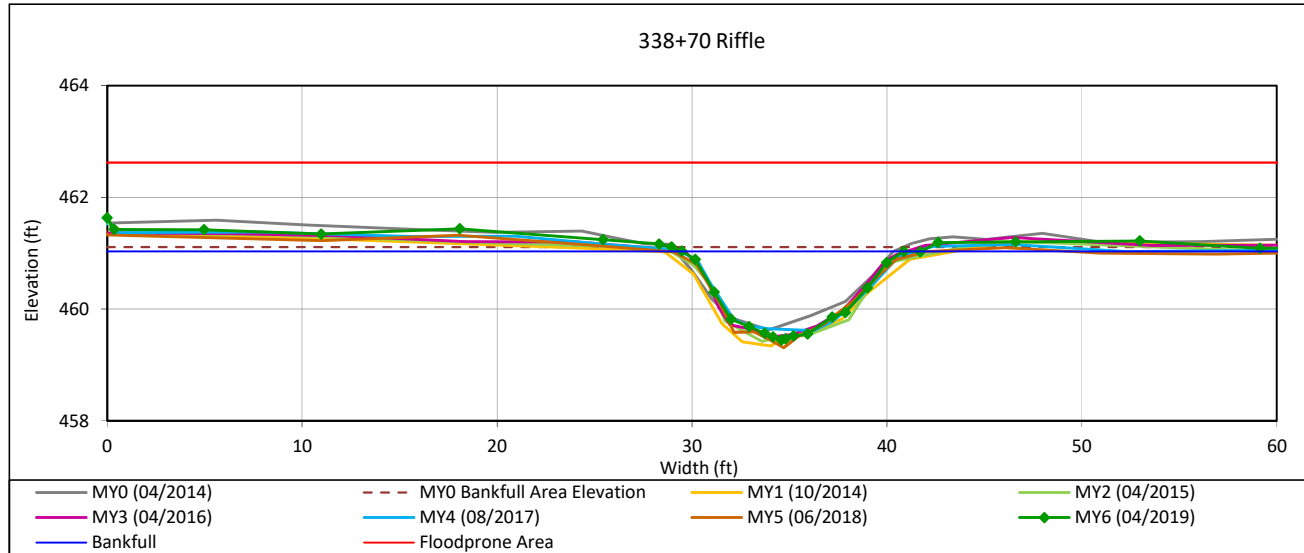
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

- 10.9 x-section area (ft.sq.)
- 11.4 width (ft)
- 1.0 mean depth (ft)
- 1.6 max depth (ft)
- 12.0 wetted perimeter (ft)
- 0.9 hyd radi (ft)
- 11.8 width-depth ratio
- 132.0 W flood prone area (ft)
- 11.6 entrenchment ratio
- 1.0 low bank height ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream

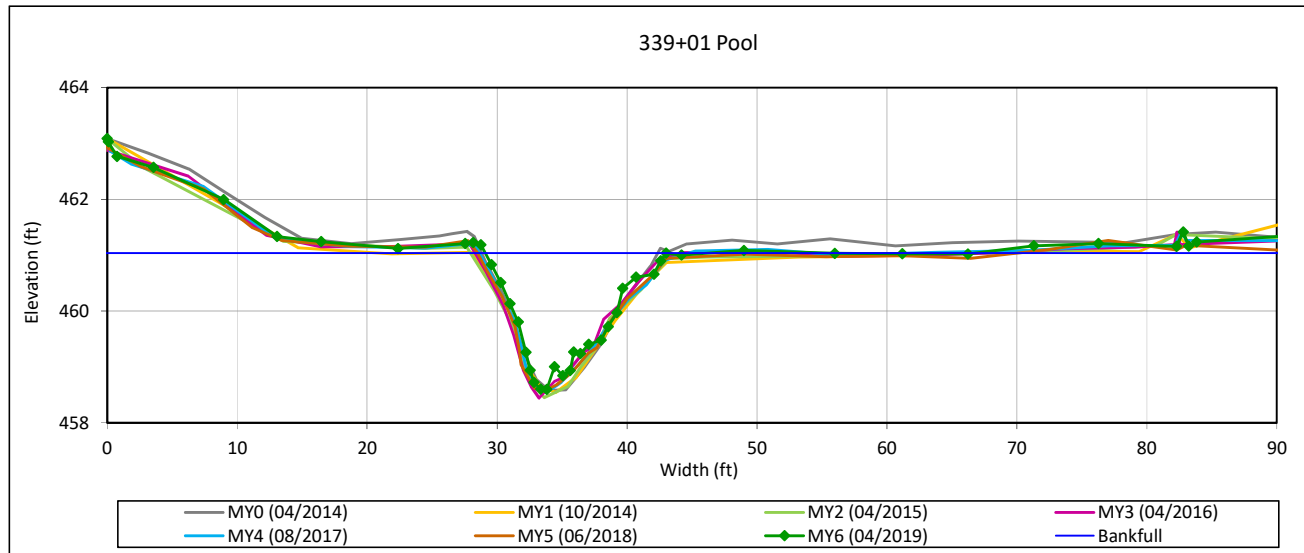
### Cross-Section Plots

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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



#### Bankfull Dimensions

- 17.2 x-section area (ft.sq.)
- 13.9 width (ft)
- 1.2 mean depth (ft)
- 2.4 max depth (ft)
- 15.3 wetted parimeter (ft)
- 1.1 hyd radi (ft)
- 11.3 width-depth ratio

Survey Date: 04/2019

Field Crew: Wildlands Engineering



View Downstream



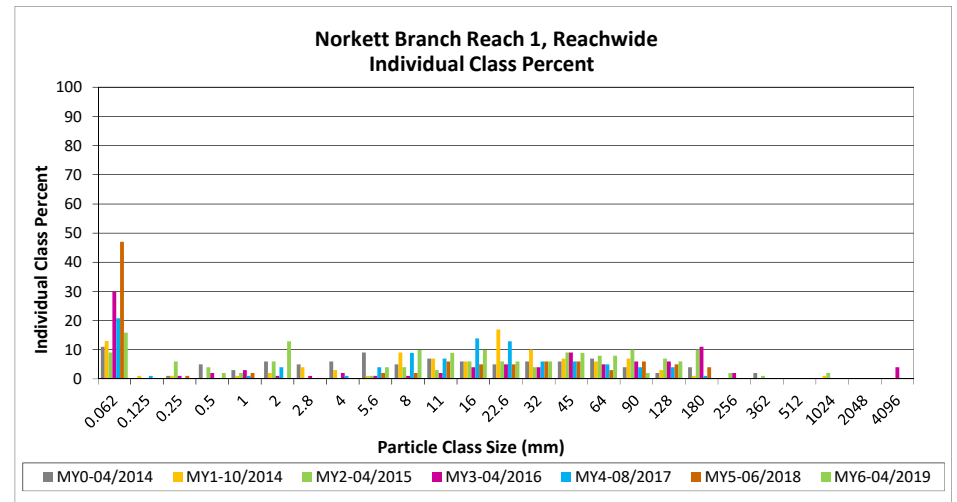
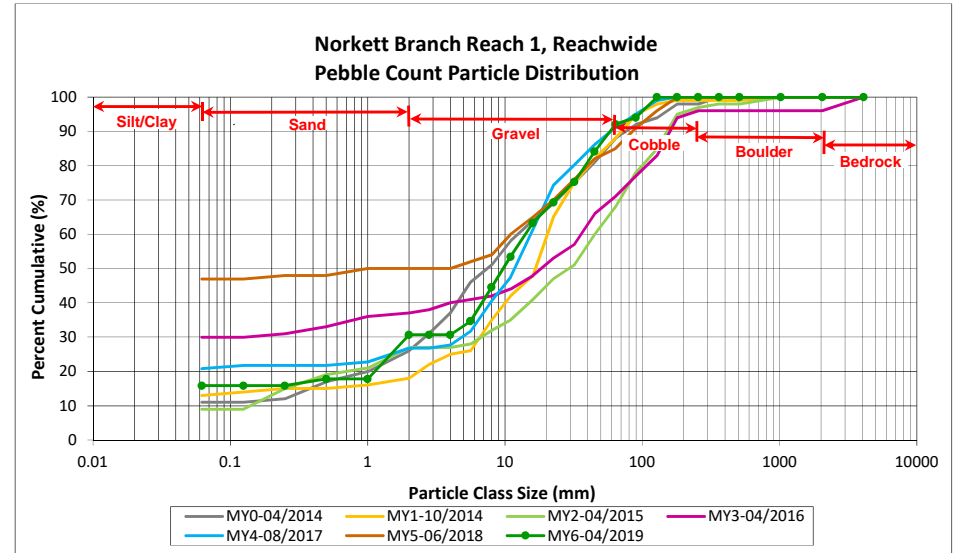
**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019

**Norkett Branch Reach 1, Reachwide**

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	5	11	16	16	16
<b>SAND</b>	Very fine	0.062	0.125					16
	Fine	0.125	0.250					16
	Medium	0.25	0.50	2		2	2	18
	Coarse	0.5	1.0					18
	Very Coarse	1.0	2.0		13	13	13	31
<b>GRAVEL</b>	Very Fine	2.0	2.8					31
	Very Fine	2.8	4.0					31
	Fine	4.0	5.6		4	4	4	35
	Fine	5.6	8.0	2	8	10	10	45
	Medium	8.0	11.0	2	7	9	9	53
	Medium	11.0	16.0	3	7	10	10	63
	Coarse	16.0	22.6	5	1	6	6	69
	Coarse	22.6	32	6		6	6	75
	Very Coarse	32	45	9		9	9	84
	Very Coarse	45	64	8		8	8	92
<b>COBBLE</b>	Small	64	90	2		2	2	94
	Small	90	128	6		6	6	100
	Large	128	180					100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
<b>BEDROCK</b>	Large/Very Large	1024	2048					100
	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>51</b>	<b>101</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	0.3
D <sub>35</sub> =	5.7
D <sub>50</sub> =	9.7
D <sub>84</sub> =	44.7
D <sub>95</sub> =	95.2
D <sub>100</sub> =	128.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

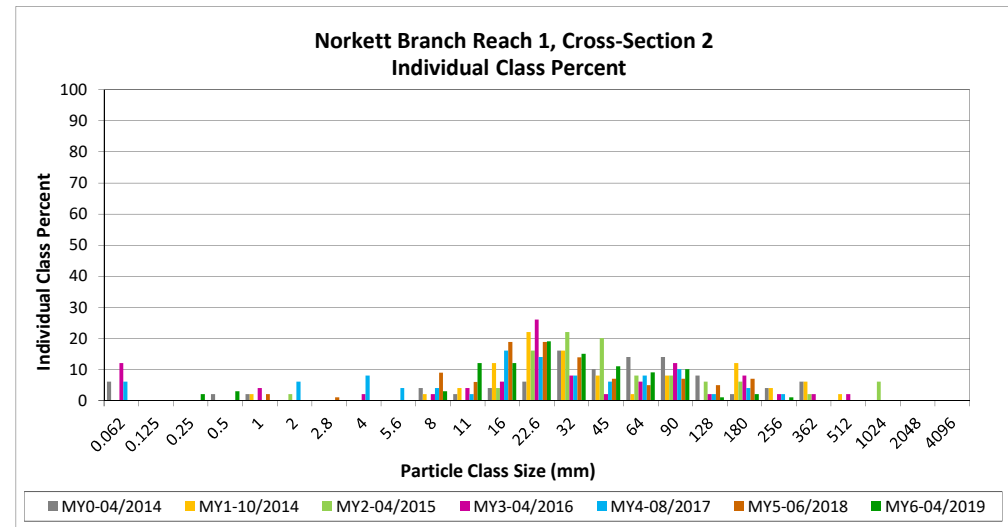
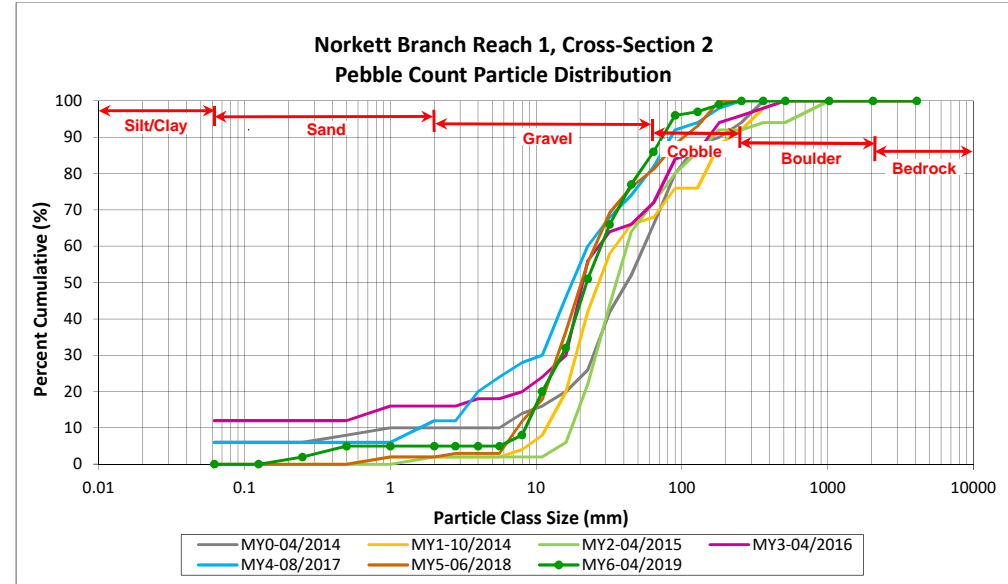
DMS Project No. 95360

Monitoring Year 6 - 2019

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

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>		Silt/Clay	0.000	0.062		0
<i>SAND</i>	Very fine	0.062	0.125			0
	Fine	0.125	0.250	2	2	2
	Medium	0.25	0.50	3	3	5
	Coarse	0.5	1.0			5
	Very Coarse	1.0	2.0			5
<i>GRAVEL</i>	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0			5
	Fine	4.0	5.6			5
	Fine	5.6	8.0	3	3	8
	Medium	8.0	11.0	12	12	20
	Medium	11.0	16.0	12	12	32
	Coarse	16.0	22.6	19	19	51
	Coarse	22.6	32	15	15	66
<i>COBBLE</i>	Very Coarse	32	45	11	11	77
	Very Coarse	45	64	9	9	86
	Small	64	90	10	10	96
	Small	90	128	1	1	97
<i>BOULDER</i>	Large	128	180	2	2	99
	Large	180	256	1	1	100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BOULDER</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 2	
Channel materials (mm)	
D <sub>16</sub> =	9.9
D <sub>35</sub> =	16.9
D <sub>50</sub> =	22.2
D <sub>84</sub> =	59.2
D <sub>95</sub> =	87.0
D <sub>100</sub> =	256.0





**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

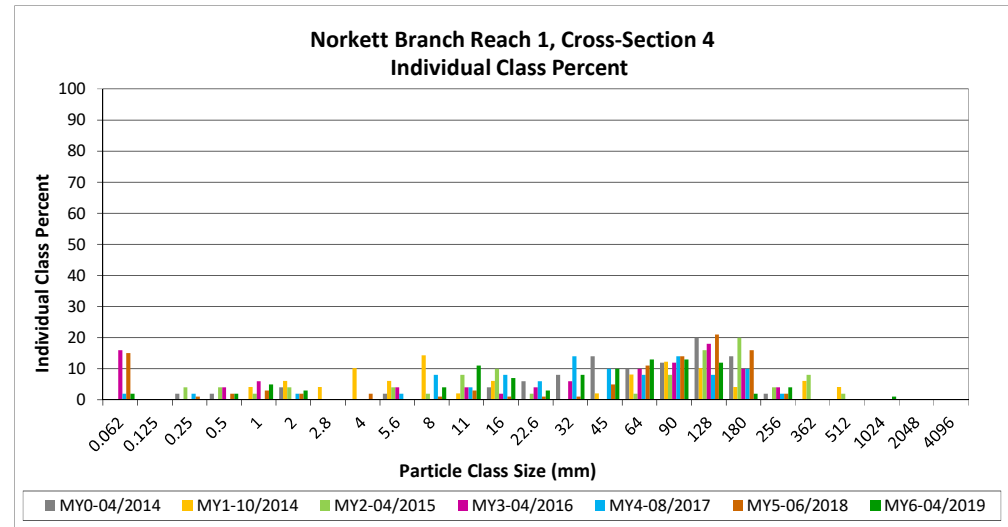
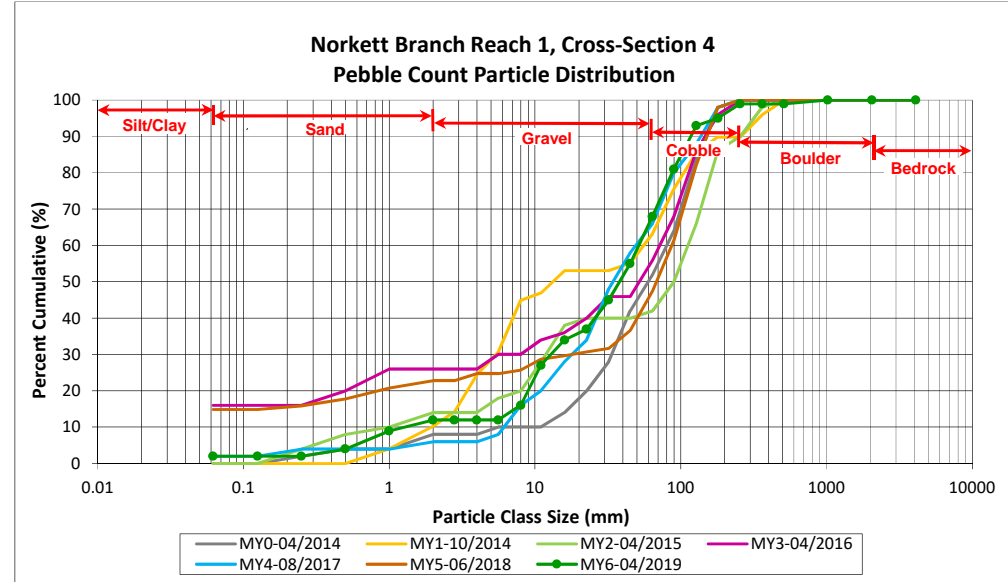
DMS Project No. 95360

Monitoring Year 6 - 2019

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

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>		Silt/Clay		2	2	2
<b>SAND</b>	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50	2	2	4
	Coarse	0.5	1.0	5	5	9
	Very Coarse	1.0	2.0	3	3	12
<b>GRAVEL</b>	Very Fine	2.0	2.8			12
	Very Fine	2.8	4.0			12
	Fine	4.0	5.6			12
	Fine	5.6	8.0	4	4	16
	Medium	8.0	11.0	11	11	27
	Medium	11.0	16.0	7	7	34
	Coarse	16.0	22.6	3	3	37
	Coarse	22.6	32	8	8	45
	Very Coarse	32	45	10	10	55
	Very Coarse	45	64	13	13	68
<b>COBBLE</b>	Small	64	90	13	13	81
	Small	90	128	12	12	93
	Large	128	180	2	2	95
	Large	180	256	4	4	99
<b>BOULDER</b>	Small	256	362			99
	Small	362	512			99
	Medium	512	1024	1	1	100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 4	
Channel materials (mm)	
D <sub>16</sub> =	8.0
D <sub>35</sub> =	18.0
D <sub>50</sub> =	37.9
D <sub>84</sub> =	98.3
D <sub>95</sub> =	180.0
D <sub>100</sub> =	1024.0



## Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

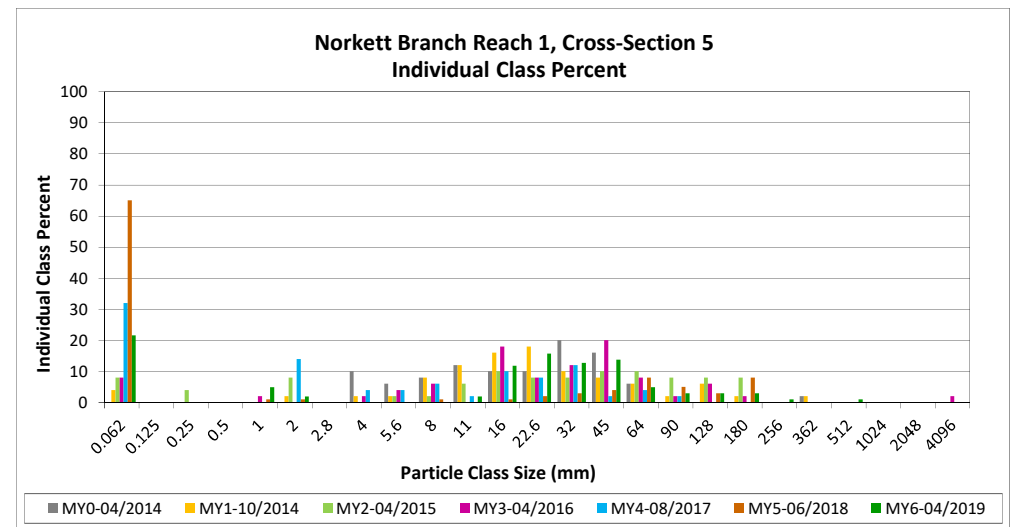
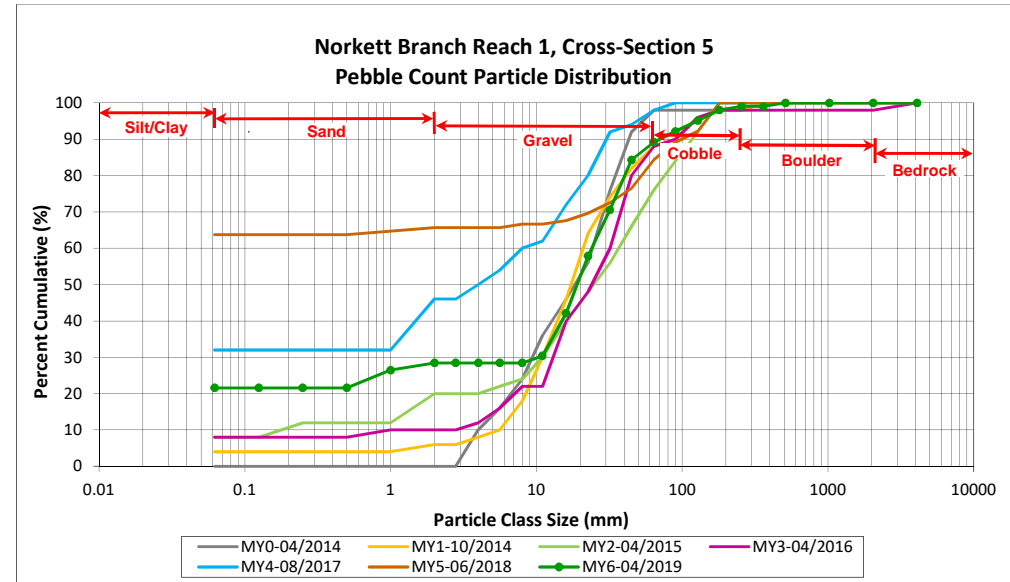
DMS Project No. 95360

Monitoring Year 6 - 2019

### Norkett Branch Reach 1, Cross-Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>		Silt/Clay		22	22	22
<b>SAND</b>	Very fine	0.062	0.125			22
	Fine	0.125	0.250			22
	Medium	0.25	0.50			22
	Coarse	0.5	1.0	5	5	26
	Very Coarse	1.0	2.0	2	2	28
<b>GRAVEL</b>	Very Fine	2.0	2.8			28
	Very Fine	2.8	4.0			28
	Fine	4.0	5.6			28
	Fine	5.6	8.0			28
	Medium	8.0	11.0	2	2	30
	Medium	11.0	16.0	12	12	42
	Coarse	16.0	22.6	16	16	58
	Coarse	22.6	32	13	13	71
	Very Coarse	32	45	14	14	84
	Very Coarse	45	64	5	5	89
<b>COBBLE</b>	Small	64	90	3	3	92
	Small	90	128	3	3	95
	Large	128	180	3	3	98
	Large	180	256	1	1	99
<b>BOULDER</b>	Small	256	362			99
	Small	362	512	1	1	100
	Medium	512	1024			100
<b>Large/Very Large</b>		1024	2048			100
<b>BEDROCK</b>		Bedrock				100
<b>Total</b>				<b>102</b>	<b>100</b>	<b>100</b>

Cross-Section 5	
Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	12.7
D <sub>50</sub> =	19.0
D <sub>84</sub> =	44.7
D <sub>95</sub> =	126.5
D <sub>100</sub> =	512.0





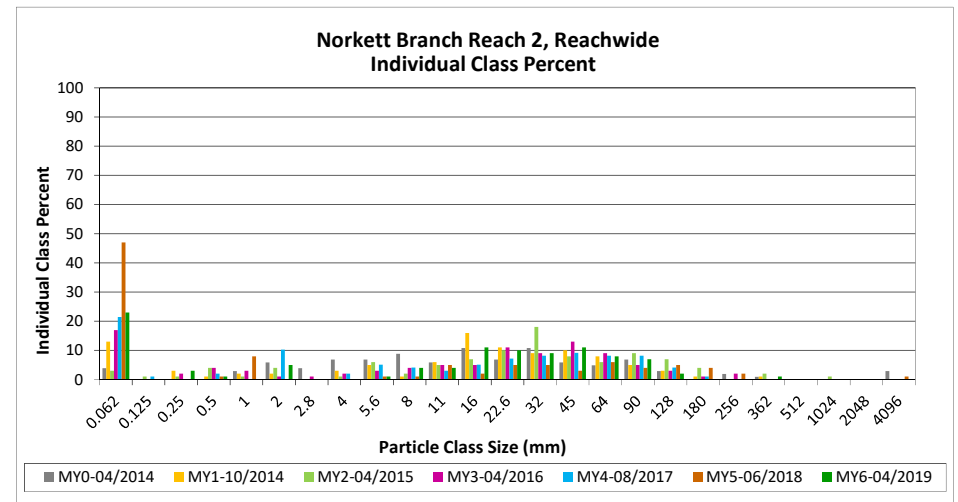
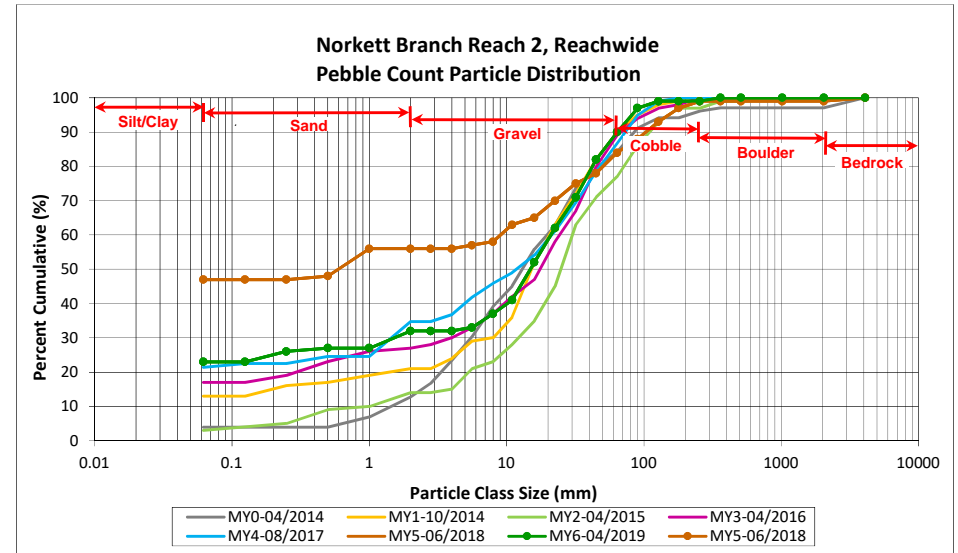
### Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site  
 DMS Project No. 95360  
 Monitoring Year 6 - 2019

#### Norkett Branch Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2	21	23	23	23
<b>SAND</b>	Very fine	0.062	0.125					23
	Fine	0.125	0.250		3	3	3	26
	Medium	0.25	0.50		1	1	1	27
	Coarse	0.5	1.0					27
	Very Coarse	1.0	2.0		5	5	5	32
<b>GRAVEL</b>	Very Fine	2.0	2.8					32
	Very Fine	2.8	4.0					32
	Fine	4.0	5.6	1		1	1	33
	Fine	5.6	8.0	3	1	4	4	37
	Medium	8.0	11.0	3	1	4	4	41
	Medium	11.0	16.0	9	2	11	11	52
	Coarse	16.0	22.6	9	1	10	10	62
	Coarse	22.6	32	5	4	9	9	71
	Very Coarse	32	45	8	3	11	11	82
	Very Coarse	45	64	4	4	8	8	90
<b>COBBLE</b>	Small	64	90	4	3	7	7	97
	Small	90	128	1	1	2	2	99
	Large	128	180					99
	Large	180	256					99
<b>BOULDER</b>	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<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> =	Silt/Clay
D <sub>35</sub> =	6.7
D <sub>50</sub> =	14.9
D <sub>84</sub> =	49.1
D <sub>95</sub> =	81.6
D <sub>100</sub> =	362.0



## Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

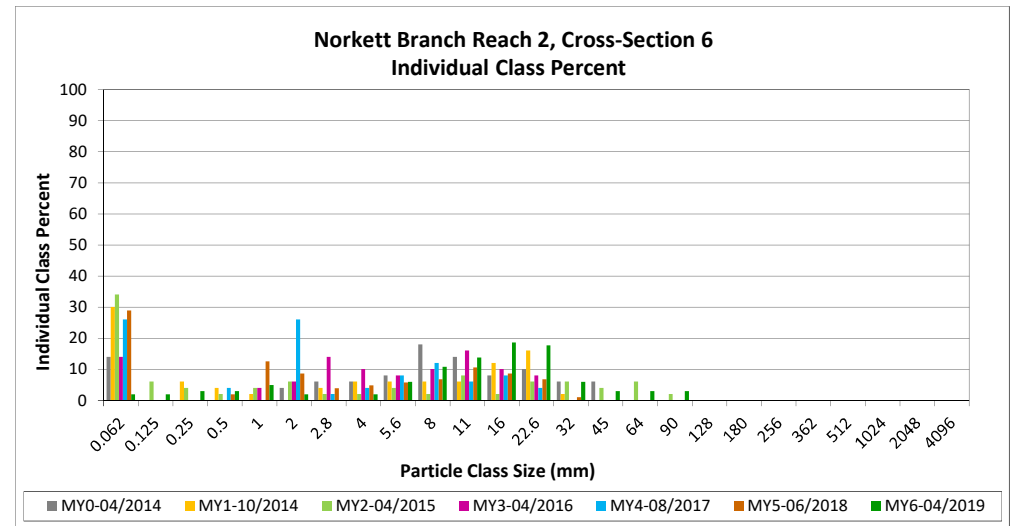
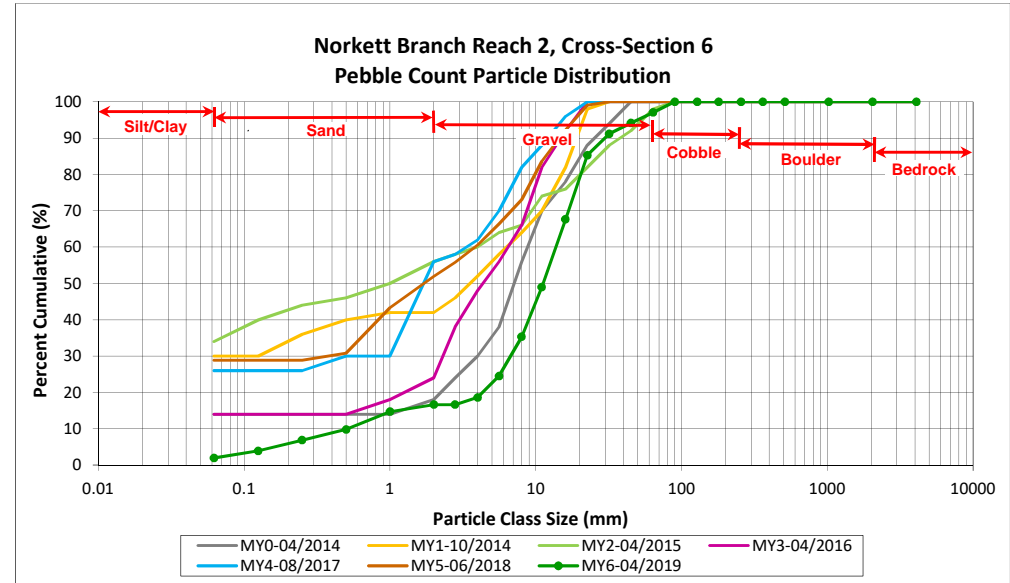
DMS Project No. 95360

Monitoring Year 6 - 2019

### Norkett Branch Reach 2, Cross-Section 6

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2	2	2
<b>SAND</b>	Very fine	0.062	0.125	2	2	4
	Fine	0.125	0.250	3	3	7
	Medium	0.25	0.50	3	3	10
	Coarse	0.5	1.0	5	5	15
	Very Coarse	1.0	2.0	2	2	17
<b>GRAVEL</b>	Very Fine	2.0	2.8			17
	Very Fine	2.8	4.0	2	2	19
	Fine	4.0	5.6	6	6	25
	Fine	5.6	8.0	11	11	35
	Medium	8.0	11.0	14	14	49
	Medium	11.0	16.0	19	19	68
	Coarse	16.0	22.6	18	18	85
	Coarse	22.6	32	6	6	91
	Very Coarse	32	45	3	3	94
	Very Coarse	45	64	3	3	97
<b>COBBLE</b>	Small	64	90	3	3	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>102</b>	<b>100</b>	<b>100</b>

Cross-Section 6	
Channel materials (mm)	
D <sub>16</sub> =	1.6
D <sub>35</sub> =	7.9
D <sub>50</sub> =	11.2
D <sub>84</sub> =	22.0
D <sub>95</sub> =	50.0
D <sub>100</sub> =	90.0





**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

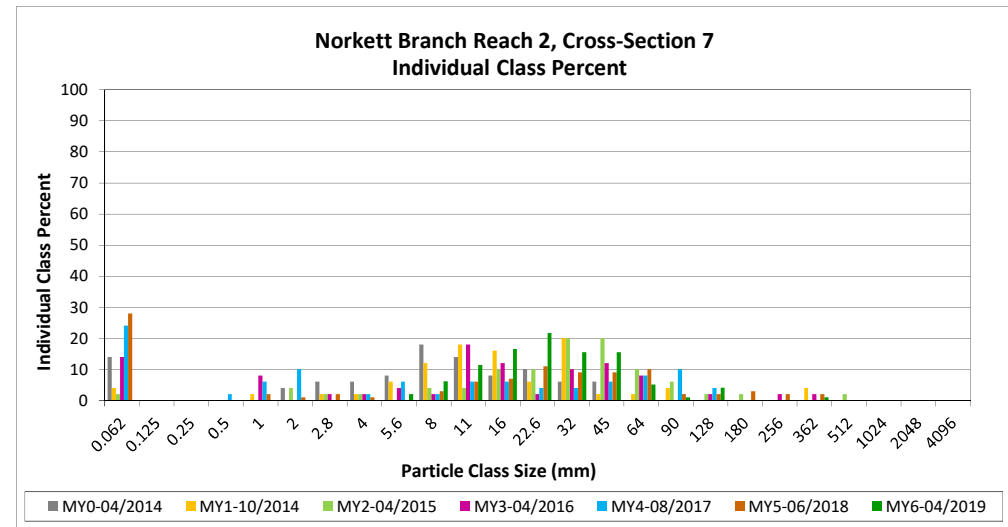
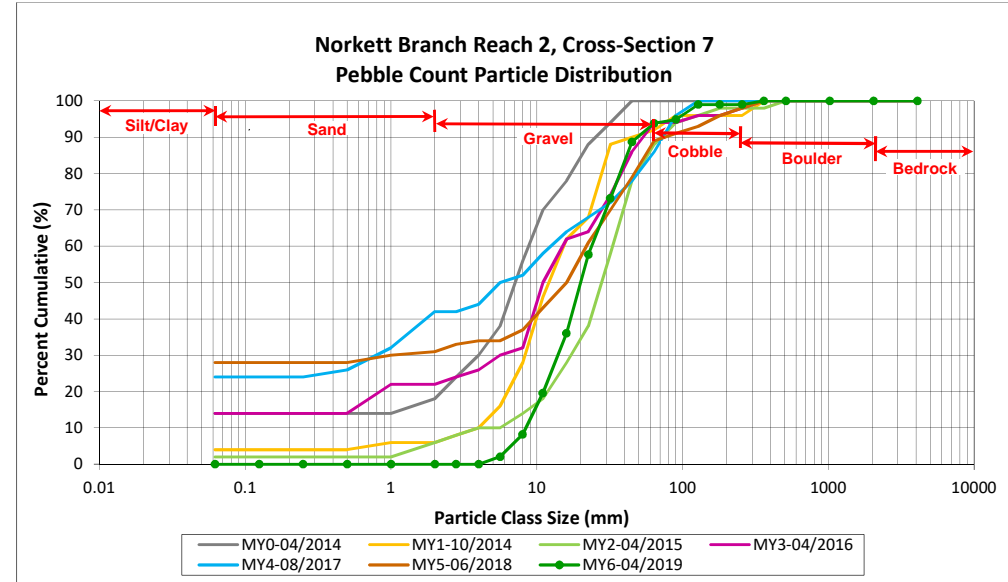
DMS Project No. 95360

Monitoring Year 6 - 2019

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

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>		Silt/Clay	0.000 - 0.062			0
<i>SAND</i>	Very fine	0.062 - 0.125				0
	Fine	0.125 - 0.250				0
	Medium	0.25 - 0.50				0
	Coarse	0.5 - 1.0				0
	Very Coarse	1.0 - 2.0				0
<i>GRAVEL</i>	Very Fine	2.0 - 2.8				0
	Very Fine	2.8 - 4.0				0
	Fine	4.0 - 5.6	2	2	2	2
	Fine	5.6 - 8.0	6	6	8	8
	Medium	8.0 - 11.0	11	11	20	20
	Medium	11.0 - 16.0	16	16	36	36
	Coarse	16.0 - 22.6	21	22	58	58
	Coarse	22.6 - 32	15	15	73	73
	Very Coarse	32 - 45	15	15	89	89
	Very Coarse	45 - 64	5	5	94	94
<i>COBBLE</i>	Small	64 - 90	1	1	95	95
	Small	90 - 128	4	4	99	99
	Large	128 - 180			99	99
	Large	180 - 256			99	99
<i>BOULDER</i>	Small	256 - 362	1	1	100	100
	Small	362 - 512			100	100
	Medium	512 - 1024			100	100
<i>Large/Very Large</i>		1024 - 2048			100	100
<i>BEDROCK</i>		Bedrock	2048 - >2048			100
<b>Total</b>				<b>97</b>	<b>100</b>	<b>100</b>

Cross-Section 7	
Channel materials (mm)	
D <sub>16</sub> =	9.9
D <sub>35</sub> =	15.6
D <sub>50</sub> =	20.0
D <sub>84</sub> =	40.6
D <sub>95</sub> =	91.2
D <sub>100</sub> =	362.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

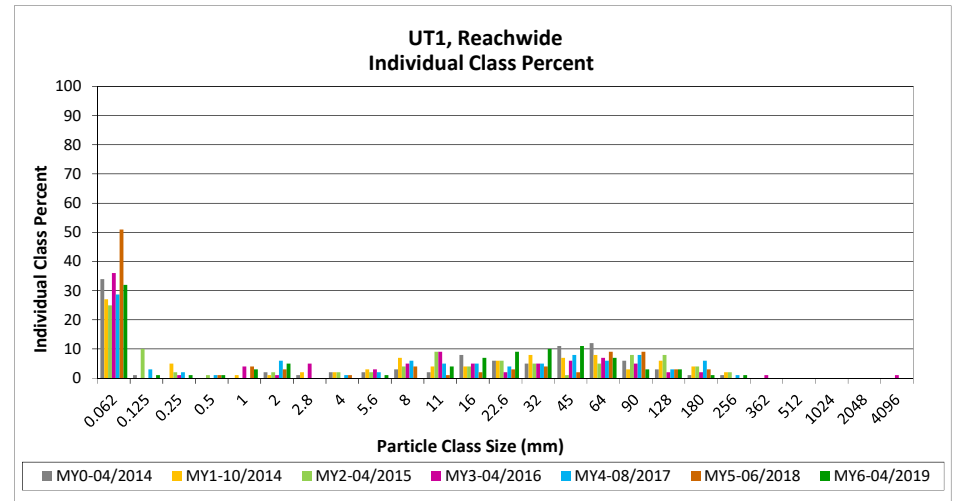
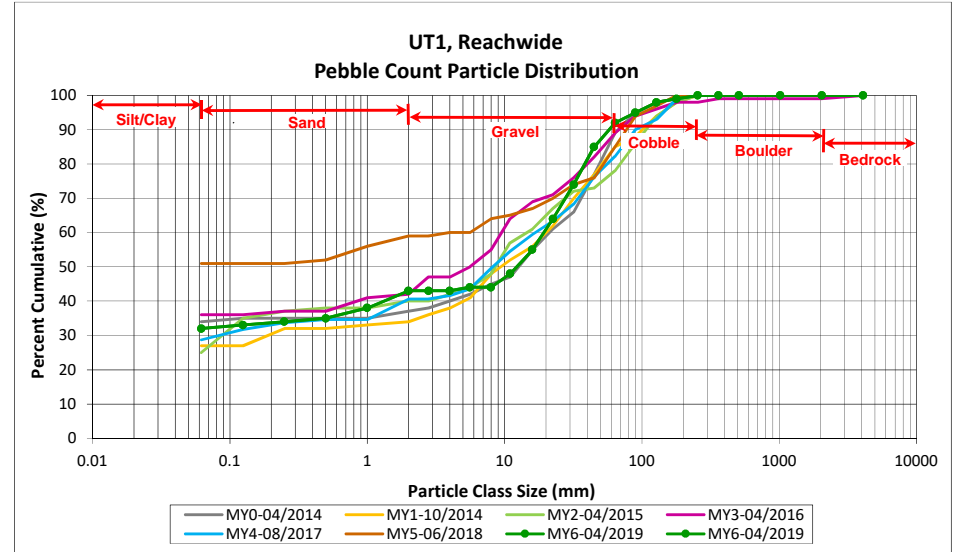
DMS Project No. 95360

Monitoring Year 6 - 2019

**UT1, Reachwide**

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	1	31	32	32	32
<b>SAND</b>	Very fine	0.062	0.125		1	1	1	33
	Fine	0.125	0.250		1	1	1	34
	Medium	0.25	0.50	1		1	1	35
	Coarse	0.5	1.0	2	1	3	3	38
	Very Coarse	1.0	2.0		5	5	5	43
<b>GRAVEL</b>	Very Fine	2.0	2.8					43
	Very Fine	2.8	4.0					43
	Fine	4.0	5.6	1		1	1	44
	Fine	5.6	8.0					44
	Medium	8.0	11.0	4		4	4	48
	Medium	11.0	16.0	6	1	7	7	55
	Coarse	16.0	22.6	8	1	9	9	64
	Coarse	22.6	32	8	2	10	10	74
	Very Coarse	32	45	8	3	11	11	85
<b>COBBLE</b>	Very Coarse	45	64	4	3	7	7	92
	Small	64	90	2	1	3	3	95
	Small	90	128	3		3	3	98
	Large	128	180	1		1	1	99
	Large	180	256	1		1	1	100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<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> =	Silt/Clay
D <sub>35</sub> =	0.5
D <sub>50</sub> =	12.2
D <sub>84</sub> =	43.6
D <sub>95</sub> =	90.0
D <sub>100</sub> =	256.0





## Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

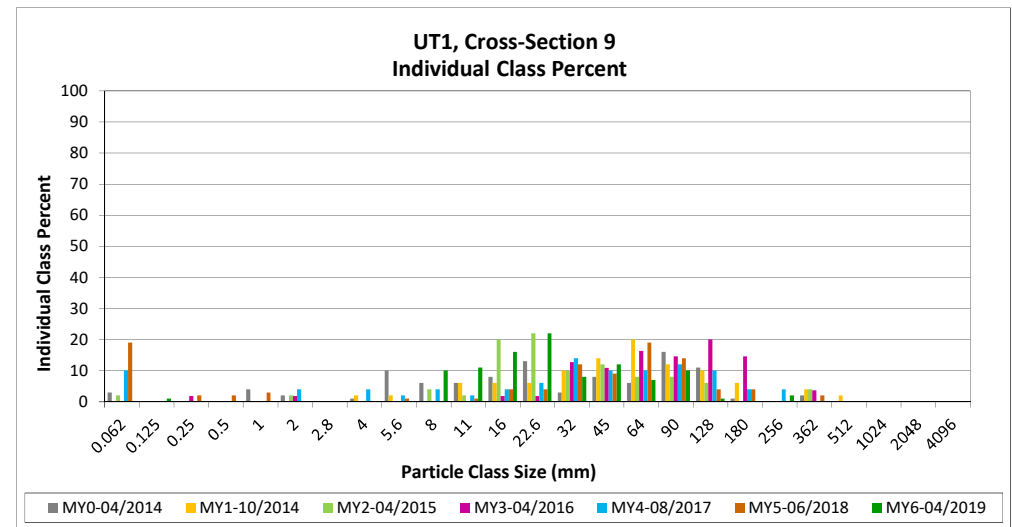
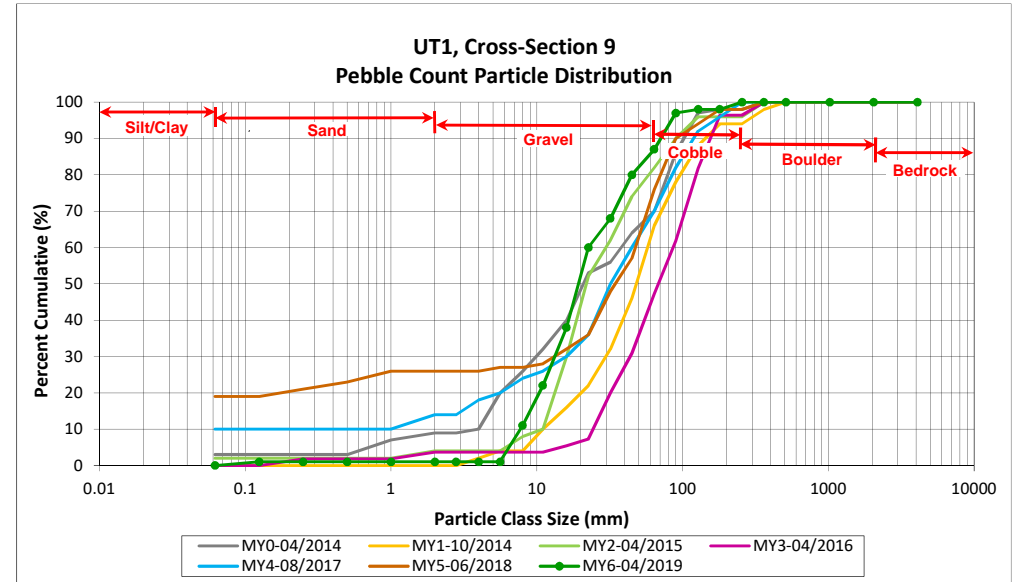
DMS Project No. 95360

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### UT1, Cross-Section 9

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>		Silt/Clay				0
<b>SAND</b>	Very fine	0.062	0.125	1	1	1
	Fine	0.125	0.250			1
	Medium	0.25	0.50			1
	Coarse	0.5	1.0			1
	Very Coarse	1.0	2.0			1
<b>GRAVEL</b>	Very Fine	2.0	2.8			1
	Very Fine	2.8	4.0			1
	Fine	4.0	5.6			1
	Fine	5.6	8.0	10	10	11
	Medium	8.0	11.0	11	11	22
	Medium	11.0	16.0	16	16	38
	Coarse	16.0	22.6	22	22	60
	Coarse	22.6	32	8	8	68
<b>COBBLE</b>	Very Coarse	32	45	12	12	80
	Very Coarse	45	64	7	7	87
	Small	64	90	10	10	97
<b>BOULDER</b>	Small	90	128	1	1	98
	Large	128	180			98
	Large	180	256	2	2	100
<b>BEDROCK</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<b>BEDROCK</b>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 9	
Channel materials (mm)	
D <sub>16</sub> =	9.2
D <sub>35</sub> =	14.9
D <sub>50</sub> =	19.3
D <sub>84</sub> =	55.0
D <sub>95</sub> =	84.1
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

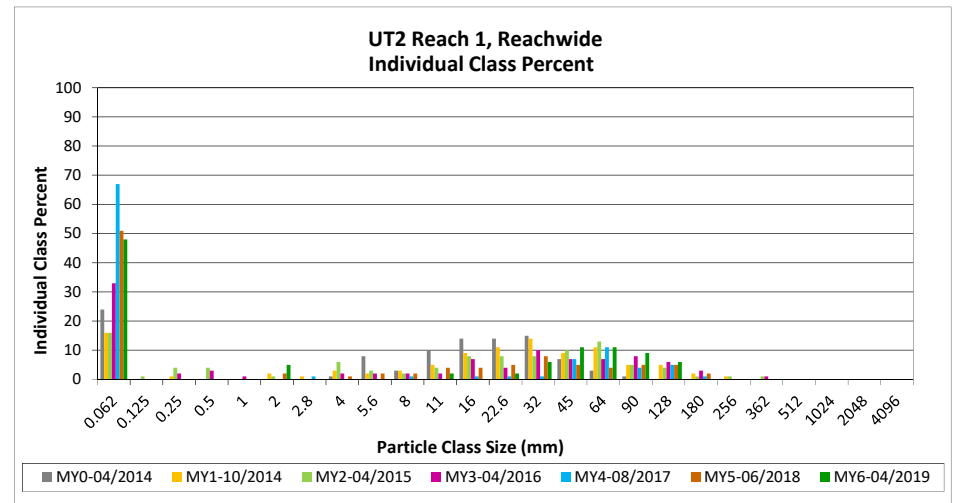
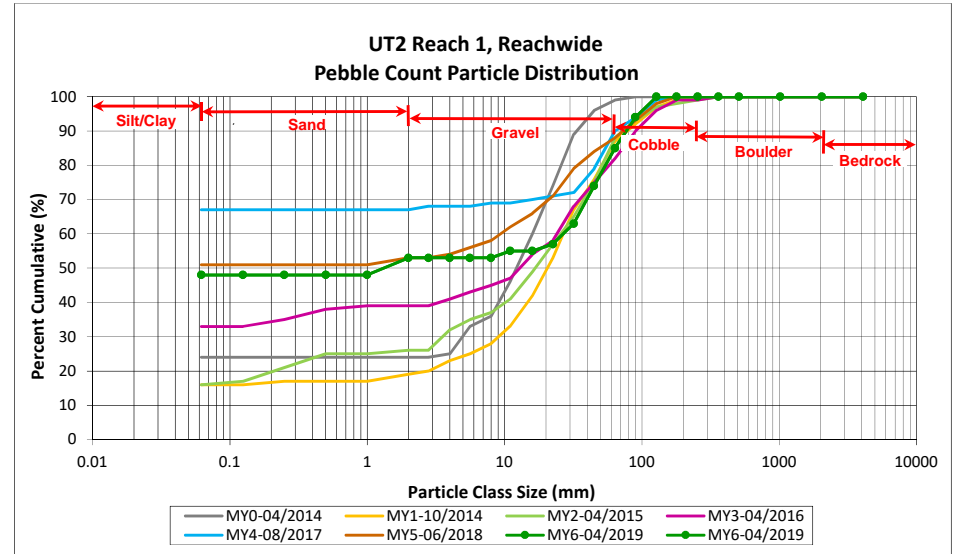
DMS Project No. 95360

Monitoring Year 6 - 2019

**UT2 Reach 1, Reachwide**

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	3	45	48	48	48
<b>SAND</b>	Very fine	0.062	0.125					48
	Fine	0.125	0.250					48
	Medium	0.25	0.50					48
	Coarse	0.5	1.0					48
	Very Coarse	1.0	2.0	2	3	5	5	53
<b>GRAVEL</b>	Very Fine	2.0	2.8					53
	Very Fine	2.8	4.0					53
	Fine	4.0	5.6					53
	Fine	5.6	8.0					53
	Medium	8.0	11.0	2		2	2	55
	Medium	11.0	16.0					55
	Coarse	16.0	22.6	2		2	2	57
	Coarse	22.6	32	6		6	6	63
	Very Coarse	32	45	10	1	11	11	74
<b>COBBLE</b>	Very Coarse	45	64	11		11	11	85
	Small	64	90	8	1	9	9	94
	Small	90	128	6		6	6	100
	Large	128	180					100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
<b>BEDROCK</b>	Large/Very Large	1024	2048					100
	Bedrock	2048	>2048					100
<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> =	Silt/Clay
D <sub>35</sub> =	Silt/Clay
D <sub>50</sub> =	1.3
D <sub>84</sub> =	62.0
D <sub>95</sub> =	95.4
D <sub>100</sub> =	128.0





**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

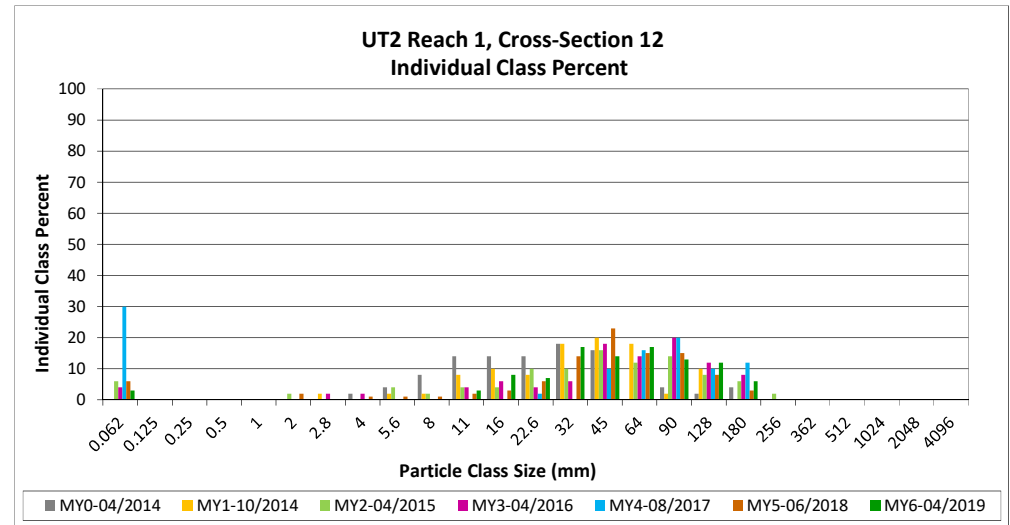
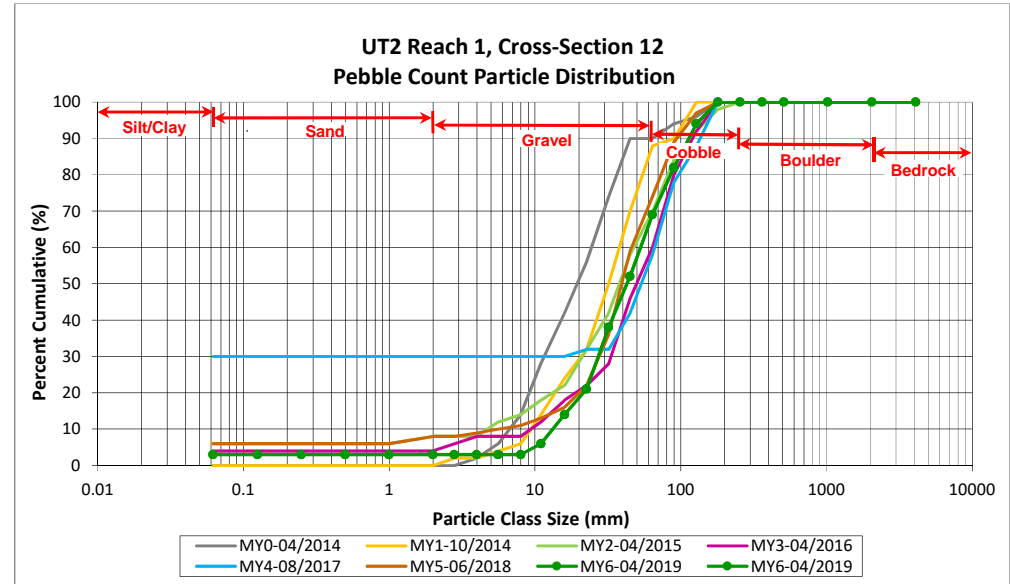
DMS Project No. 95360

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**UT2 Reach 1, Cross-Section 12**

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	3	3	3
<i>SAND</i>	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0			3
<i>GRAVEL</i>	Very Fine	2.0	2.8			3
	Very Fine	2.8	4.0			3
	Fine	4.0	5.6			3
	Fine	5.6	8.0			3
	Medium	8.0	11.0	3	3	6
	Medium	11.0	16.0	8	8	14
	Coarse	16.0	22.6	7	7	21
	Coarse	22.6	32	17	17	38
	Very Coarse	32	45	14	14	52
	Very Coarse	45	64	17	17	69
<i>COBBLE</i>	Small	64	90	13	13	82
	Small	90	128	12	12	94
	Large	128	180	6	6	100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
		<b>Total</b>		<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 12	
Channel materials (mm)	
D <sub>16</sub> =	17.7
D <sub>35</sub> =	30.1
D <sub>50</sub> =	42.9
D <sub>84</sub> =	95.4
D <sub>95</sub> =	135.5
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

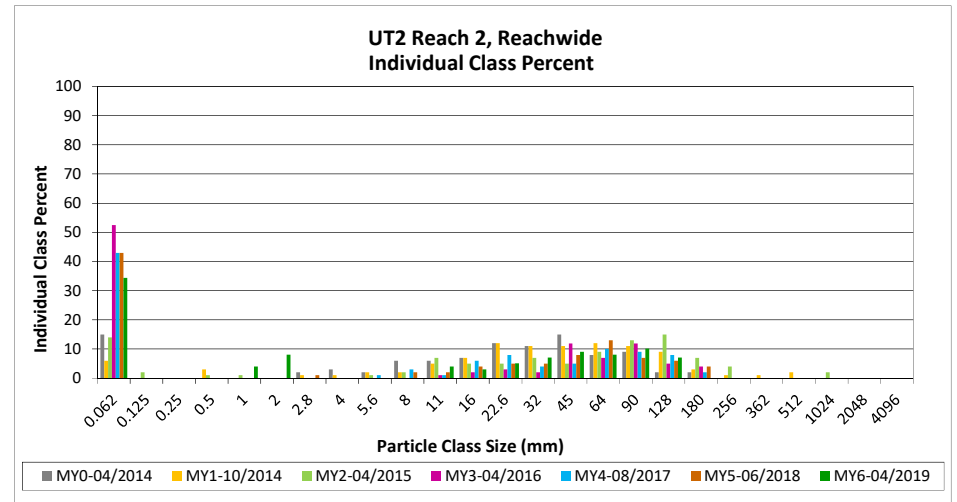
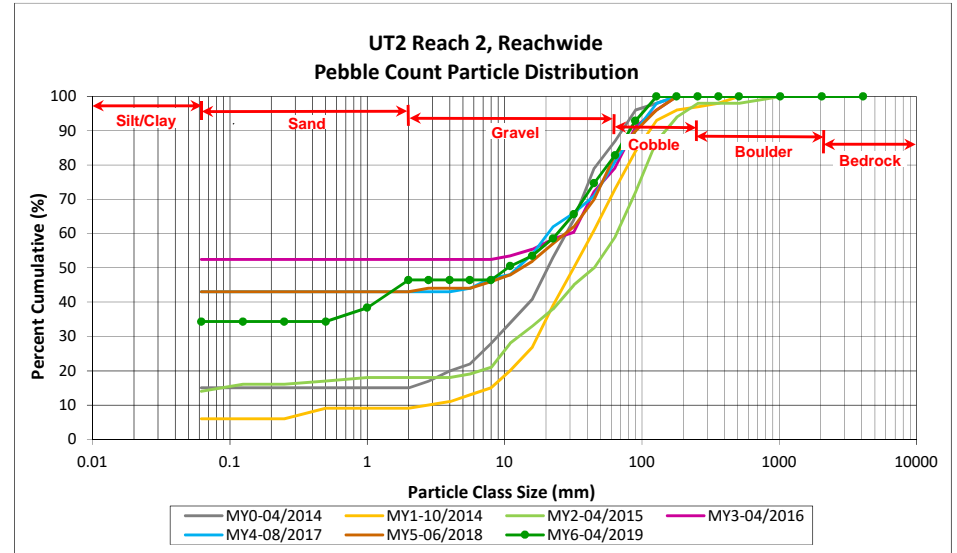
DMS Project No. 95360

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**UT2 Reach 2, Reachwide**

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062		34	34	34	34
<b>SAND</b>	Very fine	0.062	0.125					34
	Fine	0.125	0.250					34
	Medium	0.25	0.50					34
	Coarse	0.5	1.0		4	4	4	38
	Very Coarse	1.0	2.0	1	7	8	8	46
<b>GRAVEL</b>	Very Fine	2.0	2.8					46
	Very Fine	2.8	4.0					46
	Fine	4.0	5.6					46
	Fine	5.6	8.0					46
	Medium	8.0	11.0	4		4	4	51
	Medium	11.0	16.0	3		3	3	54
	Coarse	16.0	22.6	5		5	5	59
	Coarse	22.6	32	6	1	7	7	66
	Very Coarse	32	45	9		9	9	75
	Very Coarse	45	64	7	1	8	8	83
<b>COBBLE</b>	Small	64	90	9	1	10	10	93
	Small	90	128	6	1	7	7	100
	Large	128	180					100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>50</b>	<b>49</b>	<b>99</b>	<b>100</b>	<b>100</b>

Reachwide Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	0.6
D <sub>50</sub> =	10.6
D <sub>84</sub> =	66.6
D <sub>95</sub> =	99.8
D <sub>100</sub> =	128.0





**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

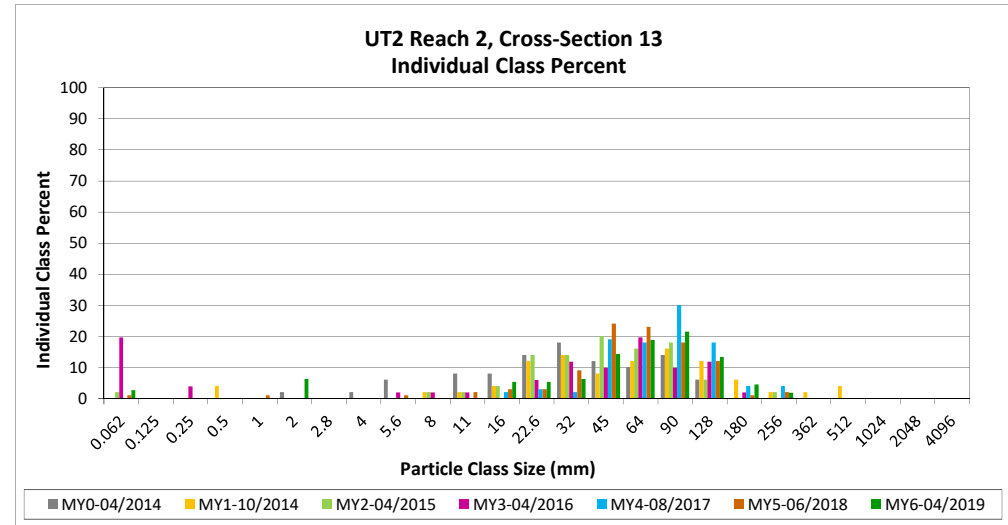
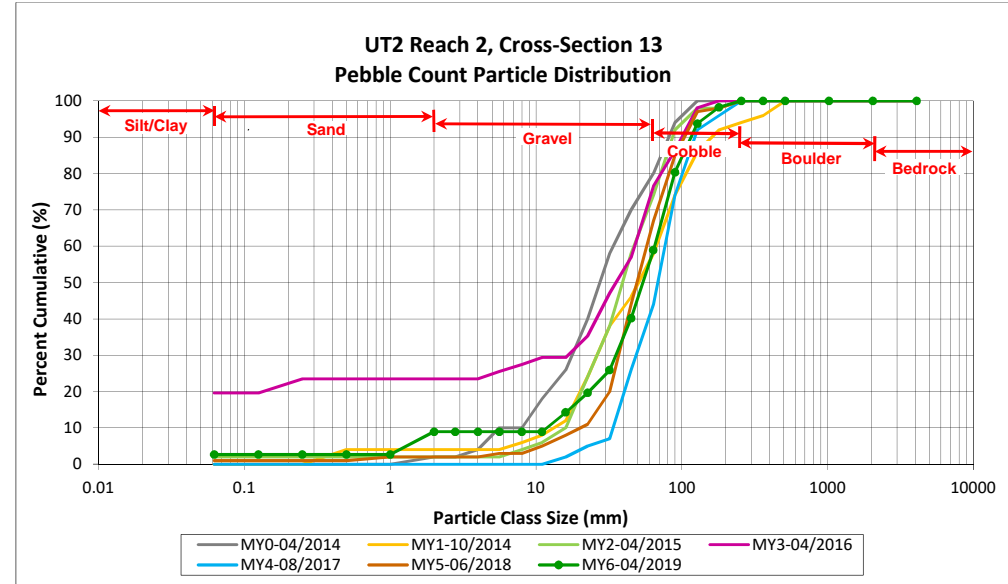
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**UT2 Reach 2, Cross-Section 13**

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	3	3	3
<b>SAND</b>	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.25	0.50			3
	Coarse	0.5	1.0			3
	Very Coarse	1.0	2.0	7	6	9
<b>GRAVEL</b>	Very Fine	2.0	2.8			9
	Very Fine	2.8	4.0			9
	Fine	4.0	5.6			9
	Fine	5.6	8.0			9
	Medium	8.0	11.0			9
	Medium	11.0	16.0	6	5	14
	Coarse	16.0	22.6	6	5	20
	Coarse	22.6	32	7	6	26
	Very Coarse	32	45	16	14	40
	Very Coarse	45	64	21	19	59
<b>COBBLE</b>	Small	64	90	24	21	80
	Small	90	128	15	13	94
	Large	128	180	5	4	98
	Large	180	256	2	2	100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<b>BEDROCK</b>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>112</b>	<b>100</b>	<b>100</b>

Cross-Section 13	
Channel materials (mm)	
D <sub>16</sub> =	17.9
D <sub>35</sub> =	39.8
D <sub>50</sub> =	54.1
D <sub>84</sub> =	99.0
D <sub>95</sub> =	140.8
D <sub>100</sub> =	256.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

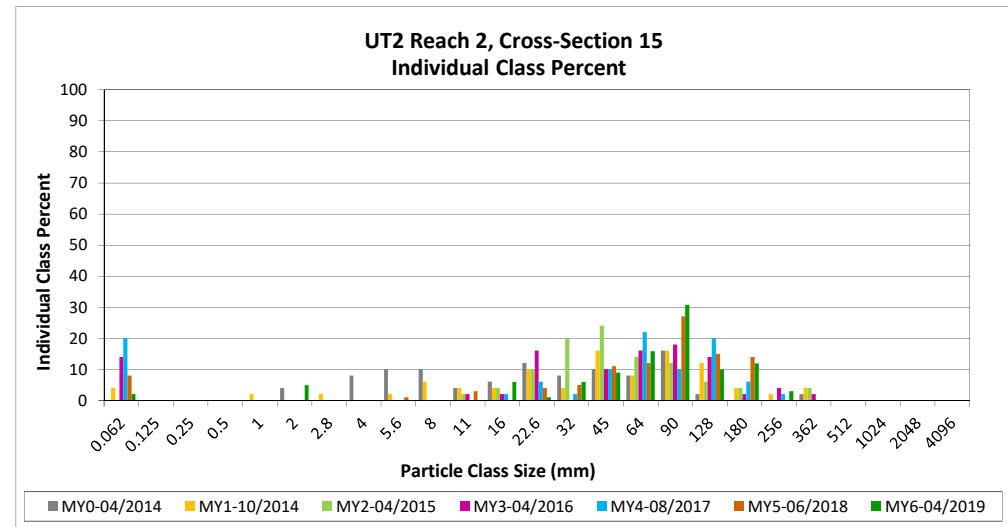
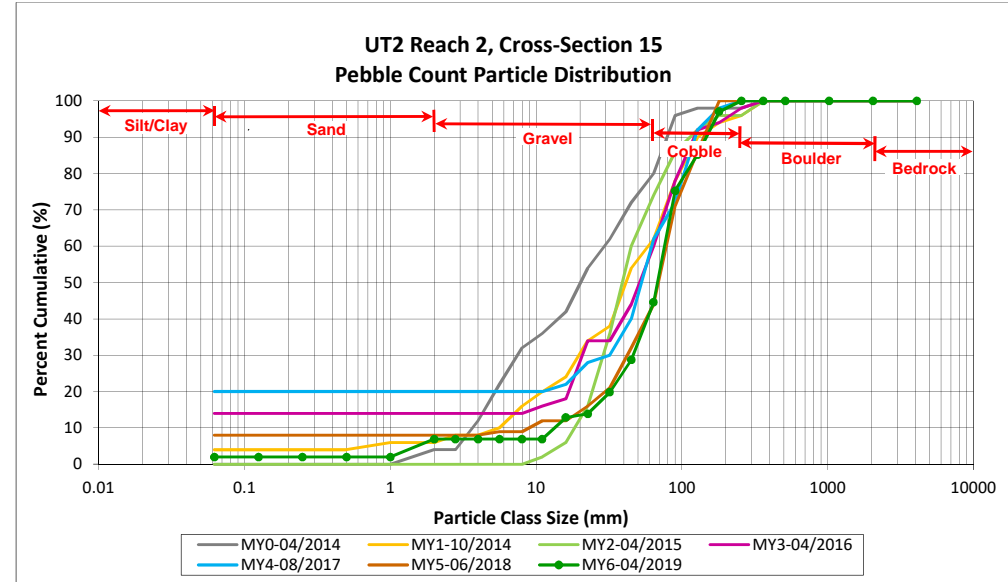
DMS Project No. 95360

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**UT2 Reach 2, Cross-Section 15**

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	2	2	2
<i>SAND</i>	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	5	5	7
<i>GRAVEL</i>	Very Fine	2.0	2.8			7
	Very Fine	2.8	4.0			7
	Fine	4.0	5.6			7
	Fine	5.6	8.0			7
	Medium	8.0	11.0			7
	Medium	11.0	16.0	6	6	13
	Coarse	16.0	22.6	1	1	14
	Coarse	22.6	32	6	6	20
	Very Coarse	32	45	9	9	29
	Very Coarse	45	64	16	16	45
<i>COBBLE</i>	Small	64	90	31	31	75
	Small	90	128	10	10	85
	Large	128	180	12	12	97
	Large	180	256	3	3	100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<i>BEDROCK</i>	Large/Very Large	1024	2048			100
	Bedrock	2048	>2048			100
<b>Total</b>				<b>101</b>	<b>100</b>	<b>100</b>

Cross-Section 15	
Channel materials (mm)	
D <sub>16</sub> =	25.6
D <sub>35</sub> =	51.8
D <sub>50</sub> =	68.0
D <sub>84</sub> =	122.9
D <sub>95</sub> =	169.8
D <sub>100</sub> =	256.0





### Reachwide and Cross-Section Pebble Count Plots

Norkett Branch Stream Mitigation Site

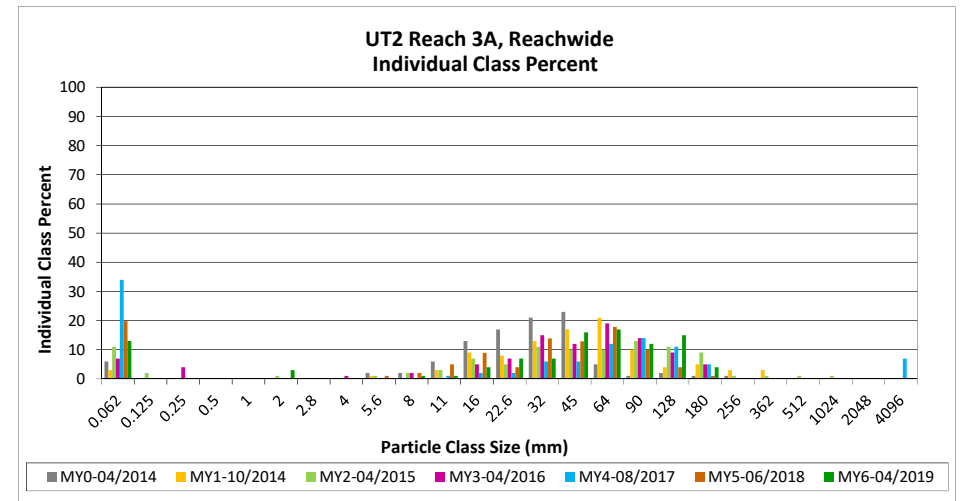
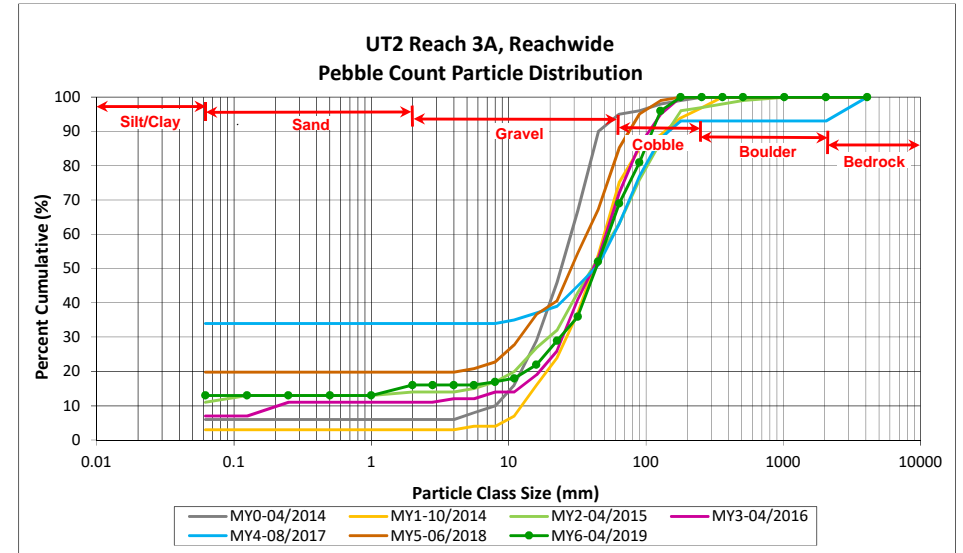
DMS Project No. 95360

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#### UT2 Reach 3A, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062		13	13	13	13
<b>SAND</b>	Very fine	0.062	0.125					13
	Fine	0.125	0.250					13
	Medium	0.25	0.50					13
	Coarse	0.5	1.0					13
	Very Coarse	1.0	2.0		3	3	3	16
<b>GRAVEL</b>	Very Fine	2.0	2.8					16
	Very Fine	2.8	4.0					16
	Fine	4.0	5.6					16
	Fine	5.6	8.0		1	1	1	17
	Medium	8.0	11.0		1	1	1	18
	Medium	11.0	16.0	2	2	4	4	22
	Coarse	16.0	22.6	2	5	7	7	29
	Coarse	22.6	32	2	5	7	7	36
	Very Coarse	32	45	12	4	16	16	52
	Very Coarse	45	64	11	6	17	17	69
<b>COBBLE</b>	Small	64	90	7	5	12	12	81
	Small	90	128	12	3	15	15	96
	Large	128	180	2	2	4	4	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
<b>BEDROCK</b>	Large/Very Large	1024	2048					100
	Bedrock	2048	>2048					100
<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> =	2.0
D <sub>35</sub> =	30.4
D <sub>50</sub> =	43.1
D <sub>84</sub> =	96.6
D <sub>95</sub> =	90.0
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

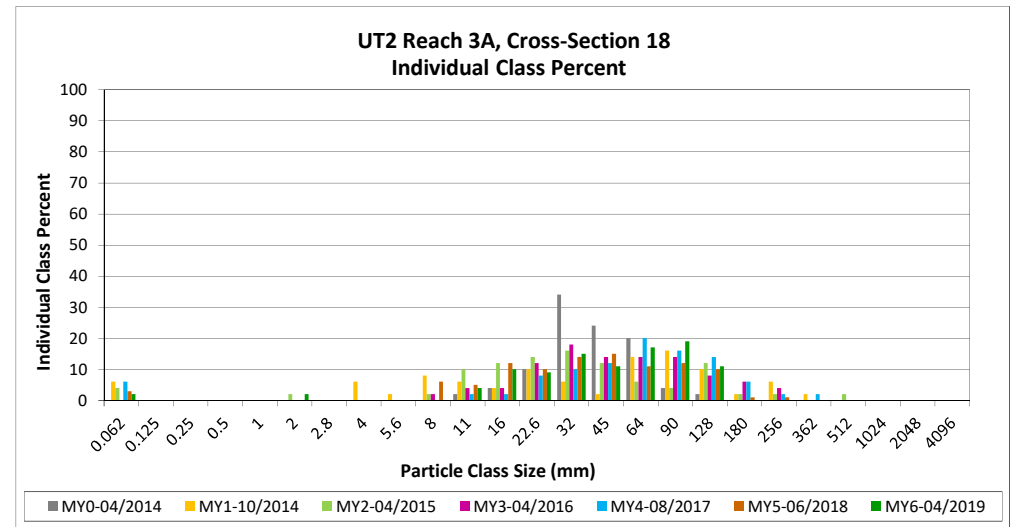
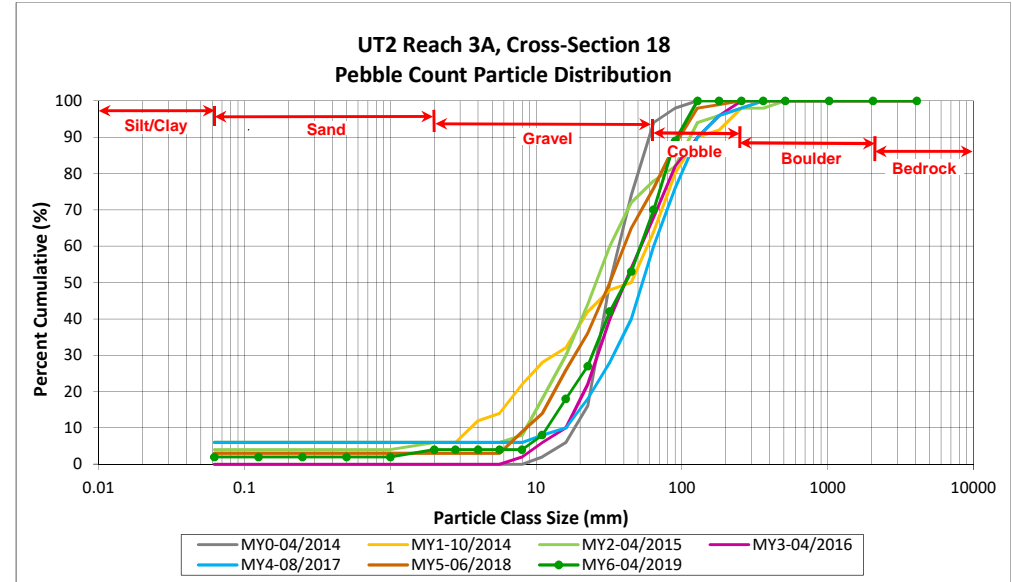
DMS Project No. 95360

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

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2	2	2
<b>SAND</b>	Very fine	0.062	0.125			2
	Fine	0.125	0.250			2
	Medium	0.25	0.50			2
	Coarse	0.5	1.0			2
	Very Coarse	1.0	2.0	2	2	4
<b>GRAVEL</b>	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0			4
	Medium	8.0	11.0	4	4	8
	Medium	11.0	16.0	10	10	18
	Coarse	16.0	22.6	9	9	27
	Coarse	22.6	32	15	15	42
	Very Coarse	32	45	11	11	53
	Very Coarse	45	64	17	17	70
<b>COBBLE</b>	Small	64	90	19	19	89
	Small	90	128	11	11	100
	Large	128	180			100
	Large	180	256			100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<b>BEDROCK</b>	Bedrock	2048	>2048			100
<b>Total</b>				<b>100</b>	<b>100</b>	<b>100</b>

Cross-Section 18	
Channel materials (mm)	
D <sub>16</sub> =	14.8
D <sub>35</sub> =	27.2
D <sub>50</sub> =	41.0
D <sub>84</sub> =	82.3
D <sub>95</sub> =	109.1
D <sub>100</sub> =	128.0





**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

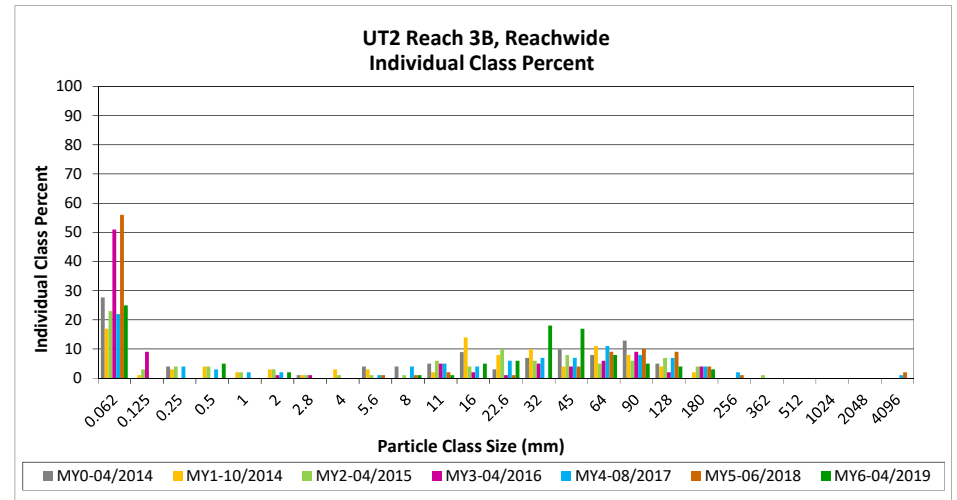
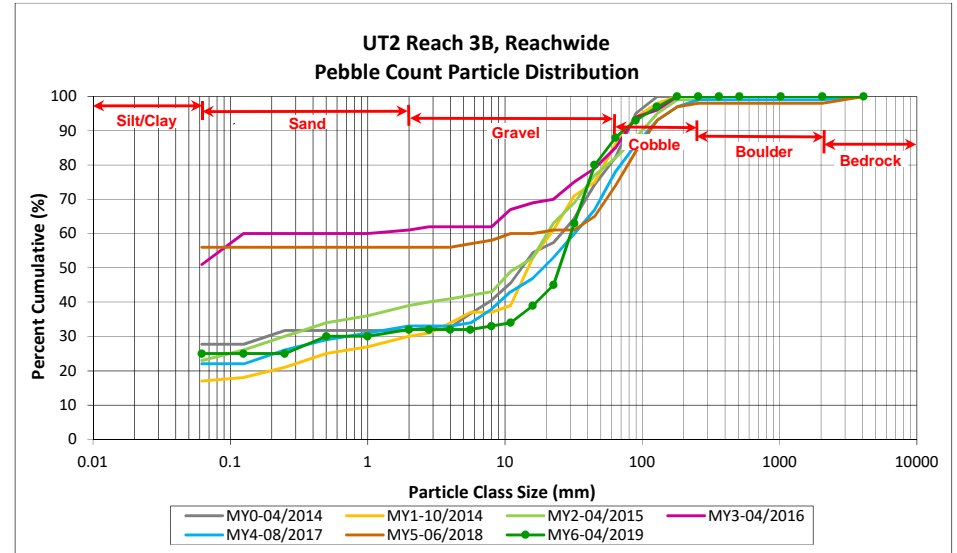
DMS Project No. 95360

Monitoring Year 6 - 2019

**UT2 Reach 3B, Reachwide**

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	2	23	25	25	25
<b>SAND</b>	Very fine	0.062	0.125					25
	Fine	0.125	0.250					25
	Medium	0.25	0.50		5	5	5	30
	Coarse	0.5	1.0					30
	Very Coarse	1.0	2.0	2		2	2	32
<b>GRAVEL</b>	Very Fine	2.0	2.8					32
	Very Fine	2.8	4.0					32
	Fine	4.0	5.6					32
	Fine	5.6	8.0	1		1	1	33
	Medium	8.0	11.0	1		1	1	34
	Medium	11.0	16.0	4	1	5	5	39
	Coarse	16.0	22.6	6		6	6	45
	Coarse	22.6	32	10	8	18	18	63
	Very Coarse	32	45	10	7	17	17	80
	Very Coarse	45	64	6	2	8	8	88
<b>COBBLE</b>	Small	64	90	3	2	5	5	93
	Small	90	128	4		4	4	97
	Large	128	180	1	2	3	3	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
<b>BEDROCK</b>	Large/Very Large	1024	2048					100
	Bedrock	2048	>2048					100
<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> =	Silt/Clay
D <sub>35</sub> =	11.9
D <sub>50</sub> =	24.9
D <sub>84</sub> =	53.7
D <sub>95</sub> =	107.3
D <sub>100</sub> =	180.0



**Reachwide and Cross-Section Pebble Count Plots**

Norkett Branch Stream Mitigation Site

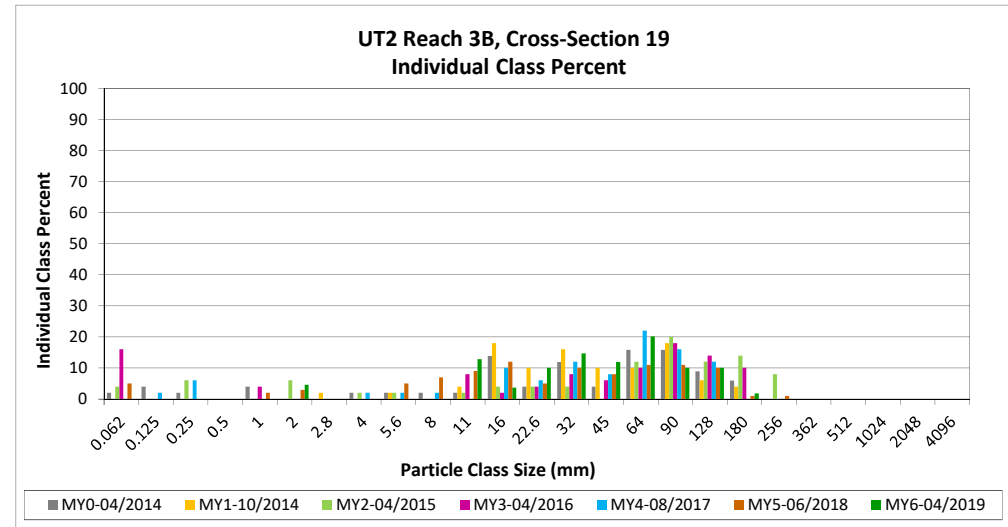
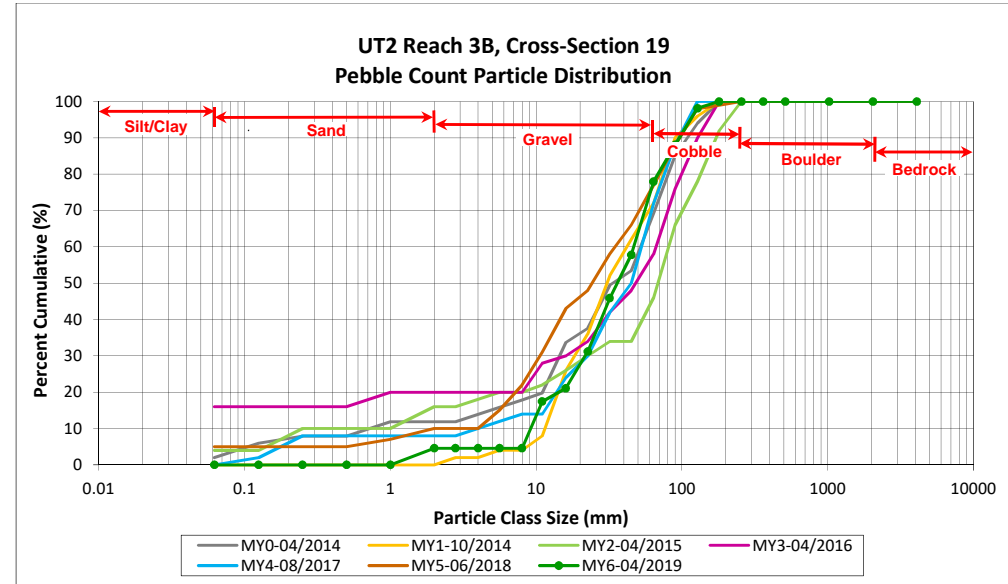
DMS Project No. 95360

Monitoring Year 6 - 2019

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

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>		Silt/Clay				0
<b>SAND</b>	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	5	5	5
<b>GRAVEL</b>	Very Fine	2.0	2.8			5
	Very Fine	2.8	4.0			5
	Fine	4.0	5.6			5
	Fine	5.6	8.0			5
	Medium	8.0	11.0	14	13	17
	Medium	11.0	16.0	4	4	21
	Coarse	16.0	22.6	11	10	31
	Coarse	22.6	32	16	15	46
<b>COBBLE</b>	Very Coarse	32	45	13	12	58
	Very Coarse	45	64	22	20	78
	Small	64	90	11	10	88
	Small	90	128	11	10	98
<b>BOULDER</b>	Large	128	180	2	2	100
	Large	180	256			100
<b>BOULDER</b>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
<b>BOULDER</b>	Large/Very Large	1024	2048			100
	Large/Very Large	2048	>2048			100
<b>BEDROCK</b>		Bedrock				100
<b>Total</b>				<b>109</b>	<b>100</b>	<b>100</b>

Cross-Section 19	
Channel materials (mm)	
D <sub>16</sub> =	10.6
D <sub>35</sub> =	24.7
D <sub>50</sub> =	36.0
D <sub>84</sub> =	78.4
D <sub>95</sub> =	114.6
D <sub>100</sub> =	180.0





## **APPENDIX 5. Hydrology Data**

**Table 14. Verification of Bankfull Events**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

Monitoring Year	Reach	Date of Data Collection	Date of Occurrence	Method
MY1	UT2 Reach 3A (CG #1 XS18)	6/3/2014	5/30/2014	Stream Gage
		9/4/2014	7/21/2014	Stream Gage
		10/17/2014	9/16/2014	Wrack 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
	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
MY2	UT2 Reach 3A (CG #1 XS18)	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
		10/3/2015	10/3/2015	Stream Gage, Crest Gage
		1/4/2015	1/4/2015	Stream Gage
	Norkett Branch Reach 2 (CG #3 XS6)	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
		4/19/2015	4/19/2015	Stream Gage, Crest Gage
		10/3/2015	10/3/2015	Stream Gage, Crest Gage
		2/3/2016	2/3/2016	Stream Gage
MY3	UT2 Reach 3A (CG #1 XS18)	2/16/2016	2/16/2016	Stream Gage
		2/24/2016	2/24/2016	Stream Gage
		3/28/2016	3/28/2016	Stream Gage, Crest Gage
		10/8/2016	10/8/2016	Stream Gage
		4/22/2016	Unknown	Crest Gage
	UT1 (CG #2 XS9)	10/8/2016	10/8/2016	Stream Gage
		2/3/2016	2/3/2016	Stream Gage
	Norkett Branch Reach 2 (CG #3 XS6)	2/16/2016	2/16/2016	Stream Gage
		2/24/2016	2/24/2016	Stream Gage
		3/28/2016	3/28/2016	Stream Gage, Crest Gage
		10/8/2016	10/8/2016	Stream Gage
		1/22/2017	1/22/2017	Stream Gage
MY4	UT2 Reach 3A (CG #1 XS18)	4/24/2017	4/24/2017	Stream Gage
		5/22/2017	5/22/2017	Stream Gage
		5/24/2017	5/24/2017	Stream Gage
		6/20/2017	6/20/2017	Stream Gage
		6/29/2017	Unknown	Crest Gage
		1/23/2017	1/23/2017	Stream Gage
	Norkett Branch Reach 2 (CG #3 XS6)	5/24/2017	5/24/2017	Stream Gage
		2/4/2018	2/4/2018	Stream Gage
		2/7/2018	2/7/2018	Stream Gage
MY5	UT2 Reach 3A (CG #1 XS18)	3/12/2018	3/12/2018	Stream Gage, Crest Gage
		4/24/2018	4/24/2018	Stream Gage
		5/24/2018	5/24/2018	Stream Gage, Crest Gage
		9/16/2018	9/16/2018	Stream Gage, Crest Gage
		5/24/2018	5/24/2018	Stream Gage
		9/16/2018 <sup>1</sup>	9/16/2018 <sup>1</sup>	Stream Gage
	UT1 (CG #2 XS9)	9/16/2018 <sup>1</sup>	9/16/2018 <sup>1</sup>	Stream Gage
		2/4/2018	2/4/2018	Stream Gage, Crest Gage
		4/24/2018	4/24/2018	Stream Gage
	Norkett Branch Reach 2 (CG #3 XS6)	5/24/2018	5/24/2018	Stream Gage, Crest Gage
		9/16/2018	9/16/2018	Stream Gage, Crest Gage
3/7/2019		Unknown	Crest Gage	
6/3/2019		5/4/2019	Stream Gage, Crest Gage	
MY6	UT2 Reach 3A (CG #1 XS18)	3/7/2019	Unknown	Crest Gage
		6/3/2019	5/4/2019	Stream Gage, Crest Gage
	UT1 (CG #2 XS9)	3/7/2019	Unknown	Crest Gage
		6/3/2019	5/4/2019	Stream Gage, Crest Gage
	Norkett Branch Reach 2 (CG #3 XS6)	3/7/2019	Unknown	Crest Gage
6/3/2019		5/4/2019	Stream Gage, Crest Gage	

<sup>1</sup> Two bankfull events were recorded on UT1 when the site received more than 5 inches of rain from the remnants of Hurricane Florence (9/16/18).

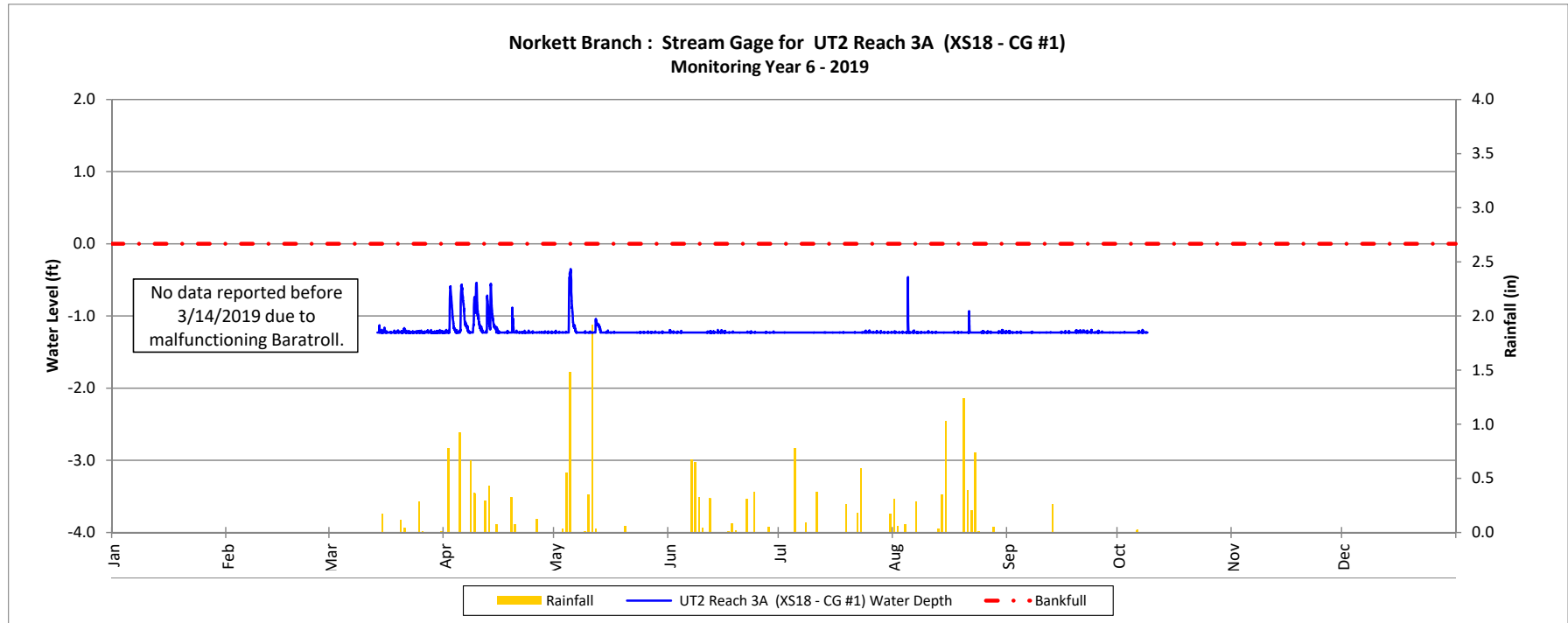


### Recorded In-stream Flow Events

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

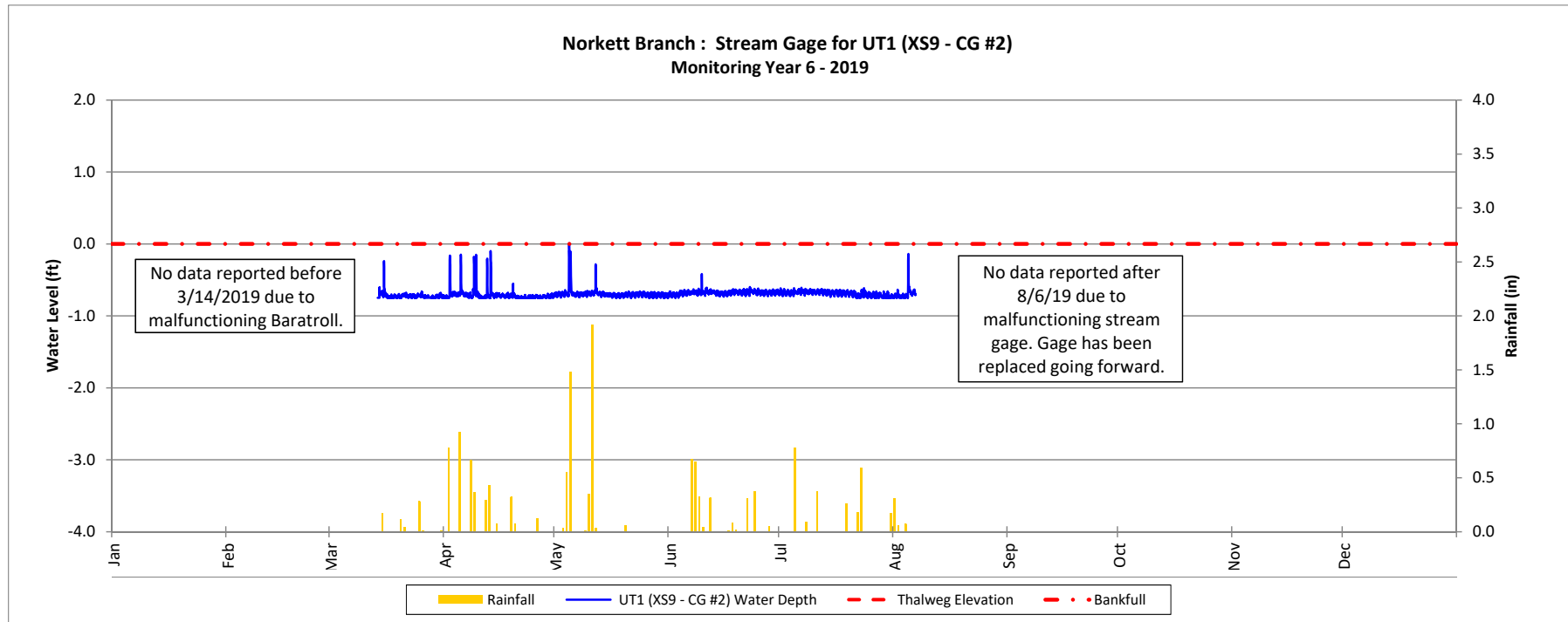


### Recorded In-stream Flow Events

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019



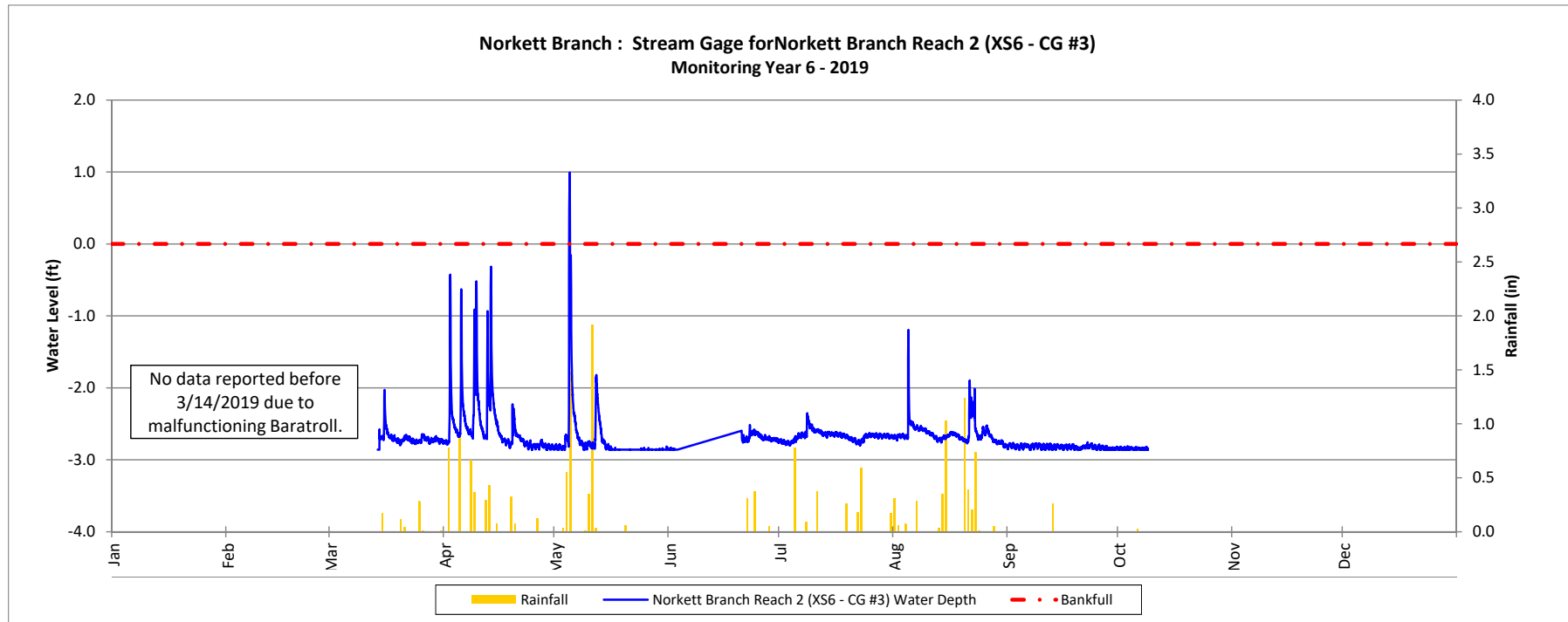


### Recorded In-stream Flow Events

Norkett Branch Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019



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



**Table 15. Water Quality Sampling Results**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019

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	10.0	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	0.3	6.2	120	277.8	10.0	7.1
	SPSC BMP Outlet		1.5	0.12	1.3	0.3	DL	DL	329.9	10.5	7.2
	PW BMP Inlet		DL	0.12	DL	0.3	16.0	120	180.0	9.5	7.3
	PW BMP Outlet		1.2	0.12	1.1	0.2	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	
MY3	SPSC BMP Inlet	9/3/2016	13.0	1.6	11.0	5.2	140.0	HT	---	---	---
	SPSC BMP Outlet		8.5	5.2	3.2	2.5	DL		---	---	---
	PW BMP Inlet		2.3	1.0	1.3	0.9	6.7		---	---	---
	PW BMP Outlet		NF								
MY4	SPSC BMP Inlet	4/4/2017	5.9	0.7	5.2	0.2	480.0	---	---	---	---
	SPSC BMP Outlet		3.2	1.2	2.1	---	---	---	---	---	---
	PW BMP Inlet		6.1	1.4	4.7	0.3	840.0	---	---	---	---
	PW BMP Outlet		5.3	0.3	5.0	DL	150.0	---	---	---	---
	SPSC BMP Inlet	5/23/2017	5.2	1.3	4.0	2.1	25.0	---	170.0	---	6.7
	SPSC BMP Outlet		3.5	0.6	2.9	1.5	30.0	---	---	---	6.6
PW BMP Inlet	2.6		0.4	2.2	0.2	21.0	---	42.0	---	5.8	
PW BMP Outlet		1.3	DL	1.3	0.3	3.5	---	51.0	---	6.4	
MY5	SPSC BMP Inlet	3/12/2018	5.9	0.5	5.3	1.6	1700.0	---	200.0	---	7.1
	SPSC BMP Outlet		3.6	DL	3.6	2.1	540.0	---	180.0	---	7.2
	PW BMP Inlet		1.3	0.3	1.0	0.5	720.0	---	300.0	---	6.5
	PW BMP Outlet		1.4	0.4	0.9	0.2	60.0	---	96.0	---	6.6
	SPSC BMP Inlet	8/6/2018	11.0	0.4	11.0	1.7	540.0	---	96.0	---	6.2
	SPSC BMP Outlet		1.9	1.0	0.9	0.2	---	---	26.0	---	6.8
	PW BMP Inlet		2.5	0.8	1.8	1.2	390.0	---	61.0	---	6.2
	PW BMP Outlet		17.0	0.3	17.0	0.2	---	---	22.0	---	6.5
MY6	SPSC BMP Inlet	3/26/2019	2.3	0.6	1.7	0.5	3500.0	---	160.0	---	6.6
	SPSC BMP Outlet		1.5	0.4	1.0	0.4	570.0	---	200.0	---	6.8
	PW BMP Inlet		5.2	0.1	5.1	0.3	2500.0	---	330.0	---	6.5
	PW BMP Outlet		5.5	DL	5.5	0.3	120.0	---	85.0	---	6.0
	SPSC BMP Inlet	8/5/2019	130.0	DL	130.0	37.0	5000 <sup>A</sup>	---	340.0	---	6.3
	SPSC BMP Outlet		9.5	5.1	4.3	2.1	220.0	---	140.0	---	6.2
	PW BMP Inlet		6.9	3.1	3.8	1.0	630.0	---	76.0	---	5.6
	PW BMP Outlet		4.6	1.5	3.1	0.7	40.0	---	67.0	---	5.4

DL: Parameter was below the detection limit

NF: No flow was available for sample collection/insufficient sample volume

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

A: Sample residue exceeds detection limit. Result is an estimate.

--- : Data was not provided

**Table 16. Pollutant Removal Rates**

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

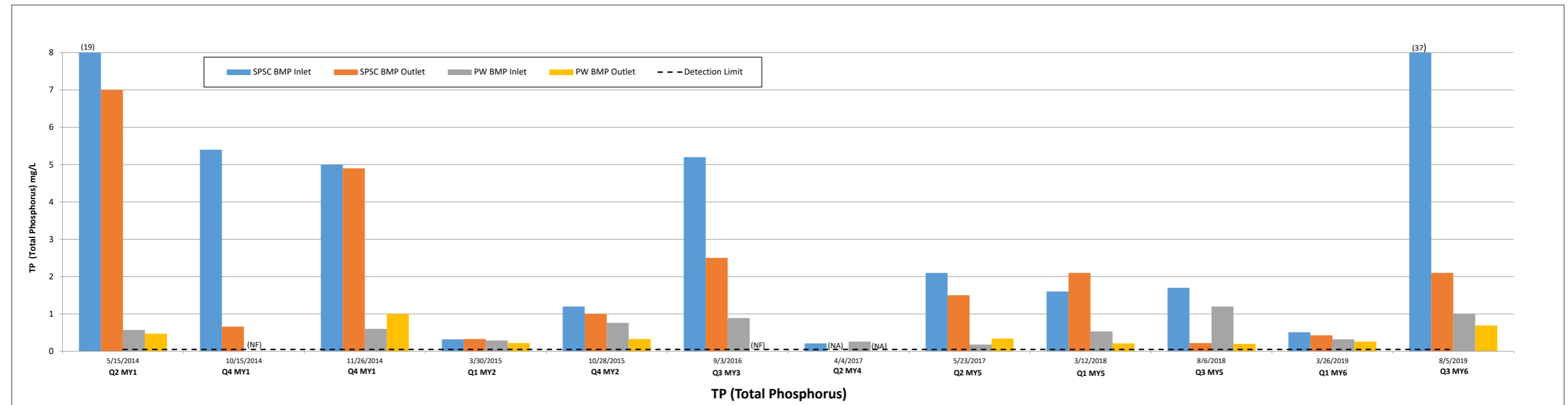
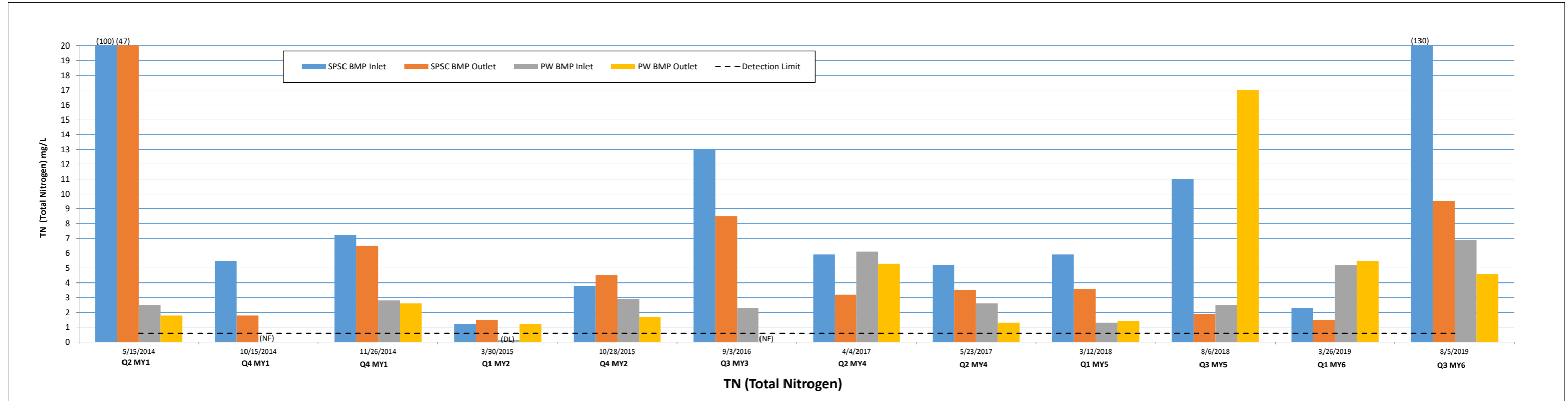
Monitoring Year 6 - 2019

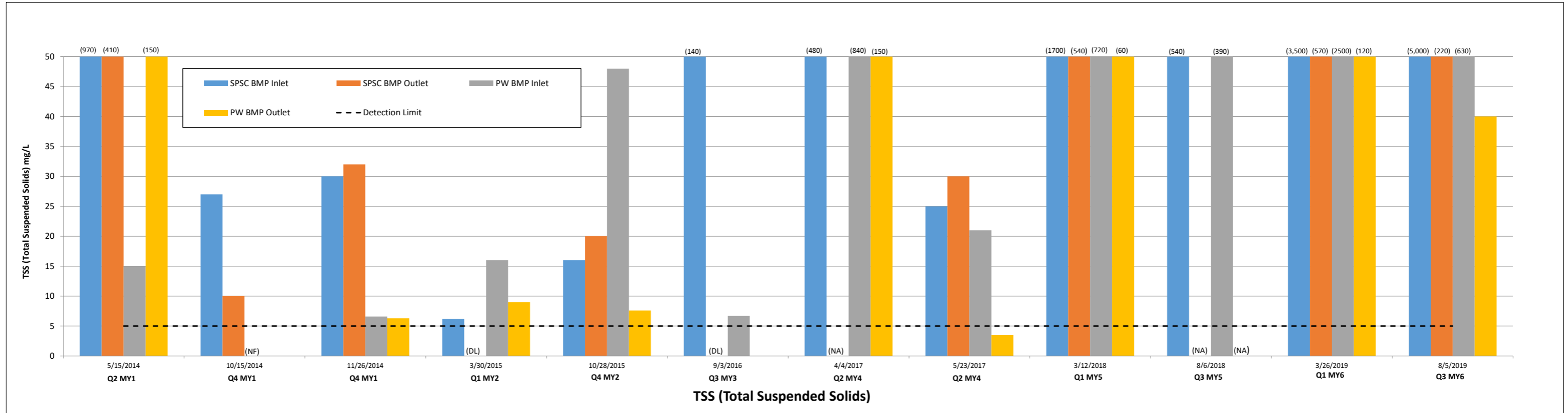
Monitoring Year	Location	Sample Collection Date	Percent Reduction <sup>1</sup>					
			TN	NO <sub>x</sub>	TKN	TP	TSS	FC
MY1	SPSC BMP	4/22/2014	18%	57%	1%	-29%	-56%	65%
	PW BMP	(Baseflow)	N/A	N/A	0%	-74%	-255%	-62%
	SPSC BMP	5/15/2014	53%	64%	42%	63%	58%	0%
	PW BMP		28%	27%	30%	18%	-900%	63%
	SPSC BMP	10/15/2014	67%	88%	60%	88%	63%	-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
MY3	SPSC BMP	9/3/2016	35%	-225%	71%	52%	N/A	N/A
	PW BMP		N/A	N/A	N/A	N/A	N/A	N/A
MY4	SPSC BMP	4/4/2017	46%	-67%	60%	N/A	N/A	N/A
	PW BMP		13%	78%	-6%	N/A	82%	N/A
	SPSC BMP	5/23/2017	33%	55%	28%	29%	-20%	N/A
	PW BMP		50%	N/A	41%	-89%	83%	N/A
MY5	SPSC BMP	3/12/2018	83%	N/A	92%	87%	N/A	N/A
	PW BMP		-580%	56%	-844%	83%	N/A	N/A
	SPSC BMP	8/6/2018	35%	24%	41%	16%	N/A	N/A
	PW BMP		-6%	N/A	-8%	19%	N/A	N/A
MY6	SPSC BMP	3/26/2019	35%	24%	41%	16%	84%	N/A
	PW BMP		-6%	N/A	-8%	19%	95%	N/A
	SPSC BMP	8/5/2019	93%	N/A	97%	94%	96%	N/A
	PW BMP		33%	52%	18%	31%	94%	N/A

<sup>1</sup>Positive values indicate a reduction in pollutant concentration from inlet to outlet samples, negative values indicate an increase in concentration

N/A: Metric cannot be calculated







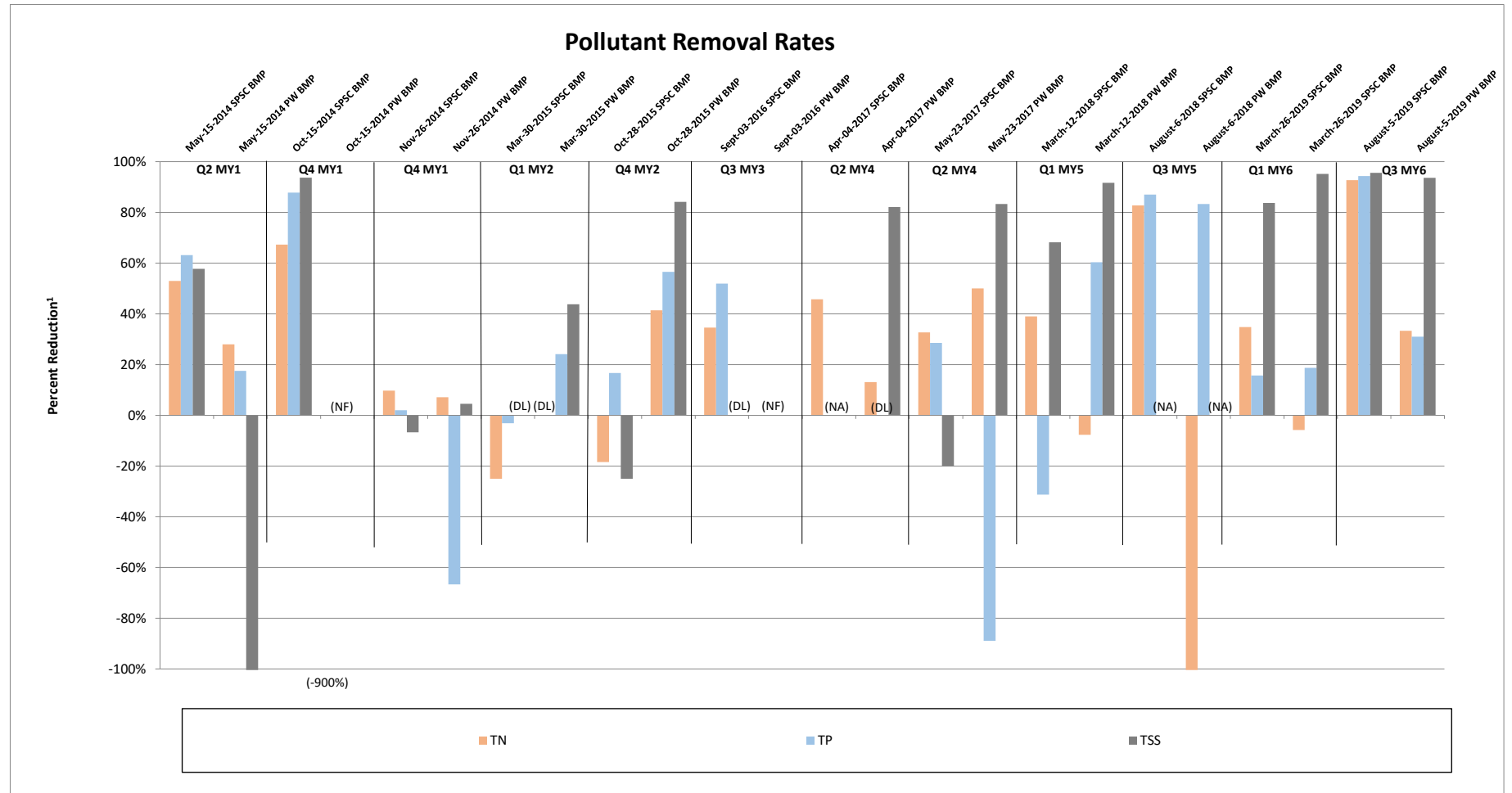


### Pollutant Removal Plot

Norkett Branch Stream Mitigation Site

DMS Project No. 95360

Monitoring Year 6 - 2019



DL: Parameter was below the detection limit

NF: No flow was available for sample collection/insufficient sample volume

NA: No data available at inlet and/or outlet sample for comparison

<sup>1</sup>Positive values indicate a reduction in pollutant concentration from inlet to outlet samples, negative values indicate an increase in concentration