NORKETT BRANCH STREAM MITIGATION SITE
Union County, NC
DENR Contract 004673
NCEEP Project Number 95360

Baseline Monitoring Document and As-Built Baseline Report
FINAL

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EXECUTIVE SUMMARY

Wildlands Engineering (Wildlands) restored and enhanced a total of 10,891 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). Stormwater Best Management Practices (BMPs) are proposed to treat water quality on the non-jurisdictional headwaters of UT3 and an adjacent ephemeral drainage feature. The project will provide 10,098 stream mitigation units (SMUs).

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

- 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.

The Site construction and as-built surveys were completed between December 2013 and May 2014. Adjustments were made during construction, where needed, based on field evaluation at the designer's discretion due to shallow bedrock found during construction. In general, adjustments were made within the Site due to the design features' proximity to vernal pools or existing wetlands, proximity to the old channel fill, or proximity to shallow bedrock. Grade control structures were added or removed due to the presence of bedrock and bioengineered bank armoring structures were shortened. Specific changes are detailed in Section 5.1. Baseline (MY-0) profiles and cross-section dimensions closely match the design parameters. The Site appears to have been built as designed and is on track to meeting the upcoming monitoring year's success criteria.

NORKETT BRANCH STREAM MITIGATION SITE

Baseline Monitoring Document and As-Built Baseline Report

APPENDICES

1.0 Project Goals, Background and Attributes

1.1 Project Location and Setting

The proposed stream mitigation site is located in southeastern Union County along Philadelphia Church Road approximately three miles east of NC Highway 601 (Figure 1). The site is located on tracts owned by Marie S. Autry (PIN 03060001A), Kay A. and Lane Haigler (PIN 03081007C; PIN 03081013; PIN 03081014), The Cox Farms Irrevocable Trust (PIN 03081010), John H. and Peggy S. Autry (3081007D), and Marion, Delano, Ruth, and John (Sr.) Cox (PIN 03081012). A conservation easement was recorded on 31.6 acres within the seven parcels (Deed book 06095, Pages 0530-0589). To access the site from Charlotte, NC, take US-74 south approximately 25 miles to US-601 in Monroe, NC. Turn right on US-601, South and continue approximately 10.5 miles and then turn left onto Landsford Road. Travel approximately 3 miles and take a left onto Philadelphia Church Road. Travel 2 miles and cross over UT2 to Norkett Branch. Both portions of the site can be accessed on either side of Philadelphia Church Road.

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. No recent disturbances were noted beyond land tillage associated with agriculture operations. The drainage area for the project site is 2,034 acres (3.18 sqmi) at the lower end of Norkett Branch Reach 2.

The Site is located within the North Carolina Division of Water Quality (NCDWR) subbasin 03-07-14. 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. These waters are also protected for Class C uses. Class C waters are protected for secondary recreation, fishing, wildlife and aquatic life, maintenance of biotic integrity, and agriculture. The Site is approximately 2 miles upstream from the outlet of Norkett Branch to Lane's Creek, which is listed as impaired for aquatic life on the North Carolina 303(d) list (NCDWR, 2009). The section of Lanes Creek downstream of the project site is listed as impaired due to turbidity (NCDWR, 2012). The 2008 NCDWR Basinwide Water Quality Report 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 Site is located in the eight-digit Cataloging Unit (CU) 03040105, in the Yadkin River Basin, otherwise known as the Yadkin 05 CU. The 14-digit hydrologic unit, or "Targeted Local Watershed," within the 03040105 CU (Yadkin 05) that includes the project site is Yadkin River Basin Hydrologic Unit Code (HUC) 03040105081020 (Middle Lane's Creek). The River Basin Restoration Priorities Plan (RBRP) identifies agricultural practices and runoff as the probable major sources of water quality impairment in the Middle Lane's Creek watershed. Restoration goals for the entire Yadkin 05 basin outlined in the 2009 RBRP document (NCEEP, 2009) include the following:

- improved management of stormwater runoff to these waters;
- protection of valuable threatened and endangered wildlife resources;
- continued mitigation of impacts resulting from rapid urbanization of the area; and
- restoration of water quality in DWQ-identified impaired streams.

Prior to construction activities, the streams had been routinely maintained to provide drainage for agricultural purposes. Impacts to the stream included straightening and ditching, eroding banks, and a lack of stabilizing riparian vegetation. The stream was used as a water source for cattle in some areas, resulting in over-widened, unstable trampled banks. Algal blooms, presumably from agricultural nutrient loading, were observed during site visits.

Trampled stream banks, over-widened channels, and banks illustrating signs of instability were a common occurrence throughout the Site. The alterations of the Site to promote farming resulted in impairment of the ecological function of Site's streams. Specific functional losses at the Site include degraded aquatic habitat, altered hydrology, and reduction of quality of in-stream and riparian wetland habitats and related water quality benefits. Table 4 in Appendix 1 and Tables 5a-c in Appendix 2 present the pre-restoration conditions in detail.

1.2 Project Goals and Objectives

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, 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 Ecosystem Enhancement Program's (NCEEP) mitigation needs while maximizing the ecological and water quality uplift within the watershed.

The following project specific goals and objectives established in the mitigation plan include:

- *Improve aquatic and terrestrial habitat within the riparian corridor and provide habitat corridor extension from adjacent downstream forested habitat.* By restoring appropriate channel cross-section and profile, including riffle and pool sequences, coarse substrate zones for macroinvertebrates and deep pool habitat for fish will also be restored. Introduction of large woody debris, rock structures, brush toe, and native stream bank vegetation will provide additional habitat and cover for both fish and macroinvertebrates. Adjacent buffer areas will be restored by planting native vegetation which will provide habitat and forage for terrestrial species. These areas will be allowed to receive more regular inundating flows, and vernal pools may develop over time increasing habitat diversity. A watershed approach, restoring riparian corridor functions on multiple interconnected tributaries as well as treating agricultural drainage from headwater features with Best Management Practices (BMPs), will allow for large-scale riparian corridor connectivity.

- *Improve additional water quality aspects within stream channels on site.* Riffle/pool sequences will be restored to provide re-aeration for oxygen levels to be maintained in the perennial reaches. Creation of deep pool zones will lower temperature, helping to maintain dissolved oxygen concentrations. Establishment and maintenance of riparian buffers will create long-term shading of the stream to minimize thermal heating. Water quality BMPs situated in the headwaters of jurisdictional streams will treat agricultural runoff before it reaches project stream reaches.

- *Decrease sediment inputs to the stream channels and decrease turbidity in receiving Lanes Creek.* Cattle will be fenced out of the riparian corridor, eliminating bank trampling. Sediment input from eroding stream banks will be reduced by installing bioengineering and in-stream structures while creating a stable channel form using geomorphic design principles. Sediment from off-site sources will be captured by deposition on restored floodplain areas where native vegetation will slow overland flow velocities. By allowing for more overbank flooding and by increasing channel roughness, in-channel velocities can be reduced. This will lower bank shear stress and decrease bank erosion.

- *Decrease phosphorus, nitrogen, and fecal coliform inputs to the stream channels.* Nitrogen and phosphorus chemical fertilizers, pesticides, and cattle waste will be decreased by buffering adjacent agricultural operations from the restored channels. Cattle will be fenced out to eliminate in-channel fecal pollution. Off-site nutrient input will be absorbed on-site by filtering flood flows through restored floodplain areas, water quality BMPs, and vernal pools positioned to treat concentrated overland flow. Flood flows will be allowed to disperse through native vegetation across the reconnected floodplain. Increased surface water residency time will provide contact treatment time and groundwater recharge potential.

1.3 Project Structure, Restoration Type and Approach

The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions and trajectory. Specially, the site design was developed to address stream degradation caused primarily by livestock access, agricultural practices, and anthropogenic modifications. Other key factors addressed in the design were to create stable habitats, and improve riparian buffers. Figure 2 and Table 1 in Appendix 1 present the stream mitigation components for the Site.

The final mitigation plan was submitted and accepted by the NCEEP in July of 2013. Construction activities were completed by Land Mechanic Designs, Inc in April 2014. The planting was completed by Bruton Natural Systems, Inc. in April 2014. The baseline as-built survey was completed by Kee Mapping and Surveying between March 2014 and April 2014. There were a few deviations reported in the as-built project elements compared to the design plans. Adjustments were made during construction, where needed, based on field evaluation at the designer's discretion due to shallow bedrock found during construction. In general, adjustments were made within the Site due to the design features' proximity to vernal pools or existing wetlands, proximity to old channel fill, or the proximity to shallow bedrock. Grade control structures were added or removed due to the presence of bedrock, and bioengineered bank armoring structures were shortened. Field adjustments made during construction are described in detail in section 5.1. Appendix 1 provides more detailed project activity, history, contact information, and watershed/site background information for this project.

1.3.1 Project Structure

The project will provide 10,098 stream mitigation units (SMUs). Please refer to Figure 2 for the project component/asset map for the stream restoration feature exhibits and Table 1 for the project component and mitigation credit information for the Site.

1.3.2 Restoration Type and Approach

The design streams have been restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions and trajectory. The project includes stream restoration and enhancement as well as water quality treatment BMPs. The specific proposed stream types are described below.

The stream restoration portion of this project includes seven reaches:

- Norkett Branch Reach 1 from the southern portion of the property to the confluence with UT2;
- Norkett Branch Reach 2 from the confluence with UT2 to the northern boundary of the property ;
- UT1 from the eastern portion of the Cox Farms property to the confluence with Norkett Branch;
- UT2 Reach 1 from its origin at a farm pond to station 310+80;
- UT2 Reach 2 from station 310+80 to the confluence with UT2A;
- UT2 Reach 3A from the confluence with UT2A to the culvert at Philadelphia Church Road; and
- UT2 Reach 3B from the culvert at Philadelphia Church Road to the confluence with Norkett Branch.

Enhancement II was implemented on two intermittent channels: UT2A, which runs from the western portion of the Haigler property to its confluence with UT2, and UT3 which runs from the eastern portion of the Haigler property to its confluence with Norkett Branch. Stormwater BMPs have been implemented to treat agricultural drainage upstream of UT3 and agricultural drainage in the right floodplain of Norkett Branch Reach 2.

The project design was developed based on similar reference conditions representing small Piedmont streams within the Carolina Slate Belt and on the border between the Triassic Basin Lithologic Belt and the Carolina Slate Belt. These reference streams were chosen because of similarities to the project streams including drainage area, valley slope and morphology, bed material, and location within or closely bordering the Carolina Slate Belt region of the Piedmont. The streams on the Site are all gravel bed channels and the design incorporates woody structures that will drive scour pool formation and provide aquatic habitat.

1.4 Project History, Contacts and Attribute Data

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

2.0 Success Criteria

The stream restoration performance criteria for the project site follow approved performance criteria presented in the NCEEP Mitigation Plan Template (version 2.1, 09/01/2011), the NCEEP Monitoring

Requirements and Performance Standards for Stream and/or Wetland Mitigation (11/7/2011), and the Stream Mitigation Guidelines issued in April 2003 by the United States Army Corps of Engineers (USACE) and NCDWQ. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The stream restoration and enhancement sections of the project have been assigned specific performance criteria components for stream morphology, hydrology, and vegetation. Performance criteria will be evaluated throughout the seven year post-construction monitoring. If all performance criteria have been successfully met and two bankfull events have occurred during separate years, Wildlands may propose to terminate stream and/or vegetation monitoring after Year 5, in accordance with the Early Closure Provision in the NCEEP Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (November 7, 2011). These success criteria are covered in detail in the following paragraphs.

2.1 Streams

2.1.1 Dimension

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. Per NCEEP guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored channels to be considered stable. 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. Remedial action would not be taken if channel changes indicate a movement toward stability.

2.1.2 Pattern and Profile

The as-built survey includes a longitudinal profile for the baseline monitoring report. Longitudinal profile surveys will not be conducted during the seven year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the NCEEP Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation (11/7/2011) and the 2003 USACE and NCDWQ Stream Mitigation Guidance for the necessary reaches.

2.1.3 Substrate

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.

2.1.4 Photo Reference Points

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

vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected. Reference photos will also be taken for each of the vegetation plots.

2.1.5 Bankfull Documentation

Two bankfull flow events must be documented on the restoration and enhancement reaches within the seven-year monitoring period. The two bankfull events must occur in separate years. Stream monitoring will continue until success criteria in the form of two bankfull events in separate years have been documented. Bankfull events will be documented using submerged pressure transducers, crest gages, photographs, and visual assessments such as debris lines.

2.2 Vegetation

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 required monitoring period (year seven). The interim measure of vegetative success for the site will be the survival of at least 320 planted stems per acre at the end of the third monitoring year and at least 260 stems per acre at the end of the fifth year of monitoring. Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. If this performance standard is met by year five and stem density is trending towards success (i.e., no less than 260 five year old stems/acre), monitoring of vegetation on the site may be terminated provided written approval is provided by the USACE in consultation with the NC Interagency Review Team. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

3.0 Monitoring Plan

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

3.1 Stream

Geomorphic assessments follow guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994), methodologies utilized in the Rosgen stream assessment and classification document (Rosgen, 1994 and 1996), and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al, 2003). Please refer to Appendix 4 for monitoring locations discussed below.

3.1.1 Dimension

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 NCEEP guidance. Each cross-section was permanently marked with pins to establish its location. Annual cross-section survey will include points measured at all breaks

in slope, including top of bank, bankfull, edge of water, and thalweg. Photographs will be taken annually of the cross-section looking upstream and downstream.

3.1.2 Pattern and Profile

During the as-built survey, seven separate longitudinal profiles were conducted on project streams; 2,313 LF on Norkett Branch Reach 1; 1,513 LF on Norkett Branch Reach 2; 1,212 LF on UT1; 1,033 LF on UT2 Reach 1; 1,416 LF on UT2 Reach 2; 1,041 LF on UT2 Reach 3A; and 668 LF on UT2 Reach 3B. Longitudinal profile surveys will not be conducted during the seven year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. Stream pattern and profile will be assessed visually as described below.

3.1.3 Substrate

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. Subsequent sampling will be performed annually at the same locations for the duration of the monitoring.

3.1.4 Photo Reference Points

A total of 51 permanent photograph reference points were established within the project area after construction. Photographs will be taken once a year to visually document stability for seven years following construction. Permanent markers were established so that the same locations and view directions on the site are monitored each year. Photographs will be used to monitor stream restoration and enhancement reaches. Photographs will also be taken along Norkett Branch Reach 1 where the old channel was filled in to document the transition in to a wetland complex. The photographer will make every effort to maintain the same view in each photo over time. The representative digital photo(s) will be taken on the same day(s) the surveys are conducted.

3.1.5 Bankfull Documentation

Three crest gages and three pressure transducers were installed on the Site (Appendix 4). The gages and transducers were installed onsite in surveyed riffle cross-sections XS6 (Norkett Branch), XS9 (UT1), and XS18 (UT2 Reach 3A), and will be checked during each site visit to determine if a bankfull event has occurred since the last visit. Photographs will be used to document the occurrence of debris lines and sediment deposition as evidence of bankfull events. Additionally, the pressure transducer data will be plotted and included in the annual monitoring reports.

3.1.6 Visual Assessment

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

3.1.7 Water Quality BMP Assessment

Water quality grab samples will be collected during the monitoring period to assess the functionality of the step pool conveyance BMP and the pocket wetland BMP and to compare to published predicted pollutant removal rates. This sampling will not be part of the success criteria for the project. Please refer to Figure 2 for a location map of these BMPs.

3.2 Vegetation

A total of 26 vegetation monitoring plots were installed and evaluated within the restoration and enhancement areas to measure the survival of the planted trees during April 2014. Vegetation plots were randomly established within the planted corridor of the restoration areas to capture the heterogeneity of the designed vegetative communities. The number of monitoring quadrants required is based on the NCEEP monitoring guidance documents (version 1.4, 11/7/11). The size of individual quadrants will be 100 square meters for woody tree species and shrubs. Vegetation assessments will be conducted following the Carolina Vegetation Survey (CVS) Level 2 Protocol for Recording Vegetation (2006). The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs at the origin looking diagonally across the plot to the opposite corner were taken in April 2014. Subsequent annual assessments following baseline survey will capture the same reference photograph locations.

The first annual vegetation monitoring activities will commence during the month of September 2014. The restoration and enhancement sites will then be evaluated each subsequent year between June 1 and September 31. Species composition, density and survival rates will be evaluated on an annual basis by plot and for the entire site. Individual plot data will be provided and will include diameter, height, density, vigor, damage (if any), and percent survival. Planted woody stems will be marked annually as needed, based off of a known origin, so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the baseline year's living planted stems and the current year's living planted stems.

3.3 Schedule and Reporting

Annual monitoring reports will be prepared in the fall of each year of monitoring and submitted to NCEEP. Based on the NCEEP Monitoring Report Template (version 1.3, 01/15/2010), the monitoring reports will include the following:

- Project background which includes project objectives, project structure, restoration type and approach, location and setting, history and background;
- As-built topographic plans of major project elements including such items as grade control structures, vegetation plots, permanent cross-sections, crest gages, and pressure transducers;
- Photographs showing views of the restored stream site taken from fixed point stations;
- Assessment of the stability of the stream site based on the cross-sections;
- Vegetative data as described above including the identification of any invasion by undesirable plant species;
- BMP water quality sampling and assessment;
- Hydrologic assessment, including bankfull documentation;

- A description of damage by animals or vandalism;
- Maintenance issues and recommended remediation measures will be detailed and documented; and
- Wildlife observations.

4.0 Maintenance and Contingency Plans

Project maintenance will be performed as described above (Section 2.0 and 3.0) in this document. If, during the course of annual monitoring it is determined the site's ability to achieve site performance standards are jeopardized, NCEEP will notify the USACE of the need to develop a Plan of Corrective Action. The Plan of Corrective Action may be prepared using in-house technical staff or may require engineering and consulting services. Once the Corrective Action Plan is prepared and finalized NCEEP will:

- Notify the USACE as required by the Nationwide 27 permit general conditions;
- Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE;
- Obtain other permits as necessary;
- Implement the Corrective Action Plan; and
- Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

5.0 As-Built Condition (Baseline)

The Site construction and as-built survey were completed between December 2013 and April 2014. The survey included developing an as-built topographic surface, locating the channel boundaries, structures, longitudinal profiles, and cross-sections. For comparison purposes, the baseline monitoring divided the reach assessments in the same way they were established for design parameters.

5.1 As-Built/Record Drawings

A half size baseline plan is located in Appendix 4 with the post-construction locations and alignments for the project. A record drawing has also been provided to NCEEP as a separate document that redlines any significant field adjustments made during construction that were different from the design plans. Adjustments were made during construction, where needed, based on field evaluation at the designer's discretion due to shallow bedrock found during construction. In general, adjustments were made within the Site due to the design features' proximity to vernal pools or existing wetlands, proximity to old channel fill, or the proximity to shallow bedrock. Additional riffle material was supplied to UT2A and at the end of UT2 Reach 3A. Grade control structures were added or removed due to the presence of bedrock, and bioengineered bank armoring structures were shortened. Rather than spanning the entire curve of a meander bend, brush toe and brush mattress was installed on the lower one third of the arc length into the bend. This change was made because protection is not as useful in the first third of the curve. Brush toe in close proximity to riparian wetlands or former channels were built as juncus sod matting or brush mattress to reduce excavation and seepage. In addition, changes were made to the species selection in the planting plan. Elderberry (*Sambucus canadensis*) and ninebark (*Physocarpus opulifolius*) replaced redosier dogwood (*Cornus sericea*) as a source for live-stakes due to the availability

of nursery stock at the time of planting. Also, live stakes were added to vernal pool areas at Norkett Branch and UT2, and rock was added at the outlet of the vernal pools to reduce floodplain erosion. Specific changes are detailed below:

5.1.1 Norkett Branch Reach 1

- STA 103+16 woody riffle built as constructed riffle;
- STA 103+82 brush toe built as juncus sod mats;
- STA 105+20 added log grade control J-hook;
- STA 109+60 sod matting removed;
- STA 110+70 riffle material added;
- STA 112+94 riffle material added;
- STA 114+75 brush toe replaced with brush mattress due to proximity with UT1;
- STA 116+05 brush mattress built as brush toe;
- STA 117+70 brush toe shortened, rip rap added at culvert inlet;
- STA 118+70 brush toe shortened at culvert outfall;
- STA 119+65 riffle material added;
- STA 122+02 sod matting removed due to shallow bedrock;
- STA 122+57 log sill removed due to shallow bedrock; and
- STA 123+06 brush toe removed due to shallow bedrock.

5.1.2 Norkett Branch Reach 2

- STA 124+91 sod mat built as brush mattress due to shallow bedrock;
- STA 132+57 log J-hook removed due to shallow bedrock;
- STA 135+30 log J-hook removed due to shallow bedrock;
- STA 135+30 brush toe built as brush mattress with live whips;
- STA 136+92 log J-hook removed due to shallow bedrock
- STA 137+50 constructed riffle removed due to bedrock within channel;
- STA 138+14 brush toe at built as brush mattress; and
- STA 139+97 constructed riffle shortened.

5.1.3 UT1

- STA 200+71 riffle shortened;
- STA 201+08 riffle material added;
- STA 209+20 brush mattress removed; and

- STA 211+45 rock and roll riffle built as constructed riffle.

5.1.4 UT2 Reach 1

- added rock to outlets of vernal pools to stabilize floodplain;
- STA 301+16 brush toe built as juncus sod mat due to proximity of wetland;
- STA 310+52 log sill removed; and
- STA 305+50 riffle extended.

5.1.5 UT2 Reach 2

- STA 312+50 brush mattress removed due to shallow bedrock;
- STA 313+22 brush mattress removed due to shallow bedrock;
- STA 316+79 juncus sod matting built instead of brush toe due to proximity of old channel fill;
- STA 320+63 juncus sod matting built instead of brush toe due to proximity of old channel fill;
- STA 322+05 brush mattress removed;
- STA 325+48 riffle material added;
- STA 327+48 log vane removed because of existing rock protecting outer bank;
- STA 328+90 brush toe removed due to proximity of old channel fill;
- STA 329+40 brush toe removed;
- STA 330+40 brush mattress removed due to proximity of old channel fill;
- STA 330+75 brush toe removed due to proximity of wetland; and
- STA 332+44 constructed riffle built as jazz riffle.

5.1.6 UT2 Reach 3A

- STA 335+25 boulder sill added.

5.1.7 UT2 Reach 3B

- STA 337+25 boulder toe ends at bedrock;
- STA 337+50 log vane removed due to bedrock;
- STA 339+87 jazz riffle built as constructed riffle;
- STA 340+02 brush mattress removed due to shallow bedrock; and
- STA 341+00 log vane removed due to shallow bedrock.

5.1.8 UT2A

- All banks were graded and bench was cut in left floodplain;
- Laid back banks at 3:1 to 5:1 slope;

- Placed matting in disturbed areas; and
- Riffle material added to riffles throughout reach.

5.1.9 UT3

- STA 505+25 added step pool.

5.2 Baseline Data Assessment

Baseline monitoring was conducted between April 2014 and May 2014. The first annual monitoring assessment (MY-1) will be completed in the fall of 2014. The streams will be monitored for a total of seven years, with the final monitoring activities conducted in 2020. The close-out for the Site will be conducted in 2021 given the success criteria is met. As part of the closeout process, NCEEP will evaluate the site at the end of the fourth year monitoring period to determine whether or not the site is eligible to closeout following monitoring year five. If the Site is meeting success criteria, NCEEP will propose to the interagency review team (IRT) to proceed with the closeout process. If the Site is not meeting success criteria, then an additional two years of monitoring will be conducted by Wildlands.

5.2.1 Morphological State of the Channel

Morphological data for the as-built profile was collected in April 2014. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The MY-0 profiles closely match the profile design parameters. On the design profiles, riffles were depicted as straight lines with consistent slopes. However, at some locations the as-built survey riffle profiles are not consistent in slope due to a backwater effect from downstream bedrock.

Dimension

The MY-0 dimension numbers closely match the design parameters with minor variations in all reaches. This is primarily due to variation in bankfull width. Summary data and cross-section plots of each project reach can be found in Appendix 2.

Pattern

The MY-0 pattern metrics fell within the design parameters for all seven reaches. No major design changes were made to alignments during construction. Pattern data will be evaluated in monitoring year five if there are any indicators through the profile or dimensions that significant geomorphic adjustments have occurred.

Sediment Transport

As-built shear stresses and velocities are similar to design parameters and should reduce the risk of further erosion along all seven restoration reaches. The as-built condition for each of these reaches indicates an overall increase in substrate particle size (Table 5a – 5c). The substrate data for each constructed reach were compared to the design shear stress parameters from the mitigation plan to assess the potential for bed degradation. The shear stresses calculated for the constructed channels are generally within the allowable range, which indicates that the channel is not at risk to trend toward channel degradation.

5.2.2 Vegetation

The MY-0 planted density is 696 stems/acre, which exceeds the MY-5 and MY-7 density requirement. Summary data and photographs of each plot can be found in Appendix 3.

5.2.4 Hydrology

Several bankfull events have been observed following completion of construction. Bankfull events recorded will be included in the year 1 monitoring report.

6.0 References

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

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

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

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

North Carolina Ecosystem Enhancement Program (NCEEP), 2009. Lower Yadkin-Pee Dee River Basin Restoration Priorities (RBRP). http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

North Carolina Division of Water Quality (NCDWQ) Basinwide Planning Program, 2008. Yadkin Pee-Dee River Basinwide Water Quality Plan.

http://h2o.enr.state.nc.us/basinwide/Neuse/2008/Yadkin2008.htm

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

North Carolina Division of Water Quality (NCDWR), 2012. North Carolina 303(d) List - Category 5. August 24, 2012. http://portal.ncdenr.org/c/document_library/get_file?uuid=9d45b3b4-d066-4619-82e6-ea8ea0e01930&groupId=38364

North Carolina Ecosystem Enhancement Program (NCEEP), 2009. Lower Yadkin-Pee Dee River Basin Restoration Priorities (RBRP). http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

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

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

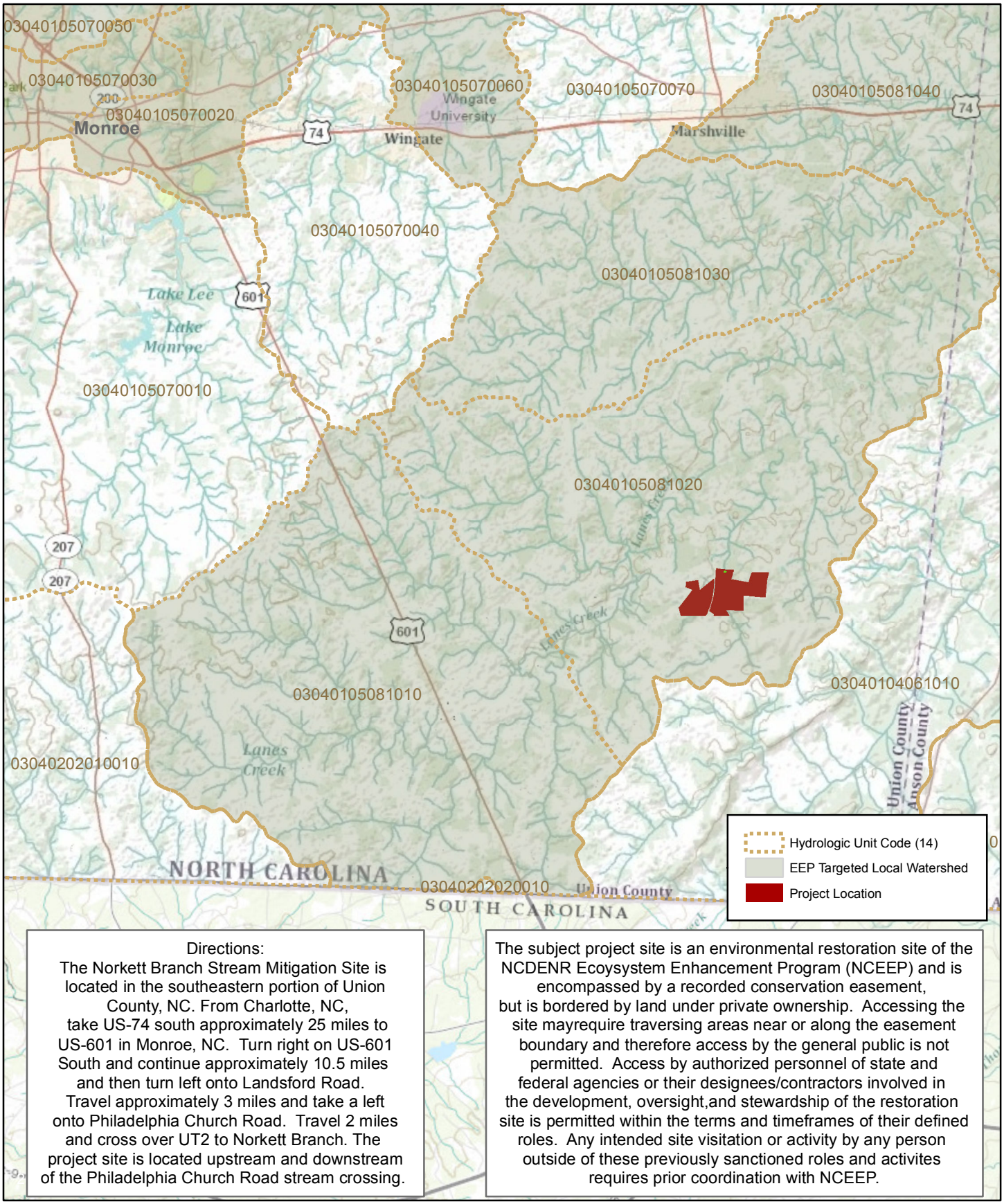
Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina, 3rd approx. North Carolina Natural Heritage Program, Raleigh, North Carolina.

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

United States Geological Survey (USGS), 1998. North Carolina Geology. http://www.geology.enr.state.nc.us/usgs/coastalp.htm

Wildlands Engineering, Inc (2013). Norkett Branch Stream Mitigation Site Mitigation Plan. NCEEP, Raleigh, NC.

APPENDIX 1. General Tables and Figures



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

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

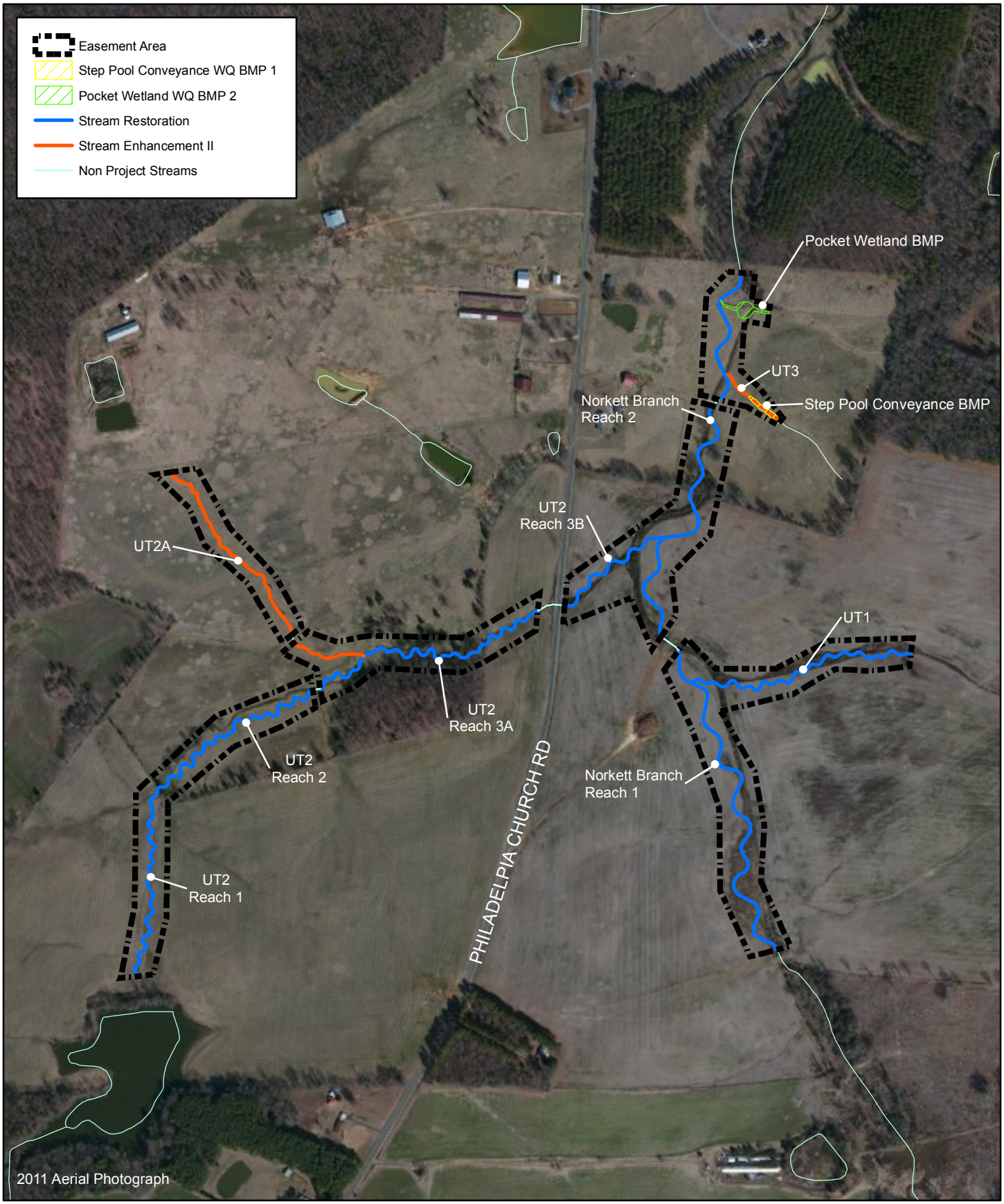
WILDLANDS ENGINEERING

Ecosystem Enhancement PROGRAM

0 1 2 Miles

N

Figure 1 Vicinity Map
Norkett Branch Stream Mitigation Site
NCEEP Project No.95360
Monitoring Year 0
Union County, NC



WILDLANDS ENGINEERING

Ecosystem Enhancement PROGRAM

0 300 600 Feet

N

Figure 2 Project Component / Asset Map
Norkett Branch Stream Mitigation Site
NCEEP Project No.95360
Monitoring Year 0
Union County, NC

Table 1. Project Components and Mitigation Credits
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360)
Monitoring Year 0

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	9,196	902	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Project Components							
Reach ID	Design/As-Built Alignment Stationing[1]	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage/ Acreage[2]	Mitigation Ratio	Credits (SMU)[2]
Streams							
Norkett Branch Reach 1	100+31-117+60 & 118+60-124+00	1,980 LF	P1	Restoration	2,313	1:1	2,313
Norkett Branch Reach 2	124+00-131+84 & 132+25-138+99	1,505 LF	P1	Restoration	1,513	1:1	1,513
UT1	200+00-211+98	840 LF	P1	Restoration	1,212	1:1	1,212
UT2 Reach 1	300+41-310+80	820 LF	P1	Restoration	1,033	1:1	1,033
UT2 Reach 2	310+80-321+71 & 322+06-325+20	1,272 LF	P1	Restoration	1,416	1:1	1,416
UT2 Reach 3A	325+20-335+58	923 LF	P1	Restoration	1,041	1:1	1,041
UT2 Reach 3B	336+90-343+48	380 LF	P1/2	Restoration	668	1:1	668
UT2A	401+53-411+46 & 411+84-415+31	1,296 LF	EII	Enhancement II	1,340	2.5:1	536
UT3	505+42-507+12	163 LF	EII	Enhancement II	170	2.5:1	68
WQ BMP 1	Upstream of UT3 intermittent drainage		Step Pool Conveyance	WQ BMP	29.7 ac treated	1:8	238[3]
WQ BMP 2	non-jurisdictional drainage in eastern Norkett Branch floodplain		Pocket Wetland	WQ BMP	19.9 ac treated	1:3	60[3]

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

N/A: not applicable

1. Stationing based off of centerline as-built alignment which matched with the design alignment.
2. Credits are based off of the as-built thalweg alignment.
3. Credits determined for the BMPs were established in the mitigation plan (2013).

Table 2. Project Activity and Reporting History
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360)
Monitoring Year 0

Activity or Report	Data Collection	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[1]	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	2014	December 2014
Year 2 Monitoring	2015	December 2015
Year 3 Monitoring	2016	December 2016
Year 4 Monitoring	2017	December 2017
Year 5 Monitoring	2018	December 2018
Year 6 Monitoring	2019	December 2019
Year 7 Monitoring	2020	December 2020

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

Table 3. Project Contact Table
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360)
Monitoring Year 0

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

Table 4. Project Information and Attributes
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360)
Monitoring Year 0

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 Drainiage 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[1]	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 Desription (stream type)	P	P	P	P	I	I
Evolutionary trend (Simon's Model) - Pre- Restoration	III	III/IV	II/III	II, IV	IV	II/ III
Underlying mapped soils	Floodplain Soil Types for Site					
	Badin channery silt loam		Badin channery silt clay loam		Cid channery silt loam	Secrest-Cid complex
Drainage class	well-drained		well-drained		well-drained with moderate shrink-swell potential	well-drained
Soil Hydric status	N		N		N	Y
Slope	2-8%		2-8%		1-5%	0-3%
FEMA classification	AE	AE	N/A	N/A	N/A	N/A
Native vegetation community	Piedmont Bottomland Forest					
Percent composition exotic invasive vegetation -Post-Restoration	0%					

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States - Section 404	X	X	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 3885.
Waters of the United States - Section 401	X	X	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	X	X	Norkett Branch Mitigation Plan; Wildlands determined "no effect" on Union County listed endangered species.
Historic Preservation Act	X	X	No historic resources were found to be impacted (letter from SHPO dated 8/20/2012).
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	X	X	CLOMR Approved, LOMR in process
Essential Fisheries Habitat	N/A	N/A	N/A

1. Total stream length does not exclude easement crossings.

APPENDIX 2. Morphological Summary and Data Plots

Table 5a. Baseline Stream Data Summary
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

Norkett Branch Reaches 1 & 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
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	n/a	12.8	21.5	22	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	60.0	114+	>81		>50		48.4	>110	60.5	>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	2.75		2.75		2.6	3.3	3.0	3.3
Bankfull Cross-sectional Area (ft^2)		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	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	2.2	>5	>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
Profile																			
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)^		62	300	60	300	71.0		19	42	33.0	93.0	29	163	30	170	67	183	98	172
Pool Volume (ft^3)																			
Pattern																			
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	1.8	3	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
Substrate, Bed and Transport Parameters																			
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		---		---		---									
Reach Shear Stress (Competency) lb/ft^2		0.41	0.44	0.17	0.38							0.28		0.4		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^2																			
Additional Reach Parameters																			
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% [1]		<1% [1]		---		---		---		<1% [1]		<1% [1]		<1% [1]		<1% [1]	
Rosgen Classification		E4		C/E5		E4		E5		C4/E4		C4		C5		C4		C4/E4	
Bankfull Velocity (fps)		3.5	4	2.5	3.5	4.9	5.4	3.2		3.5	4.1	2.8		3.3		2.6	2.8	2.8	2.9
Bankfull Discharge (cfs)		110		140		97		25		29.1	32.0	110		140		105	124	130	148
Q-NFF regression																			
Q-USGS extrapolation																			
Q-Mannings																			
Valley Length (ft)		---		---		---		---		---		1910		1249		1910		1249	
Channel Thalweg Length (ft^2)		1,980		1,505		---		---		---		2,369		1,499		2,369		1,499	
Sinuosity (ft^3)		1.1		1.1		2.30		2.50		1.00		1.24		1.20		1.24		1.20	
Water Surface Slope (ft/ft^2)		0.004		0.001	0.005	---		---		---		0.0025		0.0036		0.003		0.003	
Bankfull Slope (ft/ft)						---		---		---		---		---		0.003		0.003	

[1] No impervious land use is present within the project watershed per the CGIA Land Use Classification data set.

[2] Channel Length represented does not include easement breaks.

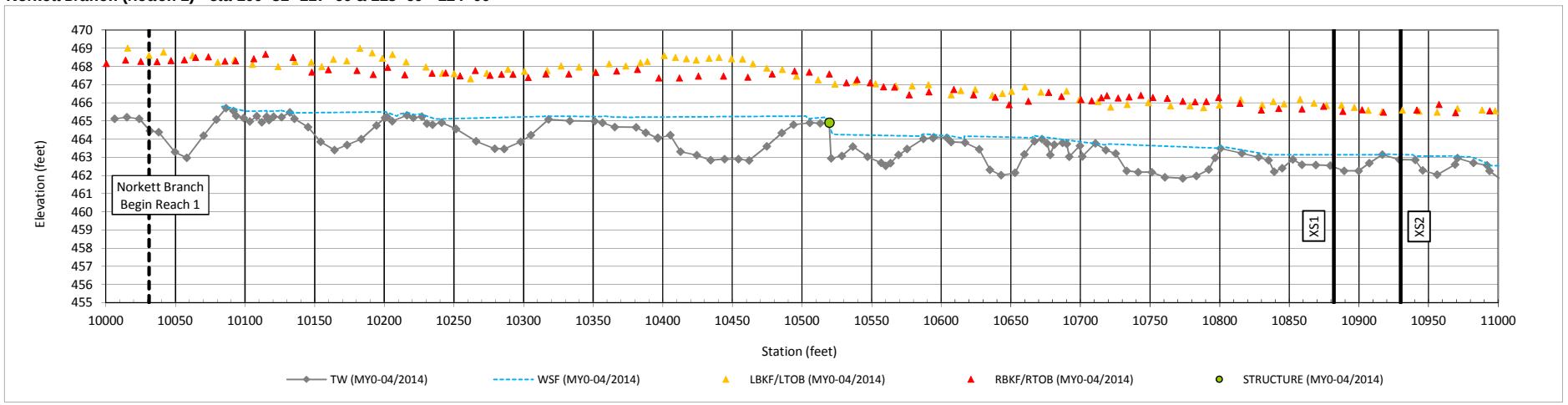
(---): Data was not provided

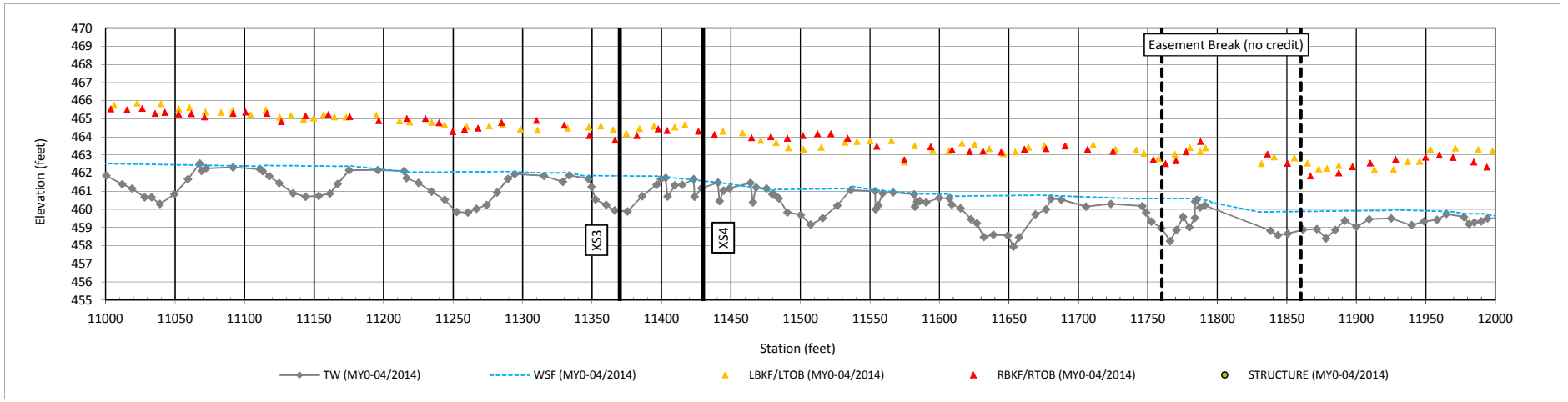
N/A: Not Applicable

SC: Silt/Clay

Longitudinal Profile Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

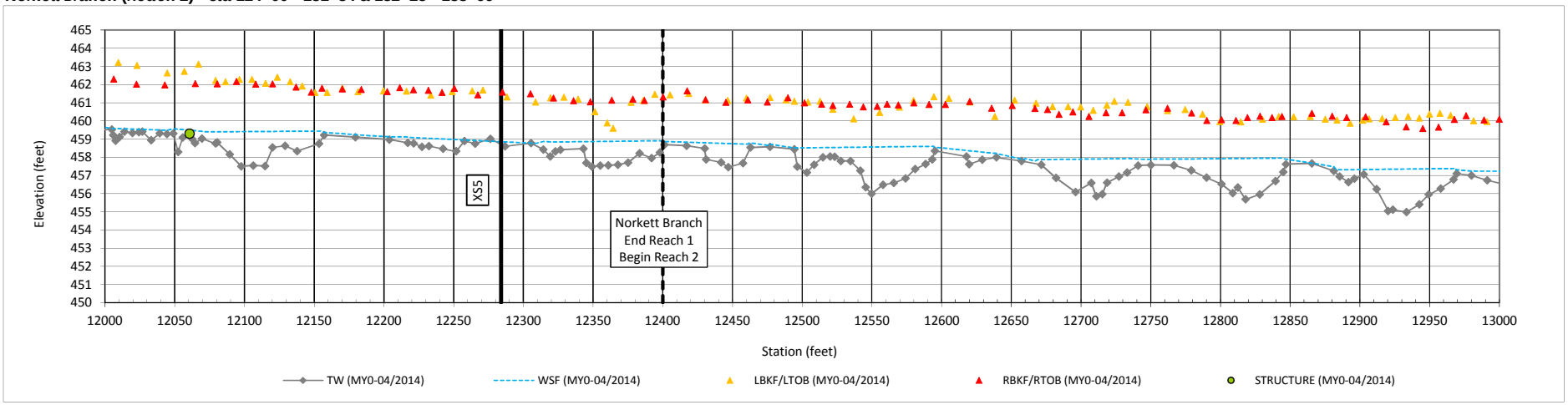
Norkett Branch (Reach 1) - Sta 100+31 -117+60 & 118+60 - 124+00





Longitudinal Profile Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

Norkett Branch (Reach 2) - Sta 124+00 - 131+84 & 132+25 - 138+99



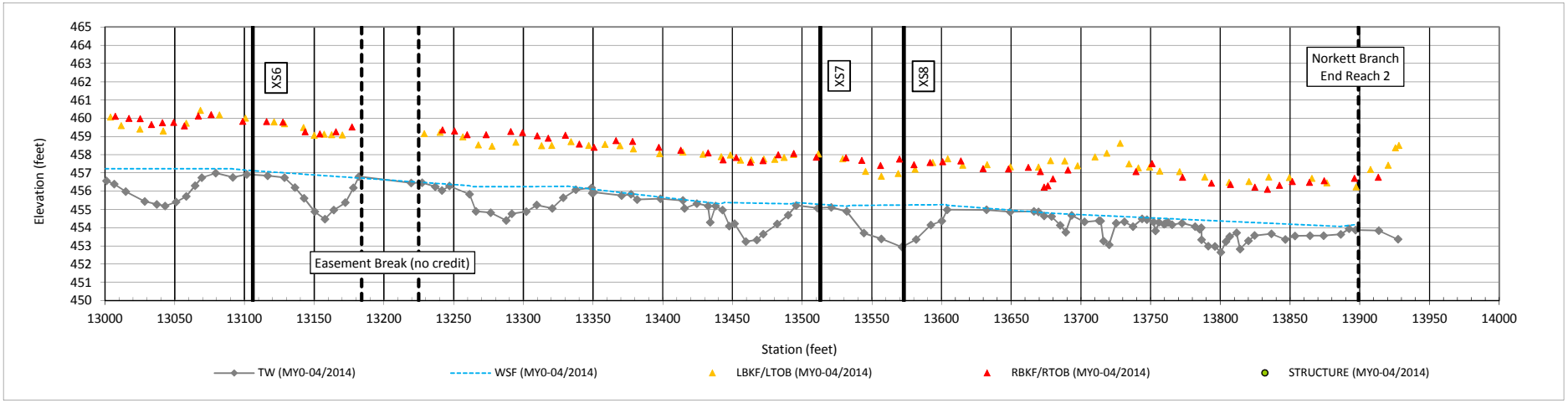


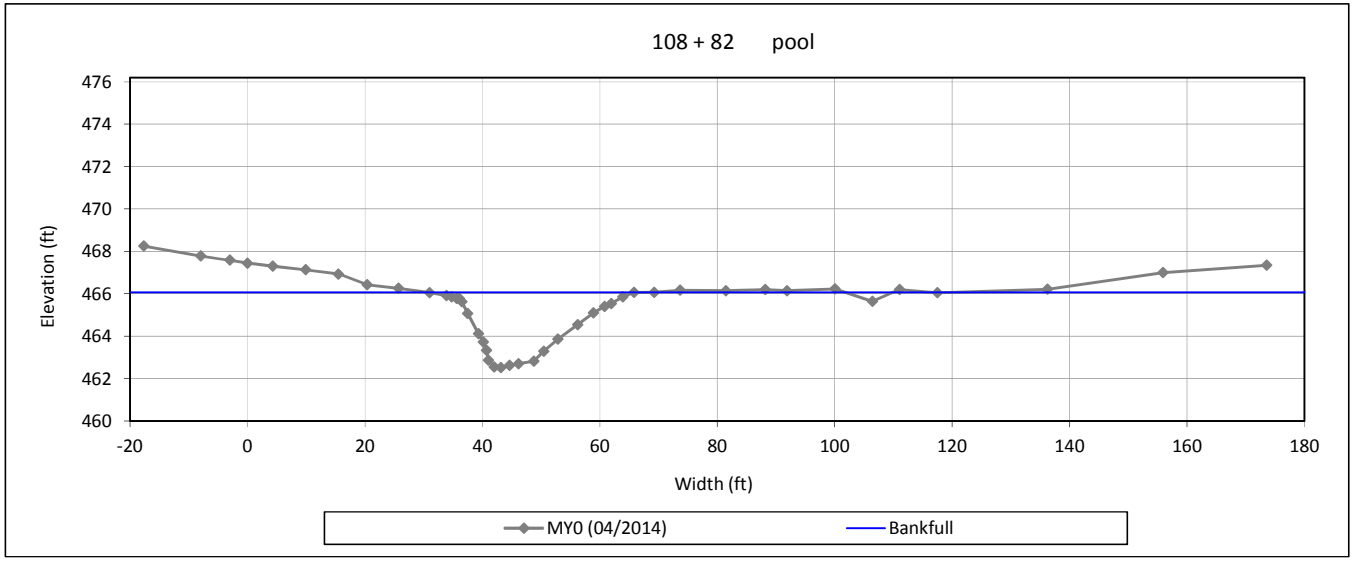
Table 6a. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

Norkett Branch Reach 1 and 2

	Cross-Section 1 (Pool)						Cross-Section 2 (Riffle)						Cross-Section 3 (Pool)						Cross-Section 4 (Riffle)					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	33.2						26.6						26.7						25.1					
Floodprone Width (ft)	**						>200						**						>200					
Bankfull Mean Depth (ft)	1.8						1.6						2.3						1.8					
Bankfull Max Depth (ft)	3.6						2.9						3.9						3.3					
Bankfull Cross-Sectional Area (ft^2)	58.4						42.6						60.3						44.6					
Bankfull Width/Depth Ratio	18.9						16.7						11.8						14.1					
Bankfull Entrenchment Ratio	**						>7.5						**						>8					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0					
	Cross-Section 5 (riffle)						**Cross-Section 6 (Riffle)**						**Cross-Section 7 (Riffle)**						**Cross-Section 8 (Pool)**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	22.5						25.7						25.6						30.1					
Floodprone Width (ft)	>200						>200						>200						**					
Bankfull Mean Depth (ft)	1.7						2.0						1.8						2.4					
Bankfull Max Depth (ft)	2.6						3.3						3.0						4.5					
Bankfull Cross-Sectional Area (ft^2)	38.8						50.8						46.7						72.5					
Bankfull Width/Depth Ratio	13.1						13.0						14.1						12.5					
Bankfull Entrenchment Ratio	>8.9						>7.8						>7.8						**					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0					

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 1-Norkett Branch Reach 1



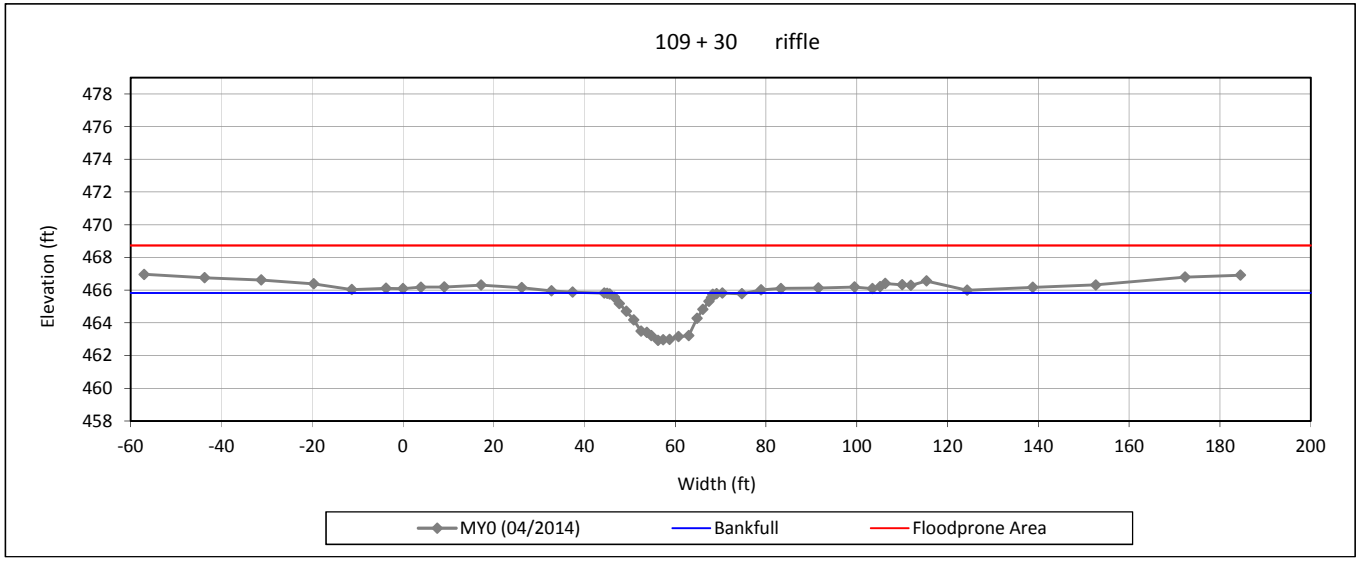
Bankfull Dimensions	
58.4	x-section area (ft.sq.)
33.2	width (ft)
1.8	mean depth (ft)
3.6	max depth (ft)
34.4	wetted parimeter (ft)
1.7	hyd radi (ft)
18.9	width-depth ratio

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 2-Norkett Branch Reach 1



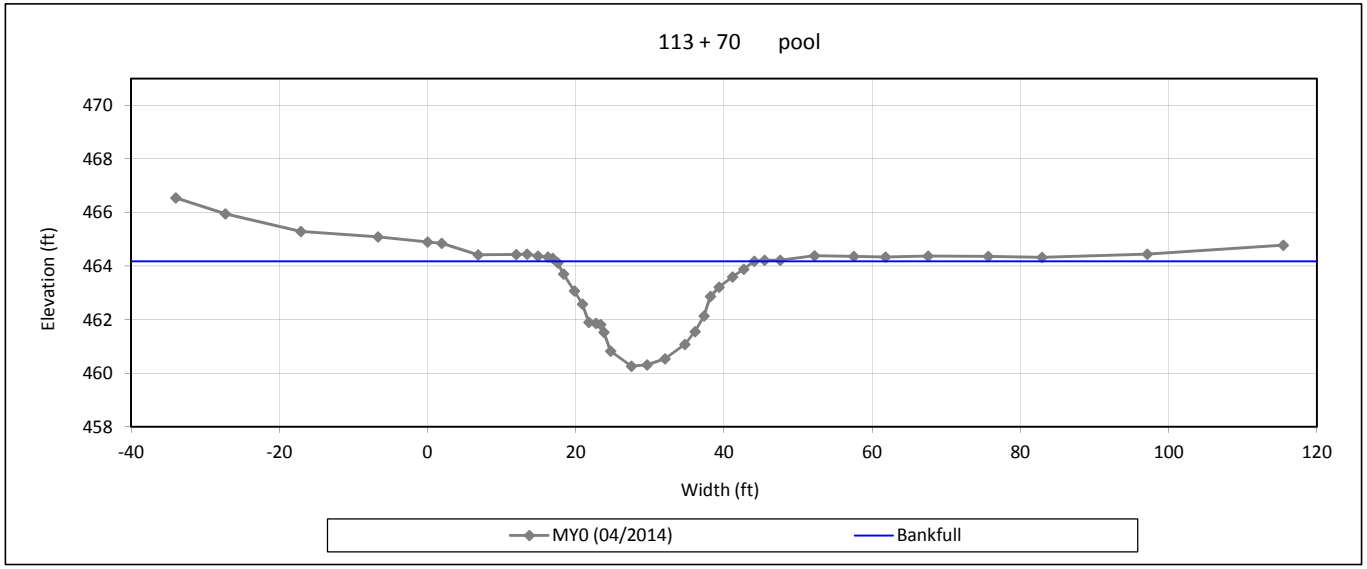
Bankfull Dimensions	
42.6	x-section area (ft.sq.)
26.6	width (ft)
1.6	mean depth (ft)
2.9	max depth (ft)
27.7	wetted parimeter (ft)
1.5	hyd radi (ft)
16.7	width-depth ratio
>200	W FPA (ft)
>2.2	ER
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 3-Norkett Branch Reach 1



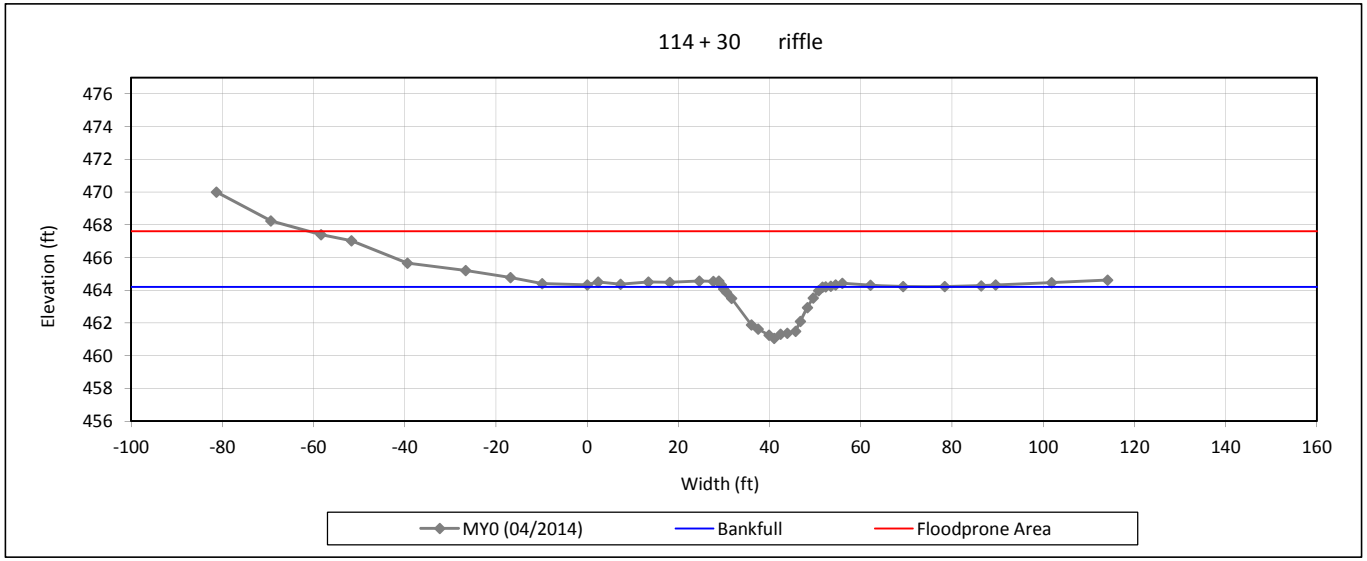
Bankfull Dimensions	
60.3	x-section area (ft.sq.)
26.7	width (ft)
2.3	mean depth (ft)
3.9	max depth (ft)
28.4	wetted parimeter (ft)
2.1	hyd radi (ft)
11.8	width-depth ratio

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 4-Norkett Branch Reach 1



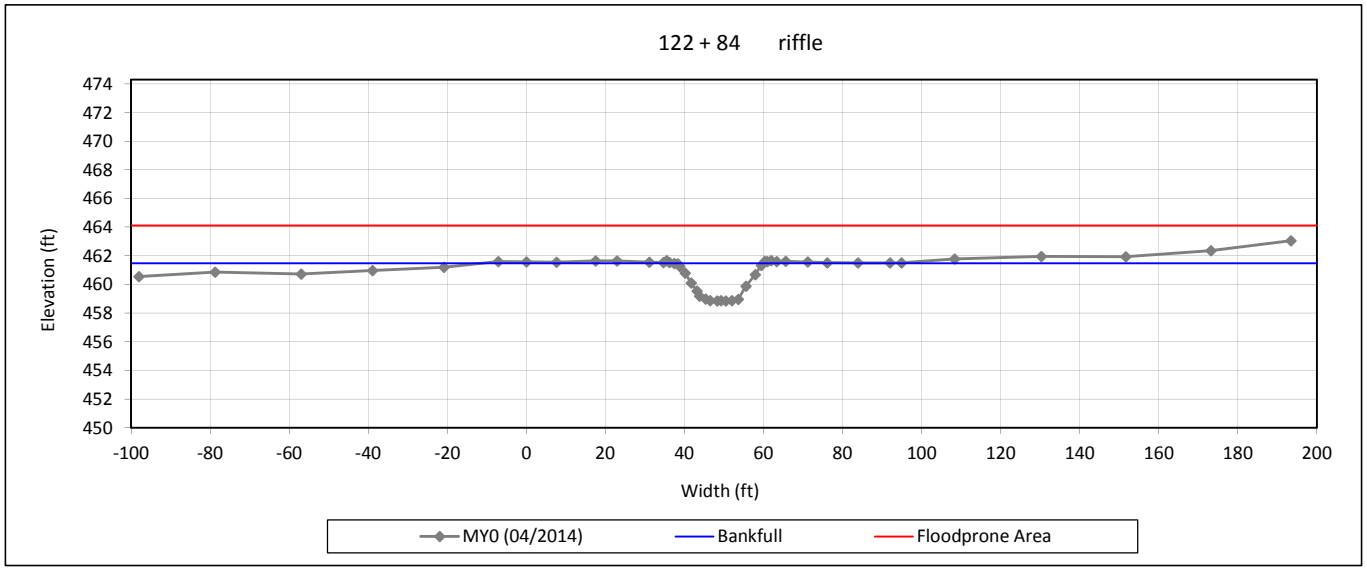
Bankfull Dimensions	
44.6	x-section area (ft.sq.)
25.1	width (ft)
1.8	mean depth (ft)
3.3	max depth (ft)
26.2	wetted parimeter (ft)
1.7	hyd radi (ft)
14.1	width-depth ratio
>200	W FPA (ft)
>2.2	ER
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 5-Norkett Branch Reach 1



Bankfull Dimensions	
38.8	x-section area (ft.sq.)
22.5	width (ft)
1.7	mean depth (ft)
2.6	max depth (ft)
23.5	wetted parimeter (ft)
1.6	hyd radi (ft)
13.1	width-depth ratio
>200	W FPA (ft)
>2.2	ER
1.0	BHR

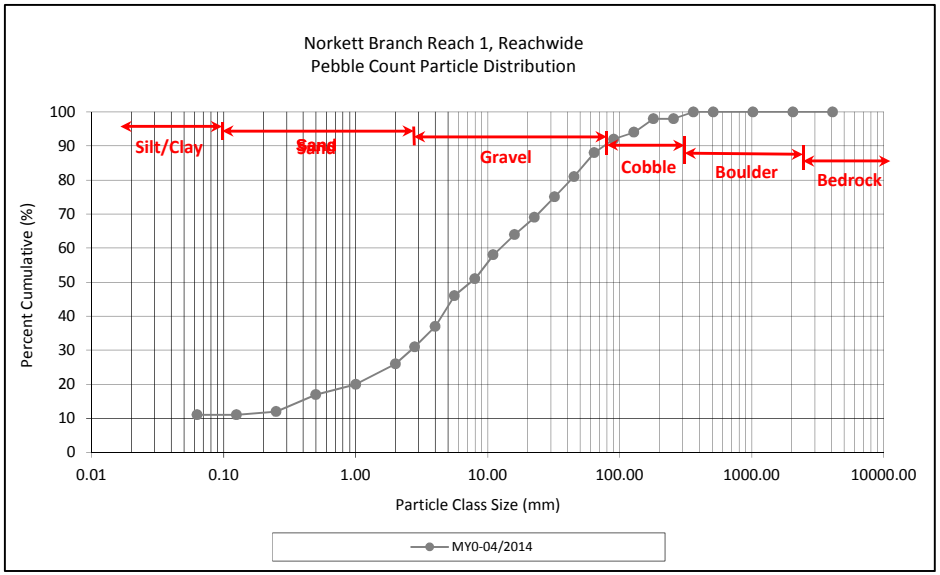
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

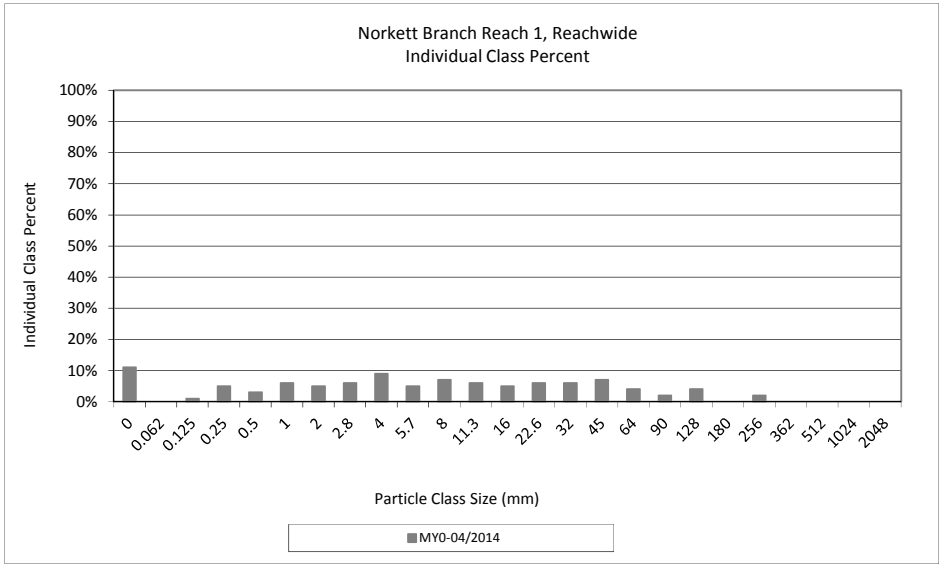
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 1, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			Norkett Branch Reach 1 Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	8	11	11	11
SAND	Very fine	0.062	0.125			0	0	11
	Fine	0.125	0.250		1	1	1	12
	Medium	0.250	0.500		5	5	5	17
	Coarse	0.5	1.0		3	3	3	20
	Very Coarse	1.0	2.0	1	5	6	6	26
GRAVEL	Very Fine	2.0	2.8		5	5	5	31
	Very Fine	2.8	4.0	1	5	6	6	37
	Fine	4.0	5.7	1	8	9	9	46
	Fine	5.7	8.0	2	3	5	5	51
	Medium	8.0	11.3	4	3	7	7	58
	Medium	11.3	16.0	3	3	6	6	64
	Coarse	16.0	22.6	4	1	5	5	69
	Coarse	22.6	32	6		6	6	75
	Very Coarse	32	45	6		6	6	81
	Very Coarse	45	64	7		7	7	88
COBBLE	Small	64	90	4		4	4	92
	Small	90	128	2		2	2	94
	Large	128	180	4		4	4	98
	Large	180	256			0	0	98
BOULDER	Small	256	362	2		2	2	100
	Small	362	512					
	Medium	512	1024					
	Large/Very Large	1024	2048					
BEDROCK	Bedrock	2048	>2048					
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	3.6
D_{50} =	7.4
D_{84} =	52.3
D_{95} =	139.4
D_{100} =	362.0

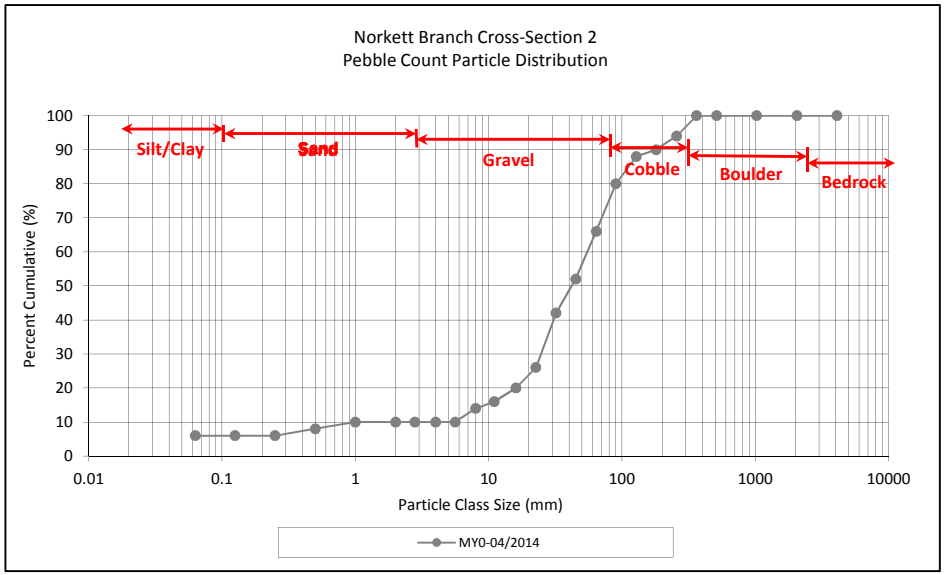


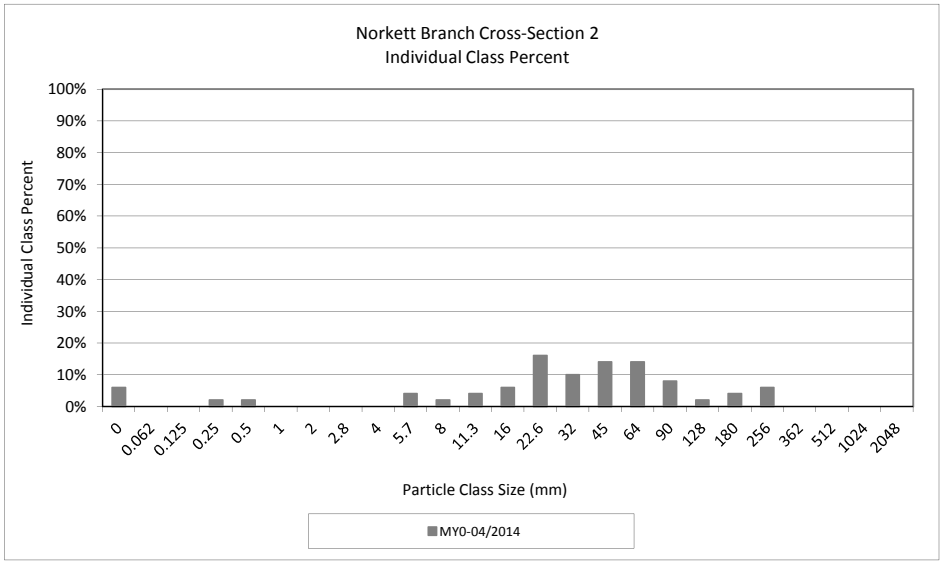


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 1, Cross-Section 2
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 2 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.250	0.500	2	2	8
	Coarse	0.5	1.0	2	2	10
	Very Coarse	1.0	2.0			10
GRAVEL	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0			10
	Fine	4.0	5.7			10
	Fine	5.7	8.0	4	4	14
	Medium	8.0	11.3	2	2	16
	Medium	11.3	16.0	4	4	20
	Coarse	16.0	22.6	6	6	26
	Coarse	22.6	32	16	16	42
	Very Coarse	32	45	10	10	52
	Very Coarse	45	64	14	14	66
COBBLE	Small	64	90	14	14	80
	Small	90	128	8	8	88
	Large	128	180	2	2	90
	Large	180	256	4	4	94
BOULDER	Small	256	362	6	6	100
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**100**	**100**	**100**

Cross-Section 2	
Channel materials (mm)	
D_{16} =	11.0
D_{35} =	27.5
D_{50} =	42.0
D_{84} =	107.3
D_{95} =	271.2
D_{100} =	362.0

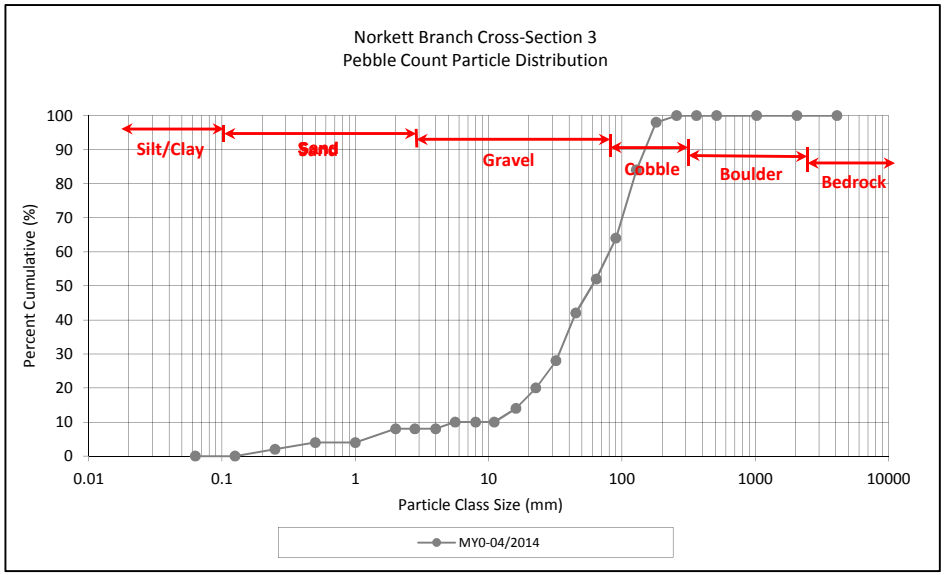


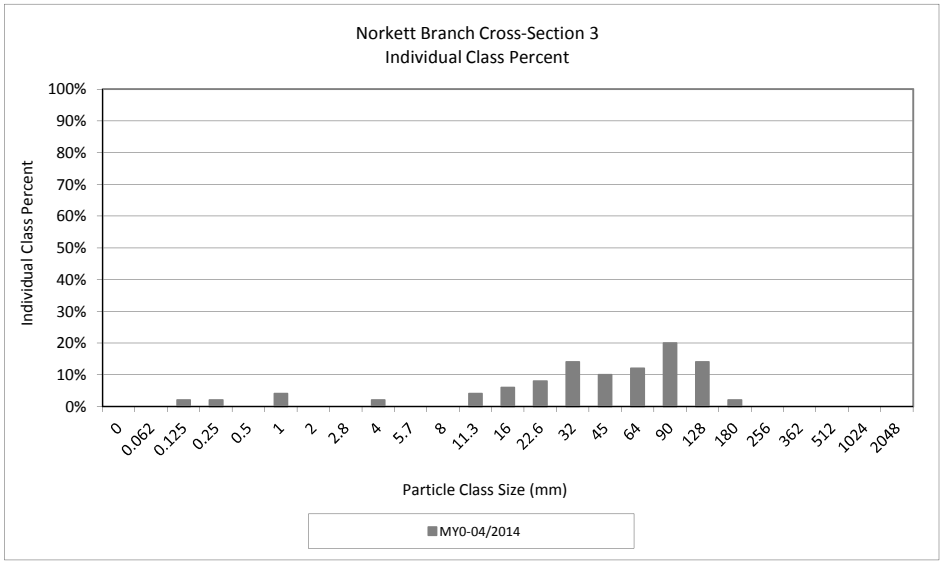


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 1, Cross-Section 3
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 3 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250	2	2	2
	Medium	0.250	0.500	2	2	4
	Coarse	0.5	1.0			4
	Very Coarse	1.0	2.0	4	4	8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.7	2	2	10
	Fine	5.7	8.0			10
	Medium	8.0	11.3			10
	Medium	11.3	16.0	4	4	14
	Coarse	16.0	22.6	6	6	20
	Coarse	22.6	32	8	8	28
	Very Coarse	32	45	14	14	42
	Very Coarse	45	64	10	10	52
COBBLE	Small	64	90	12	12	64
	Small	90	128	20	20	84
	Large	128	180	14	14	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**100**	**100**	**100**

Cross-Section 2	
Channel materials (mm)	
D_{16} =	18.0
D_{35} =	37.9
D_{50} =	59.6
D_{84} =	128.0
D_{95} =	167.3
D_{100} =	256.0

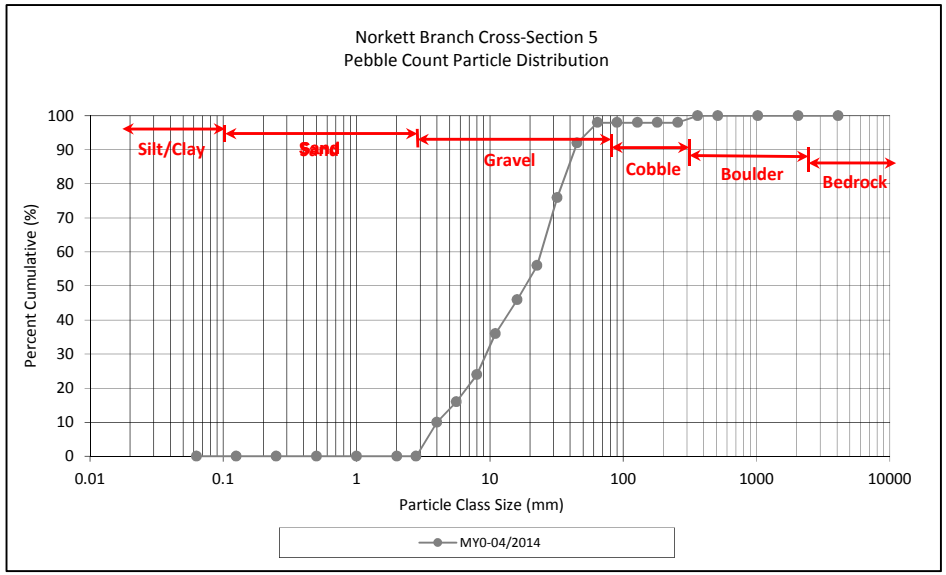


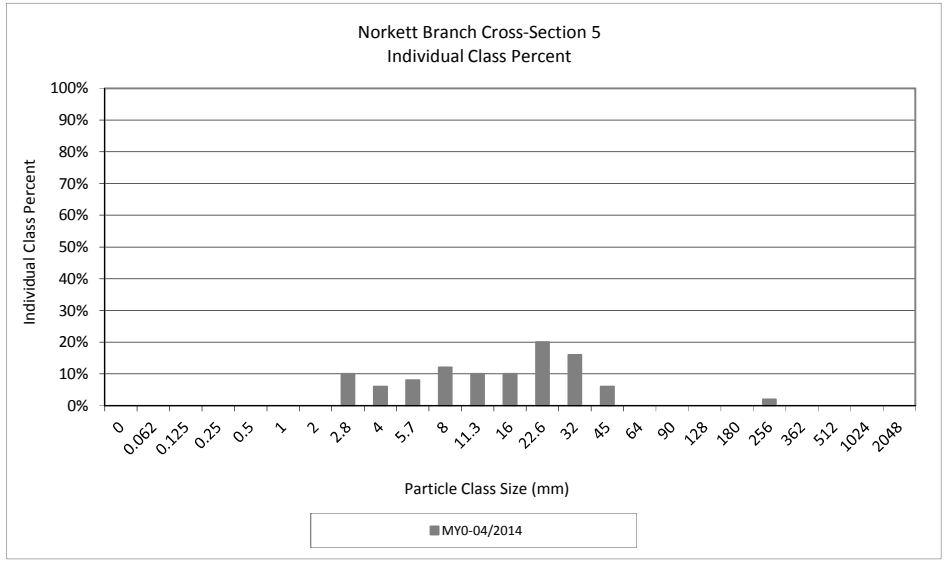


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 1, Cross-Section 5
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 5 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.250	0.500			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0	10	10	10
	Fine	4.0	5.7	6	6	16
	Fine	5.7	8.0	8	8	24
	Medium	8.0	11.3	12	12	36
	Medium	11.3	16.0	10	10	46
	Coarse	16.0	22.6	10	10	56
	Coarse	22.6	32	20	20	76
	Very Coarse	32	45	16	16	92
	Very Coarse	45	64	6	6	98
COBBLE	Small	64	90			98
	Small	90	128			98
	Large	128	180			98
	Large	180	256			98
BOULDER	Small	256	362	2	2	100
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**100**	**100**	**100**

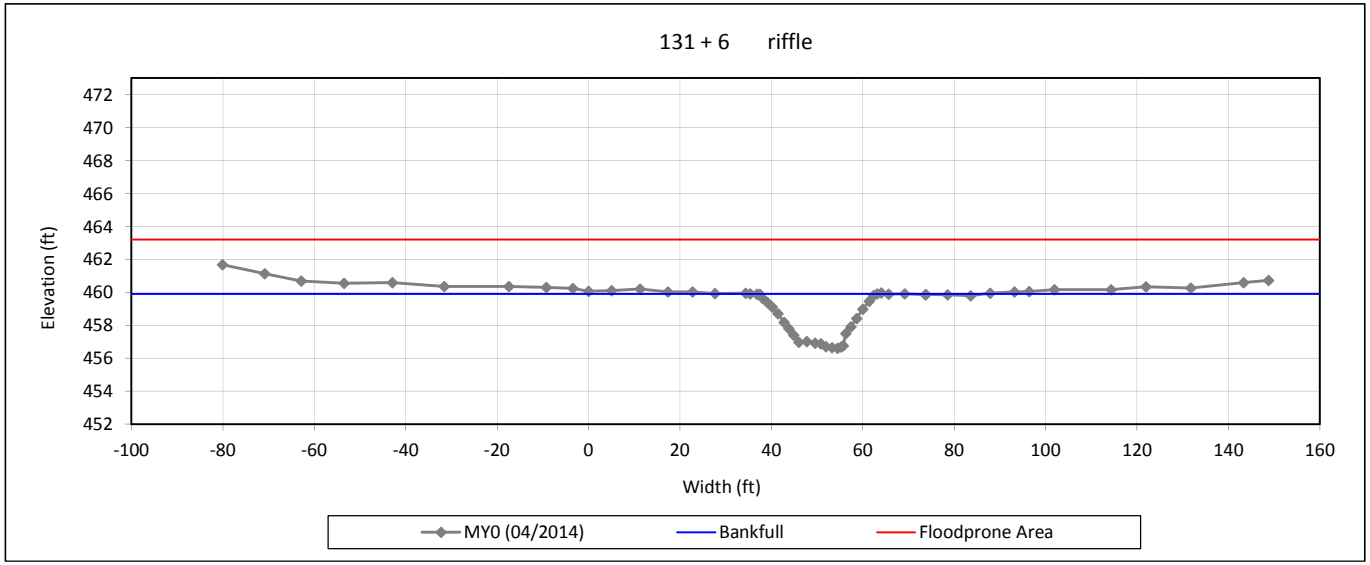
Cross-Section 5	
Channel materials (mm)	
D_{16} =	5.6
D_{35} =	10.7
D_{50} =	18.4
D_{84} =	37.9
D_{95} =	53.7
D_{100} =	362.0





Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 6-Norkett Branch Reach 2



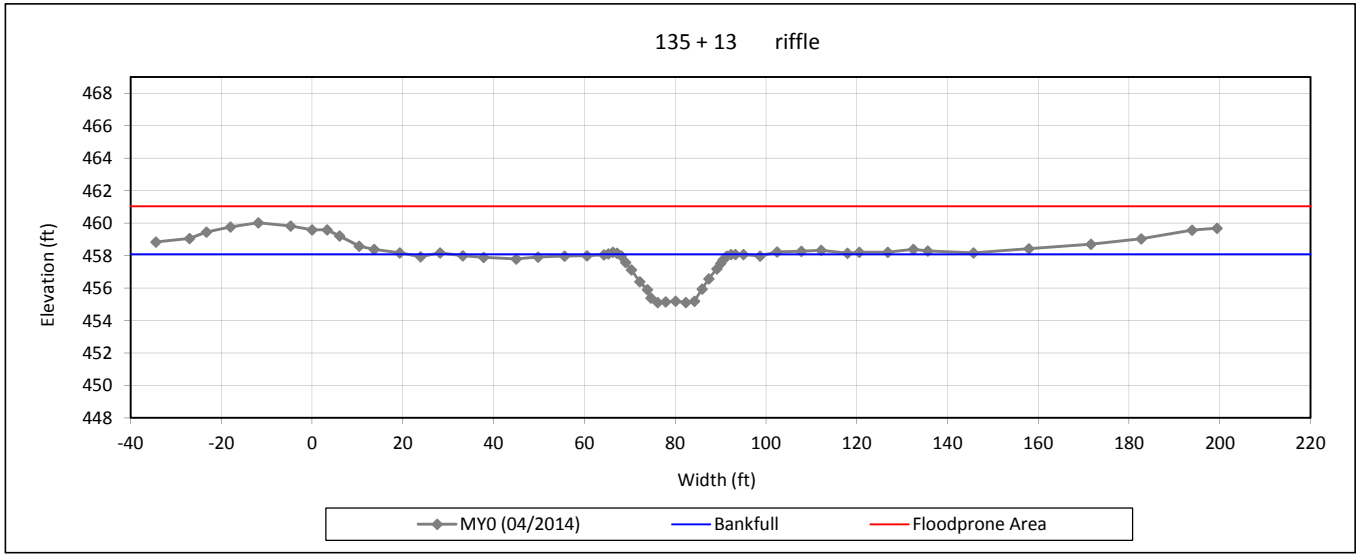
Bankfull Dimensions	
50.8	x-section area (ft.sq.)
25.7	width (ft)
2.0	mean depth (ft)
3.3	max depth (ft)
27.0	wetted parimeter (ft)
1.9	hyd radi (ft)
13.0	width-depth ratio
>200	W FPA (ft)
>2.2	ER
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 7-Norkett Branch Reach 2



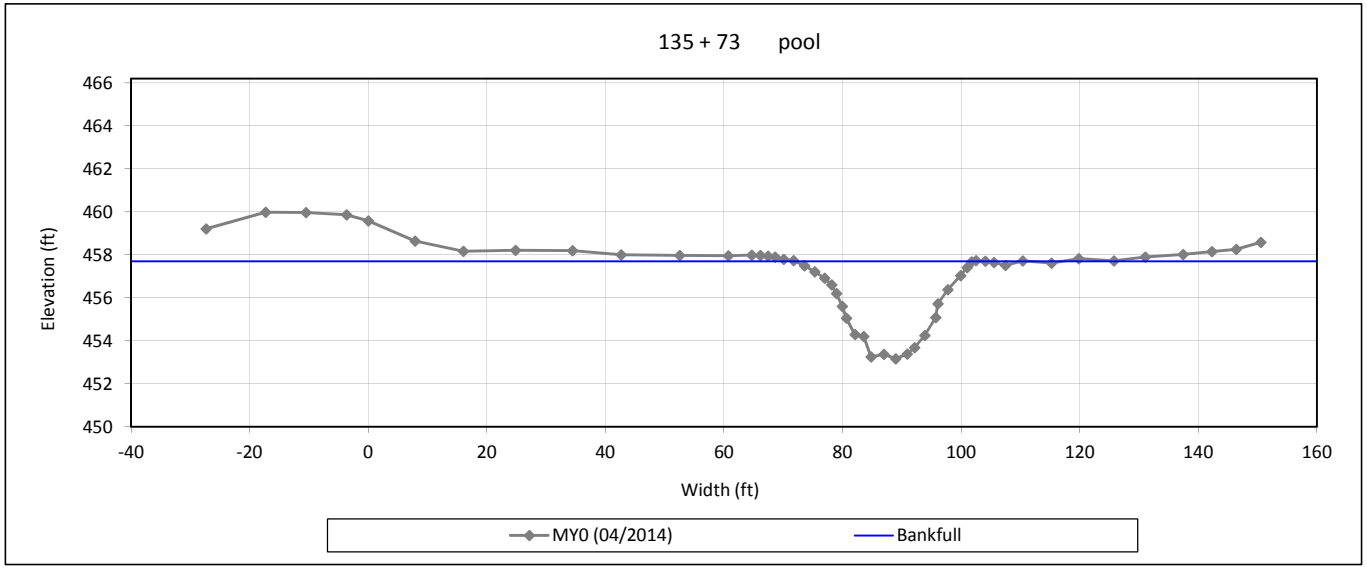
Bankfull Dimensions	
46.7	x-section area (ft.sq.)
25.6	width (ft)
1.8	mean depth (ft)
3.0	max depth (ft)
26.7	wetted parimeter (ft)
1.7	hyd radi (ft)
14.1	width-depth ratio
>200	W FPA (ft)
>2.2	ER
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 8-Norkett Branch Reach 2



Bankfull Dimensions	
72.5	x-section area (ft.sq.)
30.1	width (ft)
2.4	mean depth (ft)
4.5	max depth (ft)
32.2	wetted parimeter (ft)
2.3	hyd radi (ft)
12.5	width-depth ratio

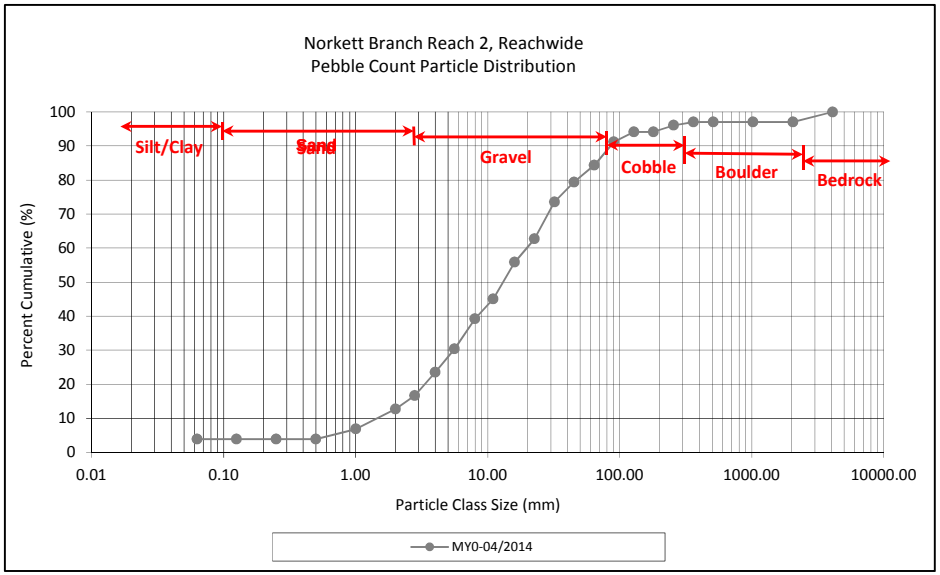
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

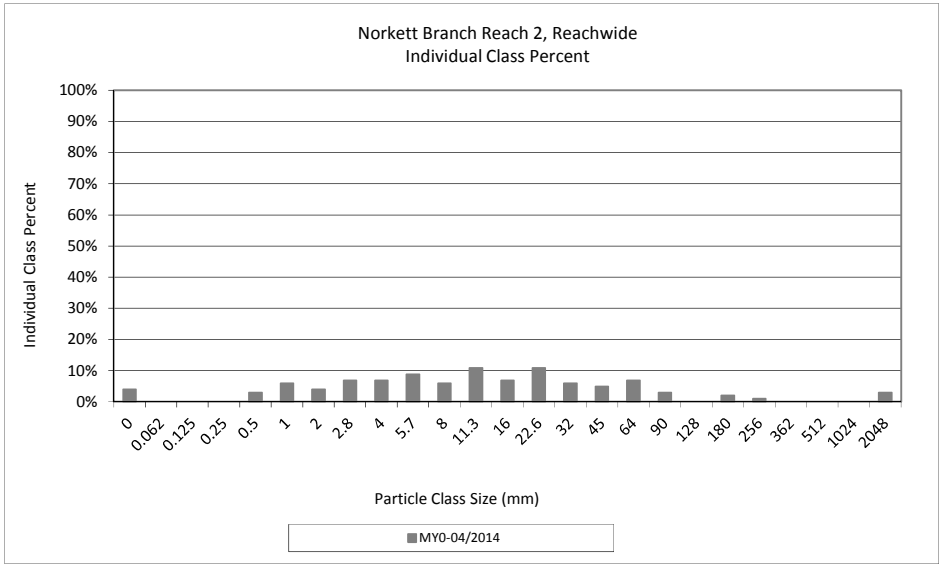
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 2, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			Norkett Branch Reach 2 Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		4	4	4	4
SAND	Very fine	0.062	0.125			0	0	4
	Fine	0.125	0.250			0	0	4
	Medium	0.250	0.500			0	0	4
	Coarse	0.5	1.0	1	2	3	3	7
	Very Coarse	1.0	2.0	2	4	6	6	13
GRAVEL	Very Fine	2.0	2.8	2	2	4	4	17
	Very Fine	2.8	4.0	3	4	7	7	24
	Fine	4.0	5.7	5	2	7	7	30
	Fine	5.7	8.0	3	6	9	9	39
	Medium	8.0	11.3	4	2	6	6	45
	Medium	11.3	16.0	3	8	11	11	56
	Coarse	16.0	22.6	5	2	7	7	63
	Coarse	22.6	32	7	4	11	11	74
	Very Coarse	32	45	3	3	6	6	79
	Very Coarse	45	64	2	3	5	5	84
COBBLE	Small	64	90	5	2	7	7	91
	Small	90	128	2	1	3	3	94
	Large	128	180			0	0	94
	Large	180	256	1	1	2	2	96
BOULDER	Small	256	362	1		1	1	97
	Small	362	512					97
	Medium	512	1024					97
	Large/Very Large	1024	2048					97
BEDROCK	Bedrock	2048	>2048	3		3	3	100
			Total	**52**	**50**	**102**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	2.6
D_{35} =	6.7
D_{50} =	13.0
D_{84} =	62.6
D_{95} =	210.9
D_{100} =	>2048

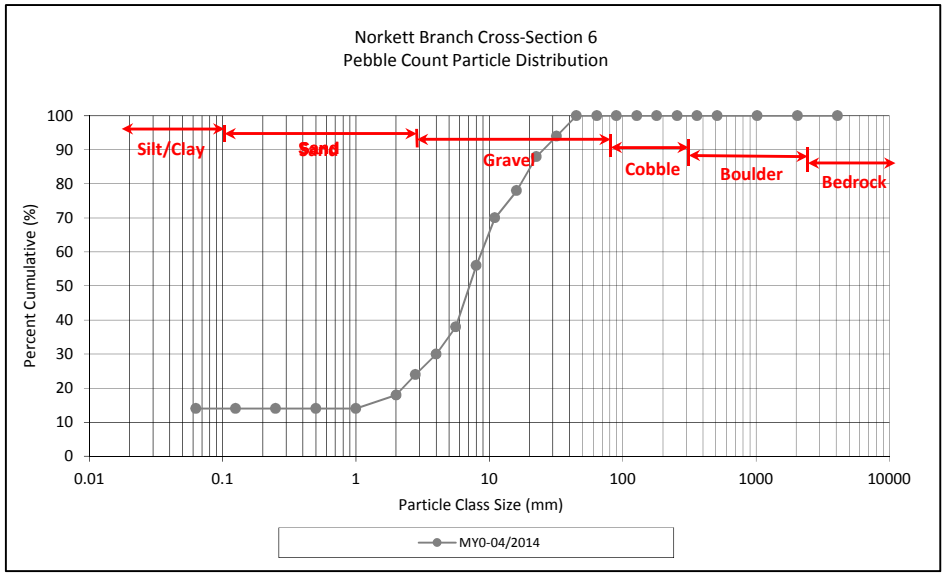


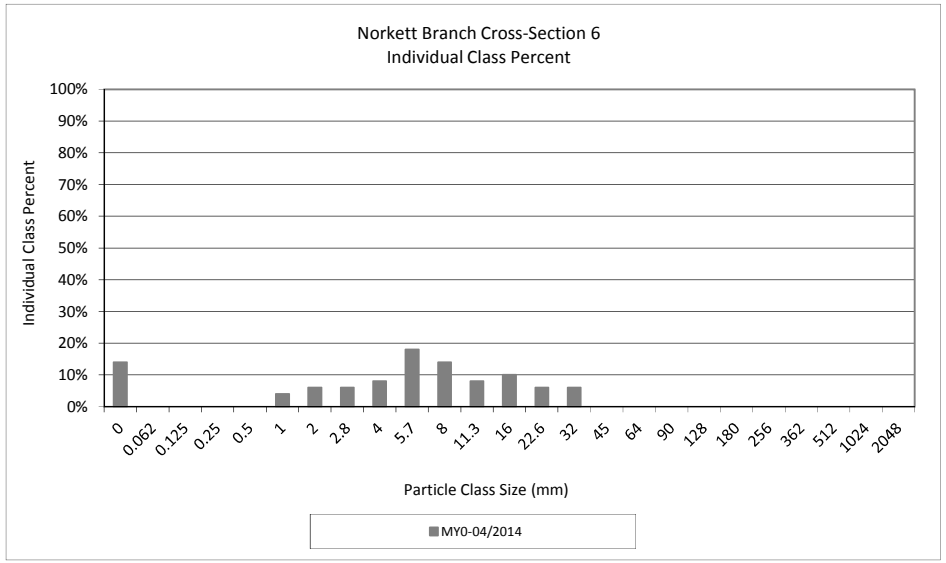


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 2, Cross-Section 6
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 6 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	14	14	14
SAND	Very fine	0.062	0.125			14
	Fine	0.125	0.250			14
	Medium	0.250	0.500			14
	Coarse	0.5	1.0			14
	Very Coarse	1.0	2.0	4	4	17
GRAVEL	Very Fine	2.0	2.8	6	6	23
	Very Fine	2.8	4.0	6	6	29
	Fine	4.0	5.7	8	8	37
	Fine	5.7	8.0	18	17	54
	Medium	8.0	11.3	14	14	68
	Medium	11.3	16.0	8	8	76
	Coarse	16.0	22.6	10	10	85
	Coarse	22.6	32	6	6	91
	Very Coarse	32	45	6	6	97
	Very Coarse	45	64			97
COBBLE	Small	64	90			97
	Small	90	128			97
	Large	128	180			97
	Large	180	256			97
BOULDER	Small	256	362			97
	Small	362	512			97
	Medium	512	1024			97
	Large/Very Large	1024	2048			97
BEDROCK	Bedrock	2048	>2048	3	3	100
			Total	**103**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	1.5
D_{35} =	5.2
D_{50} =	7.3
D_{84} =	21.5
D_{95} =	39.8
D_{100} =	>2048

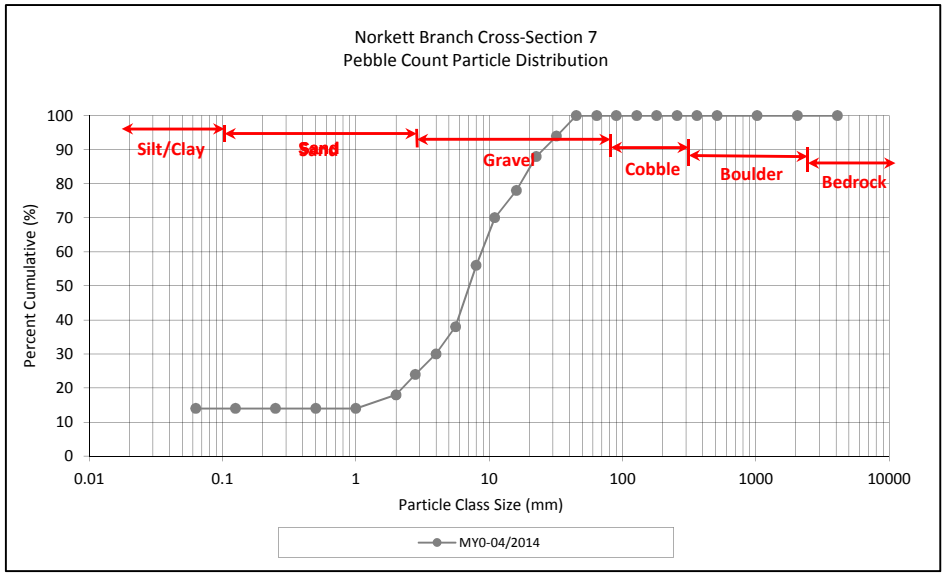




Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Norkett Branch Reach 2, Cross-Section 7
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 7 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125	2	2	4
	Fine	0.125	0.250			4
	Medium	0.250	0.500			4
	Coarse	0.5	1.0	2	2	6
	Very Coarse	1.0	2.0	6	6	12
GRAVEL	Very Fine	2.0	2.8	2	2	14
	Very Fine	2.8	4.0	8	8	22
	Fine	4.0	5.7	14	14	36
	Fine	5.7	8.0	10	10	46
	Medium	8.0	11.3	6	6	52
	Medium	11.3	16.0	8	8	60
	Coarse	16.0	22.6	16	16	76
	Coarse	22.6	32	6	6	82
	Very Coarse	32	45	8	8	90
	Very Coarse	45	64	6	6	96
COBBLE	Small	64	90	2	2	98
	Small	90	128	2	2	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	3.1
D_{35} =	5.5
D_{50} =	9.9
D_{84} =	34.8
D_{95} =	60.4
D_{100} =	128.0



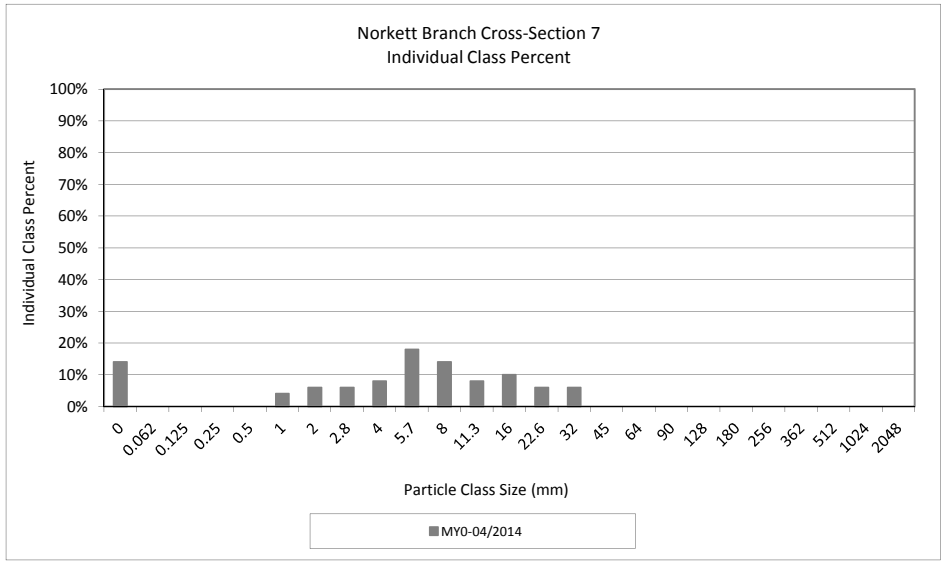


Table 5b. Baseline Stream Data Summary
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

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			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
Dimension and Substrate - Riffle																				
Bankfull Width (ft)	n/a	2.9	8.2	13.6		7.1		See Table 5a	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		176		169		>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^2)		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	
Bank Height Ratio		1.5	2.4	1		1	1.7		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
Profile																				
Riffle Length (ft)	n/a							See Table 5a	---		---		---		7	39	7	34	6	27
Riffle Slope (ft/ft)		0.017	0.054	0.009	0.032	0.006			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)^		61	295	190		51	130		10	56	10	56	10	56	30	58	21	64	22	71
Pool Volume (ft^3)																				
Pattern																				
Channel Beltwidth (ft)	n/a	N/A		N/A	N/A	26.9	49.5	See Table 5a	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
Substrate, Bed and Transport Parameters																				
Ri%/Ru%/P%/G%/S%	n/a							See Table 5a												
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														
Reach Shear Stress (Competency) lb/ft^2		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^2																				
Additional Reach Parameters																				
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% [1]		<1% [1]		<1% [1]			<1% [1]		<1% [1]		<1% [1]		<1% [1]		<1% [1]		<1% [1]	
Rosgen Classification		E6		C/E4		E4			C/E6		C/E4		C/E4		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		See Table 5a	998		866		1108		998		866		1108	
Channel Thalweg Length (ft)[2]		840		820		1,272			1,198		1,039		1,440		1,198		1,039		1,440	
Sinuosity (ft)[3]		1.0		1.0		1.1			1.20		1.20		1.30		1.20		1.20		1.30	
Water Surface Slope (ft/ft)[2]		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	

[1] No impervious land use is present within the project watershed per the CGIA Land Use Classification data set.

[2] Channel Length represented does not include easement breaks.

(---): Data was not provided

N/A: Not Applicable

SC: Silt/Clay

Table 5c. Baseline Stream Data Summary
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

UT2 Reaches 3A and 3B

Parameter	Gage	Pre-restoration Condition		Reference Reaches		Design				As Built/Baseline			
		UT2 Reach 3				UT2 Reach 3A		UT2 Reach 3B		UT2 Reach 3A		UT2 Reach 3B	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle													
Bankfull Width (ft)	n/a	7.5		See Table 5a		9.0		11.0		10.5		13.9	
Floodprone Width (ft)		24				45+		55+		>200		>200	
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^2)		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	
Profile													
Riffle Length (ft)	n/a			See Table 5a		---		---		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)						---		---		10	42	32	45
Pool Max Depth (ft)		2				1.20	3.20	1.50	4.10	1.77	2.98	2.45	3.32
Pool Spacing (ft)^		26	53			12	63	14	77	26	66	38	72
Pool Volume (ft^3)													
Pattern													
Channel Beltwidth (ft)	n/a	N/A	N/A	See Table 5a		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
Substrate, Bed and Transport Parameters													
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 5a						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^2						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^2													
Additional Reach Parameters													
Drainage Area (SM)	n/a	0.71		See Table 5a		0.46		0.46		0.46		0.46	
Watershed Impervious Cover Estimate (%)		<1% [1]				<1% [1]		<1% [1]		<1% [1]		<1% [1]	
Rosgen Classification		E4				C/E4		C/E4		E4		C4	
Bankfull Velocity (fps)		3.7				3.7		3.0		2.1		1.7	
Bankfull Discharge (cfs)		26	33			26		33		15		20	
Q-NFF regression													
Q-USGS extrapolation													
Q-Mannings													
Valley Length (ft)		1184		See Table 5a		830		548		830		548	
Channel Thalweg Length (ft^2)		1,303				1,038		658		1,038		658	
Sinuosity (ft^3)		1.1				1.25		1.20		1.25		1.20	
Water Surface Slope (ft/ft^2)		0.009				0.006		0.004		0.006		0.003	
Bankfull Slope (ft/ft)						---		---		0.007		0.002	

[1] No impervious land use is present within the project watershed per the CGIA Land Use Classification data set.

[2] Channel Length represented does not include easement breaks.

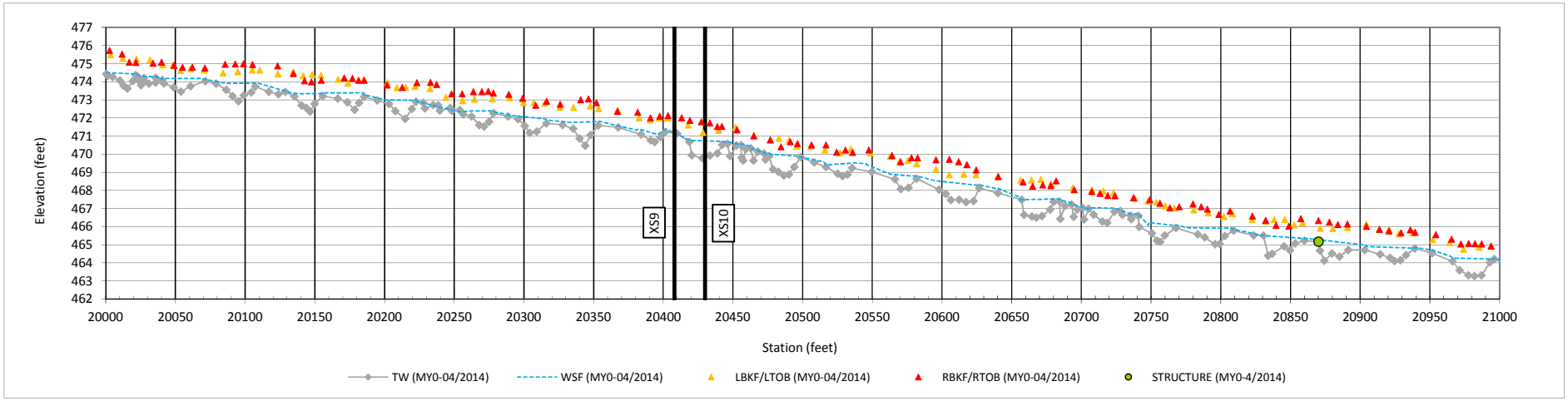
(---): Data was not provided

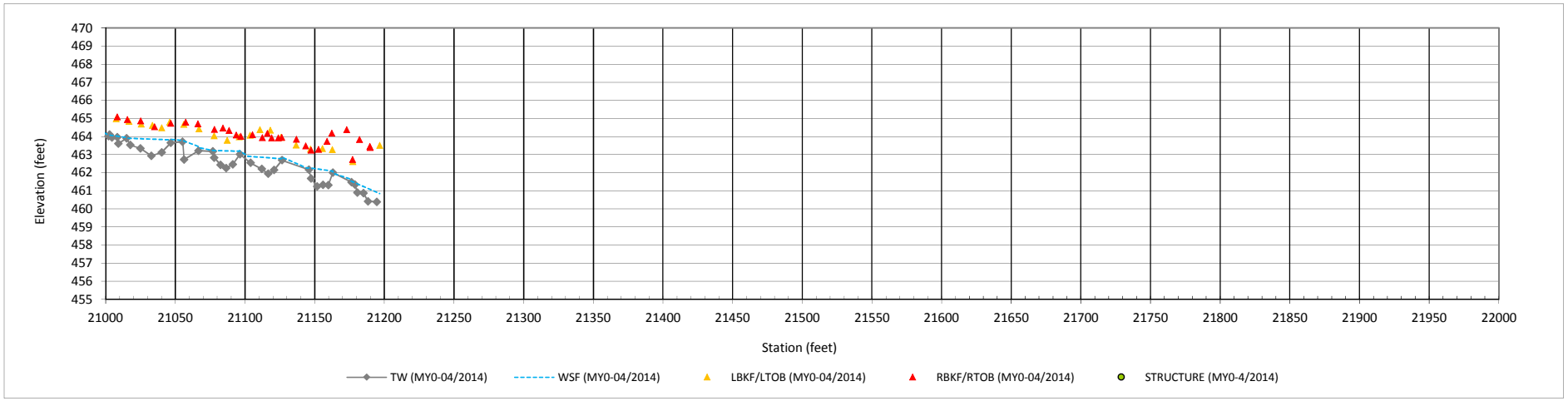
N/A: Not Applicable

SC: Silt/Clay

Longitudinal Profile Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

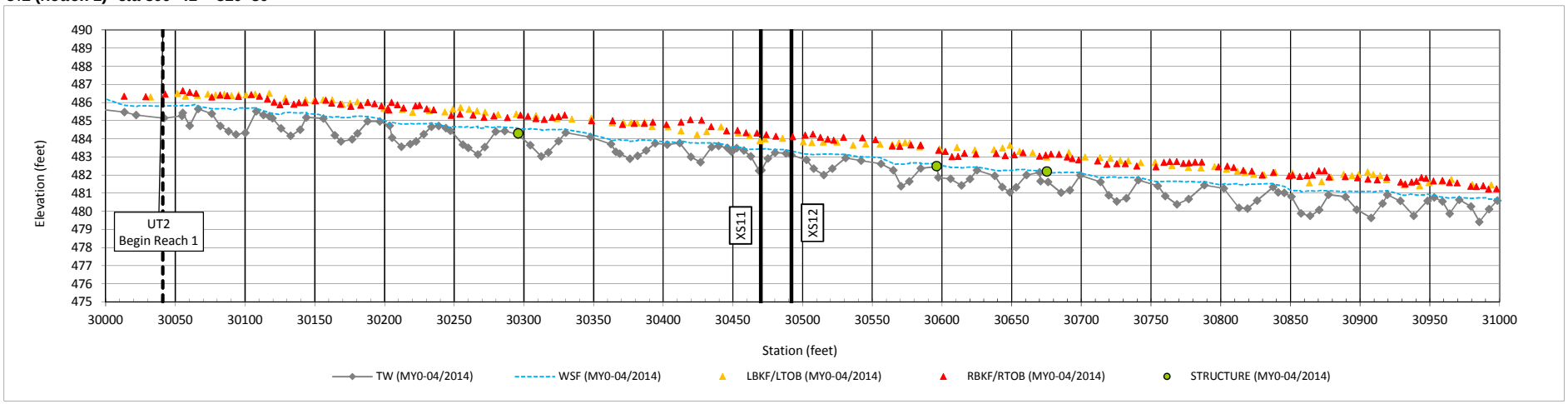
UT1 Sta- 200+00-211+98



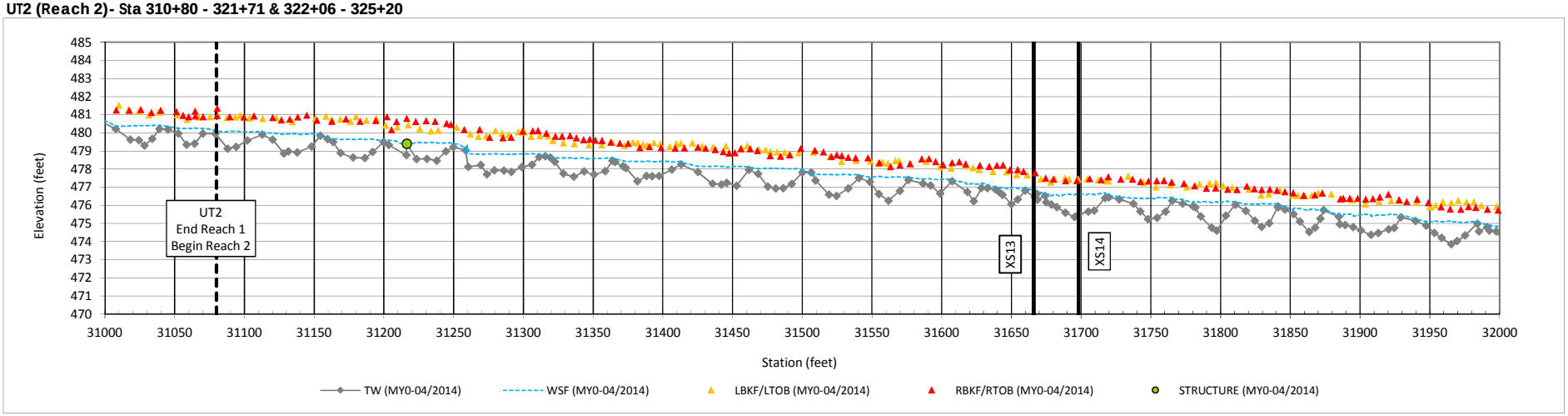


Longitudinal Profile Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

UT2 (Reach 1)- Sta 300+41 - 310+80

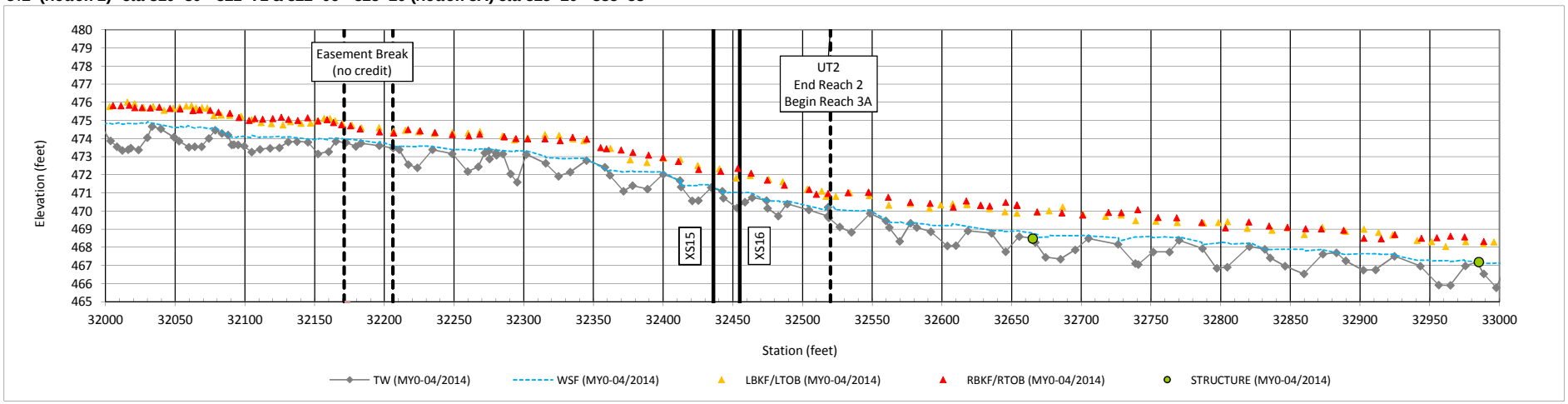


UT2 (Reach 2)- Sta 310+80 - 321+71 & 322+06 - 325+20

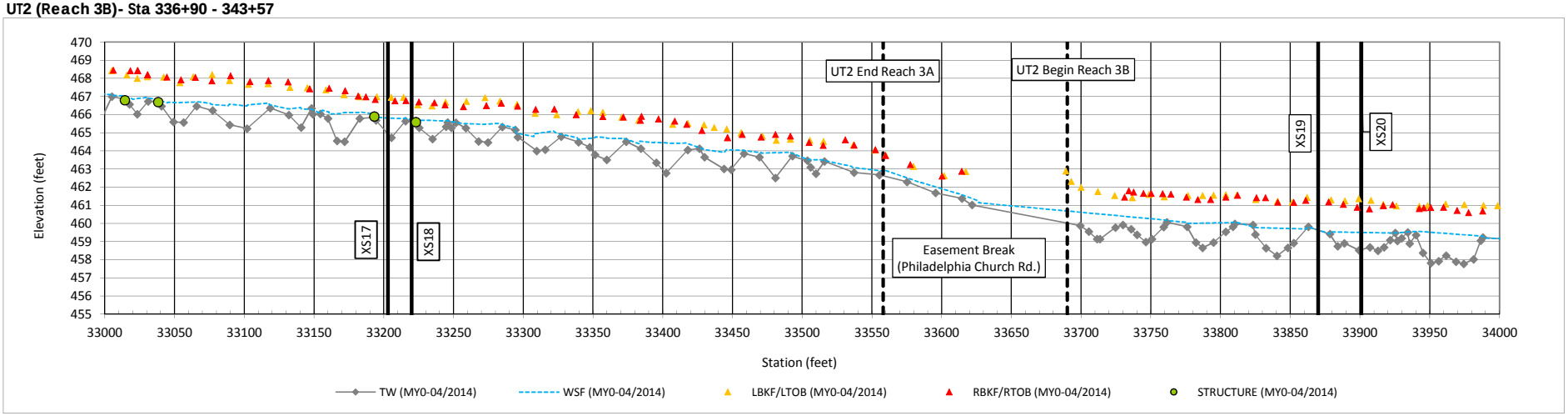


Longitudinal Profile Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

UT2 (Reach 2)- Sta 310+80 - 321+71 & 322+06 - 325+20 (Reach 3A) Sta 325+20 - 335+58



UT2 (Reach 3B)- Sta 336+90 - 343+57



Longitudinal Profile Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

UT2 (Reach 3B)- Sta 336+90 - 343+57

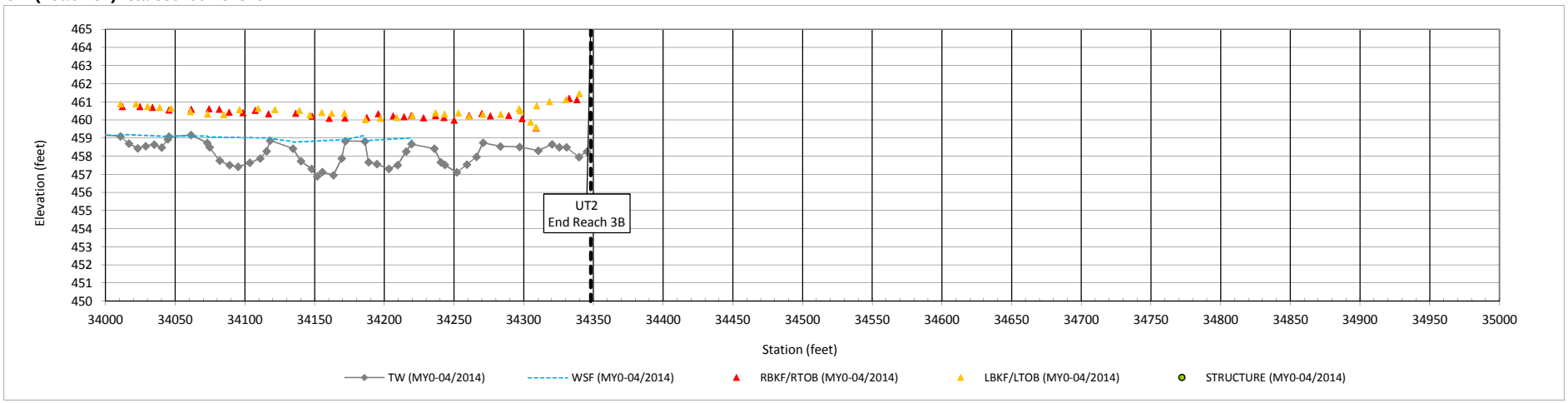


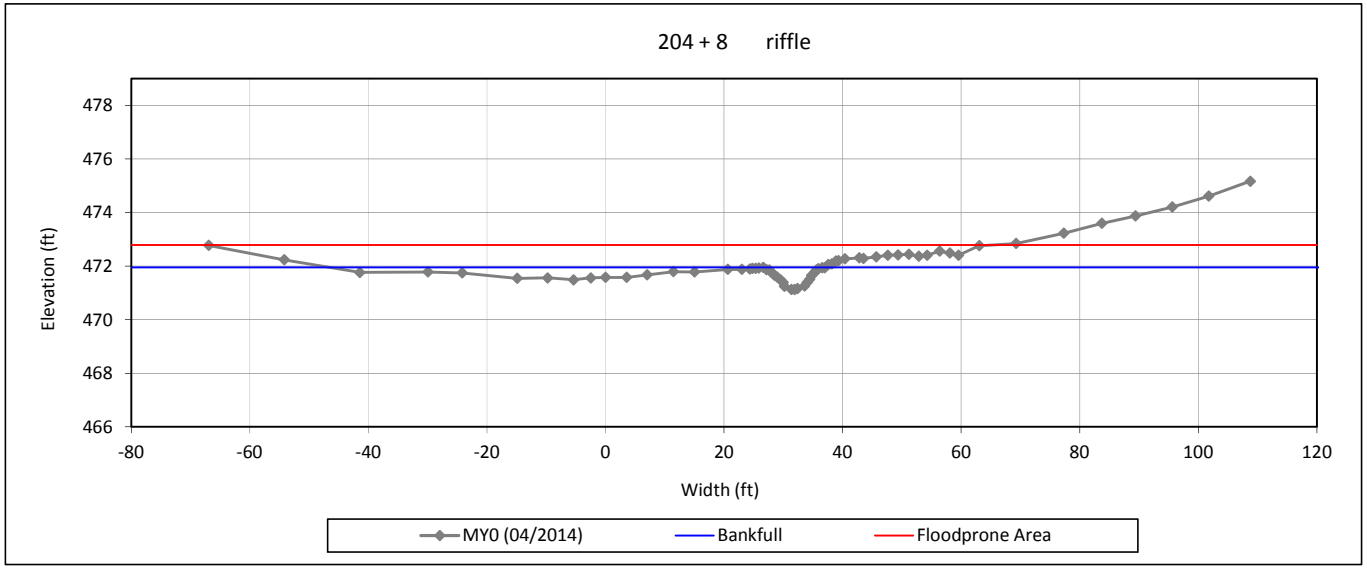
Table 6b. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

UT1 and UT2 Reaches 1 and 2

	Cross-Section 9 (Riffle)						Cross-Section 10 (Pool)						Cross-Section 11 (Pool)						Cross-Section 12 (Riffle)					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	10.5						18.1						10.6						9.4					
Floodprone Width (ft)	200.0						N/A						N/A						0.0					
Bankfull Mean Depth (ft)	0.4						0.5						0.7						0.5					
Bankfull Max Depth (ft)	0.8						1.8						1.9						1.2					
Bankfull Cross-Sectional Area (ft^2)	4.5						9.8						7.5						4.5					
Bankfull Width/Depth Ratio	24.5						33.3						15.2						19.8					
Bankfull Entrenchment Ratio	19.1						N/A						N/A						0.0					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0					
	Cross-Section 13 (Riffle)						**Cross-Section 14 (Pool)**						**Cross-Section 15 (Riffle)**						**Cross-Section 16 (Pool)**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	9.0						13.9						9.6						9.6					
Floodprone Width (ft)	200.0						**						>200						N/A					
Bankfull Mean Depth (ft)	0.6						0.8						0.5						0.7					
Bankfull Max Depth (ft)	1.2						2.1						1.1						1.8					
Bankfull Cross-Sectional Area (ft^2)	5.3						11.7						5.2						7.0					
Bankfull Width/Depth Ratio	15.3						16.4						17.6						13.3					
Bankfull Entrenchment Ratio	22.1						**						>15						N/A					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0					

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 9-UT1



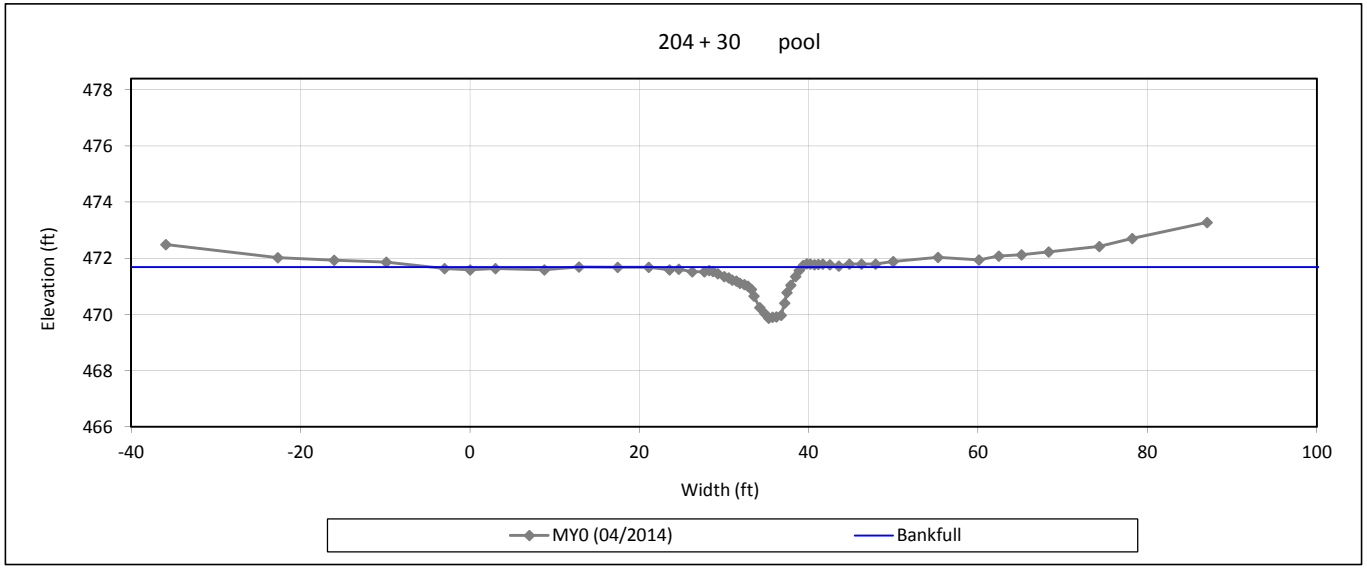
Bankfull Dimensions	
4.5	x-section area (ft.sq.)
10.5	width (ft)
0.4	mean depth (ft)
0.8	max depth (ft)
10.7	wetted parimeter (ft)
0.4	hyd radi (ft)
24.5	width-depth ratio
200	W FPA (ft)
>2.2	ER
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 10-UT1



Bankfull Dimensions

9.8	x-section area (ft.sq.)
18.1	width (ft)
0.5	mean depth (ft)
1.8	max depth (ft)
19.0	wetted parimeter (ft)
0.5	hyd radi (ft)
33.3	width-depth ratio

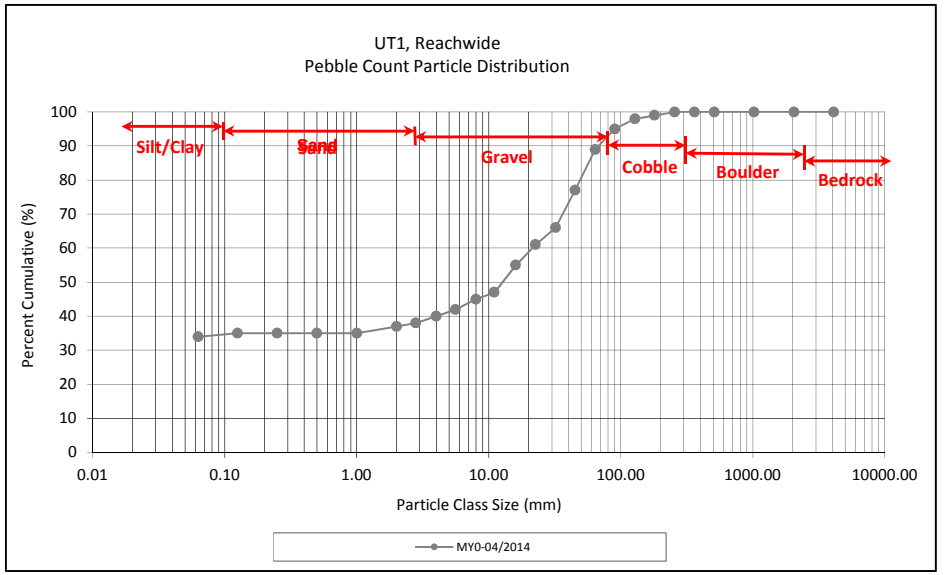
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

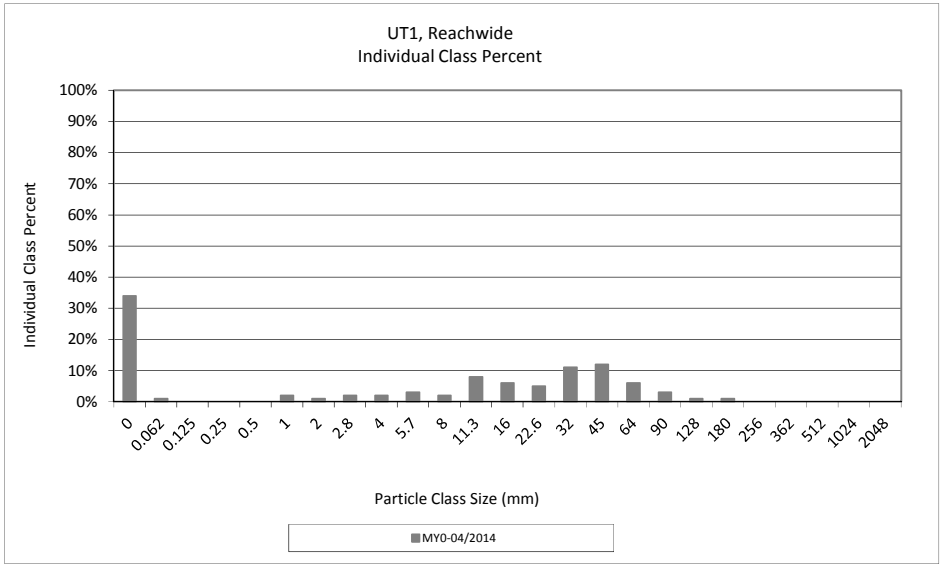
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT1, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			UT1 Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	32	34	34	34
SAND	Very fine	0.062	0.125		1	1	1	35
	Fine	0.125	0.250			0	0	35
	Medium	0.250	0.500			0	0	35
	Coarse	0.5	1.0			0	0	35
	Very Coarse	1.0	2.0		2	2	2	37
GRAVEL	Very Fine	2.0	2.8		1	1	1	38
	Very Fine	2.8	4.0	2		2	2	40
	Fine	4.0	5.7	2		2	2	42
	Fine	5.7	8.0	2	1	3	3	45
	Medium	8.0	11.3	2		2	2	47
	Medium	11.3	16.0	2	6	8	8	55
	Coarse	16.0	22.6	3	3	6	6	61
	Coarse	22.6	32	5		5	5	66
	Very Coarse	32	45	10	1	11	11	77
	Very Coarse	45	64	12		12	12	89
COBBLE	Small	64	90	4	2	6	6	95
	Small	90	128	3		3	3	98
	Large	128	180		1	1	1	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					
	Small	362	512					
	Medium	512	1024					
	Large/Very Large	1024	2048					
BEDROCK	Bedrock	2048	>2048					
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.0
D_{50} =	12.7
D_{84} =	55.3
D_{95} =	90.0
D_{100} =	256.0

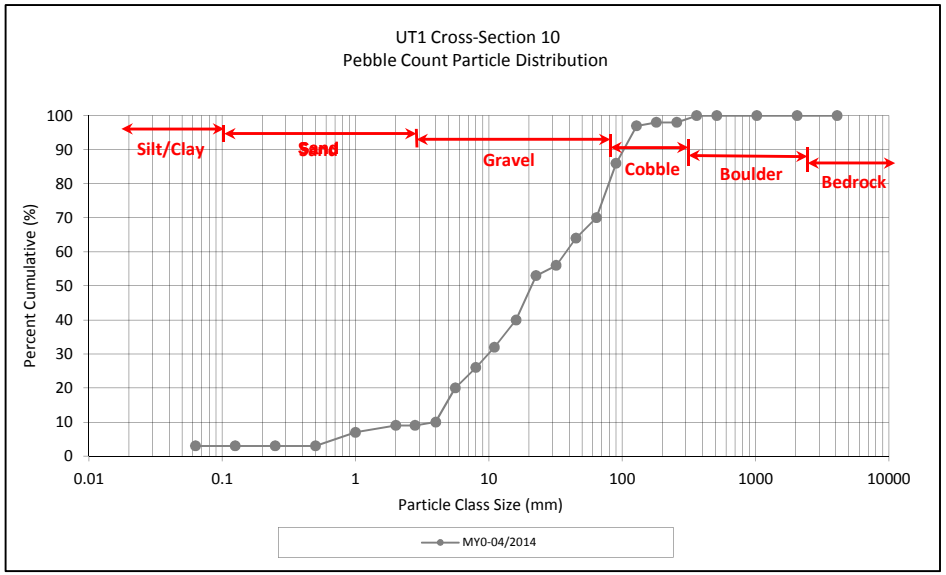


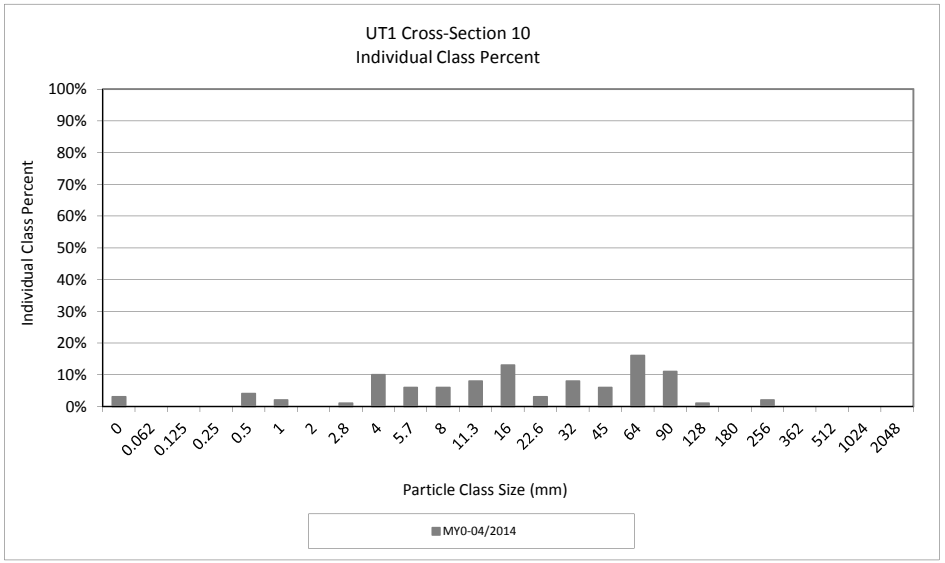


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT1, Cross-Section 10
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 10 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	3
SAND	Very fine	0.062	0.125			3
	Fine	0.125	0.250			3
	Medium	0.250	0.500			3
	Coarse	0.5	1.0	4	4	7
	Very Coarse	1.0	2.0	2	2	9
GRAVEL	Very Fine	2.0	2.8			9
	Very Fine	2.8	4.0	1	1	10
	Fine	4.0	5.7	10	10	20
	Fine	5.7	8.0	6	6	26
	Medium	8.0	11.3	6	6	32
	Medium	11.3	16.0	8	8	40
	Coarse	16.0	22.6	13	13	53
	Coarse	22.6	32	3	3	56
	Very Coarse	32	45	8	8	64
	Very Coarse	45	64	6	6	70
COBBLE	Small	64	90	16	16	86
	Small	90	128	11	11	97
	Large	128	180	1	1	98
	Large	180	256			98
BOULDER	Small	256	362	2	2	100
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**100**	**100**	**100**

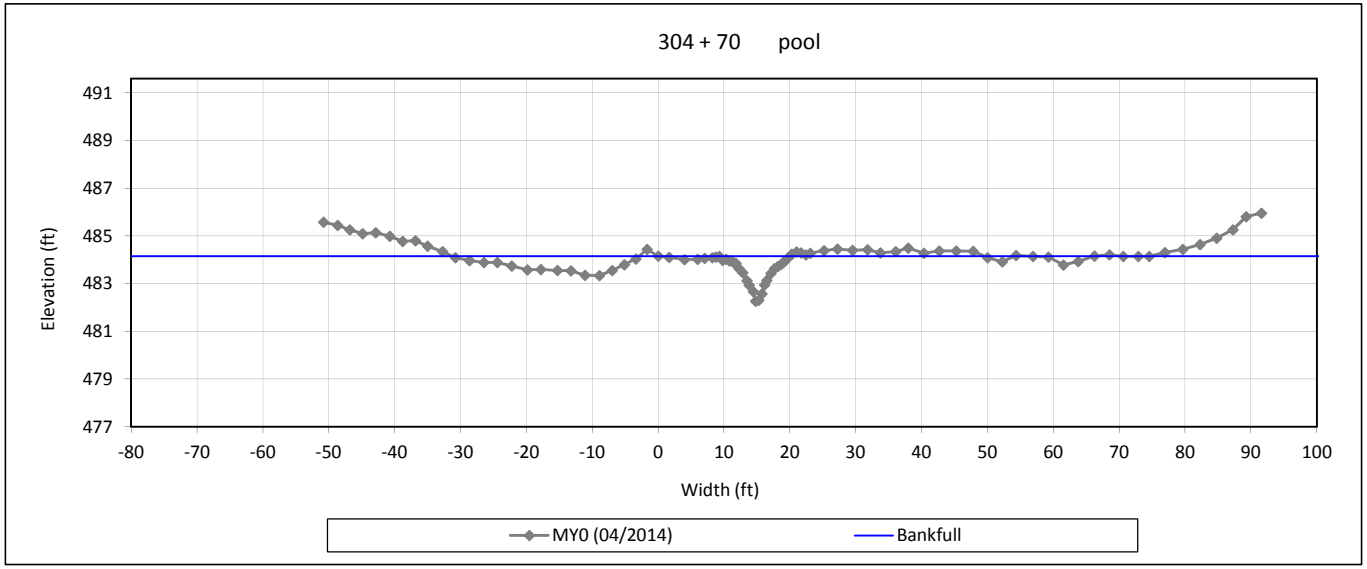
Cross-Section 10	
Channel materials (mm)	
D_{16} =	4.9
D_{35} =	12.7
D_{50} =	20.9
D_{84} =	86.2
D_{95} =	120.1
D_{100} =	362.0





Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 11-UT2 Reach 1



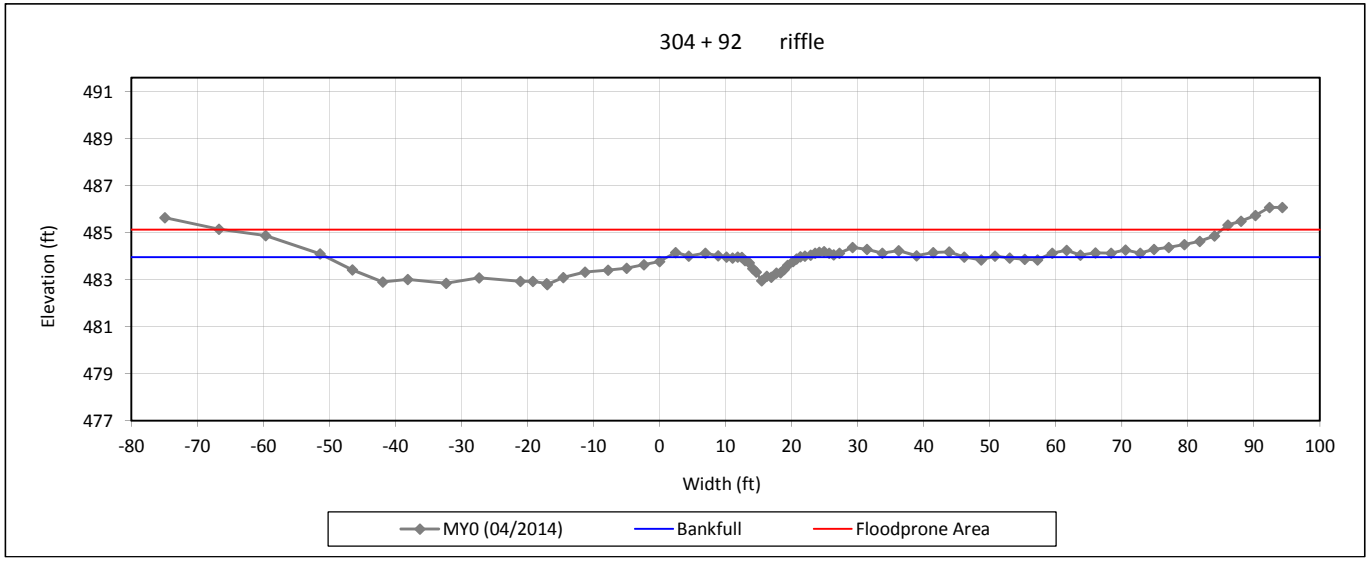
Bankfull Dimensions	
7.5	x-section area (ft.sq.)
10.6	width (ft)
0.7	mean depth (ft)
1.9	max depth (ft)
11.6	wetted parimeter (ft)
0.6	hyd radi (ft)
15.2	width-depth ratio

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 12-UT2 Reach 1



Bankfull Dimensions	
4.5	x-section area (ft.sq.)
9.4	width (ft)
0.5	mean depth (ft)
1.2	max depth (ft)
9.8	wetted parimeter (ft)
0.5	hyd radi (ft)
19.8	width-depth ratio
180	width FPA (ft)
>2.2	Entrenchement Ratio
1.0	BHR

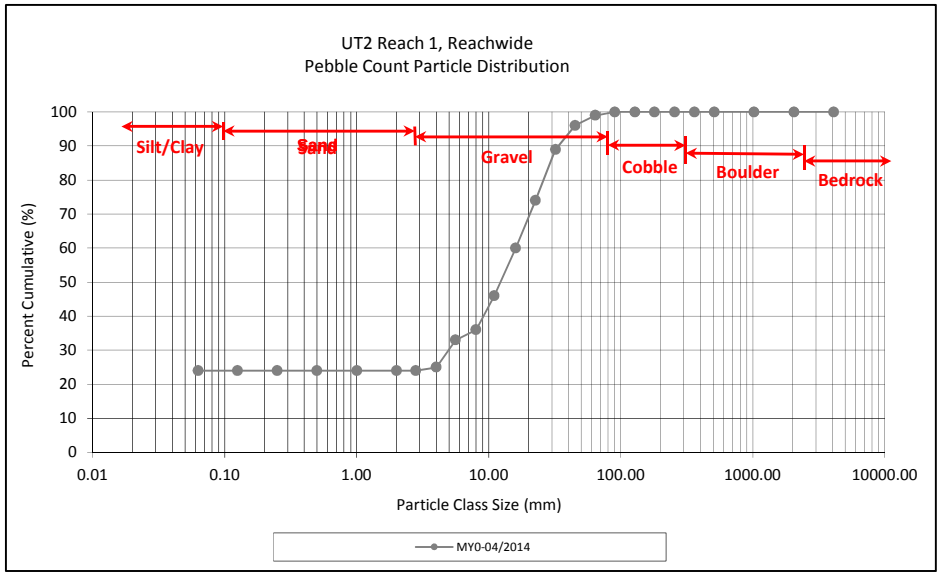
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

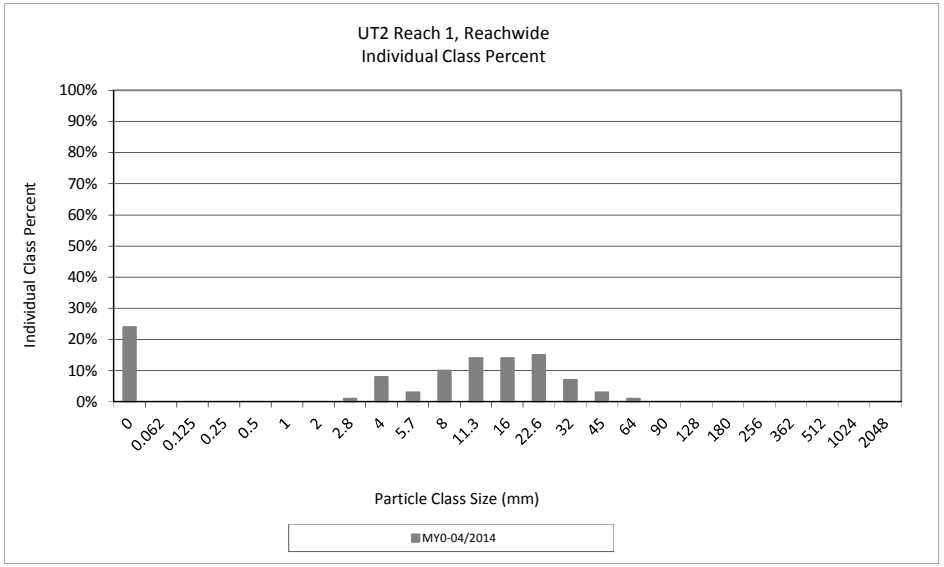
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 1, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			UT2 Reach 1 Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	4	20	24	24	24
SAND	Very fine	0.062	0.125			0	0	24
	Fine	0.125	0.250			0	0	24
	Medium	0.250	0.500			0	0	24
	Coarse	0.5	1.0			0	0	24
	Very Coarse	1.0	2.0			0	0	24
GRAVEL	Very Fine	2.0	2.8			0	0	24
	Very Fine	2.8	4.0		1	1	1	25
	Fine	4.0	5.7	2	6	8	8	33
	Fine	5.7	8.0	2	1	3	3	36
	Medium	8.0	11.3	5	5	10	10	46
	Medium	11.3	16.0	7	7	14	14	60
	Coarse	16.0	22.6	13	1	14	14	74
	Coarse	22.6	32	8	7	15	15	89
	Very Coarse	32	45	6	1	7	7	96
	Very Coarse	45	64	2	1	3	3	99
COBBLE	Small	64	90	1		1	1	100
	Small	90	128					
	Large	128	180					
	Large	180	256					
BOULDER	Small	256	362					
	Small	362	512					
	Medium	512	1024					
	Large/Very Large	1024	2048					
BEDROCK	Bedrock	2048	>2048					
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	7.1
D_{50} =	12.2
D_{84} =	28.5
D_{95} =	42.9
D_{100} =	90.0

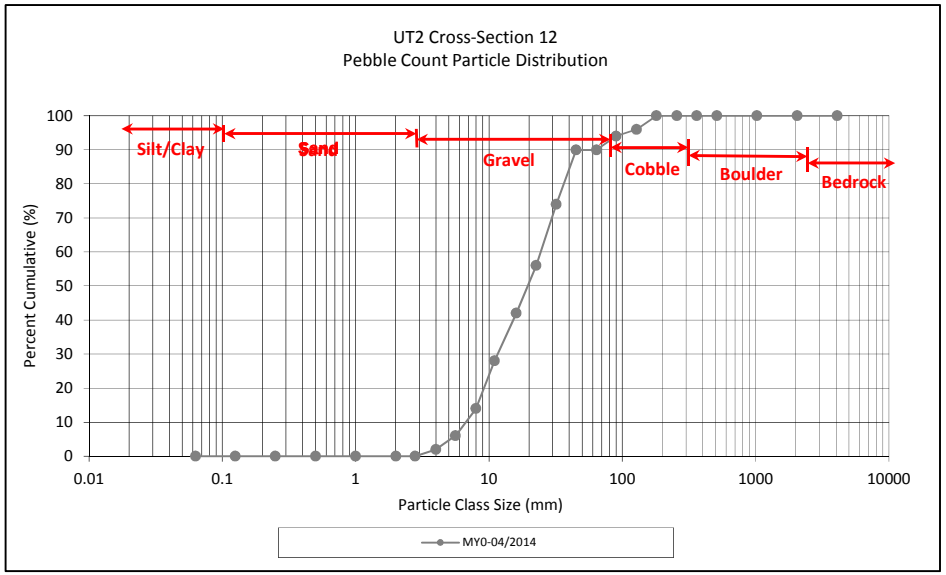


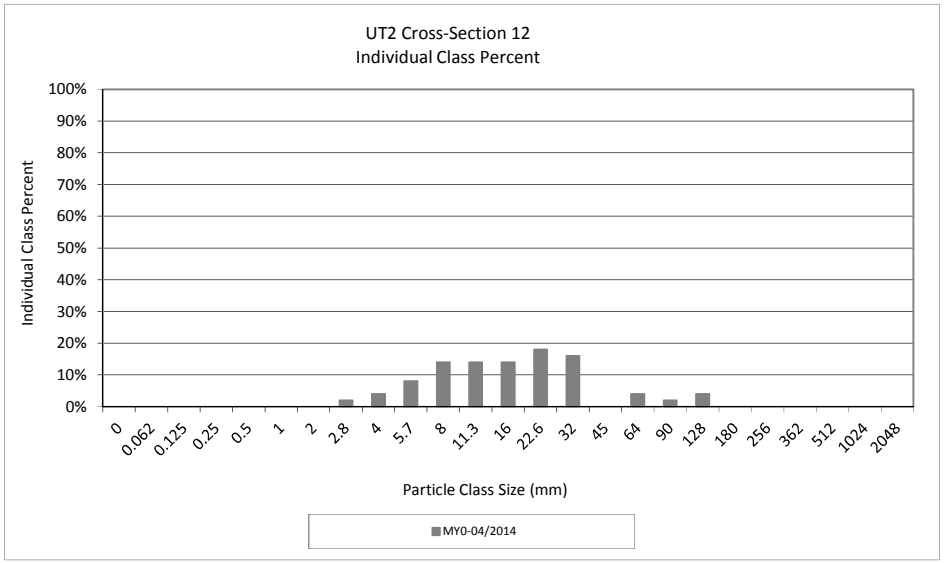


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 1, Cross-Section 12
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 12 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.250	0.500			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0	2	2	2
	Fine	4.0	5.7	4	4	6
	Fine	5.7	8.0	8	8	14
	Medium	8.0	11.3	14	14	28
	Medium	11.3	16.0	14	14	42
	Coarse	16.0	22.6	14	14	56
	Coarse	22.6	32	18	18	74
	Very Coarse	32	45	16	16	90
	Very Coarse	45	64			90
COBBLE	Small	64	90	4	4	94
	Small	90	128	2	2	96
	Large	128	180	4	4	100
	Large	180	256			
BOULDER	Small	256	362			
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**100**	**100**	**100**

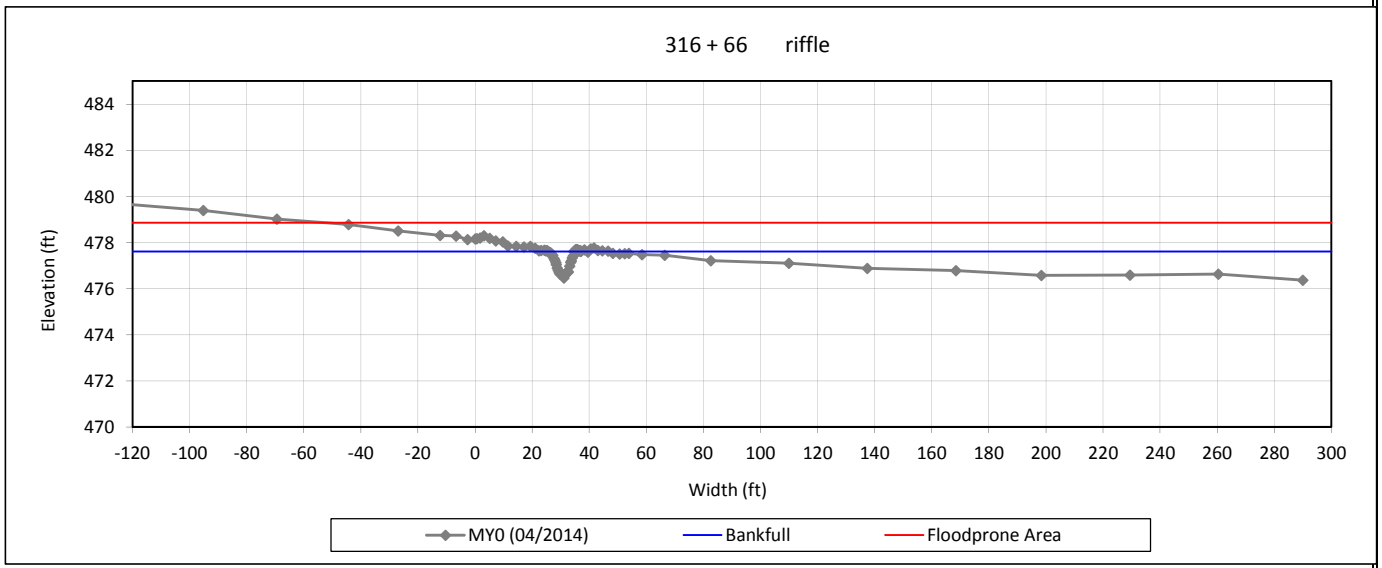
Cross-Section 12	
Channel materials (mm)	
D_{16} =	8.4
D_{35} =	13.3
D_{50} =	19.5
D_{84} =	39.6
D_{95} =	107.3
D_{100} =	180.0





Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 13-UT2 Reach 2



Bankfull Dimensions	
5.3	x-section area (ft.sq.)
9.0	width (ft)
0.6	mean depth (ft)
1.2	max depth (ft)
9.5	wetted parimeter (ft)
0.6	hyd radi (ft)
15.3	width-depth ratio
200	width FPA (ft)
>2.2	Entrenchement Ratio
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

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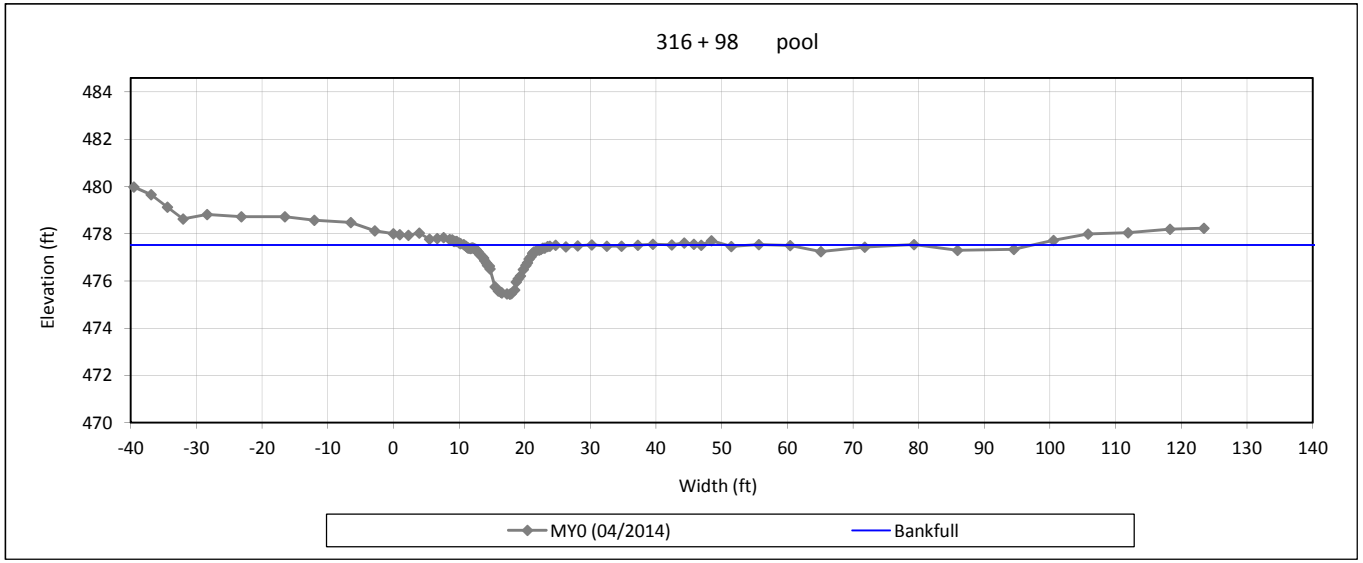
Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 14-UT2 Reach 2



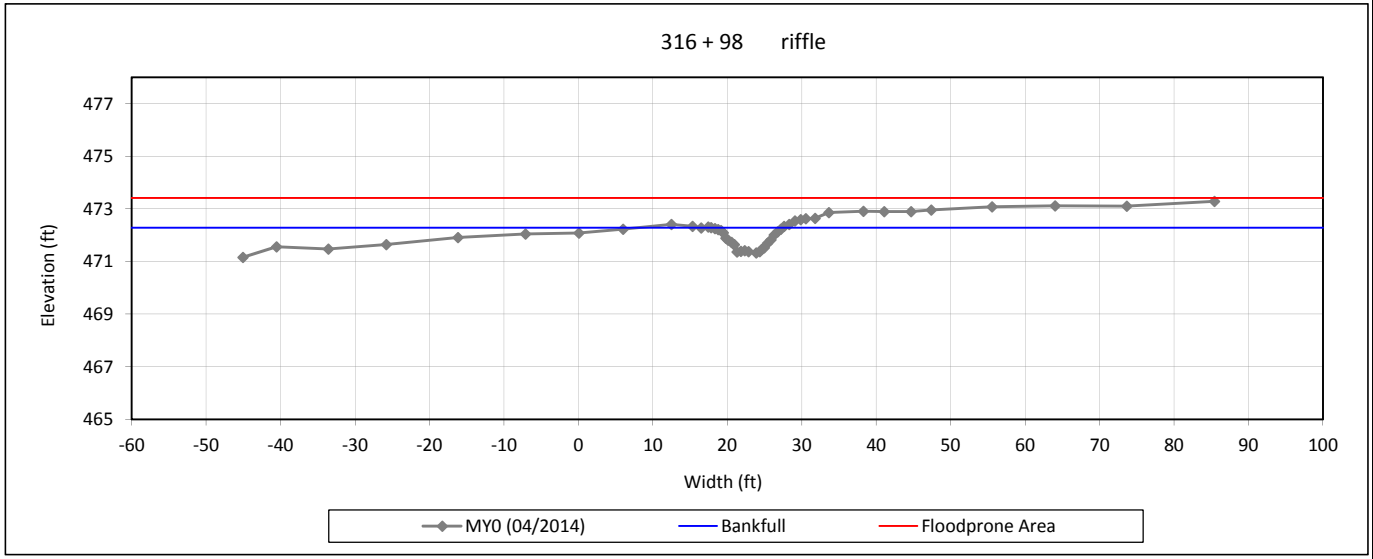
Bankfull Dimensions	
11.7	x-section area (ft.sq.)
13.9	width (ft)
0.8	mean depth (ft)
2.1	max depth (ft)
14.9	wetted parimeter (ft)
0.8	hyd radi (ft)
16.4	width-depth ratio

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 15-UT2 Reach 2



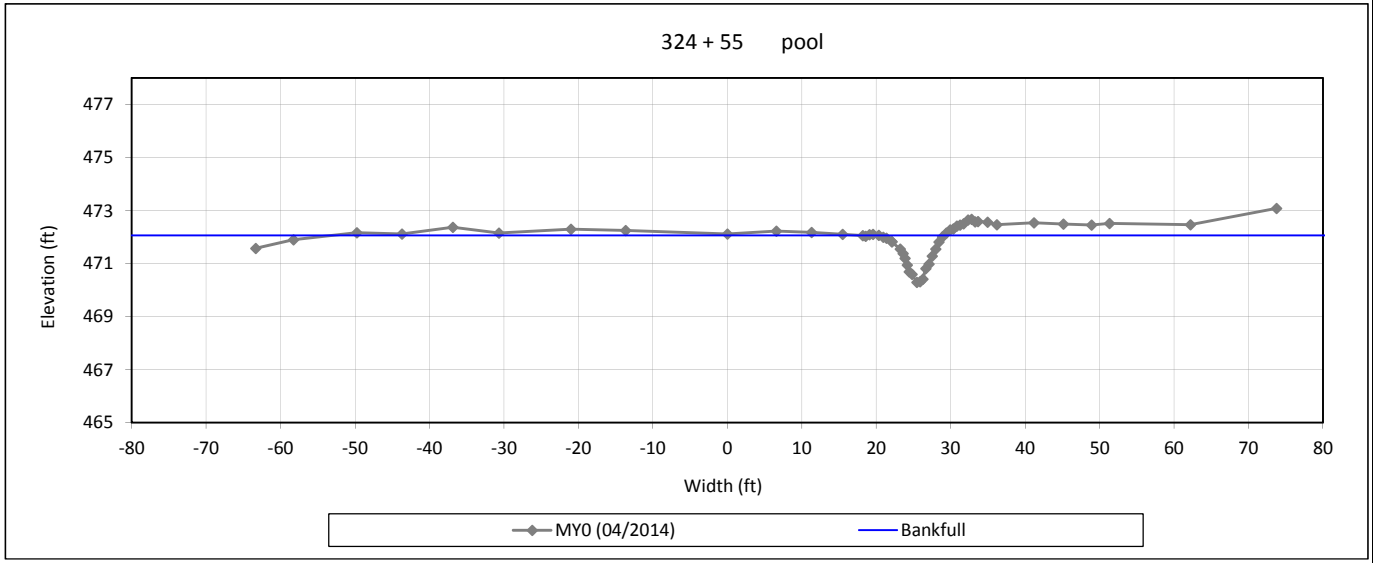
Bankfull Dimensions	
5.2	x-section area (ft.sq.)
9.6	width (ft)
0.5	mean depth (ft)
1.1	max depth (ft)
9.9	wetted parimeter (ft)
0.5	hyd radi (ft)
17.6	width-depth ratio
>N59	width FPA (ft)
>2.2	Entrenchement Ratio
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

View Downstream 4/22/14

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 16-UT2 Reach 2



Bankfull Dimensions	
7.0	x-section area (ft.sq.)
9.6	width (ft)
0.7	mean depth (ft)
1.8	max depth (ft)
10.6	wetted parimeter (ft)
0.7	hyd radi (ft)
13.3	width-depth ratio

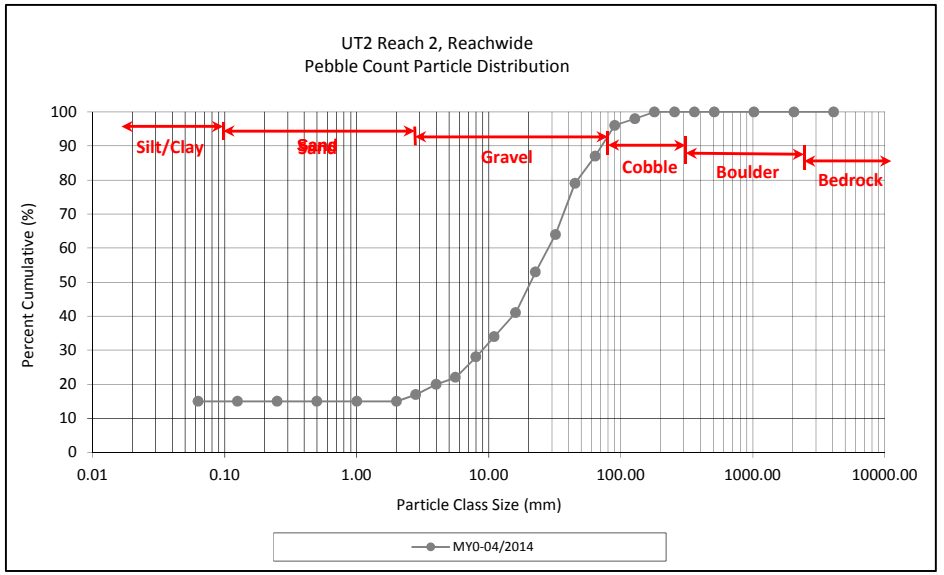
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

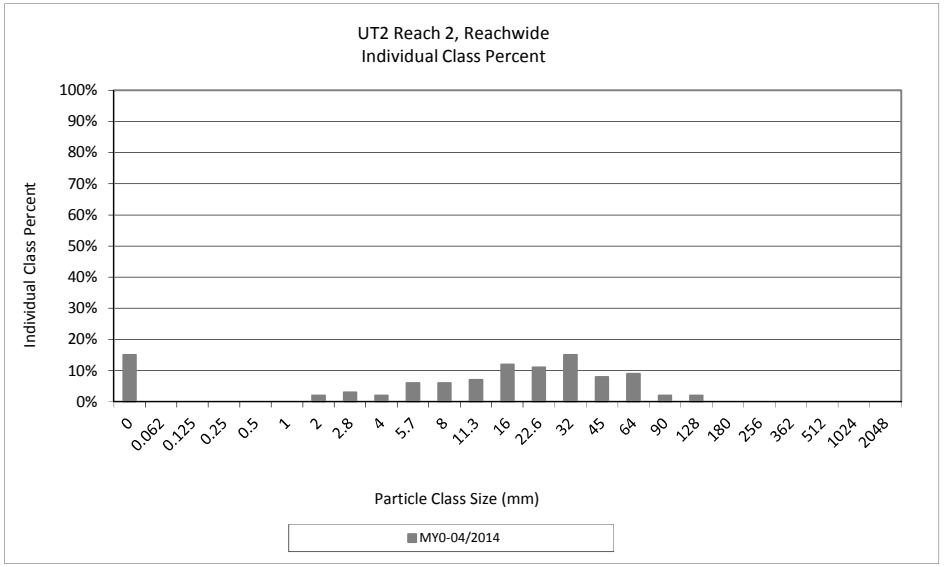
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 2, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			UT2 Reach 2 Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	13	15	15	15
SAND	Very fine	0.062	0.125			0	0	15
	Fine	0.125	0.250			0	0	15
	Medium	0.250	0.500			0	0	15
	Coarse	0.5	1.0			0	0	15
	Very Coarse	1.0	2.0			0	0	15
GRAVEL	Very Fine	2.0	2.8		2	2	2	17
	Very Fine	2.8	4.0		3	3	3	20
	Fine	4.0	5.7		2	2	2	22
	Fine	5.7	8.0	2	4	6	6	28
	Medium	8.0	11.3	2	4	6	6	34
	Medium	11.3	16.0	2	5	7	7	41
	Coarse	16.0	22.6	7	5	12	12	53
	Coarse	22.6	32	4	7	11	11	64
	Very Coarse	32	45	12	3	15	15	79
	Very Coarse	45	64	7	1	8	8	87
COBBLE	Small	64	90	9		9	9	96
	Small	90	128	2		2	2	98
	Large	128	180	1	1	2	2	100
	Large	180	256					
BOULDER	Small	256	362					
	Small	362	512					
	Medium	512	1024					
	Large/Very Large	1024	2048					
BEDROCK	Bedrock	2048	>2048					
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	2.4
D_{35} =	11.6
D_{50} =	20.7
D_{84} =	56.1
D_{95} =	86.7
D_{100} =	180.0

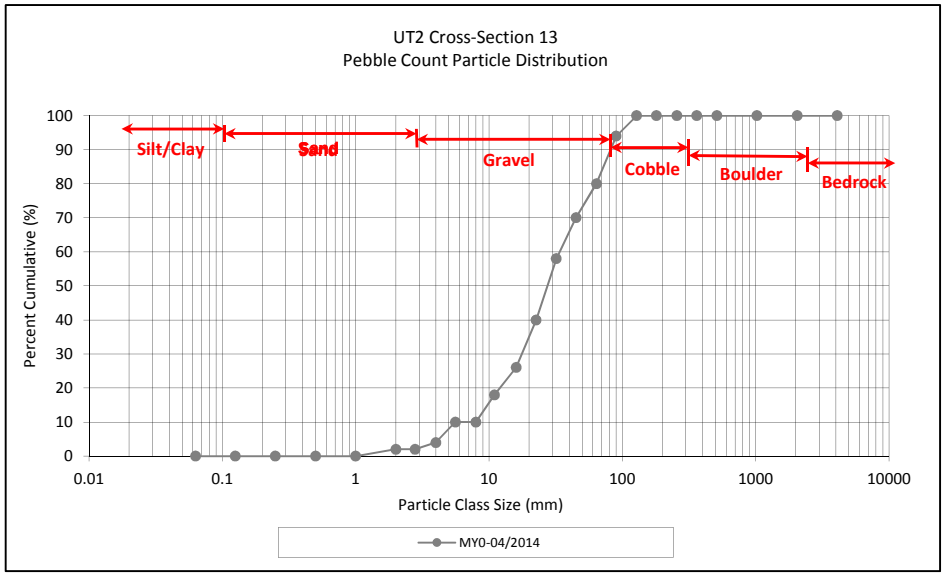


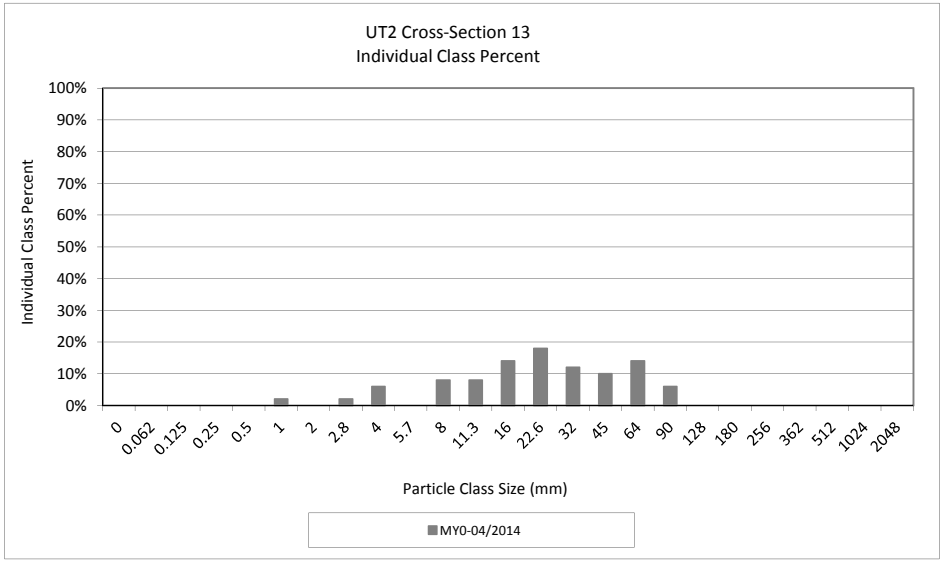


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 2, Cross-Section 13
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 13 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.250	0.500			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0	2	2	4
	Fine	4.0	5.7	6	6	10
	Fine	5.7	8.0			10
	Medium	8.0	11.3	8	8	18
	Medium	11.3	16.0	8	8	26
	Coarse	16.0	22.6	14	14	40
	Coarse	22.6	32	18	18	58
	Very Coarse	32	45	12	12	70
	Very Coarse	45	64	10	10	80
COBBLE	Small	64	90	14	14	94
	Small	90	128	6	6	100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 13	
Channel materials (mm)	
D_{16} =	10.2
D_{35} =	20.0
D_{50} =	27.4
D_{84} =	70.5
D_{95} =	95.4
D_{100} =	128.0

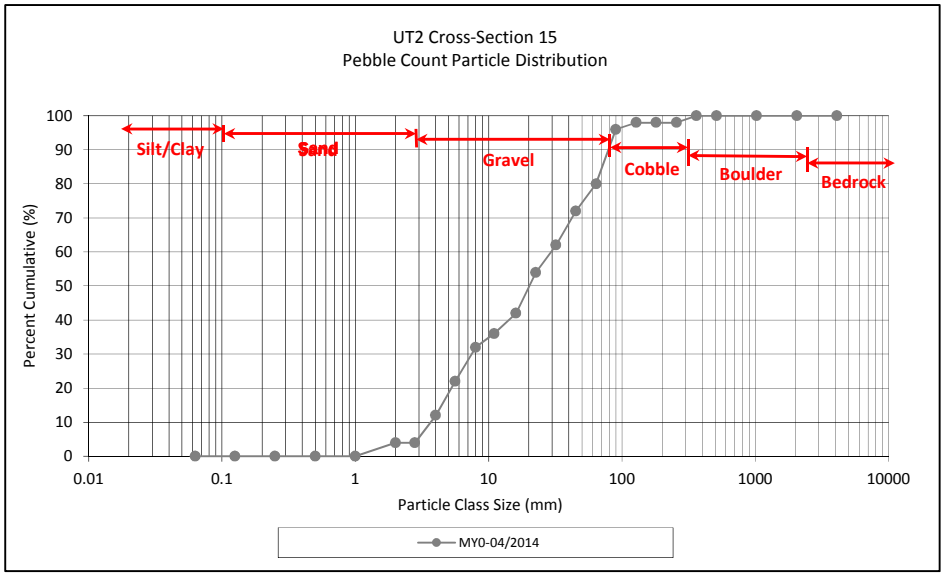




Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 2, Cross-Section 15
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 15 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.250	0.500			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	4	4	4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0	8	8	12
	Fine	4.0	5.7	10	10	22
	Fine	5.7	8.0	10	10	32
	Medium	8.0	11.3	4	4	36
	Medium	11.3	16.0	6	6	42
	Coarse	16.0	22.6	12	12	54
	Coarse	22.6	32	8	8	62
	Very Coarse	32	45	10	10	72
	Very Coarse	45	64	8	8	80
COBBLE	Small	64	90	16	16	96
	Small	90	128	2	2	98
	Large	128	180			98
	Large	180	256			98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 15	
Channel materials (mm)	
D_{16} =	4.6
D_{35} =	10.2
D_{50} =	20.1
D_{84} =	69.7
D_{95} =	88.1
D_{100} =	362.0



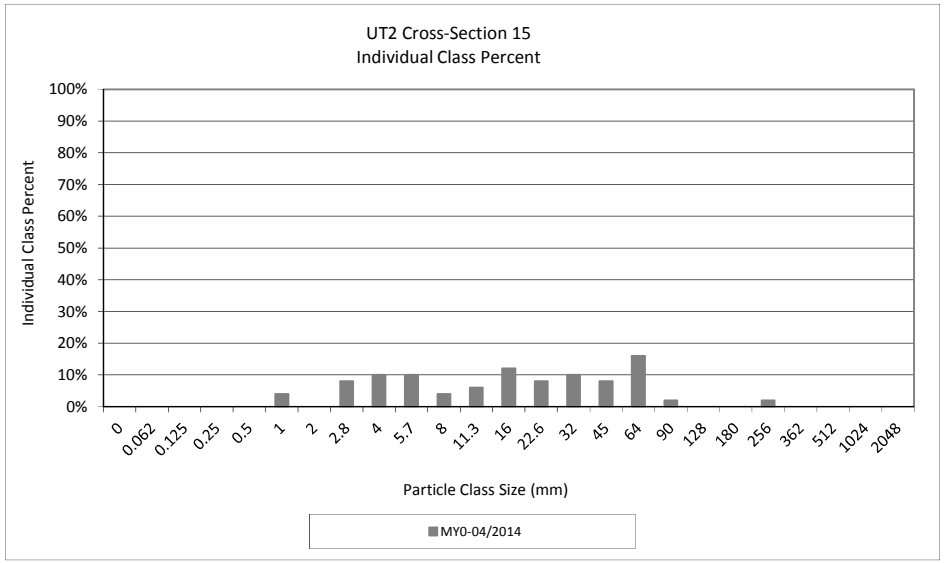


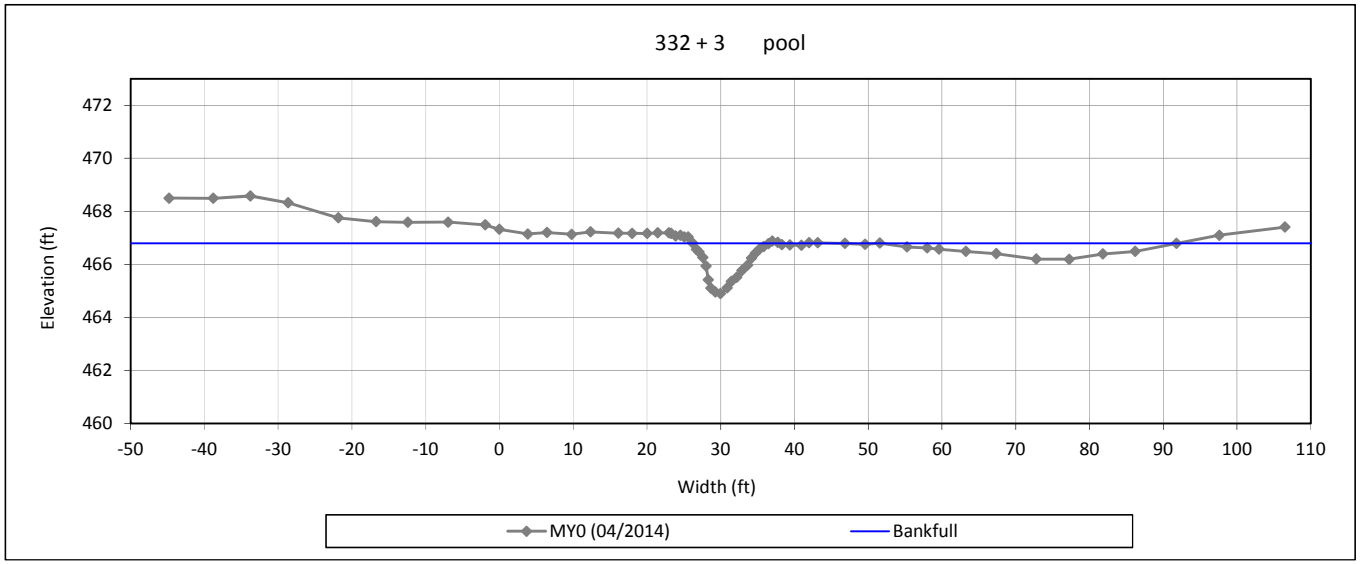
Table 6c. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
Monitoring Year 0

UT2 Reaches 3A and 3B

	Cross-Section 17 (Pool)						Cross-Section 18 (Riffle)						Cross-Section 19 (Riffle)						Cross-Section 20 (Pool)					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
based on fixed bankfull elevation																								
Bankfull Width (ft)	10.5						10.5						13.9						14.7					
Floodprone Width (ft)	N/A						200.0						161.8						**					
Bankfull Mean Depth (ft)	1.0						0.7						0.8						1.4					
Bankfull Max Depth (ft)	2.0						1.2						1.6						2.6					
Bankfull Cross-Sectional Area (ft^2)	10.7						7.2						11.8						21.2					
Bankfull Width/Depth Ratio	10.2						15.3						16.5						10.2					
Bankfull Entrenchment Ratio	N/A						19.1						11.6						**					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0					

Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 17-UT2 Reach 3A



Bankfull Dimensions	
10.7	x-section area (ft.sq.)
10.5	width (ft)
1.0	mean depth (ft)
2.0	max depth (ft)
11.4	wetted parimeter (ft)
0.9	hyd radi (ft)
10.2	width-depth ratio

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

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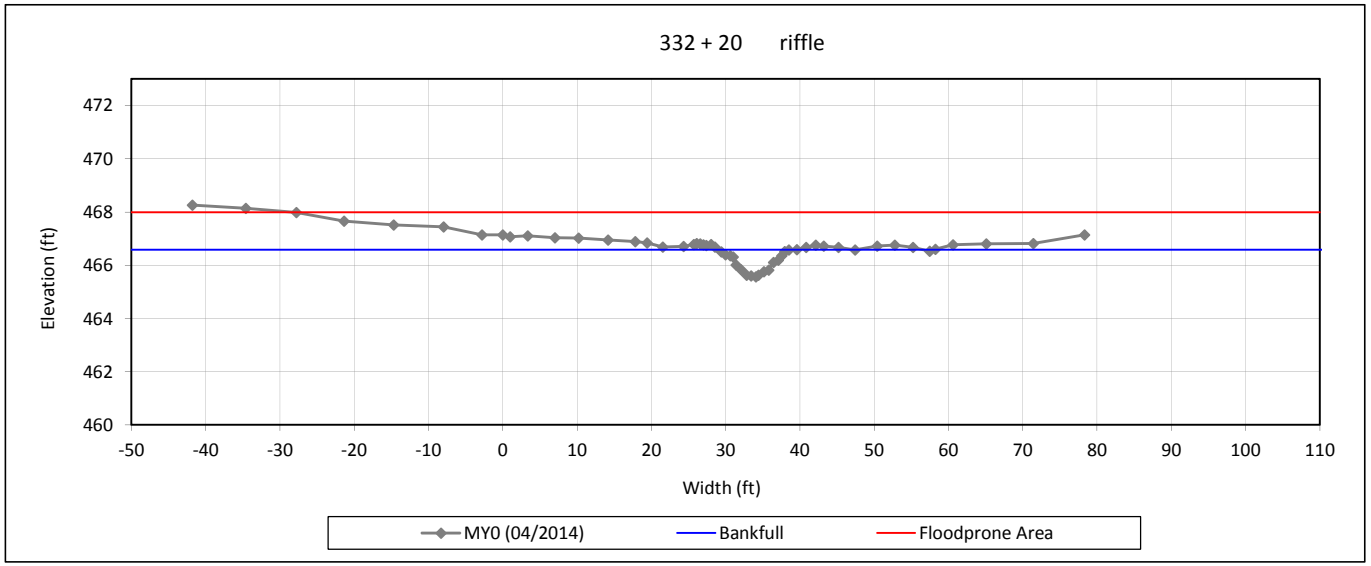
Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 18-UT2 Reach 3A



Bankfull Dimensions	
7.2	x-section area (ft.sq.)
10.5	width (ft)
0.7	mean depth (ft)
1.2	max depth (ft)
10.8	wetted parimeter (ft)
0.7	hyd radi (ft)
15.3	width-depth ratio
>97	width FPA (ft)
>2.2	Entrenchement Ratio
1.0	BHR

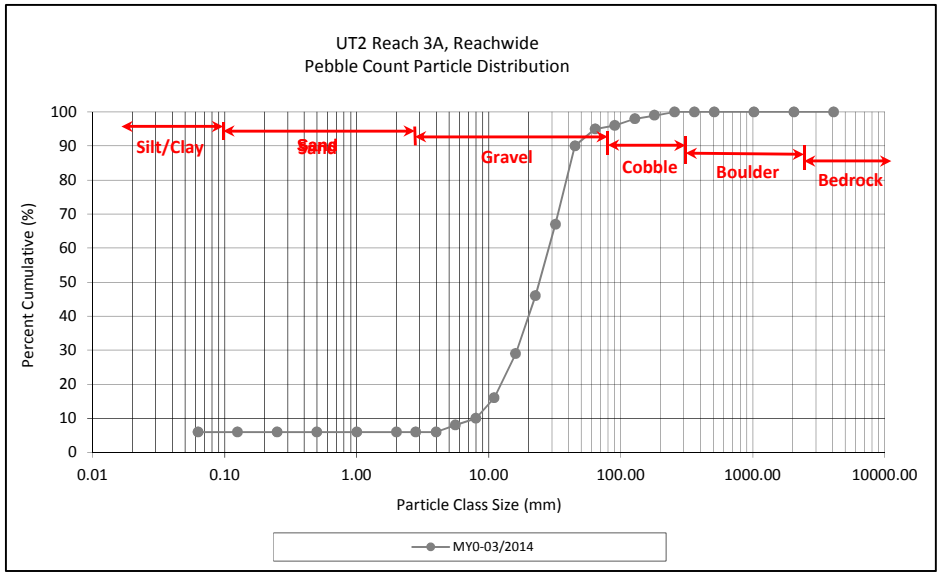
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

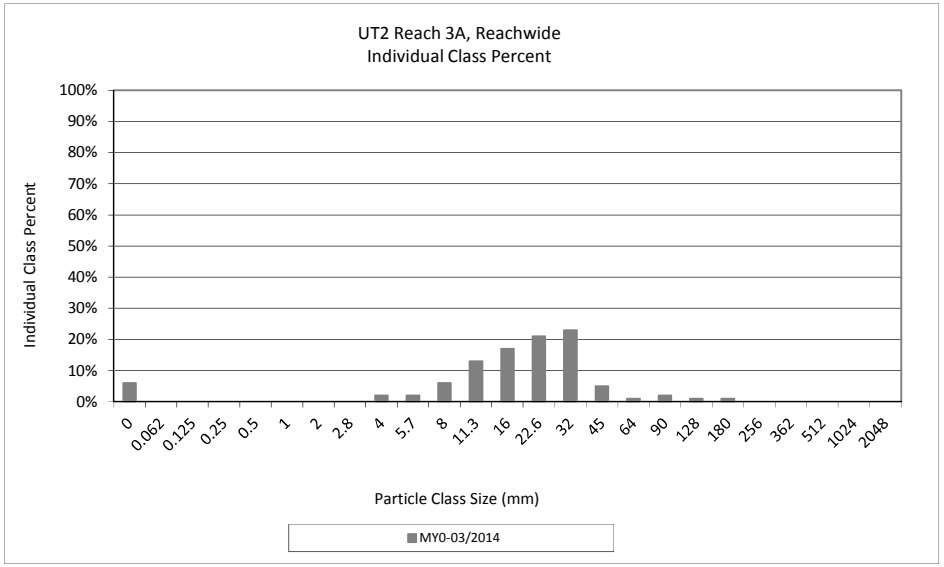
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 3a, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			UT2 Reach 3A Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	4	6	6	6
SAND	Very fine	0.062	0.125			0	0	6
	Fine	0.125	0.250			0	0	6
	Medium	0.250	0.500			0	0	6
	Coarse	0.5	1.0			0	0	6
	Very Coarse	1.0	2.0			0	0	6
GRAVEL	Very Fine	2.0	2.8			0	0	6
	Very Fine	2.8	4.0			0	0	6
	Fine	4.0	5.7		2	2	2	8
	Fine	5.7	8.0		2	2	2	10
	Medium	8.0	11.3	3	3	6	6	16
	Medium	11.3	16.0	3	10	13	13	29
	Coarse	16.0	22.6	11	6	17	17	46
	Coarse	22.6	32	11	10	21	21	67
	Very Coarse	32	45	15	8	23	23	90
	Very Coarse	45	64	2	3	5	5	95
COBBLE	Small	64	90		1	1	1	96
	Small	90	128	1	1	2	2	98
	Large	128	180	1		1	1	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					
	Small	362	512					
	Medium	512	1024					
	Large/Very Large	1024	2048					
BEDROCK	Bedrock	2048	>2048					
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	11.0
D_{35} =	18.1
D_{50} =	24.1
D_{84} =	41.2
D_{95} =	64.0
D_{100} =	256.0

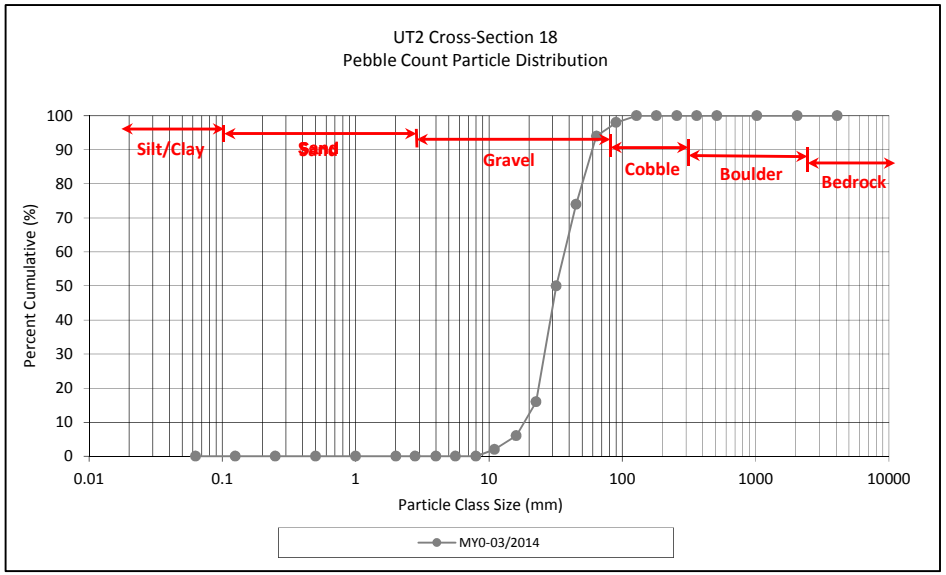


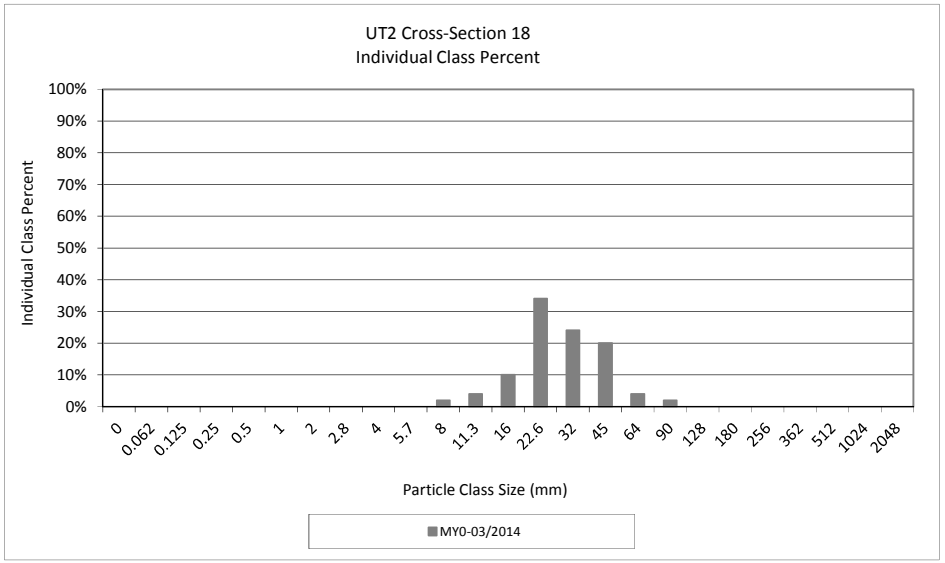


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 3A, Cross-Section 18
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 1 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.250	0.500			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0			0
	Fine	4.0	5.7			0
	Fine	5.7	8.0			0
	Medium	8.0	11.3	2	2	2
	Medium	11.3	16.0	4	4	6
	Coarse	16.0	22.6	10	10	16
	Coarse	22.6	32	34	34	50
	Very Coarse	32	45	24	24	74
	Very Coarse	45	64	20	20	94
COBBLE	Small	64	90	4	4	98
	Small	90	128	2	2	100
	Large	128	180			
	Large	180	256			
BOULDER	Small	256	362			
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**100**	**100**	**100**

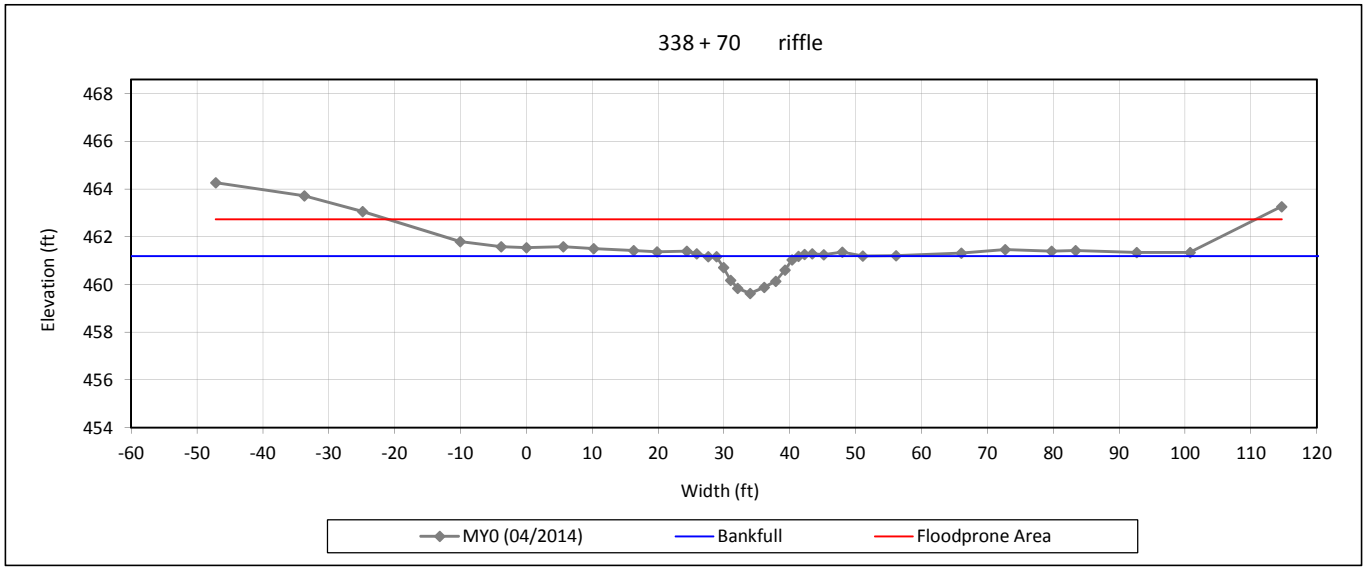
Cross-Section 18	
Channel materials (mm)	
D_{16} =	22.6
D_{35} =	27.4
D_{50} =	32.0
D_{84} =	53.7
D_{95} =	69.7
D_{100} =	128.0





Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 19-UT2 Reach 3B



Bankfull Dimensions	
11.8	x-section area (ft.sq.)
13.9	width (ft)
0.8	mean depth (ft)
1.6	max depth (ft)
14.4	wetted parimeter (ft)
0.8	hyd radi (ft)
16.5	width-depth ratio
132	width FPA (ft)
>2.2	Entrenchement Ratio
1.0	BHR

Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

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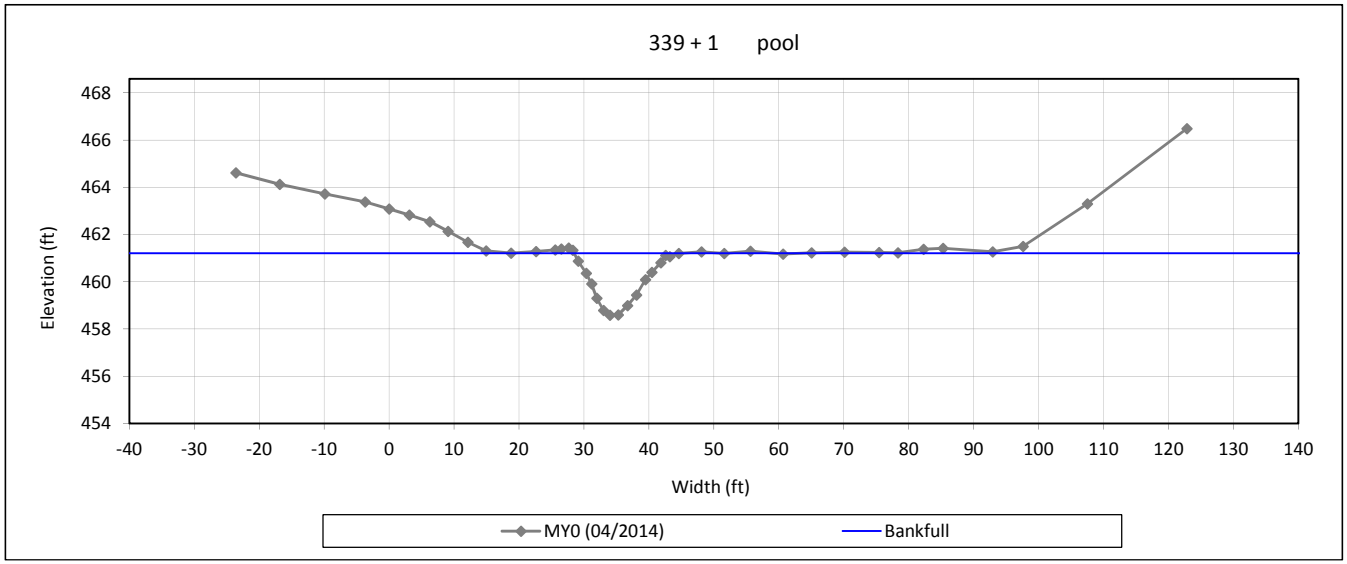
Cross-Section Plots
Norkett Branch Stream Mitigation Site (Project No. 95360)
Monitoring Year 0

Cross Section 20-UT2 Reach 3B



Bankfull Dimensions	
21.2	x-section area (ft.sq.)
14.7	width (ft)
1.4	mean depth (ft)
2.6	max depth (ft)
15.8	wetted parimeter (ft)
1.3	hyd radi (ft)
10.2	width-depth ratio

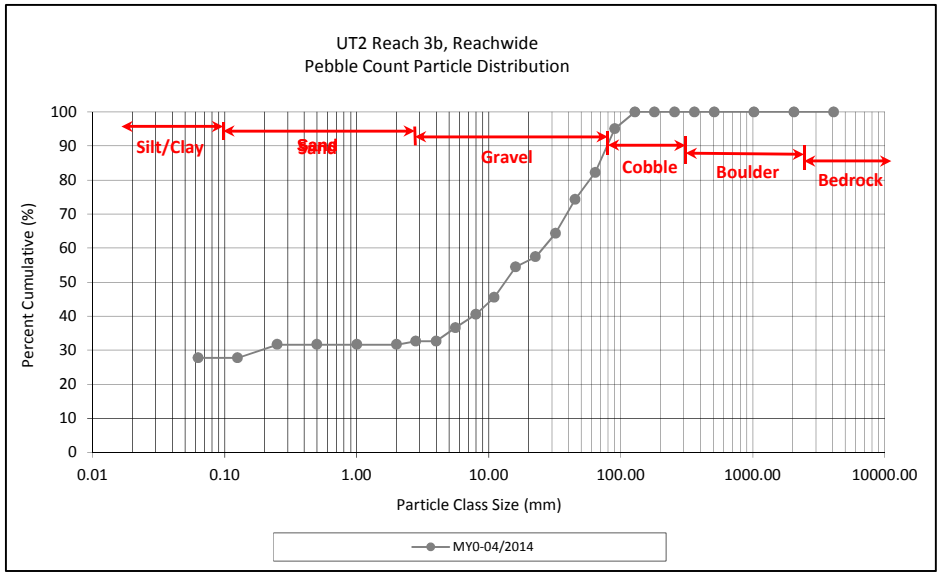
Survey Date: April 2014
Field Crew: Kee Mapping and Surveying

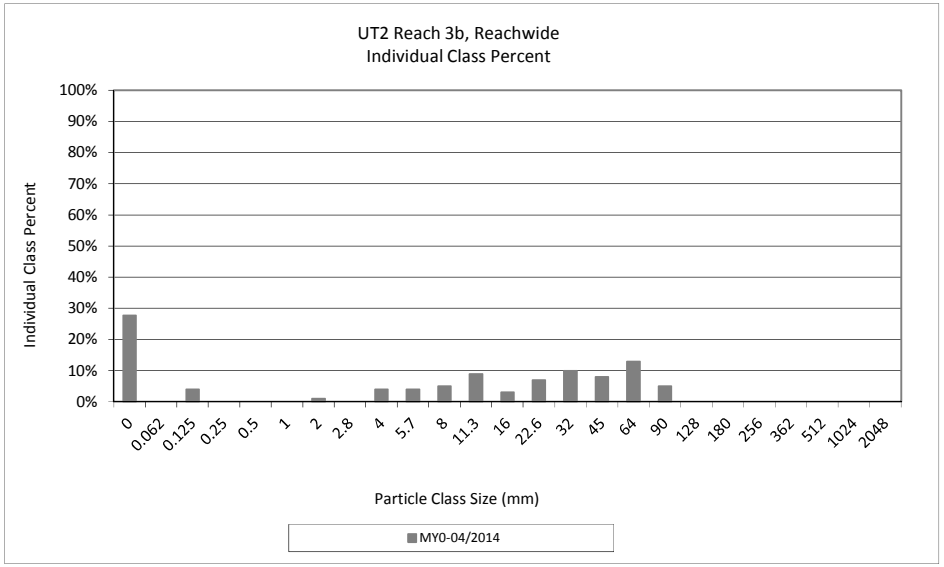
View Downstream 4/22/14

Reachwide and Cross-Section Pebble Count Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 3b, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			BC2 Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	8	20	28	28	28
SAND	Very fine	0.062	0.125			0	0	28
	Fine	0.125	0.250		4	4	4	32
	Medium	0.250	0.500			0	0	32
	Coarse	0.5	1.0			0	0	32
	Very Coarse	1.0	2.0			0	0	32
GRAVEL	Very Fine	2.0	2.8	1		1	1	33
	Very Fine	2.8	4.0			0	0	33
	Fine	4.0	5.7	2	2	4	4	37
	Fine	5.7	8.0	3	1	4	4	41
	Medium	8.0	11.3	5		5	5	46
	Medium	11.3	16.0	7	2	9	9	54
	Coarse	16.0	22.6	1	2	3	3	57
	Coarse	22.6	32	3	4	7	7	64
	Very Coarse	32	45	4	6	10	10	74
	Very Coarse	45	64	5	3	8	8	82
COBBLE	Small	64	90	10	3	13	13	95
	Small	90	128	2	3	5	5	100
	Large	128	180					
	Large	180	256					
BOULDER	Small	256	362					
	Small	362	512					
	Medium	512	1024					
	Large/Very Large	1024	2048					
BEDROCK	Bedrock	2048	>2048					
			Total	**51**	**50**	**101**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	4.9
D_{50} =	13.3
D_{84} =	67.2
D_{95} =	89.9
D_{100} =	128.0

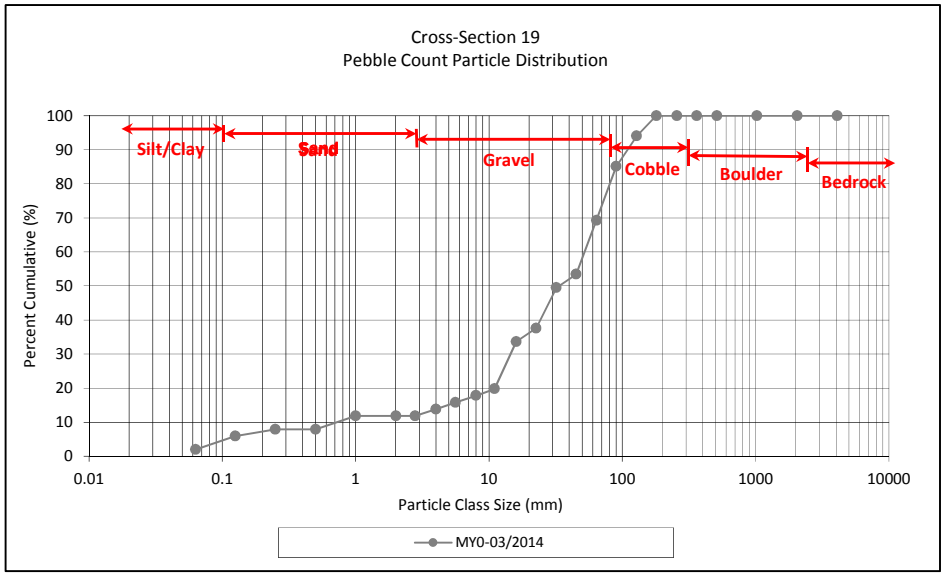


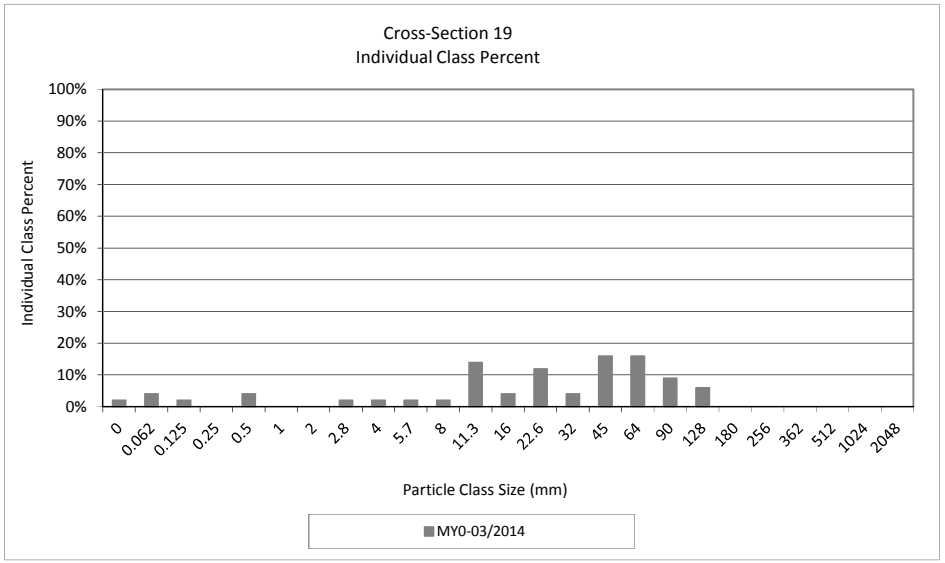


Reachwide and Cross-Section Substrate Plots
Norkett Branch Stream Mitigation Site (NCEEP Project No. 95360)
UT2 Reach 3b, Cross-Section 19
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count	Cross-Section 1 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125	4	4	6
	Fine	0.125	0.250	2	2	8
	Medium	0.250	0.500			8
	Coarse	0.5	1.0	4	4	12
	Very Coarse	1.0	2.0			12
GRAVEL	Very Fine	2.0	2.8			12
	Very Fine	2.8	4.0	2	2	14
	Fine	4.0	5.7	2	2	16
	Fine	5.7	8.0	2	2	18
	Medium	8.0	11.3	2	2	20
	Medium	11.3	16.0	14	14	34
	Coarse	16.0	22.6	4	4	38
	Coarse	22.6	32	12	12	50
	Very Coarse	32	45	4	4	53
	Very Coarse	45	64	16	16	69
COBBLE	Small	64	90	16	16	85
	Small	90	128	9	9	94
	Large	128	180	6	6	100
	Large	180	256			
BOULDER	Small	256	362			
	Small	362	512			
	Medium	512	1024			
	Large/Very Large	1024	2048			
BEDROCK	Bedrock	2048	>2048			
			Total	**101**	**100**	**100**

Cross-Section 18	
Channel materials (mm)	
D_{16} =	5.8
D_{35} =	18.0
D_{50} =	33.4
D_{84} =	87.8
D_{95} =	135.1
D_{100} =	180.0





Stream Photographs

	
Photo Point 1 – looking upstream (04/23/2014)	Photo Point 1 – looking downstream (04/23/2014)
	
Photo Point 2 – looking upstream (04/23/2014)	Photo Point 2 – looking downstream (04/23/2014)
	
Photo Point 3 – looking upstream (04/23/2014)	Photo Point 3 – looking downstream (04/23/2014)

	
Photo Point 4 – looking upstream (04/23/2014)	Photo Point 4 – looking downstream (04/23/2014)
	
Photo Point 5 – looking upstream (04/23/2014)	Photo Point 5 – looking downstream (04/23/2014)
	
Photo Point 6 – looking upstream (04/23/2014)	Photo Point 6 – looking downstream (04/23/2014)

	
Photo Point 7 – looking upstream (04/23/2014)	Photo Point 7 – looking downstream (04/23/2014)
	
Photo Point 8 – looking upstream (04/23/2014)	Photo Point 8 – looking downstream (04/23/2014)
	
Photo Point 9 – looking upstream (04/23/2014)	Photo Point 9 – looking downstream (04/23/2014)

	
Photo Point 10 – looking upstream (04/23/2014)	Photo Point 10 – looking downstream (04/23/2014)
	
Photo Point 11 – looking upstream (04/23/2014)	Photo Point 11 – looking downstream (04/23/2014)
	
Photo Point 12 – looking upstream (04/23/2014)	Photo Point 12 – looking downstream (04/23/2014)

	
Photo Point 13 – looking upstream (04/23/2014)	Photo Point 13 – looking downstream (04/23/2014)
	
Photo Point 14 – looking upstream (04/23/2014)	Photo Point 14 – looking downstream (04/23/2014)
	
Photo Point 15 – looking upstream (04/23/2014)	Photo Point 15 – looking downstream (04/23/2014)

	
Photo Point 16 – looking upstream (04/23/2014)	Photo Point 16 – looking downstream (04/23/2014)
	
Photo Point 17 – looking upstream (04/23/2014)	Photo Point 17 – looking downstream (04/23/2014)
	
Photo Point 18 – looking upstream (04/23/2014)	Photo Point 18 – looking downstream (04/23/2014)

	
Photo Point 19 – looking upstream (04/23/2014)	Photo Point 19 – looking downstream (04/23/2014)
	
Photo Point 20 – looking upstream (04/23/2014)	Photo Point 20 – looking downstream (04/23/2014)
	
Photo Point 21 – looking upstream (04/23/2014)	Photo Point 21 – looking downstream (04/23/2014)

	
Photo Point 22 – looking upstream (04/23/2014)	Photo Point 22 – looking downstream (04/23/2014)
	
Photo Point 23 – looking upstream (04/23/2014)	Photo Point 23 – looking downstream (04/23/2014)
	
Photo Point 24 – looking upstream (04/23/2014)	Photo Point 24 – looking downstream (04/23/2014)

	
Photo Point 25 – looking upstream (04/23/2014)	Photo Point 25 – looking downstream (04/23/2014)
	
Photo Point 26 – looking upstream (04/23/2014)	Photo Point 26 – looking downstream (04/23/2014)
	
Photo Point 27 – looking upstream (04/23/2014)	Photo Point 27 – looking downstream (04/23/2014)

	
Photo Point 28 – looking upstream (04/23/2014)	Photo Point 28 – looking downstream (04/23/2014)
	
Photo Point 29 – looking upstream (04/23/2014)	Photo Point 29 – looking downstream (04/23/2014)
	
Photo Point 30 – looking upstream (04/23/2014)	Photo Point 30 – looking downstream (04/23/2014)

	
Photo Point 31 – looking upstream (04/23/2014)	Photo Point 31 – looking downstream (04/23/2014)
	
Photo Point 32 – looking upstream (04/23/2014)	Photo Point 32 – looking downstream (04/23/2014)
	
Photo Point 33 – looking upstream (04/23/2014)	Photo Point 33 – looking downstream (04/23/2014)

	
Photo Point 34 – looking upstream (04/23/2014)	Photo Point 34 – looking downstream (04/23/2014)
	
Photo Point 35 – looking upstream (04/23/2014)	Photo Point 35 – looking downstream (04/23/2014)
	
Photo Point 36 – looking upstream (04/23/2014)	Photo Point 36 – looking downstream (04/23/2014)

	
Photo Point 37 – looking upstream (04/23/2014)	Photo Point 37 – looking downstream (04/23/2014)
	
Photo Point 38 – looking upstream (04/23/2014)	Photo Point 38 – looking downstream (04/23/2014)
	
Photo Point 39 – looking upstream (04/23/2014)	Photo Point 39 – looking downstream (04/23/2014)

	
Photo Point 40 – looking upstream (04/23/2014)	Photo Point 40 – looking downstream (04/23/2014)
	
Photo Point 41 – looking upstream (04/23/2014)	Photo Point 41 – looking downstream (04/23/2014)
	
Photo Point 42 – looking upstream (04/23/2014)	Photo Point 42 – looking downstream (04/23/2014)

	
Photo Point 43 – looking upstream (04/23/2014)	Photo Point 43 – looking downstream (04/23/2014)
	
Photo Point 44 – looking upstream (04/23/2014)	Photo Point 44 – looking downstream (04/23/2014)
	
Photo Point 45 – looking upstream (04/23/2014)	Photo Point 45 – looking downstream (04/23/2014)

	
Photo Point 46 – looking upstream (04/23/2014)	Photo Point 46 – looking downstream (04/23/2014)
	
Photo Point 47 – looking upstream (04/23/2014)	Photo Point 47 – looking downstream (04/23/2014)
	
Photo Point 48 – looking upstream (04/23/2014)	Photo Point 48 – looking downstream (04/23/2014)

	
Photo Point 49 – looking upstream (04/23/2014)	Photo Point 49 – looking downstream (04/23/2014)
	
Photo Point 50 – looking downstream at pond (04/23/2014)	Photo Point 51 – looking upstream at pond (04/23/2014)

APPENDIX 3. Vegetation Plot Data

Table 7. Planted and Total Stem Counts
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360)
Monitoring Year 0

			Current Plot Data (MY0 2014)																												
			95360-WEI-0001			95360-WEI-0002			95360-WEI-0003			95360-WEI-0004			95360-WEI-0005			95360-WEI-0006			95360-WEI-0007			95360-WEI-0008			95360-WEI-0009			95360-WEI-0010		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	river birch	Tree	4	4	4	1	1	1	1	1	1	4	4	4	2	2	2				2	2	2	1	1	1	1	1	1	2	2	2
Celtis laevigata	sugarberry	Tree							1	1	1							1	1	1												
Cercis canadensis	eastern redbud	Tree	2	2	2	3	3	3	1	1	1	2	2	2	3	3	3	5	5	5	1	1	1	1	1	1	1	1	1	2	2	2
Cornus florida	flowering dogwood	Tree	1	1	1	3	3	3	9	9	9	4	4	4	4	4	4	4	4	4	5	5	5	2	2	2	2	2	2	3	3	3
Fraxinus pennsylvanica	green ash	Tree				4	4	4							1	1	1	3	3	3	2	2	2	3	3	3	3	3	3	3	3	3
Hamamelis virginiana	American witchhazel	Tree				1	1	1							2	2	2	1	1	1												
Liriodendron tulipifera	tuliptree	Tree	4	4	4	2	2	2				2	2	2	1	1	1				2	2	2	2	2	2	2	2	2	5	5	5
Platanus occidentalis	American sycamore	Tree	2	2	2	1	1	1																4	4	4	4	4	4			
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	2	2	2	2	2	2	3	3	3	2	2	2	3	3	3	1	1	1	1	1	1	1	1	1			
Quercus phellos	willow oak	Tree																						2	2	2	2	2	2			
Quercus rubra	northern red oak	Tree	4	4	4				1	1	1													1	1	1	1	1	1	1	1	1
Sambucus canadensis	common elderberry	Shrub							2	2	2	2	2	2	2	2	2				4	4	4							1	1	1
Stem count			18	18	18	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
size (ares)			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			7	7	7	8	8	8	7	7	7	6	6	6	8	8	8	6	6	6	7	7	7	9	9	9	9	9	9	7	7	7
Stems per ACRE			728	728	728	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688

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: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total Stems

Table 7. Planted and Total Stem Counts
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360
Monitoring Year 0

			Current Plot Data (MY0 2014)																																
			95360-WEI-0011			95360-WEI-0012			95360-WEI-0013			95360-WEI-0014			95360-WEI-0015			95360-WEI-0016			95360-WEI-0017			95360-WEI-0018			95360-WEI-0019			95360-WEI-0020			95360-WEI-0021			95360-WEI-0022		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Betula nigra	river birch	Tree	1	1	1	2	2	2	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1
Celtis laevigata	sugarberry	Tree																															1	1	1	3	3	3
Cercis canadensis	eastern redbud	Tree	3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	6	6			
Cornus florida	flowering dogwood	Tree	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	4	4	4
Fraxinus pennsylvanica	green ash	Tree	3	3	3				2	2	2	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3				6	6	6
Hamamelis virginiana	American witchhazel	Tree																															3	3	3			
Liriodendron tulipifera	tuliptree	Tree	4	4	4	5	5	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	6	6	6	1	1	1
Platanus occidentalis	American sycamore	Tree	1	1	1	1	1	1	5	5	5	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4						
Quercus michauxii	swamp chestnut oak	Tree				2	2	2	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3			
Quercus phellos	willow oak	Tree							2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2				1	1	1
Quercus rubra	northern red oak	Tree				3	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Sambucus canadensis	common elderberry	Shrub	2	2	2																																	
Stem count			17	17	17	17	17	17	17	17	17	17	17	17	18	18	18	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	21	21	21	16	16	16
size (ares)			1			1			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			7	7	7	7	7	7	9	9	9	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	7	7	7	6	6	6
Stems per ACRE			688	688	688	688	688	688	688	688	688	688	688	688	728	728	728	688	688	688	688	688	688	688	688	688	688	688	688	688	688	688	849	849	849	647	647	647

Color for Density

Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

PnoLS: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total Stems

Table 7. Planted and Total Stem Counts
Norkett Branch Stream Mitigation Site (NCEEP Project No.95360
Monitoring Year 0

			Current Plot Data (MY0 2014)															
			95360-WEI-0023			95360-WEI-0024			95360-WEI-0025			95360-WEI-0026			MY0 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree	1	1	1	1	1	1	1	1	1				32	32	32
Celtis laevigata	sugarberry	Tree										1	1	1	7	7	7
Cercis canadensis	eastern redbud	Tree	1	1	1	1	1	1	1	1	1				42	42	42
Cornus florida	flowering dogwood	Tree	2	2	2	2	2	2	2	2	2	5	5	5	75	75	75
Fraxinus pennsylvanica	green ash	Tree	3	3	3	3	3	3	3	3	3	5	5	5	67	67	67
Hamamelis virginiana	American witchhazel	Tree										1	1	1	8	8	8
Liriodendron tulipifera	tuliptree	Tree	2	2	2	2	2	2	2	2	2	1	1	1	59	59	59
Platanus occidentalis	American sycamore	Tree	4	4	4	4	4	4	4	4	4				57	57	57
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	1	1	1	1	1	1	3	3	3	36	36	36
Quercus phellos	willow oak	Tree	2	2	2	2	2	2	2	2	2				27	27	27
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	1	1	1	1	1	1	24	24	24
Sambucus canadensis	common elderberry	Shrub													13	13	13
Stem count			17	17	17	17	17	17	17	17	17	17	17	17	447	447	447
size (ares)			1			1			1			1			26		
size (ACRES)			0.02			0.02			0.02			0.02			0.64		
Species count			9	9	9	9	9	9	9	9	9	7	7	7	12	12	12
Stems per ACRE			688	688	688	688	688	688	688	688	688	688	688	688	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

PnoLS: Number of Planted stems excluding live stakes
P-all: Number of planted stems including live stakes
T: Total Stems

Vegetation Photographs

	
Vegetation Plot 1 – (04/22/2014)	Vegetation Plot 2 – (04/22/2014)
	
Vegetation Plot 3 – (04/22/2014)	Vegetation Plot 4 – (04/22/2014)
	
Vegetation Plot 5 – (04/22/2014)	Vegetation Plot 6 – (04/22/2014)

	
Vegetation Plot 7 – (04/22/2014)	Vegetation Plot 8 – (04/09/2014)
	
Vegetation Plot 9 – (04/09/2014)	Vegetation Plot 10 – (04/22/2014)
	
Vegetation Plot 11 – (04/22/2014)	Vegetation Plot 12 – (04/23/2014)

	
Vegetation Plot 13 – (04/08/2014)	Vegetation Plot 14 – (04/08/2014)
	
Vegetation Plot 15 – (04/08/2014)	Vegetation Plot 16 – (04/08/2014)
	
Vegetation Plot 17 – (04/08/2014)	Vegetation Plot 18 – (04/08/2014)

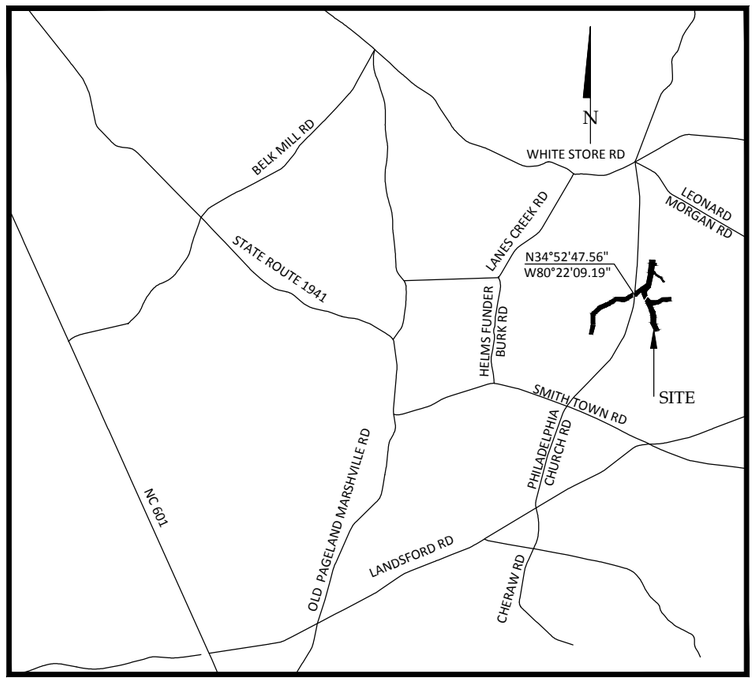
	
Vegetation Plot 19 – (04/08/2014)	Vegetation Plot 20 – (04/08/2014)
	
Vegetation Plot 21 – (04/22/2014)	Vegetation Plot 22 – (06/03/2014)
	
Vegetation Plot 23 – (04/08/2014)	Vegetation Plot 24– (04/08/2014)

	
Vegetation Plot 25 – (04/08/2014)	Vegetation Plot 26 – (04/22/2014)

APPENDIX 4. Baseline Drawings

Norkett Branch Stream Mitigation Site

Yadkin River Basin 03040105
Union County, North Carolina
for
North Carolina Ecosystem Enhancement Program



Vicinity Map
Not to Scale

Ecosystem Enhancement PROGRAM

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

BASELINE DRAWINGS
ISSUED JULY 15, 2014

Site Directions:

From Charlotte take US-74 E.
Turn Right onto US 601 S.
Turn Left onto Landsford Rd.
Turn Right onto Philadelphia Church Rd.
Norkett Branch, UT1, UT3 and BMPs are on the right. UT2 and UT2A are on the left.

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
1430 South Mint Street
Suite 104
Charlotte, NC 28203
Emily G. Reinicker, PE
704-332-7754

Surveying:
Kee Mapping and Survey
111 Central Avenue,
Asheville, NC 28801
Brad Kee, PLS
828-645-8275

Owner:
Ecosystem Enhancement Program
NC Department of Environment and Natural Resources
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

EEP Project ID: 95360

DENR Contract No. 004673

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Norkett Branch Stream Mitigation Site
Union County, North Carolina

Title Sheet
Baseline Drawings

Revisions:

Date: July 15, 2014
Job Number: 005-02134
Project Engineer: EGR
Drawn By: JCK
Checked By: KYG

Sheet 0.1

Property Line

Trees Saved During Construction

Power Pole

Farm Road

CE 10+00 CE — Conservation Easement

Thalweg Alignment

As-Built Bankfull

100 — As-Built Major Contour

As-Built Minor Contour

As-Built Cross Section (XS)

As-Built Log Sill

As-Built Boulder Toe Protection

CR-T

CR-W

CR-J

CR-C

CR-R

CR-B

As-Built Log Vane

As-Built Log J-Hook

As-Built Rock Cross Vane

As-Built Brush Mattress

As-Built Sod Mats

As-Built Brush Toe

Vernal Pool Oultet Protection

VP# 1 — Vegetation Plot

PP 3 — Photo Point

CG 3 — Crest/Stream Gauge

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Norkett Branch Stream Mitigation Site
Union County, North Carolina

General Notes and Symbols
Baseline Drawings

Revisions:

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Job Number:	105-02134
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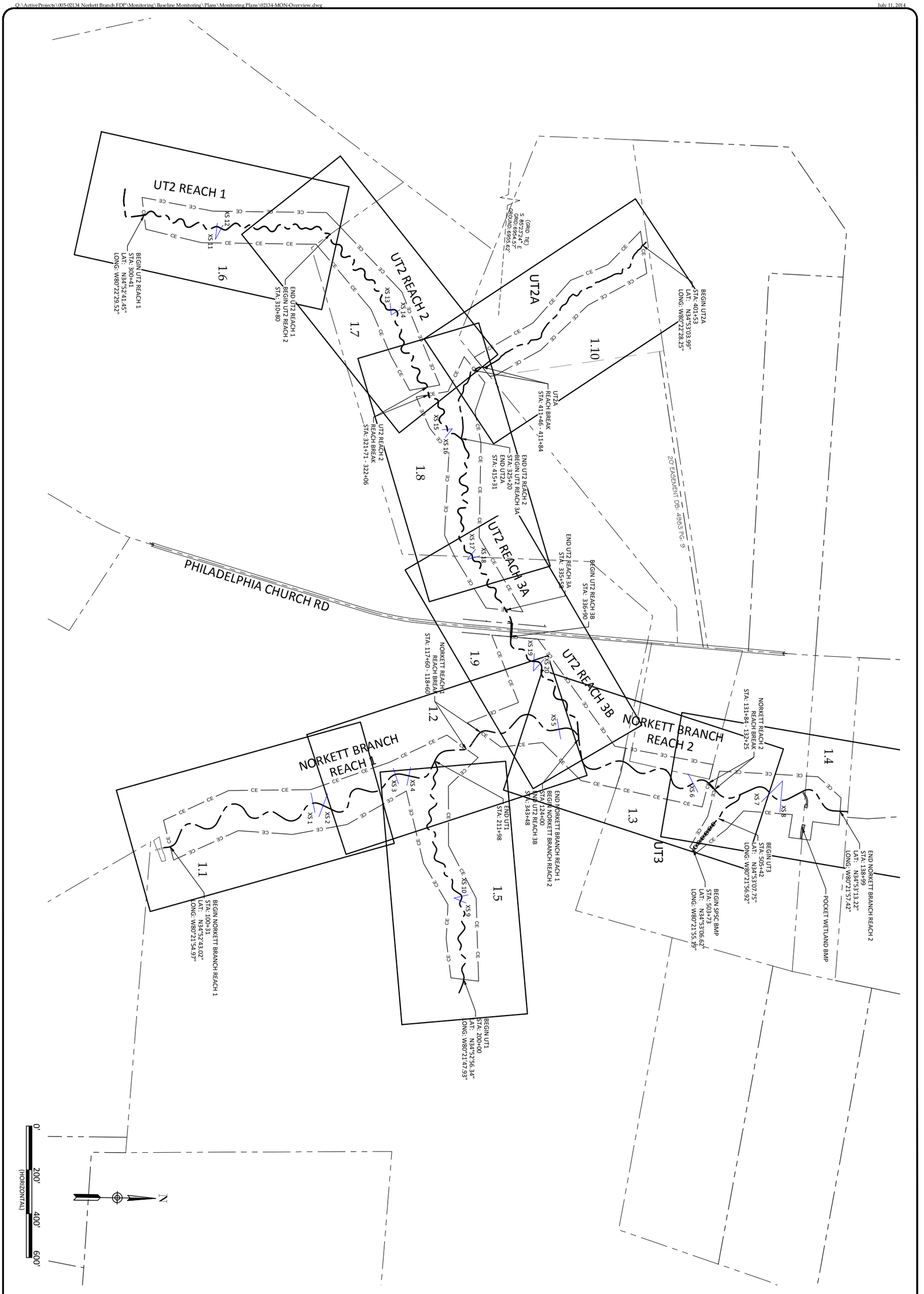
Checked By:	KYG

Sheet 0.2



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Revisions:

1.0

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Norkett Branch Stream Mitigation Site
Union County, North Carolina

Project Overview
Baseline Drawings

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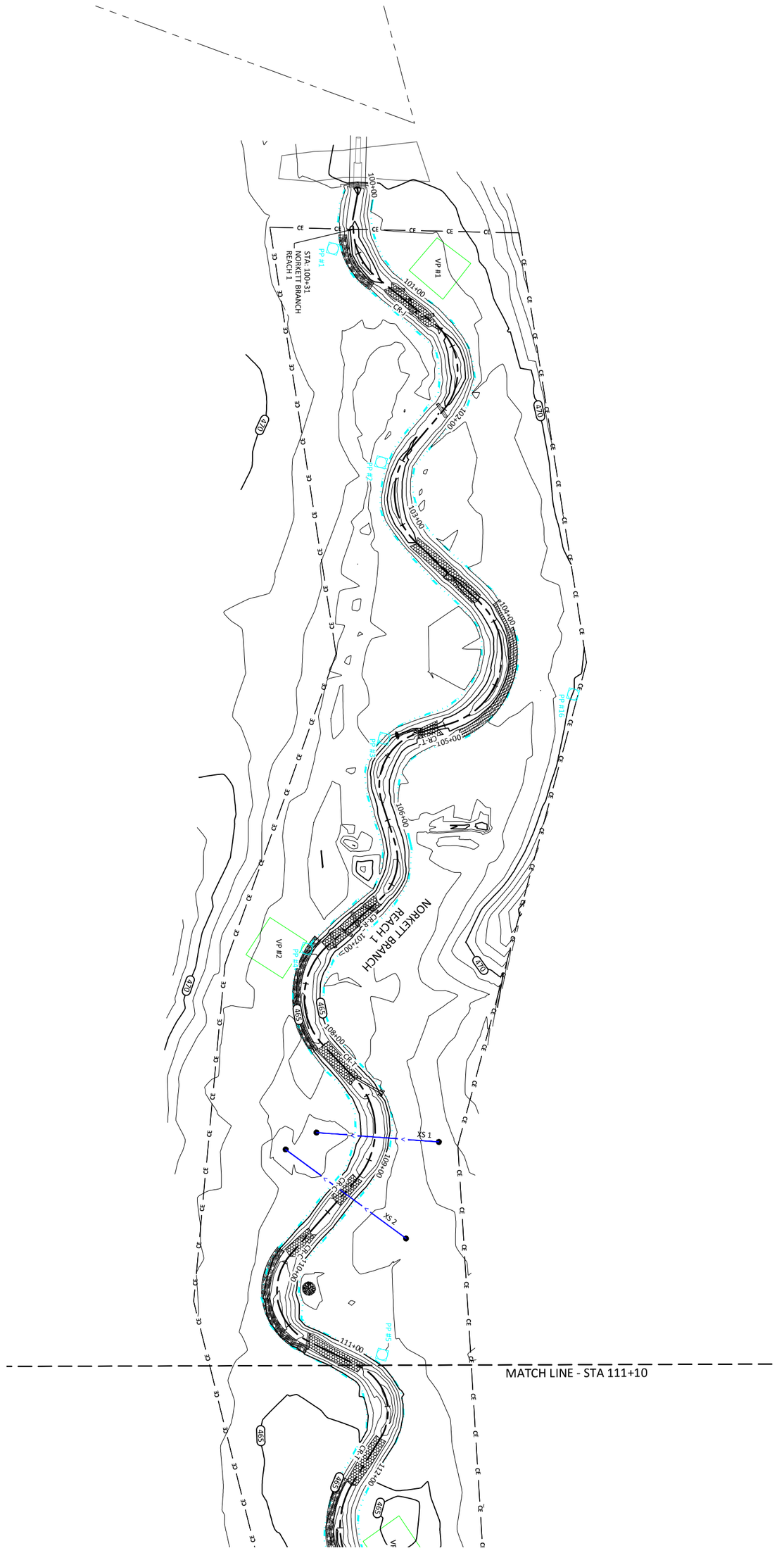

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Job Number:	005-02134
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1.1
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Norkett Branch Stream Mitigation Site
Union County, North Carolina

Norkett Reach 1
Baseline Drawings

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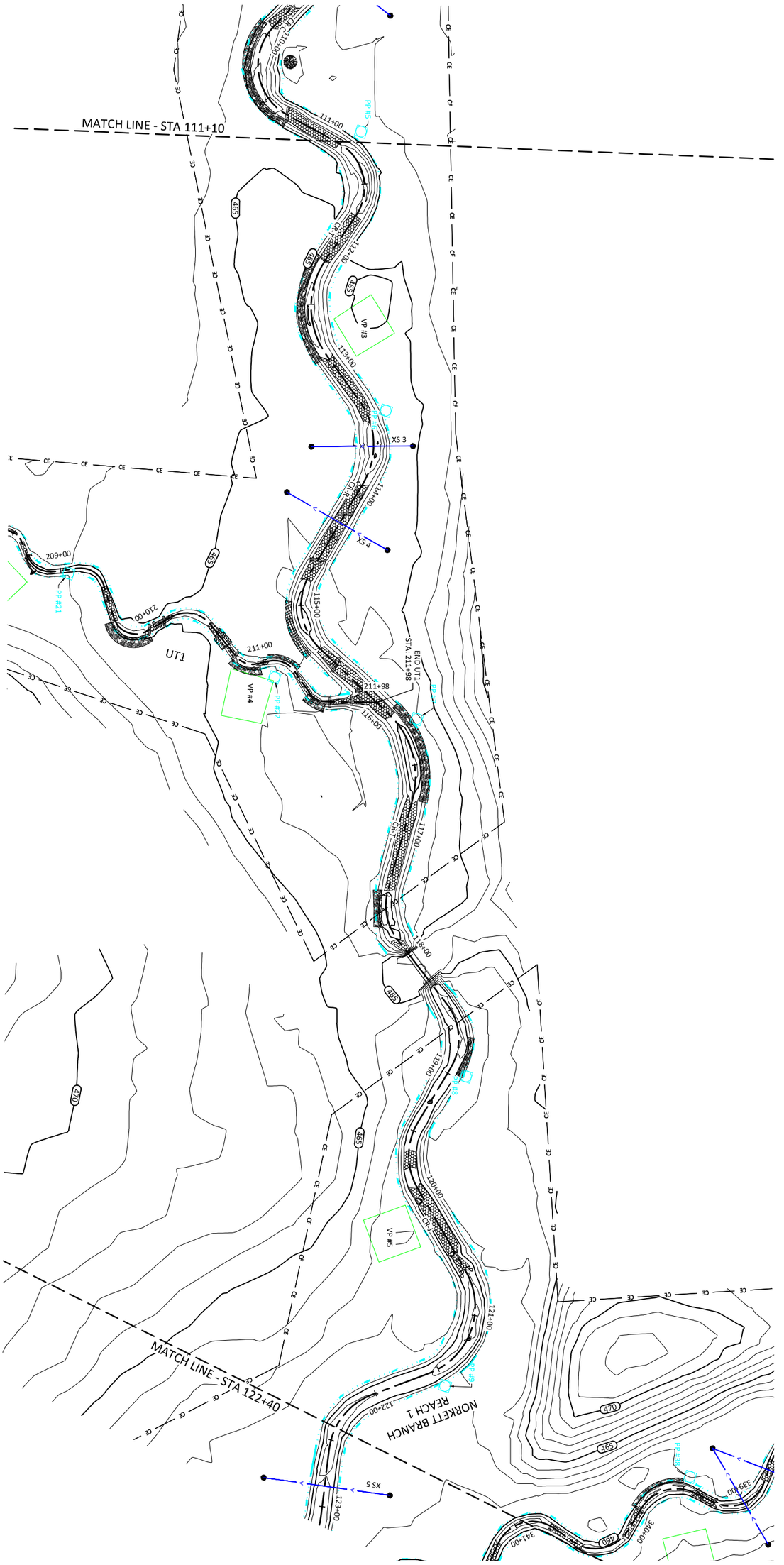

0' 40' 80' 120'
(HORIZONTAL)

N

Date:	July 15, 2014
Job Number:	005-02134
Project Engineer:	EGR
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1.2
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Revisions:

Norkett Branch Stream Mitigation Site
Union County, North Carolina

Norkett Reach 1
Baseline Drawings

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1.3
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Revisions:

Norkett Branch Stream Mitigation Site
Union County, North Carolina

Norkett Reach 1 & 2
Baseline Drawings

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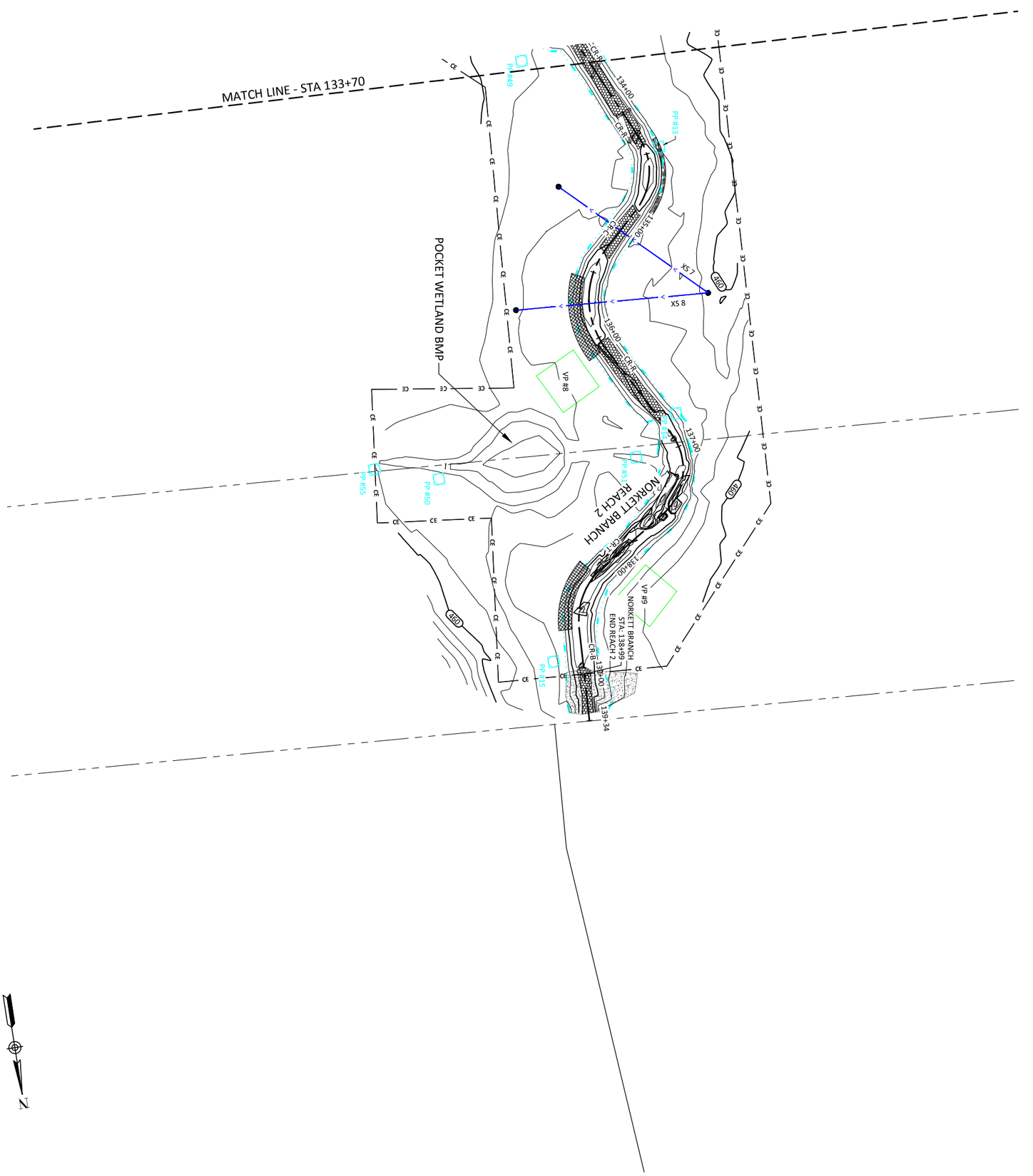

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1.4
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Revisions:

Norkett Branch Stream Mitigation Site
Union County, North Carolina

Norkett Reach 2
Baseline Drawings

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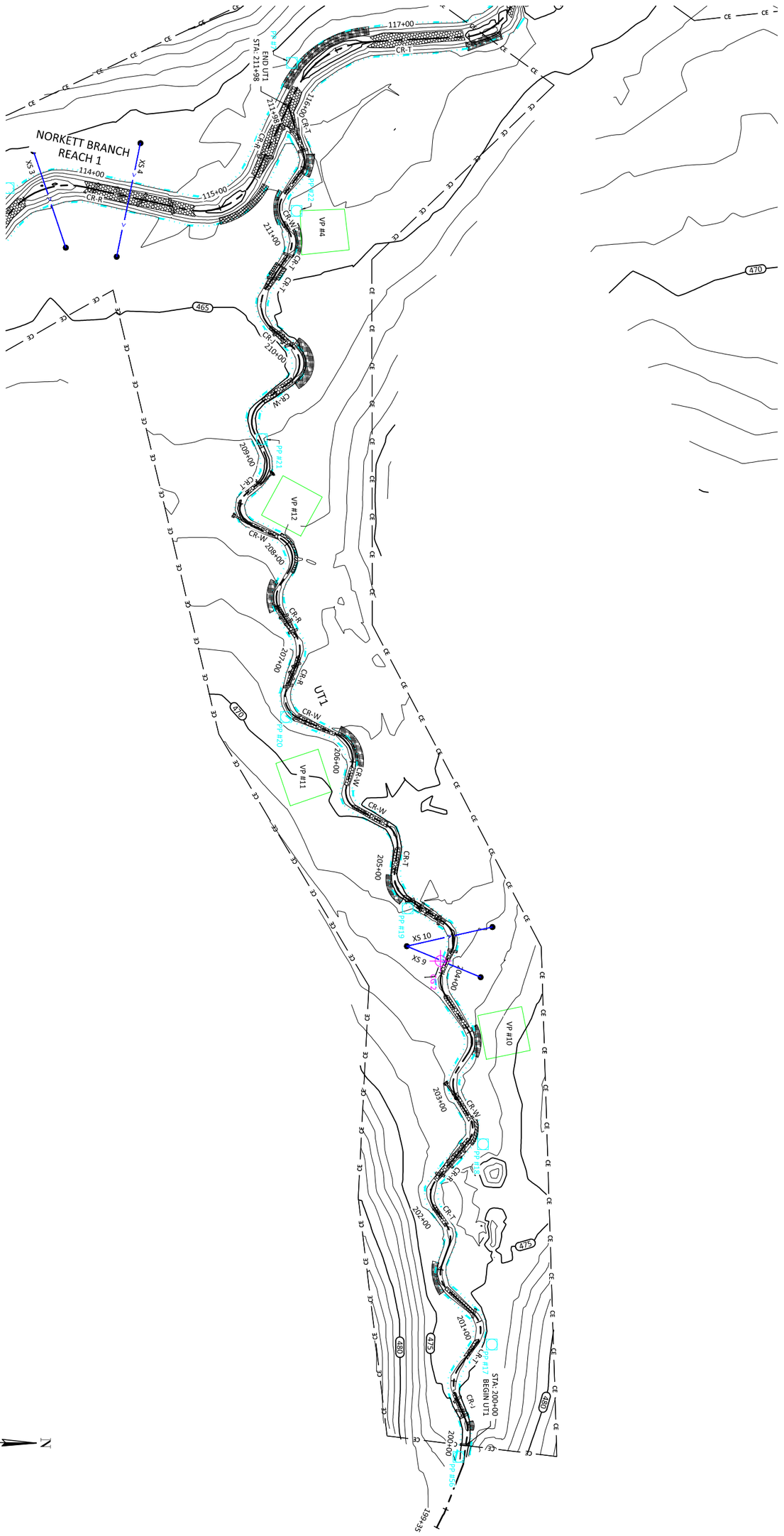

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Revisions:

Norkett Branch Stream Mitigation Site
Union County, North Carolina

UT1
Baseline Drawings

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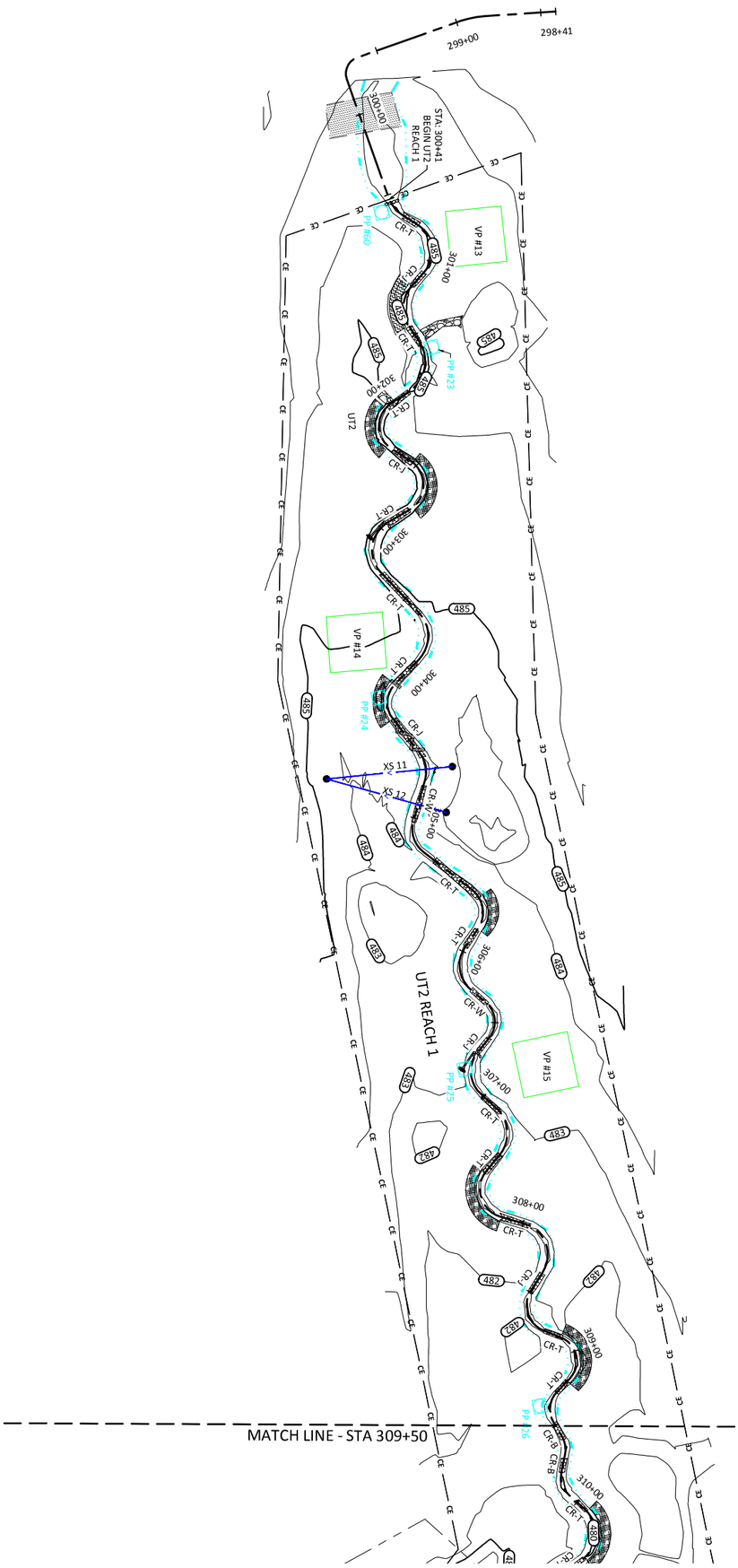

0' 40' 80' 120'
(HORIZONTAL)

N

Date:	July 15, 2014
Job Number:	005-02134
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Revisions:

Norkett Branch Stream Mitigation Site
Union County, North Carolina

UT2 Reach 1
Baseline Drawings

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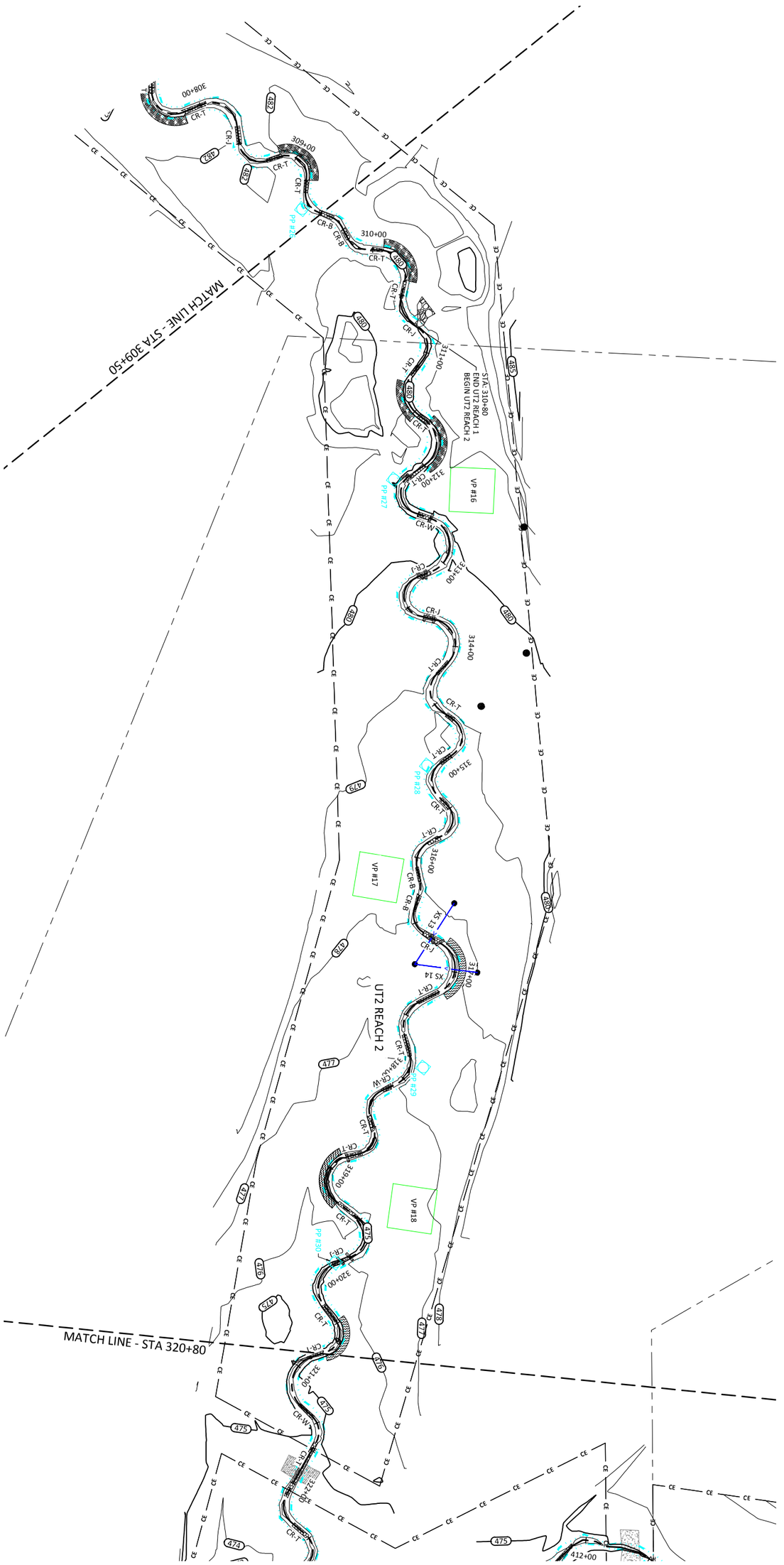

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Union County, North Carolina

UT2 Reach 1 & 2
Baseline Drawings

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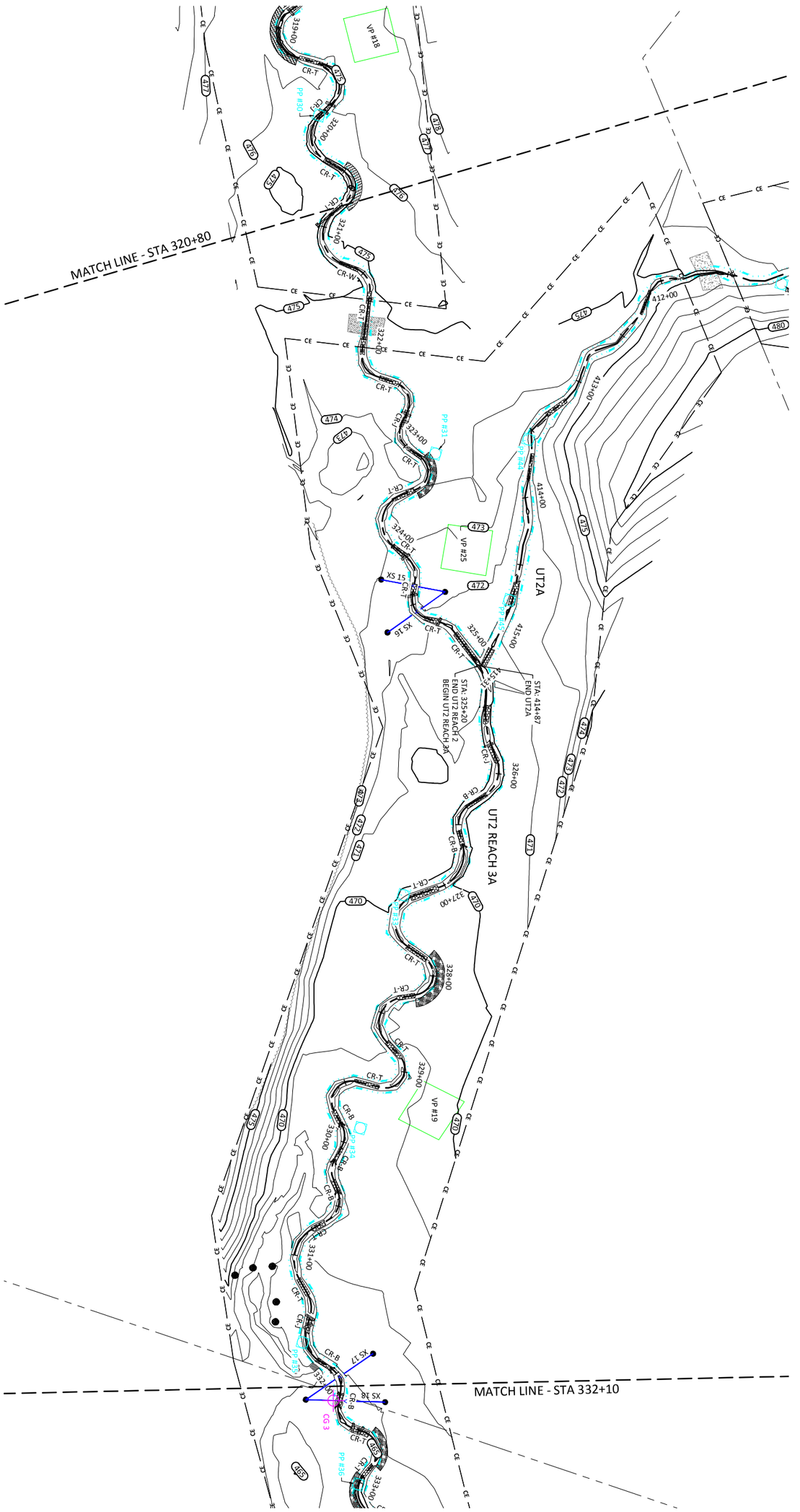

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Norkett Branch Stream Mitigation Site
Union County, North Carolina

UT2 Reach 2 & Reach 3A
Baseline Drawings

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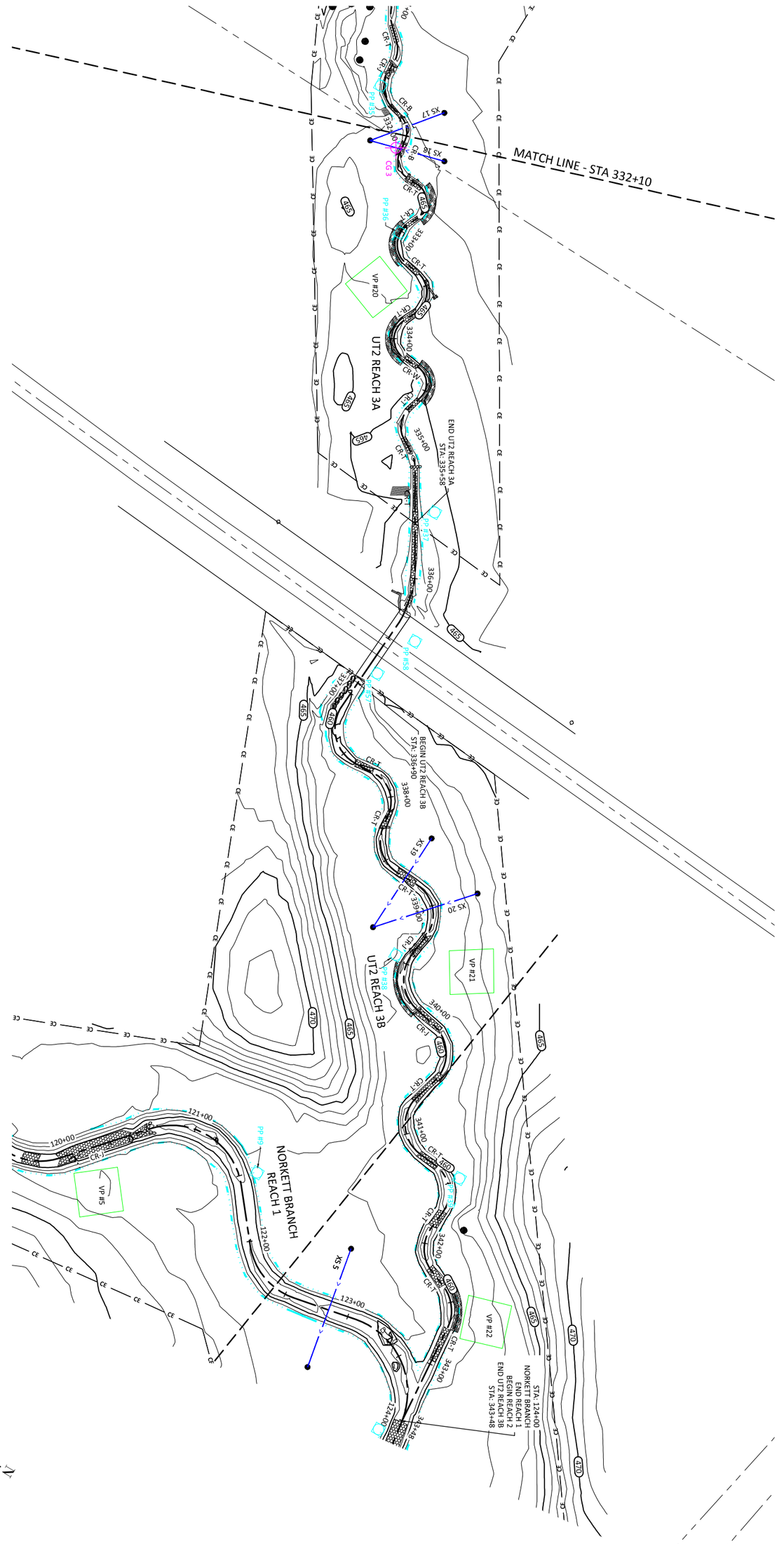

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UT2 Reach 3A & 3B
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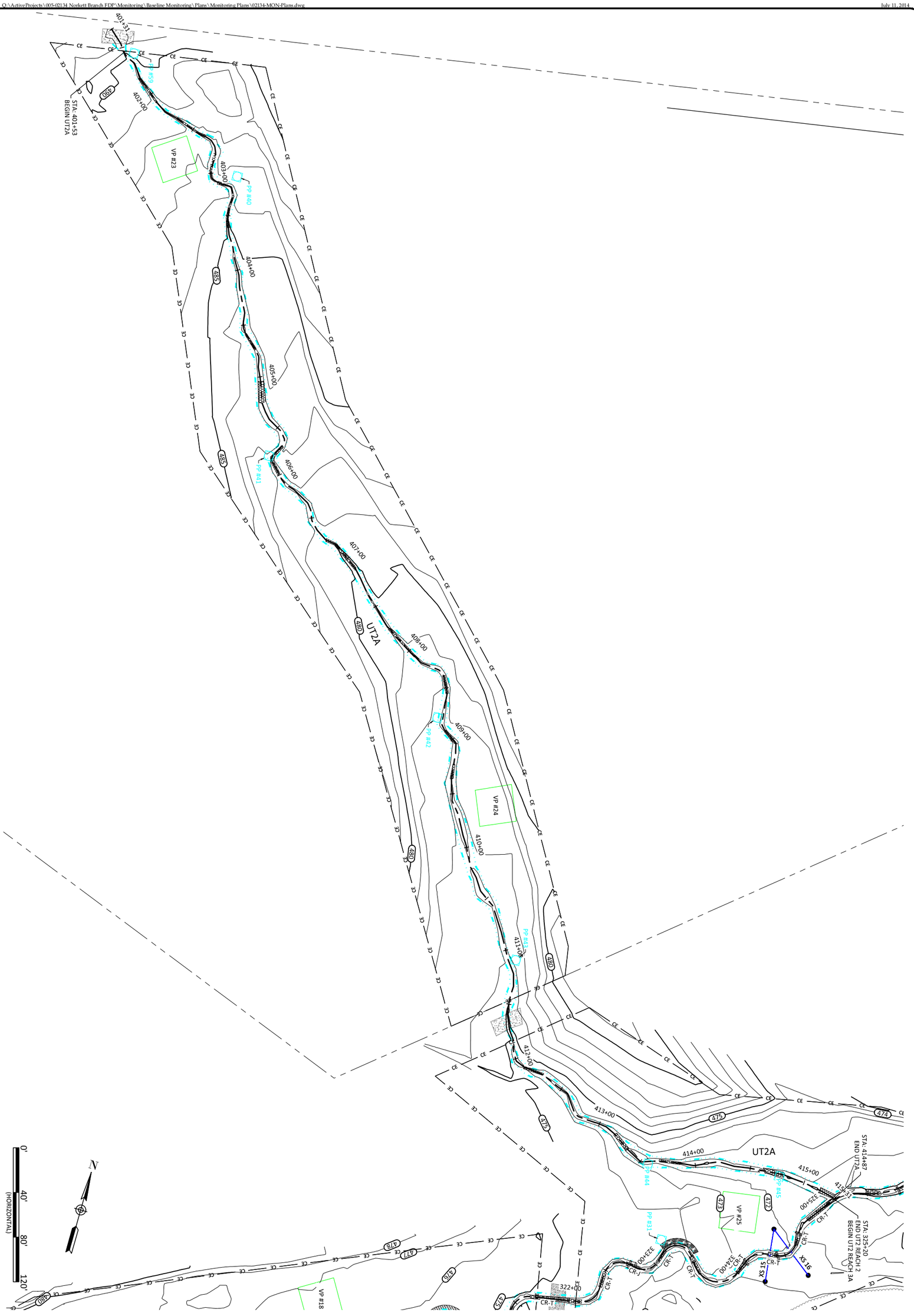

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Union County, North Carolina

UT2A
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