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Baseline Monitoring Document and As-Built Baseline Report
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EXECUTIVE SUMMARY 1
1.0 Project Goals, Background and Attributes 2
1.1 Project Location and Setting 2
1.2 Project Goals and Objectives 3
1.3 Project Structure, Restoration Type and Approach 4
1.4 Project History, Contacts and Attribute Data 5
2.0 Success Criteria 5
2.1 Streams 5
2.2 Vegetation 6
2.3 Schedule and Reporting 6
3.0 Monitoring Plan 7
3.1 Stream 7
3.2 Vegetation 8
4.0 Maintenance and Contingency Plans 9
4.1 Stream 9
4.2 Vegetation 9
5.0 As-Built Condition (Baseline) 9
5.1 As-Built/Record Drawings 9
5.2 Baseline Data Assessment 10
6.0 References 12

APPENDICES

Appendix 1 **General Tables and Figures**
Figure 1 Project Vicinity Map
Figure 2 Project Component/Asset Map
Table 1 Project Components and Mitigation Credits
Table 2 Project Activity and Reporting History
Table 3 Project Contact Table
Table 4 Project Information and Attributes

Appendix 2 **Morphological Summary Data and Plots**
Table 5a-c Baseline Stream Data Summary
Table 6 Morphology and Hydraulic Summary
Longitudinal Profile Plots
Cross-Section Plots
Reachwide and Cross-Section Substrate Plots
Stream Photographs

Appendix 3 **Vegetation Plot Data**

Appendix 4 **As-Built Plan Sheets**

EXECUTIVE SUMMARY

The Byrds Creek Mitigation Site is located in southwestern Person County within the Neuse River Basin (USGS Hydrologic Unit 03020201). The project site is located south and east of Wolfe Road south of Hurdle Mills, North Carolina. The adjacent land to the stream and wetlands is mainly used for agricultural purposes. The project goals established were completed with careful consideration of goals and objectives that were described in the *Neuse River Basin Restoration Priorities* (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 established in the mitigation plan include:

- Reduce nutrient loads within the watershed and to downstream waters;
- Stabilize eroding stream banks greatly reducing, if not eliminating, sediment loads;
- Restore riffle/pool sequencing resulting in decreased water temperatures and increased dissolved oxygen concentrations;
- Establish in-stream structures to improve habitat diversity and trap detritus;
- Restore native vegetation and riparian buffers; and
- Protect the restored land in perpetuity through a conservation easement.

These objectives were achieved through restoring and enhancing 7,328 linear feet (LF) of perennial and intermittent stream channel. The riparian areas were also planted with native vegetation to improve habitat and protect water quality. The project stream reaches consist of Byrds Creek reach 2 (BC-2), Byrds Creek reach 3 (BC-3), south branch (SB-1), Southeast branch reach 1 (SE-1), Southeast branch reach 2 (SE-2), and unnamed tributary (UT2) (stream restoration and/or enhancement level I approach) and Byrds Creek reach 1 (BC-1), Byrds Creek reach 4 (BC-4), and west branch (WB-1) (enhancement level II approach).

Pre-Construction Site Conditions

The Byrds Creek Mitigation Site is located in the Carolina Slate Belt of the Piedmont Physiographic Province (USGS, 1998). The Multi-Resolution Land Characteristics Consortium (MRLC, 2001) classified approximately 57% of the land in the project watershed as managed herbaceous cover or agricultural, 42% is classified as forested/scrubland, and the remaining 1% is open water. The drainage area for the Byrds Creek Site is 2,957 acres (4.62 square miles).

Prior to construction activities, the streams on the Byrds Creek Site were heavily impacted by cattle, which led to stream bank erosion and instability. Related degradation includes declining aquatic habitat, loss of forest, degraded riparian buffers, and water quality problems related to increased sediment and nutrient loadings. Table 4 in Appendix 1 and Tables 5a, 5b, and 5c in Appendix 2 present the pre-restoration conditions in detail.

Restoration Approach and Implementation

The mitigation project is intended to provide numerous ecological benefits within the Neuse River Basin. While many of these benefits are limited to the Byrds Creek Site project area, others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects. Expected improvements to water quality and ecological processes are outlined below in Section 1.2 as project goals and objectives.

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. The designs were developed to correct incision and lack of pattern caused by channelization, bank instability caused by erosion and livestock access, lack of vegetation in riparian zones, and lack of riparian and aquatic habitat. Figure 2 and Table 1 present the stream restoration and enhancement mitigation components for the Byrds Creek Mitigation Site.

The final mitigation plan was submitted and accepted by the NCEEP in January of 2013. Construction activities were completed by North State Environmental in September 2013. Due to the construction completion occurring in September, the site planting has been delayed until the dormant season in order to maximize the survivability of the planted trees and shrubs on the site. The planting will be completed by Bruton Natural Systems, Inc. in December 2013/January 2014. The baseline as-built survey was completed by North State Environmental between September and October 2013. During construction, a modification was made to the upstream easement boundary along Southeast Branch due to a disagreement with the landowner. This change resulted in a decrease in restored channel length on Southeast Branch of 328 LF. The easement adjustment was coordinated through the NCEEP, North Carolina State Property Office, and the USACE. Other than this change, there were no significant deviations reported in the as-built project elements compared to the design plans. A few structures were either eliminated or adjusted slightly based on field conditions. 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.

Monitoring

Baseline monitoring (MY-0) was conducted between September 2013 and January 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 five years, with the final monitoring activities conducted in 2018. The close-out for the Byrds Creek Mitigation Site will be conducted in 2019 given the success criteria are 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 NCEEP will close it out or amend the contract to cover an additional two years of monitoring.

Monitoring will consist of collecting morphological, vegetative, and hydrological data on an annual basis to assess the project success based on the restoration goals and objectives. The success of the project will be assessed using measurements of the stream channel's dimension, pattern, profile, 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.

1.0 Project Goals, Background and Attributes

1.1 Project Location and Setting

The Byrds Creek Mitigation Site is located in southwestern Person County, southwest of Roxboro, North Carolina within the Neuse River Basin (USGS Hydrologic Unit 03020201). The project site is located south and east of the end of Wolfe Road and is bound by Route 157 to the west and Walnut Grove Church Road to the east. The adjacent land to the stream is mainly used for livestock grazing purposes.

The Byrds Creek Mitigation Site is located within three tracts of land. The first is an 81 acre tract owned by The Homeplace (Deed Book 206, Page Number 411). A conservation easement (Deed Book 819, Page 176) was recorded on 19.701 acres of this tract. The second tract includes a 136 acre tract owned by Charles E. Hall (Deed Book 208, Page 326) in which a conservation easement (Deed Book 819, Page 202) was recorded on 3.39 acres. The third tract include a 159.66 acre tract owned by Noell W. Bradsher and Floyd D. Bradsher (Deed Book 57, Page Number 209). A conservation easement (Deed Book 819, Page 191) was recorded on 2.542 acres of this tract.

Byrds Creek (North Carolina Division of Water Quality (NCDWQ) AU No. 27- 3-3-2) is the main stream of the project and has been classified as Class WS-III; NSW waters. Class WS-III waters are waters used as sources of water supply for drinking, culinary, or food processing purposes where a more protective WS-I or II classification is not feasible. These waters are also protected for Class C uses. WS-III waters are generally in low to moderately developed watersheds. The Nutrient Sensitive Waters (NSW) classification is a supplemental classification for waters needing additional nutrient management due to being subject to excessive growth of microscopic or macroscopic vegetation (NCDWQ, 2011).

A local watershed plan has not been developed at this time for the South Flat River watershed, the 14-digit HUC in which the project is located. The 2010 Neuse River Basin Restoration Priorities (RBRP) identified the South Flat River Watershed, as a Targeted Local Watershed (TLW) (http://www.nceep.net/services/restplans/FINAL%20RBRP%20Neuse%2020111207%20CORRECTED.pdf) and identified nutrient inputs from agriculture and stream bank erosion in altered reaches as major stressors. The project site was identified as a stream restoration and cattle exclusion opportunity to improve water quality and buffers within the TLW. Restoration goals for the Neuse 01 catalog unit defined in the 2010 Neuse River Basin RBRP included nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers; support of the Falls Lake Watershed Management Plan; continuing to implement planning initiatives including the NCEEP Phase IV LWP for the Upper Neuse; and protecting, augmenting and connecting Natural Heritage Areas and other conservation lands. Specific priorities for the South Flat River TLW included implementing projects that offset nutrient inputs to streams and agriculture best management practices; stream restoration in altered reaches where erosion is a major source of sediment input to the streams; and protecting rare species and communities.

Directions and a map of the Byrds Creek Mitigation Site are provided in Figure 1.

1.2 Project Goals and Objectives

The Byrds Creek Mitigation Site was designed to meet the over-arching goals as described in the mitigation plan (2013). The project addresses multiple watershed stressors that have been documented for both South Flat River and the Falls Lake watersheds. The following project specific goals established in the mitigation plan include:

- Reduce nutrient loads within the watershed and to downstream waters;
- Stabilize eroding stream banks greatly reducing, if not eliminating, sediment loads;
- Restore riffle/pool sequencing resulting in decreased water temperatures and increased dissolved oxygen concentrations;
- Establish in-stream structures to improve habitat diversity and trap detritus;
- Restore native vegetation and riparian buffers; and
- Protect the restored land in perpetuity through a conservation easement.

The design features of this project were developed to achieve multiple project objectives. The stream restoration elements were designed to frequently flood the reconnected floodplain. This design

approach provides more frequent dissipation of energy from higher flows (bankfull and above) to improve channel stability; provide water quality treatment through detention, settling, and biological removal of pollutants; and restore a more natural hydrologic regime. The project objectives defined in the mitigation plan (2013) are as follows:

- On-site nutrient inputs will be decreased by removing cattle from streams and filtering on-site runoff through buffer zones. Off-site nutrient input will be absorbed on-site by filtering flood flows through restored floodplain areas, where flood flow will spread through native vegetation. Vegetation is expected to uptake excess nutrients.
- Stream bank erosion which contributes sediment load to the creek will be greatly reduced, if not eliminated, in the project area. Eroding stream banks will be stabilized using bioengineering, natural channel design techniques, and grading to reduce bank angles and bank height. Storm flow containing grit and fine sediment will be filtered through restored floodplain areas, where flow will spread through native vegetation. Spreading flood flows will also reduce velocity and allow sediment to settle out. Sediment transport capacity of restored reaches will be improved so that capacity balances more closely to load. Sediment load reduction will be monitored through assessing bank stability with cross section and profile surveys and visual assessment through photo documentation which serves as an accepted surrogate for direct turbidity measurements.
- Restored riffle/pool sequences will promote aeration of water and create deep water zones, helping to lower water temperature. Establishment and maintenance of riparian buffers will create long-term shading of the channel flow to minimize thermal heating. Lower water temperatures will help maintain dissolved oxygen concentrations.
- In-stream structures will be constructed to improve habitat diversity and trap detritus. Wood habitat structures will be included in the stream as part of the restoration design. Such structures may include log drops and rock structures that incorporate woody debris.
- Adjacent buffer and riparian habitats will be restored with native vegetation as part of the project. Native vegetation will provide cover and food for terrestrial creatures. Native plant species will be planted and invasive species will be treated. Eroding and unstable areas will also be stabilized with vegetation as part of this project.
- The restored land will be protected in perpetuity through a conservation easement.

1.3 Project Structure, Restoration Type and Approach

1.3.1 Project Structure

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 Byrds Creek Mitigation Site.

1.3.2 Restoration Type and Approach

The design streams were restored to the appropriate type based on the surrounding landscape, climate, and natural vegetation communities but also with strong consideration to existing watershed conditions and trajectory. The designs were developed to correct incision and lack of pattern caused by channelization, bank instability caused by erosion and livestock access, lack of vegetation in riparian zones, and lack of riparian and aquatic habitat. The project includes stream restoration and enhancement.

Restoration of dimension, pattern, and profile was implemented for reaches BC3, SB1, SE1, and SE2b. The project also includes stream enhancement on five reaches classified as either

Enhancement I (EI) or Enhancement II (EII). All stream restoration and EI reaches (all or portions of BC-2, BC-3, SB-1, SE-1, and SE-2) were constructed as C type streams according to the Rosgen classification system (Rosgen, 1996). The specific values for the design parameters were selected based on designer experience and judgment and were verified with morphologic data form reference reach data sets. The design width to depth ratio for most of the reaches is approximately 12. The expectation is that the streams will narrow over time and classify as E stream types in some locations and, therefore, resemble the C/E morphology of the references. The design channel slopes of the restoration and EI reaches range from 0.0039 to 0.0161. Each of the design reaches were reconnected with the existing floodplain (Priority 1). The restored channels were designed to have an entrenchment ratio of greater than 2. The sinuosity for the restored channels was designed to be near 1.2.

1.4 Project History, Contacts and Attribute Data

The Byrds Creek Mitigation 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 success criteria for the Byrds Creek Mitigation Site follow approved performance criteria presented in the NCEEP Mitigation Plan Template (version 1.0, 10/01/2010), EEP Baseline Monitoring Template (version 2.0, 10/14/2010), and the Stream Mitigation Guidelines issued in April 2003 by the USACE and NCDWQ. Annual monitoring and quarterly site visits will be conducted to assess the condition of the finished project for five years or until success criteria are met. The stream restoration and EI reaches (BC-2, BC-3, SB-1, SE-1, and SE-2) of the project have been assigned specific performance criteria components for stream morphology, hydrology, and vegetation. The EII reaches (BC-1, BC-4, and WB- 1) will be documented through photographs and visual assessments to verify that no significant degradational changes are occurring in the stream channel or riparian corridor. 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 EEP guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored channels to be considered stable. Riffle cross-sections should 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

Longitudinal profile data for the stream restoration reaches should show that the bedform features are remaining stable. The riffles should be steeper and shallower than the pools, while the pools

should be deep with nearly flat water surface slopes. The relative percentage of riffles and pools should not change significantly from the design parameters. Adjustments in length and slope of run and glide features are expected and will not be considered a sign of instability. The longitudinal profile should show that the bank height ratio remains very near to 1.0 for the majority of the restoration 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. A reach wide-wide pebble count will be performed annually in each restoration reach for classification purposes. A pebble count will be performed at each surveyed riffle to characterize the pavement.

2.1.4 Photo Documentation

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

2.1.5 Bankfull Events

Two bankfull flow events in separate years must be documented on the project within the five-year monitoring period. Bankfull events will be documented using crest gages, pressure transducers, photographs, and visual assessments for physical evidence such as debris lines.

2.2 Vegetation

The final vegetative success criteria will be the survival of 260 planted stems per acre in the riparian corridor along restored and enhanced reaches at the end of the required monitoring year (MY-5). 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. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period (MY-5).

2.3 Schedule and Reporting

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 and longitudinal profile, where applicable;
- Vegetative data as described above including the identification of any invasion by undesirable plant species;
- A description of damage by animals or vandalism;

- Maintenance issues and recommended remediation measures will be detailed and documented; and
- Wildlife observations.

3.0 Monitoring Plan

Annual Monitoring will be conducted for the monitoring parameters as noted below for five years for stream and hydrology assessments beyond completion of construction or until performance criteria have been met.

3.1 Stream

In order to ensure the streams on site meet regulatory stream success criteria, stream dimension, pattern, and profile will be monitored annually for five years for restoration and EI reaches (BC-2, BC-3, SB-1, SE-1, SE-2a, and SE-2b). Geomorphic assessments should be performed following 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).

3.1.1 Dimension

In order to monitor the channel dimension, two permanent cross-sections were installed per 1,000 LF along stream restoration/enhancement reaches, with riffle and pool sections in proportion to EEP guidance. Each cross-section was permanently marked with pins to establish its location. Cross-section surveys will be performed annually and will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.

A total of five permanent cross-sections were installed along BC-2, four on BC-3, two on SB-1, two on SE-1, and two on SE-2a. Cross-sections were located at representative riffle and pool sections on each monitored reach. Each cross-section was permanently marked with rebar pins to establish its location. Cross-section surveys will be performed annually and will include points measured at all breaks in slope including top of bank, bankfull, edge of water, and thalweg.

3.1.2 Pattern and Profile

During the as-built survey, six separate longitudinal profiles were conducted on project streams; 1,646 LF on BC2, 1,407 LF on BC3, 1,009 LF on SB1, 485 LF on SE1, 536 LF on SE2a, and 195 LF on SE2b. The beginning and end of each longitudinal profile have been established such that they are able to be located either through field identification or with the use of a GPS unit. Each longitudinal profile survey following the initial as-built survey will include re-surveying the same profile. The location of bedform features, in-stream structures, water surface, bankfull, top of bank, and permanent benchmarks will be collected during each survey. Data will be processed in CAD and analyzed using RiverMorph and Microsoft Excel.

Stream pattern was assessed and ranges of pattern parameters were defined for BC-2, BC-3, SB-1, SE-1, SE-2a, and SE-2b. Stream pattern assessment will not be conducted in subsequent monitoring years unless issues in the profile and dimension indicate that pattern might be changed.

3.1.3 Substrate

A reach-wide pebble count was conducted in each restoration and EI reaches (BC-2, BC-3, SB-1, SE-1, and SE-2) 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 36 permanent photograph reference points were established within the project area after construction. Photographs will be taken once a year to visually document stability for five 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. 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 Events

Three crest gages and pressure transducers were installed on the site; one on BC-3, one on SB-1, one on SE-2a. The gages and transducers were installed onsite in a surveyed riffle cross-section of the restored channels at a central site location 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 conducted along all reaches each year to obtain qualitative geomorphic data. Each visual assessment evaluation after the baseline survey will include re-evaluation along the same profile.

3.2 Vegetation

Planted woody vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2006) to monitor and assess the planted woody vegetation. A total of 14 vegetation plots were established within the project easement area. The majority of the plots were established as standard 10 meter by 10 meters with one plot established as a 5 meter by 20 meter plot.

Vegetation plots were randomly established within the planted corridor of the restoration areas to capture the heterogeneity of the designed vegetative communities. The vegetation plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs at the origin looking diagonally across the plot to the opposite corner will be taken during the scheduled baseline monitoring in January 2014. Subsequent annual assessments following baseline survey will capture the same reference photograph locations. Species composition, density and survival rates will be evaluated on an annual basis by plot and for the entire site. Individual plot data will be provided and will include 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.

4.0 Maintenance and Contingency Plans

Any identified high priority problem areas, 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.

4.1 Stream

Stream problem areas will be mapped and included in the Current Condition Plan View (CCPV) as part of the annual stream assessment. Stream problems areas may include bank erosion, structure failure, beaver dams, aggradation/degradation, etc. Appropriate remedial actions will be determined with NCEEP correspondence. A proposal of work will be submitted if remediation of an area is required.

4.2 Vegetation

Vegetative problem areas will be mapped and included in the CCPV as part of the annual vegetation assessment. Vegetation problems areas may include planted vegetation not meeting success criteria, persistent invasive species, barren areas with little to no herbaceous cover, or grass suffocation/crowding of planted stems. Appropriate remedial actions will be determined with NCEEP correspondence. A proposal of work will be submitted if remediation of an area is required.

5.0 As-Built Condition (Baseline)

The Byrds Creek Mitigation Site construction and as-built surveys were completed between July and October of 2013. The survey included developing an as-built topographic surface, locating the channel boundaries, structures, and cross-sections. For comparison purposes, the baseline monitoring divided the reach assessments in the same way they were established for design parameters: Byrds Creek, South Branch, Southeast Branch, and West Branch.

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.

During construction, a modification was made to the upstream easement boundary along Southeast Branch due to a disagreement with the landowner. This change resulted in a decrease in restored channel length on Southeast Branch of 328 LF. A pre-existing knickpoint located at the revised easement boundary allowed for Priority 1 restoration throughout the reach. A slight field change was made in the channel alignment to correct the tie in location at the upstream end of the reach. These changes are documented in the record drawings.

In addition to the change to Southeast Branch discussed above, minimal adjustments were made during construction, where needed, based on field evaluation. Specific changes are detailed below:

5.1.1 Byrds Creek

- Station 12+00 brush toe was added to stabilize an eroding bend;
- Station 14+50 brush toe was replaced with boulder toe to avoid impacts to several large trees;
- Station 15+75 a log j-hook and two log vanes were replaced with boulder toe due to bedrock that was already partially stabilizing this bend;

- Station 17+00 brush toe was replaced with two roller logs to avoid impacts to several large trees;
- Station 21+00 a combined structure consisting of a jazz riffle and cross vane was replaced with a boulder tail riffle to avoid impacts to several large trees;
- Station 23+00 brush toe was added to stabilize an eroding bend;
- Station 30+50 two log vanes were replaced with boulder toe to avoid impacts to several large trees; and
- Station 32+50 a cross vane was replaced with a boulder j-hook to avoid grading a stable bank.

5.1.2 South Branch

- Station 60+00 alignment was adjusted to avoid removing a large oak tree;
- Station 60+25 brush toe was omitted to avoid impacts to the root system of a large tree;
- Station 64+25 brush toe was omitted to avoid impacts to the root system of a large tree;
- Station 66+00 brush toe was omitted to avoid impacts to the root system of a large tree; and
- Station 68+60 a j-hook was added to create a stable drainage point for the adjacent wetland.

5.1.3 Southeast Branch

- Station 80+00 the channel alignment was revised to correct the tie in location at the revised edge of easement;
- Station 80+75 a log vane was added to create a stable tie in with a spring fed drainage feature;
- Station 84+75 brush toe was omitted to avoid impacts to the root system of a large tree; and
- Station 85+00 a log j-hook was replaced with boulder toe to avoid removing several trees.

5.1.4 West Branch

- Station 102+50 two log vanes were replaced with three roller logs and additional transplants to work within the existing channel geometry and
- Station 102+75 two log vanes were replaced with three roller logs and additional transplants to work within the existing channel geometry.

The following sections further detail the as-built conditions in comparison to the design plans.

5.2 Baseline Data Assessment

5.2.1 Morphological State of the Channel

Morphological data for the as-built profile was collected in September and October 2013. Please refer to Appendix 2 for summary data tables, morphological plots, and stream photographs.

Profile

The baseline (MY-0) profiles closely match the profile design parameters. One adjustment was made along Southeast branch at the start of the profile to accommodate that change in the conservation easement line. 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 rock and log riffle features installed during construction for habitat variability. The as-built profile reflects the installation of log and rock sills with micro-pools interspersed in the riffle. The pools on the restoration reaches were generally excavated slightly deeper than design depths to increase habitat and bed form diversity. The design plans for Southeast Branch Reach 2 called for filling the pools to a specified design depth. Upon review of post construction monitoring of several other similar projects, the decision was made to leave the pools at existing depths. This approach creates better holding habitat in summer months where stream flow is low and creates areas for sediment settling.

Dimension

The baseline (MY-0) dimension numbers closely match the design parameters with minor variations in all reaches. These variations are primarily due to constructed riffles in the riffle sections and brush toe in the pool sections. Installation of these structures results in irregularity of the surface which is reflected in the cross sections. Summary data and cross-section plots of each project reach can be found in Appendix 2.

Pattern

The baseline (MY-0) pattern metrics fell within the design parameters for all six reaches. With the exception of the beginning reach of Southeast branch, there were 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 three 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 stress calculated for the constructed channels are generally within the allowable range, which indicate that the channel is not at risk to trend toward channel degradation.

5.2.2 Vegetation

The baseline monitoring (MY-0) vegetative survey was completed in January 2014. The baseline vegetation monitoring resulted in an average density of 734 stems per acre, which is greater than the design density required. There was an average of 18 stems per plot. Please refer to Appendix 3 for vegetation summary tables, raw data tables, and vegetation plot photographs

5.2.3 Photo Documentation

A total of 36 permanent photographs locations were installed and photographed by Wildlands. These photographs can be found in Appendix 2.

5.2.4 Hydrology

No bankfull events have been observed following completion of construction. Bankfull events will be documented in annual monitoring reports.

6.0 References

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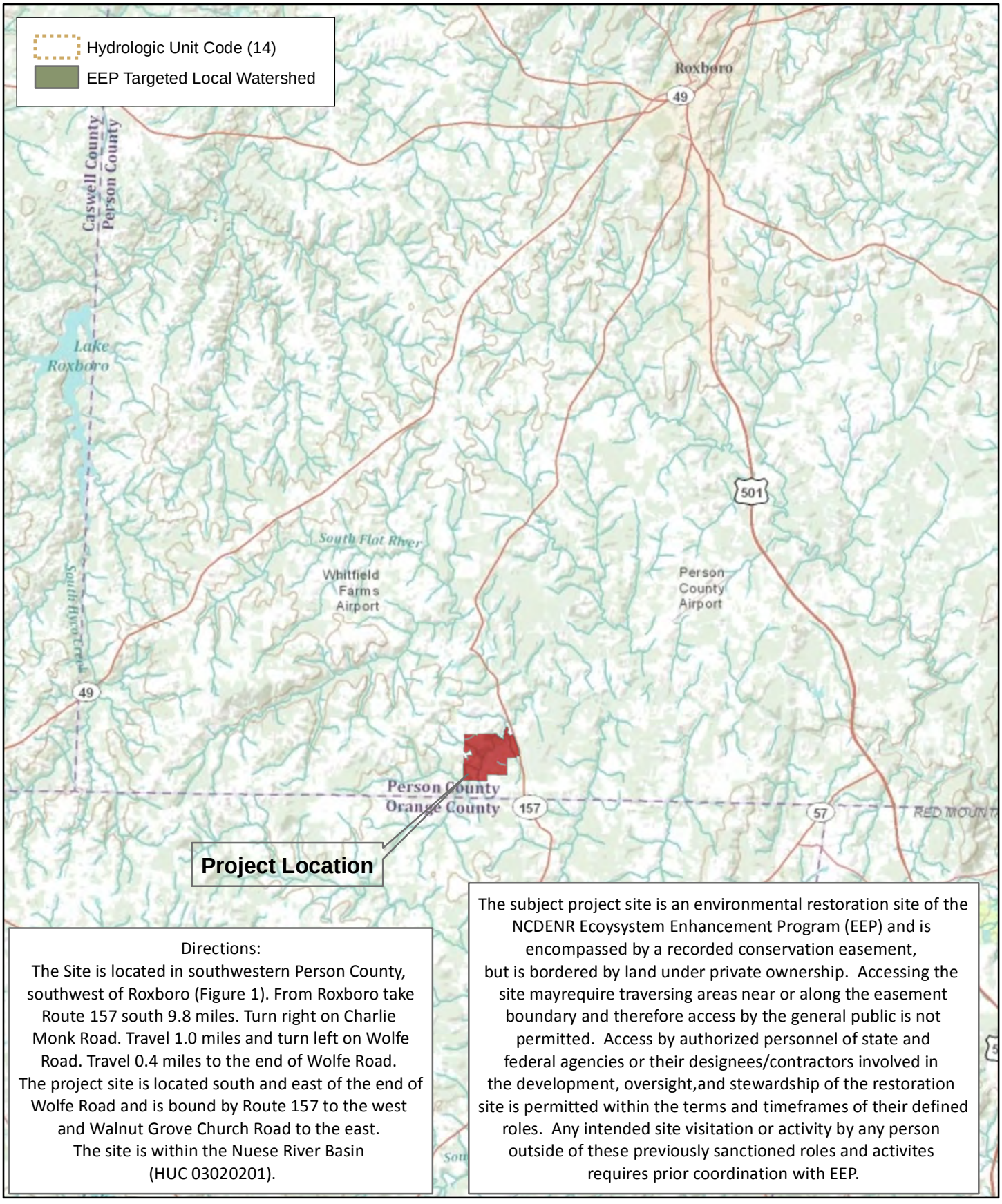
APPENDIX 1. General Tables and Figures



WILDLANDS ENGINEERING

0 1 2 Miles

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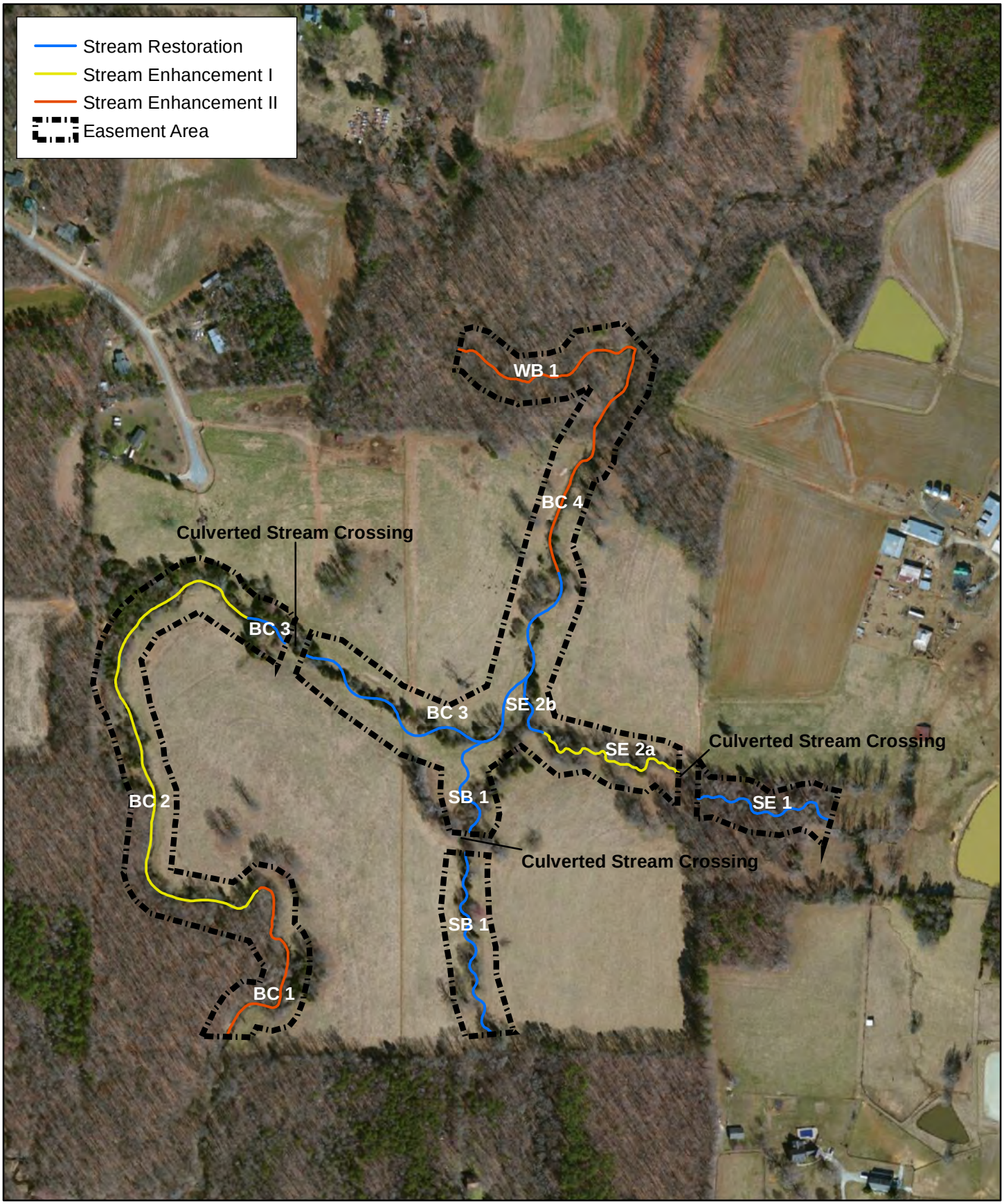
Figure 1 Project Vicinity Map
Byrds Creek Mitigation Site
NCEEP Project # 95020
Monitoring Year 0

Person County, NC



WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 2 Project Componenet/ Asset Map
Byrds Creek Mitigation Site
NCEEP Project #95020
Monitoring Year 0

Person County, NC

Table 1. Project Components and Mitigation Credits
Byrds Creek Mitigation Site (NCEEP Project No.95020)
Monitoring Year 0

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,371	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Project Components							
Reach ID	As-Built Stationing/ Location (LF)	Footage (LF) / Acreage (Ac)	Approach	Restoration or Restoration Equivalent	Restoration Footage (LF) / Acreage (Ac)*	Mitigation Ratio	Credits (SMU/ WMU)
Streams							
BC1	10+00-16+43	637	N/A	Enhancement Level II	643	2.5:1	257
BC2	16+43-32+89	1,630	N/A	Enhancement Level I	1,646	1.5:1	1097
BC3	32+89-34+05 34+64-47+55	1,368	Priority 1	Restoration	1,407	1:1	1407
BC4	47+55-55+51	787	N/A	Enhancement Level II	796	2.5:1	318
SB1	60+00-66+48 67+08-70+69	976	Priority 1	Restoration	1,009	1:1	1009
SE1	80+00-84+85	916	Priority 1	Restoration	485	1:1	485
SE2a	85+88-91+24	524	N/A	Enhancement Level I	536	1.5:1	357
SE2b	91+24-93+19	50	Priority 1	Restoration	195	1:1	195
WB1	100+00-106+11	589	N/A	Enhancement Level II	611	2.5:1	244

Component Summation						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	3,096	-	-	-	-	-
Enhancement		-	-	-	-	-
Enhancement I	2,182					
Enhancement II	2,050					
Creation		-	-	-		
Preservation	-	-	-	-		-
High Quality Preservation	-	-	-	-		-

Table 2. Project Activity and Reporting History
Byrds Creek Mitigation Site (NCEEP Project No.95020)
Monitoring Year 0

Activity or Report	Date Collection	Completion or Scheduled
Mitigation Plan	January 2013	January 2013
Final Design - Construction Plans	June 2013	June 2013
Construction	September 2013	September 2013
Temporary S&E mix applied to entire project area[1]	September 2013	September 2013
Permanent seed mix applied to reach/segments	September 2013	September 2013
Bare root and live stake plantings for reach/segments	December 2013	December 2013
Baseline Monitoring Document (Year 0)	October 2013	January 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

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

Table 3. Project Contact Table
Byrds Creek Mitigation Site (NCEEP Project No.95020)
Monitoring Year 0

Designer	**Wildlands Engineering, Inc.**
Jeff Keaton, PE	5605 Chapel Hill Road, Suite 122 Raleigh, NC 27606 919.851.9986
Construction Contractor	**North State Environmental** 2889 Lowery Street Winston Salem, NC 27101
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**North State Environmental** 2889 Lowery Street Winston Salem, NC 27101
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers	
Bare Roots	**ArborGlen, Inc**
Live Stakes	**Foggy Mountain Nursery**
Monitoring Performers	**Wildlands Engineering, Inc.**
Stream and Vegetation Monitoring, POC	Kirsten Gimbert 704.332.7754, ext. 110

Table 4. Project Information and Attributes
Byrds Creek Mitigation Site (NCEEP Project No.95020)
Monitoring Year 0

Project Information									
Project Name	Byrds Creek Mitigation Site								
County	Person County								
Project Area (acres)	24.42								
Project Coordinates (latitude and longitude)	36° 14.744' N, 79° 79° 2.636' W								
Project Watershed Summary Information									
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province								
River Basin	Neuse								
USGS Hydrologic Unit 8-digit	03020201								
USGS Hydrologic Unit 14-digit	03020201010020								
DWQ Sub-basin	03-04-01								
Project Drainiage Area (acres)	2,957 ac								
Project Drainage Area Percentage of Impervious Area	<1%								
CGIA Land Use Classification	57% managed herbaceous cover/agricultural, 42% forested/scrubland, 1% open								
Reach Summary Information									
Parameters	**BC1**	**BC2**	**BC3**	**BC4**	**SB1**	**SE1**	**SE2a**	**SE2b**	**WB1**
Length of reach (linear feet) - Post-Restoration	643	1,646	1,407	796	1,009	485	536	195	611
Drainage area (acres)	2,635	2,637	2,703	2,957	164	56	62	62	255
NCDWQ stream identification score	51.75				25.75	46.25			46.75
NCDWQ Water Quality Classification	WS-III, NSW								
Morphological Desription (stream type)	P	P	P	P	I	P	P	P	P
Evolutionary trend (Simon's Model) - Pre- Restoration	IV/V	IV	IV/V	IV	III	IV/V	III/IV	III/IV	IV/V
Underlying mapped soils	Chewacla / Georgeville Loam								
Drainage class	---	---	---	---	---	---	---	---	---
Soil Hydric status	---	---	---	---	---	---	---	---	---
Slope	---	---	---	---	---	---	---	---	---
FEMA classification	---	---	---	---	---	---	---	---	---
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	Byrds Creek Mitigation Plan; no critical habitat for listed species exists within the project area (Pedestrian
Historic Preservation Act	X	X	No historic resources were found to be impacted
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	N/A	N/A	N/A
Essential Fisheries Habitat	N/A	N/A	N/A

APPENDIX 2. Morphological Summary and Data Plots

Table 5a. Baseline Stream Data Summary
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
Monitoring Year 0

Parameter	Gage	Pre-Restoration Condition				Reference Reach Data								Design				As-Built/Baseline			
		BC2		BC3		Spencer Creek Downstream		UT Cane Creek[1]		UT Richland Creek Upstream[2]		UT Rocky Branch[2]		BC2		BC3		BC2		BC3	
		Min	Max	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	19.0	26.1	27.4	35.9	10.7	11.2	11.5	12.3	8.8	10.4	12.2		33.2	38.3	25.0		28.9	42.7	20.4	36.9
Floodprone Width (ft)		145	231	116	124	60.0	114+	31.0		27.6	31.4	72.0		156	160	95	350	150+	150+	150+	150+
Bankfull Mean Depth		2.2	3.4	1.9	2.3	1.6	1.8	0.8	1.0	0.8	0.9	1.3		1.6	1.9	1.8		1.6	2.1	1.0	1.4
Bankfull Max Depth		3.8	4.4	2.6	3.4	2.1	2.6	1.2	1.6	1.1	1.3	1.8		2.8	3.2	2.8		2.9	3.4	2.1	3.0
Bankfull Cross-sectional Area (ft^2)		58.4	64.5	62.5	66.7	17.8	19.7	8.9	12.2	7.8	8.5	16.3		59.8	61.5	45.3		56.2	88.7	28.8	37.4
Width/Depth Ratio		5.6	11.7	9.3	19.3	5.8	7.1	12.3	14.4	10.0	12.8	9.1		18.0	24.5	13.8		14.8	22.2	14.5	36.5
Entrenchment Ratio		5.5	12.1	3.2	5.5	5.5	10.2	>2.5		2.5	4.0	6.0		4.1	4.8	3.8	14.0	3.5+	5.2+	4.7+	7.4+
Bank Height Ratio		1.0	1.0	1.0	1.3	1.0		---		1.4	2.1	1.0		1.0		1.0		1.0	1.0	1.0	1.0
D50 (mm)		0.41		22.6														12.5	26.4	29.3	45.0
Profile																					
Riffle Length (ft)	n/a					---		---		---		---		---		---		13	59	12	57
Riffle Slope (ft/ft)		0.0074	0.0075	0.0043	0.0133	0.0130		0.0188	0.0704	0.0210	0.0450	0.0606	0.0892	0.0029	0.0052	0.0076	0.0134	0.0036	0.0097	0.0022	0.0190
Pool Length (ft)						---		---		---		---		---		---		34	179	46	129
Pool Max Depth (ft)		---	---	---	---	---		---		---		---		---		---		1.21	2.58	0.97	2.43
Pool Spacing (ft)^		54	103	70	124	71.0		27	73	N/A		26	81	102	211	60	141	84	278	73	129
Pool Volume (ft^3)																					
Pattern																					
Channel Beltwidth (ft)	n/a	N/A		N/A		38	41	102		N/A		N/A		---		52	116	26	57	31	62
Radius of Curvature (ft)		N/A		N/A		11	15	23	38	N/A		N/A		---		50	80	19	79	44	84
Rc:Bankfull Width (ft/ft)		---		---		1.0	1.3	2.0	3.1	N/A		N/A		---		2.0	3.2	0.7	1.9	2.2	2.3
Meander Length (ft)		N/A		N/A		46	48	45	81	N/A		N/A		---		177	263	279	603	190	255
Meander Width Ratio		---		---		3.6	3.7	3.9	6.6	N/A		N/A		---		2.1	4.6	0.9	1.3	1.5	1.7
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/0.19/0.41/116/232/>2048		SC/0.41/22.6/143.4/2048/>2048		---		---		---		---						SC/SC/SC/55/128/362		SC/SC/SC/107.3/362/>2048	
Reach Shear Stress (Competency) lb/ft^2		---		---										---		0.69	1.71	N/A		0.31	0.23
Max part size (mm) mobilized at bankfull																					
Stream Power (Capacity) W/m^2																					
Additional Reach Parameters																					
Drainage Area (SM)	n/a	4.12		4.22		0.96		0.29		0.28		1.10		4.12		4.22		4.12		4.22	
Watershed Impervious Cover Estimate (%)		1%		<1%		---		---		---		---		1%		<1%		1%		<1%	
Rosgen Classification		C5/E5		C4/E4		E4		C4/E4		C4/E4		E4b		C4		C4		C4		C4	
Bankfull Velocity (fps)		2.7	3.0	2.5	2.5	4.9	5.4	3.8		3.5	4.1	5.5		3.0	3.3	4.6		3.6		7.3	
Bankfull Discharge (cfs)		---		---		97		40		29.1	32.0	85.0		~200		210		200		210	
Q-NFF regression		---		---																	
Q-USGS extrapolation		---		---																	
Q-Mannings		---		---																	
Valley Length (ft)		---		---		---		---		---		---		---		---					
Channel Thalweg Length (ft)		1,630		1,368		---		---		---		---		1,630		1,402		1,646		1,407	
Sinuosity (ft^3)		1.18		1.01		1.30		1.40		1.00		1.10		---		1.11		1.18		0.00	
Water Surface Slope ($ft/ft)^2$		---		---		---		---		---		---		---		0.0039		0.0016		0.0043	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0046		0.0013		0.0042	

(---): Data was not provided
N/A: Not Applicable
[1]UT Cane Creek reference reach data only utilized for pattern and a reference point in the project specific regional curve
[2]Data only utilized as a reference point on the the project-specific drainage area-discharge curve
[3]Existing condition sinuosity based on valley length/channel length given no flow and therefore no water sureface shots at time of survey

Table 5b. Baseline Stream Data Summary
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
Monitoring Year 0

Parameter	Gage	Pre-Restoration Condition				Reference Reach Data										Design				As-Built/Baseline			
		SB1		SE1		Spencer Creek Upstream		UT Richland Creek Downstream		UT Cane Creek[1]		UT Richland Creek Upstream[2]		UT Rocky Branch[2]		SB1		SE1		SB1		SE1	
		Min	Max	Min	Max	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)		7.4	7.9	7.7		8.7		13.3	15.2	11.5	12.3	8.8	10.4	12.2		10.0		8.0		7.8		19.0	
Floodprone Width (ft)		96.0	98.0	9.5		229.0		>50		31.0		27.6	31.4	72.0		70.0	375.0	30	100	>100		>75	
Bankfull Mean Depth		1.0	1.2	0.8		1.2		1.1	1.3	0.8	1.0	0.8	0.9	1.3		1.0		0.7		0.8		0.5	
Bankfull Max Depth		2.3	2.4	1.0		1.9		1.8	2.1	1.2	1.6	1.1	1.3	1.8		1.3		1.0		1.4		1.5	
Bankfull Cross-sectional Area (ft^2)	n/a	8.0	8.7	6.2		10.6		16.5	17.5	8.9	12.2	7.8	8.5	16.3		9.6		5.7		6.1		9.6	
Width/Depth Ratio		6.2	7.8	9.6		7.3		10.1	13.9	12.3	14.4	10.0	12.8	9.1		10.4		11.2		10.1		37.7	
Entrenchment Ratio		12.4	13.1	1.2		26.3		>2.5		>2.5		2.5	4.0	6.0		7.0	37.5	3.8	12.5	>2.2		>2.2	
Bank Height Ratio		1.0		3.7		1.0		1.4	2.1	---		1.4	2.1	1.0		1.0		1.0		1.0		1.0	
D50 (mm)		1.0		0.09																56.1		28.5	
Profile																							
Riffle Length (ft)						---		---		---		---		---		---		---		8	46	10	28
Riffle Slope (ft/ft)		0.0176	0.0349	0.0247	0.0490	0.0188	0.0704	0.0183	0.0355	0.0188	0.0704	0.0210	0.0450	0.0606	0.0892	0.0052	0.0199	0.0220	0.0410	0.0021	0.0178	0.0023	0.0527
Pool Length (ft)	n/a					---		---		---		---		---		---		---		20	64	7	45
Pool Max Depth (ft)		---	---	---	---	---		---		---		---		---		---		---		0.4	2.2	0.9	2.3
Pool Spacing (ft)^		30	62	35	90	13	47	33	93	27	73	N/A		26	81	34	85	21	53	36	116	26	58
Pool Volume (ft^3)																							
Pattern																							
Channel Beltwidth (ft)		N/A		N/A		24	52	NA		102		N/A		N/A		25	48	16	39	14	35	10	27
Radius of Curvature (ft)		N/A		N/A		5.4	22.1	NA		23	38	N/A		N/A		20	35	18	26	17	32	14	30
Rc:Bankfull Width (ft/ft)	n/a	---		---		0.6	2.5	NA		2.0	3.1	N/A		N/A		2.0	3.5	2.3	3.3	2.2	4.1	0.7	1.6
Meander Length (ft)		N/A		N/A		54	196	NA		45	81	N/A		N/A		76	120	47	93	78	127	65	74
Meander Width Ratio		---		---		2.8	6	NA		3.9	6.6	N/A		N/A		7.6	12.0	5.9	11.6	10.0	16.2	3.4	3.9
Substrate, Bed and Transport Parameters																							
Ri%/Ru%/P%/G%/S%																							
SC%/Sa%/G%/C%/B%/Be%																							
d16/d35/d50/d84/d95/d100	n/a	SC/SC/1.0/45/107.33/180		SC/SC/0.09/26.23/50.61/180		---		---		---		---		---						SC/SC/SC/103.6/256/362		SC/SC/SC/68.1/180/362	
Reach Shear Stress (Competency) lb/ft		---		---												0.28	0.98	0.94	1.34	0.25		0.37	
Max part size (mm) mobilized at bankfull																							
Stream Power (Capacity) W/m																							
Additional Reach Parameters																							
Drainage Area (SM)		0.25		0.09		0.50		0.97		0.29		0.28		1.10		0.25		0.09		0.25		0.09	
Watershed Impervious Cover Estimate (%)		<1%		1%		---		---		---		---		---		<1%		1%		<1%		1%	
Rosgen Classification		E5		E6/G6		E4		C4/E4		C4/E4		C4/E4		E4b		E4		E4		C3		C4	
Bankfull Velocity (fps)		3.7		2.8		---		4.2	4.5	3.8		3.5	4.1	5.5		3.1		3.5		5.0		2.1	
Bankfull Discharge (cfs)		---		---		---		68.9	78.6	40		29.1	32.0	85.0		30		20		30		20	
Q-NFF regression		---		---																			
Q-USGS extrapolation	n/a	---		---																			
Q-Mannings		---		---																			
Valley Length (ft)		---		---		---		---		---		---		---		---		---					
Channel Thalweg Length (ft)		976		916		---		---		---		---		---		971		792		1,009		485	
Sinuosity (ft)[3]		1.03		1.31		1.40		1.10		1.40		1.00		1.10		---		1.13		1.06		1.18	
Water Surface Slope (ft/ft)		---		---		---		---		---		---		---		0.0068		0.0161		0.0070		0.0138	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0075		0.0182		0.0068		0.0136	

(---): Data was not provided
N/A: Not Applicable
[1]UT Cane Creek reference reach data only utilized for pattern and a reference point in the project specific regional curve
[2]Data only utilized as a reference point on the the project-specific drainage area-discharge curve
[3]Existing condition sinuosity based on valley length/channel length given no flow and therefore no water sureface shots at time of survey

Table 5c. Baseline Stream Data Summary
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
Monitoring Year 0

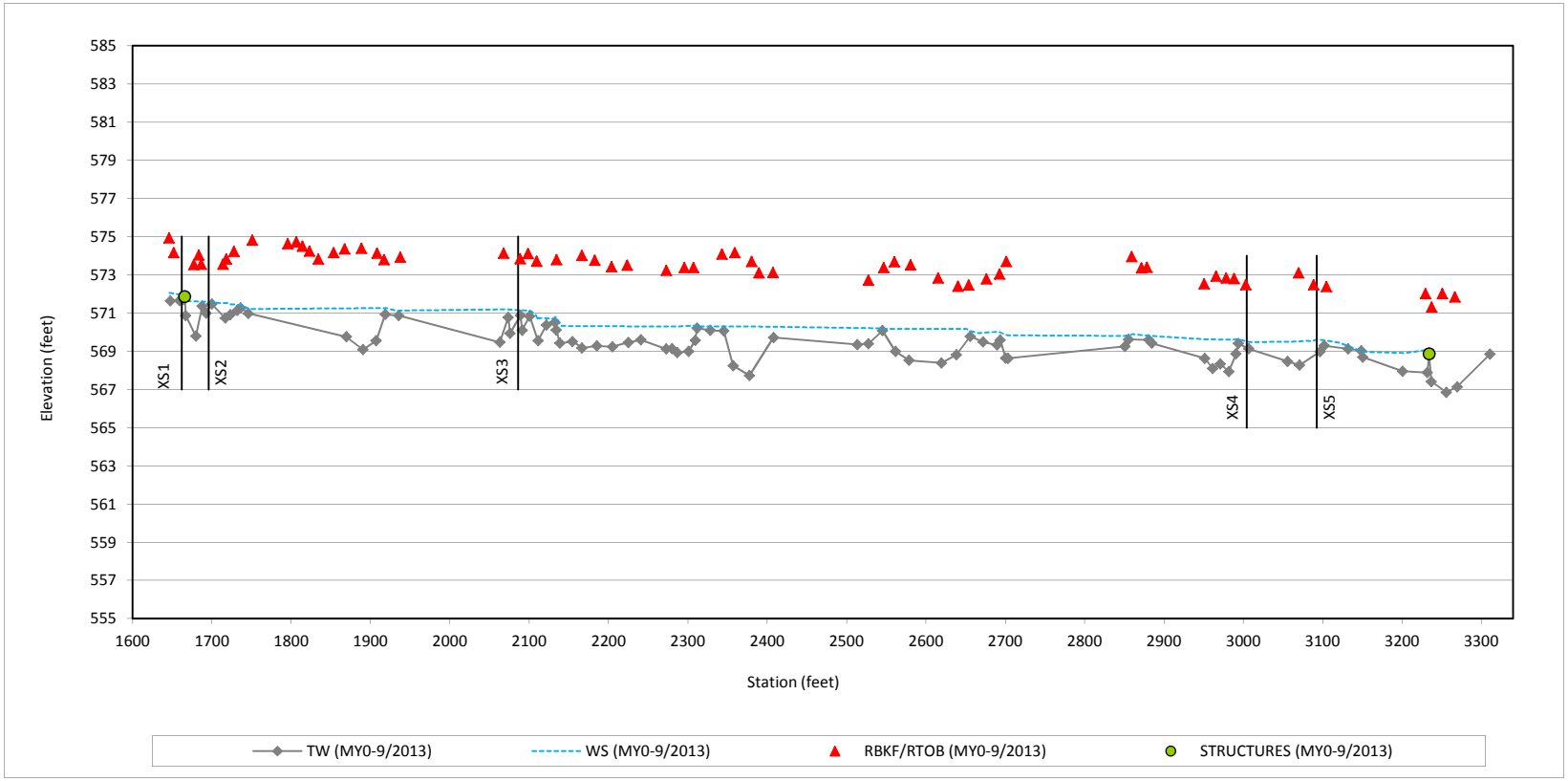
Parameter	Gage	Pre-Restoration Condition		Reference Reach Data										Design		Design		As-Built/Baseline		As-Built/Baseline	
		SE2		Spencer Creek Upstream		UT Richland Creek Downstream		UT Cane Creek[1]		UT Richland Creek Upstream[2]		UT Rocky Branch[2]		SE2a		SE2b		SE2a		SE2b	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																					
Bankfull Width (ft)	n/a	7.2	7.4	8.7		13.3	15.2	11.5	12.3	8.8	10.4	12.2		11.7	15.0	9.0		10.6			
Floodprone Width (ft)		8.0	9.8	229.0		>50		31.0		27.6	31.4	72.0		114.7	120.1	140.0	310.0	>100			
Bankfull Mean Depth		1.3	1.4	1.2		1.1	1.3	0.8	1.0	0.8	0.9	1.3		0.7	0.9	0.7		0.6			
Bankfull Max Depth		1.6	1.9	1.9		1.8	2.1	1.2	1.6	1.1	1.3	1.8		0.9	1.0	1.0		1.2			
Bankfull Cross-sectional Area (ft^2)		8.9	9.4	10.6		16.5	17.5	8.9	12.2	7.8	8.5	16.3		10.2	10.5	6.5		6.8			
Width/Depth Ratio		5.8	7.3	7.3		10.1	13.9	12.3	14.4	10.0	12.8	9.1		13.5	21.3	12.5		16.5			
Entrenchment Ratio		1.6	6.2	26.3		>2.5		>2.5		2.5	4.0	6.0		7.7	10.3	15.6	34.4	>2.2			
Bank Height Ratio		1.5	2.1	1.0		1.4	2.1	---		1.4	2.1	1.0		1.0		1.0		1.0			
D50 (mm)		0.04																37.2			
Profile																					
Riffle Length (ft)	n/a			---		---		---		---		---		---		---		4	20	11	36
Riffle Slope (ft/ft)		0.0047	0.0147	0.0188	0.0704	0.0183	0.0355	0.0188	0.0704	0.0210	0.0450	0.0606	0.0892	0.0122	0.0367	0.0202		0.0145	0.0454	0.0119	0.0606
Pool Length (ft)				---		---		---		---		---		---		---		21	53	27	45
Pool Max Depth (ft)		---	---	---		---		---		---		---		---		---		1.3	2.6	0.89	2.23
Pool Spacing (ft)^		17	122	13	47	33	93	27	73	N/A		26	81	27	55	43	49	25	54	34	73
Pool Volume (ft^3)																					
Pattern																					
Channel Beltwidth (ft)	n/a	N/A		24	52	NA		102		N/A		N/A		N/A		27		3	22	12	22
Radius of Curvature (ft)		N/A		5.4	22.1	NA		23	38	N/A		N/A		N/A		22	30	7	58	21	25
Rc:Bankfull Width (ft/ft)		---		0.6	2.5	NA		2.0	3.1	N/A		N/A		N/A		2.4	3.3	0.7	5.5	N/A	
Meander Length (ft)		N/A		54	196	NA		45	81	N/A		N/A		N/A		82.0		43	80	88	88
Meander Width Ratio		---		2.8	6	NA		3.9	6.6	N/A		N/A		N/A		3.0		4.1	7.5	N/A	
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/0.02/0.04/0.05/33.2/79.6		---		---		---		---		---						SC/SC/SC/70.9/256/362		SC/SC/SC/70.9/256/362	
Reach Shear Stress (Competency) lb/ft		---												0.93	1.14	0.93	1.14	0.47		N/A	
Max part size (mm) mobilized at bankfull																					
Stream Power (Capacity) W/m																					
Additional Reach Parameters																					
Drainage Area (SM)	n/a	0.09		0.50		0.97		0.29		0.28		1.10		0.09		0.10		0.09		0.10	
Watershed Impervious Cover Estimate (%)		1%		---		---		---		---		---		*1%*		*1%*		*1%*		*1%*	
Rosgen Classification		E6/G6		E4		C4/E4		C4/E4		C4/E4		E4b		C4		C4		C4		C4	
Bankfull Velocity (fps)		2.9	3.4	---		4.2	4.5	3.8		3.5	4.1	5.5		3.0	3.3	3.1		4.4		N/A	
Bankfull Discharge (cfs)		---		---		68.9	78.6	40		29.1	32.0	85.0		~30		20		30		N/A	
Q-NFF regression		---																			
Q-USGS extrapolation		---																			
Q-Mannings		---																			
Valley Length (ft)		---		---		---		---		---		---		---		---					
Channel Thalweg Length (ft)		524		---		---		---		---		---		533		180		536		195	
Sinuosity (ft^3)		1.17		1.40		1.10		1.40		1.00		1.10		---		1.21		1.11		1.23	
Water Surface Slope (ft/ft)		---		---		---		---		---		---		---		0.0101		0.0144		0.0160	
Bankfull Slope (ft/ft)		---		---		---		---		---		---		---		0.0122		0.0146		0.0168	

(---): Data was not provided
N/A: Not Applicable
[1]UT Cane Creek reference reach data only utilized for pattern and a reference point in the project specific regional curve.
[2]Data only utilized as a reference point on the the project-specific drainage area-discharge curve.
[3]Existing condition sinuosity based on valley length/channel length given no flow and therefore no water sureface shots at time of survey.

Table 6. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
Monitoring Year 0

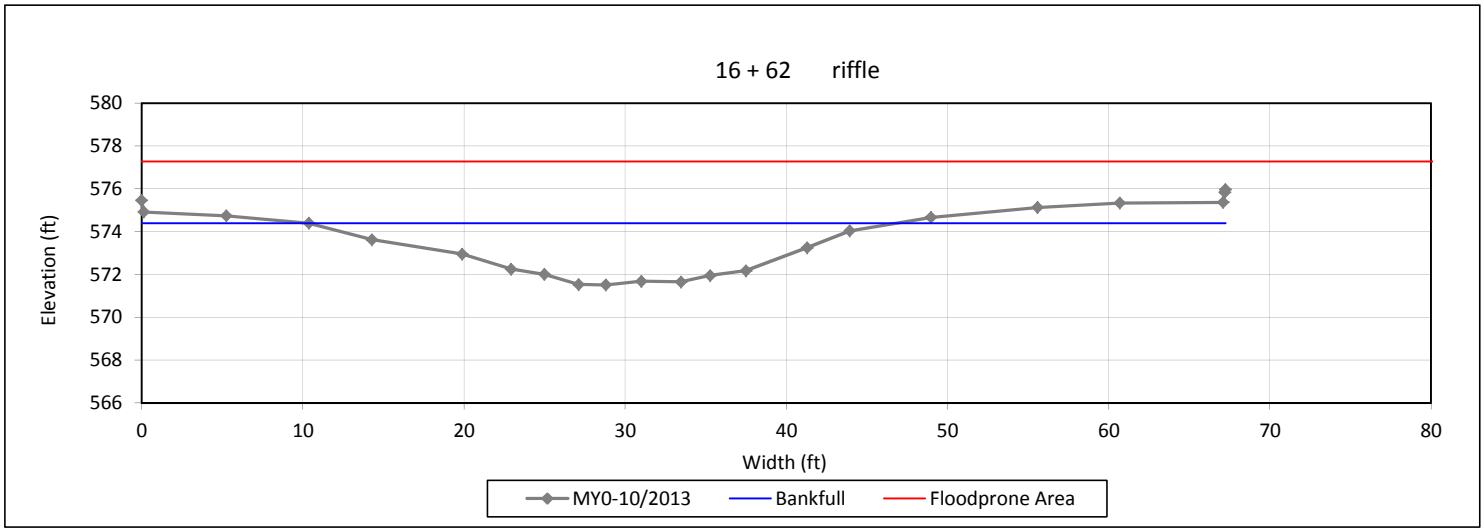
	BC2																											
	Cross-Section 1 (Riffle)						Cross-Section 2 (Pool)						Cross-Section 3 (Riffle)						Cross-Section 4 (Riffle)						Cross-Section 5 (Pool)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**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)	36.4						42.2						28.9						42.7						34.8					
Floodprone Width (ft)	>150						N/A						>150						>150						N/A					
Bankfull Mean Depth (ft)	1.6						1.9						1.9						2.1						2.4					
Bankfull Max Depth (ft)	2.9						4.6						3.4						3.2						3.7					
Bankfull Cross-Sectional Area (ft^2)	59.8						80.3						56.2						88.7						84.3					
Bankfull Width/Depth Ratio	22.2						22.1						14.8						20.6						14.3					
Bankfull Entrenchment Ratio	>2.2						N/A						>2.2						>2.2						N/A					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0						1.0					
	BC3																								SB1					
	Cross-Section 6 (Pool)						Cross-Section 7 (Riffle)						Cross-Section 8 (Riffle)						Cross-Section 9 (Pool)						Cross-Section 10 (Riffle)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**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)	34.7						20.4						36.9						34.2						7.8					
Floodprone Width (ft)	N/A						>150						>150						N/A						>100					
Bankfull Mean Depth (ft)	1.4						1.4						1.0						2.0						0.8					
Bankfull Max Depth (ft)	3.2						2.1						3.0						3.9						1.4					
Bankfull Cross-Sectional Area (ft^2)	47.7						28.8						37.4						69.6						6.1					
Bankfull Width/Depth Ratio	25.3						14.5						36.5						16.8						10.1					
Bankfull Entrenchment Ratio	N/A						>2.2						>2.2						N/A						>2.2					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.3						1.0					
	SB1						SE1						SE1						SE2											
	Cross-Section 11 (Pool)						Cross-Section 12 (Riffle)						Cross-Section 13 (Pool)						Cross-Section 14 (Pool)						Cross-Section 15 (Riffle)					
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**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)	10.2						19.0						12.8						16.7						10.6					
Floodprone Width (ft)	N/A						>75						N/A						N/A						>100					
Bankfull Mean Depth (ft)	1.1						0.5						1.3						1.7						0.6					
Bankfull Max Depth (ft)	2.0						1.5						2.5						3.5						1.2					
Bankfull Cross-Sectional Area (ft^2)	11.6						9.6						16.9						28.0						6.8					
Bankfull Width/Depth Ratio	8.9						37.7						9.8						10.0						16.5					
Bankfull Entrenchment Ratio	N/A						>2.2						N/A						N/A						>2.2					
Bankfull Bank Height Ratio	1.0						1.0						1.0						1.0						1.0					

Longitudinal Profile Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC2
Monitoring Year 0



Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 1-BC2



View Upstream (10/2013)

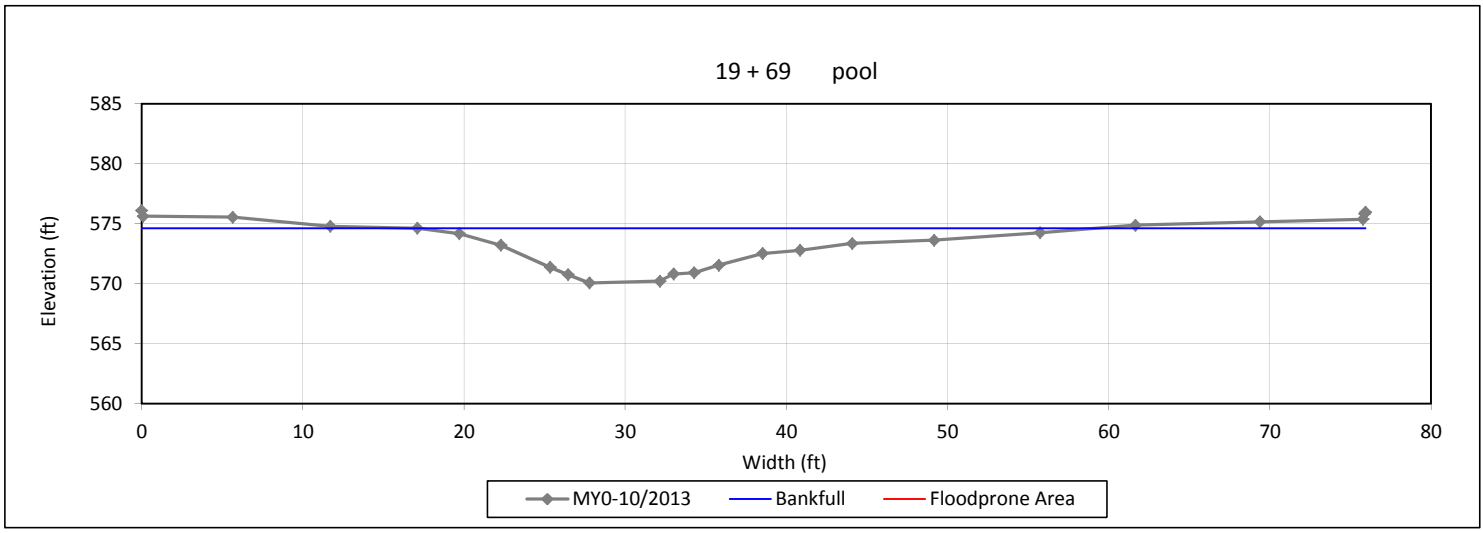
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
59.8	x-section area (ft.sq.)	150.0	W flood prone area (ft)
36.4	width (ft)	4.1	entrenchment ratio
1.6	mean depth (ft)	2.9	low bank height (ft)
2.9	max depth (ft)	1.0	low bank height ratio
37.0	wetted parimeter (ft)		
1.6	hyd radi (ft)		
22.2	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 2-BC2



View Upstream (10/2013)

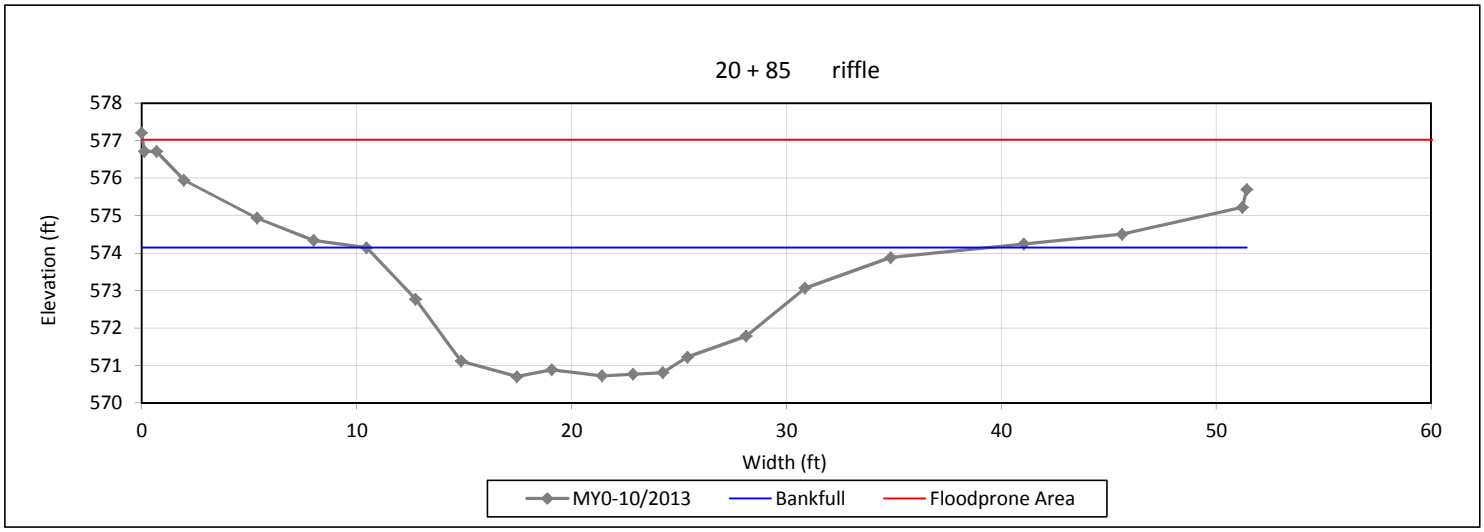
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
80.3	x-section area (ft.sq.)	---	W flood prone area (ft)
42.2	width (ft)	---	entrenchment ratio
1.9	mean depth (ft)	4.6	low bank height (ft)
4.6	max depth (ft)	1.0	low bank height ratio
43.8	wetted parimeter (ft)		
1.8	hyd radi (ft)		
22.1	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 3-BC2



View Upstream (10/2013)

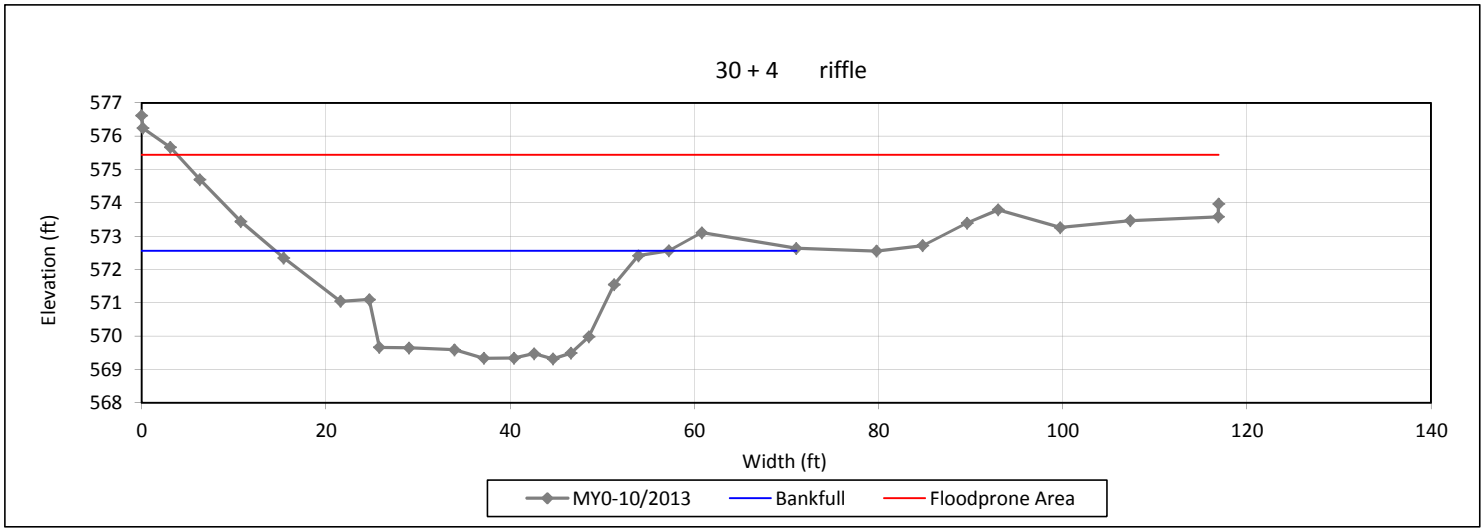
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
56.2	x-section area (ft.sq.)	150.0	W flood prone area (ft)
28.9	width (ft)	5.2	entrenchment ratio
1.9	mean depth (ft)	3.4	low bank height (ft)
3.4	max depth (ft)	1.0	low bank height ratio
30.4	wetted parimeter (ft)		
1.8	hyd radi (ft)		
14.8	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 4-BC2



View Upstream (10/2013)

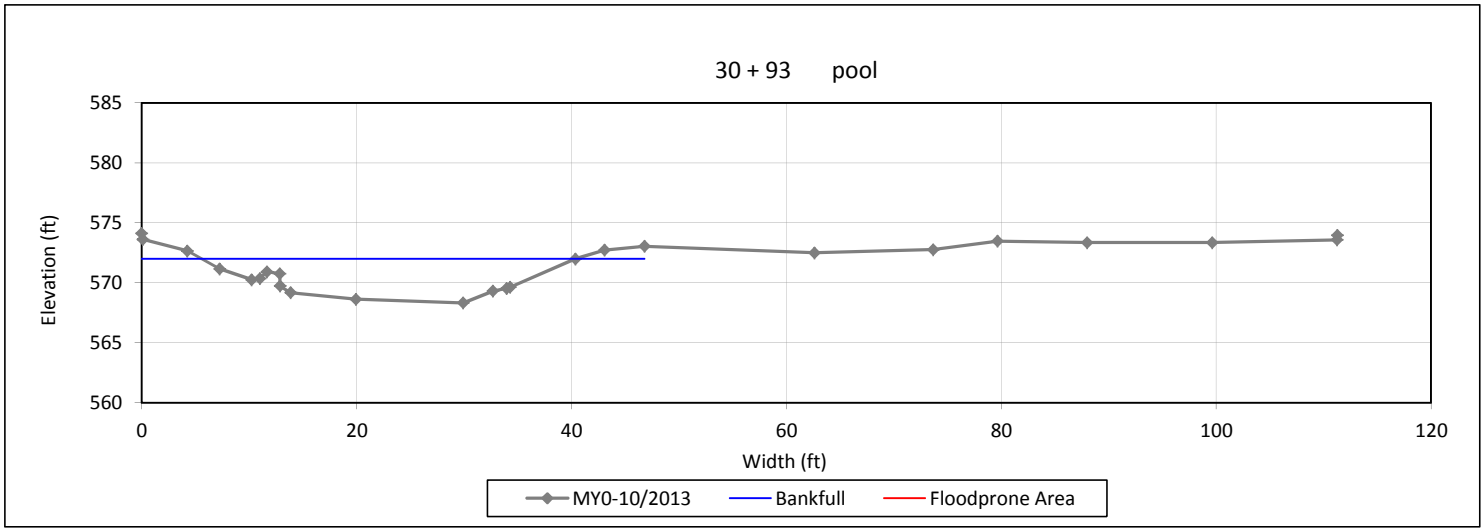
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
88.7	x-section area (ft.sq.)	150.0	W flood prone area (ft)
42.7	width (ft)	3.5	entrenchment ratio
2.1	mean depth (ft)	3.2	low bank height (ft)
3.2	max depth (ft)	1.0	low bank height ratio
44.3	wetted parimeter (ft)		
2.0	hyd radi (ft)		
20.6	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 5-BC2



View Upstream (10/2013)

View Downstream (10/2013)

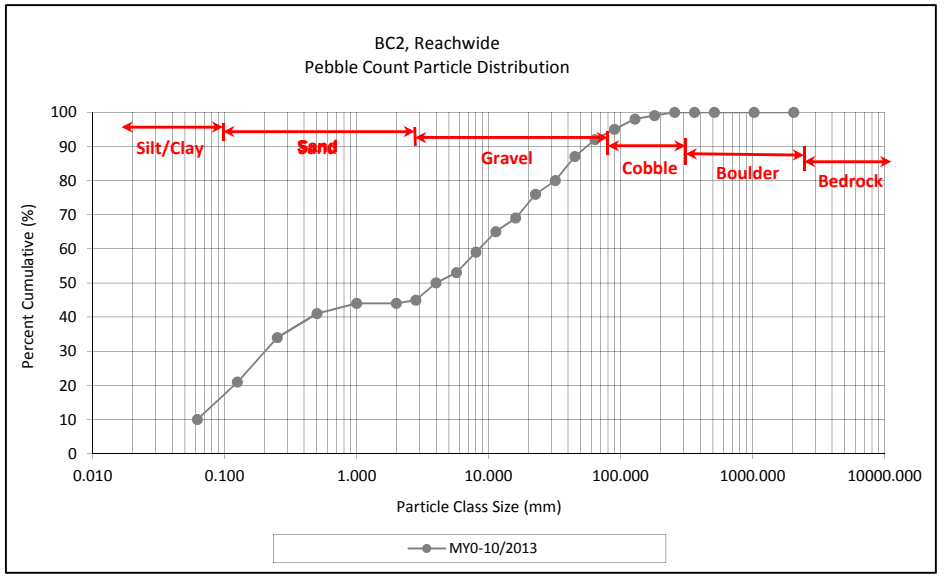
Bankfull Dimensions		Flood Dimensions	
84.3	x-section area (ft.sq.)	---	W flood prone area (ft)
34.8	width (ft)	---	entrenchment ratio
2.4	mean depth (ft)	4.4	low bank height (ft)
3.7	max depth (ft)	1.2	low bank height ratio
37.1	wetted parimeter (ft)		
2.3	hyd radi (ft)		
14.3	width-depth ratio		

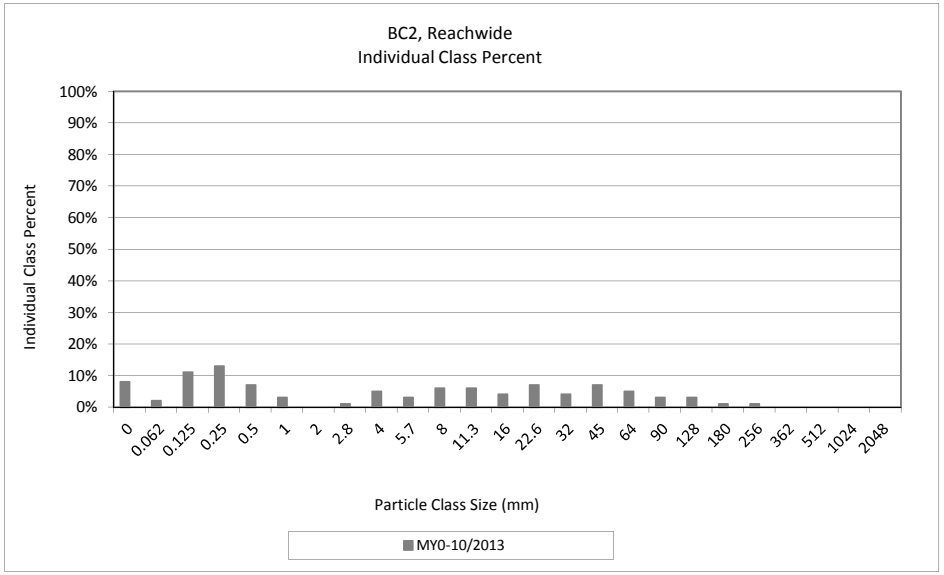
Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Reachwide and Cross-Section Pebble Count Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC2, 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	5	3	8	8	8
SAND	Very fine	0.062	0.125		2	2	2	10
	Fine	0.125	0.250	5	6	11	11	21
	Medium	0.250	0.500		13	13	13	34
	Coarse	0.5	1.0	2	5	7	7	41
	Very Coarse	1.0	2.0	1	2	3	3	44
GRAVEL	Very Fine	2.0	2.8					44
	Very Fine	2.8	4.0		1	1	1	45
	Fine	4.0	5.7	4	1	5	5	50
	Fine	5.7	8.0	2	1	3	3	53
	Medium	8.0	11.3	4	2	6	6	59
	Medium	11.3	16.0	3	3	6	6	65
	Coarse	16.0	22.6	3	1	4	4	69
	Coarse	22.6	32	3	4	7	7	76
	Very Coarse	32	45	2	2	4	4	80
	Very Coarse	45	64	5	2	7	7	87
COBBLE	Small	64	90	4	1	5	5	92
	Small	90	128	3		3	3	95
	Large	128	180	3		3	3	98
	Large	180	256	1		1	1	99
BOULDER	Small	256	362		1	1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.6
D_{50} =	5.6
D_{84} =	55.0
D_{95} =	128.0
D_{100} =	362.0

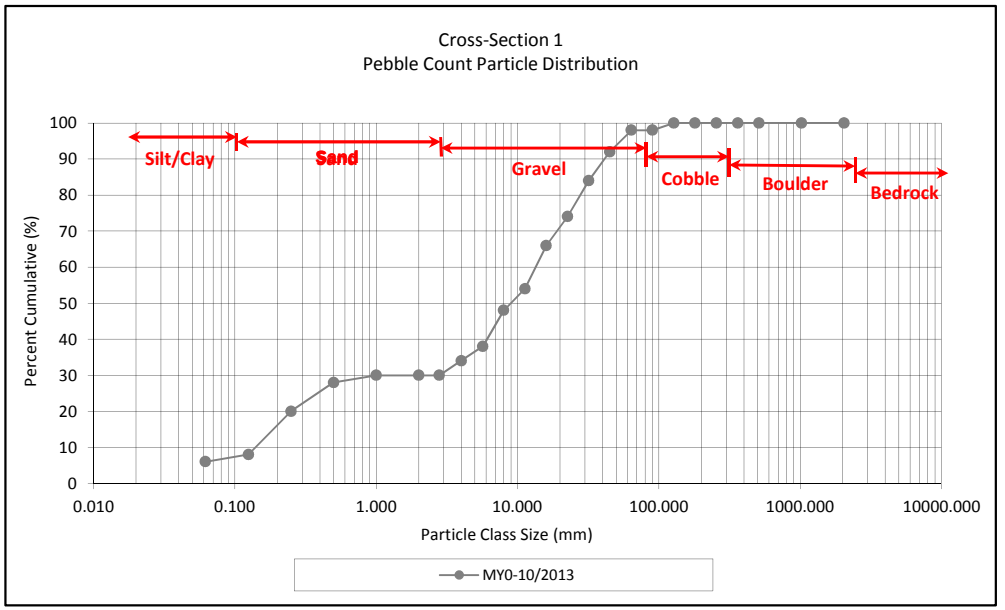


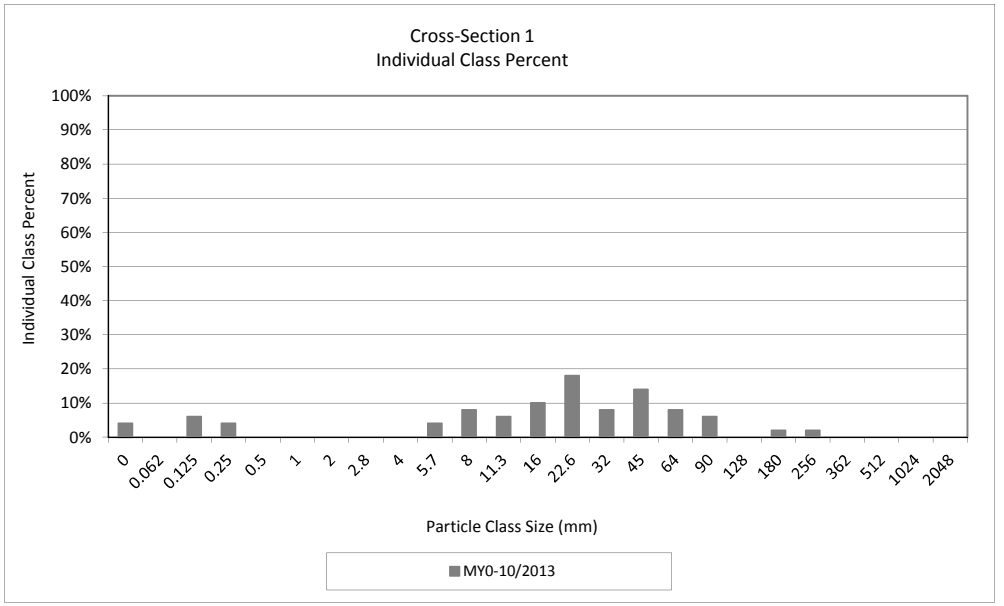


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC2, Cross-Section 1
Monitoring Year 0

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	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250	2	2	8
	Medium	0.250	0.500	12	12	20
	Coarse	0.5	1.0	8	8	28
	Very Coarse	1.0	2.0	2	2	30
GRAVEL	Very Fine	2.0	2.8			30
	Very Fine	2.8	4.0			30
	Fine	4.0	5.7	4	4	34
	Fine	5.7	8.0	4	4	38
	Medium	8.0	11.3	10	10	48
	Medium	11.3	16.0	6	6	54
	Coarse	16.0	22.6	12	12	66
	Coarse	22.6	32	8	8	74
	Very Coarse	32	45	10	10	84
	Very Coarse	45	64	8	8	92
COBBLE	Small	64	90	6	6	98
	Small	90	128			98
	Large	128	180	2	2	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-Section 1	
Channel materials (mm)	
D_{16} =	0.4
D_{35} =	6.1
D_{50} =	12.5
D_{84} =	45.0
D_{95} =	75.9
D_{100} =	180.0

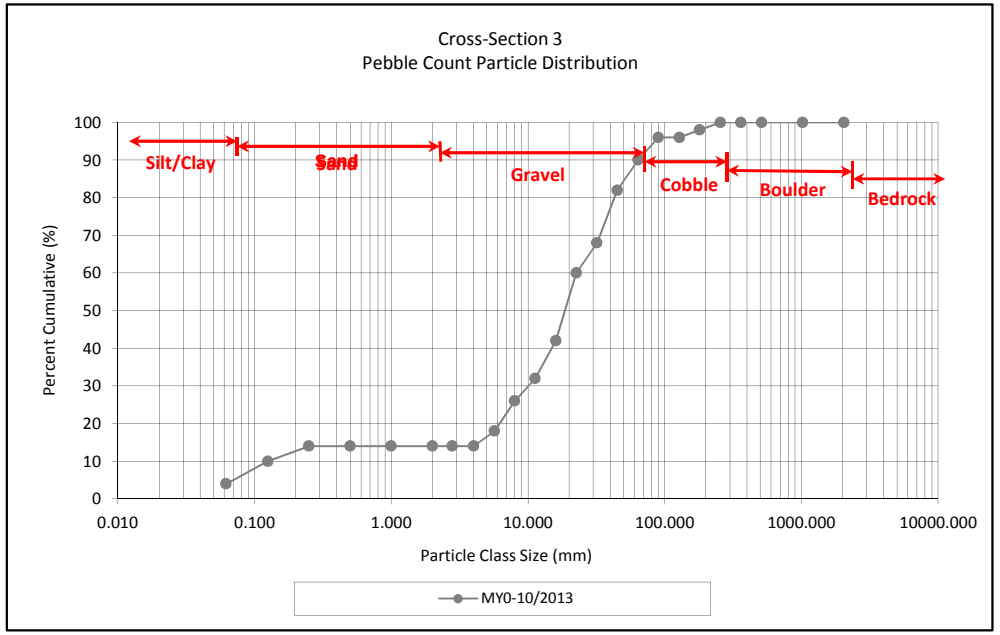


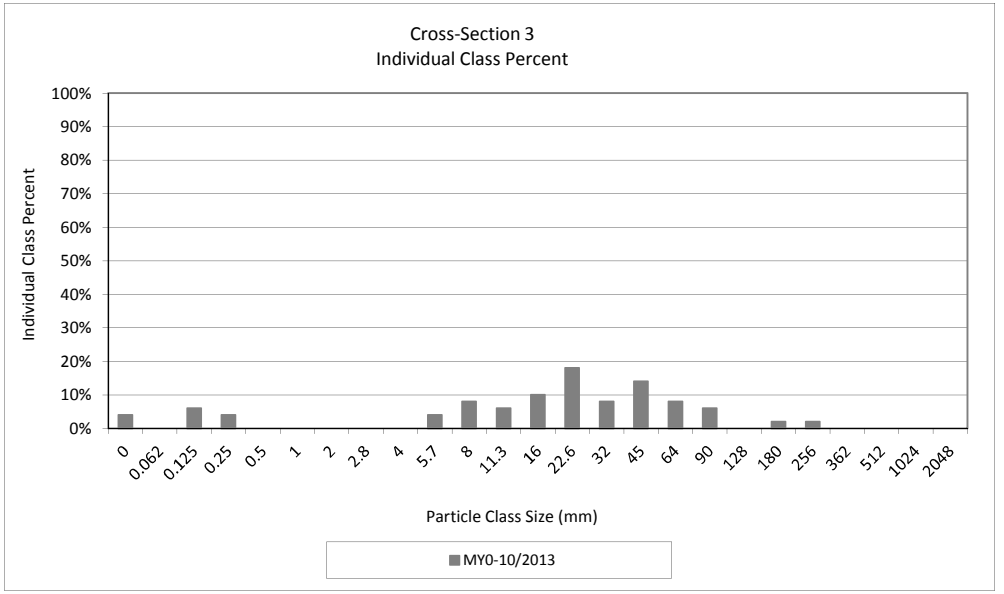


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC2, Cross-Section 3
Monitoring Year 0

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	4	4	4
SAND	Very fine	0.062	0.125			4
	Fine	0.125	0.250	6	6	10
	Medium	0.250	0.500	4	4	14
	Coarse	0.5	1.0			14
	Very Coarse	1.0	2.0			14
GRAVEL	Very Fine	2.0	2.8			14
	Very Fine	2.8	4.0			14
	Fine	4.0	5.7			14
	Fine	5.7	8.0	4	4	18
	Medium	8.0	11.3	8	8	26
	Medium	11.3	16.0	6	6	32
	Coarse	16.0	22.6	10	10	42
	Coarse	22.6	32	18	18	60
	Very Coarse	32	45	8	8	68
	Very Coarse	45	64	14	14	82
COBBLE	Small	64	90	8	8	90
	Small	90	128	6	6	96
	Large	128	180			96
	Large	180	256	2	2	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 3	
Channel materials (mm)	
D_{16} =	6.7
D_{35} =	17.7
D_{50} =	26.4
D_{84} =	69.7
D_{95} =	120.7
D_{100} =	362.0

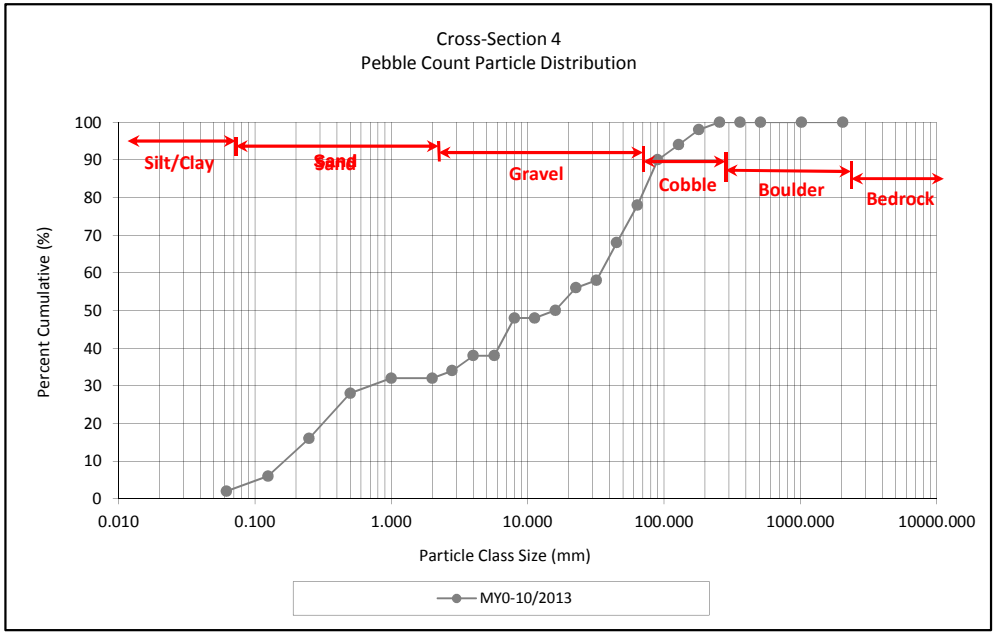


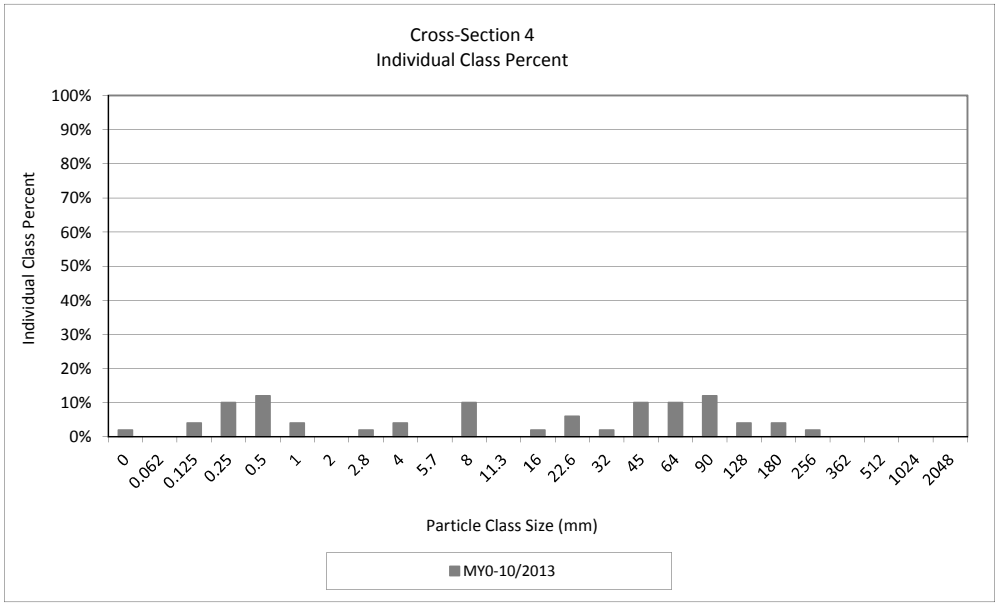


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC2, Cross-Section 4
Monitoring Year 0

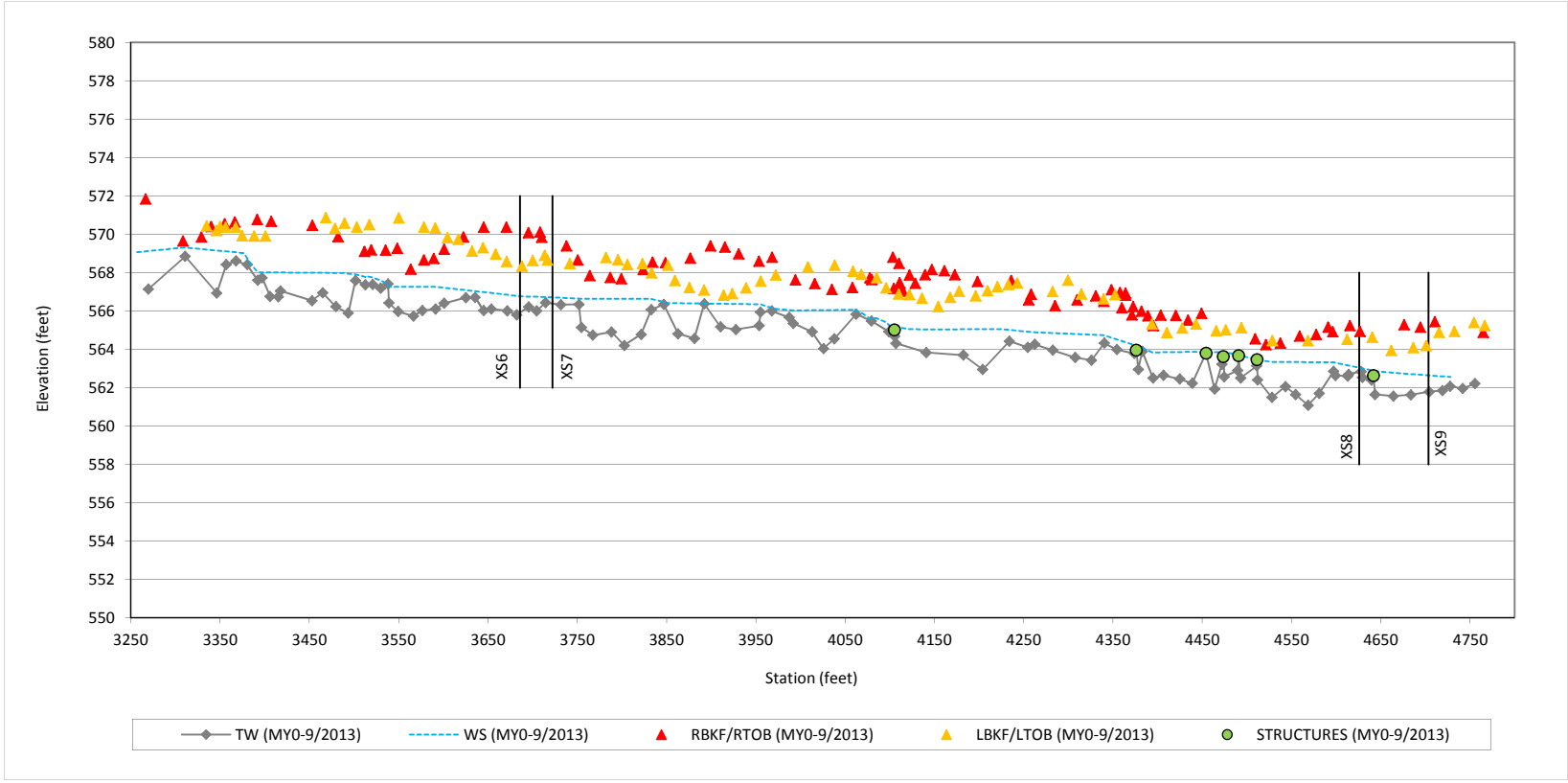
Particle Class		Diameter (mm)		Particle Count	Cross-Section 4 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	2	2
SAND	Very fine	0.062	0.125			2
	Fine	0.125	0.250	4	4	6
	Medium	0.250	0.500	10	10	16
	Coarse	0.5	1.0	12	12	28
	Very Coarse	1.0	2.0	4	4	32
GRAVEL	Very Fine	2.0	2.8			32
	Very Fine	2.8	4.0	2	2	34
	Fine	4.0	5.7	4	4	38
	Fine	5.7	8.0			38
	Medium	8.0	11.3	10	10	48
	Medium	11.3	16.0			48
	Coarse	16.0	22.6	2	2	50
	Coarse	22.6	32	6	6	56
	Very Coarse	32	45	2	2	58
	Very Coarse	45	64	10	10	68
COBBLE	Small	64	90	10	10	78
	Small	90	128	12	12	90
	Large	128	180	4	4	94
	Large	180	256	4	4	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 4	
Channel materials (mm)	
D_{16} =	0.5
D_{35} =	4.4
D_{50} =	22.6
D_{84} =	107.3
D_{95} =	196.6
D_{100} =	362.0



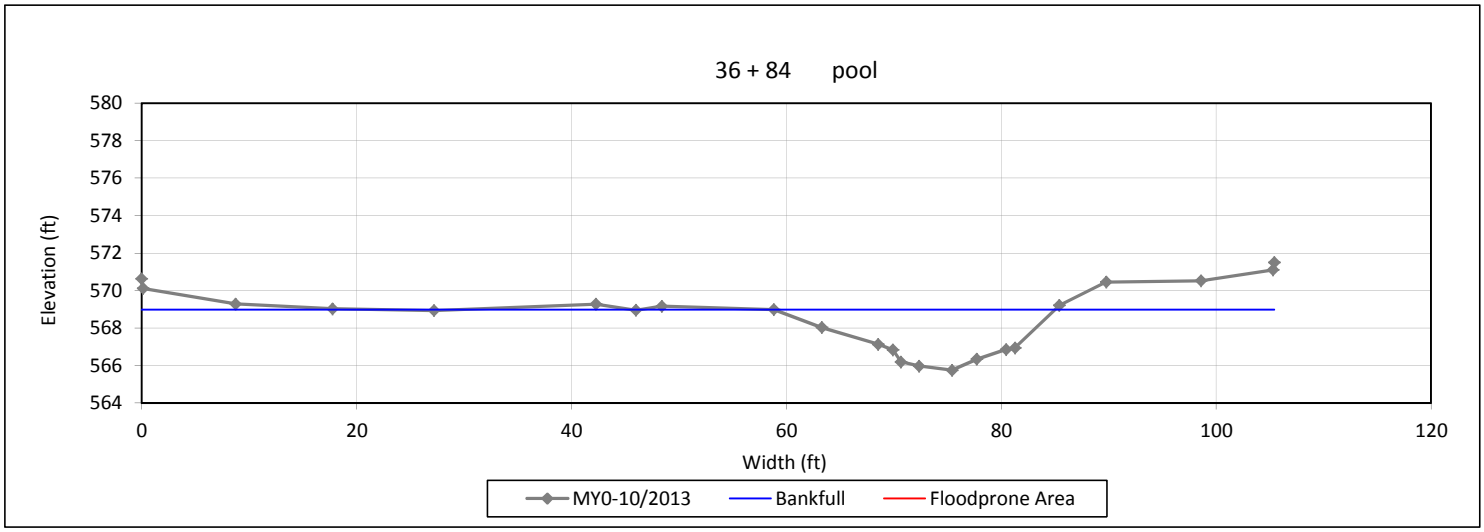


Longitudinal Profile Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC3
Monitoring Year 0



Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 6-BC3



View Upstream (10/2013)

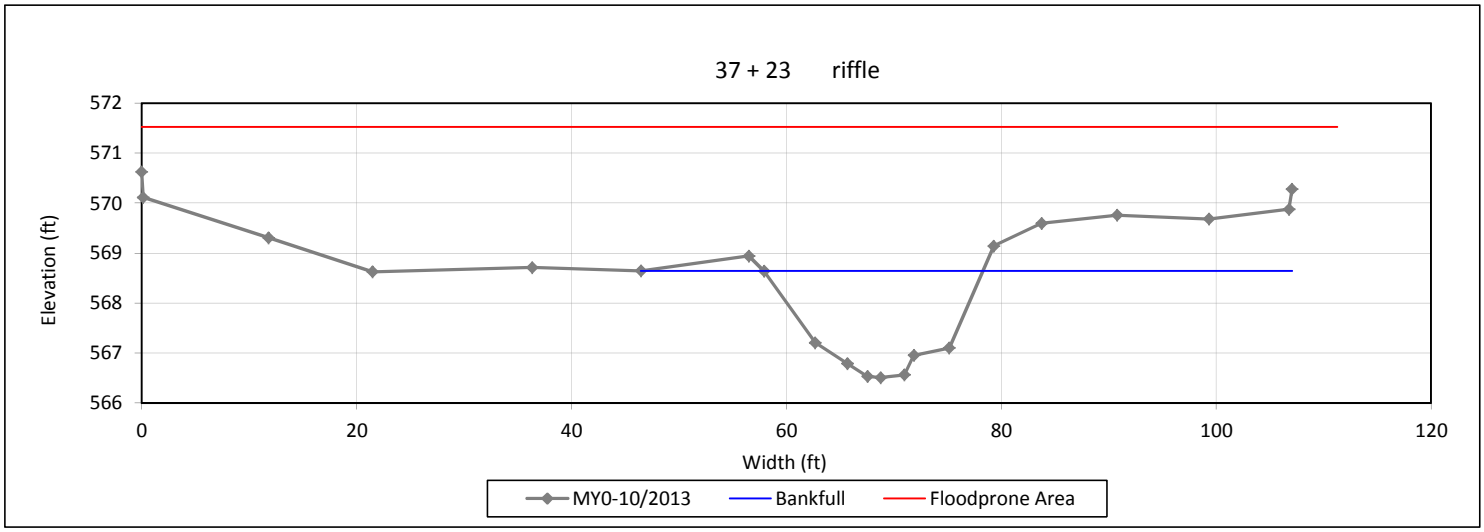
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
47.7	x-section area (ft.sq.)	---	W flood prone area (ft)
34.7	width (ft)	---	entrenchment ratio
1.4	mean depth (ft)	3.2	low bank height (ft)
3.2	max depth (ft)	1.0	low bank height ratio
35.9	wetted parimeter (ft)		
1.3	hyd radi (ft)		
25.3	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 7-BC3



View Upstream (10/2013)

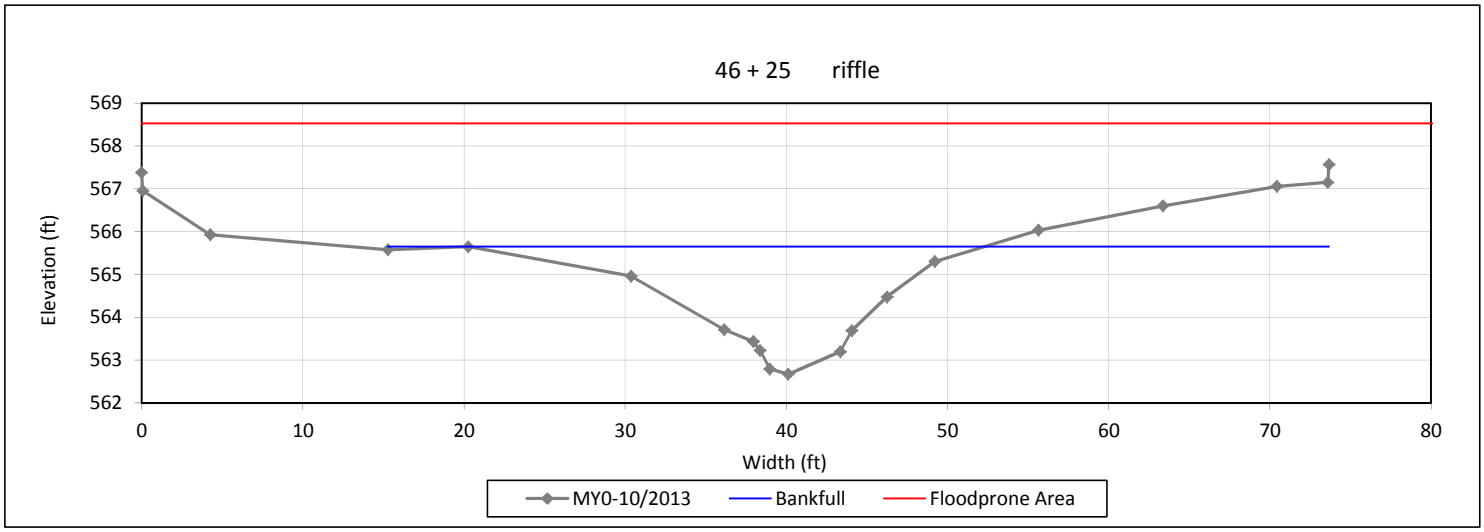
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
28.8	x-section area (ft.sq.)	150.0	W flood prone area (ft)
20.4	width (ft)	7.4	entrenchment ratio
1.4	mean depth (ft)	2.1	low bank height (ft)
2.1	max depth (ft)	1.0	low bank height ratio
21.1	wetted parimeter (ft)		
1.4	hyd radi (ft)		
14.5	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 8-BC3



View Upstream (10/2013)

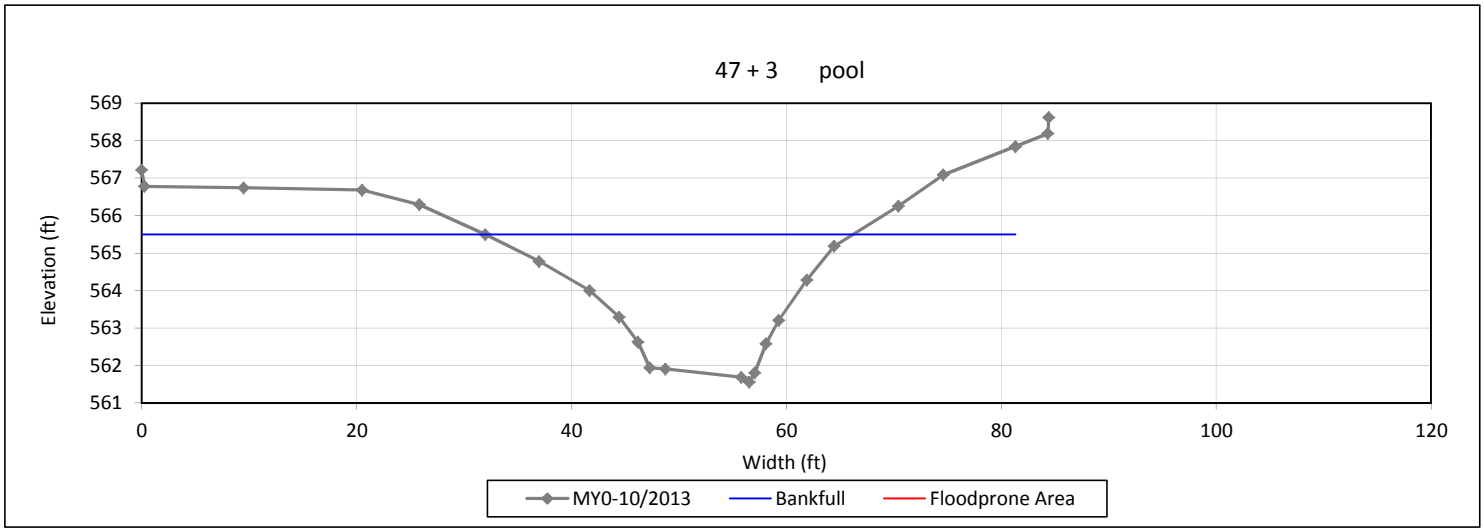
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
37.4	x-section area (ft.sq.)	---	W flood prone area (ft)
36.9	width (ft)	---	entrenchment ratio
1.0	mean depth (ft)	3.0	low bank height (ft)
3.0	max depth (ft)	1.0	low bank height ratio
37.8	wetted parimeter (ft)		
1.0	hyd radi (ft)		
36.5	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 9-BC3



View Upstream (10/2013)

View Downstream (10/2013)

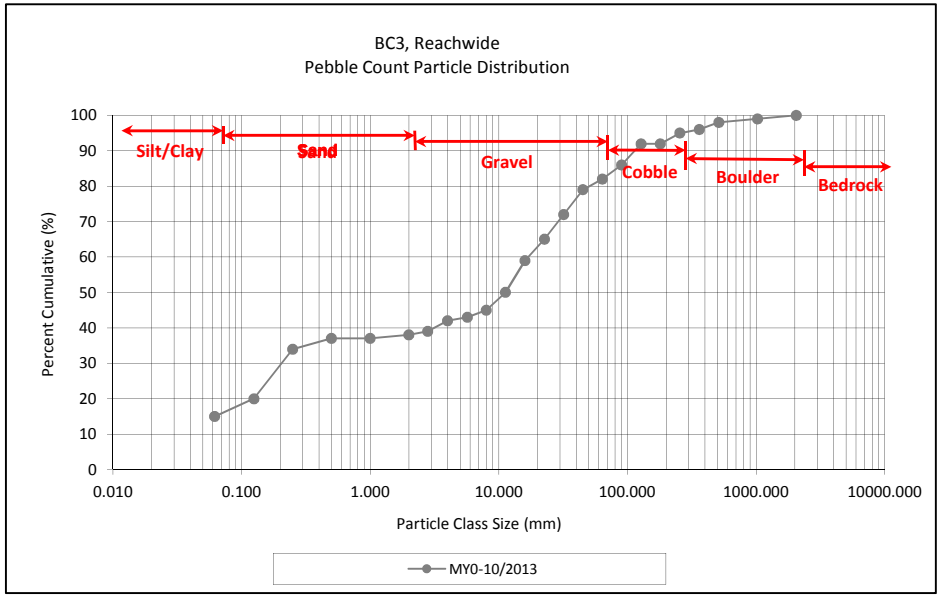
Bankfull Dimensions		Flood Dimensions	
69.6	x-section area (ft.sq.)	---	W flood prone area (ft)
34.2	width (ft)	---	entrenchment ratio
2.0	mean depth (ft)	5.1	low bank height (ft)
3.9	max depth (ft)	1.3	low bank height ratio
35.6	wetted parimeter (ft)		
2.0	hyd radi (ft)		
16.8	width-depth ratio		

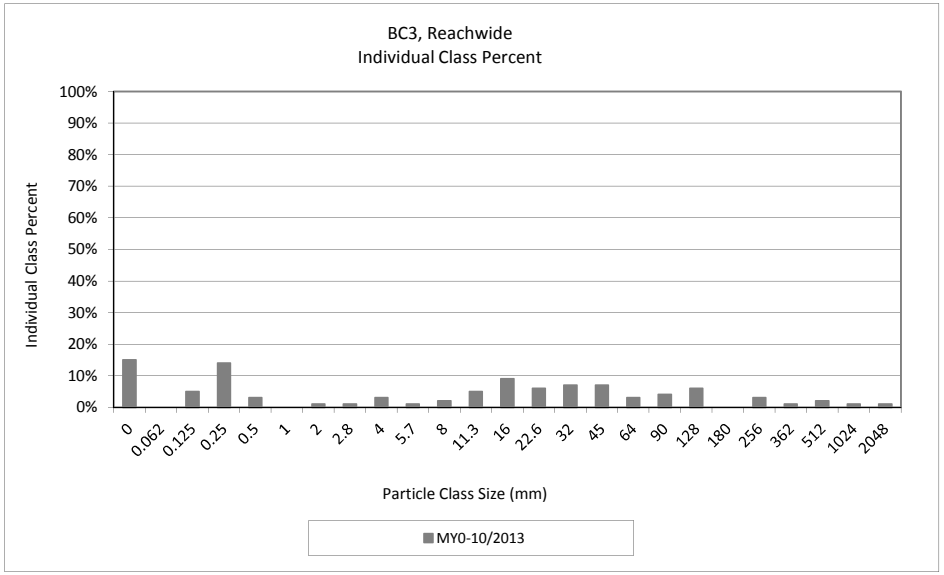
Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Reachwide and Cross-Section Pebble Count Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC3, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			BC3 Reach 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					15
	Fine	0.125	0.250	1	4	5	5	20
	Medium	0.250	0.500	3	11	14	14	34
	Coarse	0.5	1.0		3	3	3	37
	Very Coarse	1.0	2.0					37
GRAVEL	Very Fine	2.0	2.8	1		1	1	38
	Very Fine	2.8	4.0	1		1	1	39
	Fine	4.0	5.7		3	3	3	42
	Fine	5.7	8.0		1	1	1	43
	Medium	8.0	11.3	1	1	2	2	45
	Medium	11.3	16.0	3	2	5	5	50
	Coarse	16.0	22.6	6	3	9	9	59
	Coarse	22.6	32	3	3	6	6	65
	Very Coarse	32	45	5	2	7	7	72
	Very Coarse	45	64	7		7	7	79
COBBLE	Small	64	90	3		3	3	82
	Small	90	128	3	1	4	4	86
	Large	128	180	6		6	6	92
	Large	180	256					92
BOULDER	Small	256	362	3		3	3	95
	Small	362	512		1	1	1	96
	Medium	512	1024	1	1	2	2	98
	Large/Very Large	1024	2048		1	1	1	99
BEDROCK	Bedrock	2048	>2048	1		1	1	100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.1
D_{35} =	0.6
D_{50} =	16.0
D_{84} =	107.3
D_{95} =	362.0
D_{100} =	>2048

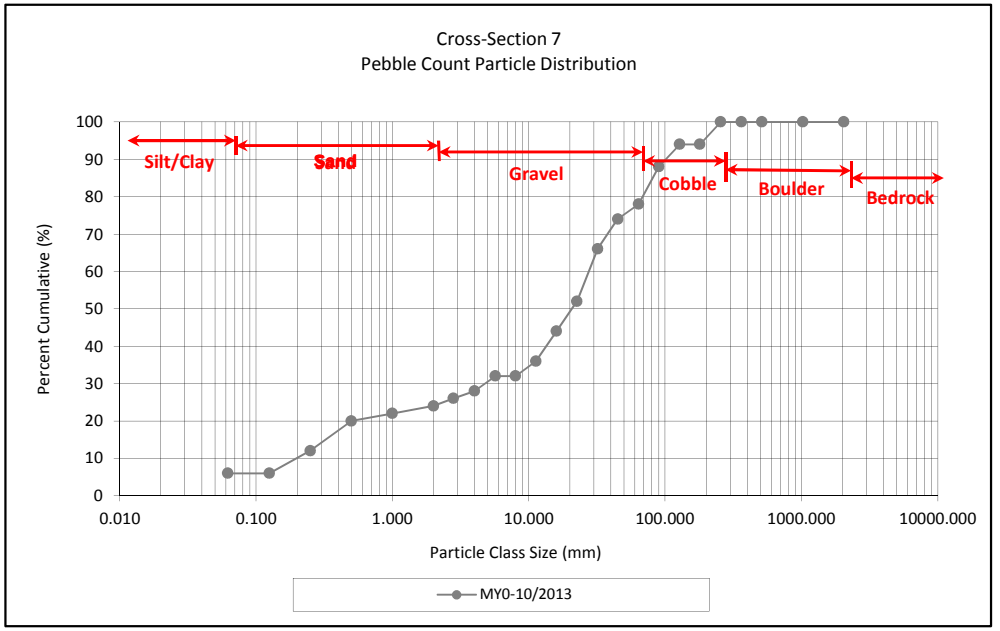


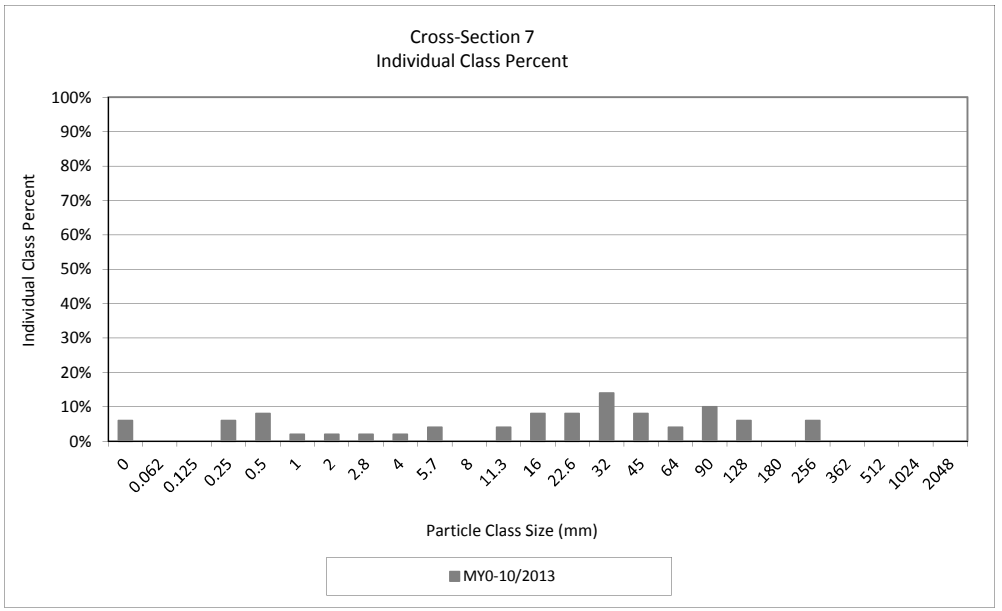


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC3, Cross-Section 7
Monitoring Year 0

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	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.250	0.500	6	6	12
	Coarse	0.5	1.0	8	8	20
	Very Coarse	1.0	2.0	2	2	22
GRAVEL	Very Fine	2.0	2.8	2	2	24
	Very Fine	2.8	4.0	2	2	26
	Fine	4.0	5.7	2	2	28
	Fine	5.7	8.0	4	4	32
	Medium	8.0	11.3			32
	Medium	11.3	16.0	4	4	36
	Coarse	16.0	22.6	8	8	44
	Coarse	22.6	32	8	8	52
	Very Coarse	32	45	14	14	66
	Very Coarse	45	64	8	8	74
COBBLE	Small	64	90	4	4	78
	Small	90	128	10	10	88
	Large	128	180	6	6	94
	Large	180	256			94
BOULDER	Small	256	362	6	6	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} =	0.7
D_{35} =	14.6
D_{50} =	29.3
D_{84} =	111.2
D_{95} =	271.2
D_{100} =	362.0

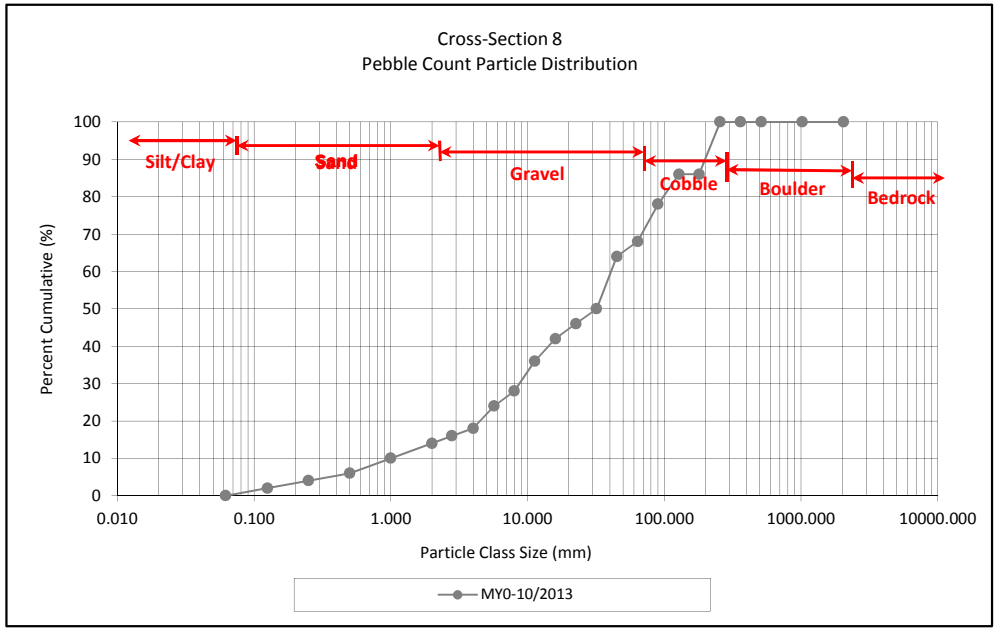


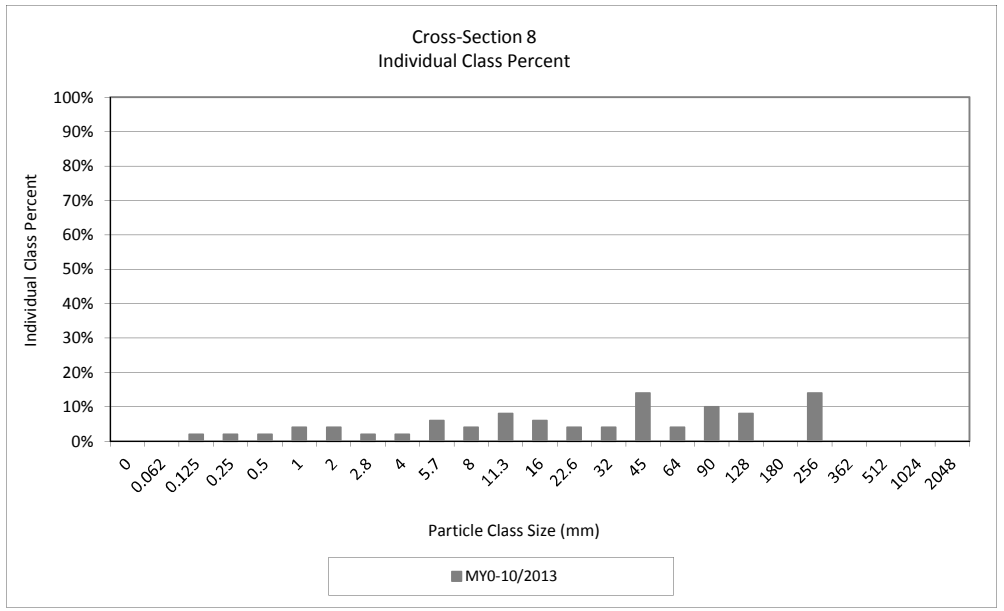


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
BC3, Cross-Section 8
Monitoring Year 0

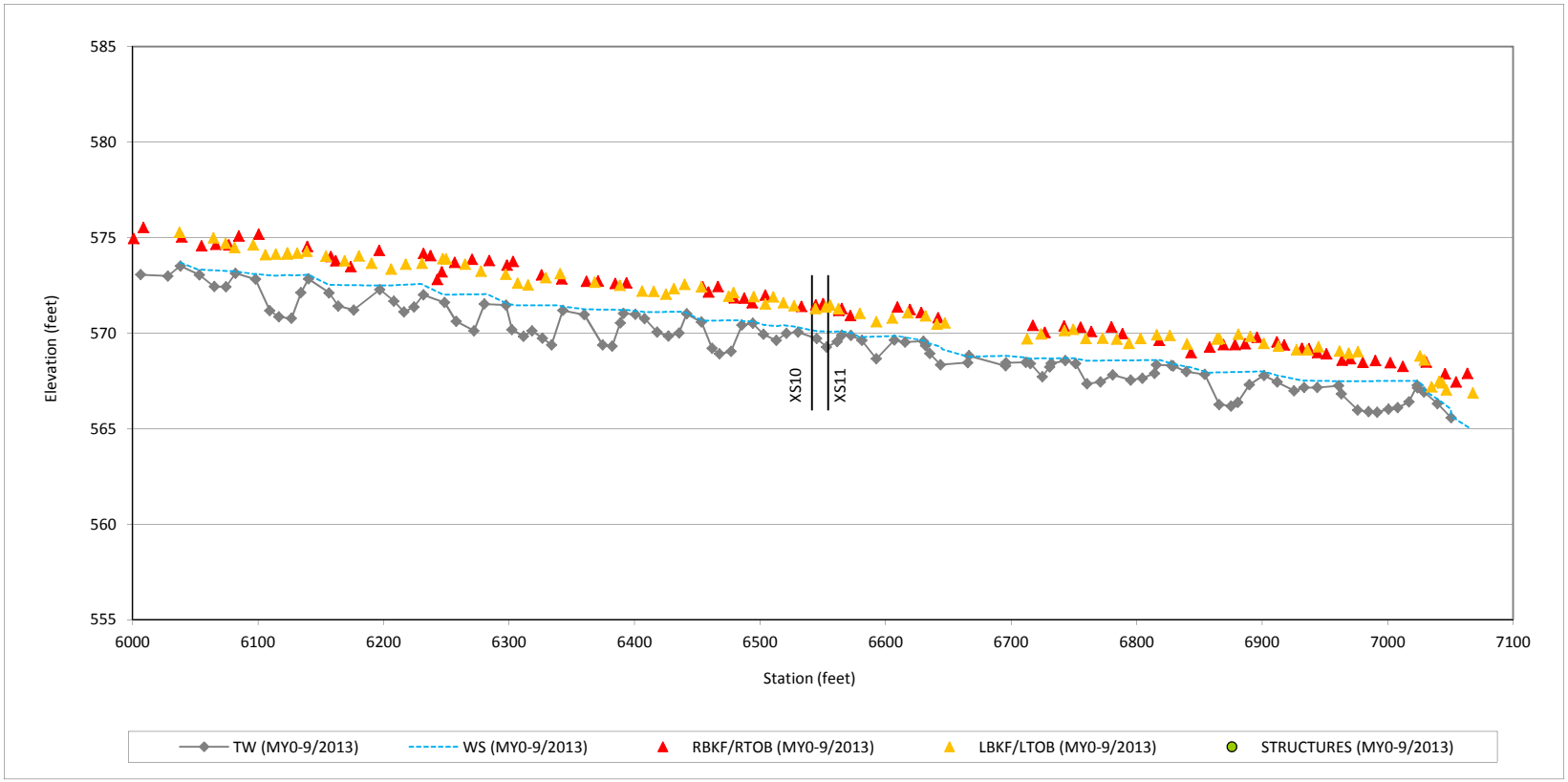
Particle Class		Diameter (mm)		Particle Count	Cross-Section 8 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250	2	2	2
	Medium	0.250	0.500	2	2	4
	Coarse	0.5	1.0	2	2	6
	Very Coarse	1.0	2.0	4	4	10
GRAVEL	Very Fine	2.0	2.8	4	4	14
	Very Fine	2.8	4.0	2	2	16
	Fine	4.0	5.7	2	2	18
	Fine	5.7	8.0	6	6	24
	Medium	8.0	11.3	4	4	28
	Medium	11.3	16.0	8	8	36
	Coarse	16.0	22.6	6	6	42
	Coarse	22.6	32	4	4	46
	Very Coarse	32	45	4	4	50
	Very Coarse	45	64	14	14	64
COBBLE	Small	64	90	4	4	68
	Small	90	128	10	10	78
	Large	128	180	8	8	86
	Large	180	256			86
BOULDER	Small	256	362	14	14	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} =	4.0
D_{35} =	15.3
D_{50} =	45.0
D_{84} =	165.3
D_{95} =	319.9
D_{100} =	362.0



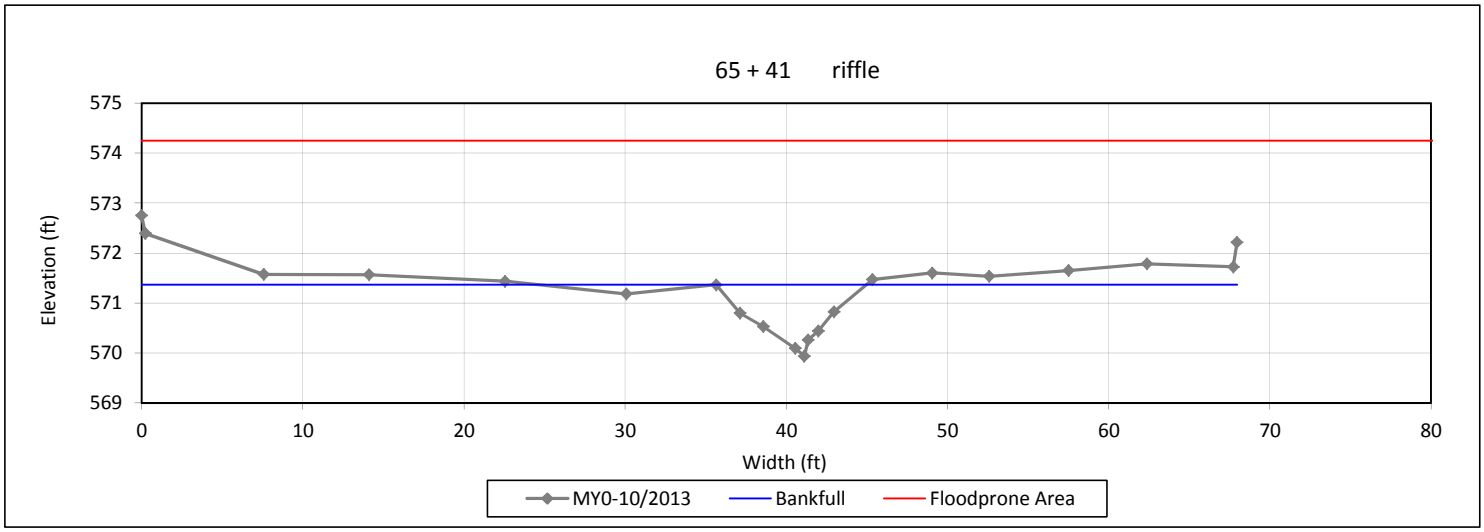


Longitudinal Profile Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SB1
Monitoring Year 0



Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 10- SB1



View Upstream (10/2013)

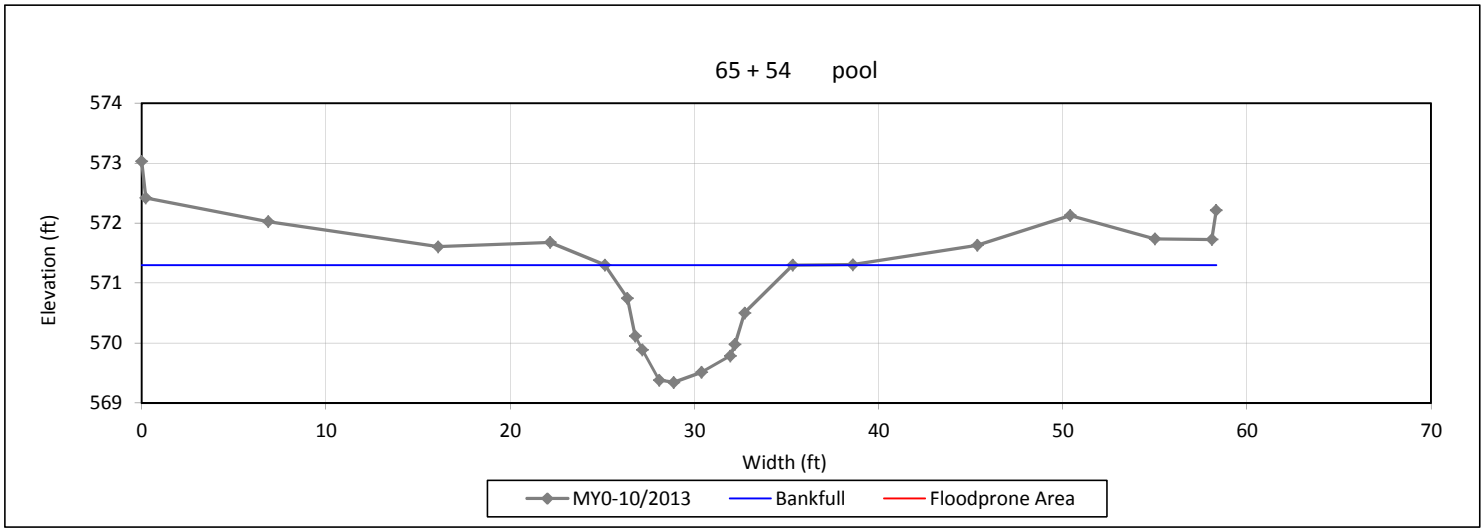
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
6.1	x-section area (ft.sq.)	100.0	W flood prone area (ft)
7.8	width (ft)	12.8	entrenchment ratio
0.8	mean depth (ft)	1.4	low bank height (ft)
1.4	max depth (ft)	1.0	low bank height ratio
8.3	wetted parimeter (ft)		
0.7	hyd radi (ft)		
10.1	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 11- SB1



View Upstream (10/2013)

View Downstream (10/2013)

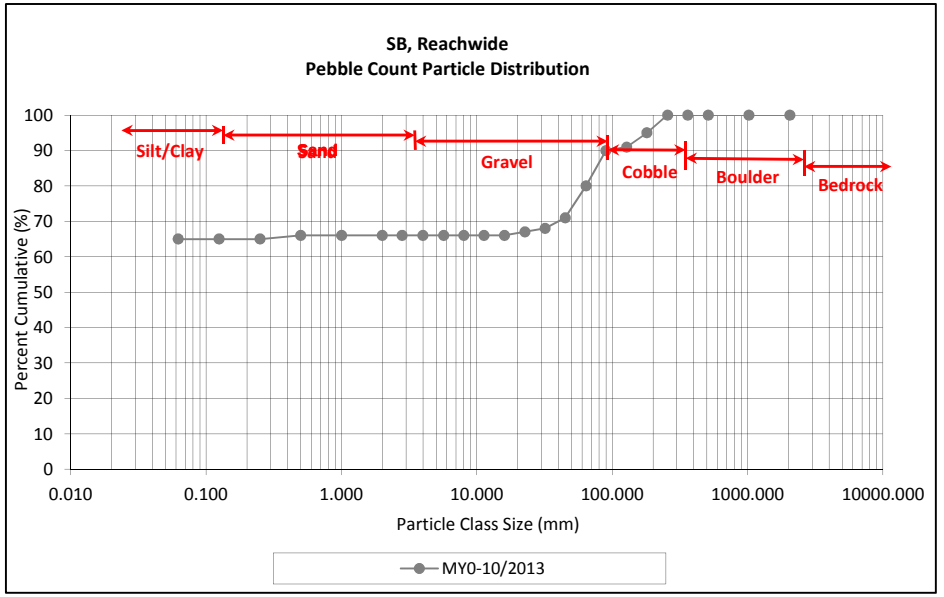
Bankfull Dimensions		Flood Dimensions	
11.6	x-section area (ft.sq.)	---	W flood prone area (ft)
10.2	width (ft)	---	entrenchment ratio
1.1	mean depth (ft)	2.0	low bank height (ft)
2.0	max depth (ft)	1.0	low bank height ratio
11.3	wetted parimeter (ft)		
1.0	hyd radi (ft)		
8.9	width-depth ratio		

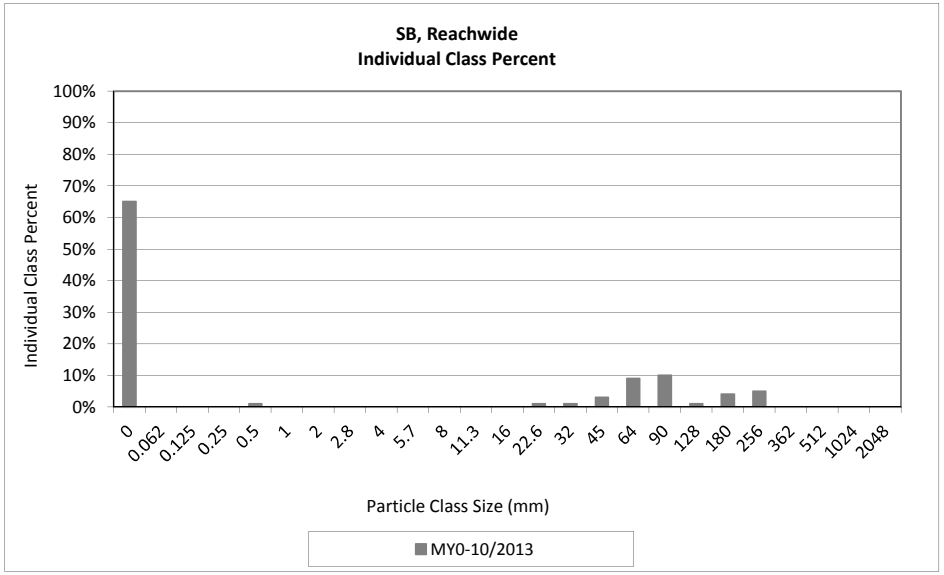
Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Morphological Summary Data and Plots
Reachwide and Cross-Section Pebble Count Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SB, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			SB Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	15	50	65	65	65
SAND	Very fine	0.062	0.125					65
	Fine	0.125	0.250					65
	Medium	0.250	0.500					65
	Coarse	0.5	1.0	1		1	1	66
	Very Coarse	1.0	2.0					66
GRAVEL	Very Fine	2.0	2.8					66
	Very Fine	2.8	4.0					66
	Fine	4.0	5.7					66
	Fine	5.7	8.0					66
	Medium	8.0	11.3					66
	Medium	11.3	16.0					66
	Coarse	16.0	22.6					66
	Coarse	22.6	32	1		1	1	67
	Very Coarse	32	45	1		1	1	68
	Very Coarse	45	64	3		3	3	71
COBBLE	Small	64	90	9		9	9	80
	Small	90	128	10		10	10	90
	Large	128	180	1		1	1	91
	Large	180	256	4		4	4	95
BOULDER	Small	256	362	5		5	5	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	silt/clay
D_{35} =	silt/clay
D_{50} =	silt/clay
D_{84} =	103.6
D_{95} =	256.0
D_{100} =	362.0

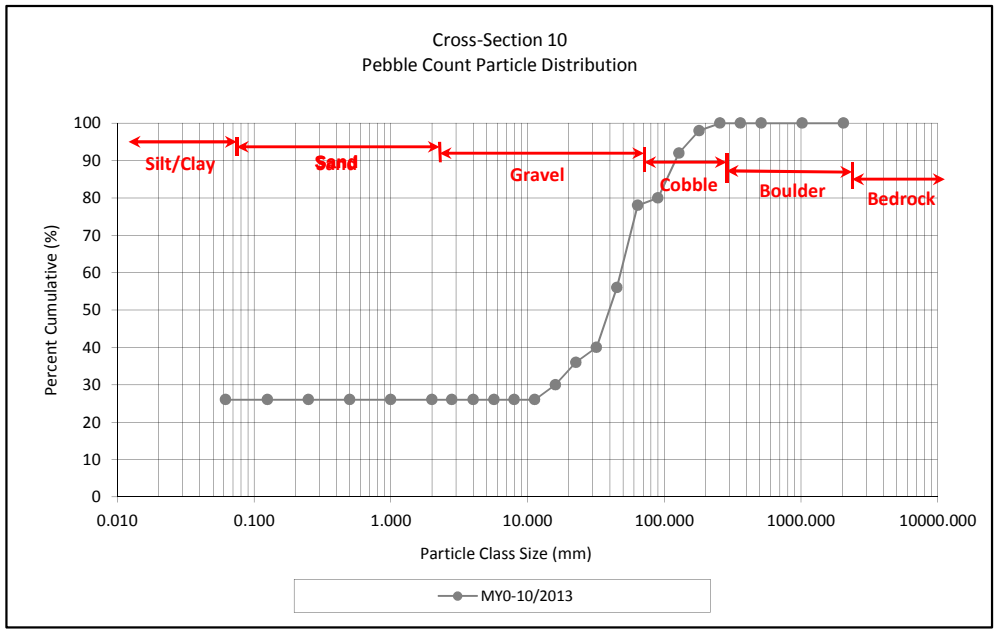


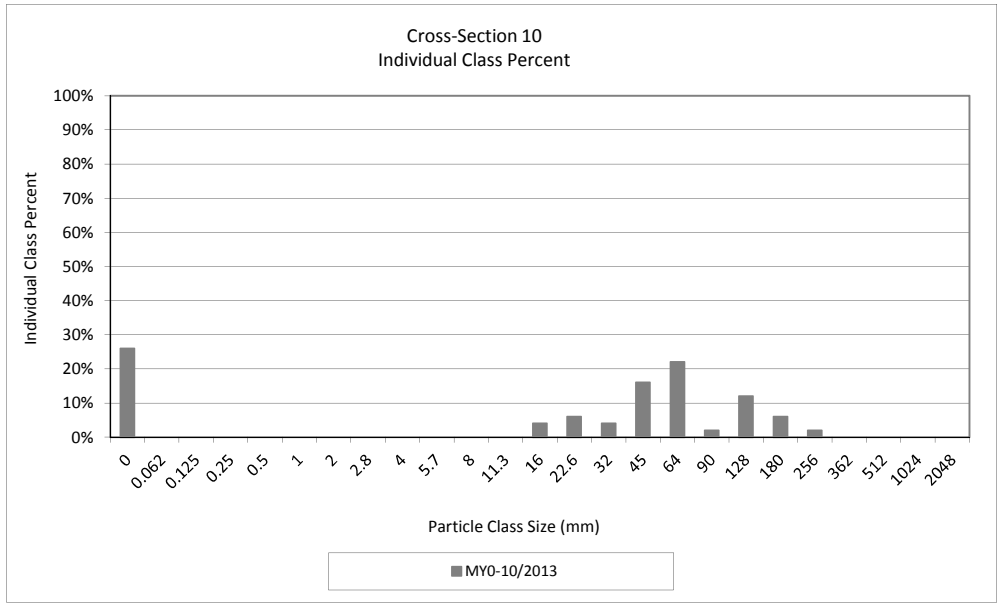


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SB, Cross-Section 10
Monitoring Year 0

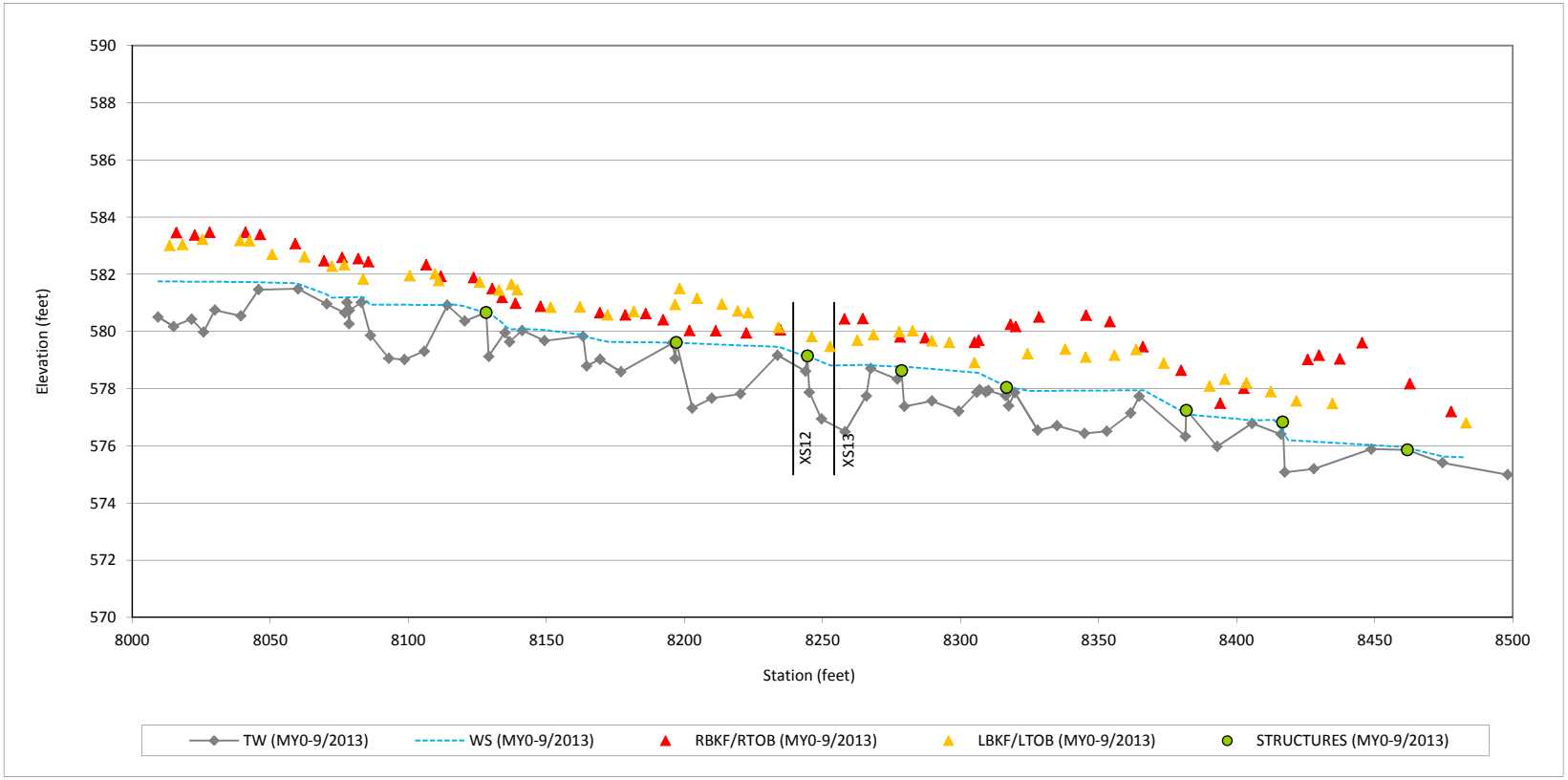
Particle Class		Diameter (mm)		Particle Count	Cross-Section 10 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	26	26	26
SAND	Very fine	0.062	0.125			26
	Fine	0.125	0.250			26
	Medium	0.250	0.500			26
	Coarse	0.5	1.0			26
	Very Coarse	1.0	2.0			26
GRAVEL	Very Fine	2.0	2.8			26
	Very Fine	2.8	4.0			26
	Fine	4.0	5.7			26
	Fine	5.7	8.0			26
	Medium	8.0	11.3			26
	Medium	11.3	16.0			26
	Coarse	16.0	22.6	4	4	30
	Coarse	22.6	32	6	6	36
	Very Coarse	32	45	4	4	40
	Very Coarse	45	64	16	16	56
COBBLE	Small	64	90	22	22	78
	Small	90	128	2	2	80
	Large	128	180	12	12	92
	Large	180	256	6	6	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 10	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	30.2
D_{50} =	56.1
D_{84} =	143.4
D_{95} =	214.7
D_{100} =	362.0



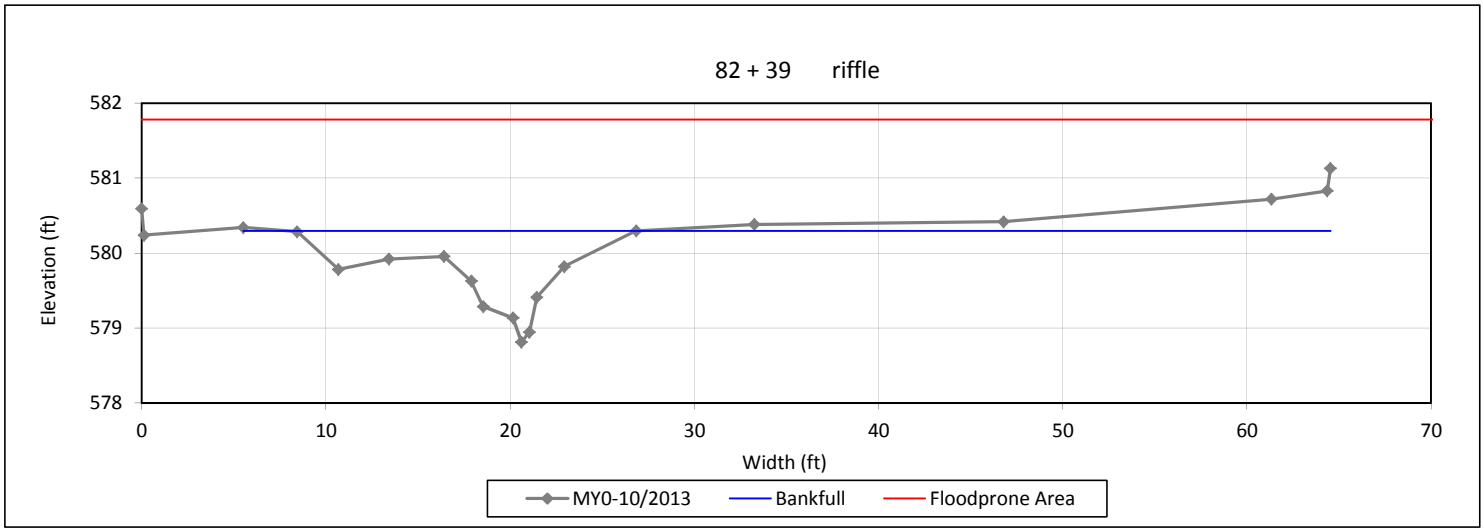


Longitudinal Profile Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SE1
Monitoring Year 0



Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 12 - SE1



View Upstream (10/2013)

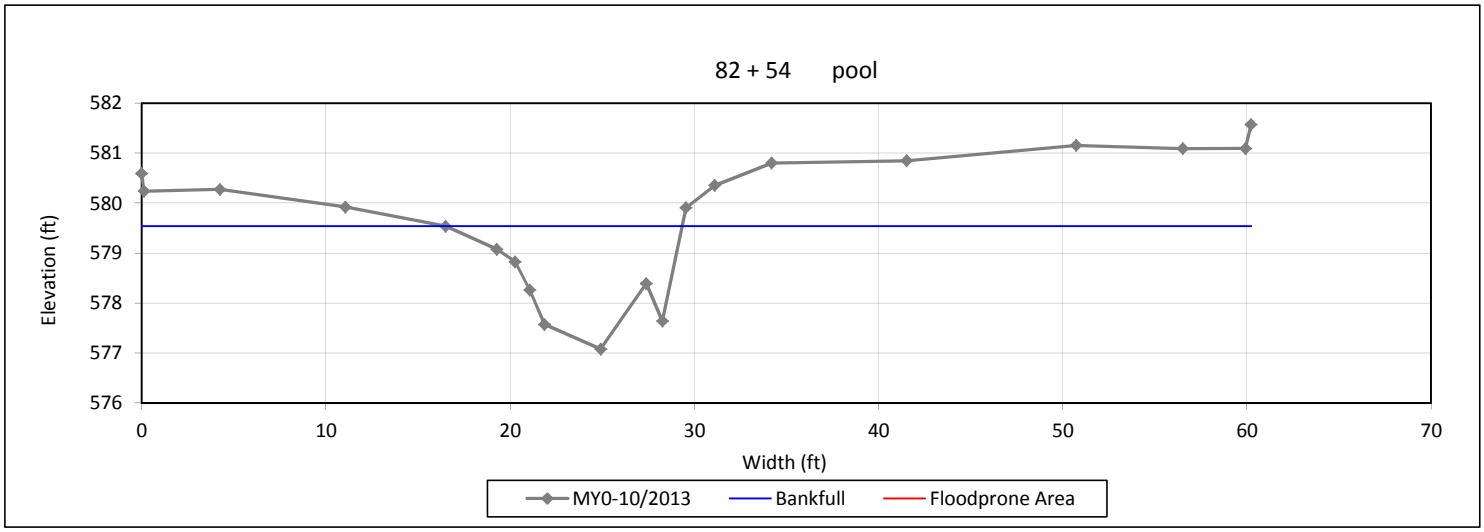
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
9.6	x-section area (ft.sq.)	75.0	W flood prone area (ft)
19.0	width (ft)	3.9	entrenchment ratio
0.5	mean depth (ft)	1.5	low bank height (ft)
1.5	max depth (ft)	1.0	low bank height ratio
19.6	wetted parimeter (ft)		
0.5	hyd radi (ft)		
37.7	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 13 - SE1



View Upstream (10/2013)

View Downstream (10/2013)

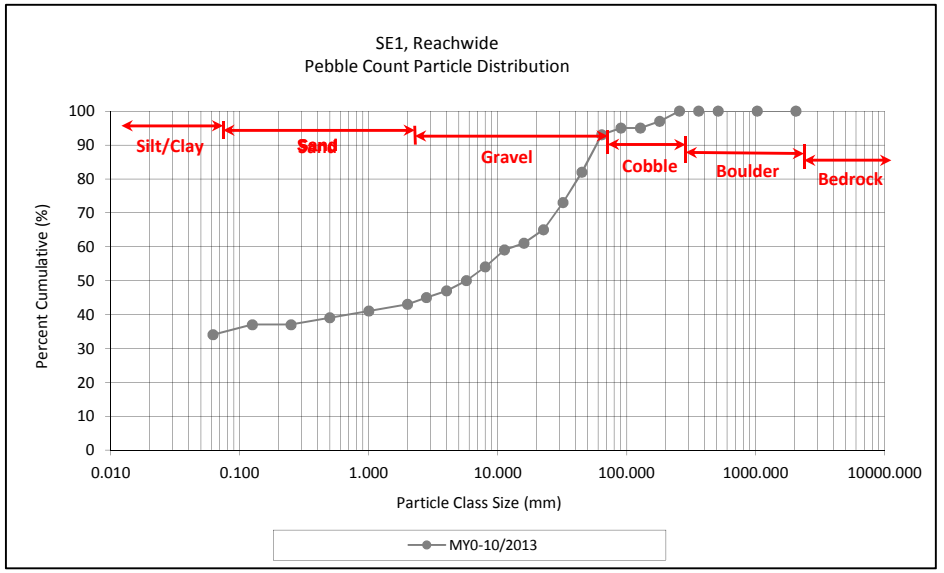
Bankfull Dimensions		Flood Dimensions	
16.9	x-section area (ft.sq.)	---	W flood prone area (ft)
12.8	width (ft)	---	entrenchment ratio
1.3	mean depth (ft)	2.8	low bank height (ft)
2.5	max depth (ft)	1.2	low bank height ratio
15.1	wetted parimeter (ft)		
1.1	hyd radi (ft)		
9.8	width-depth ratio		

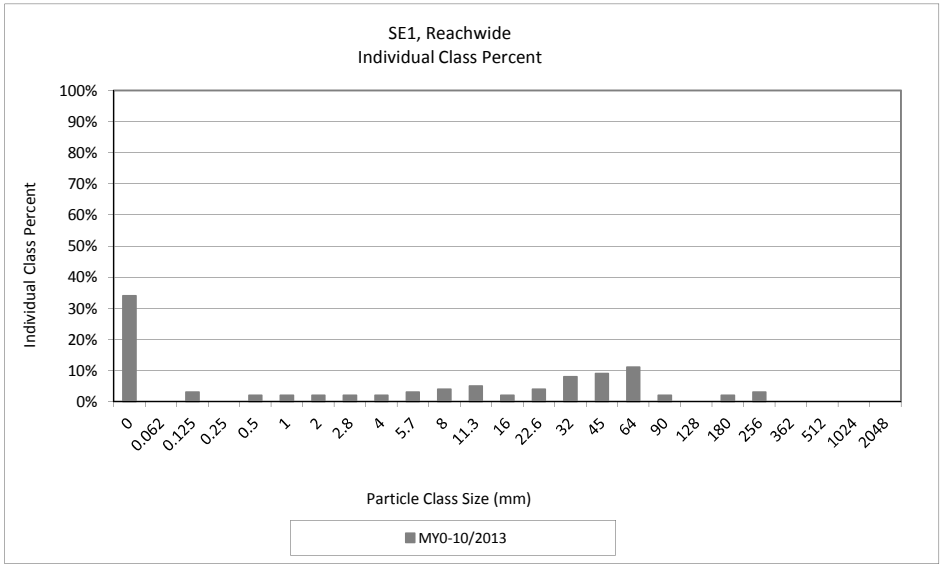
Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Reachwide and Cross-Section Pebble Count Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SE1, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			SE1 Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		34	34	34	34
SAND	Very fine	0.062	0.125					34
	Fine	0.125	0.250		3	3	3	37
	Medium	0.250	0.500					37
	Coarse	0.5	1.0		2	2	2	39
	Very Coarse	1.0	2.0		2	2	2	41
GRAVEL	Very Fine	2.0	2.8	1	1	2	2	43
	Very Fine	2.8	4.0	1	1	2	2	45
	Fine	4.0	5.7	1	1	2	2	47
	Fine	5.7	8.0		3	3	3	50
	Medium	8.0	11.3	4		4	4	54
	Medium	11.3	16.0	4	1	5	5	59
	Coarse	16.0	22.6	1	1	2	2	61
	Coarse	22.6	32	4		4	4	65
	Very Coarse	32	45	8		8	8	73
	Very Coarse	45	64	9		9	9	82
COBBLE	Small	64	90	10	1	11	11	93
	Small	90	128	2		2	2	95
	Large	128	180					95
	Large	180	256	2		2	2	97
BOULDER	Small	256	362	3		3	3	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	silt/clay
D_{35} =	0.2
D_{50} =	8.0
D_{84} =	68.1
D_{95} =	180.0
D_{100} =	362.0

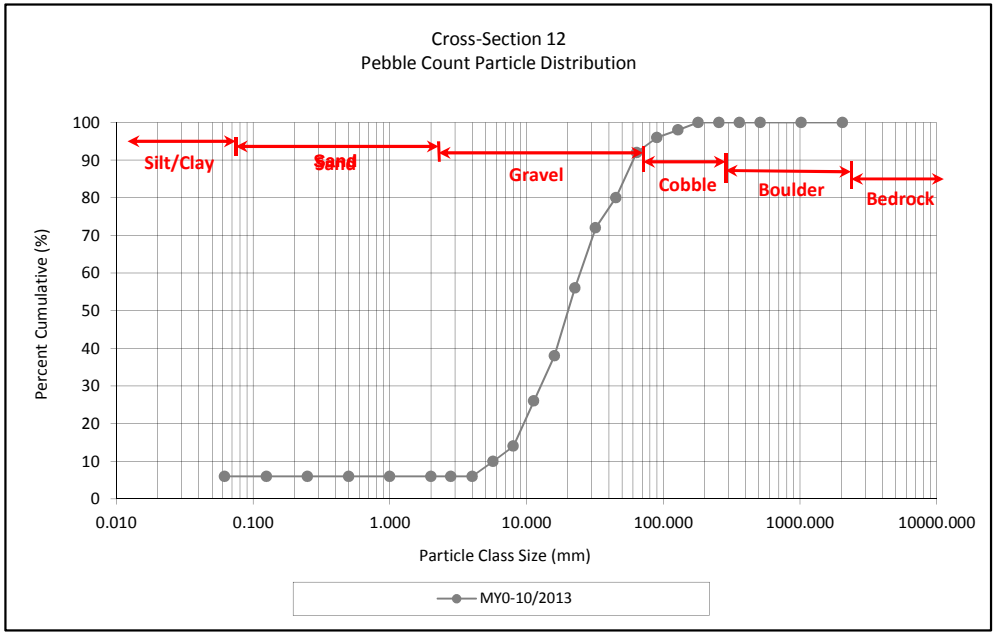


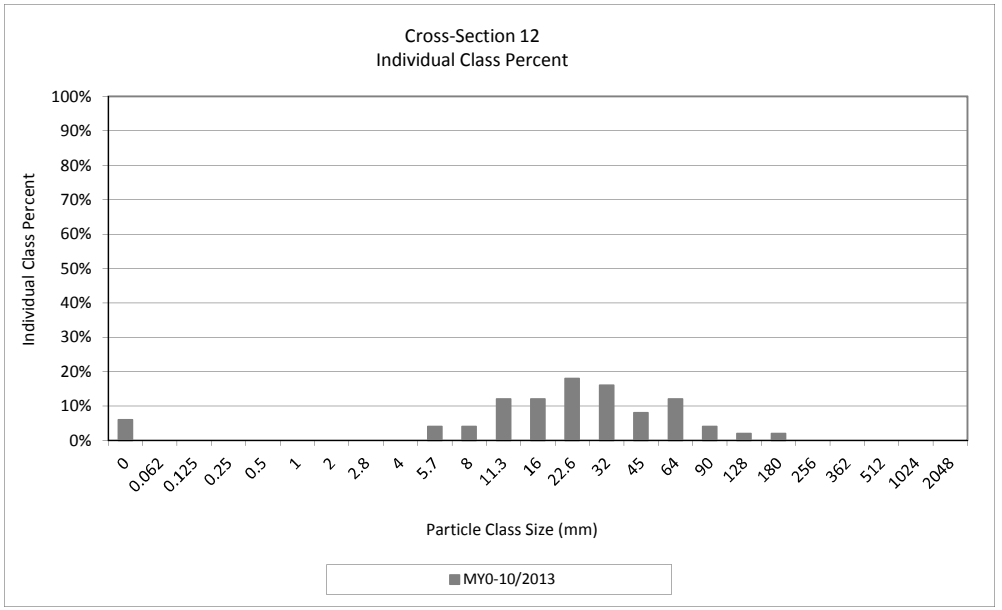


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SE1, Cross-Section 12
Monitoring Year 0

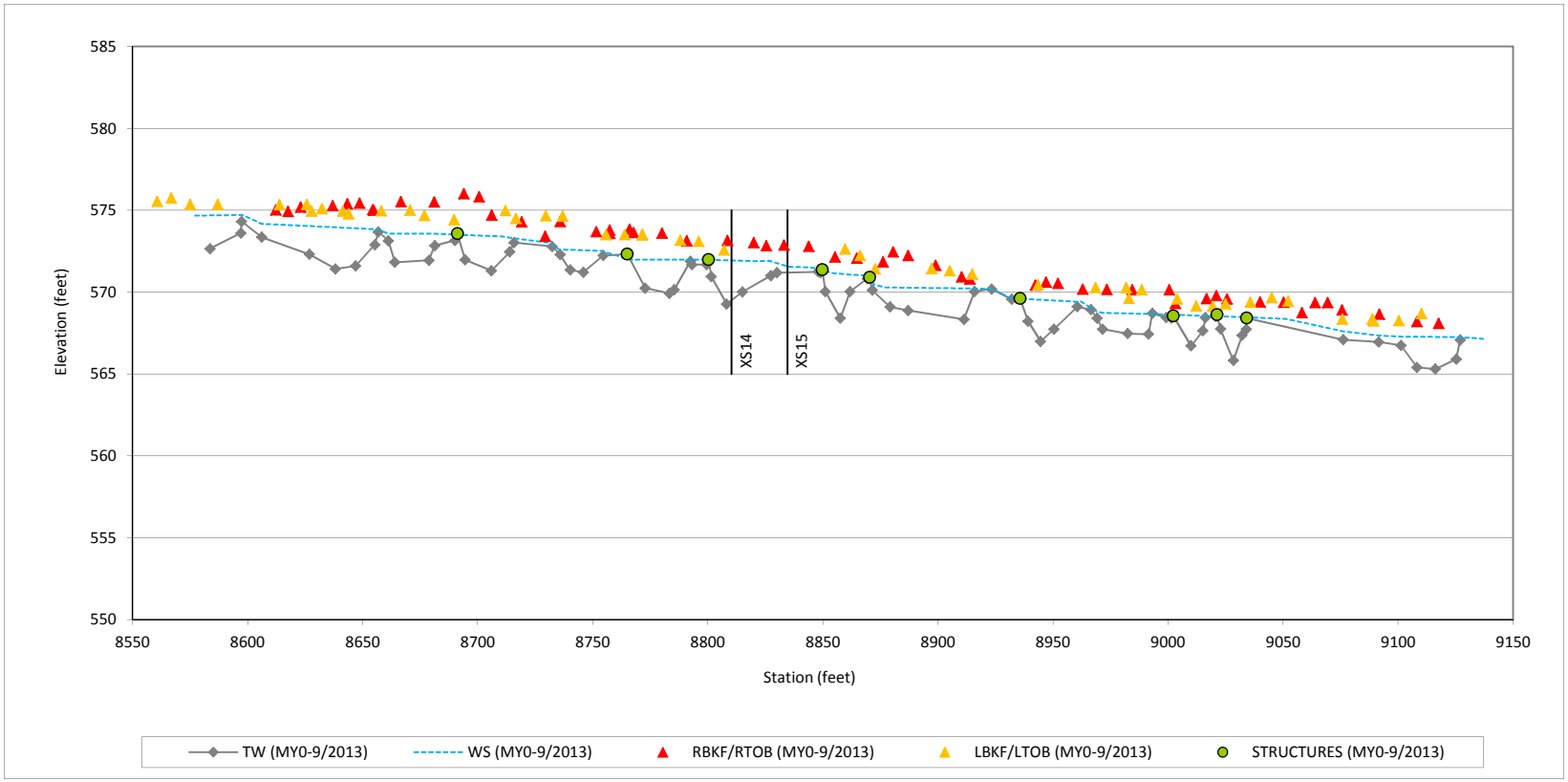
Particle Class		Diameter (mm)		Particle Count	Cross-Section 12 Summary	
		min	max	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.250	0.500			6
	Coarse	0.5	1.0			6
	Very Coarse	1.0	2.0			6
GRAVEL	Very Fine	2.0	2.8			6
	Very Fine	2.8	4.0			6
	Fine	4.0	5.7			6
	Fine	5.7	8.0	4	4	10
	Medium	8.0	11.3	4	4	14
	Medium	11.3	16.0	12	12	26
	Coarse	16.0	22.6	12	12	38
	Coarse	22.6	32	18	18	56
	Very Coarse	32	45	16	16	72
	Very Coarse	45	64	8	8	80
COBBLE	Small	64	90	12	12	92
	Small	90	128	4	4	96
	Large	128	180	2	2	98
	Large	180	256	2	2	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 12	
Channel materials (mm)	
D_{16} =	11.7
D_{35} =	20.7
D_{50} =	28.5
D_{84} =	71.7
D_{95} =	117.2
D_{100} =	256.0

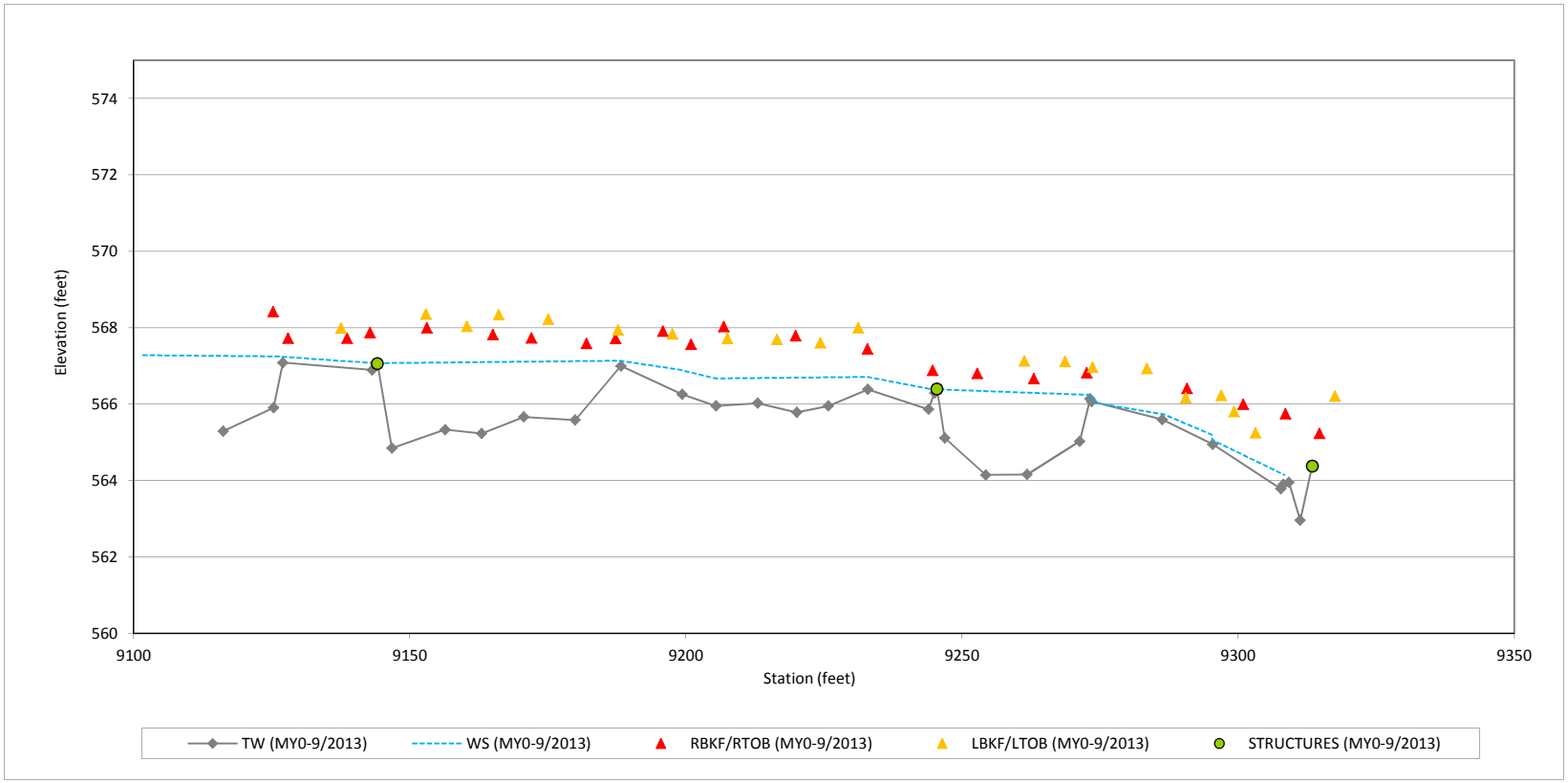




Longitudinal Profile Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SE2a
Monitoring Year 0

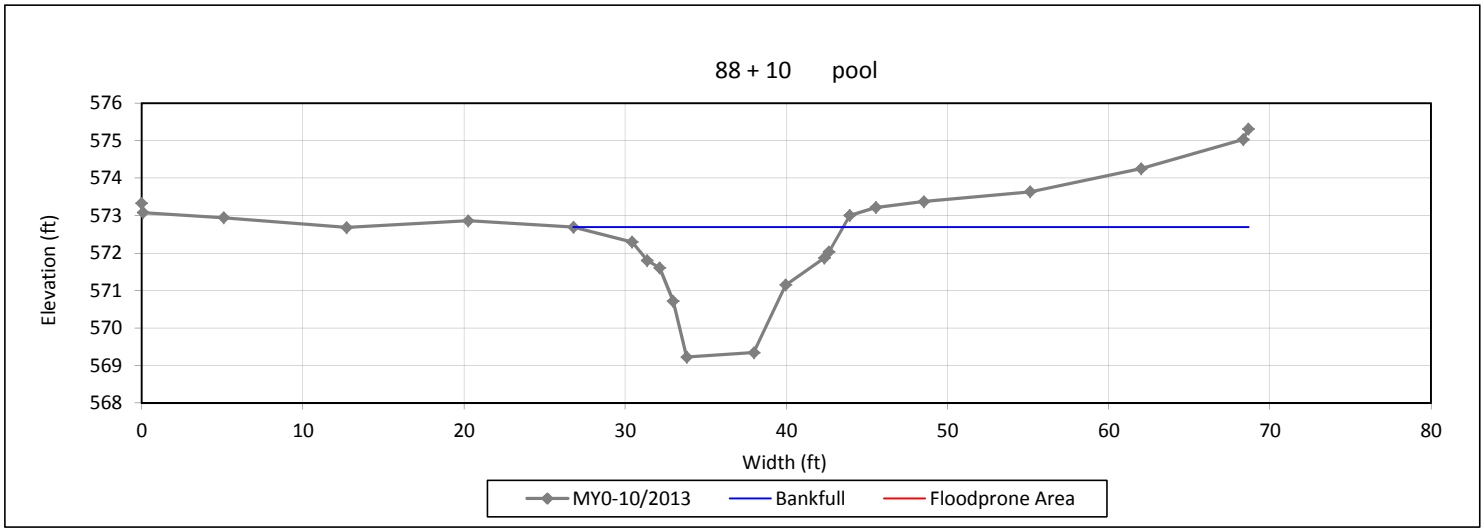


Longitudinal Profile Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SE2b
Monitoring Year 0



Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 14 - SE2



View Upstream (10/2013)

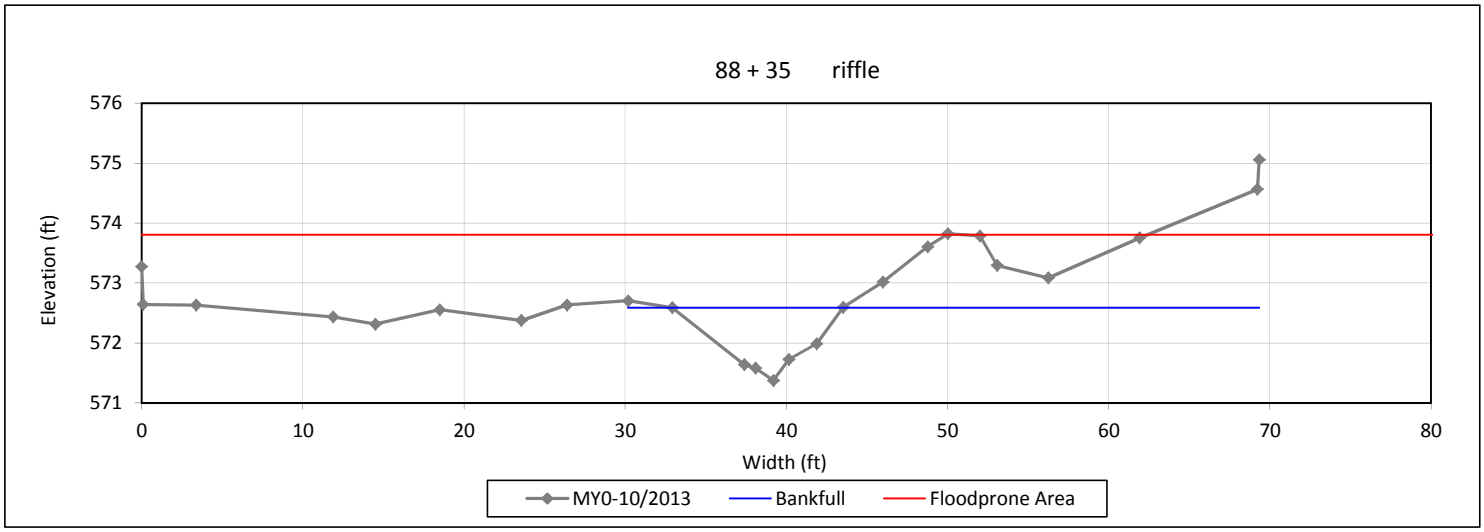
View Downstream (10/2013)

Bankfull Dimensions		Flood Dimensions	
28.0	x-section area (ft.sq.)	---	W flood prone area (ft)
16.7	width (ft)	---	entrenchment ratio
1.7	mean depth (ft)	3.5	low bank height (ft)
3.5	max depth (ft)	1.0	low bank height ratio
19.2	wetted parimeter (ft)		
1.5	hyd radi (ft)		
10.0	width-depth ratio		

Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Cross-Section Plots
Byrds Creek Mitigation Site
EEP Project No. 95020
Monitoring Year 0

Cross Section 15 - SE2



View Upstream (10/2013)

View Downstream (10/2013)

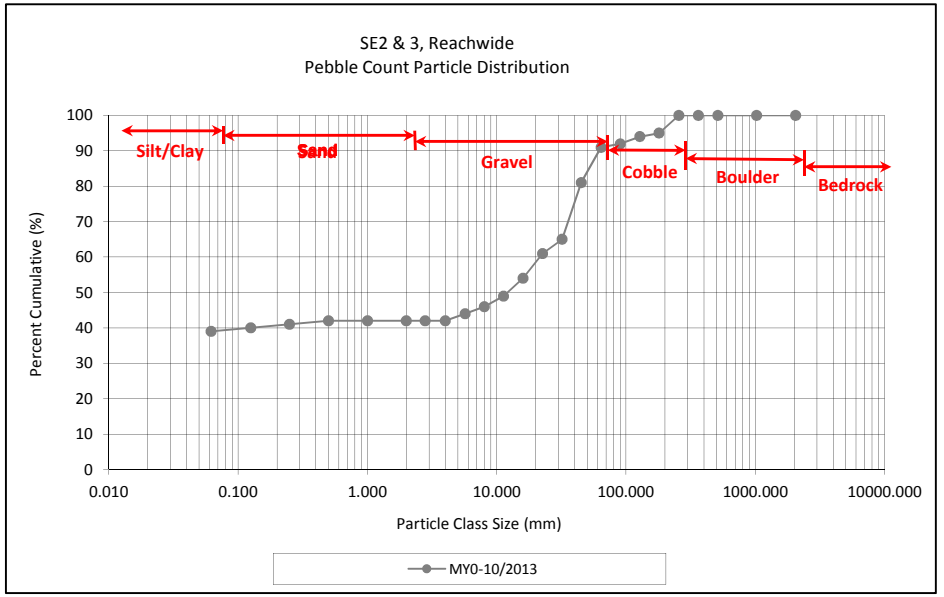
Bankfull Dimensions		Flood Dimensions	
6.8	x-section area (ft.sq.)	100.0	W flood prone area (ft)
10.6	width (ft)	9.4	entrenchment ratio
0.6	mean depth (ft)	1.2	low bank height (ft)
1.2	max depth (ft)	1.0	low bank height ratio
10.9	wetted parimeter (ft)		
0.6	hyd radi (ft)		
16.5	width-depth ratio		

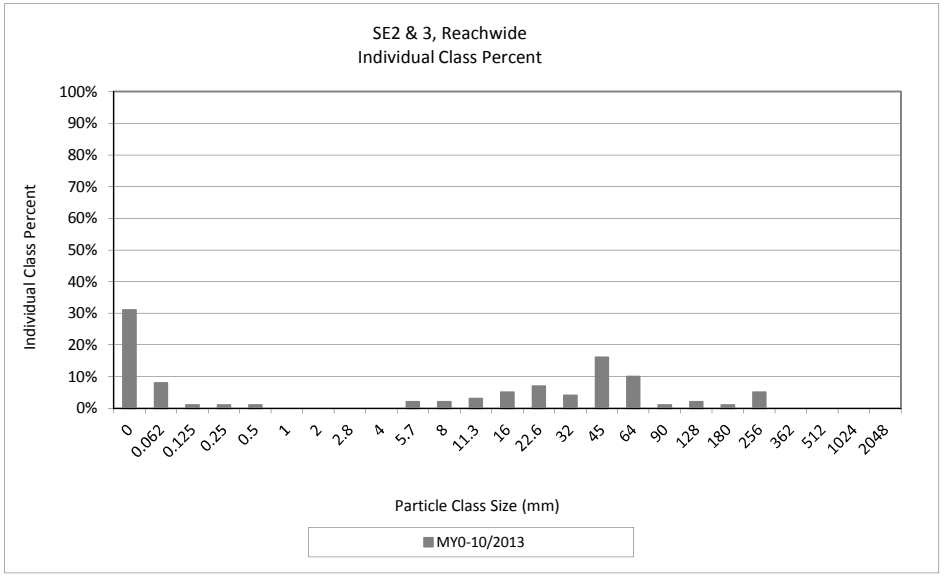
Survey Date: 9/2013
Field Crew: N.State Environmental (D.Allen)

Reachwide and Cross-Section Pebble Count Plots
Byrds Creek Mitigation Site (NCEEP Project No. 94641)
SE 2 and 3, Reachwide
Monitoring Year 0

Particle Class		Diameter (mm)		Particle Count			SE2 & 3 Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	30	1	31	31	31
SAND	Very fine	0.062	0.125	8		8	8	39
	Fine	0.125	0.250		1	1	1	40
	Medium	0.250	0.500		1	1	1	41
	Coarse	0.5	1.0		1	1	1	42
	Very Coarse	1.0	2.0					42
GRAVEL	Very Fine	2.0	2.8					42
	Very Fine	2.8	4.0					42
	Fine	4.0	5.7					42
	Fine	5.7	8.0		2	2	2	44
	Medium	8.0	11.3	1	1	2	2	46
	Medium	11.3	16.0	1	2	3	3	49
	Coarse	16.0	22.6	3	2	5	5	54
	Coarse	22.6	32	1	6	7	7	61
	Very Coarse	32	45	1	3	4	4	65
	Very Coarse	45	64	1	15	16	16	81
COBBLE	Small	64	90	1	9	10	10	91
	Small	90	128		1	1	1	92
	Large	128	180		2	2	2	94
	Large	180	256		1	1	1	95
BOULDER	Small	256	362	3	2	5	5	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	silt/clay
D_{35} =	0.1
D_{50} =	17.1
D_{84} =	70.9
D_{95} =	256.0
D_{100} =	362.0

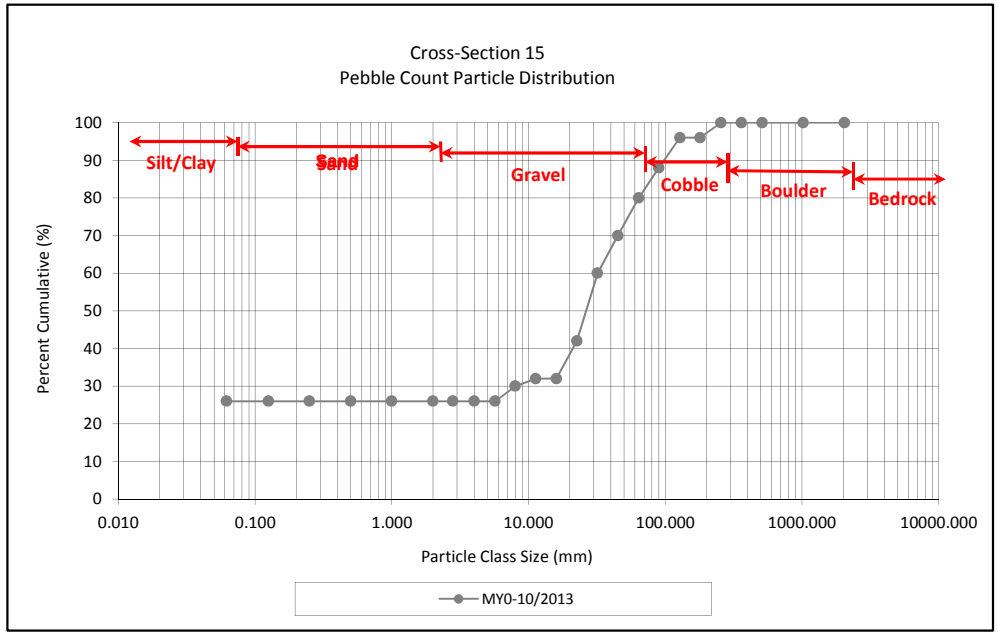


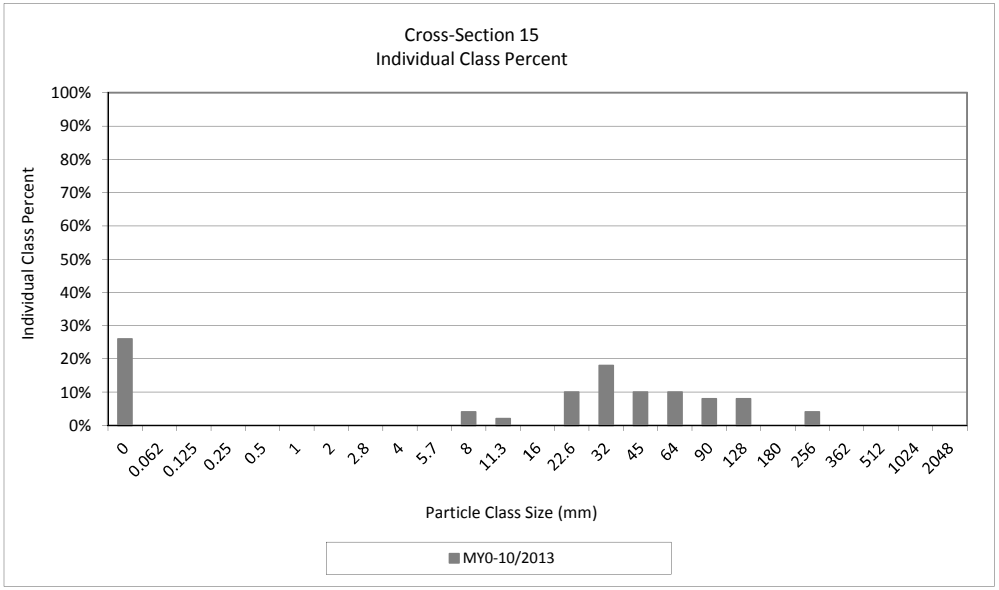


Reachwide and Cross-Section Substrate Plots
Byrds Creek Mitigation Site (NCEEP Project No. 95020)
SE2, Cross-Section 15
Monitoring Year 0

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	13	26	26
SAND	Very fine	0.062	0.125			26
	Fine	0.125	0.250			26
	Medium	0.250	0.500			26
	Coarse	0.5	1.0			26
	Very Coarse	1.0	2.0			26
GRAVEL	Very Fine	2.0	2.8			26
	Very Fine	2.8	4.0			26
	Fine	4.0	5.7			26
	Fine	5.7	8.0			26
	Medium	8.0	11.3	2	4	30
	Medium	11.3	16.0	1	2	32
	Coarse	16.0	22.6			32
	Coarse	22.6	32	5	10	42
	Very Coarse	32	45	9	18	60
	Very Coarse	45	64	5	10	70
COBBLE	Small	64	90	5	10	80
	Small	90	128	4	8	88
	Large	128	180	4	8	96
	Large	180	256			96
BOULDER	Small	256	362	2	4	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	50	100	100

Cross-Section 15	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	25.1
D_{50} =	37.2
D_{84} =	107.3
D_{95} =	172.5
D_{100} =	362.0





Stream Photographs

	
Photo Point 1 – looking upstream (10/15/2013)	Photo Point 1 – looking downstream (10/15/2013)
	
Photo Point 2 – looking upstream (10/15/2013)	Photo Point 2 – looking downstream (10/15/2013)
	
Photo Point 3 – looking upstream (10/15/2013	Photo Point 3 – looking downstream (10/15/2013)

	
Photo Point 4 – looking upstream (10/15/2013)	Photo Point 4 – looking downstream (10/15/2013)
	
Photo Point 5 – looking upstream (10/15/2013)	Photo Point 5 – looking downstream (10/15/2013)

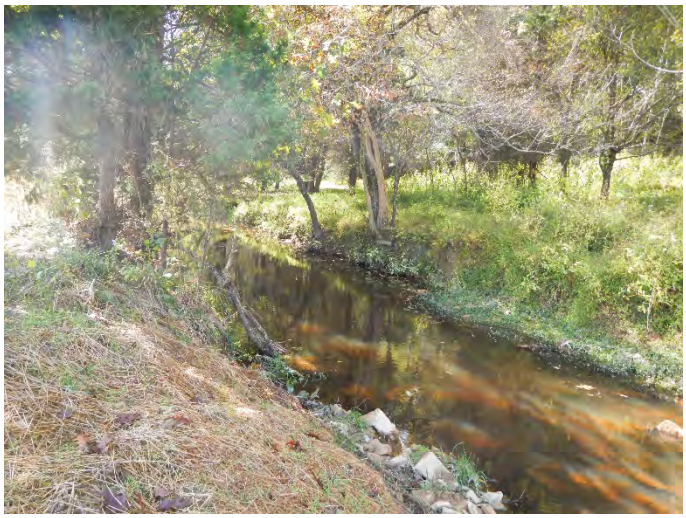



Photo Point 6 – looking upstream (10/15/2013)	Photo Point 6 – looking downstream (10/15/2013)

	
Photo Point 7 – looking upstream (10/15/2013)	Photo Point 7 – looking downstream (10/15/2013)
	
Photo Point 8 – looking upstream (10/15/2013)	Photo Point 8 – looking downstream (10/15/2013)
	
Photo Point 9 – looking upstream (10/15/2013)	Photo Point 9 – looking downstream (10/15/2013)

	
Photo Point 10 – looking upstream (10/15/2013)	Photo Point 10 – looking downstream (10/15/2013)
	
Photo Point 11 – looking upstream (10/15/2013)	Photo Point 11 – looking downstream (10/15/2013)
	
Photo Point 12 – looking upstream (10/15/2013)	Photo Point 12 – looking downstream (10/15/2013)

	
Photo Point 13 – looking upstream (10/15/2013)	Photo Point 13 – looking downstream (10/15/2013)
	
Photo Point 14 – looking upstream (10/15/2013)	Photo Point 14 – looking downstream (10/15/2013)
	
Photo Point 15 – looking upstream (10/15/2013)	Photo Point 15 – looking downstream (10/15/2013)

Photo Point 16 – looking upstream (10/15/2013)

Photo Point 16 – looking downstream (10/15/2013)

Photo Point 19 – looking downstream (10/15/2013)

Photo Point 20 – looking upstream (10/15/2013)

Photo Point 20 – looking upstream (10/15/2013)

	
Photo Point 21 – looking upstream (10/15/2013)	Photo Point 21 – looking downstream (10/15/2013)
	
Photo Point 22 – looking upstream (10/15/2013)	Photo Point 22 – looking downstream (10/15/2013)
	
Photo Point 23 – looking upstream (10/15/2013)	Photo Point 23 – looking downstream (10/15/2013)

	
Photo Point 24 – looking upstream (10/15/2013)	Photo Point 24 – looking downstream (10/15/2013)
	
Photo Point 25 – looking upstream (01/22/2013)	Photo Point 25 – looking downstream (01/22/2013)
	
Photo Point 26 – looking upstream (10/15/2013)	Photo Point 26 – looking downstream (10/15/2013)

	
Photo Point 27 – looking upstream (10/15/2013)	Photo Point 27 – looking downstream (10/15/2013)
	
Photo Point 28 – looking upstream (10/15/2013)	Photo Point 28 – looking downstream (10/15/2013)
	
Photo Point 29 – looking upstream (10/15/2013)	Photo Point 29 – looking downstream (10/15/2013)

	
Photo Point 30 – looking upstream (10/15/2013)	Photo Point 30 – looking downstream (10/15/2013)
	
Photo Point 31 – looking upstream (10/15/2013)	Photo Point 31 – looking downstream (10/15/2013)
	
Photo Point 32 – looking upstream (10/15/2013)	Photo Point 32– looking downstream (10/15/2013)

	
Photo Point 33 – looking upstream (10/15/2013)	Photo Point 33 – looking downstream (10/15/2013)
	
Photo Point 34 – looking upstream (10/15/2013)	Photo Point 34 – looking downstream (10/15/2013)
	
Photo Point 35 – looking upstream (02/12/2013)	Photo Point 35 – looking downstream (02/12/2013)

	
Photo Point 36 – looking upstream (10/15/2013)	Photo Point 36 – looking downstream (10/15/2013)

APPENDIX 3. Vegetation Plot Data

Table 7. Planted and Total Stem Counts
Byrds Creek Mitigation Site (EEP Project No. 95020)
Baseline Monitoring

			Current Plot Data (MY0 2014)																												
			95020-01-0001			95020-01-0002			95020-01-0003			95020-01-0004			95020-01-0005			95020-01-0006			95020-01-0007			95020-01-0008			95020-01-0009			95020-01-0010		
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	2	2	2				2	2	2	4	4	4	3	3	3	4	4	4	4	4	4	2	2	2
Carpinus caroliniana	American hornbeam	Tree				1	1	1	2	2	2	1	1	1										2	2	2	1	1	1			
Fraxinus pennsylvanica	green ash	Tree	3	3	3	7	7	7	10	10	10	14	14	14	1	1	1	3	3	3	3	3	3	1	1	1	4	4	4	9	9	9
Liriodendron tulipifera	tuliptree	Tree	3	3	3	4	4	4	2	2	2	1	1	1	5	5	5	4	4	4	4	4	4	2	2	2	7	7	7	3	3	3
Platanus occidentalis	American sycamore	Tree	3	3	3	1	1	1	2	2	2	1	1	1	8	8	8	2	2	2	4	4	4	4	4	4				1	1	1
Quercus michauxii	swamp chestnut oak	Tree	2	2	2	1	1	1							1	1	1	3	3	3	1	1	1	3	3	3	2	2	2			
Quercus phellos	willow oak	Tree				2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
Quercus rubra	northern red oak	Tree	2	2	2	1	1	1	1	1	1							1	1	1	2	2	2	1	1	1				3	3	3
		Stem count	17	17	17	18	18	18	21	21	21	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
		size (ACRES)	0.025			0.025			0.025			0.025			0.025			0.025			0.025			0.025			0.025			0.025		
		Species count	6	6	6	8	8	8	7	7	7	5	5	5	6	6	6	7	7	7	7	7	7	8	8	8	5	5	5	5	5	5
		Stems per ACRE	688	688	688	728	728	728	850	850	850	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728	728

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
Byrds Creek Mitigation Site (EEP Project No. 95020)
Baseline Monitoring

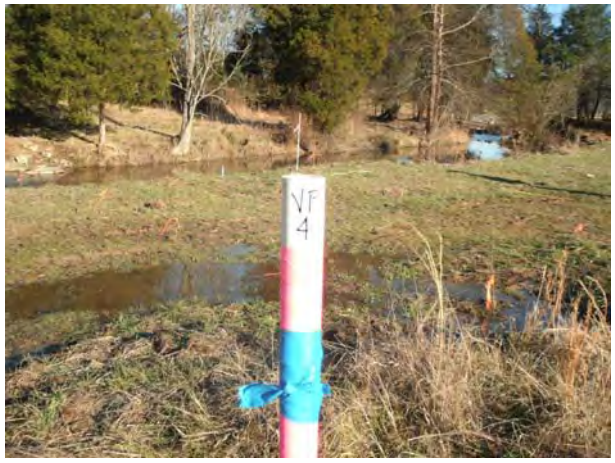
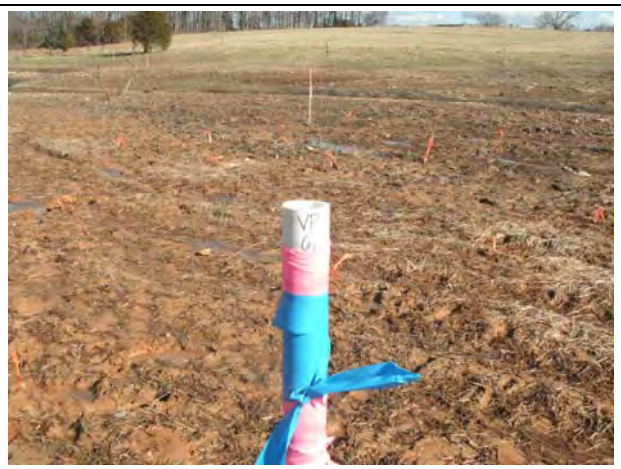
			Current Plot Data (MY0 2014)												Annual Summary		
			95020-01-0011			95020-01-0012			95020-01-0013			95020-01-0014			MY0 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree	3	3	3	5	5	5	4	4	4	3	3	3	41	41	41
Carpinus caroliniana	American hornbeam	Tree	2	2	2				1	1	1	2	2	2	12	12	12
Fraxinus pennsylvanica	green ash	Tree	4	4	4	2	2	2	4	4	4	7	7	7	72	72	72
Liriodendron tulipifera	tuliptree	Tree	5	5	5	3	3	3	3	3	3	3	3	3	49	49	49
Platanus occidentalis	American sycamore	Tree				4	4	4	2	2	2				32	32	32
Quercus michauxii	swamp chestnut oak	Tree	3	3	3	1	1	1	1	1	1	1	1	1	19	19	19
Quercus phellos	willow oak	Tree				2	2	2	2	2	2				13	13	13
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	1	1	1	2	2	2	16	16	16
		Stem count	18	18	18	18	18	18	18	18	18	18	18	18	254	254	254
		size (ACRES)	0.025			0.025			0.025			0.025			0.346		
		Species count	6	6	6	7	7	7	8	8	8	6	6	6	8	8	8
		Stems per ACRE	728	728	728	728	728	728	728	728	728	728	728	728	734	734	734

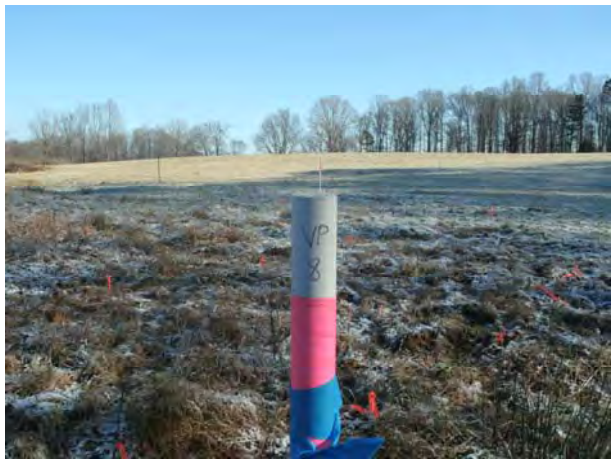
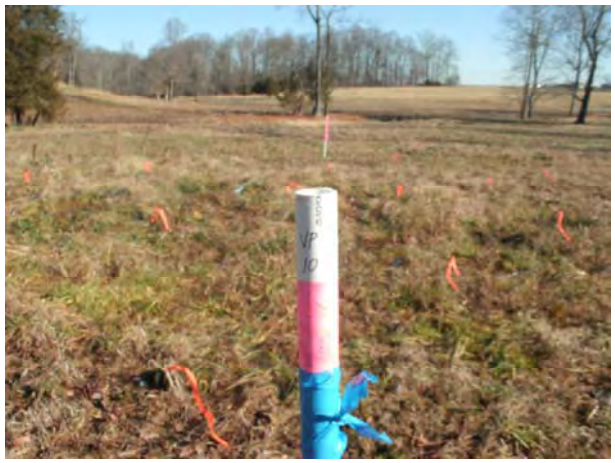
Color for Density

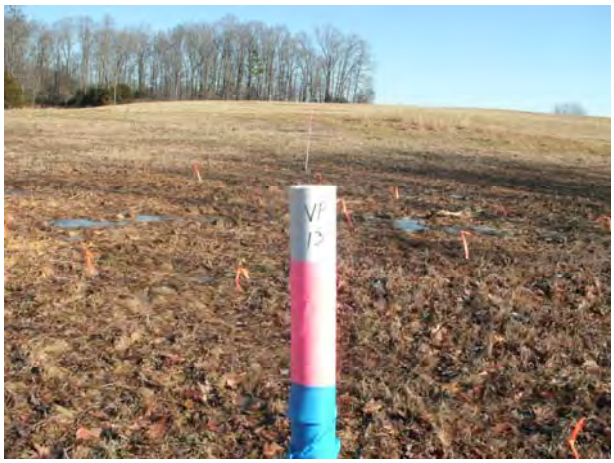
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%
Volunteer species included in total

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 (01/15/2014)	Vegetation Plot 2 (01/15/2014)
	
Vegetation Plot 3 (01/15/2014)	Vegetation Plot 4 (01/15/2014)
	
Vegetation Plot 5 (01/15/2014)	Vegetation Plot 6 (01/15/2014)

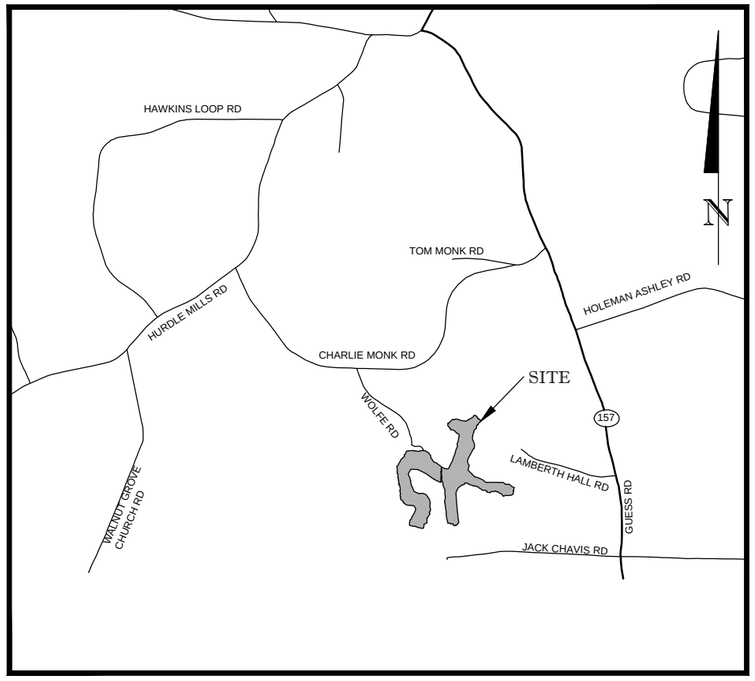
	
Vegetation Plot 7 (01/15/2014)	Vegetation Plot 8 (01/15/2014)
	
Vegetation Plot 9 (01/15/2014)	Vegetation Plot 10 (01/15/2014)
	
Vegetation Plot 11 (01/15/2014)	Vegetation Plot 12 (01/15/2014)

	
Vegetation Plot 13 (01/15/2014)	Vegetation Plot 14 (01/15/2014)

APPENDIX 4. As-Built Plan Sheets

Byrds Creek Stream Restoration Project

Person County, NC
for
North Carolina Ecosystem Enhancement Program



Vicinity Map
Not to Scale

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

Directions to Project Site

The Site is located in southwestern Person County, southwest of Roxboro. From Roxboro take Route 157 south 9.8 miles. Turn right on Charlie Monk Road. Travel 1.0 miles and turn left on Wolfe Road. Travel 0.4 miles to the end of Wolfe Road. The project site is located south and east of the end of Wolfe Road and is bound by Route 157 to the west and Walnut Grove Church Road to the east.

Baseline Drawing Issued
January 27, 2014

Stream Origins

Stream	Latitude	Longitude
Byrds Creek	N 36° 14' 40.01"	W 79° 02' 50.77"
South Branch	N 36° 14' 40.09"	W 79° 02' 40.89"
Southeast Branch	N 36° 14' 46.45"	W 79° 02' 28.46"
West Branch	N 36° 15' 00.74"	W 79° 02' 42.13"

Sheet Index

Title Sheet	0.1
Legend	0.2
Stream Baseline Overview	1.0
Stream Baseline Plans	2.1-2.13

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
5605 Chapel Hill Road
Suite 122
Raleigh, NC 27607
Jeff Keaton, PE
919-851-9986

Surveying:
North State Environmental
2889 Lowery Street
Winston Salem, NC 27101
David K. Alley, PLS
336-245-1248

Owner:
NC Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652
Perry Sugg
919.715.1359

Contractor:
North State Environmental
2889 Lowery Street
Winston Salem, NC 27101
336-725-2010

EEP Project No. 95020

DENR Contract No. 003987

WILDLANDS ENGINEERING
5605 Chapel Hill Road, Ste 122
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Byrds Creek Stream Restoration Project
Person County, NC

Title Sheet

Baseline Drawing

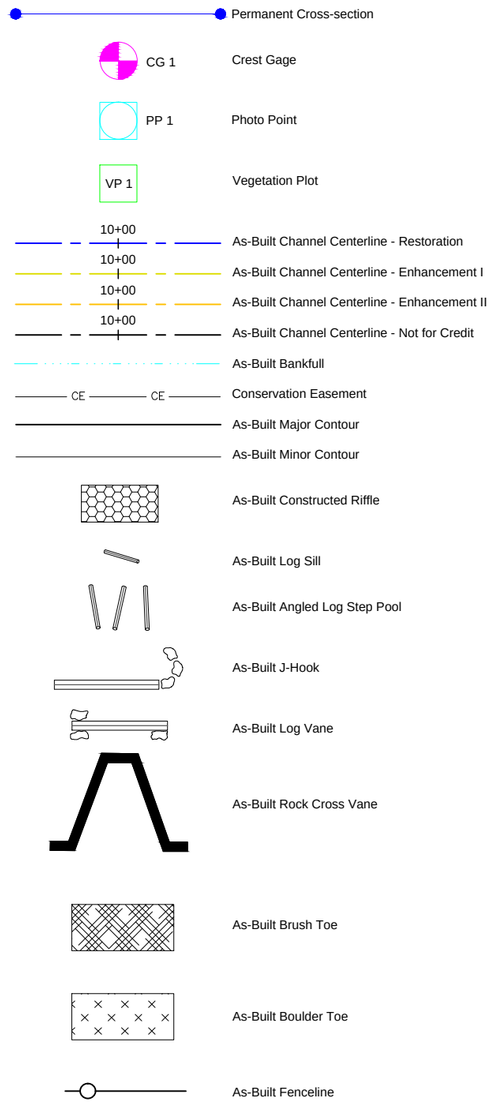
Revisions:

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
Checked By:	JWH

Sheet 0.1

January 24, 2014

LEGEND



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Byrds Creek Stream Restoration Project
Person County, NC

General Notes and Symbols

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
Checked By:	JWH

Revisions:

Sheet 0.2

0'
150'
300'
450'
(HORIZONTAL)

N

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
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1.0
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Byrds Creek Stream Restoration Project
Person County, NC

Stream Baseline Overview

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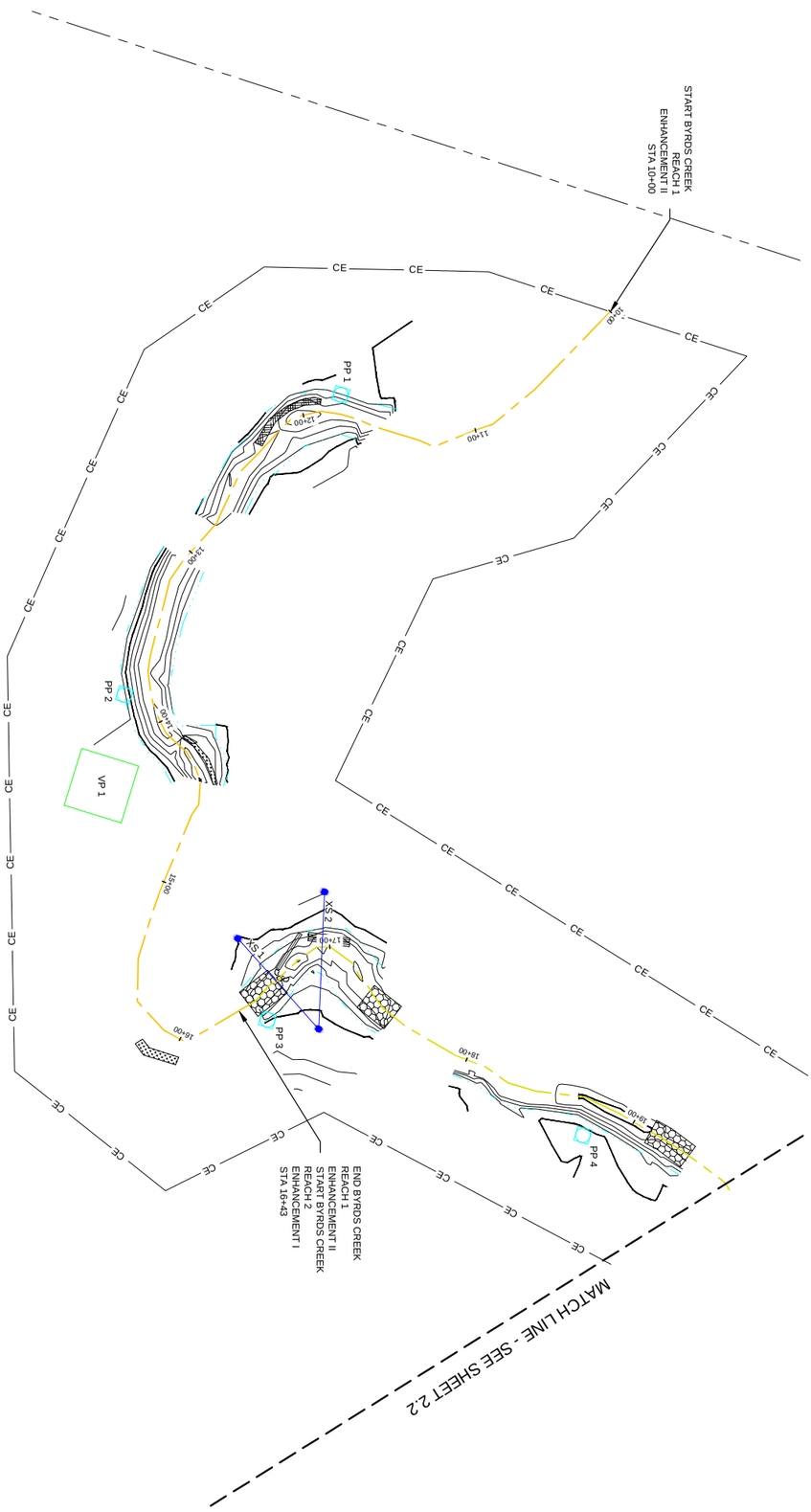

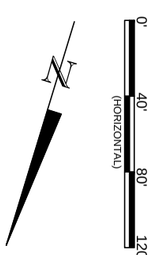

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
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Checked By:	JWH

2.1
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Person County, NC

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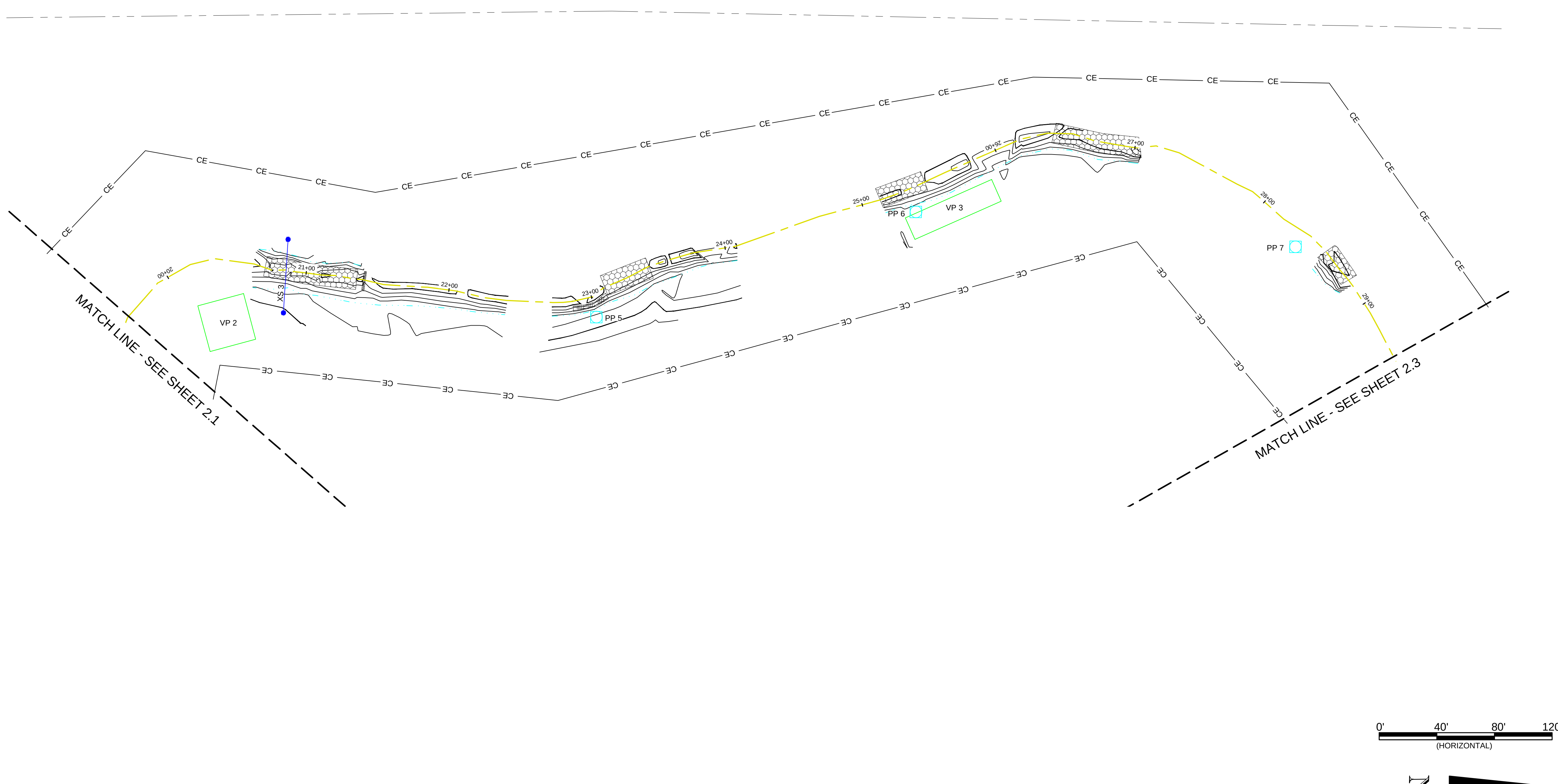

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Date: 01.27.2014
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Project Engineer: JNK
Drawn By: CLM
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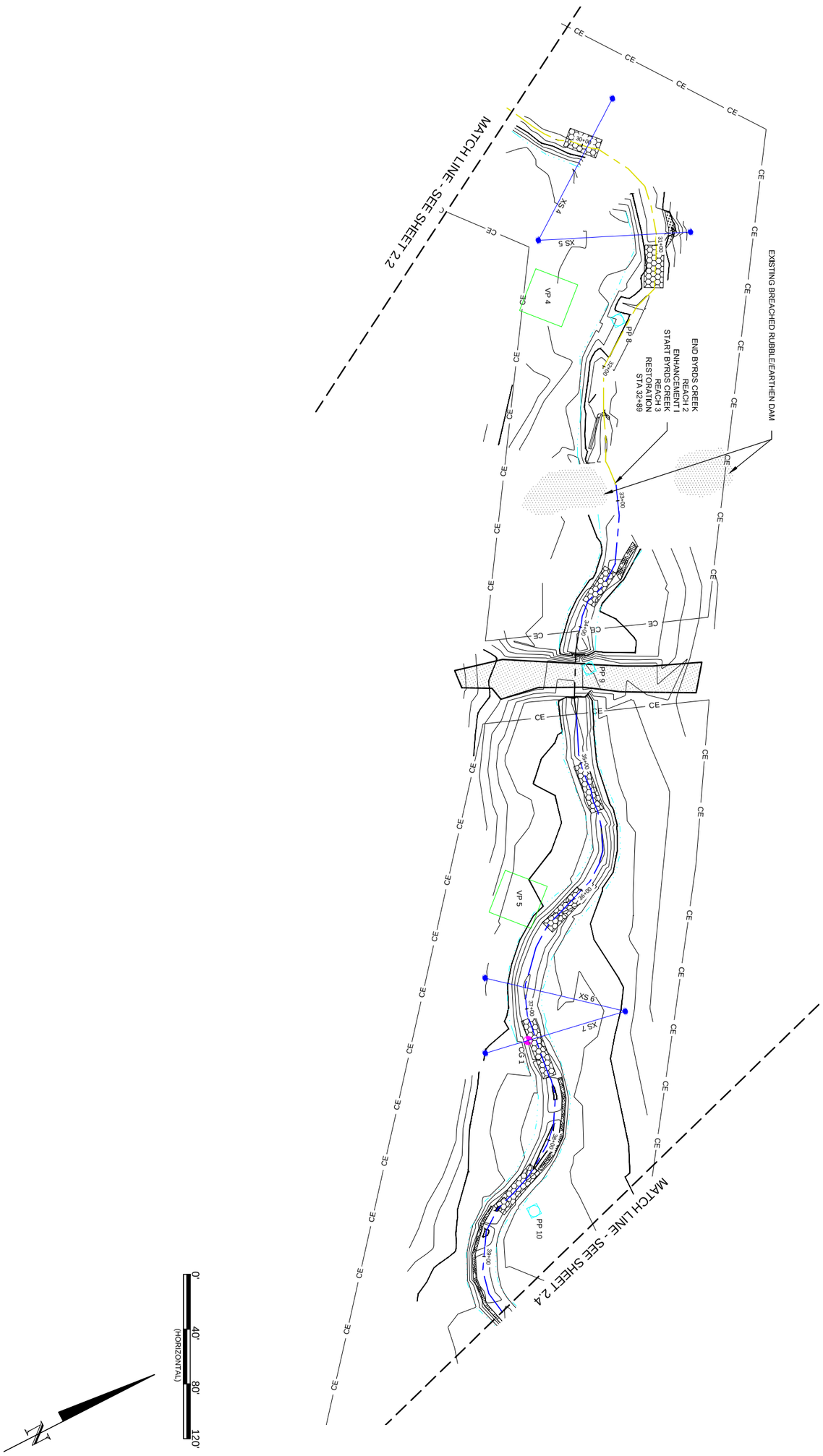

0' 40' 80' 120'
(HORIZONTAL)

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
Checked By:	JWH

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2.3
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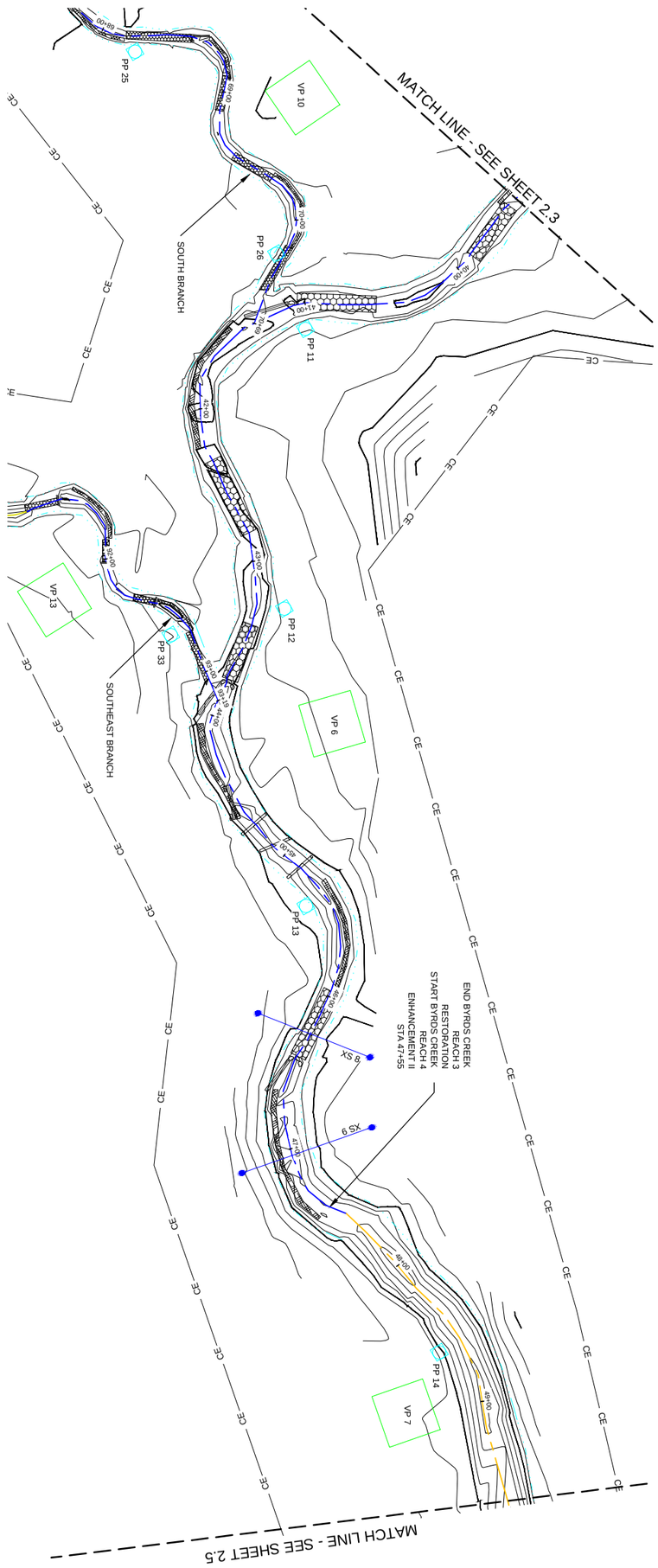

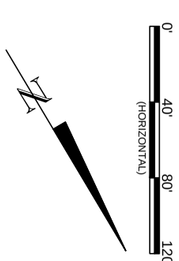

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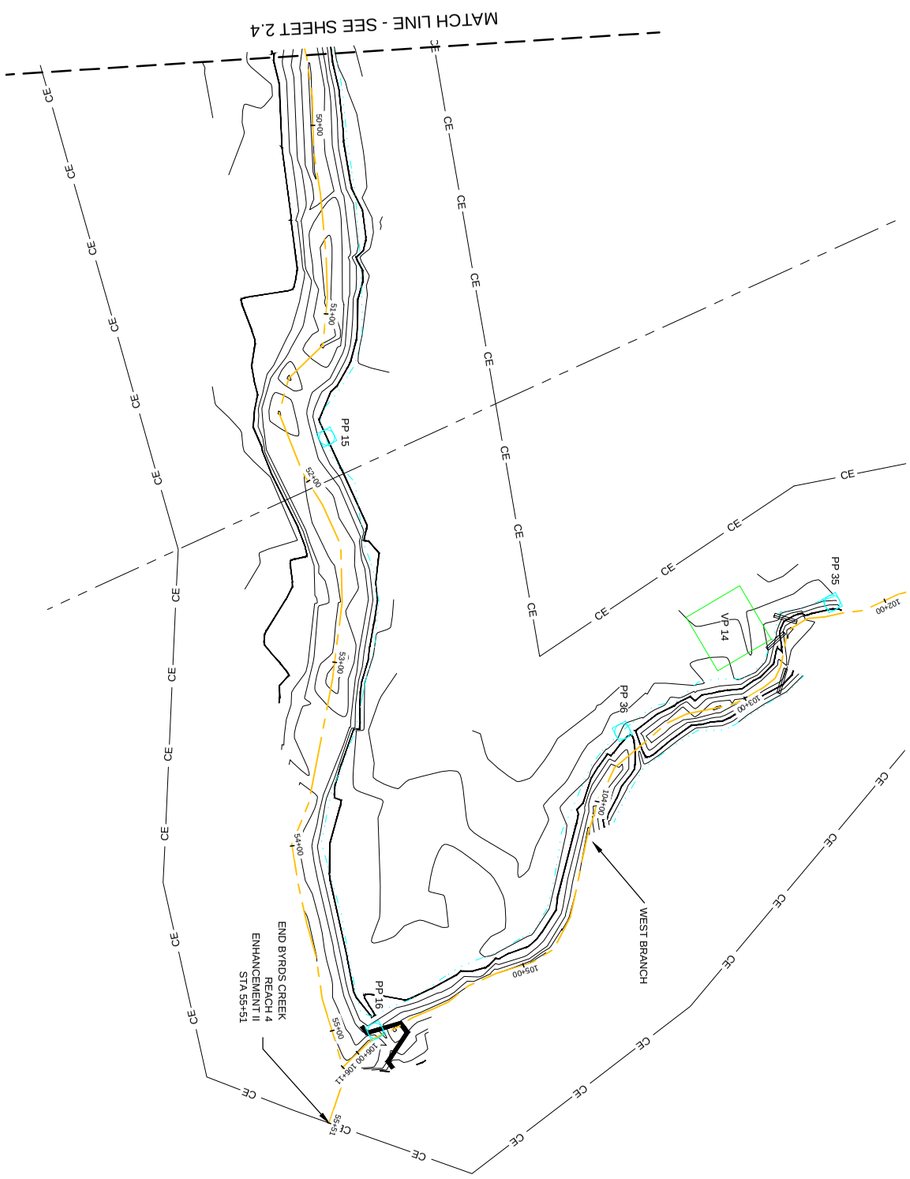

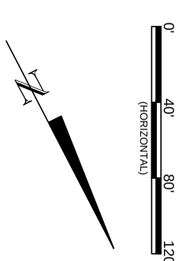

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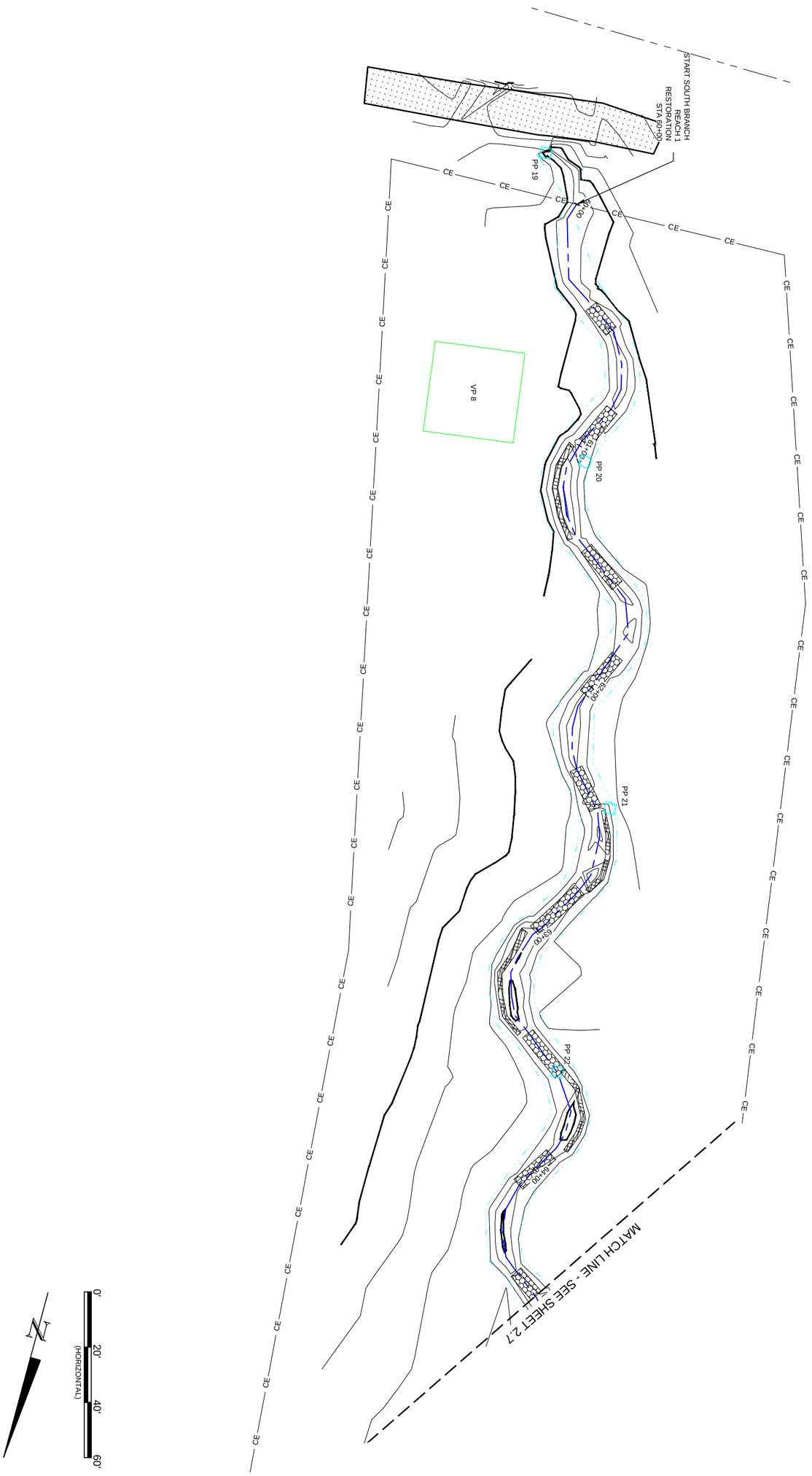

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
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2.6
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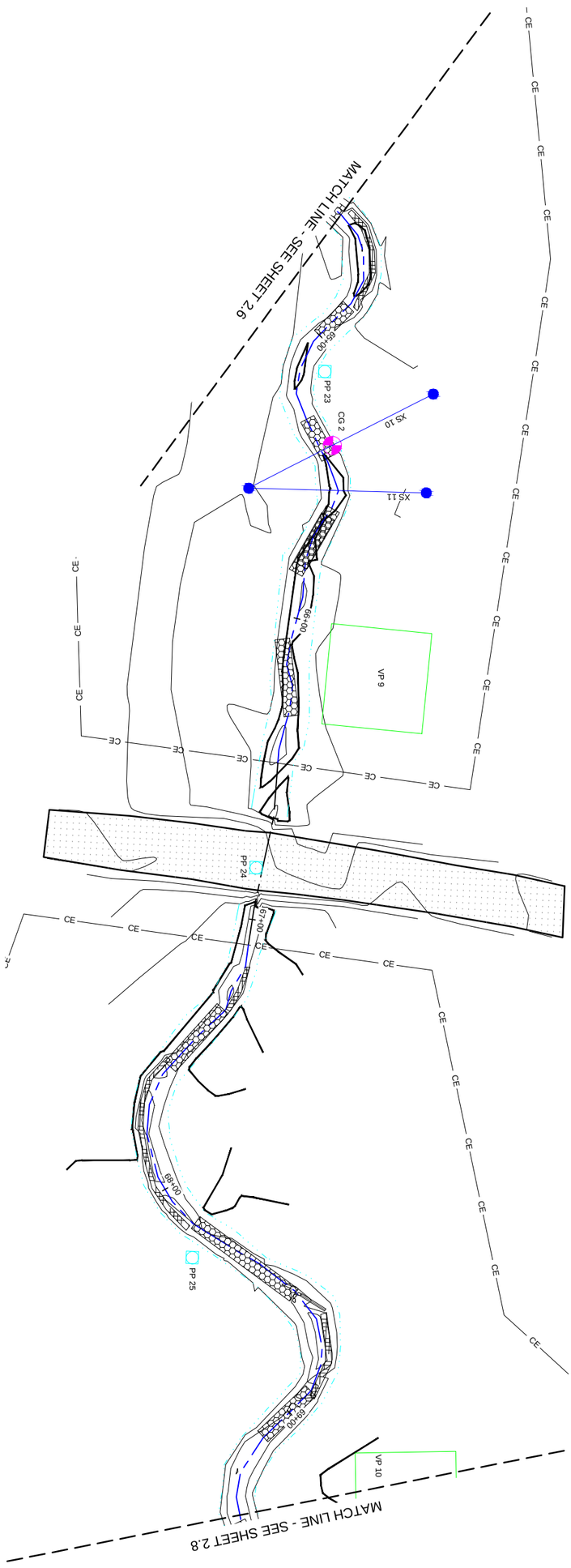

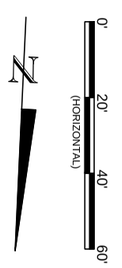

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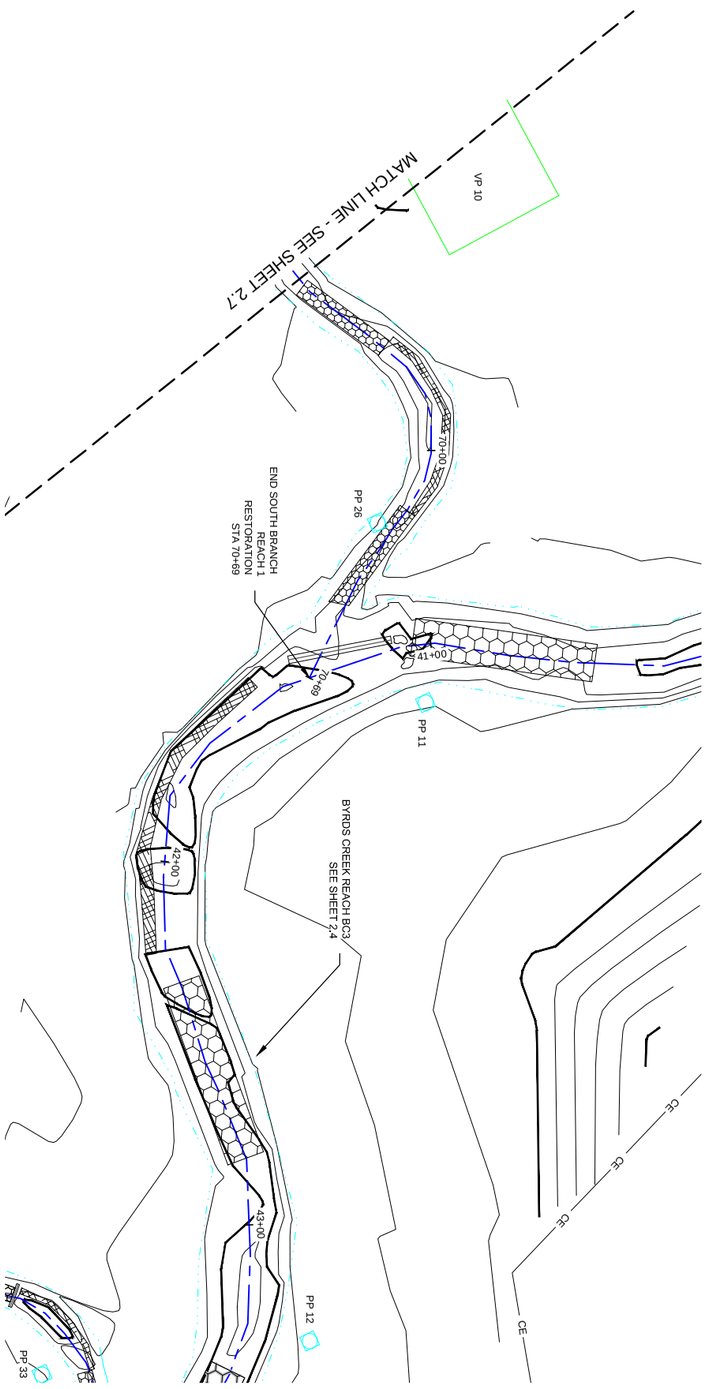

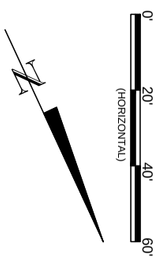

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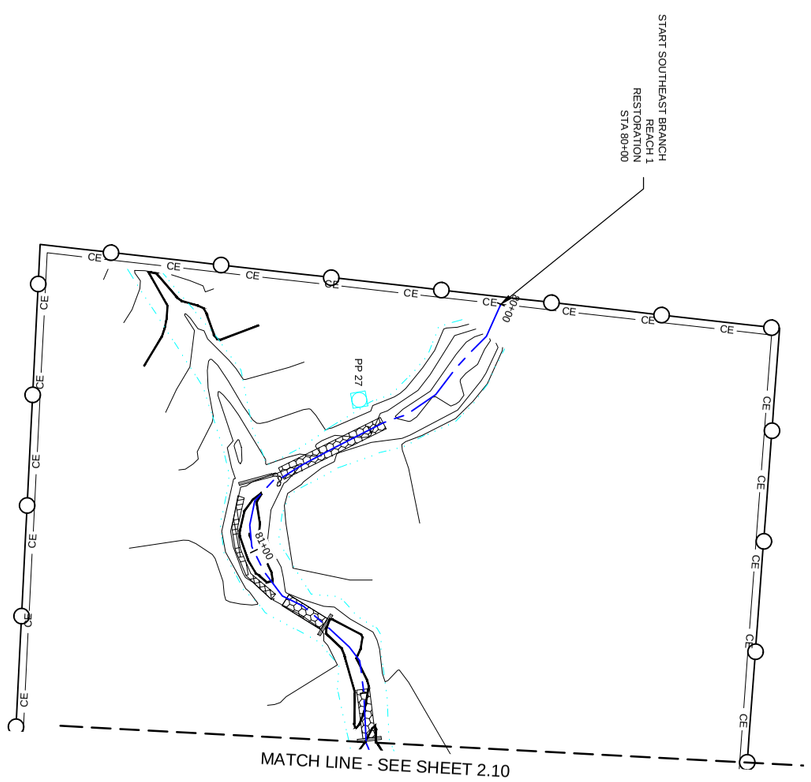

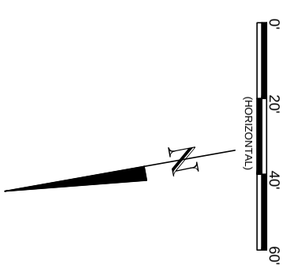

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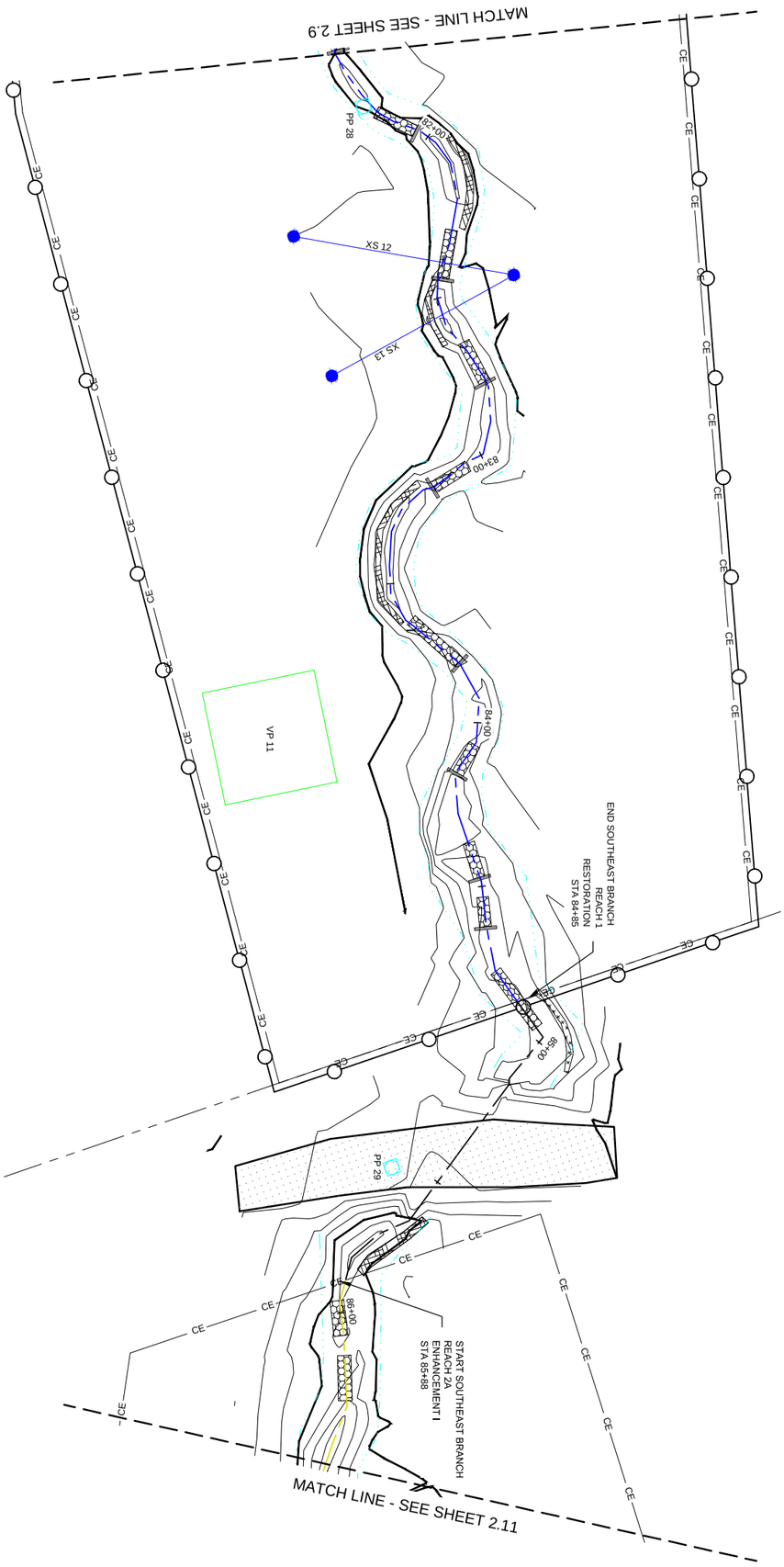

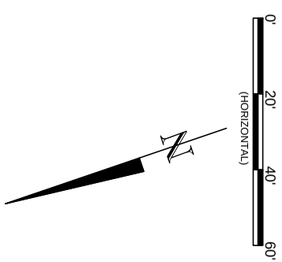

Baseline Drawing

Date:	01.27.2014
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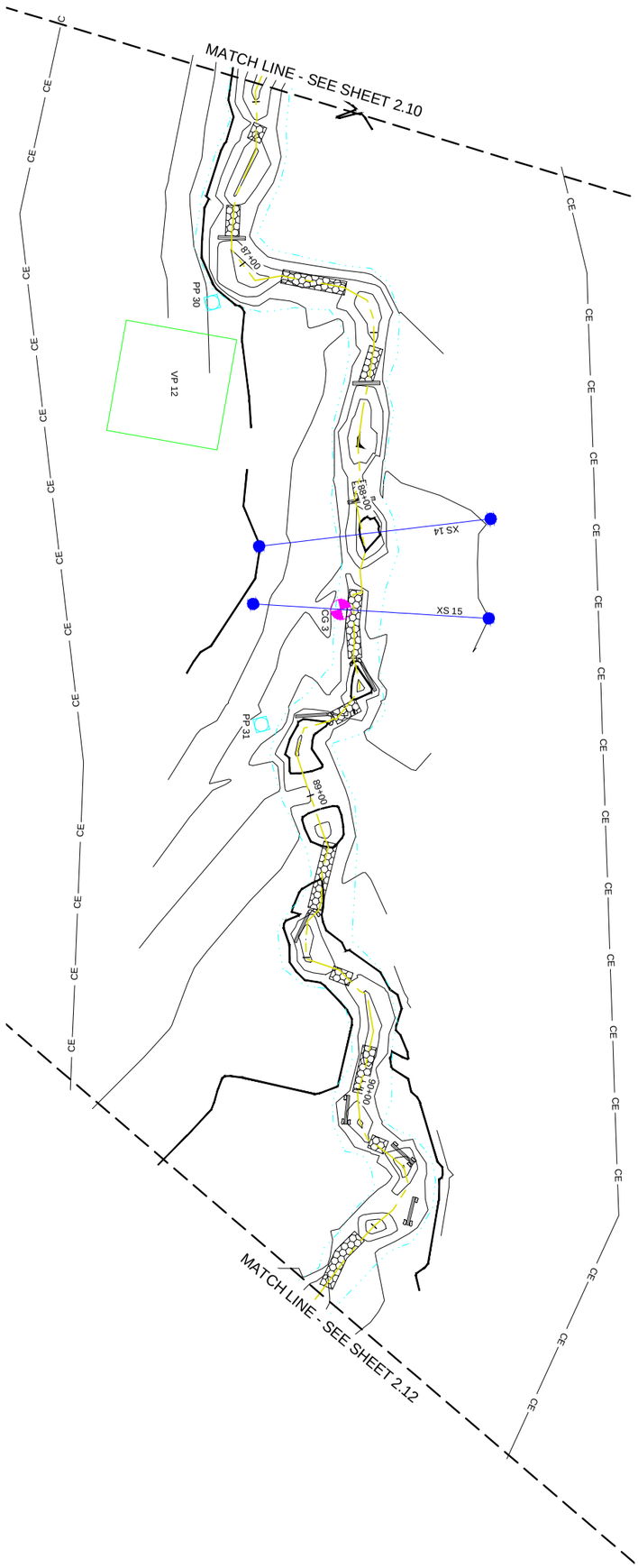

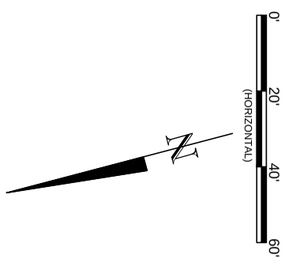

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
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Person County, NC

Southeast Branch
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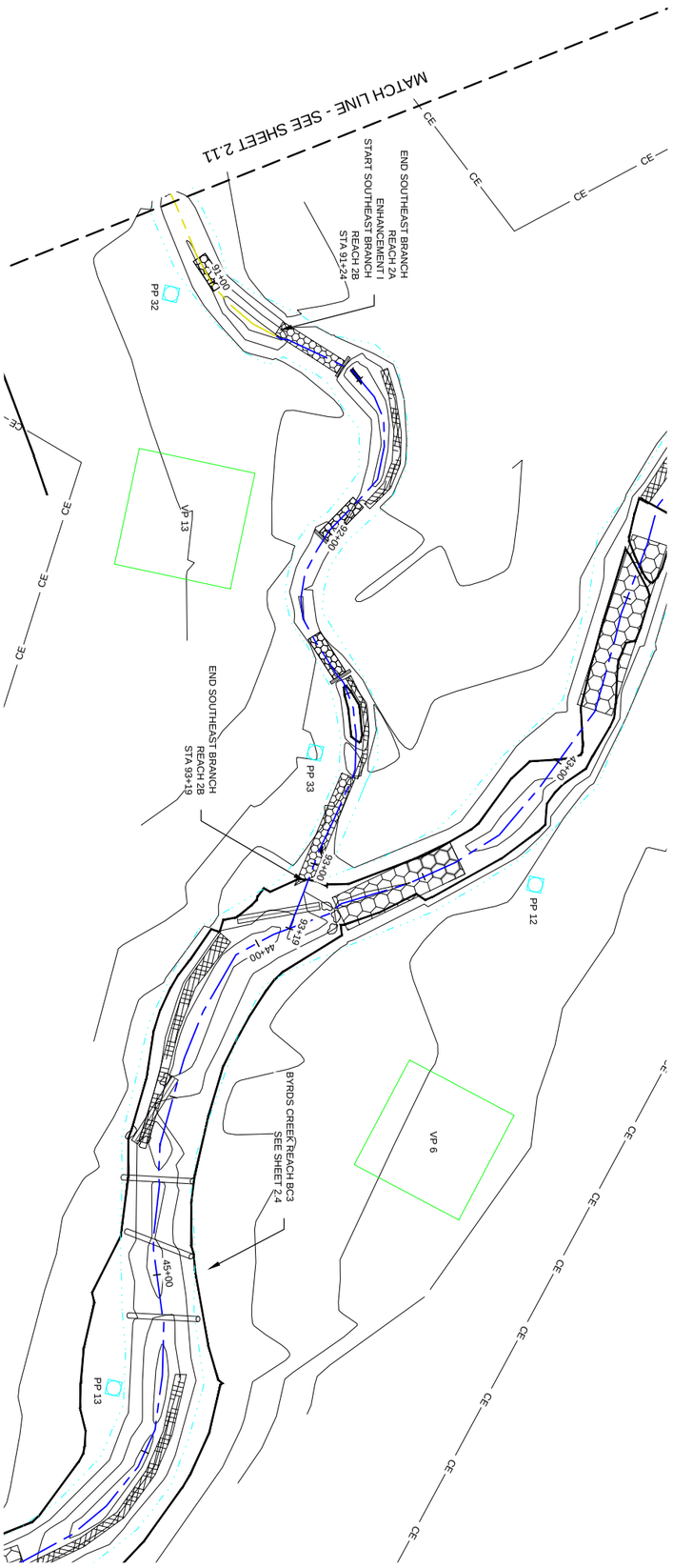

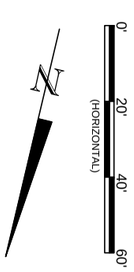

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
Checked By:	JWH

2.12
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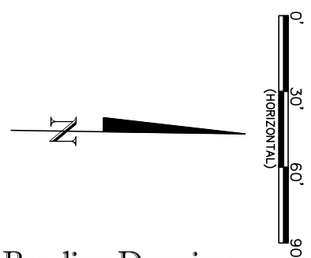

Baseline Drawing

Date:	01.27.2014
Job Number:	005-02128
Project Engineer:	JNK
Drawn By:	CLM
Checked By:	JWH

2.13
Sheet

Revisions:

Byrds Creek Stream Restoration Project
Person County, NC

West Branch
Stream Baseline Plans

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