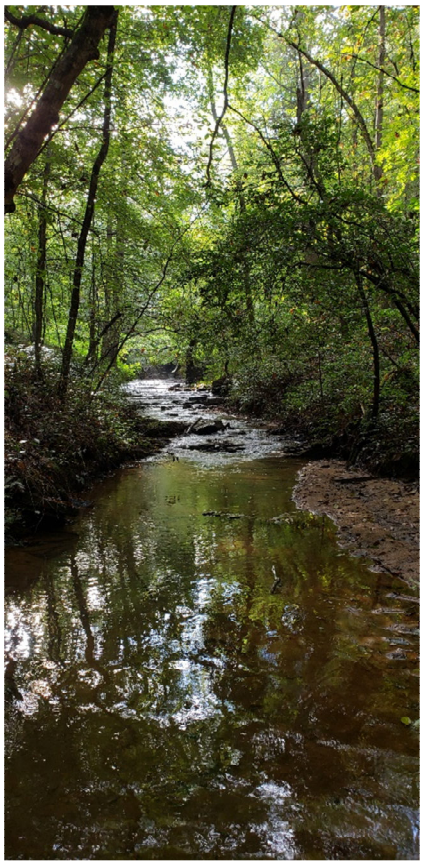
FINAL
YEAR 3 (2018) ANNUAL MONITORING REPORT

NEIGHBORS BRANCH/WALTON CRAWLEY BRANCH STREAM & WETLAND RESTORATION SITE

NCDMS Project No. 92872
Contract No. D09023S
USACE Action ID No. SAW-2009-917 & NCDWR Project No. 10-0122
SCO No. 08-07308-01
McDowell County, North Carolina

Data Collection: May-November 2018
Submission: November 2018



PREPARED FOR:

N.C. DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1601 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1601

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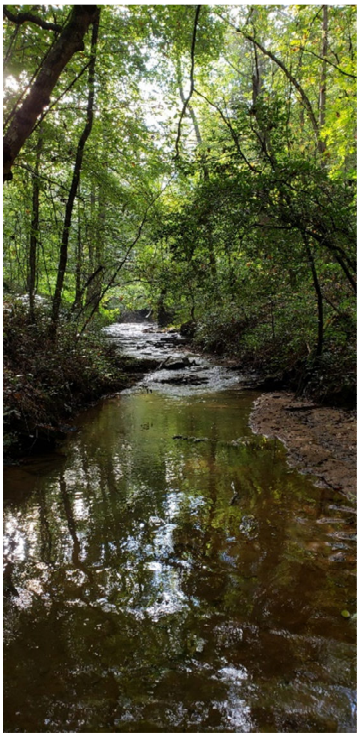

PREPARED BY:

AXIOM ENVIRONMENTAL, INC.
218 SNOW AVENUE
RALEIGH, NORTH CAROLINA 27603

Axiom Environmental, Inc.

Axiom Environmental, Inc.

218 Snow Avenue, Raleigh, NC 27603 919-215-1693

November 30, 2018

Mr. Matthew Reid
North Carolina Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Drive, #102
Asheville, North Carolina 28801

RE: Neighbors Branch/ Walton Crawley Branch Monitoring (DMS Project # 92879, Contract # D09023S)
Final Year 3 (2018) Annual Monitoring Report **12-004.21**

Dear Matthew:

Axiom Environmental, Inc. (AXE) is pleased to provide you with three hard copies and one cd of electronic files for the Final Neighbors Branch/ Walton Crawley Branch Year 3 (2018) Annual Monitoring Report. We received your comments via email on November 29, 2018 and have addressed them as follows.

- Streams: Please add the following or similar to discussion regarding Areas of Concern: DMS has developed an adaptive management plan to address the areas of concern on Walton Crawley Branch. A contract is in place, and the work will be completed this winter.
  This verbiage was added to the stream areas of concern discussion.

- Vegetation: Please add the following or similar to discussion regarding path: DMS and DEQ Stewardship have worked with the property owner to limit the width of the path to a minimum cutting for foot traffic only and stop mowing the path as wide as it has been.
  This verbiage was added to the discussion regarding the path.

- Vegetation: Last sentence in this section references "photos below", but they are not included in the draft report. Please remove from report or add photos in appendix.
  The reference to "photos below" was removed from the text.

- Wetland Hydrology: Report indicates Gauge malfunctions during the growing season. Has the gauge been replaced or repaired? Please add a statement in this section stating the corrective action and that the gauge is functioning correctly.
  The following statement was added to the discussion regarding the functionality of the groundwater gauges: "Both gauges have been repaired/replaced and are currently functioning as designed. They will be checked again for functionality and battery life prior to the start of the year 4 (2019) growing season."

- Table 2: Under Year 3 Monitoring, please add two lines of additional data with dates. One for vegetation monitoring and one for geomorphology monitoring. The Table included with the MY2 (2017) report was revised to show these dates beginning last year. Please continue using that table and provide these dates for all future monitoring report submissions.
  Table 2 was revised to include completion dates for vegetation and stream monitoring for years 2 and 3. Axiom will use this format for all future report submissions.

- Cross-sections and Table 11a and 11c: Please confirm that the MY3 (2018) BHRs have been calculated based on the recent BHR DMS technical guidance. Please add note on table indicating that beginning in MY3, the bankfull elevation and channel cross section dimensions are calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (9/2018). Cross-section 8 does not show the same Abkf as previous year.
  This note was added to Tables 11A and 11C, and the dimension calculations for cross section 8 were revised to reflect a fixed bankfull area.

- Table 12: Description for bankfull event collected on May 9, 2018 references UT8. This must be for the Bob's Creek Project. Please update as necessary for the Neighbors Branch/Walton Crawley Branch project.
  As the photos indicate, wrack was observed in the floodplains of Neighbors Branch and Walton Crawley Branch. The text in the table was revised to indicate this.

- As Axiom had done in the past, please include a response to the comment letter and how/where the comments were addressed. Please insert this letter directly behind the cover page and before the table of contents in the final deliverables. The IRT has requested that we include this letter with the final deliverables. The response letter will need to be included with all future monitoring deliverables.
  This response letter has been included directly behind the cover page in the final PDF deliverable. A word version of this letter was also included in the digital submittal.

Please let us know if you have any questions or comments regarding any component of this submittal. Thank you for the opportunity to continue to assist the Division of Mitigation Services with this important project.

Sincerely,
AXIOM ENVIRONMENTAL, INC.

Kenan R. Jernigan
Project Scientist

Attachments: 3 hard copies Year 3 (2018) Neighbors Branch/ Walton Crawley Branch Annual Monitoring Report
1 CD containing digital support files

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APPENDICES

1.0 PROJECT SUMMARY

The North Carolina Division of Mitigation Services (NCDMS) has established the Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site (Site). The primary goals of the project focused on improving water quality and long term stability by reducing nutrient loading from the on-site cattle and horse operation, reducing excess sedimentation input from Site channel banks and contributing non-jurisdictional tributaries/drainages, reducing excess sedimentation from Site access roads and deteriorated crossings, increasing the attenuation of floodwater flows, reintroducing natural watershed flows to Walton Crawley Branch by removing a pond and restoring the channel through its natural valley, and restoring and enhancing aquatic and riparian habitat. Long term stability will be evidenced by channels maintaining stable inverts and banks over an extended period of time.

These goals were accomplished through the following objectives.

- Reduce point (i.e. cattle/horses directly accessing the channel) and non-point source (i.e. stormwater runoff through pastures) pollution associated with an on-site cattle and horse operation by installing exclusionary fencing along the stream and riparian buffer, and by providing a vegetative buffer on stream banks and adjacent floodplains to treat nutrient enriched surface runoff from adjacent pastureland.
- Stabilize degraded portions of on-site streams, eroding ephemeral/stormwater channels, and existing maintained dirt roads to reduce sediment inputs. Stabilization methods included:
    - Restoring a stable dimension, pattern, and profile to selected sections of channels to ensure the channel will transport and attenuate watershed flows and sediment loads without aggrading or degrading.
    - Stabilize selected channel banks by excavating bankfull benches, placing stream structures to reduce shearing forces on outside meander bends, and planting native vegetative species to provide soil stability.
    - Stabilize ephemeral/stormwater channels by planting native vegetation along eroded banks and floodplain and constructing stabilization weirs through the channel valley to lower facet slopes and decrease erosion.
    - Place gravel along existing degraded soil roads that are situated adjacent to Site streams.
- Reintroduce natural watershed flows to Walton Crawley Branch by restoring the channel through the low point of the natural valley and removing a dam that impedes natural down valley flows.
- Improve aquatic habitat by enhancing stream bed variability, providing shading/covered areas within the stream channel, and introducing woody debris in the form of rootwads, log vanes, and log sills.
- Enhance fish passage within Neighbors Branch and Walton Crawley Creek. This was accomplished by eliminating a pond and restoring the stream through the natural valley and by restoring Neighbors Branch and replacing an existing perched culvert to allow fish passage upstream.
- Enhance riparian wildlife habitat by:
    - Fencing cattle out of existing wetlands and planting impacted wetlands with native vegetative species. Wetlands were also restored by raising Site stream inverts to allow groundwater tables to rise throughout the affected valleys.
    - Fencing livestock out of existing and restored riparian buffers as well as installing alternative watering devices that will ensure livestock have sufficient watering areas. This is detailed further in the Farm Management Plans completed for the Site by NCDMS.
    - Vegetating the existing fescue dominated riparian buffers with native trees, shrubs, herbs, and grasses. Forest vegetation species were selected by studying a Reference Forest Ecosystem located on-site and reviewing Montane Alluvial Forest species listed in

Classification of the Natural Communities of North Carolina: Third Approximation (Schafale and Weakley 1990).

- Creating wildlife corridors through agricultural lands which have significantly dissected the landscape. The corridors will provide connectivity to a diversity of habitats including mature forest, early successional forest, stream-side forest, riparian wetlands, and uplands.

The Site is located approximately six miles southeast of the town of Marion (Figure 1, Appendix B). The Site is situated due southwest of the intersection of Deer Park Road and Harmony Grove Road in McDowell County, North Carolina and is located within the United States Geological Survey (USGS) Hydrologic Unit and Targeted Local Watershed 03050101040010 (North Carolina Division of Water Quality Subbasin 03-08-30) of the Catawba River Basin and will service USGS 8-digit Cataloging Unit 03050101.

The contributing watersheds are characterized primarily by forest land (approximately 84 percent of the total area) with pasture at the lower elevations (approximately 10 percent of the total area) and low-density residential development scattered along the outer fringes of the watershed. Impervious surfaces appear to account for approximately one percent of the watershed land surface. Prior to Site construction, riparian vegetation had been removed, stream channels were manipulated, and hoof shear from livestock on stream banks and floodplain soils was responsible for degraded water quality and unstable channel characteristics (stream entrenchment, erosion, and bank collapse).

Project mitigation efforts resulted in the following:

- Restore 2456 linear feet of Site streams
- Enhance (Level I) 202 linear feet of Site streams
- Enhance (Level II) 1863 linear feet of Site streams
- Preserve 3139 linear feet of Site streams
- Restore 0.52 acre of existing hydric soils to riparian wetlands
- Enhance 1.62 acres of riparian wetlands
- Preserve 1.29 acres of riparian wetlands

The Muddy Creek Restoration Partnership (Partnership) was formed in 1998 to address impacts to the Muddy Creek Watershed. The Partnership completed the *Muddy Creek Watershed Restoration Initiative Feasibility Report and Restoration Plan* (Watershed Plan) for the Muddy Creek Watershed in December of 2003 (MCRP 2003). Since 2004 NCDMS has informally participated in the Partnership by implementing priority projects named by the partnership and adopted the 2003 report as part of its Local Watershed Plan (LWP). The NCDMS's *Upper Catawba River Basin Restoration Priorities* (2009) identifies North Muddy Creek as a Targeted Local Watershed (TLW). The Site is located within the North Muddy Creek Watershed. In 2008 NCDMS contracted with a consulting firm to conduct outreach programs with landowners and identify additional project sites in the Muddy Creek Watershed.

The primary goals identified by the Partnership's Watershed Plan include the following.

1. Restore the Watershed to its Full Intended Use
2. Restore Riparian Buffers
3. Enhance Open Space Preservation
4. Improve Water Quality
5. Restore Physical Habitat
6. Establish a Trout Fishery

The Watershed Plan listed the following components of watershed restoration to be expected:

1. Natural Channel Design Stream Restoration
2. Riparian Reforestation
3. Livestock Exclusion
4. Riparian Forest Preservation

These four components were included within the *Neighbors Branch/Walton Crawley Branch Site Mitigation Plan* (NCDMS 2013). The project restored the watershed to its full intended use by restoring a stream, floodplain, and riparian wetland ecosystem through stream and wetland restoration, enhancement, and preservation. The project restored riparian buffers through revegetation of buffer zones with native riparian and wetland species along all Site streams. The project enhanced open space preservation by placing Site streams, wetlands, and their buffers into a permanent conservation easement. The overall Site helps improve water quality by reducing sedimentation in on-Site streams and planted a vegetated riparian buffer that filters nutrients from adjacent pasturelands. Additionally, exclusionary fencing and alternate watering devices removed livestock from accessing on-site channels and riparian buffers. The project restored and enhanced physical habitat for both aquatic and terrestrial species by planting native vegetation along stream banks and riparian buffers, creating wildlife corridors through a dissected landscape, and restoring bedform variability to Site streams. The stabilization of streams and buffers in the project area enhanced water quality in downstream receiving waters, which should help in the re-establishment of the watershed's ability to host trout and enhance their ability to propagate.

Site design was completed on March 7, 2013. Site construction and planting were completed in December 2015. Completed project activities, reporting history, completion dates, project contacts, and project attributes are summarized in Tables 1-4 (Appendix A).

Stream Success Criteria: Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system.

Collected data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio and bank-height ratios should be indicative of a stable or moderately unstable channel with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of instream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, abandonment of the channel around the structure, and/or stream flow beneath the structure.

Stream Dimension: General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. Some changes in dimension (such as lowering of bankfull width) should be expected. Riffle cross-sections should generally maintain a bank-height ratio approaching 1.0, with some variation in this ratio naturally occurring. Pool cross-sections naturally adjust based on recent flows and time between flows, therefore more leeway on pool cross-section geometry is expected.

Stream Pattern and Profile: The profile should not demonstrate significant trends towards degradation or aggradation over a significant portion of a reach. Additionally, bed form variables should remain noticeably intact and consistent with original design parameters that were based off

of reference conditions. Pattern features should show little adjustment over the standard 5-year monitoring period and will be monitored to ensure adjustment is minor prior to close out.

Substrate: Substrate measurements should indicate the progression towards or the maintenance of the known distributions from the design phase.

Sediment Transport: There should be an absence of any significant trend in the aggradational or depositional potential of the channel.

Hydraulics: A minimum of two bankfull events must be documented within the standard 5-year monitoring period. The two bankfull events shall occur within separate years.

Vegetation Success Criteria: Success criteria have been established to verify that the vegetation component supports community elements necessary for forest development. Success criteria are dependent upon the density and growth of characteristic forest species. An average density of 320 stems per acre of planted stems must be surviving in the first three monitoring years. Subsequently, 290 planted stems per acre must be surviving in year 4 and 260 planted stems per acre in year 5.

Wetland Hydrology Success Criteria: Target hydrological characteristics include saturation or inundation for 5 to 12.5 percent of the growing season, during average climatic conditions. During growing seasons with atypical climatic conditions, groundwater gauges in reference wetlands may dictate threshold hydrology success criteria (75 percent of reference). These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

2.0 METHODS

Monitoring of restoration efforts will be performed for five years, or until success criteria are fulfilled. Monitoring is proposed for the stream channel, vegetation, and wetland hydrology. In general, the restoration success criteria, and required remediation actions, are based on the *Stream Mitigation Guidelines* (USACE et al. 2003). Monitoring features are described below and are depicted on Figures 2A-B (Appendix B).

Streams

The restored stream reaches are proposed to be monitored for geometric activity as follows.

- 1750 linear feet of stream profile
- 5 riffle cross-sections
- 3 pool cross-section

The data will be presented in graphic and tabular format. Data to be presented will include 1) cross-sectional area, 2) bankfull width, 3) average depth, 4) maximum depth, 5) width-to-depth ratio, 6) meander wavelength, 7) belt-width, 8) water surface slope, and 9) sinuosity. Substrate analysis will be evaluated through pebble counts at five cross sections and data presented as a D50 for stream classification and tracking purposes. The stream will subsequently be classified according to stream geometry and substrate (Rosgen 1996). Significant changes in channel morphology will be tracked and reported by comparing data in each successive monitoring year. Annual photographs will include 43 fixed station photographs (Appendix B). In addition, the Site contains two stream crest gauges to assist with documentation of

bankfull events. Three bankfull event were documented during monitoring year 3 (2018) making a total of at least five bankfull events occurring in three separate monitoring years (Table 12, Appendix E).

Early in year 1 (2016), several structures were damaged by significant storm events that occurred shortly after Site construction. Warranty repair work was completed in October 2016 to address these issues. The repaired structures appeared stable during year 3 (2018). Four stream areas of concern were observed during year 3 (2018) monitoring. The header of a drop structure at the bottom of a series of structures on UT-1 to Neighbors Branch (approximately 11+15) appears to have dislodged, causing serious degradation in the accompanying pool and downstream riffle (Area of Concern #1, Figure 2A, Appendix B). The down-cutting appears to pose a threat to the integrity of the rock structure above the pool. Additionally, a log J-hook structure at approximately 21+35 on Walton Crawley Branch appears to have shifted during a higher stream flow event, causing some scour behind it (Area of Concern #2, Figure 2B, Appendix B). The structure appears somewhat stable, but exposed soil and lack of rooted vegetation securing the log structure in place is concerning. This area was first observed in March 2018 and the scour appears to have worsened slightly over the course of the monitoring year. Lastly, two small areas of bank erosion were observed along the downstream portion of Walton Crawley Branch; approximately 10 feet of the right bank of an outer bend (Area of Concern #3 from 24+40 to 24+50), and approximately 10 feet of another outer bend, just upstream from a log J-hook structure (Area of Concern #4 from 26+65 to 26+75). These areas are depicted on Figure 2B (Appendix B). NCDMS has developed an adaptive management plan to address the areas of concern on Walton Crawley Branch. A contract is in place, and the work will be completed this winter (2018/2019).

Vegetation

Restoration monitoring procedures for vegetation will monitor plant survival and species diversity. Planted areas within the Site include approximately 12.3 acres. After planting of the area was completed, eight vegetation plots were installed and monitored at the Site; annual monitoring results can be found in Appendix C. Annual measurements of vegetation will consist of 8 CVS vegetation plots.

A photographic record of plant growth should be included in each annual monitoring report; current monitoring photographs are included in Appendix B. During the first year, vegetation will receive a cursory, visual evaluation on a periodic basis to ascertain the degree of overtopping of planted elements by nuisance species. Subsequently, quantitative sampling of vegetation will be performed as outlined in the *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) in September of the first monitoring year and annually between June 1 and September 30 for the remainder of the monitoring period until vegetation success criteria are achieved.

Year 3 stem count measurements indicate planted stem densities are well above the required 320 stems per acre. Planted stem density across the Site is 440 planted stems per acre (Table 9, Appendix C). In addition, all eight individual CVS plots met success criteria based on planted stems alone (Table 7, Appendix C). Therefore, the Site is currently meeting vegetation success criteria.

Several dense populations of Chinese privet (*Ligustrum sinense*) were observed along Walton Crawley Branch (Figure 2B, Appendix B). Some additional privet and multiflora rose (*Rosa multiflora*) was observed scattered throughout Site restoration reaches in quantities below mapping threshold. NCDMS plans to treat invasive species during year 4 (2019), and Axiom will monitor these areas to determine the success of the treatments.

Several areas of compromised easement integrity were observed during year 3 (2018). The fence on the northeast side of the crossing over UT-2 to Neighbors Brach has been compromised by large amounts of

sediment during several high flow events. It is recommended that this be repaired in order to prevent livestock access to the easement. Additionally, an approximately 8-foot wide path has been cut from the gravel road on the west side of the Walton Crawley Branch easement, toward the east to a neighboring lawn. A small wooden footbridge was constructed along this path across UT-2 to Walton Crawley Branch. NCDMS and DEQ Stewardship have worked with the property owner to limit the width of the path to a minimum cutting for foot traffic only and stop mowing the path as wide as it has been. Lastly, just upstream from the southern-most crossing of Walton Crawley Branch, it appears that a piece of plastic pipe has been installed to draw water from the Walton Crawley Branch into the neighboring pond. These areas are depicted on Figures 2A-B, and NCDMS has been working with the neighboring landowner to resolve these issues.

Wetland Hydrology

Two groundwater monitoring gauges were installed to take measurements after hydrological modifications were performed at the Site. Hydrological sampling will occur quarterly throughout the growing season (March 26 to November 5). Approximate locations of gauges are depicted on Figure 2A (Appendix B) and hydrology data can be found in Appendix E.

Both gauges were saturated or inundated for well over 12.5 percent of the growing season. Gauge 1 batteries died several time throughout the growing season due to excessive inundation resulting in data loss; however, groundwater was at or near the soil surface for the entire 2018 growing season. Gauge 2 missed several days of data collection due to a malfunction caused by excessive inundation during the remnants of Hurricane Florence. It began collecting points again once overbank flow receded. Both gauges have been repaired/replaced and are currently functioning as designed. They will be checked again for functionality and battery life prior to the start of the year 4 (2019) growing season. The groundwater level at both gauges remained within 12 inches of the surface for the entire growing season (225 days). Wetland hydrology is currently meeting success criteria.

3.0 REFERENCES

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

Muddy Creek Restoration Partners (MCRP), 2003. Feasibility Report and Restoration Plan for the Muddy Creek Watershed.

North Carolina Division of Mitigation Services (NCDMS). 2013. Neighbor Branch/Walton Crawley Branch Stream and Wetland Mitigation Site Mitigation Plan. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Ecosystem Enhancement Program (NCEEP). 2009. Upper Catawba River Basin Restoration Priorities 2009 (online). Available: http://www.nceep.net/services/restplans/Upper_Catawba_RBRP_2009.pdf [March 12, 2009]. North Carolina Department of Environment and Natural Resources, Raleigh, North Carolina.

Rosgen D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

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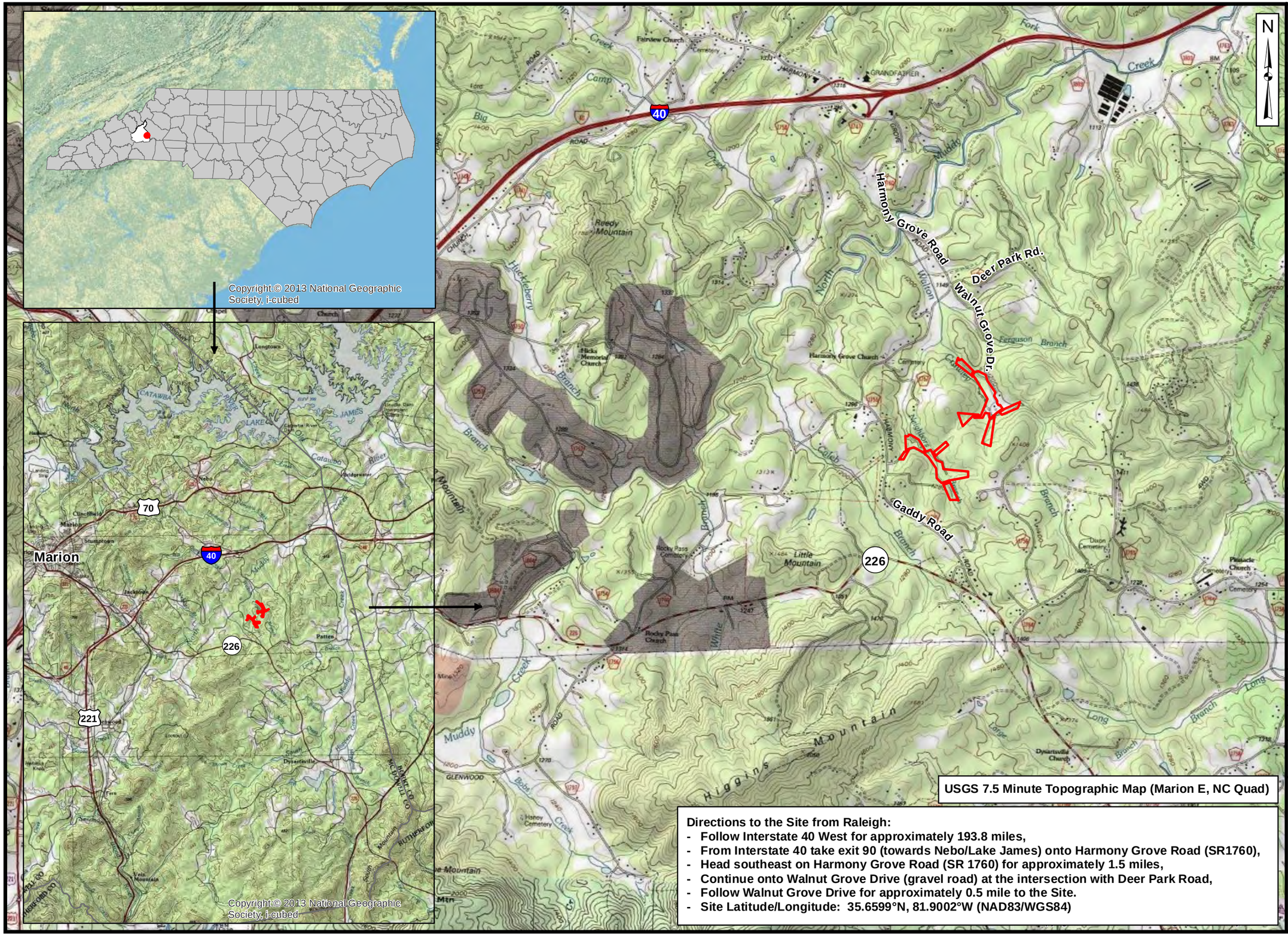
United States Army Corps of Engineers (USACE), United States Environmental Protection Agency (USEPA), North Carolina Wildlife Resources Commission (NCWRC), Natural Resources Conservation Service (NRCS), and North Carolina Division of Water Quality (NCDWQ). 2003. Stream Mitigation Guidelines. State of North Carolina.

Weather Underground. 2017. Station KFQD at Bostic, North Carolina (online). Available: www.wunderground.com/history/airport/KFQD/ [November 28, 2017]. Weather Underground.

Weather Underground. 2018. Station KEHO at Shelby, North Carolina (online). Available: https://www.wunderground.com/history/monthly/us/nc/shelby/KEHO/date/2018-10 [November 8, 2018]. Weather Underground.

Appendix A.
Site Location Map and Background Tables

Figure 1. Site Location
Table 1. Project Mitigation Components
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table



USGS 7.5 Minute Topographic Map (Marion E, NC Quad)

Directions to the Site from Raleigh:

- Follow Interstate 40 West for approximately 193.8 miles,
- From Interstate 40 take exit 90 (towards Nebo/Lake James) onto Harmony Grove Road (SR1760),
- Head southeast on Harmony Grove Road (SR 1760) for approximately 1.5 miles,
- Continue onto Walnut Grove Drive (gravel road) at the intersection with Deer Park Road,
- Follow Walnut Grove Drive for approximately 0.5 mile to the Site.
- Site Latitude/Longitude: 35.6599°N, 81.9002°W (NAD83/WGS84)

Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Site Location

Drawn by: KRJ

Date: JUN 2016

Scale: 1:30000

Project No.: 12-004.21

FIGURE

1

Table 1. Project Components and Mitigation Credits

Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site/ DMS Number 92872

Mitigation Credit Summations					
Stream	**Riparian Wetland**	**Nonriparian Wetland**	**Buffer**	**Nitrogen Offset**	**Phosphorous Offset**
3954	**1.59**	**---**	**---**	**---**	**---**

Projects Components							
Project Component –or-Reach ID	**Stationing**	**Existing Footage or Acreage**	**Restoration Footage or Acreage**	**Restoration Level/Equivalent**	**Mitigation Ratio**	**Mitigation Credits**	**Comment**
Walton Crawley	15+40 – 27+36 (09+37 – 21+68)	2498	1196 1231-35 = 1196	Restoration (PI)	1:1	1186	Channel returned to natural valley. The easement break at the road crossing has been removed from credit summation. A 20 foot reach lies within a powerline ROW and will receive half credit. Removed 35 feet from credit calculations for road crossing.
Walton Crawley	29+11 – 29+23		12	Enhance I	1.5:1	8	Bank grading and stabilization.
Walton Crawley	27+36 – 29+11 29+23 – 29+90		242	Enhance II	2.5:1	97	Fence cattle out of easement area and remove invasive plants. The easement break at 29+90 has been removed from credit summation.
Walton Crawley	10+00 – 15+40 29+90 – 35+01		1051	Preservation	5:1	210	The easement break has been removed from credit summation.
UT 1 Walton Crawley As-built Plan Stationing	18+13 – 20+01 (10+00 – 11+88)	872	188 188	Restoration (PI)	1:1	188	Restore channel through existing pond and reconnect to Walton Crawley.
UT 1 Walton Crawley	14+83 – 18+13		330	Enhance II	2.5:1	132	Fence cattle out of easement area and remove invasive plants.
UT 1 Walton Crawley	10+00 – 14+83		483	Preservation	5:1	97	The easement break has been removed from credit summation.
UT 2 Walton Crawley As-built Plan Stationing	10+00 – 13+83 (10+00 – 13+83) 16+36 – 18+02 (10+00 – 11+66)	600	549 549	Restoration (PI)	1:1	549	Channel routed to the center of the valley, away from toe of slope.
UT 2 Walton Crawley	13+83 – 16+36		253	Enhance II	2.5:1	101	Fence cattle out of easement area and remove invasive plants.
Neighbors Branch As-built Plan Stationing	24+74 – 29+97 (09+93 – 15+52)	2262	523 559 – 36 = 523	Restoration (PI)	1:1	523	Channel routed through low point of valley and invert raised from perched culvert. The easement break at the road crossing has been removed from credit summation. Removed 36 feet from credit calculations for road crossing.

Neighbors Branch	18+89 – 19+09		20	Enhance I	1.5:1	13	Place channel structure and stabilize bank. The easement break has been removed from credit summation.
Neighbors Branch	18+69 – 18+89 19+09 – 24+74 29+97 – 33+39		927	Enhance II	2.5:1	371	Fence cattle out of easement area and matt, seed, and plant vegetation on scoured banks.
Neighbors Branch	09+67 – 18+69		902	Preservation	5:1	180	The easement break has been removed from credit summation.
UT 1 Neighbors Branch As-built Plan Stationing	10+56 – 10+95 11+50 – 12+81 (10+06 – 10+44 10+77 – 12+09)	281	170 170	Enhance I	1.5:1	113	Bank grading and stabilization.
UT 1 Neighbors Branch	10+00 – 10+56 10+95 – 11+50		111	Enhance II	2.5:1	44	Fence cattle out of easement area and plant vegetation.
UT 3 Neighbors Branch	11+72 – 18+75	703	703	Preservation	5:1	141	---
Riparian Wetland	---	0.0	0.52	Restoration	1:1	0.52	Restore hydrology to hydric soils adjacent to Neighbors Branch.
Riparian Wetland	---	1.62	1.62	Enhancement	2:1	0.81	Plant native vegetation on impacted wetlands and fence cattle.
Riparian Wetland	---	1.29	1.29	Preservation	5:1	0.26	---

Length and Area Summations

Restoration Level	Stream (linear footage)	Riparian Wetland (acreage)		Nonriparian Wetland (acreage)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	2,456	0.52		--		
Enhancement (Level I)	202	1.62		--		
Enhancement (Level II)	1,863	--		--		
Preservation	3,139	1.29		--		
Totals	**7,660**	**3.43**		**--**		
Mitigation Units	**3,954 SMUs**	**1.59 Riparian WMUs**		**0.00 Nonriparian WMUs**		

BMP Elements

Element	Location	Purpose/Function	Notes

Table 2. Project Activity and Reporting History
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site / DMS Number 92872

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Project Institution		
Mitigation Plan	April 2009	March 7, 2013
Permits Issued		
Final Design – Construction Plans		April 2014
Construction	--	December 2015
Temporary S&E Mix applied to Entire Project Site	--	December 2015
Permanent Seed Mix applied to the Entire Project Site	--	December 2015
Bare Root; Containerized; and B&B Plantings for the Entire Project Site	--	December 2015
Baseline Monitoring Document (Year 0 Monitoring Baseline)	April 2016	July 2016
Repair	--	October 2016
Year 1 Monitoring	November 2016	January 2017
Year 2 Monitoring	November 2017	December 2017
Year 2 Vegetation Monitoring	August 30, 2017	--
Year 2 Geomorphology Monitoring	February 22, 2017	--
Year 3 Monitoring	November 2018	November 2018
Year 3 Vegetation Monitoring	September 26, 2018	--
Year 3 Geomorphology Monitoring	March 22, 2018	--
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contact Table
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site / DMS Number 92872

Designer	Florence & Hutcheson Engineering (Now HDR) 5121 Kingdom Way, Suite 100 Raleigh, NC 27607 Kevin Williams (919) 851-6066
Construction Plans and Sediment and Erosion Control Plans	Florence & Hutcheson Engineering (Now HDR) 5121 Kingdom Way, Suite 100 Raleigh, NC 27607 Kevin Williams (919) 851-6066
Construction Contractor	Carolina Environmental Contracting, Inc. Mount Airy, NC (336) 320-3849
Planting Contractor	Keller Environmental 7291 Haymarket Lane Raleigh, NC 27615 Jay Keller (919) 749-8259
As-built Surveyor	Turner Land Surveying. PLLC 3719 Benson Drive Raleigh, NC 27609 Elisabeth Turner (919) 827-0745
Baseline Data Collection	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis (919) 215-1693

Table 4. Project Baseline Information and Attributes

Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site / DMS Number 92872

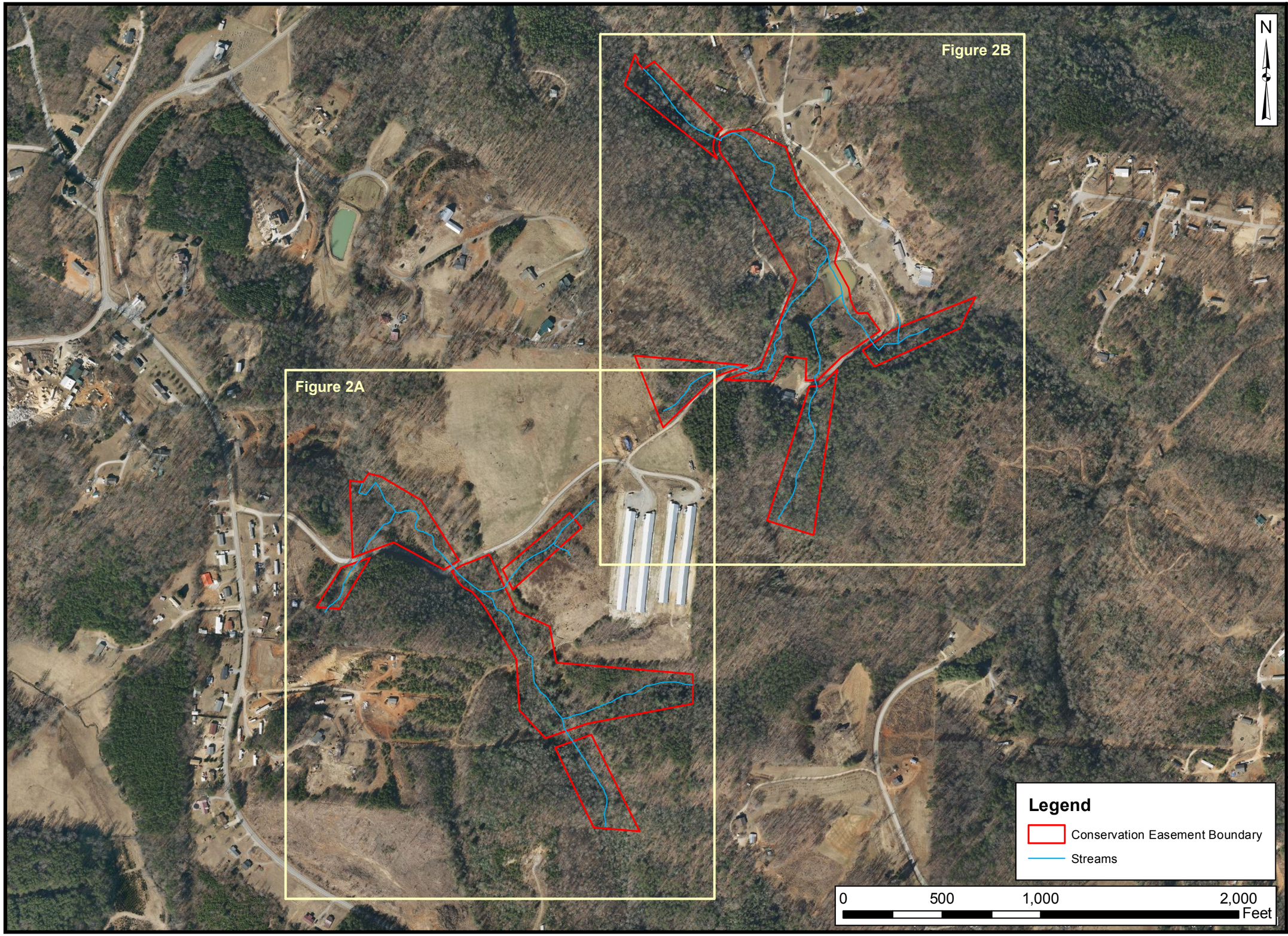
Project Information						
Project name	Neighbors Branch/Walton Crawley Branch Mitigation Site					
Project county	McDowell County, North Carolina					
Project area (Acres)	33.4					
Project coordinates (lat/long)	35.6599°N, 81.9002°W					
Project Watershed Summary Information						
Physiographic region	Blue Ridge					
Project river basin	Catawba River Basin					
USGS hydrologic unit (8 digit)	03050101					
NCDWQ Sub-basin	03-08-30					
Project drainage area (acres)	678					
% Drainage area impervious	< 1%					
CGIA land use classification	----					
Reach Summary Information						
Parameters	**Walton Crawley Branch**	**UTs to Walton Crawley Branch**		**Neighbors Branch**	**UTs to Neighbors Branch**	
		UT 1	**UT 2**		**UT 1**	**UT 3**
Length of reach (linear feet)	2529	1001	802	2339	281	875
Valley classification	VIII	II	II	VIII	II	II
Drainage area (acres)	458	29	20	220	13	15
NCDWQ stream identification score	18.5	25	25	33.5	23.5	16.5
NCDWQ water quality classification	C	C	C	C	C	C
Morphological description (stream type)	B4/5c-G4/5	E5	E5-G5	E5/4-G5/4	E5/4	E5
Design Rosgen stream type	C4	E/C5	E/C5	C4	E5/4	E5
Evolutionary trend						
Design approach (P1, P2, P3, E, etc.)	PI, EI, EII, & P	PI, EII, & P	PI & EII	PI, EI, EII, & P	EI & EII	P
Underlying mapped soils	Elsinboro, Evard, Hayesville	Evard	Evard, Hayesville	Hayesville, Iotla	Evard	Hayesville
Drainage class	Well	Well	Well	Well / SW Poorly	Well	Well
Soil hydric status	Nonhydric	Nonhydric	Nonhydric	Nonhydric / Hydric	Nonhydric	Nonhydric
Slope	0.0340	0.0380	0.0545	0.0260	0.0820	0.0656
FEMA classification	Not Mapped	Not Mapped	Not Mapped	Not Mapped	Not Mapped	Not Mapped
Native vegetation community	Forest / Pasture	Forest	Forest	Forest / Pasture	Forest	Forest
% Composition of exotic invasive spp.	<5	<5	<5	<5	<5	<5

Wetland Summary Information						
Parameters	**Walton Crawley Branch**	**UTs to Walton Crawley Branch**		**Neighbors Branch**	**UTs to Neighbors Branch**	
		UT 1	**UT 2**		**UT 1**	**UT 3**
Size of wetland (acres)	0.95	0.37	N/A	1.88	0.23	N/A
Wetland type	Riparian Riverine	Riparian Riverine	N/A	Riparian Riverine	Riparian Riverine	N/A
Mapped soil series	Wehadkee	Wehadkee	N/A	Wehadkee	Wehadkee	N/A
Drainage class	poorly	poorly	N/A	poorly	poorly	N/A
Soil hydric status	hydric	hydric	N/A	hydric	hydric	N/A
Source of hydrology	Overbank and springs	Overbank and springs	N/A	Overbank and springs	Overbank and springs	N/A
Hydrologic impairment	Cleared	Invasives	N/A	Drained/ Cleared/ Invasives	Invasives	N/A
Native vegetation community	Forest / Pasture	Forest	N/A	Forest / Pasture	Forest	N/A
% Composition of exotic invasive spp.	<5	<5	N/A	<5	<5	N/A

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the US – Section 404	Yes	Yes	SAW-2009-917
Waters of the US – Section 401	Yes	Yes	SAW-2009-917
Endangered Species Act	Yes	Yes	No Effect – CE Document
Historic Preservation Act	Yes	Yes	CE Document
Coastal Zone Management Act (CZMA/CAMA)	No	NA	NA
FEMA Floodplain Compliance	No	NA	NA
Essential Fisheries Habitat	No	NA	NA

Appendix B
Visual Assessment Data

Figures 2, 2A-2B. Current Conditions Plan View
Figures 3, 3A-3B. Project Assets
Tables 5A-5E. Visual Stream Morphology Stability Assessment
Table 6. Vegetation Condition Assessment
Stream Fixed Station Photo Points
Vegetation Plot Photos



Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Current Conditions Plan View

Drawn by: KRJ

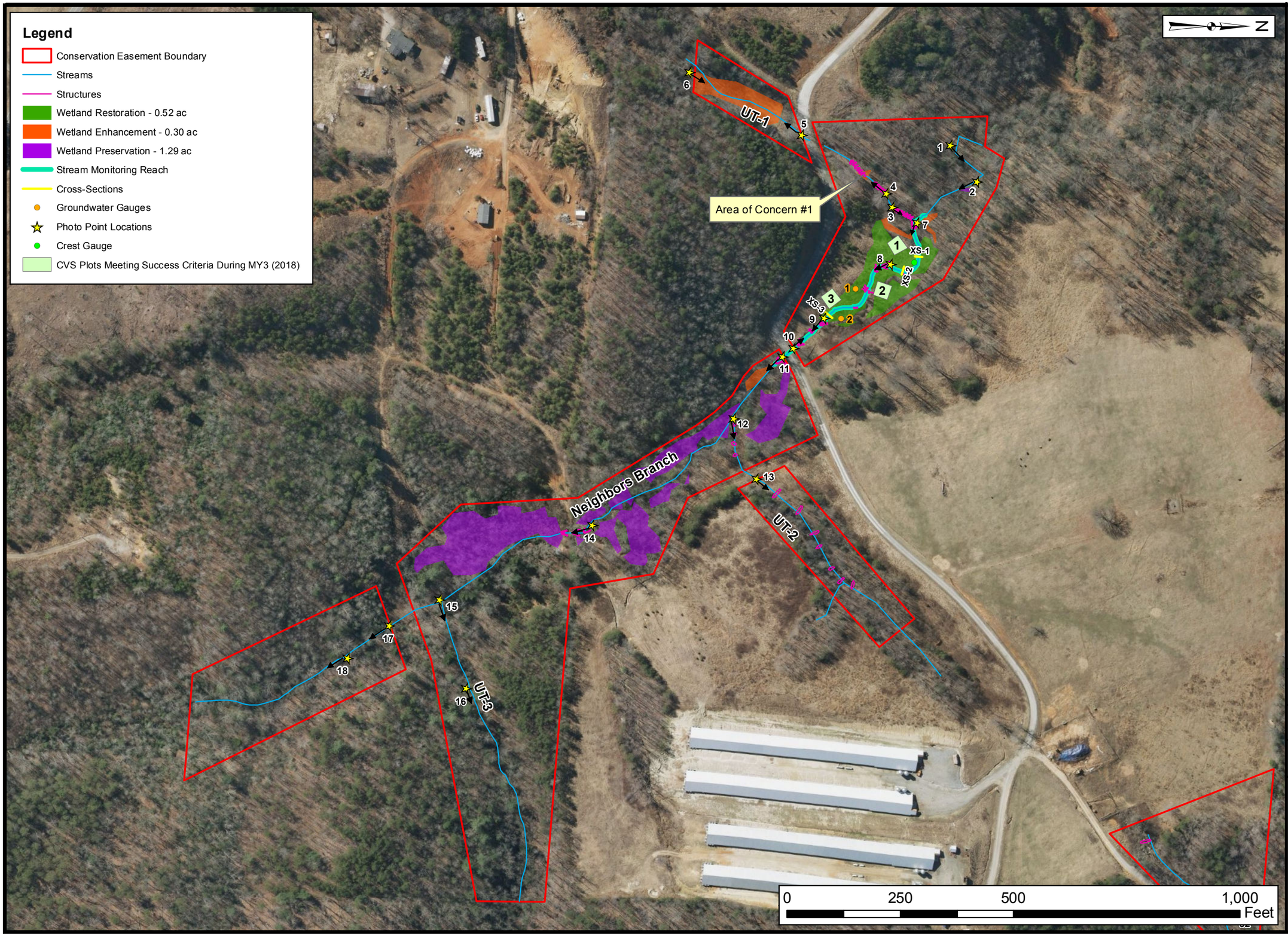
Date: NOV 2018

Scale: 1:5500

Project No.: 12-004.21

FIGURE

2



Axiom Environmental, Inc.

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Division of Mitigation Services

Project:

Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Current Conditions Plan View

Drawn by: KRJ

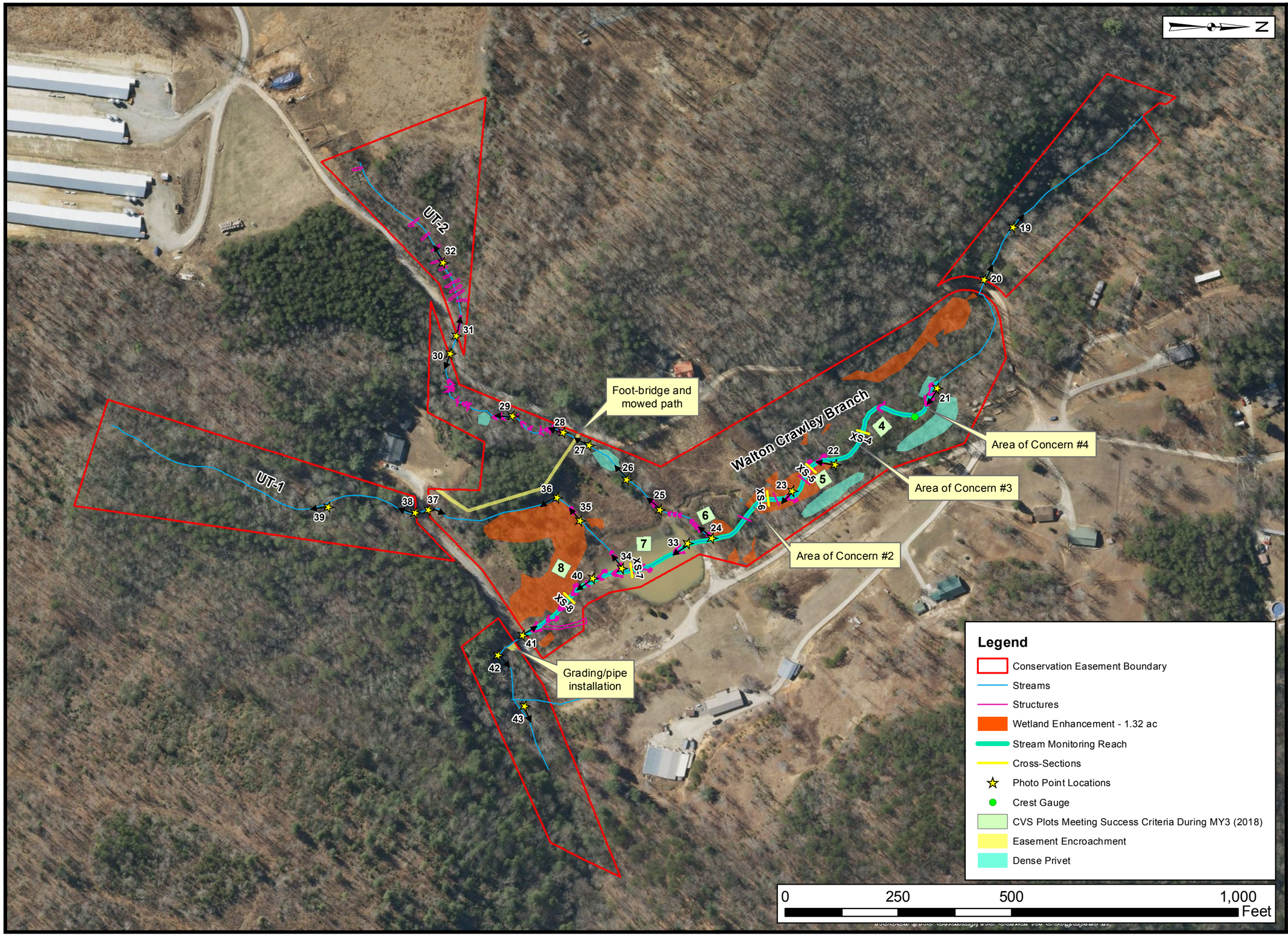
Date: NOV 2018

Scale: 1:2400

Project No.: 12-004.21

FIGURE

2A



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Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Current Conditions Plan View

Drawn by: KRJ

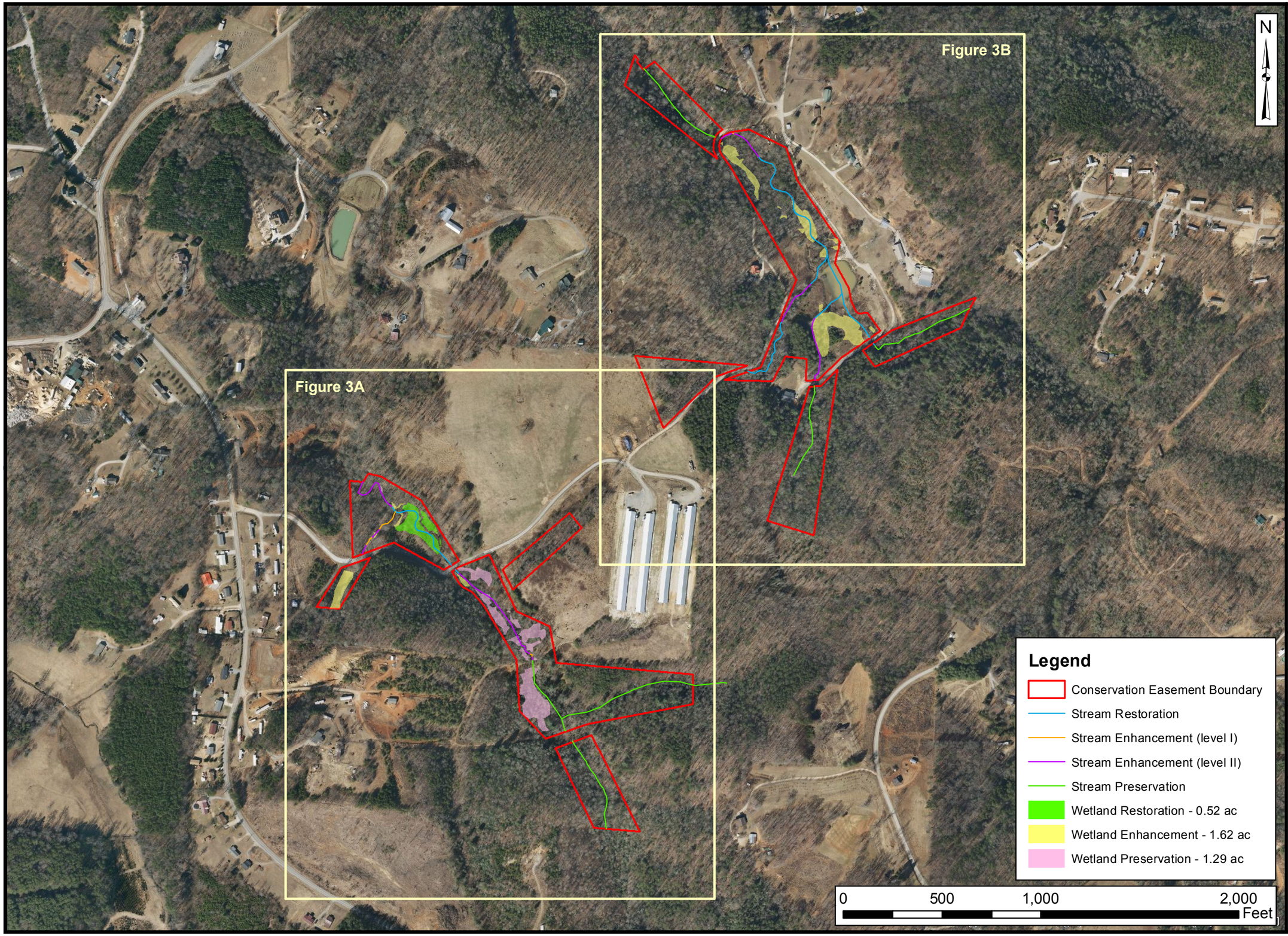
Date: NOV 2018

Scale: 1:2400

Project No.: 12-004.21

FIGURE

2B



Axiom Environmental, Inc.

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Division of Mitigation Services

Project:

Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Project Assets

Drawn by: KRJ

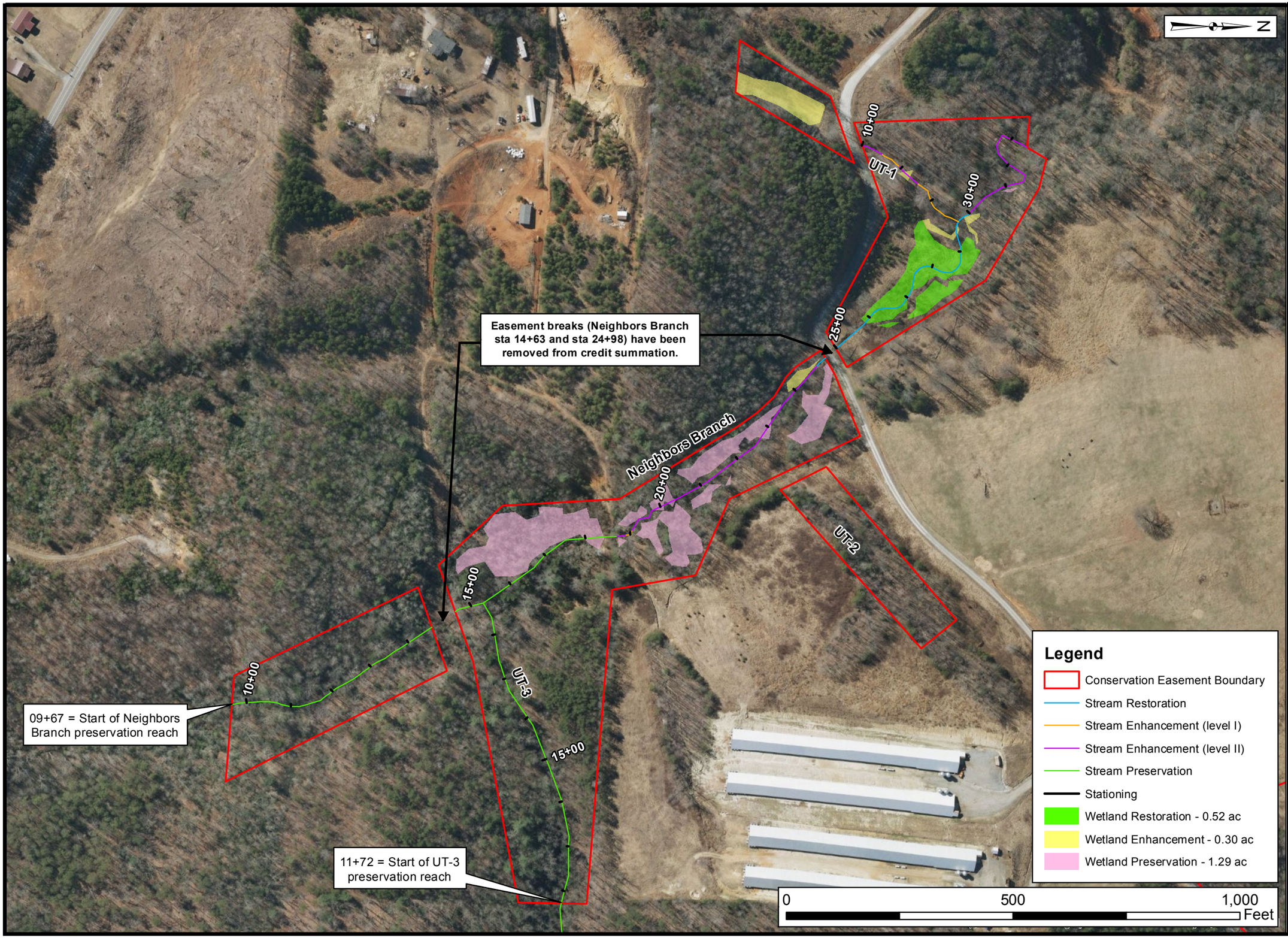
Date: JUL 2016

Scale: 1:5500

Project No.: 12-004.21

FIGURE

3



Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Project Assets

Drawn by: KRJ

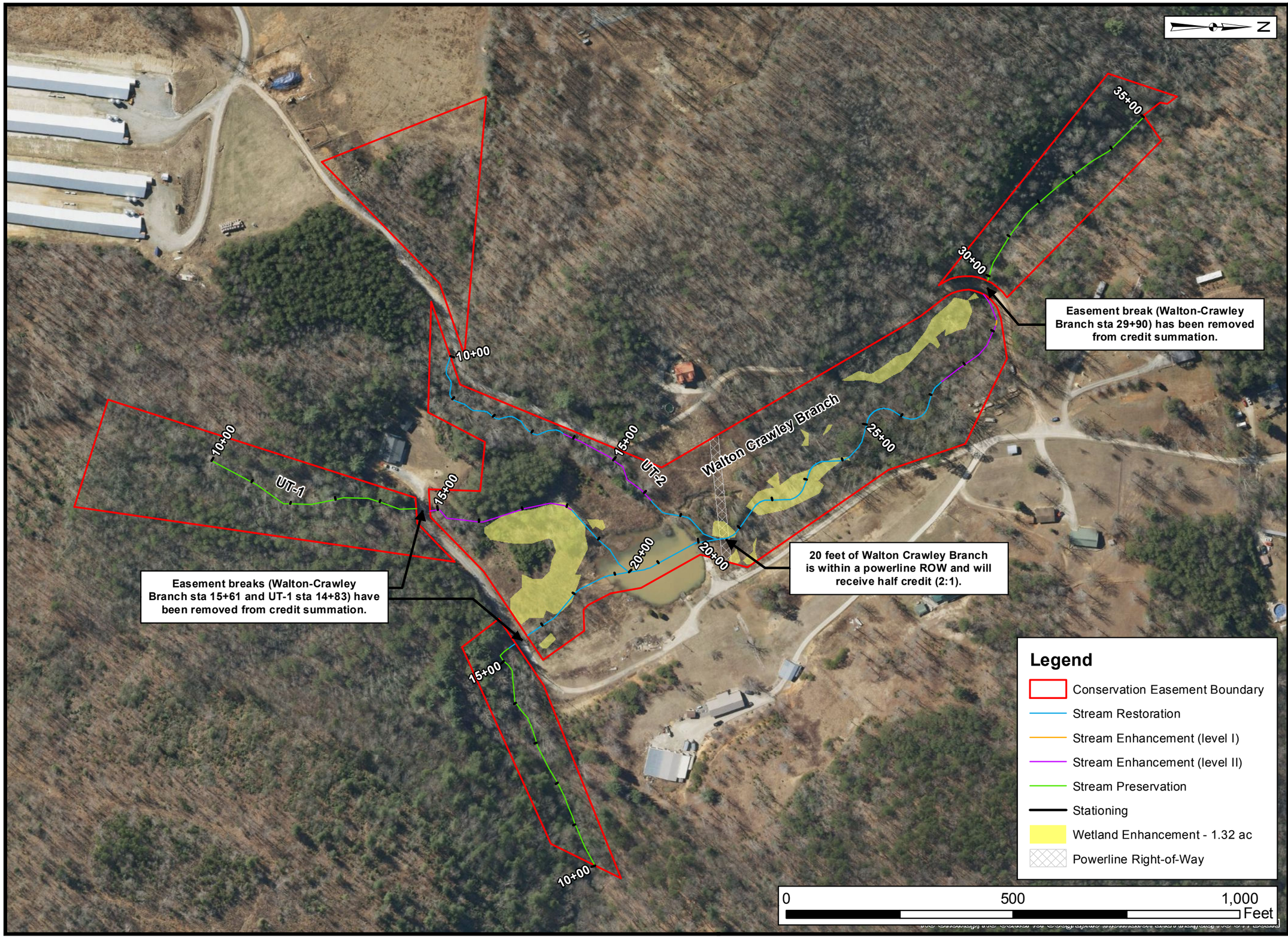
Date: JUL 2016

Scale: 1:2400

Project No.: 12-004.21

FIGURE

3A



Axiom Environmental, Inc.

Prepared for:

NC Department of Environmental Quality

Division of Mitigation Services

Project:

Neighbors Branch/ Walton Crawley Branch Stream and Wetland Restoration Site

DMS Project # 92872

McDowell County, NC

Title:

Project Assets

Drawn by: KRJ

Date: MAY 2018

Scale: 1:2400

Project No.: 12-004.21

FIGURE

3B

Table 5A **Visual Stream Morphology Stability Assessment**
Reach ID **Walton Crawley Branch**
Assessed Length **1450**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	26	26			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	25	25			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	25	25			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	25	25			100%			
		2. Thalweg centering at downstream of meander (Glide)	25	25			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	20	99%			99%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	2	20	99%	0	0	99%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	24	24			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	24	24			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	24	24			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	23	24			96%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	24	24			100%			

Table 5B **Visual Stream Morphology Stability Assessment**
Reach ID **UT1 to Walton Crawley Branch**
Assessed Length **518**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	8	8			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	7	7			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	7	7			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	7	7			100%			
		2. Thalweg centering at downstream of meander (Glide)	7	7			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	10	10			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	10	10			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	10	10			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	10	10			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	10	10			100%			

Table 5C **Visual Stream Morphology Stability Assessment**
Reach ID **UT2 to Walton Crawley Branch**
Assessed Length **802**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	12	12			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	11	11			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	11	11			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		2. Thalweg centering at downstream of meander (Glide)	11	11			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	12	12			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	12	12			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	12	12			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	12	12			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	12	12			100%			

Table 5D **Visual Stream Morphology Stability Assessment**
Reach ID **Neighbors Branch**
Assessed Length **1470**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	22	22			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	21	21			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	21	21			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	21	21			100%			
		2. Thalweg centering at downstream of meander (Glide)	21	21			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	16	16			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	16	16			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	16	16			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	16	16			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	16	16			100%			

Table 5E **Visual Stream Morphology Stability Assessment**
Reach ID **UT1 to Neighbors Branch**
Assessed Length **281**

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			1	60	79%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	19	20			95%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	19	19			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	19	19			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	19	19			100%			
		2. Thalweg centering at downstream of meander (Glide)	19	19			100%			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%			100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%			100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%			100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	20			95%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	20	20			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	20	20			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	19	20			95%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	19	20			95%			

Table 6 — Vegetation Condition Assessment

Neighbors Branch/Walton Crawley Branch Mitigation Project

Planted Acreage[1] **11.78**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	None	0.1 acres	none	0	0.00	0.0%
2. Low Stem Density Areas	None	0.1 acres	none	0	0.00	0.0%
2B. Low Planted Stem Density Areas	None	0.1 acres	none	0	0.00	0.0%
			Total	0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	None	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2] **33.4**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Dense populations of Chinese privet	1000 SF	blue	5	0.31	0.9%
5. Easement Encroachment Areas[3]	Mowed footpath and footbridge contructed within easement. Grading due to plastic pipe instalation in the stream.	none	yellow	2	0.08	0.2%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by DMS such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018

Photo Point 1 – Neighbors Branch

Photo Point 2 – Neighbors Branch

Photo Point 3 – UT-1 to Neighbors Branch

Photo Point 4 – UT-1 to Neighbors Branch

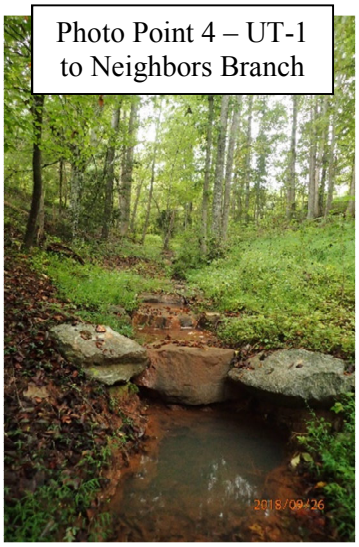


Photo Point 5 – UT-1 to Neighbors Branch

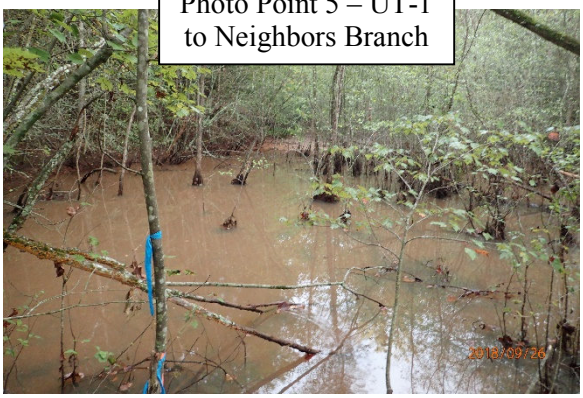
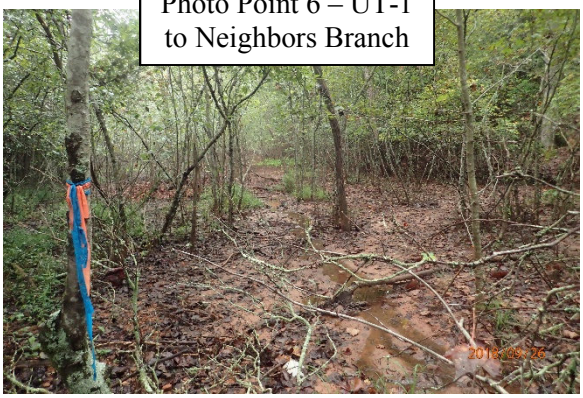


Photo Point 6 – UT-1 to Neighbors Branch



Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 7 – Neighbors Branch

Photo Point 8 – Neighbors Branch

Photo Point 9 – Neighbors Branch

Photo Point 10 – Neighbors Branch

Photo Point 11 – Neighbors Branch

Photo Point 12 – UT-2 to Neighbors Branch

Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 13 – UT-2 to Neighbors Branch

Photo Point 14 – Neighbors Branch

Photo Point 15 – UT-3 to Neighbors Branch

Photo Point 16 – UT-3 to Neighbors Branch

Photo Point 17 – Neighbors Branch

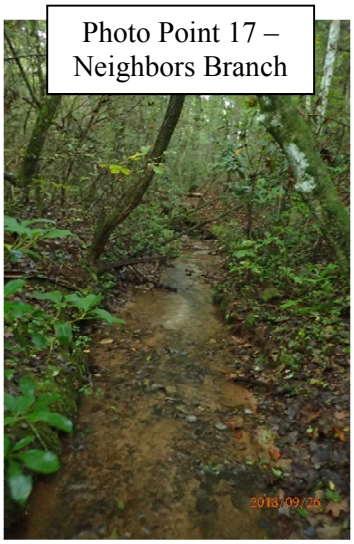


Photo Point 18 – Neighbors Branch

Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 19 – Walton Crawley Branch

Photo Point 20 - Walton Crawley Branch

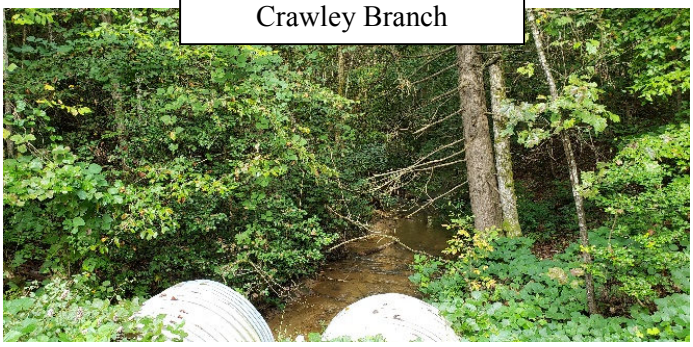


Photo Point 21 - Walton Crawley Branch

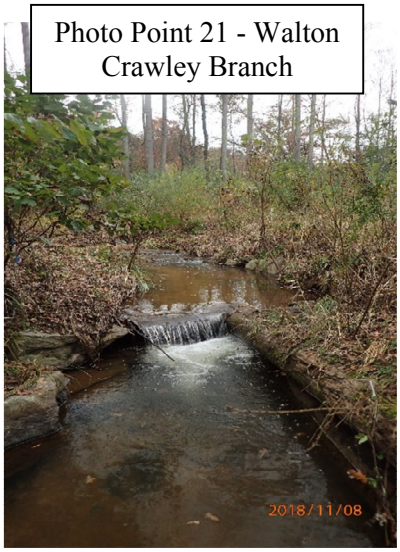


Photo Point 22 - Walton Crawley Branch

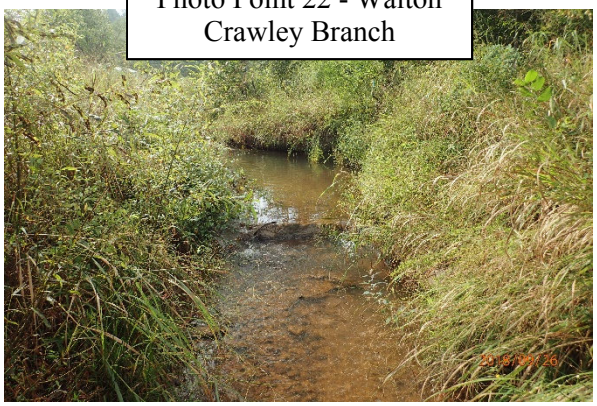


Photo Point 23 - Walton Crawley Branch

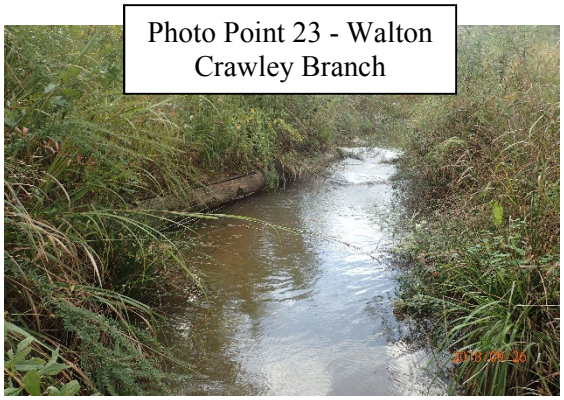


Photo Point 24 – UT-2 to Walton Crawley Branch

Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 25 – UT-2 to Walton Crawley Branch

Photo Point 26 – UT-2 to Walton Crawley Branch

Photo Point 27 – UT-2 to Walton Crawley Branch

Photo Point 28 – UT-2 to Walton Crawley Branch

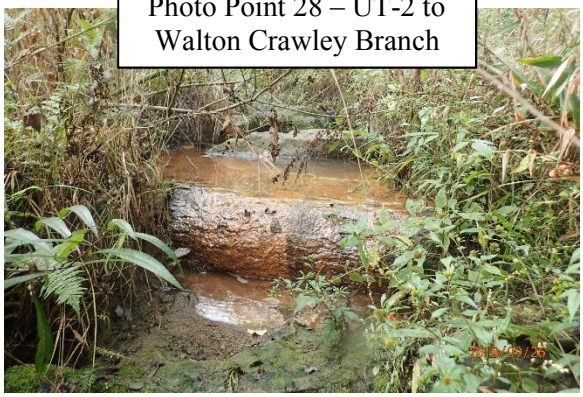


Photo Point 29 – UT-2 to Walton Crawley Branch

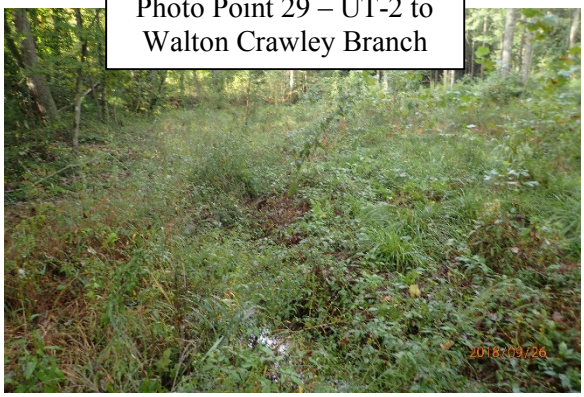


Photo Point 30 – UT-2 to Walton Crawley Branch

Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 31 – UT-2 to Walton Crawley Branch

Photo Point 32 – UT-2 to Walton Crawley Branch

Photo Point 33 - Walton Crawley Branch

Photo Point 34 – UT-1 to Walton Crawley Branch

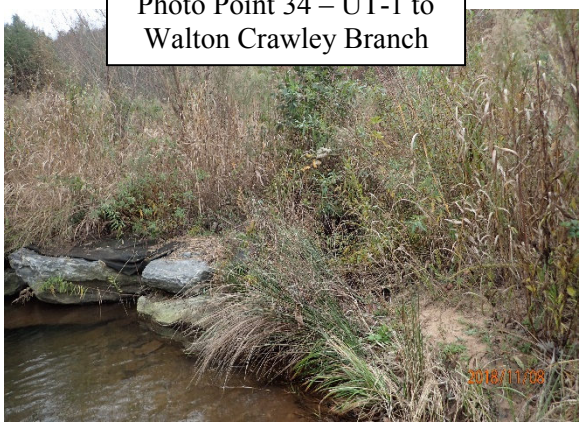


Photo Point 35 – UT-1 to Walton Crawley Branch

Photo Point 36 – UT-1 to Walton Crawley Branch

Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 37 – UT-1 to Walton Crawley Branch

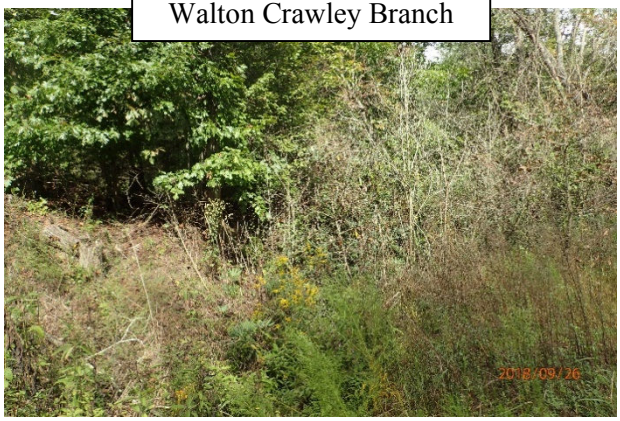


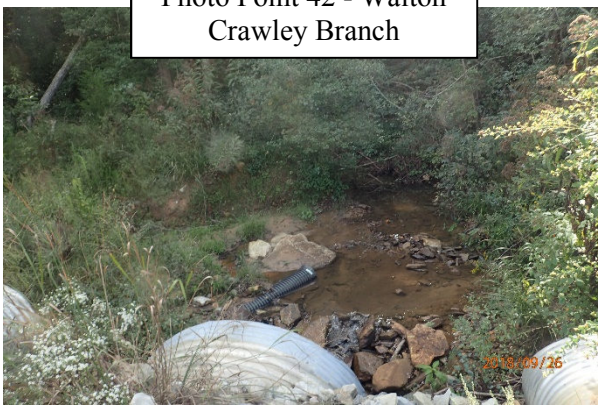
Photo Point 38 – UT-1 to Walton Crawley Branch

Photo Point 39 – UT-1 to Walton Crawley Branch

Photo Point 40 - Walton Crawley Branch

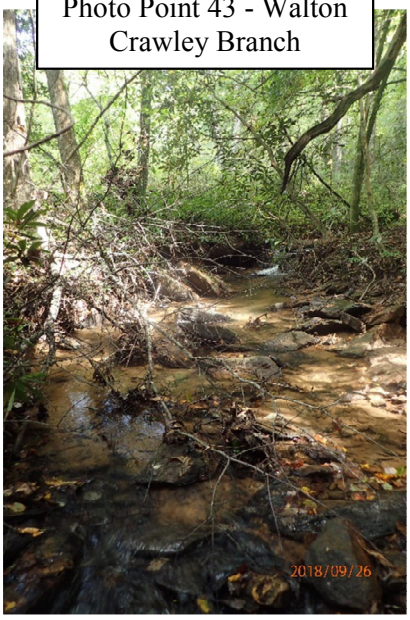
Photo Point 41 - Walton Crawley Branch

Photo Point 42 - Walton Crawley Branch



Neighbors Branch/Walton Crawley Branch
Fixed Station Photographs
September & November 2018
(continued)

Photo Point 43 - Walton Crawley Branch

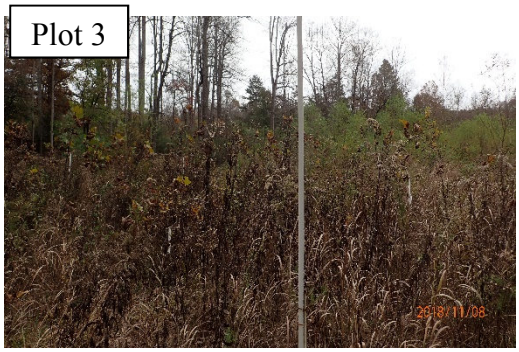


Neighbors Branch/Walton Crawley Branch
Vegetation Monitoring Photographs Taken September/November 2018

Plot 1

Plot 2

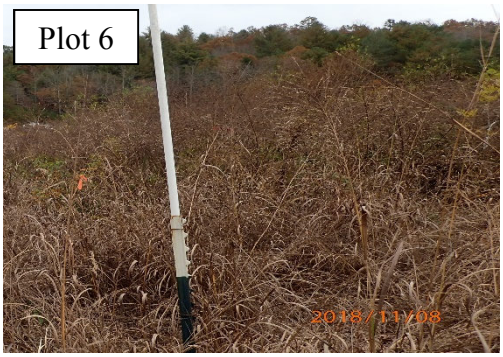
Plot 3



Plot 4

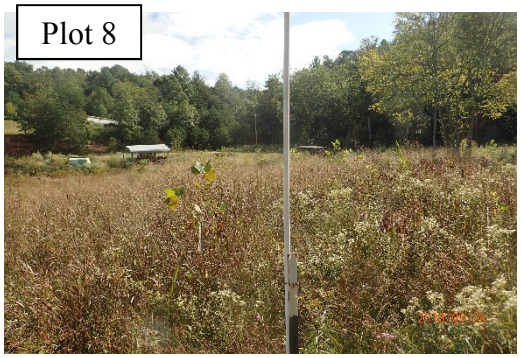
Plot 5

Plot 6



Plot 7

Plot 8



Appendix C.
Vegetation Data

Table 7. Vegetation Plot Success Summary
Table 8. CVS Vegetation Plot Metadata
Table 9. Total Planted Stems by Plot and Species

Table 7. Vegetation Plot Success Summary

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	

Table 8. CVS Vegetation Plot Metadata

Report Prepared By	Kenan Jernigan
Date Prepared	9/27/2018 13:14
database name	Axiom-NeighborsWalton-2018MY3-A-v2.3.1.mdb
database location	S:\Business\Projects\12\12-004 EEP Monitoring\12-004.21 Neighbors Bob\Neighbors Branch and Walton Crawley Branch\2018 MY-03\CVS
computer name	KEENAN-PC
file size	58728448
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	92872
project Name	Neighbors Branch/ Walton Crawley Branch
River Basin	Catawba
length(ft)	
stream-to-edge width (ft)	
Required Plots (calculated)	
Sampled Plots	8

Table 9. Total Planted Stems by Plot and Species
EEP Project Code 92872. Project Name: Neighbors Branch/ Walton Crawley Branch

			Current Plot Data (MY3 2018)																						
			92872-01-0001			92872-01-0002			92872-01-0003			92872-01-0004			92872-01-0005			92872-01-0006			92872-01-0007			92872-01-0008		
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**
Acer rubrum	red maple	Tree	2	2	6				2	2	2	5	5	5	1	1	1									
Betula nigra	river birch	Tree				1	1	1	5	5	5	4	4	4							1	1	1	1	1	1
Cornus amomum	silky dogwood	Shrub																								
Diospyros virginiana	common persimmon	Tree													1	1	1				2	2	2	2	2	2
Fraxinus pennsylvanica	green ash	Tree							4	4	4	1	1	1	6	6	6	5	5	5	2	2	2	1	1	1
Liriodendron tulipifera	tuliptree	Tree			3									4	1	1	1			2			2			
Nyssa	tupelo	Tree										1	1	1				1	1	1						
Nyssa sylvatica	blackgum	Tree				1	1	1	1	1	1															
Platanus occidentalis	American sycamore	Tree	7	7	15	6	6	6	4	4	4			4			4				4	4	6	2	2	2
Quercus	oak	Tree																								
Quercus nigra	water oak	Tree													1	1	1	4	4	4	2	2	2			
Quercus phellos	willow oak	Tree	1	1	1							1	1	1										2	2	2
Quercus rubra	northern red oak	Tree			1																			2	2	2
Salix nigra	black willow	Tree																								
Sambucus canadensis	Common Elderberry	Shrub																								
		Stem count	10	10	26	8	8	8	16	16	16	12	12	20	10	10	14	10	10	12	11	11	15	10	10	10
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	3	3	5	3	3	3	5	5	5	5	5	7	5	5	6	3	3	4	5	5	6	6	6	6
		Stems per ACRE	404.7	404.7	1052	323.7	323.7	323.7	647.5	647.5	647.5	485.6	485.6	809.4	404.7	404.7	566.6	404.7	404.7	485.6	445.2	445.2	607	404.7	404.7	404.7

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%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 9. Total Planted Stems by Plot and Species (continued)
EEP Project Code 92872. Project Name: Neighbors Branch/ Walton Crawley Branch

			Annual Means											
			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree	10	10	14	10	10	10	11	11	11	6	6	17
Betula nigra	river birch	Tree	12	12	12	12	12	12	15	15	15	16	16	16
Cornus amomum	silky dogwood	Shrub							1	1	1	1	1	1
Diospyros virginiana	common persimmon	Tree	5	5	5	5	5	8	1	1	1	1	1	1
Fraxinus pennsylvanica	green ash	Tree	19	19	19	19	19	19	24	24	24	31	31	31
Liriodendron tulipifera	tuliptree	Tree	1	1	12	1	1	8			3			
Nyssa	tupelo	Tree	2	2	2	1	1	1	1	1	1			
Nyssa sylvatica	blackgum	Tree	2	2	2	2	2	2	3	3	3	6	6	6
Platanus occidentalis	American sycamore	Tree	23	23	41	24	24	59	28	28	81	29	29	29
Quercus	oak	Tree							1	1	1			
Quercus nigra	water oak	Tree	7	7	7	6	6	6	2	2	2	4	4	4
Quercus phellos	willow oak	Tree	4	4	4	5	5	5	12	12	12	12	12	12
Quercus rubra	northern red oak	Tree	2	2	3	2	2	2	1	1	1	1	1	1
Salix nigra	black willow	Tree						6			3			10
Sambucus canadensis	Common Elderberry	Shrub						2						4
		Stem count	87	87	121	87	87	140	100	100	159	107	107	132
		size (ares)	8			8			8			8		
		size (ACRES)	0.20			0.20			0.20			0.20		
		Species count	11	11	11	11	11	13	12	12	14	10	10	12
		Stems per ACRE	440.1	440.1	612.1	440.1	440.1	708.2	505.9	505.9	804.3	541.3	541.3	667.7

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%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Appendix D.
Stream Measurements and Geomorphology Data

Cross Section Plots
Longitudinal Profile Plots
Substrate Plots
Tables 10A-10B. Baseline Stream Data Summary
Tables 11A-11D. Monitoring Data-Dimensional Data Summary

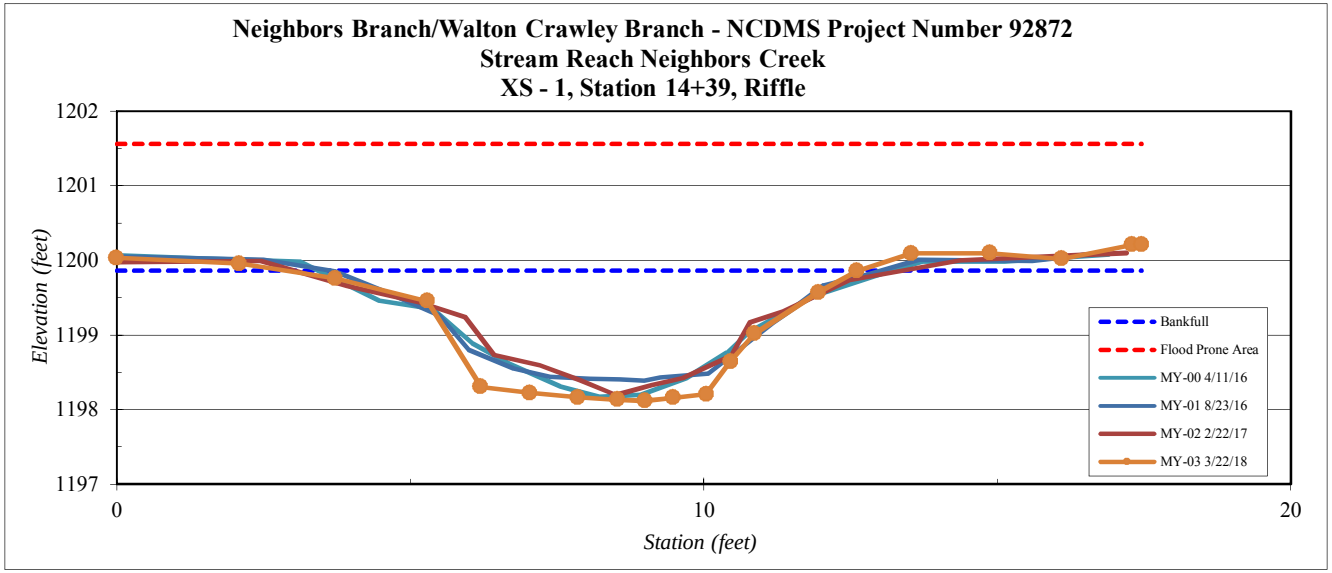
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 1, Riffle
Reach	Neighbors Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	1200.03
2.09	1199.96
3.72	1199.76
5.29	1199.45
6.20	1198.30
7.04	1198.22
7.86	1198.16
8.53	1198.13
9.00	1198.12
9.48	1198.16
10.04	1198.21
10.46	1198.64
10.86	1199.02
11.95	1199.57
12.61	1199.86
13.54	1200.09
14.9	1200.10
16.1	1200.02
17.3	1200.21
17.5	1200.21

SUMMARY DATA	
Bankfull Elevation:	1199.9
Bankfull Cross-Sectional Area:	9.5
Bankfull Width:	9.7
Flood Prone Area Elevation:	1201.6
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.7
Low Bank Height:	1.7
Mean Depth at Bankfull:	1.0
W / D Ratio:	9.9
Entrenchment Ratio:	10.3
Bank Height Ratio:	1.0

XS 1 Looking Upstream

Stream Type	E



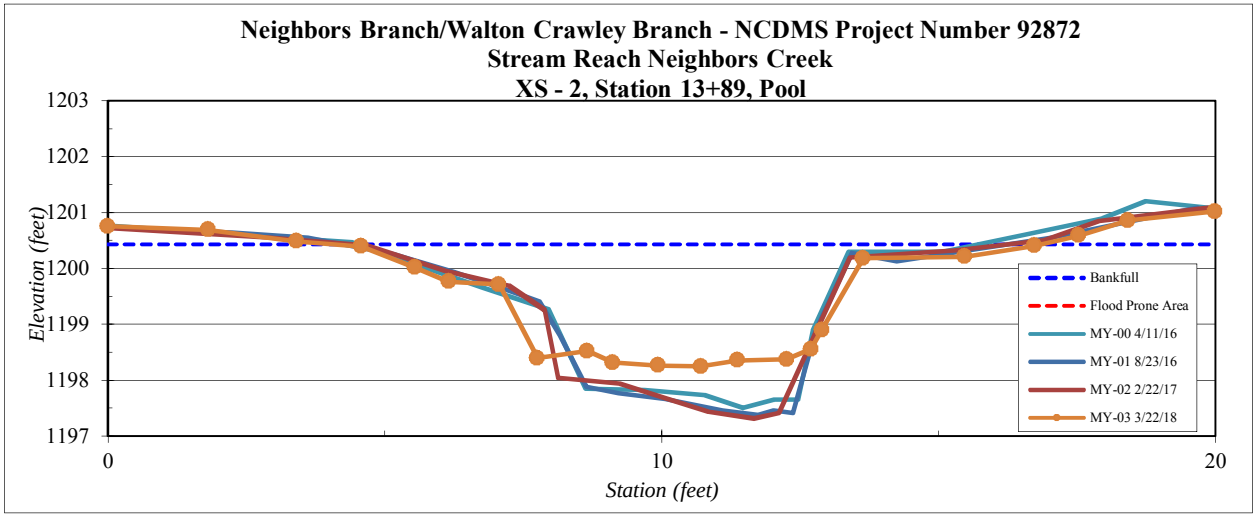
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 2, Pool
Reach	Neighbors Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1200.8
1.8	1200.7
3.4	1200.5
4.6	1200.4
5.5	1200.0
6.2	1199.8
7.1	1199.7
7.8	1198.4
8.7	1198.5
9.1	1198.3
9.9	1198.3
10.7	1198.2
11.4	1198.4
12.3	1198.4
12.7	1198.6
12.9	1198.9
13.6	1200.2
15.5	1200.2
16.7	1200.4
17.5	1200.6
18.4	1200.9
20.0	1201.02

SUMMARY DATA	
Bankfull Elevation:	1200.4
Bankfull Cross-Sectional Area:	14.0
Bankfull Width:	12.8
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	2.2
Low Bank Height:	2.2
Mean Depth at Bankfull:	1.1
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

XS 2 Looking Upstream

Stream Type	E



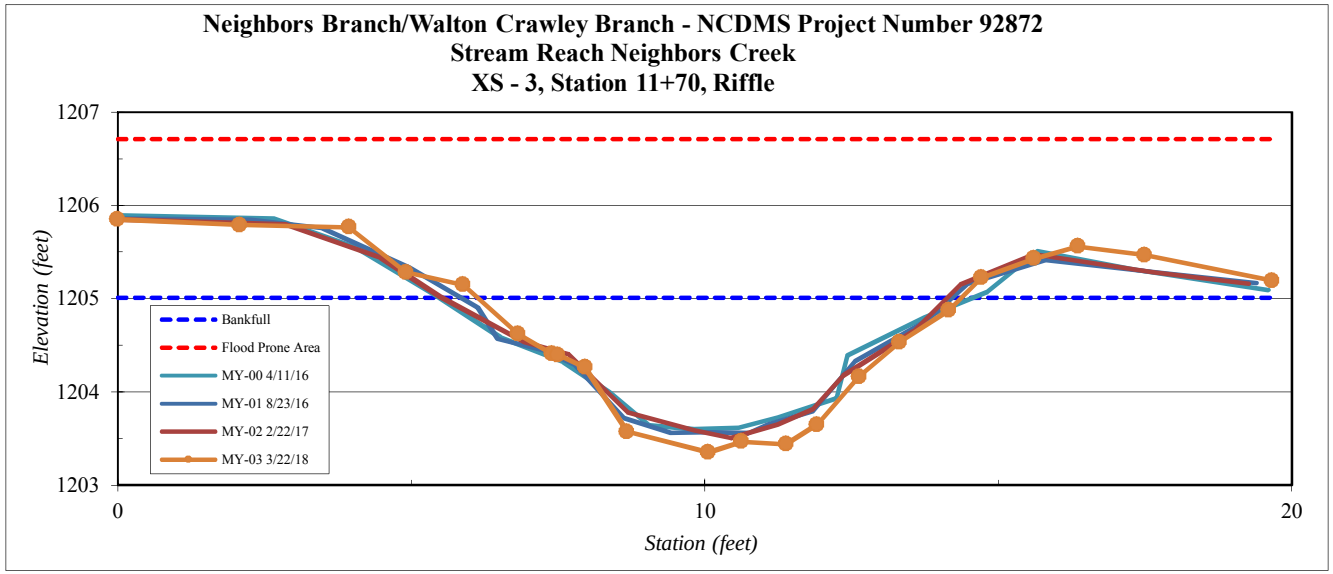
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 3, Riffle
Reach	Neighbors Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	1205.85
2.07	1205.79
3.94	1205.77
4.91	1205.28
5.88	1205.15
6.82	1204.62
7.40	1204.41
7.50	1204.40
7.96	1204.26
8.68	1203.57
10.06	1203.35
10.63	1203.47
11.39	1203.44
11.91	1203.65
12.63	1204.16
13.32	1204.53
14.2	1204.88
14.7	1205.22
15.6	1205.43
16.4	1205.56
17.5	1205.47
19.7	1205.19

SUMMARY DATA	
Bankfull Elevation:	1205.0
Bankfull Cross-Sectional Area:	8.1
Bankfull Width:	8.2
Flood Prone Area Elevation:	1206.7
Flood Prone Width:	100.0
Max Depth at Bankfull:	1.7
Low Bank Height:	1.8
Mean Depth at Bankfull:	1.0
W / D Ratio:	8.3
Entrenchment Ratio:	12.2
Bank Height Ratio:	1.1

XS 3 Looking Upstream

Stream Type	E



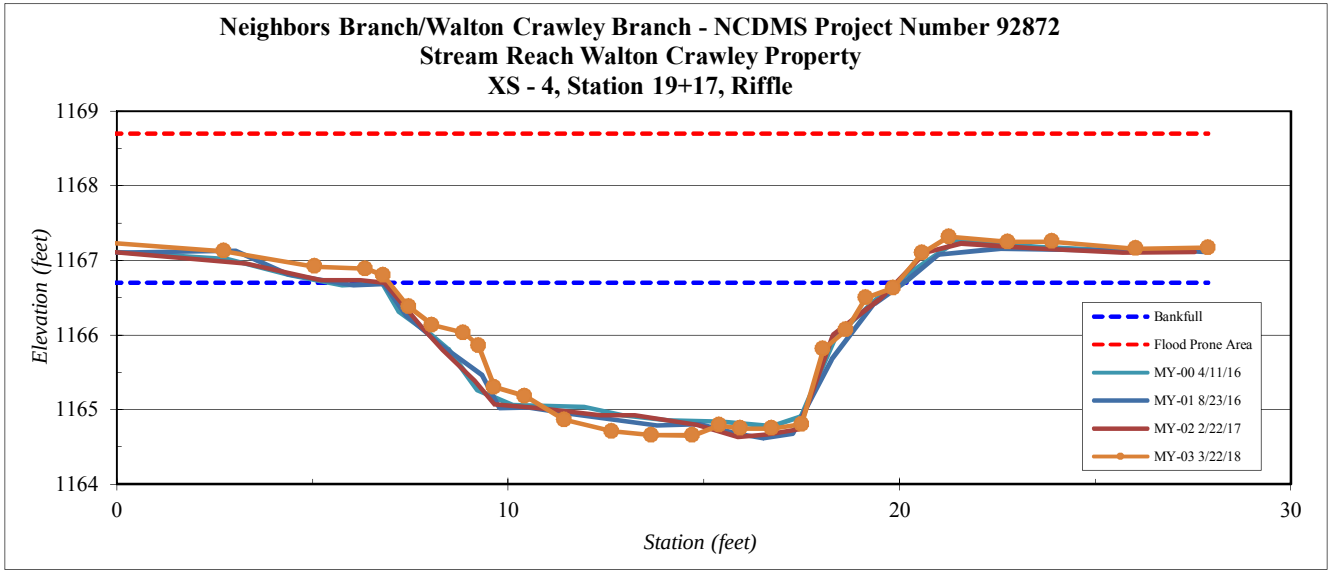
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 4, Riffle
Reach	Walton Crawley Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
-0.10	1167.23
2.75	1167.12
5.06	1166.92
6.36	1166.89
6.81	1166.80
7.46	1166.38
8.06	1166.13
8.86	1166.03
9.25	1165.86
9.64	1165.30
10.43	1165.18
11.44	1164.86
12.65	1164.71
13.66	1164.65
14.71	1164.65
15.39	1164.79
15.9	1164.75
16.7	1164.75
17.51	1164.80
18.05	1165.81
18.64	1166.07
19.14	1166.50
19.84	1166.63
20.58	1167.10
21.26	1167.32
22.77	1167.25
23.91	1167.25
26.04	1167.16
27.89	1167.17

SUMMARY DATA	
Bankfull Elevation:	1166.7
Bankfull Cross-Sectional Area:	17.9
Bankfull Width:	13.0
Flood Prone Area Elevation:	1168.7
Flood Prone Width:	100.0
Max Depth at Bankfull:	2.0
Low Bank Height:	2.1
Mean Depth at Bankfull:	1.4
W / D Ratio:	9.4
Entrenchment Ratio:	7.7
Bank Height Ratio:	1.1

XS 4 Looking Upstream

Stream Type	E



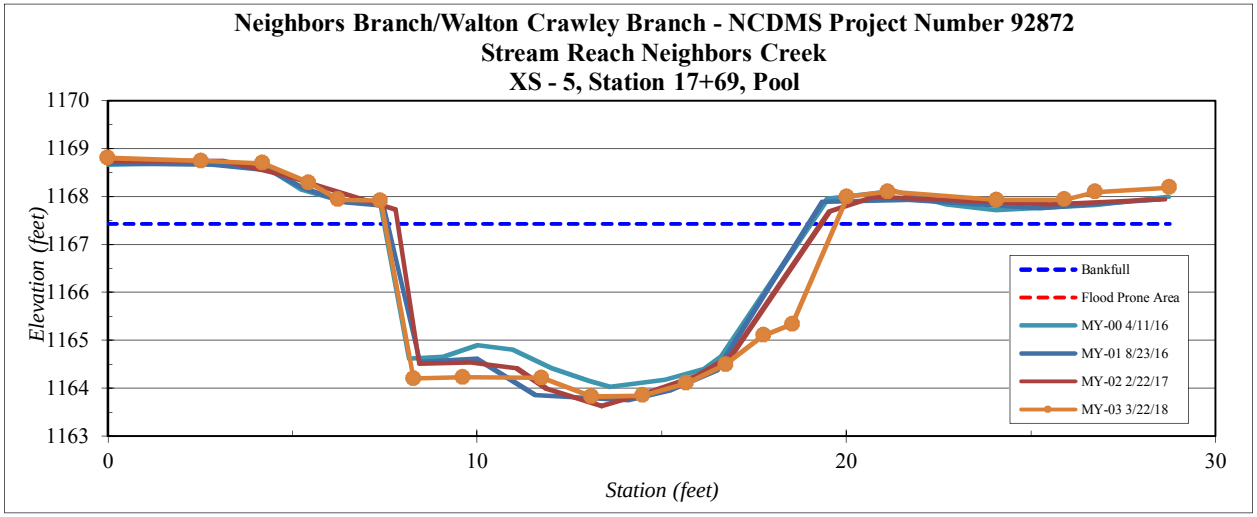
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 5, Pool
Reach	Walton Crawley Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1168.8
2.5	1168.7
4.2	1168.7
5.4	1168.3
6.2	1167.9
7.4	1167.9
8.3	1164.2
9.6	1164.2
11.8	1164.2
13.1	1163.8
14.5	1163.8
15.7	1164.1
16.7	1164.5
17.8	1165.1
18.5	1165.3
20.0	1168.0
21.1	1168.1
24.1	1167.9
25.9	1167.9
26.7	1168.1
28.8	1168.2

SUMMARY DATA	
Bankfull Elevation:	1167.4
Bankfull Cross-Sectional Area:	35.1
Bankfull Width:	12.2
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	3.6
Low Bank Height:	4.1
Mean Depth at Bankfull:	2.9
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.1

XS 5 Looking Upstream

Stream Type	E



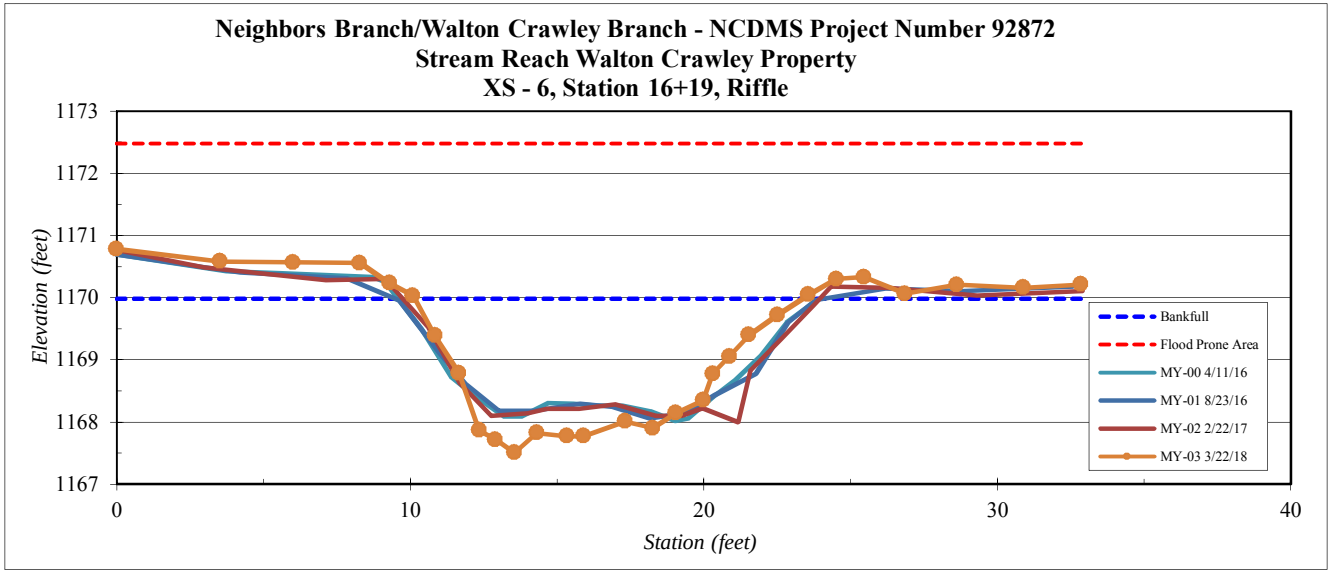
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 6, Riffle
Reach	Walton Crawley Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	1170.78
3.53	1170.58
6.02	1170.57
8.28	1170.55
9.29	1170.23
10.10	1170.03
10.84	1169.39
11.66	1168.78
12.35	1167.86
12.90	1167.71
13.54	1167.50
14.32	1167.82
15.33	1167.77
15.90	1167.77
17.32	1168.01
18.27	1167.90
19.1	1168.14
20.0	1168.35
20.3	1168.78
20.9	1169.05
21.5	1169.40
22.5	1169.72
23.6	1170.05
24.5	1170.30
25.5	1170.33
26.9	1170.06
28.6	1170.20
30.9	1170.16
32.8	1170.21

SUMMARY DATA	
Bankfull Elevation:	1170.0
Bankfull Cross-Sectional Area:	20.2
Bankfull Width:	13.2
Flood Prone Area Elevation:	1172.5
Flood Prone Width:	100.0
Max Depth at Bankfull:	2.5
Low Bank Height:	2.5
Mean Depth at Bankfull:	1.5
W / D Ratio:	8.6
Entrenchment Ratio:	7.6
Bank Height Ratio:	1.0

XS 6 Looking Upstream

Stream Type	E



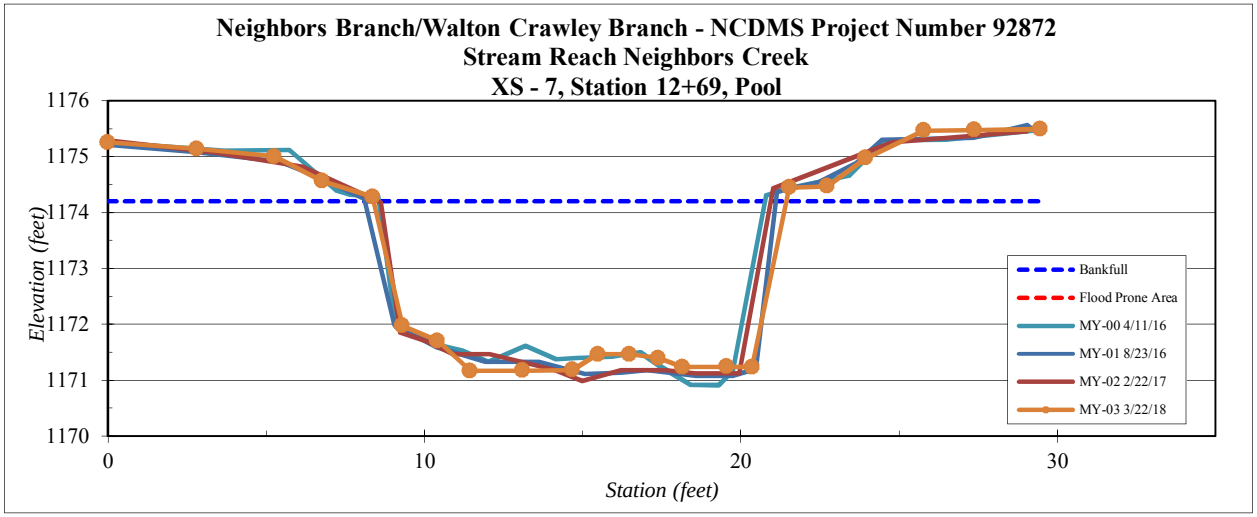
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 7, Pool
Reach	Walton Crawley Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.0	1175.3
2.8	1175.1
5.3	1175.0
6.8	1174.6
8.4	1174.3
9.3	1172.0
10.4	1171.7
11.5	1171.2
13.1	1171.2
14.7	1171.2
15.5	1171.5
16.5	1171.5
17.4	1171.4
18.1	1171.2
19.5	1171.2
20.4	1171.2
21.5	1174.4
22.7	1174.5
24.0	1175.0
25.8	1175.5
27.4	1175.5
29.5	1175.5

SUMMARY DATA	
Bankfull Elevation:	1174.2
Bankfull Cross-Sectional Area:	34.1
Bankfull Width:	13.0
Flood Prone Area Elevation:	NA
Flood Prone Width:	NA
Max Depth at Bankfull:	3.0
Low Bank Height:	3.1
Mean Depth at Bankfull:	2.6
W / D Ratio:	NA
Entrenchment Ratio:	NA
Bank Height Ratio:	1.0

XS 7 Looking Upstream

Stream Type	E



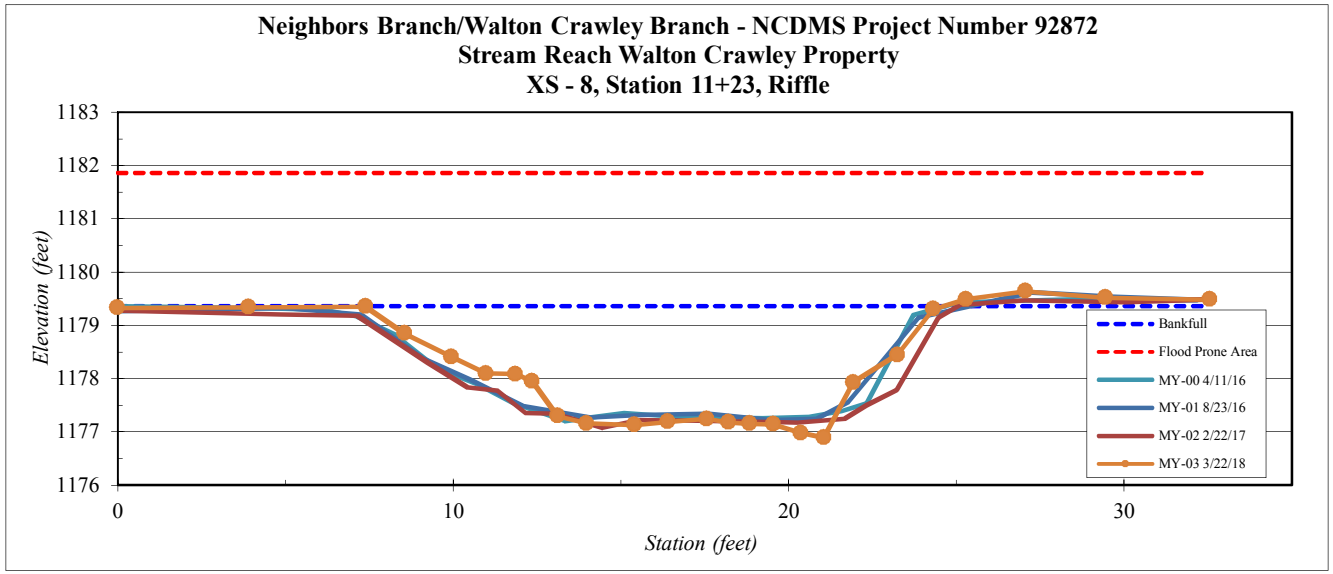
Site	Neighbors Br./Walton Crawley Br.
Project Number:	92872
XS ID	XS - 8, Riffle
Reach	Walton Crawley Branch
Date:	3/22/2018
Field Crew:	Perkinson, Keith

Station	Elevation
0.00	1179.33
3.91	1179.34
7.39	1179.35
8.56	1178.85
9.95	1178.41
10.98	1178.09
11.86	1178.08
12.36	1177.94
13.11	1177.29
13.97	1177.16
15.41	1177.13
16.40	1177.19
17.56	1177.24
18.21	1177.17
18.85	1177.15
19.54	1177.14
20.4	1176.98
21.1	1176.89
21.9	1177.93
23.2	1178.44
24.3	1179.30
25.3	1179.49
27.1	1179.64
29.4	1179.52
32.6	1179.48

SUMMARY DATA	
Bankfull Elevation:	1179.4
Bankfull Cross-Sectional Area:	27.0
Bankfull Width:	17.2
Flood Prone Area Elevation:	1181.9
Flood Prone Width:	100.0
Max Depth at Bankfull:	2.5
Low Bank Height:	2.5
Mean Depth at Bankfull:	1.6
W / D Ratio:	11.0
Entrenchment Ratio:	5.8
Bank Height Ratio:	1.0

XS 8 Looking Upstream

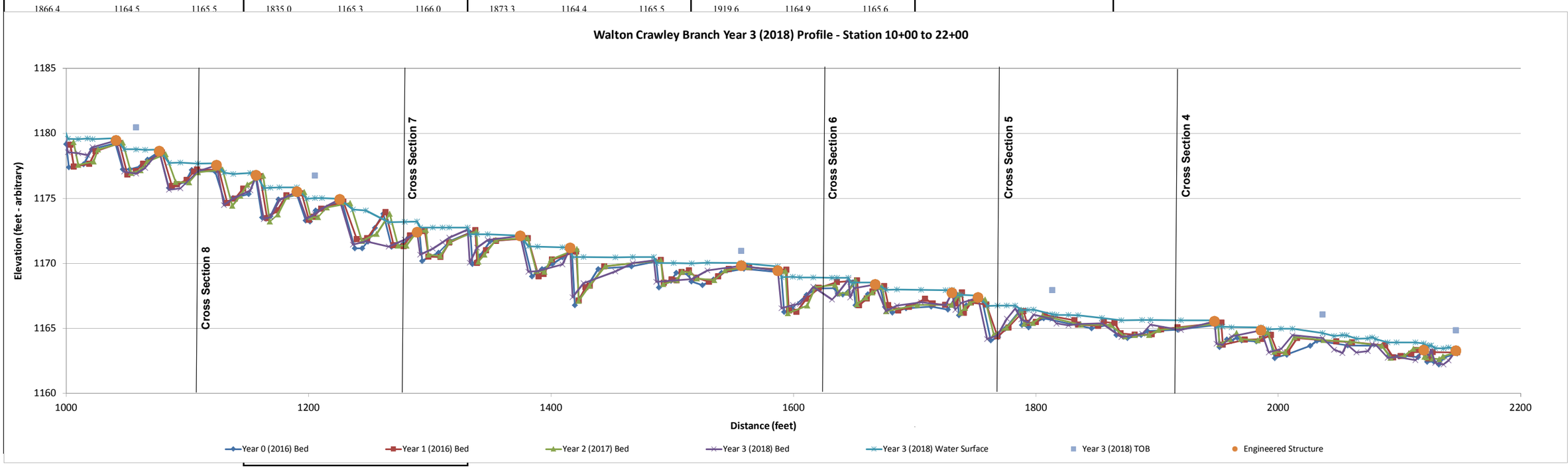
Stream Type	E



Project Name	Neighbors Branch/Walton Crawley Branch - Profile
Reach	Walton Crawley Branch, Station 10+00 - 22+00
Feature	Profile
Date	3/22/18
Crew	Perkinson, Butler

2016 Year 0 Monitoring \Survey			2016 Year 1 Monitoring \Survey			2017 Year 2 Monitoring \Survey			2018 Year 3 Monitoring \Survey			2019 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
2147.7	1163.1	1163.3	2147.7	1163.1	1163.4	2146.6	1163.2	1163.3	2146.6	1163.3	1163.5			
2136.7	1162.8	1163.4	2127.6	1163.2	1163.6	2135.8	1162.8	1163.3	2140.5	1162.5	1163.5			
2132.5	1162.2	1163.3	2123.9	1162.7	1163.6	2132.9	1162.6	1163.2	2136.4	1162.2	1163.5			
2128.3	1162.5	1163.3	2121.6	1163.4	1163.7	2127.3	1162.7	1163.3	2129.5	1162.3	1163.5			
2122.8	1162.4	1163.5	2114.1	1163.3	1163.9	2125.3	1163.1	1163.5	2126.2	1163.3	1163.7			
2119.2	1163.5	1163.7	2109.9	1163.0	1163.9	2122.6	1162.7	1163.5	2124.8	1162.9	1163.7			
2115.3	1162.8	1163.7	2101.0	1162.9	1163.9	2120.6	1162.8	1163.6	2121.8	1163.1	1163.7			
2104.0	1162.9	1163.8	2094.9	1162.8	1163.8	2119.4	1163.6	1163.7	2120.0	1163.3	1163.8			
2091.7	1162.9	1163.8	2088.3	1163.7	1164.1	2111.5	1163.4	1163.8	2113.2	1162.6	1163.9			
2085.1	1163.6	1163.9	2060.8	1163.9	1164.4	2103.9	1162.9	1163.7	2097.8	1162.8	1163.9			
2057.2	1163.7	1164.3	2048.0	1164.0	1164.4	2092.7	1162.7	1163.8	2090.3	1162.7	1163.9			
2031.9	1164.0	1164.5	2015.6	1164.3	1164.8	2085.5	1163.7	1163.9	2080.4	1163.7	1164.2			
2026.5	1163.7	1164.6	2007.5	1163.1	1164.8	2058.9	1164.0	1164.3	2077.4	1163.8	1164.3			
2007.1	1163.0	1164.6	1999.5	1163.1	1164.8	2037.4	1164.1	1164.5	2073.9	1163.3	1164.2			
1997.2	1162.7	1164.6	1993.9	1164.5	1165.0	2013.4	1164.3	1164.7	2064.6	1163.1	1164.2			
1991.6	1164.6	1165.0	1986.7	1164.2	1165.0	2005.8	1163.1	1164.7	2056.5	1163.8	1164.5			
1981.9	1164.0	1164.9	1972.6	1164.1	1165.0	1996.8	1163.2	1164.7	2052.9	1163.1	1164.5			
1969.8	1164.1	1164.9	1954.3	1163.7	1165.1	1991.4	1164.7	1164.9	2046.1	1163.4	1164.4			
1966.1	1164.3	1164.9	1953.1	1165.4	1165.6	1983.0	1164.1	1164.9	2036.5	1164.3	1164.6			
1961.1	1164.0	1165.0	1916.9	1165.1	1165.6	1969.1	1164.2	1165.0	2011.7	1164.5	1165.0			
1957.7	1164.1	1164.9	1903.5	1164.9	1165.6	1965.6	1164.6	1164.9	2002.3	1163.4	1165.0			
1951.6	1163.6	1165.0	1895.6	1164.5	1165.6	1960.0	1164.2	1164.9	1992.1	1163.1	1164.9			
1950.3	1165.3	1165.4	1881.5	1164.5	1165.6	1951.5	1163.8	1164.9	1985.7	1164.8	1165.1			
1916.9	1164.9	1165.5	1870.0	1164.6	1165.6	1950.2	1165.4	1165.5	1961.6	1164.4	1165.1			
1892.2	1164.8	1165.5	1864.9	1165.4	1165.8	1901.2	1164.9	1165.5	1953.9	1163.7	1165.1			
1886.9	1164.5	1165.5	1856.2	1165.5	1165.9	1893.4	1164.5	1165.5	1949.0	1163.8	1165.1			
1875.7	1164.2	1165.5	1851.4	1165.2	1165.9	1881.7	1164.5	1165.5	1947.3	1165.5	1165.6			
1866.4	1164.5	1165.5	1835.0	1165.3	1166.0	1873.3	1164.4	1165.5	1919.6	1164.9	1165.6			

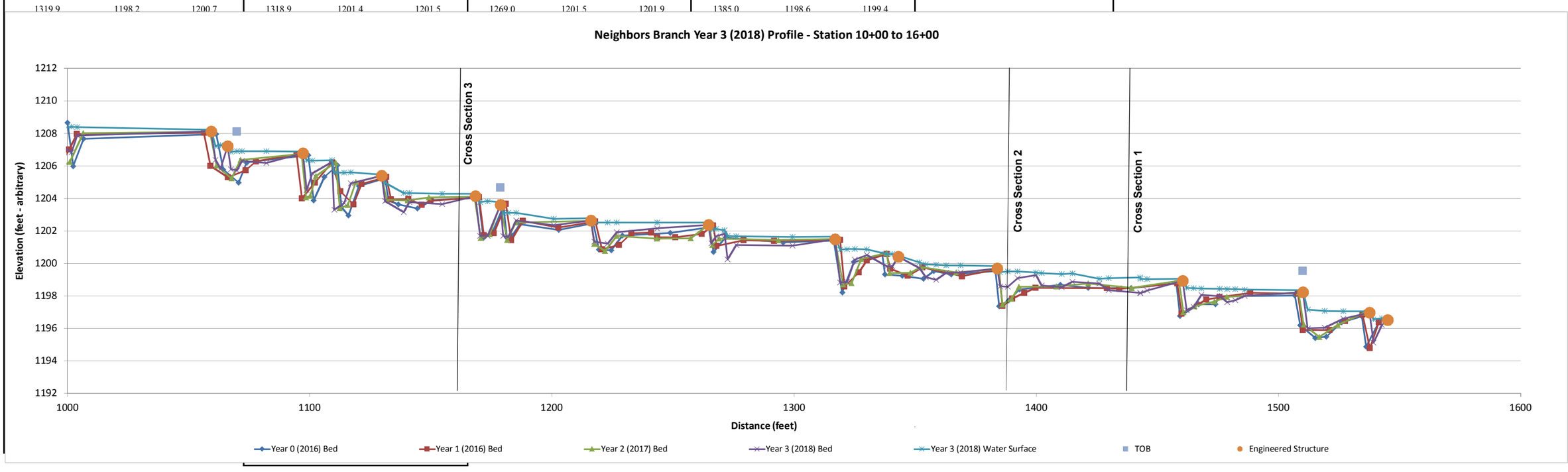
	2016	2016	2017	2018	2019
Avg. Water Surface Slope	0.0145	0.0143	0.0146	0.0145	
Riffle Length	24	24	25	20	
Avg. Riffle Slope	0.0032	0.0055	0.0030	0.0087	
Pool Length	25	23	22	27	
Pool to Pool Spacing	43	42	41	41	



Project Name	Neighbors Branch/Walton Crawley Branch - Profile
Reach	Neighbors Branch, Station 10+00 - 16+00
Feature	Profile
Date	3/22/18
Crew	Perkinson, Butler

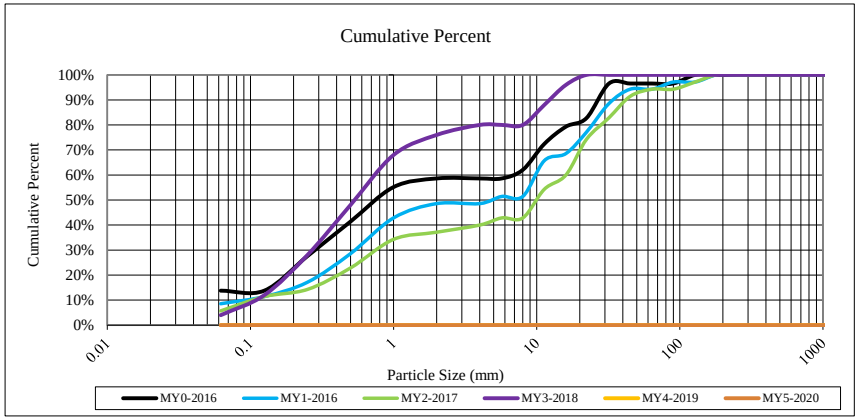
2016 Year 0 Monitoring \Survey			2016 Year 1 Monitoring \Survey			2017 Year 2 Monitoring \Survey			2018 Year 3 Monitoring \Survey			2019 Year 4 Monitoring \Survey		
Station	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**	**Station**	**Bed Elevation**	**Water Elevation**
1541.4	1196.4	1196.4	1541.4	1196.4	1196.4	1535.4	1197.0	1196.9	1545.0	1196.5	1196.6			
1536.2	1194.9	1196.4	1537.7	1194.8	1196.4	1524.5	1196.2	1196.9	1542.7	1196.2	1196.6			
1534.4	1196.7	1196.9	1534.6	1196.8	1196.9	1516.8	1195.5	1196.9	1539.2	1195.1	1196.5			
1526.1	1196.4	1196.9	1527.5	1196.5	1196.9	1510.4	1196.2	1196.9	1537.6	1197.0	1197.0			
1519.8	1195.5	1196.9	1521.1	1195.9	1196.9	1508.3	1198.2	1198.2	1526.8	1196.6	1197.0			
1515.2	1195.4	1196.9	1510.1	1195.9	1197.0	1478.7	1197.9	1198.3	1519.1	1196.0	1197.1			
1508.9	1196.2	1197.0	1507.9	1198.1	1198.3	1473.5	1197.6	1198.3	1512.1	1196.0	1197.1			
1506.7	1198.0	1198.2	1488.4	1198.2	1198.3	1465.3	1197.4	1198.4	1510.1	1198.2	1198.3			
1475.6	1198.0	1198.3	1475.6	1197.9	1198.3	1460.7	1197.0	1198.3	1486.0	1198.0	1198.4			
1473.9	1197.5	1198.3	1470.3	1197.8	1198.3	1458.8	1198.9	1198.9	1482.1	1197.7	1198.4			
1467.1	1197.5	1198.3	1460.0	1196.9	1198.3	1439.4	1198.5	1198.9	1478.8	1197.6	1198.4			
1459.3	1196.8	1198.4	1458.2	1198.8	1199.0	1421.4	1198.7	1199.0	1475.7	1198.0	1198.4			
1457.8	1198.8	1198.9	1434.3	1198.4	1199.0	1408.3	1198.6	1199.0	1468.2	1198.1	1198.4			
1439.1	1198.5	1199.0	1429.2	1198.5	1199.0	1392.8	1198.6	1199.0	1465.0	1197.3	1198.5			
1421.5	1198.5	1199.0	1399.7	1198.5	1199.1	1389.8	1197.8	1199.0	1462.1	1197.1	1198.5			
1410.0	1198.7	1199.0	1395.0	1198.2	1199.1	1386.0	1197.5	1199.0	1460.4	1198.9	1199.1			
1393.1	1198.4	1199.1	1390.1	1197.8	1199.1	1384.4	1199.6	1199.7	1445.7	1198.3	1199.0			
1388.5	1197.7	1199.0	1386.0	1197.4	1199.1	1367.0	1199.4	1199.7	1443.0	1198.2	1199.1			
1384.7	1197.4	1199.0	1384.5	1199.7	1199.7	1352.5	1199.8	1199.9	1442.8	1198.2	1199.1			
1383.2	1199.5	1199.7	1369.3	1199.2	1199.8	1348.0	1199.4	1199.9	1429.8	1198.4	1199.1			
1364.9	1199.3	1199.8	1353.1	1199.7	1199.9	1339.4	1199.4	1200.1	1426.0	1198.8	1199.0			
1357.6	1199.5	1199.9	1346.9	1199.2	1200.0	1338.2	1200.6	1200.7	1414.9	1198.9	1199.4			
1353.4	1199.0	1199.9	1339.7	1199.7	1200.2	1327.7	1200.3	1200.6	1410.5	1198.5	1199.3			
1344.8	1199.2	1199.9	1338.2	1200.6	1200.7	1323.7	1198.8	1200.6	1402.2	1198.6	1199.4			
1337.5	1199.3	1200.3	1330.0	1200.2	1200.7	1320.3	1198.7	1200.7	1399.9	1199.3	1199.4			
1336.4	1200.5	1200.7	1326.7	1199.4	1200.8	1316.8	1201.5	1201.5	1392.3	1199.1	1199.5			
1324.7	1200.1	1200.7	1320.8	1198.6	1200.7	1293.6	1201.4	1201.6	1388.2	1198.5	1199.5			
1319.9	1198.2	1200.7	1318.9	1201.4	1201.5	1269.0	1201.5	1201.9	1385.0	1198.6	1199.4			

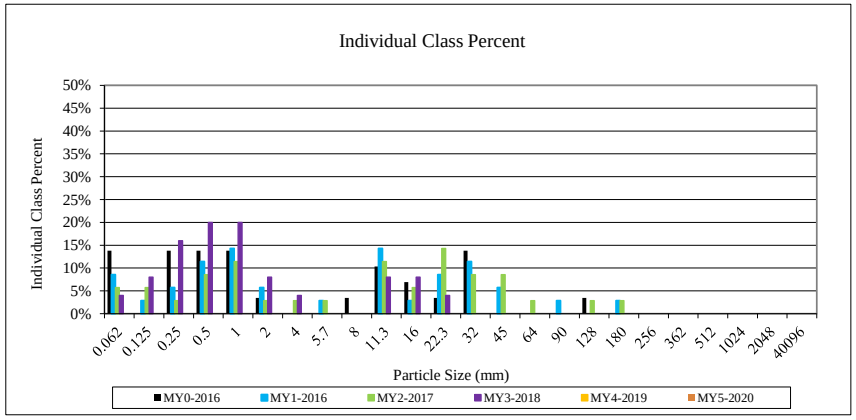
	2016	2016	2017	2018	2019
Avg. Water Surface Slope	0.0222	0.0220	0.0221	0.0225	
Riffle Length	28	26	31	19	
Avg. Riffle Slope	0.0043	0.0046	0.0041	0.0082	
Pool Length	12	15	12	9	
Pool to Pool Spacing	36	34	38	26	



Project Name: Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site					
Cross-Section: 1					
Feature: Riffle					
			2018		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	1	4%	4%
Sand	very fine sand	0.125	2	8%	12%
	fine sand	0.250	4	16%	28%
	medium sand	0.50	5	20%	48%
	coarse sand	1.00	5	20%	68%
	very coarse sand	2.0	2	8%	76%
Gravel	very fine gravel	4.0	1	4%	80%
	fine gravel	5.7	0	0%	80%
	fine gravel	8.0	0	0%	80%
	medium gravel	11.3	2	8%	88%
	medium gravel	16.0	2	8%	96%
	course gravel	22.3	1	4%	100%
	course gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			25	100%	100%

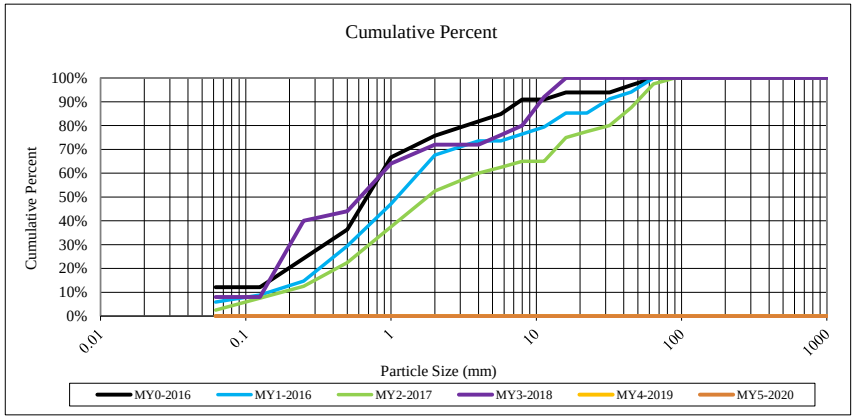
Summary Data	
D50	0.75
D84	10
D95	15

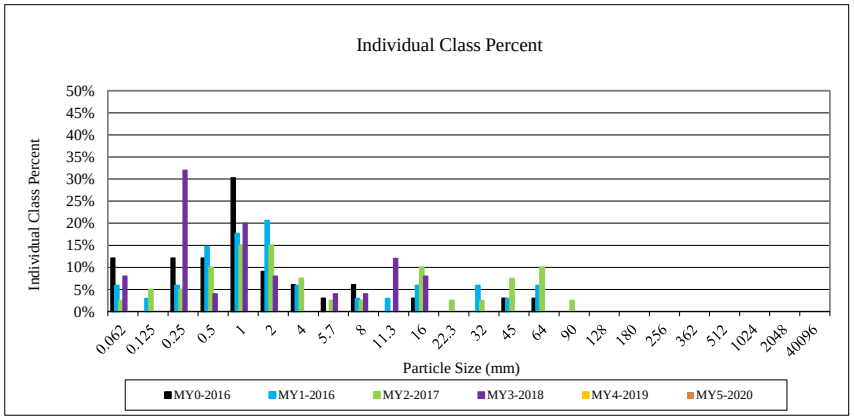




Project Name: Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site					
Cross-Section: 3					
Feature: Riffle					
			2018		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	2	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	8	32%	40%
	medium sand	0.50	1	4%	44%
	coarse sand	1.00	5	20%	64%
	very coarse sand	2.0	2	8%	72%
Gravel	very fine gravel	4.0	0	0%	72%
	fine gravel	5.7	1	4%	76%
	fine gravel	8.0	1	4%	80%
	medium gravel	11.3	3	12%	92%
	medium gravel	16.0	2	8%	100%
	course gravel	22.3	0	0%	100%
	course gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			25	100%	100%

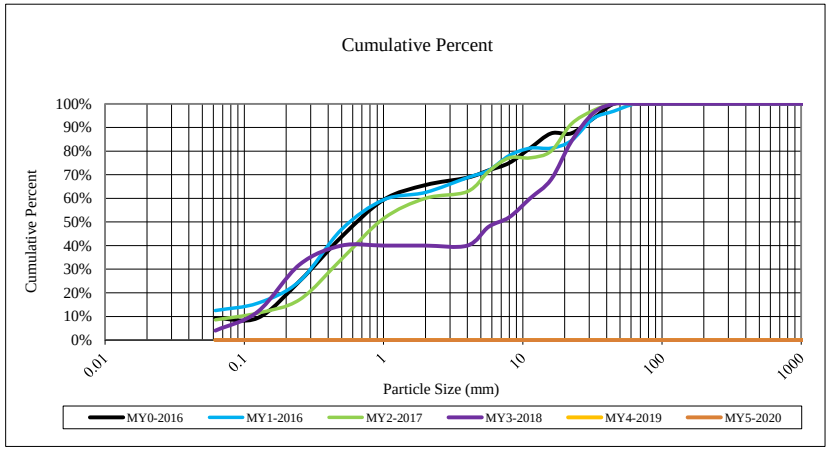
Summary Data	
D50	0.8
D84	9
D95	13

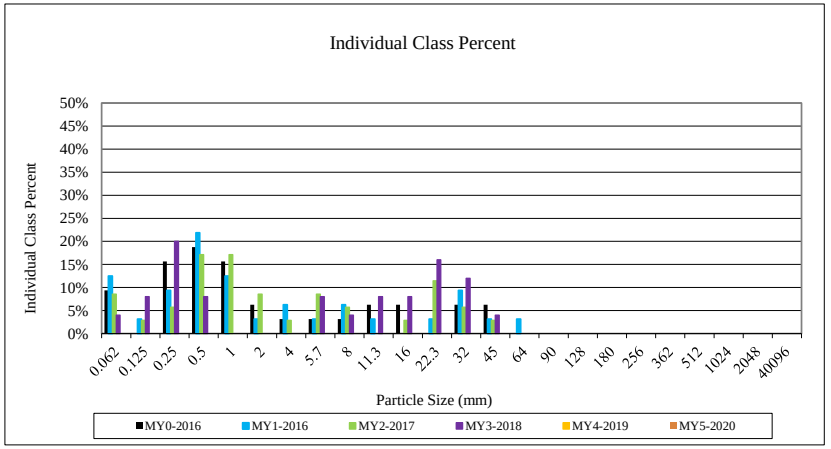




Project Name: Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site					
Cross-Section: 4					
Feature: Riffle					
			2018		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	1	4%	4%
Sand	very fine sand	0.125	2	8%	12%
	fine sand	0.250	5	20%	32%
	medium sand	0.50	2	8%	40%
	coarse sand	1.00	0	0%	40%
	very coarse sand	2.0	0	0%	40%
Gravel	very fine gravel	4.0	0	0%	40%
	fine gravel	5.7	2	8%	48%
	fine gravel	8.0	1	4%	52%
	medium gravel	11.3	2	8%	60%
	medium gravel	16.0	2	8%	68%
	course gravel	22.3	4	16%	84%
	course gravel	32.0	3	12%	96%
	very coarse gravel	45	1	4%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			25	100%	100%

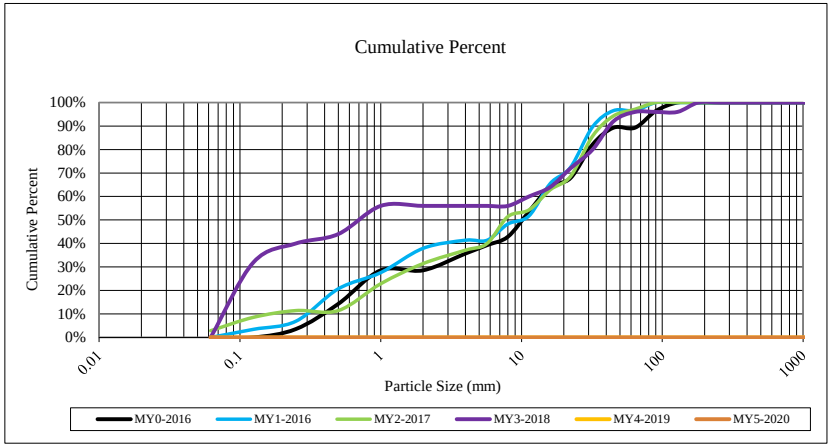
Summary Data	
D50	7
D84	22.3
D95	30

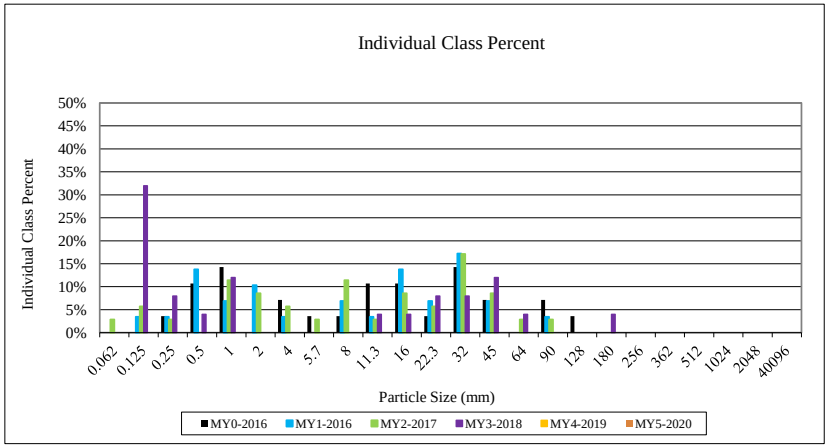




Project Name: Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site					
Cross-Section: 6					
Feature: Riffle					
			2018		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	8	32%	32%
	fine sand	0.250	2	8%	40%
	medium sand	0.50	1	4%	44%
	coarse sand	1.00	3	12%	56%
	very coarse sand	2.0	0	0%	56%
Gravel	very fine gravel	4.0	0	0%	56%
	fine gravel	5.7	0	0%	56%
	fine gravel	8.0	0	0%	56%
	medium gravel	11.3	1	4%	60%
	medium gravel	16.0	1	4%	64%
	course gravel	22.3	2	8%	72%
	course gravel	32.0	2	8%	80%
	very coarse gravel	45	3	12%	92%
	very coarse gravel	64	1	4%	96%
Cobble	small cobble	90	0	0%	96%
	medium cobble	128	0	0%	96%
	large cobble	180	1	4%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			25	100%	100%

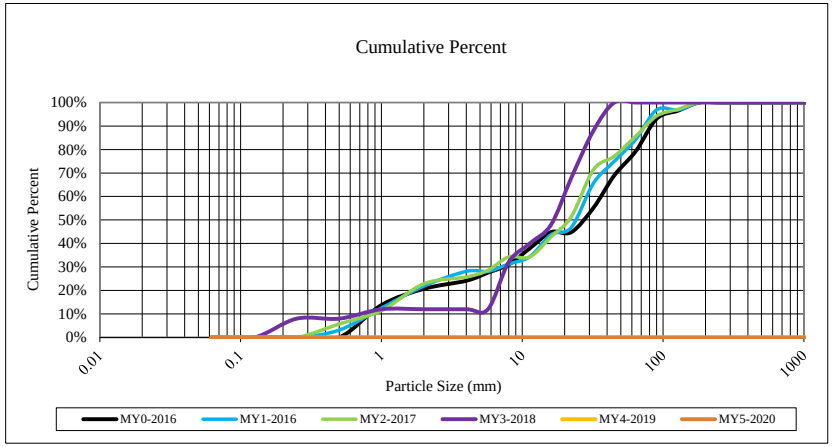
Summary Data	
D50	0.75
D84	35
D95	60





Project Name: Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site					
Cross-Section: 8					
Feature: Riffle					
			2018		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	2	8%	8%
	medium sand	0.50	0	0%	8%
	coarse sand	1.00	1	4%	12%
	very coarse sand	2.0	0	0%	12%
Gravel	very fine gravel	4.0	0	0%	12%
	fine gravel	5.7	0	0%	12%
	fine gravel	8.0	5	20%	32%
	medium gravel	11.3	2	8%	40%
	medium gravel	16.0	2	8%	48%
	course gravel	22.3	5	20%	68%
	course gravel	32.0	5	20%	88%
	very coarse gravel	45	3	12%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			25	100%	100%

Summary Data	
D50	18
D84	29
D95	40



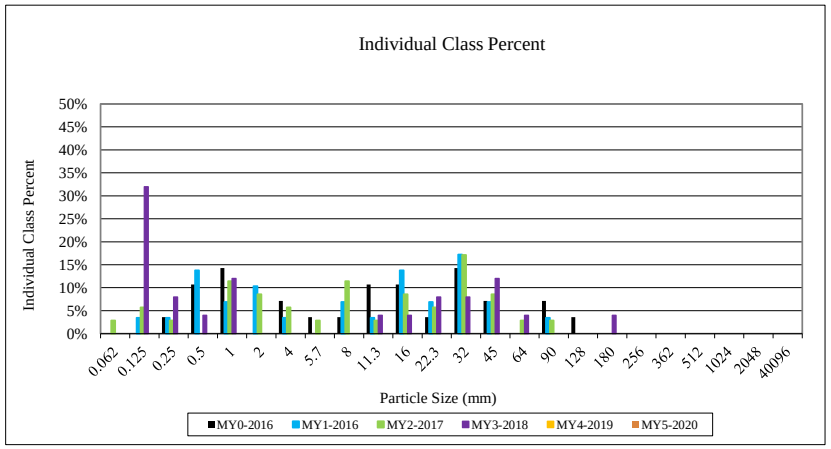


Table 10a. Baseline Stream Data Summary (Neighbors Creek)
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site - NCDMS Project Number 92872

Parameter	Gauge	Regional Curve			Pre-Existing Condition (Neighbors Cr)					Reference Reach(es) Data					Design (Neighbors Cr)			Monitoring Baseline (Neighbors Cr)					
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
BF Width (ft)					5.4			5.9			12.7						11.0	9.6		11.1	12.5		2
Floodprone Width (ft)					7.4			17.1			150						70			100			2
BF Mean Depth (ft)					0.9			1.1			0.9						0.8	0.8		0.8	0.8		2
BF Max Depth (ft)					1.2			1.5			1.2						1.1	1.5		1.7	1.8		2
BF Cross Sectional Area (ft^2)					4.9			6.5			11.4						8.3	8.0		9.0	9.9		2
Width/Depth Ratio					5.3			5.8			14.1						14.0	12.0		13.8	15.6		2
Entrenchment Ratio					1.4			2.9			11.8						6.4	8.0		9.2	10.4		2
Bank Height Ratio					1.6			2.6			1.0						1.0			1.0			2
Profile																							
Riffle length (ft)																		5.4	28.3	25.5	64.7	18.2	13
Riffle slope (ft/ft)					0.025			0.035			0.0344						0.0120	0.0000	0.0043	0.0022	0.0121	0.0046	13
Pool length (ft)																		6.5	11.9	10.4	21.3	5.2	15
Pool Max depth (ft)					1.7			1.8			2.2						2.0	2.8		2.8	2.8		1
Pool spacing (ft)					16.4			99.2		38.8			64.7		33.0	56.1		7.0	36.1	37.9	74.7	19.8	15
Pattern																							
Channel Beltwidth (ft)					8			22		30.5			32		27.5	66		27.5			66		2
Radius of Curvature (ft)					5			22		14.5			20		22	44		22			44		2
Rc:Bankfull width (ft/ft)					0.9			1.5		1.1			1.6		2	4		2			4		2
Meander Wavelength (ft)					30			128		95			98		44	110		44			110		2
Meander Width ratio					1.5			4.1		2.4			2.5		4	10		4			10		2
Transport parameters																							
Reach Shear Stress (competency) lbs/ft^2																							
Max part size (mm) mobilized at bankfull																							
Stream Power (transport capacity) W/m^2																							
Additional Reach Parameters																							
Rosgen Classification					G5/4 - E5/4					C					C			E/C					
Bankfull Velocity (fps)					3.86 - 5.09																		
Bankfull Discharge (cfs)					25																		
Valley Length (ft)					----					----													
Channel Thalweg Length (ft)					----					----					----			541					
Sinuosity					1.01 - 1.21					1.22					1.18			1.18					
Water Surface Slope (ft/ft)					0.019 - 0.0204					0.0205					0.008			0.0222					
BF slope (ft/ft)					----					----					----			----					
Bankfull Floodplain Area (acres)					----					----					----			----					
% of Reach with Eroding Banks					----					----													
Channel Stability or Habitat Metric					----					----													
Biological or Other					----					----													

Table 10b. Baseline Stream Data Summary (Walton Crawley Property)
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site - NCDMS Project Number 92872

Parameter	Gauge	Regional Curve			Pre-Existing Condition (WC Property)					Reference Reach(es) Data					Design (WC Property)			Monitoring Baseline (WC Property)					
Dimension and Substrate - Riffle Only		**LL**	**UL**	**Eq.**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Mean**	**Med**	**Max**	**SD**	**Min**	**Max**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
BF Width (ft)					7.9			9.4			12.7						15.5	13.2		14.3	16.8		3
Floodprone Width (ft)					12.9			16.8			150				55	90				100			3
BF Mean Depth (ft)					0.8			0.9			0.9						1.1	1.3		1.4	1.5		3
BF Max Depth (ft)					0.9			1.1			1.2						1.4	1.9		2.0	2.0		3
BF Cross Sectional Area (ft^2)					6.2			8.4			11.4						16.6	17.6		19.4	25.0		3
Width/Depth Ratio					10.2			10.4			14.1						14.0	10.2		10.2	11.2		3
Entrenchment Ratio					1.6			1.8			11.8						4.5	6.0		7.0	7.6		3
Bank Height Ratio					1.0			2.8			1.0						1.0			1.0			3
Profile																							
Riffle length (ft)																		6.7	23.9	16.2	58.1	18	20
Riffle slope (ft/ft)					0.024			0.030			0.0344						0.0077	0.0000	0.0032	0.0018	0.0113	0.0036	20
Pool length (ft)																		7.9	24.8	24.8	63.1	10.8	27
Pool Max depth (ft)					1.9			2.1			2.2						2.4	1.3		1.4	1.5		2
Pool spacing (ft)					6.0			40.8		38.8			64.7		15.5	79.2		14.9	42.5	36.4	93.6	21.3	27
Pattern																							
Channel Beltwidth (ft)					16			25		30.5			32		38.8	93		38.8			93		2
Radius of Curvature (ft)					5			14		14.5			20		31	62		31			62		2
Rc:Bankfull width (ft/ft)					0.5			1.5		1.1			1.6		2	4		2			4		2
Meander Wavelength (ft)					103			121		95			98		77.5	155		77.5			155		2
Meander Width ratio					11			12.9		2.4			2.5		5	10		5			10		2
Transport parameters																							
Reach Shear Stress (competency) lbs/ft^2																							
Max part size (mm) mobilized at bankfull																							
Stream Power (transport capacity) W/m^2																							
Additional Reach Parameters																							
Rosgen Classification					B/G					C					C			E/C					
Bankfull Velocity (fps)					3.9-7.5																		
Bankfull Discharge (cfs)					24-63																		
Valley Length (ft)					----					----													
Channel Thalweg Length (ft)					----					----					----			1148					
Sinuosity					1.01-1.2					1.22					1.1			1.1					
Water Surface Slope (ft/ft)					0.0135-0.0340					0.0205					0.0045			0.0145					
BF slope (ft/ft)					----					----					----			----					
Bankfull Floodplain Area (acres)					----					----					----			----					
% of Reach with Eroding Banks					----					----													
Channel Stability or Habitat Metric					----					----													
Biological or Other					----					----													

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site - NCDMS Project Number 92872

Parameter	Cross Section 1 (Neighbors Branch) Riffle							Cross Section 2 (Neighbors Branch) Pool							Cross Section 3 (Neighbors Branch) Riffle						
Dimension*	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	12.5	11.1	11.9	9.5				8.5	10.4	9.7	12.8				9.6	8.7	8.9	8.2			
Floodprone Width (ft) (approx)	100.0	100.0	100.0	100.0				NA	NA	NA	NA				100.0	100.0	100.0	100.0			
BF Mean Depth (ft)	0.8	0.9	0.8	1.0				1.6	1.4	1.4	1.1				0.8	0.9	0.9	1.0			
BF Max Depth (ft)	1.8	1.6	1.8	1.7				2.8	2.9	3.0	2.2				1.5	1.5	1.6	1.7			
Low Bank Height (ft)	1.8	1.6	1.8	1.7				2.8	2.9	3.0	2.2				1.5	1.5	1.6	1.8			
BF Cross Sectional Area (ft^2)	9.9	9.6	9.5	9.5				13.6	14.1	14.0	14.0				8.0	8.1	8.1	8.1			
Width/Depth Ratio	15.8	12.8	14.9	9.5				NA	NA	NA	NA				11.5	9.3	9.8	8.3			
Entrenchment Ratio	8.0	9.0	8.4	10.5				NA	NA	NA	NA				10.4	11.5	11.2	12.2			
Bank Height Ratio	1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.1			
d50 (mm)	0.8	4.9	9.8	0.8				----	----	----	----				0.7	1.1	1.8	0.8			

*Beginning in Year 3 (2018), the bankfull elevation and channel cross section dimensions are calculated using a fixed Abkf as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (9/2018).

Table 11b. Monitoring Data - Stream Reach Data Summary
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site - NCDMS Project Number 92872

Parameter	Baseline (Neighbors Branch)						MY-1 (Neighbors Branch)						MY-2 (Neighbors Branch)						MY-3 (Neighbors Branch)						MY-4 (Neighbors Branch)						MY-5 (Neighbors Branch)					
Dimension and Substrate - Riffle Only	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	9.6		11.1	12.5		2	8.7		9.9	11.1		2	8.9		10.4	11.9		2	8.2		9.0	9.7		2												
Floodprone Width (ft)			100			2			100			2			100			2			100			2												
BF Mean Depth (ft)	0.8		0.8	0.8		2	0.9		0.9	0.9		2	0.8		0.9	0.9		2	1.0		1.0	1.0		2												
BF Max Depth (ft)	1.5		1.7	1.8		2	1.5		1.6	1.6		2	1.6		1.7	1.8		2	1.7		1.7	1.7		2												
BF Cross Sectional Area (ft^2)	8.0		9.0	9.9		2	8.1		8.9	9.6		2	8.1		8.8	9.5		2	8.1		8.8	9.5		2												
Width/Depth Ratio	12.0		13.8	15.6		2	9.7		11.0	12.3		2	9.9		12.4	14.9		2	8.3		9.1	9.9		2												
Entrenchment Ratio	8.0		9.2	10.4		2	9.0		10.3	11.5		2	8.4		9.8	11.2		2	10.3		11.3	12.2		2												
Bank Height Ratio			1.0			2			1.0			2			1.0			2	1.0		1.0	1.1		2												
Profile																																				
Riffle length (ft)	5.4	28.3	25.5	64.7	18.2	13	7.2	26.2	24.9	58.5	17.6	12	8	31	30	66	18	12	2	19	13	55	15	19												
Riffle slope (ft/ft)	0.0000	0.0043	0.0022	0.0121	0.0046	13	0.0000	0.0046	0.0035	0.0157	0.0046	12	0.0000	0.0041	0.0028	0.0143	0.0042	12	0.0000	0.0082	0.0026	0.0482	0.0127	19												
Pool length (ft)	7	12	10	21	5	15	7	15	15	26	5	16	4	12	11	27	6	14	3	9	8	20	4	21												
Pool Max depth (ft)	2.8		2.8	2.8		1	2.9		2.9	2.9		1	3.0		3.0	3.0		1	2.2		2.2	2.2		1.0												
Pool spacing (ft)	7	36	38	75	20	15	7	34	32	74	19	16	11	38	38	74	19	14	7	26	26	63	15	21												
Pattern																																				
Channel Beltwidth (ft)	27.5			66		2																														
Radius of Curvature (ft)	22			44		2																														
Rc:Bankfull width (ft/ft)	2			4		2																														
Meander Wavelength (ft)	44			110		2																														
Meander Width ratio	4			10		2																														
Additional Reach Parameters																																				
Rosgen Classification	E/C-type						E/C-type						E/C-type						E/C-type																	
Channel Thalweg Length (ft)	541						547						538						548																	
Sinuosity	1.18						1.18						1.18						1.18																	
Water Surface Slope (Channel) (ft/ft)	0.0222						0.022						0.0221						0.0225																	
BF slope (ft/ft)	-----						-----						-----						-----																	
Ri%/RU%P%G%/S%																																				
SC%/SA%/G%/C%/B%BE%																																				
d16/d35/d50/d84/d95																																				
% of Reach with Eroding Banks	0						0						0						0																	
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Table 11c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters - Cross Sections)
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site - NCDMS Project Number 92872

Parameter	Cross Section 4 (Walton Crawley Br) Riffle							Cross Section 5 (Walton Crawley Br) Pool							Cross Section 6 (Walton Crawley Br) Riffle							Cross Section 7 (Walton Crawley Br) Pool							Cross Section 8 (Walton Crawley Br) Riffle						
Dimension*	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+	MY0	MY1	MY2	MY3	MY4	MY5	MY5+
BF Width (ft)	13.2	13.1	13.0	13.0				11.9	11.7	11.9	12.2				14.3	14.5	14.2	13.2				12.2	13.0	12.6	13.0				16.8	16.9	17.4	17.2			
Floodprone Width (ft) (approx)	100.0	100.0	100.0	100.0				NA	NA	NA	NA				100.0	100.0	100.0	100.0				NA	NA	NA	NA				100.0	100.0	100.0	100.0			
BF Mean Depth (ft)	1.3	1.4	1.4	1.4				2.8	3.0	2.9	2.9				1.4	1.3	1.4	1.5				2.7	2.8	2.7	2.6				1.5	1.4	1.6	1.6			
BF Max Depth (ft)	1.9	2.0	2.0	2.0				3.7	4.0	4.1	3.6				2.0	1.9	2.0	2.5				3.4	3.2	3.3	3.0				2.0	2.0	2.1	2.5			
Low Bank Height (ft)	1.9	2.0	2.0	2.1				3.7	4.0	4.1	4.1				2.0	1.9	2.0	2.5				3.4	3.2	3.3	3.1				2.0	2.0	2.1	2.5			
BF Cross Sectional Area (ft^2)	17.6	18.2	17.9	17.9				32.9	35.2	35.1	35.1				19.4	19.5	20.2	20.2				33.0	35.9	34.1	34.1				25.0	24.4	27.0	27.0			
Width/Depth Ratio	9.9	9.4	9.4	9.4				NA	NA	NA	NA				10.5	10.8	10.0	8.6				NA	NA	NA	NA				11.3	11.7	11.2	11.0			
Entrenchment Ratio	7.6	7.6	7.7	7.7				NA	NA	NA	NA				7.0	6.9	7.0	7.6				NA	NA	NA	NA				6.0	5.9	5.7	5.8			
Bank Height Ratio	1.0	1.0	1.0	1.1				1.0	1.0	1.0	1.1				1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0				1.0	1.0	1.0	1.0			
d50 (mm)	0.7	0.6	0.9	7.0				----	----	----	----				9.9	9.4	7.7	0.8				----	----	----	----				26.5	23.4	20.9	18.0			

*Beginning in Year 3 (2018), the bankfull elevation and channel cross section dimensions are calculated using a fixed bankfull Area as described in the Standard Measurement of the BHR Monitoring Parameter provided by NCIRT and NCDMS (9/2018).

Table 11d. Monitoring Data - Stream Reach Data Summary
Neighbors Branch/Walton Crawley Branch Stream and Wetland Restoration Site - NCDMS Project Number 92872

Parameter	Baseline (Walton Crawley Br)						MY-1 (Walton Crawley Br)						MY-2 (Walton Crawley Br)						MY-3 (Walton Crawley Br)						MY-4 (Walton Crawley Br)						MY-5 (Walton Crawley Br)					
Dimension and Substrate - Riffle Only	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
BF Width (ft)	13.2		14.3	16.8		3	13.1		14.5	16.9		3	13.0		14.2	17.4		3	13.0		13.2	17		3												
Floodprone Width (ft)			100			3			100			3			100			3			100			3												
BF Mean Depth (ft)	1.3		1.4	1.5		3	1.3		1.4	1.4		3	1.4		1.4	1.5		3	1.4		1.5	1.6		3												
BF Max Depth (ft)	1.9		2.0	2.0		3	1.9		2.0	2.0		3	2.0		2.0	2.1		3	2.0		2.4	2.5		3												
BF Cross Sectional Area (ft^2)	17.6		19.4	25.0		3	18.2		19.5	24.4		3	17.9		20.2	27.0		3	17.9		20.2	26.4		3												
Width/Depth Ratio	10.2		10.2	11.2		3	9.4		11.2	12.1		3	9.3		10.1	11.6		3	8.6		9.4	10.9		3												
Entrenchment Ratio	6.0		7.0	7.6		3	5.9		6.9	7.6		3	5.7		7.0	7.7		3	5.9		7.6	7.7		3												
Bank Height Ratio			1.0			3			1.0			3			1.0			3	1.0		1.0	1.1		3												
Profile																																				
Riffle length (ft)	6.7	23.9	16.2	58.1	18	20	6	24	20	73	17	22	7	25	19	72	19	21	3	20	16	58	14	19												
Riffle slope (ft/ft)	0.0000	0.0032	0.0018	0.0113	0.0036	20	0.0000	0.0055	0.0015	0.0241	0.0071	21	0.0000	0.0030	0.0013	0.0124	0.0041	21	0.0000	0.0087	0.0040	0.0481	0.0131	19.00												
Pool length (ft)	8	25	25	63	11	27	6	23	22	41	9	27	6	22	20	57	10	28	5	27	25	63	14	28												
Pool Max depth (ft)	1.3		1.4	1.5		2	3.2		3.6	4.0		2	3.3		3.7	4.1		2	3.0		3.3	3.6		2.0												
Pool spacing (ft)	15	43	36	94	21	27	20	42	35	94	19	27	6	41	35	94	22	28	6	41	37	102	21	28												
Pattern																																				
Channel Beltwidth (ft)	38.8			93		2																														
Radius of Curvature (ft)	31			62		2																														
Rc:Bankfull width (ft/ft)	2			4		2																														
Meander Wavelength (ft)	77.5			155		2																														
Meander Width ratio	5			10		2																														
Additional Reach Parameters																																				
Rosgen Classification	E/C-type						E/C-type						E/C-type						E/C-type																	
Channel Thalweg Length (ft)	1148						1144						1141						1147																	
Sinuosity	1.1						1.1						1.1						1.1																	
Water Surface Slope (Channel) (ft/ft)	0.0145						0.0143						0.0146						0.0145																	
BF slope (ft/ft)	-----						-----						-----						-----																	
Ri%/RU%P%G%/S%																																				
SC%/SA%/G%/C%/B%BE%																																				
d16/d35/d50/d84/d95																																				
% of Reach with Eroding Banks	0						0						0						0																	
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Appendix E.
Hydrology Data

Table 12. Verification of Bankfull Events
Table 13. Wetland Hydrology Criteria Attainment Summary
Figure E1. 30-70 Percentile Graph for Rainfall
Groundwater Gauge Graphs

Table 12. Verification of Bankfull Events
Neighbors Branch/Walton Crawley Branch Site (DMS Project Number 92872)

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
August 19, 2016	July 4, 2016	Crest gauge data indicates a bankfull event after approximately 1.88 inches of rain documented* in one day.	---
May 18, 2017	April 23, 2017	Crest gauge data indicates a bankfull event after approximately 1.76 inches of rain documented* in one day.	---
May 9, 2018	April 24, 2018	Crest gauge data along with wrack observed on the floodplains of both Neighbors Branch and Walton Crawley Branch indicate a bankfull event after 3.89 inches of rain documented** over two days.	1-2
September 25, 2018	September 16, 2018	Crest gauge data indicates a bankfull event after 2.42 inches of rain** resulting from the remnants of Hurricane Florence.	--
November 8, 2018	October 11, 2018	Crest gauge data along with wrack, sediment, and laid-back vegetation indicate a bankfull event after 2.79 inches of rain** resulting from Hurricane Michael.	3

*Weather Underground 2017
**Weather Underground 2018

Photo 1: Wrack on TOB of Neighbors Branch

Photo 2: Wrack in the floodplain of Walton Crawley Branch

Photo 3: Wrack, sediment, and laid back vegetation in the floodplain of Neighbors Branch

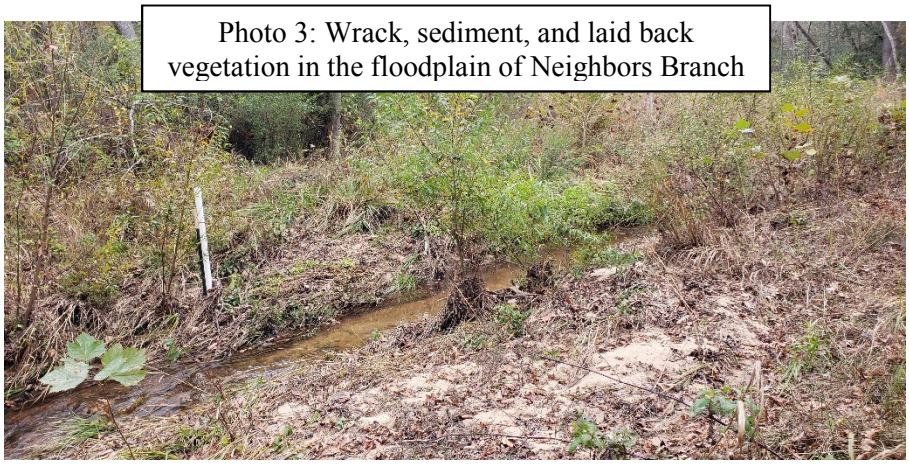


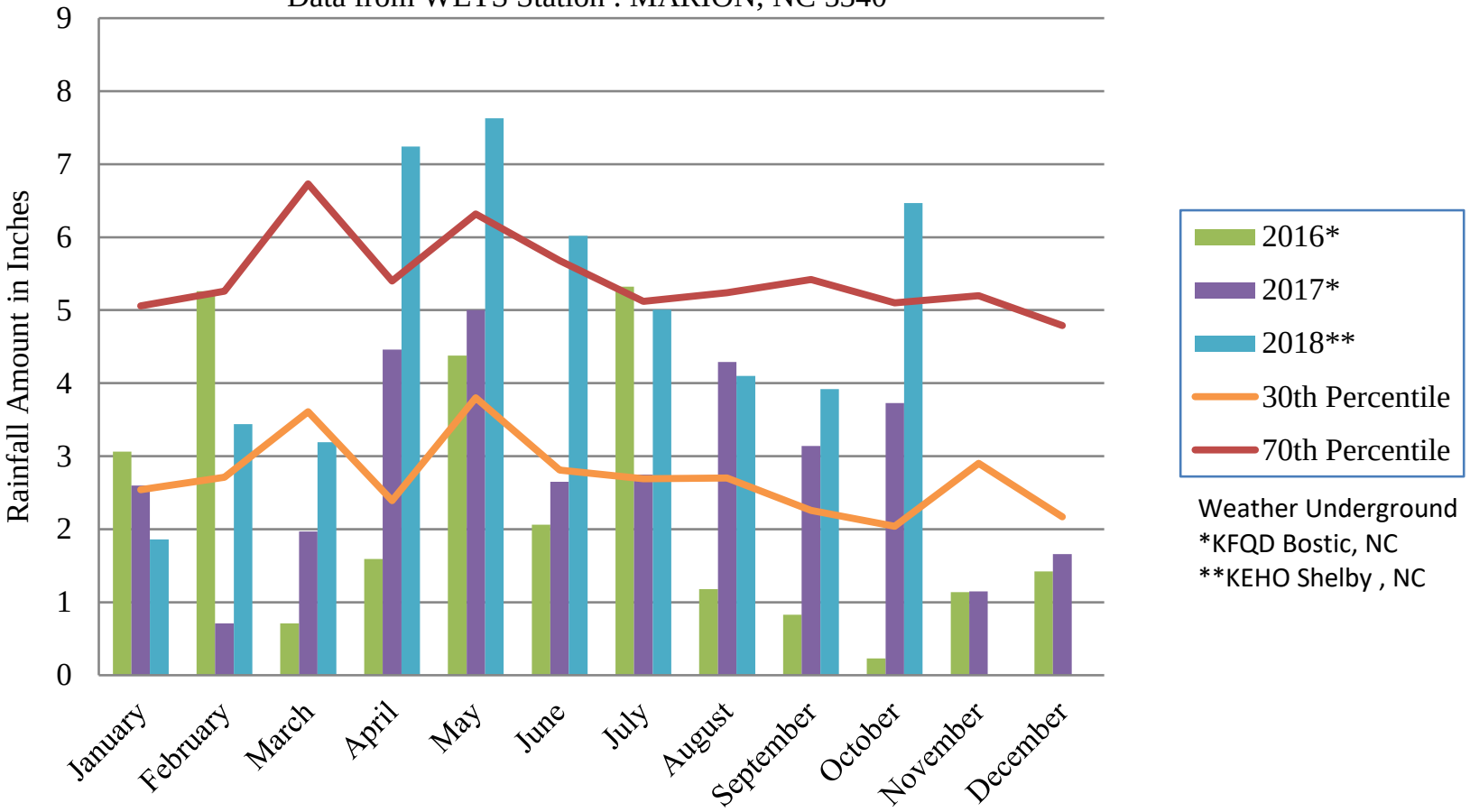
Table 13. Wetland Hydrology Criteria Attainment Summary
Neighbors Branch/Walton Crawley Branch Site (DMS Project Number 92872)

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)	Year 4 (2019)	Year 5 (2020)
1	Yes/208 Days (92.4%)	Yes/225 Days* (100%)	Yes/225 Days** (100%)		
2	Yes/164 Days (72.9%)	Yes/225 Days (100%)	Yes/225 Days^ (100%)		

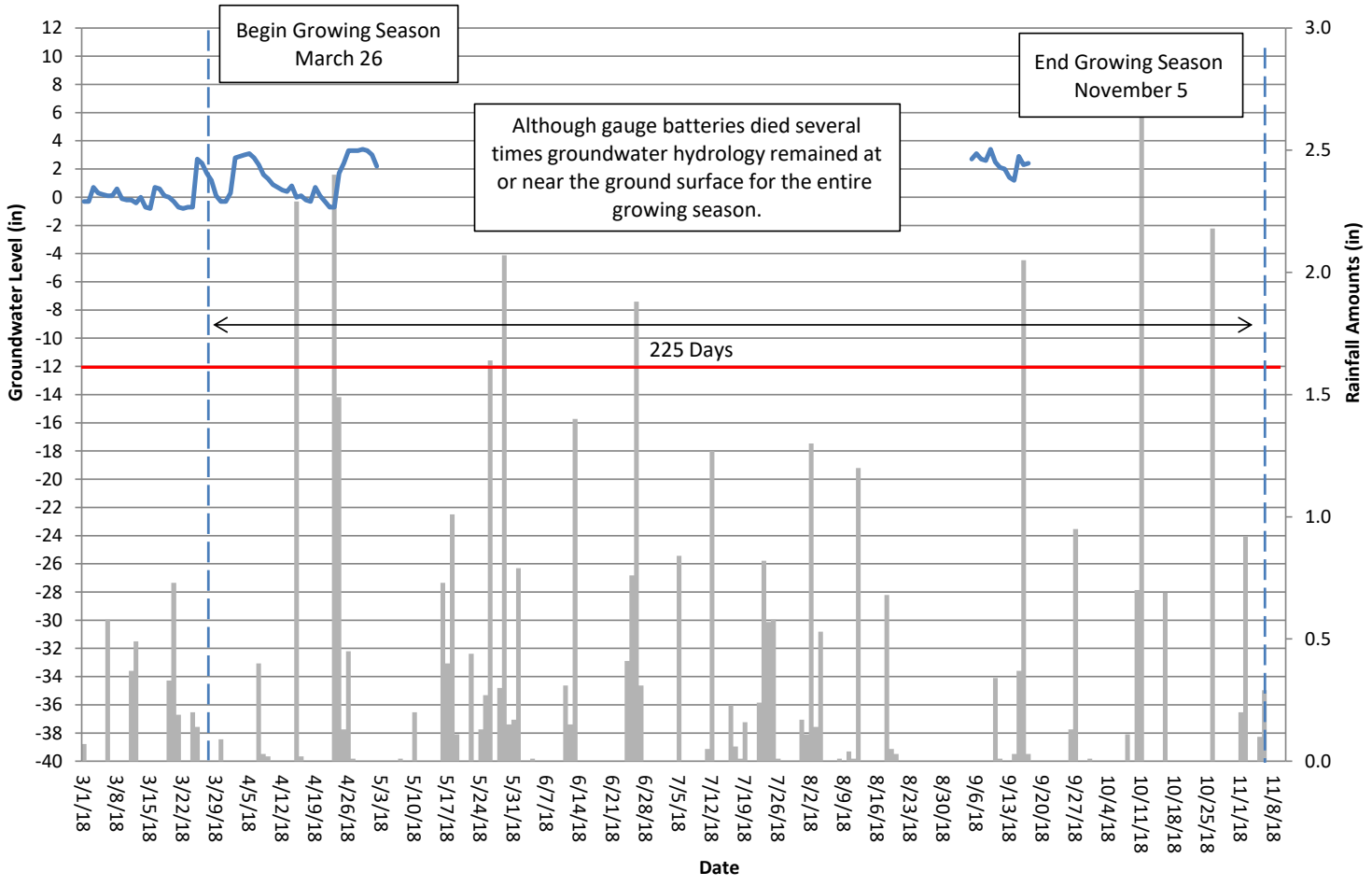
*Gauge 1 malfunctioned for 6 days (July 29 to August 3, 2017); however, based on precipitation data as well as data from Gauge 2, it is expected that this gauge would have continued to be saturated/inundated during this 6 day period.
**Gauge 1 batteries died several time throughout the growing season due to excessive inundation resulting in data loss; however, groundwater was at or near the soil surface for the entire 2018 growing season.
^Gauge 2 missed several days of data collection due to a malfunction caused by excessive inundation during the remnants of Hurricane Florence. It began collecting points again once overbank flow receded.

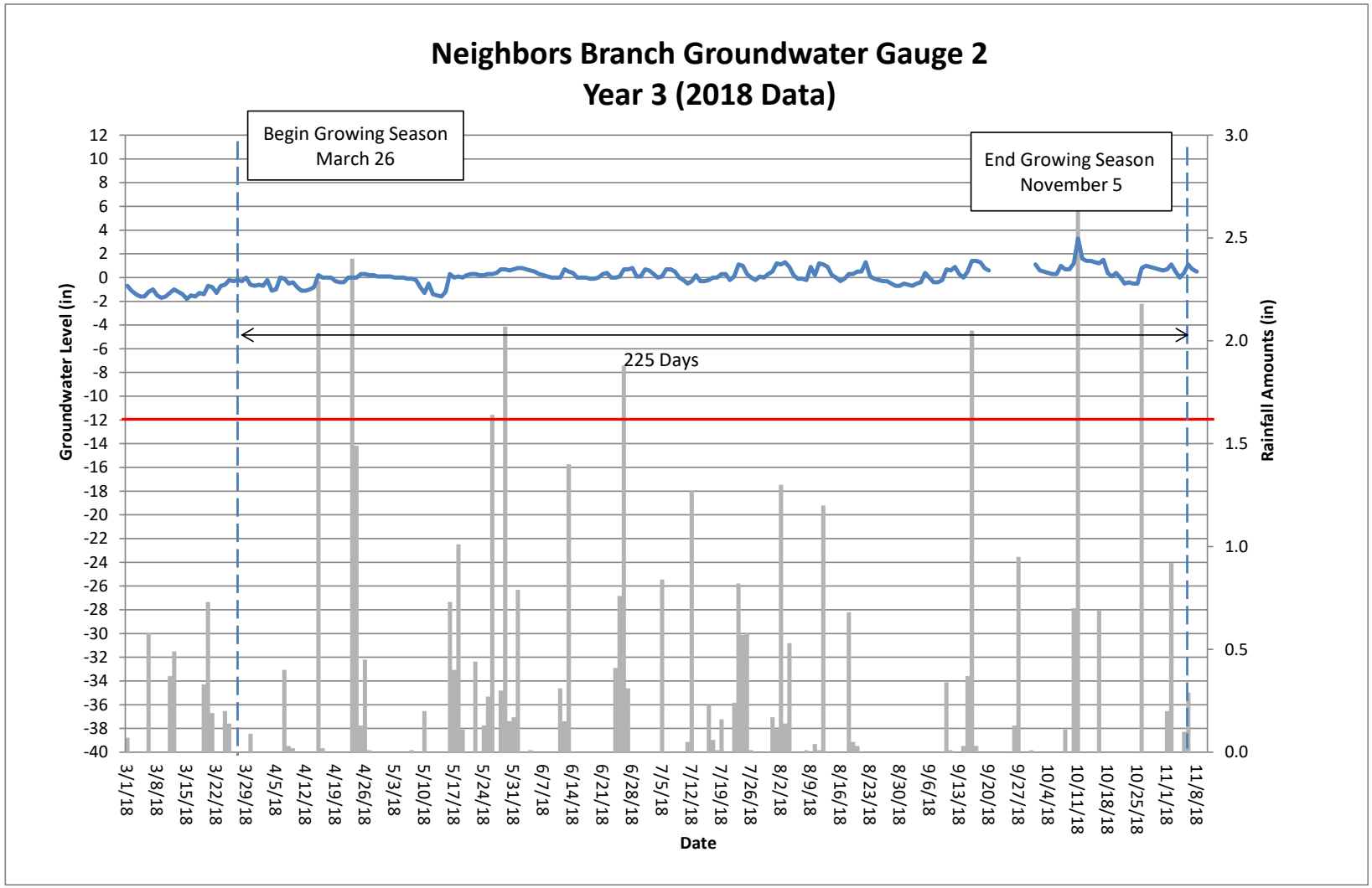
Figure E1: Neighbors Branch/Walton Crawley Branch
30-70 Percentile Graph for Rainfall

Data from WETS Station : MARION, NC 5340



Neighbors Branch Groundwater Gauge 1
Year 3 (2018 Data)




Neighbors Branch Groundwater Gauge 2
Year 3 (2018 Data)
Begin Growing Season
March 26
End Growing Season
November 5
225 Days
Groundwater Level (in)
Rainfall Amounts (in)
Date
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
3.0
2.5
2.0
1.5
1.0
0.5
0.0
3/1/18
3/8/18
3/15/18
3/22/18
3/29/18
4/5/18
4/12/18
4/19/18
4/26/18
5/3/18
5/10/18
5/17/18
5/24/18
5/31/18
6/7/18
6/14/18
6/21/18
6/28/18
7/5/18
7/12/18
7/19/18
7/26/18
8/2/18
8/9/18
8/16/18
8/23/18
8/30/18
9/6/18
9/13/18
9/20/18
9/27/18
10/4/18
10/11/18
10/18/18
10/25/18
11/1/18
11/8/18