



# MITIGATION PLAN

Final

May 29, 2018

## DEEP MEADOW MITIGATION PLAN

Union County, NC  
NCDEQ Contract No. 6887  
DMS ID No. 97131

Yadkin River Basin  
HUC 03040105

USACE Action ID No. 2012-01107  
RFP #: 16-006785

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**PREPARED FOR:**



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

**PREPARED BY:**



**Wildlands Engineering, Inc.**  
1430 South Mint Street, Suite 104  
Charlotte, NC 28203  
Phone: (704) 332-7754



DEPARTMENT OF THE ARMY  
WILMINGTON DISTRICT, CORPS OF ENGINEERS  
69 DARLINGTON AVENUE  
WILMINGTON, NORTH CAROLINA 28403-1343

May 3, 2018

Regulatory Division

Re: NCIRT Review and USACE Approval of the Deep Meadow Draft Mitigation Plan;  
SAW-2012-01107; DMS Project #97131

Mr. Tim Baumgartner  
North Carolina Division of Mitigation Services  
1652 Mail Service Center  
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day review for the Deep Meadow Draft Mitigation Plan, which closed on March 30, 2018. The comment period was extended to allow for a site visit. These comments are attached for your review.

Based on our review of these comments, we have determined that no significant concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several issues were identified, as described in the attached comment memo, which must be appropriately addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) application for Nationwide permit (NWP) approval of the project along with a copy of this letter. Issues identified in the attached memos must be appropriately addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. **Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed.** Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your interest in restoring and protecting aquatic resources. If you have questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please contact Andrea Hughes at (919) 554-4884 extension 59.

Sincerely,

*for*  
Henry M. Wicker, Jr.  
Deputy Chief, Regulatory

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List  
Paul Wiesner, NCDMS



REPLY TO  
ATTENTION OF:

**DEPARTMENT OF THE ARMY**  
WILMINGTON DISTRICT, CORPS OF ENGINEERS  
69 DARLINGTON AVENUE  
WILMINGTON, NORTH CAROLINA 28403-1343

CESAW-RG/Hughes

April 16, 2018

MEMORANDUM FOR RECORD

SUBJECT: NCDMS Deep Meadow Mitigation Site - NCIRT Comments During 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCDMS Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCDMS Project Name: NCDMS Deep Meadow Mitigation Site, Union County, North Carolina

USACE AID#: SAW-2012-01107

NCDMS #: 97131

30-Day Comment Deadline: 30 March 2018. The comment period was extended for a site visit.

Todd Bowers, USEPA, 23 March, 2018:

See attached comments.

Andrea Hughes, USACE, 5 April, 2018:

1. The correct AID number for this project is SAW-2012-01107.
2. Page 1: For future submittals, please provide location in deci-degrees.
3. Resource labels should match the labels used for the preliminary jurisdictional determination. (UT 2 versus WF 2, etc.)
4. The wetland hydrology performance standard should be changed to 10% of the growing season.
5. Please provide a copy of the approved JD map.
6. According to the field notes dated July 20, 2016, Wildlands indicated they would check for drain tiles once crop areas were harvested. Were drain tiles found on the mitigation site?



7. Design Sheet 3.2: The typical section B-B depicts wetland “grading”. Will wetland re-establishment/rehabilitation involve floodplain excavation? If so, please provide a chart showing existing versus proposed elevations for all wetland re-establishment and rehabilitation areas.
8. Please note that assets are based on mitigation amounts.
9. Please note that we do not recommend inclusion of *Acer rubrum* in planting plans as this species may currently be present onsite. At this time we are not asking that the species be removed from the planting plan, however please be aware that adaptive management may be required if *Acer rubrum* is determined to be a dominant species at any time during the monitoring period.
10. All temporary and permanent impacts to existing wetlands and streams must be accounted for in the PCN and the loss or conversion of those waters must be replaced on-site. Please include a map depicting the location of all impacts with the PCN and explain how impacts will be offset by the project.

Mac Haupt, NCDWR, 6 April, 2018:

1. Section 8.3 Wetlands- the proposed wetland performance criteria is 8.8% hydro-period of the growing season. Two gauges are already meeting the proposed criteria (#4 -9.2% and #5- 11.8%), grading will be taking place on site and the Meadow Branch drainage area is over 7 square miles which should provide many overbank events that will enhance the hydrology of the adjacent wetlands. The standard should be 12% on this project, but DWR will accept 10%. DWR does like the fact that pre-monitoring is occurring on site.
2. DWR will require several additional gauges be placed in the eastern side wetlands. A gauge needs to be placed in W-E6, W-E4, and two gauges placed in W-E2. All of these wetlands were termed "marginal" in the soils report and are more at risk for making the required wetland hydrology standard. Moreover, all additionally placed gauges need to be installed in the upper portions of the wetland polygons. For W-E2, gauges should be placed at and above the 486 elevation line (see wetland grading sheet 3.2). For W-E4, a gauge should be placed between the 484 and 485 elevation lines. For W-E6, a gauge should be placed above the 484 elevation.

HUGHES.ANDREA.  
WADE.1258339165

Digitally signed by  
HUGHES.ANDREA.WADE.1258339165  
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI,  
ou=USA, cn=HUGHES.ANDREA.WADE.1258339165  
Date: 2018.04.16 10:48:18 -04'00'

Andrea Hughes  
Mitigation Project Manager  
Regulatory Division

Memorandum to the Record  
March 23, 2018

**Agency Comments for the Deep Meadow Mitigation Site (SAW-2012-01107)  
Final Mitigation Plan Associated with the NCDMS In-Lieu Fee Program in  
Union County, NC**

Andrea,

Thank you for the opportunity to provide feedback and comments on the Deep Meadow Stream and Wetland Mitigation Site (the Site or Project) Final Mitigation Plan as an addition to the North Carolina Division of Mitigation Resources In-Lieu Fee Program (NCDMS ILF). Wildlands Engineering, Inc. has presented a potentially suitable plan to provide compensatory mitigation for stream impacts associated with the US Army Corps of Engineers Clean Water Act Section 404 permit program. The site, as presented, is expected to provide approximately 2,839 Stream Mitigation Units (SMU) through enhancement, restoration and preservation of Meadow Branch and four tributaries, and provide approximately 8.6 Wetland Mitigation Units (WMU) via wetland re-establishment and rehabilitation within the Yadkin River watershed HUC 03040105. The Deep Meadow site will also provide an opportunity for the restoration and enhancement of Piedmont Bottomland forest within the riparian floodplains of the project streams and adjacent wetlands within the conservation easements. No nutrient offsets or riparian buffers are presented specifically for additional compensatory mitigation credit.

The EPA Region 4 Ocean, Wetlands and Stream Protection Branch offers the following site-specific comments as they pertain to the Deep Meadow Mitigation Plan dated February 13, 2018:

- Cover Page: The USACE Action ID No. 2017-00241 does not match the Corps ID on the Public Notice (SAW-2012-01107).
- Section 4/Pages 6-9: Functional Uplift Potential.
  - Overall, I would like to see considerable improvement of this section as it is. I encourage the sponsor to expand on their analysis to really demonstrate the potential for functional uplift with this project. The impairments and stressors of each stream's categorical functions are described and addressed but not rated. Those same functions need to be broken down into components that can be rated as either Not Functioning, Functioning-at-Risk, or Functioning (NF, FAR, F) especially those that are tied to performance standards. Please refer to Wildlands' Big Harris Final Mitigation Plan Baseline Section 5 for a good example of the use of stream reach functional summaries. Each reach was broken down and analyzed for functional uplift.
  - Hydrology: The analysis of the watershed including the lack of available data, current and projected stressors and limited ability to provide functional uplift with this project is reasonable and sound. In this regard a conclusion that ties in the functional status, in this case NF or FAR, should be stated as well as the anticipated outcome of NF or FAR assuming no functional uplift.

- Hydraulics: Each reach should be broken down and given a current functional status (assuming NF or FAR). For example, one component (BHR) of the hydraulics category is stated as F for the overall outcome but its current rating on a per reach basis is unknown.
- Channel Geomorphology: Once again a great breakdown of stressors and impairments of each reach on the site however the functional ratings are confusing. Functions range from moderate (FAR?) to poor (NF?) across the site and while various measures to improve channel geomorphology are presented, a functional endpoint (F) is not given and some lift is assumed. LWD is an example of a component that can be measured prior to work, rated as compared to an index or reference reach (NF or FAR), and improved to emulate the desired index rating or reference conditions (F). Performance standards may or not be applicable (such as is the case with buffer width) but the point is to show current condition, the departure from reference or ideal conditions (potential lift), and how well the project will improve that function (anticipated or actual lift).
- Physiochemical: Recommend the sponsor obtain some information on water quality (in-situ data, macroinvertebrates, samples) to confirm the streams are not functioning or FAR. While uplift may or may not occur, some baseline data will be of use to determine if any water quality improvements, and therefore functional lift, has occurred.
- Biology: Excellent use of a target species or suite of organisms to tie function towards. In this case two native mussels were presented, actions to improve their habitat and a likely outcome were given. Even if no performance standards are tied to this, I think some functional uplift or lack thereof can be demonstrated and should be noted.
- The conclusion of “the Deep Meadow site has great functional uplift potential” seems considerably inflated particularly since only 2 of the 5 Functional Categories are presented as having any meaningful and/or measurable potential uplift. If “there is no basis for classifying the existing condition of these functions” then I would suggest that Wildlands provide some basis of establishing their functional assessment to conclude that any functional lift can be demonstrated.
- Wetland functions are not addressed in the Functional Uplift Potential. Recommend the sponsor develop an analysis of wetland functions, current ratings and the anticipated functional uplift that will be realized by the end of the monitoring period.
- Section 6.0/Page 11: Please include the programmatic goals and objectives that are being addressed and applied by this project such as providing Stream Mitigation Units to be used as compensatory mitigation for permitted activity/impacts to waters of the US under Section 404 of the Clean Water Act.
  - Wetland functions were not addressed in Section 4.
  - Recommend referencing the NCDMS ILF Program by name within the Restoration Project Goals especially since this site is operating within the bounds of the MBI and will be combined with other sites within the watershed to provide stream and wetland credits for the program.

- Generally, the goals and objectives presented are well presented. A project goal should be a broad statement of the intended outcome of the project, including a list of the functions or services to be provided by the mitigation site. Project objectives will then include the specific elements, functions, or services to be provided by the project and those features that are critical to establishment of the desired aquatic resource or functional uplift. Objectives should be clear and concise statements that specify what is to be achieved, include measurable parameters, is achievable within the context of the site conditions, clearly supportive of project goals and bound by specific time frames.
- The Expected Outcomes should be endpoints of the project outcome. As stated the expected outcomes are in present tense and presented as actions and not outcomes. I recommend the sponsor significantly reword the column to reflect project endpoints.
- Recommend adding “remove invasive species” as an objective towards the goal of “Restore and enhance native...vegetation”. Remove “add source of LWD...” from expected outcomes for the same goal.
- Lack of any baseline NC Stream and/or Wetland Assessment Method datasheets and results makes rating these areas for functional uplift difficult.
- Section 7.7.2/Page 21: Schafale (2012) is not in cited references. Assuming 4<sup>th</sup> approximation of the Classification of Natural Communities of NC.
- Figure 11: Recommend additional ground water gages placed in non-wetland areas to verify wetland boundaries within the uplands contained within the conservation easement.
- Sheet 4.1: Wetland Planting Plan appears to lack understory trees or shrubs that were alluded to in Section 7.8. The plan stated that “The understory and shrub layers will be restored through a combination of planting bare root, low growth species and installing live stake shrub species.” Species included in the planting plan do not appear to meet this criteria except for streambank planting zone which is primarily live stake shrubs confined to the stream banks. Please include a plan and species to be included that will add to the diversity of a Piedmont Bottomland Forest understory and shrub layer that can be applied to the buffer and wetland planting zones.

Thank you for the opportunity to provide feedback, comments and concerns with the Deep Meadow Stream and Wetland Mitigation Site Plan in Union County, NC. The sponsor has provided a potentially suitable plan to offset impacts and provide compensatory stream and wetland credits to the NCDMS ILF program within the Yadkin River watershed service area. However, many concerns with the project functional analysis remain and should be adequately addressed before the EPA can concur with an approval of the final mitigation plan. If you or the sponsor have any questions or need clarification on any of the comments stated above, please contact me at 404-562-9225 or at [bowers.todd@epa.gov](mailto:bowers.todd@epa.gov).

Best Regards,

Todd Bowers



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**MEMORANDUM**

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TO: Harry Tsomides, NC DMS

FROM: Aaron Earley, PE

DATE: May 29, 2018

RE: Deep Meadow Mitigation Site  
Union County, NC  
USACE AID#: SAW-2012-01107, NCDMS #: 97131  
FINAL Mitigation Plan – IRT Comment Response

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This memo documents NCIRT's Mitigation Plan review comments (*in italics*) received from Andrea Hughes' letter dated 04/16/2018, the project team's responses, and where the revisions have been included in the final Mitigation Plan.

**Andrea Hughes, USACE, 5 April, 2018:**

1. *The correct AID number for this project is SAW-2012-01107.*  
All instances of the AID number have been corrected.
2. *Page 1: For future submittals, please provide location in deci-degrees.*  
The location was changed to deci-degrees format.
3. *Resource labels should match the labels used for the preliminary jurisdictional determination. (UT 2 versus WF 2, etc.)*  
The resource labels in the preliminary jurisdictional determination match the resource labels in the mitigation plan. There are instances in the appendix where the old nomenclature was used (UT1, UT2, etc.), but these were figures part of agency correspondence and meeting minutes. These instances should be kept unchanged to preserve the documentation of the correspondence.
4. *The wetland hydrology performance standard should be changed to 10% of the growing season.*  
The wetland performance standard was changed to 10% of the growing season throughout the report, including updating the proposed DrainMOD groundwater modeling results.
5. *Please provide a copy of the approved JD map.*  
A copy of Figure 3 (Site Map) from the JD request depicting delineated resources is included as part of the issued Preliminary Jurisdictional Determination in Appendix 2.
6. *According to the field notes dated July 20, 2016, Wildlands indicated they would check for drain tiles once crop areas were harvested. Were drain tiles found on the mitigation site?*  
Drain tiles were not found on the site. A sentence was added to section 3.4 for clarification.

7. *Design Sheet 3.2: The typical section B-B depicts wetland "grading". Will wetland re-establishment/rehabilitation involve floodplain excavation? If so, please provide a chart showing existing versus proposed elevations for all wetland re-establishment and rehabilitation areas.*

As stated in Section 7.7.3 – Groundwater Modeling Overview; minor grading is proposed within the wetland zones to remove overburden material, restore natural topographic variations to the site, and to shallow the overall dimensions of Meadow Branch to improve stream and floodplain connection. Cut depth is limited to approximately 10-inches or less throughout the site. Typical sections shown on Sheets 3.1 and 3.2 are representative and not to scale (primarily provided for the contractor). A full wetland grading plan including existing and proposed contours is provided in Sheets 3.1 and 3.2. Cut depths within proposed wetland restoration areas can easily be read from the provided wetland grading plan.

8. *Please note that assets are based on mitigation amounts.*

Wildlands is aware that assets are based on mitigation amounts.

9. *Please note that we do not recommend inclusion of *Acer rubrum* in planting plans as this species may currently be present onsite. At this time we are not asking that the species be removed from the planting plan, however please be aware that adaptive management may be required if *Acer rubrum* is determined to be a dominant species at any time during the monitoring period.*

*Acer rubrum* was removed from the wetland bare root planting plan.

10. *All temporary and permanent impacts to existing wetlands and streams must be accounted for in the PCN and the loss or conversion of those waters must be replaced on-site. Please include a map depicting the location of all impacts with the PCN and explain how impacts will be offset by the project.*

All impacts to existing stream and wetlands are accounted for in the Pre-Construction Notification and a figure depicting impact locations is included with the PCN submittal. Enhancement along Meadow Branch and WF1 will result in temporary impacts for bank stabilization and instream structures with no loss or conversion of streams. Restoration on EF1 and WF2 will result in permanent impacts as degraded existing channels are relocated and filled. The relocated streams will be restored using natural channel design with Priority I and Priority II approaches. Enhancement and restoration will result in an uplift in project stream function by providing long term stability, improved instream habitat, floodplain connectivity, and a native riparian floodplain buffer. Stream restoration and enhancement will also result in a net increase of 204 LF of stream. Approximately 0.32 acres of existing wetlands will be impacted by grading and/or construction access. These impacts will be offsite by wetland rehabilitation and re-establishment that will result in approximately 8.8 acres of wetlands post-construction.

**Mac Haupt, NCDWR, 6 April, 2018:**

11. *Section 8.3 Wetlands- the proposed wetland performance criteria is 8.8% hydro-period of the growing season. Two gauges are already meeting the proposed criteria (#4 -9.2% and #5- 11.8%), grading will be taking place on site and the Meadow Branch drainage area is over 7 square miles which should provide many overbank events that will enhance the hydrology of the adjacent wetlands. The standard should be 12% on this project, but DWR will accept 10%. DWR does like the fact that pre-monitoring is occurring on site.*

The wetland performance standard was changed to 10% of the growing season throughout the report, including updating the proposed DrainMOD groundwater modeling results.

12. *DWR will require several additional gauges be placed in the eastern side wetlands. A gauge needs to be placed in W-E6, W-E4, and two gauges placed in W-E2. All of these wetlands were termed "marginal" in the soils report and are more at risk for making the required wetland*

*hydrology standard. Moreover, all additionally placed gauges need to be installed in the upper portions of the wetland polygons. For W-E2, gauges should be placed at and above the 486 elevation line (see wetland grading sheet 3.2). For W-E4, a gauge should be placed between the 484 and 485 elevation lines. For W-E6, a gauge should be placed above the 484 elevation.*

Wildlands added proposed groundwater monitoring gages to wetlands W-E6 and W-E4 and added an additional wetland gage to W-E2 as shown in Sheets 3.1 and 3.2 and Figure 11. Gages within W-E6 and W-E4 were placed according to elevation suggestions noted in the comment. One gage within W-E2 was moved above the proposed 486 elevation line. Generally, Wildlands agrees with the groundwater monitoring approach noted above but wants to acknowledge that groundwater monitoring gages are meant to be representative of *overall* wetland mitigation site groundwater conditions and focusing wetland gages to boundaries and/or toe of slopes does not generally fit that criteria. Furthermore, when placing proposed groundwater monitoring gages, Wildlands prefers to overlap pre-construction monitoring gages and, as best as possible, place wells in linear transects to get a better understanding of overall groundwater levels on-site. After the edits above, the preliminary monitoring plan includes 11 groundwater gages for approximately 8.8-acres of restored wetland; which is higher than what has previously been required by the IRT. Wildlands understands that this is due to multiple pocket wetlands on the east side of the Site but does want to acknowledge the extensive groundwater monitoring proposed on the Site.

**Todd Bowers, EPA Region 4, 23 March 2018:**

13. *Cover Page: The USACE Action ID No. 2017-00241 does not match the Corps ID on the Public Notice (SAW-2012-01107).*

All instances of the AID number have been corrected.

14. *Section 4/Pages 6-9: Functional Uplift Potential.*

a. *Overall, I would like to see considerable improvement of this section as it is. I encourage the sponsor to expand on their analysis to really demonstrate the potential for functional uplift with this project. The impairments and stressors of each stream's categorical functions are described and addressed but not rated. Those same functions need to be broken down into components that can be rated as either Not Functioning, Functioning-at-Risk, or Functioning (NF, FAR, F) especially those that are tied to performance standards. Please refer to Wildlands' Big Harris Final Mitigation Plan Baseline Section 5 for a good example of the use of stream reach functional summaries. Each reach was broken down and analyzed for functional uplift.*

Wildlands typically does not include Stream Function Pyramid analysis or ratings in mitigation plans since our client does not want to see it. Big Harris was a special case with all the BMPs and headwater treatments.

b. *Hydrology: The analysis of the watershed including the lack of available data, current and projected stressors and limited ability to provide functional uplift with this project is reasonable and sound. In this regard a conclusion that ties in the functional status, in this case NF or FAR, should be stated as well as the anticipated outcome of NF or FAR assuming no functional uplift.*

Since we are not providing ratings and we state that no improvements are expected, no revisions to the hydrology section were made.

c. *Hydraulics: Each reach should be broken down and given a current functional status (assuming NF or FAR). For example, one component (BHR) of the hydraulics category is stated as F for the overall outcome but its current rating on a per reach basis is unknown.*



This section was rewritten to provide better clarification for each reach.

- d. *Channel Geomorphology: Once again a great breakdown of stressors and impairments of each reach on the site however the functional ratings are confusing. Functions range from moderate (FAR?) to poor (NF?) across the site and while various measures to improve channel geomorphology are presented, a functional endpoint (F) is not given and some lift is assumed. LWD is an example of a component that can be measured prior to work, rated as compared to an index or reference reach (NF or FAR), and improved to emulate the desired index rating or reference conditions (F). Performance standards may or not be applicable (such as is the case with buffer width) but the point is to show current condition, the departure from reference or ideal conditions (potential lift), and how well the project will improve that function (anticipated or actual lift).*

The final paragraph in this section was revised to expand on potential uplift.

- e. *Physiochemical: Recommend the sponsor obtain some information on water quality (in-situ data, macroinvertebrates, samples) to confirm the streams are not functioning or FAR. While uplift may or may not occur, some baseline data will be of use to determine if any water quality improvements, and therefore functional lift, has occurred.*

As stated in the section, physiochemical uplift typically occurs after the monitoring period. Since water quality is not tied to performance standards, baseline sampling will not occur.

- f. *Biology: Excellent use of a target species or suite of organisms to tie function towards. In this case two native mussels were presented, actions to improve their habitat and a likely outcome were given. Even if no performance standards are tied to this, I think some functional uplift or lack thereof can be demonstrated and should be noted.*

Clarification of expected habitat uplift was added to the second paragraph in this section.

- g. *The conclusion of "the Deep Meadow site has great functional uplift potential" seems considerably inflated particularly since only 2 of the 5 Functional Categories are presented as having any meaningful and/or measurable potential uplift. If "there is no basis for classifying the existing condition of these functions" then I would suggest that Wildlands provide some basis of establishing their functional assessment to conclude that any functional lift can be demonstrated.*

The conclusion section was rewritten to be more concise on expected uplift potential.

- h. *Wetland functions are not addressed in the Functional Uplift Potential. Recommend the sponsor develop an analysis of wetland functions, current ratings and the anticipated functional uplift that will be realized by the end of the monitoring period.*

The Stream Functions Pyramid for evaluating Functional Uplift Potential does not directly address stream and wetland complexes. However, Wildlands outlines in Section 4.0 how the current condition of floodplain wetlands has negatively affected each of the five stream functions and how the restoration of these wetlands will provide potential uplift for stream functions based on the re-establishment of appropriate hydrology, hydraulics, and aquatic and terrestrial habitat.

15. *Section 6.0/Page 11: Please include the programmatic goals and objectives that are being addressed and applied by this project such as providing Stream Mitigation Units to be used as compensatory mitigation for permitted activity/impacts to waters of the US under Section 404 of the Clean Water Act.*

Clarification was added to the opening paragraph in this section.

- a. *Wetland functions were not addressed in Section 4.*

See the response to #14, part h regarding the potential functional uplift section as it

relates to riparian wetland function.

- b. *Recommend referencing the NCDMS ILF Program by name within the Restoration Project Goals especially since this site is operating within the bounds of the MBI and will be combined with other sites within the watershed to provide stream and wetland credits for the program.*

Reference to the DMS ILF program was added to the opening paragraph in this section.

- c. *Generally, the goals and objectives presented are well presented. A project goal should be a broad statement of the intended outcome of the project, including a list of the functions or services to be provided by the mitigation site. Project objectives will then include the specific elements, functions, or services to be provided by the project and those features that are critical to establishment of the desired aquatic resource or functional uplift. Objectives should be clear and concise statements that specify what is to be achieved, include measurable parameters, is achievable within the context of the site conditions, clearly supportive of project goals and bound by specific time frames.*

Table 6 was revised for more concise statements that tie to the category.

- d. *The Expected Outcomes should be endpoints of the project outcome. As stated the expected outcomes are in present tense and presented as actions and not outcomes. I recommend the sponsor significantly reword the column to reflect project endpoints.*

The expected outcomes were rewritten to be in expected, future tense as opposed to present actions.

- e. *Recommend adding "remove invasive species" as an objective towards the goal of "Restore and enhance native...vegetation". Remove "add source of LWD..." from expected outcomes for the same goal.*

These revisions were made to Table 6.

- 16. *Lack of any baseline NC Stream and/or Wetland Assessment Method datasheets and results makes rating these areas for functional uplift difficult.*

This project was contracted at a time when NCSAM and NCWAM were not required by DMS.

- 17. *Section 7.7.2/Page 21: Schafale (2012) is not in cited references. Assuming 4<sup>th</sup> approximation of the Classification of Natural Communities of NC.*

The Schafale reference was added.

- 18. *Figure 11: Recommend additional ground water gages placed in non-wetland areas to verify wetland boundaries within the uplands contained within the conservation easement.*

Additional groundwater monitoring gages were added to the proposed wetland mitigation areas (see comment response #12 above). Wildlands does not intend to gage areas which are not proposed for wetland mitigation crediting.

- 19. *Sheet 4.1: Wetland Planting Plan appears to lack understory trees or shrubs that were alluded to in Section 7.8. The plan stated that "The understory and shrub layers will be restored through a combination of planting bare root, low growth species and installing live stake shrub species." Species included in the planting plan do not appear to meet this criteria except for streambank planting zone which is primarily live stake shrubs confined to the stream banks. Please include a plan and species to be included that will add to the diversity of a Piedmont Bottomland Forest understory and shrub layer that can be applied to the buffer and wetland planting zones.*

Button Bush (*Cephalanthus occidentalis*), Spice Bush (*Lindera bezion*), and Silky Dogwood (*Cornus amomum*) were added to the wetland bare root planting zones to provide woody shrub and understory habitat. Wildlands will also harvest and transplant on-site herbaceous species

including soft rushes (*Juncus effuses*), woolgrass (*Scirpus cyperinus*), hop sedge (*Cares lupulina*), duck potato (*Sagittaria latifolia*), arrow arum (*Peltandra virginica*), and lizard's tail (*Saururus cernuus*) as available on-site to provide emergent and herbaceous habitat.

## DRAFT MITIGATION PLAN

### DEEP MEADOW MITIGATION SITE

Union County, NC  
NCDEQ Contract No. 6887  
DMS ID No. 97131  
Yadkin River Basin  
HUC 03040105

USACE Action ID No. 2012-01107

PREPARED FOR:

---



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

PREPARED BY:

---



**Wildlands Engineering, Inc.**  
1430 South Mint Street, Suite 104  
Charlotte, NC 28203  
Phone: (704) 332-7754

**This mitigation Plan has been written in conformance with the requirements of the following:**

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

**These documents govern DMS operations and procedures for the delivery of compensatory mitigation.**

#### **Contributing Staff:**

Aaron Earley, PE, CFM, *Project Manager and Designer*  
Shawn Wilkerson, *Principal in Charge*  
Ian Eckardt, PWS, *Wetland Delineations*  
Christine Blackwelder, *Mitigation Plan Development*

Eric Neuhaus, PE, *Project Engineer*  
Ruby Davis, *Existing Conditions Analysis*  
Jesse Kelly, *Construction Documents*  
Jeff Keaton, PE, *Lead Quality Assurance*

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## 1.0 Introduction

The Deep Meadow Mitigation Site (Site) is located in Union County approximately two miles north of Wingate, NC and approximately six miles northeast of Monroe, NC (Figure 1). The project is located within the NC Division of Mitigation Services (DMS) targeted watershed for the Yadkin River Basin Hydrologic Unit (HU) 03040105070060 and NC Division of Water Resources (DWR) Subbasin 03-07-14. The Site was selected by DMS to provide stream mitigation units (SMUs) and buffer credits in the Yadkin River Basin 03040105. The project involves the restoration, enhancement, and preservation of 4,298 existing linear feet of incised streams from Meadow Branch and three unnamed tributaries of Meadow Branch. These unnamed tributaries have been given names by Wildlands to facilitate labeling and communication in this mitigation plan and for the life of the project (Figure 2). These tributaries will be hereafter referred to as West Fork 1 (WF1), West Fork 2 (WF2), and East Fork 1 (EF1). Restoration and enhancement of these reaches will provide 2,838.9 SMUs. The project will produce 0.6 acres of wetland rehabilitation which will provide 0.4 WMU's, and 8.2 acres of wetland re-establishment which will provide 8.2 WMU's. The Site will be protected by a 23.80-acre conservation easement. The Site Protection Instrument detailing the easement is located in Appendix 1.

**Table 1: Project Attribute Table Part 1**

Project Information	
Project Name	Deep Meadow Mitigation Site
County	Union
Project Area (acres)	23.80
Project Coordinates (latitude and longitude)	35.022169 -80.451483
Planted Acreage (acres of woody stems planted)	21.48

## 2.0 Watershed Approach and Site Selection

The 2008 DWR Yadkin-Pee Dee River Basin Plan noted general habitat degradation in the Rocky River watershed including sediment and erosion from construction and general agriculture in the upper portions of the watershed as stressors resulting in habitat degradation. The 2009 Lower Yadkin Pee Dee River Basin Restoration Priorities (RBRP) notes that the Lower Richardson Creek 03040105070060 HUC, which contains the Site, is a newly designated TLW. The RBRP cites goals of improving management of agriculture-related stressors and their sources and reducing levels of sediment, turbidity, and nutrients.



**Deep Meadow Mitigation Site**

The Yadkin-Pee Dee River basin is also discussed in the 2005 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP). In the report, stream impacts from excessive sedimentation and changes in geomorphology related to agricultural practices are discussed. The report also notes that water quality in the watershed suffers due to excessive nutrient loading in agricultural areas. The WAP discussed the importance of stream restoration efforts, and notes that the Richardson Creek watershed, which the Site is located within, is a priority watershed for

freshwater conservation. Restoration of the Site will directly and indirectly address stressors identified in the RBRP, the DWR Basinwide Plan and the NCWRC WAP by creating stable stream banks,





reconnecting incised streams to floodplains, restoring wetlands that will treat agricultural runoff, and restoring a forest to agriculturally maintained buffer areas, which in areas will extend over twice the width typically required for Piedmont streams. These actions will reduce nutrient and sediment inputs to project streams, and ultimately to Richardson Creek and the Yadkin River.

### 3.0 Baseline and Existing Conditions

The Site watershed (Table 2 and Figure 3) is located in a southwestern HU of the Lower Yadkin CU. It is situated in the rural countryside in Union County near Wingate, NC. The following sections describe the existing conditions of the watershed and watershed processes, including disturbance and response.

**Table 2: Project Attribute Table Part 2**

Project Watershed Summary Information	
Physiographic Province	Piedmont
Ecoregion	Slate Belt
River Basin	Yadkin River
USGS HUC (8 digit, 14 digit)	03040105, 03040105070060
NCDWR Sub-basin	03-07-14
Project Drainage Area (acres)	4,472
Project Drainage Area Percentage of Impervious Area	4.27%
CGIA Land Use Classification	24.4% forested, 50.4% cultivated, 4.3% impervious

#### 3.1 Landscape Characteristics

##### 3.1.1 Physiography and Topography

The Site is located in the Piedmont Physiographic Province of North Carolina. The Piedmont Province is characterized by gently rolling, well rounded hills with long low ridges and elevations ranging from 300-1,500 feet above sea level. The Site topography and relief are typical for the region, as illustrated in Figure 4. Meadow Branch has a gentle (0.22%) unconfined alluvial valley. EF1 transitions from a gentle (1.00%) moderately confined valley at the upstream project limits to an unconfined valley as it approaches Meadow Branch. Due to the valley shape present along Meadow Branch, a swath of wetlands developed at the toe of the right valley slope and along an existing ditch off Meadow Branch (Figure 2).

##### 3.1.2 Geology and Soils

The Site is located in a portion of the Piedmont known as the Carolina Slate Belt (NCGS, 1985). The rocks in this region are primarily volcanic and sedimentary rocks that underwent low-grade metamorphism giving them a slaty cleavage. Coarse-grained intrusive granites comprise the rest of the Slate Belt rocks (Rogers, 2006). Streams in the Carolina Slate Belt tend to go dry during late summer and early fall as a result of geologic, topographic, and climatic factors. A study by Guise and Mason (1993) states that the, “Carolina slate belt has among the lowest potential for sustaining baseflow in streams” throughout the year as compared to other regions of North Carolina. Median low flows in the Carolina Slate Belt, defined by the study as the 7Q10 (the annual minimum 7-day consecutive low flow), can be as low as 0.005 ft<sup>3</sup>/s/mi<sup>2</sup> (Guise and Mason, 1993). If streambank vegetation is not well established it can die back in late summer when flows are low, leaving banks exposed to erosive storm flows. Low baseflow appears to happen during the summer months and periods of drought along Meadow Branch, EF1, WF1, and WF2.

The Deep Meadow floodplain is dominated by Chewacla loams (Figure 5). While this soil frequently floods and is poorly drained, aiding in the maintenance of wetlands, the loamy soil is greater than 80 inches deep. This depth to bedrock provides no natural grade control within the streambeds, making degradation and incision likely. Once the incision process begins, degradation would likely continue in the Site streams until the channels reach the underlying bedrock.

It is Wildlands' experience that small streams in the Slate Belt are low bedload sediment supply systems. These streams commonly have small gravel and sand bed material that is derived from highly weathered parent material. Largely forested watersheds with low rolling topography in this region will often result in low sediment supply. Without naturally high bedload supply to drive morphologic change, these streams are relatively slow to adjust without manipulation or watershed disturbance.

### 3.2 Land Use/Land Cover

Land use and land cover were investigated throughout the watershed by conducting a windshield survey and by reviewing historical aeriels of the Site and adjacent parcels from 1951-2012. Currently, the watershed is 24% forested. The most common historical and current land uses in the watershed are agriculture and urban development. A review of historic aeriels shows that the Site has been in agricultural production since 1951. In the 1951 aerial, the entire Site was cleared except Meadow Branch's right floodplain upstream of the EF1 confluence and a small portion of Meadow Branch's left floodplain just downstream of the WF2 confluence. The woods in the left floodplain were cleared between 1951 and 1961, and the rest of Meadow Branch within the Site was cleared between 1961 and 1969. In the 1951 aerial, EF1 flows parallel to Meadow Branch for a distance before the two join. EF1's flowpath is obscured in the 1961 aerial; however, by 1969, it appears that EF1 was pushed closer to Meadow Branch to maximize a farm field north of EF1. EF1 stays in this configuration until the 2005 aerial where it is clearly shortened, eliminating the parallel flow path and instead joining Meadow Branch at a perpendicular angle that we observe onsite today. These historic aerial photos are included in the appendix.

This consistency in land use within the project watershed over the past 61 years indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied widely over time. The Union County 2025 Comprehensive Plan states that Wingate's future land use objectives will consist of additional medium density residential development in the Site's watershed.

### 3.3 Existing Vegetation

Riparian buffers are largely absent from the Site streams and row crops exist right up to the top of stream bank except for a narrow row of early successional woody species in some spots along Meadow Branch. These woody species include green ash (*Fraxinus pennsylvanica*), young boxelder (*Acer negundo*), silky dogwood (*Cornus amomum*) and black elderberry (*Sambucus Canadensis*). The herbaceous ground cover throughout the row crops contains a variety of cool season broadleaf weeds and grass such as creeping buttercup (*Ranunculus* sp.), Carolina geranium (*Geranium carolinianum*), curly dock (*Rumex crispus*) and annual bluegrass (*Poa annua*). Warm season plants include goldenrod (*Solidago* sp.), various smartweed (*Polygonum* spp) species, and two-headed water-starwort (*Callitriche heterophylla*) in EF1. There is a single mature white oak (*Quercus alba*) on the interior bend of Meadow Branch upstream of the ford crossing and a single mature willow oak (*Quercus phellos*) along EF1. A small area of deciduous forest is present at the Meadow Branch/WF1 confluence, which contains a variety of trees including sweet gum (*Liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*) and several oak species (*Quercus* spp.). Meadow Branch's floodplain is ditched as depicted on Figure 2, and invasive aquatic plants such as parrots feather (*Myriophyllum aquaticum*) and Indian hygrophylla (*Hygrophylla polysperma*) are found in these ditches.



### 3.4 Project Resources

Wildlands reviewed the project area for potential jurisdictional waters of the United States (US). Jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers Wetlands Delineation Manual and the subsequent Eastern Mountain and Piedmont Regional Supplement. Potential jurisdictional wetland areas as well as typical upland areas were classified using the USACE Wetland Determination Data Form. Evaluation methods also utilized the North Carolina Department of Water Resources (NCDWR) Stream Identification Form. Jurisdictional waters of the US were surveyed for inclusion on plans and figures.

The results of the on-site investigation include four jurisdictional stream channels (Meadow Branch, WF1, WF2, and EF1) and two wetlands (A and B). USACE Wetland Determination Data Forms and the approved jurisdictional determination (USACE Action ID No. 2012-01107; Date of JD: 05/23/2017) are in Appendix 2 and NCDWR Stream Identification Forms are in Appendix 3. Table 3 provides a summary of water resources within the project limits. Existing conditions are also illustrated in Figure 6. Reach specific cross sections and geomorphic summaries are provided in Appendix 4.

**Table 3: Project Attribute Table Part 3**

Reach Summary Information				
Parameter	Meadow Branch	WF1	WF2	EF1
Length of Reach (lf)	2,570	136	391	1,201
Valley Confinement (confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Moderately confined
Drainage Area (acres)	4,472	58	131	226
Perennial, Intermittent, Ephemeral	P	P	P	P
NCDWR Water Quality Classification	C			
Stream Classification (Existing and Proposed) <sup>1</sup>	C4/5 (no proposed change in stream classification)	G4 (proposed B4)	Incised and straightened E4 (proposed C4)	Incised and straightened E4 (proposed C4)
Evolutionary Trend (Simon) <sup>1</sup>	VI: Quasi Equilibrium	III: Degrading	IV: Degrading and Widening	III: Degrading
FEMA Classification	Zone AE			
Wetland Summary Information				
Parameter	A		B	
Size of Wetland (acres) <sup>3</sup>	0.28		0.30	
Wetland Type (non riparian, riparian riverine or riparian non-riverine)	Riparian Riverine			
Mapped Soil Series	Tatum/ Chewacla		Chewacla	
Drainage Class	Well Drained/ Poorly Drained		Poorly Drained	
Soil Hydric Status	No / Yes		Yes	
Source of Hydrology	Groundwater and over bank events			
Restoration or enhancement method (hydrologic, vegetative, etc)	Re-establishment (hydrologic, vegetative)			

1. The Rosgen classification system (Rosgen, 1994) is for natural streams. These channels have been heavily manipulated by agricultural operations and therefore may not fit the classification category as described by these models. Results of the classification are provided as a basis for discussion of existing channel form.



### **Meadow Branch**

Meadow Branch originates approximately 2.6 miles upstream of the Site near the Wingate University campus. In the section upstream of the existing ford crossing, the stream runs along the left valley wall and is influenced by several beaver dams, debris jams, and depositional bars. The channel makes a couple of meanders turns before reaching the ford crossing. The left bank just upstream of the ford crossing is up against the valley wall and is actively eroding in several locations. The valley slope upstream of the ford crossing is approximately 0.35%. Immediately downstream of the ford crossing, the channel width drastically narrows from an average of 20 ft to an



**Bank erosion along Meadow Branch**

average of 9 ft. The right bank is nearly vertical and approximately 2.5 ft high. The left bank is lower and flatter and ties into a floodplain bench where several parallel ditches have formed in the left floodplain. These ditches can be attributed to more frequent inundation of the floodplain due to the smaller channel cross sectional area in this section. Approximately 350 ft downstream of the ford crossing, the channel widens back out to an average width of 28 ft. From this point to the downstream limits, the channel is dominated by long, sluggish pools formed by several debris jams. The valley downstream of the ford crossing is wide and flat with an average slope of 0.14%. Bed material is primarily coarse sand and fine gravel based on visual assessment. Vegetation along Meadow Branch consists of a single row of sporadic successional green ash boxelder, silky dogwood, and black elderberry, with the addition of a few older hardwoods on the right floodplain upstream of the ford crossing. Buffer vegetation and channel pattern has been kept to a minimum due to adjacent row crop operations.

### **WF1**

WF1 originates outside of the conservation easement but on the Site property. It runs along a woodline and joins Meadow Branch near the upstream project limits. The entire length of the project reach is straight, dominated by privet on both banks with a few interspersed hardwoods. A headcut has progressed approximately 100 LF upstream of the confluence to a bedrock knickpoint due to the lower invert elevation of Meadow Branch. The bank height ratio downstream of the headcut is 4.0 and closer to 1.0 upstream of the headcut. The channel bed consists primarily of large gravel and small cobble sized material.

### **WF2**

WF2 begins immediately downstream of an existing ford crossing outside of the conservation easement and flows straight through a corn field from the west into Meadow Branch. No buffer exists along WF2 and several instances of farm machinery impact have been observed. This channel is maintained to drain the adjacent agricultural fields. The valley is wide and flat with a slope of 1.08%. The channel bed is dominated by fine gravel. There are a couple of minor headcuts. The reach is characterized by inconsistent bank heights and slopes, most likely attributed to the farm machinery impact.





## **EF1**

EF1 enters the Site just downstream of an existing culvert crossing on McIntyre Road. For the first 125 LF, the valley is relatively confined with a slope of approximately 2.4%. The channel through this upstream section is dominated by bedrock with no bedform diversity. After the first 125 LF, the valley widens out and flattens to an average slope of 0.5%. The channel bed begins to form sporadic silty pools and gravel riffles, with occasional bedrock outcroppings. The channel flows relatively straight along the left edge of the valley, most likely relocated to this location to maximize agricultural production. Row crops and open fields are maintained up to the top of banks; no riparian buffer exists. An existing ford crossing exists approximately 350 LF upstream of the Meadow Branch confluence.

In the 1951 aerial, EF1 flows parallel to Meadow Branch for a distance before the two join. EF1's flow path is obscured in the 1961 aerial; however, by 1969, it appears that EF1 was pushed closer to Meadow Branch to maximize a farm field north of EF1. EF1 stays in this configuration until the 2005 aerial where it is clearly shortened, eliminating the parallel flow path and instead joining Meadow Branch at a perpendicular angle that we observe onsite today.



## **Wetlands A – B**

An on-site delineation of jurisdictional resources identified two areas of existing jurisdictional wetland within the proposed conservation easement. Table 3 above outlines the specific details of the on-site wetland resources including size, type, soils etc. Both wetland features are linear and appear to have been altered previously based on their landscape position. Wetland A, located just south of the existing farm road and ford crossing, has likely been deepened or maintained to facilitate drainage from the adjacent agricultural field and adjacent farm road. Wetland B catches hill slope drainage from the adjacent row crops and redirects this flow to Meadow Branch. The toe slope position of the wetland, and the current shape, indicate that this wetland was dredged to drain the adjacent fields to better suit them for row crops. Wetland A and B exhibited one or more of the following wetland hydrology indicators: shallow inundation, drift deposits, algal mats, and/or saturation within the upper 12 inches of the soil profile. Common hydrophytic vegetation within the wetlands included shallow sedge (*Carex lurida*), rice cut grass (*Leersia oryzoides*), and parrotfeather (*Myriophyllum aquaticum*). No drain tiles were found within the Site.

## **4.0 Functional Uplift Potential**

The potential for functional uplift is described in this section according to the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology.

### **4.1 Hydrology**

The major watershed disturbances have been deforestation, conversion of approximately 50% of the watershed to agricultural land uses, and approximately 20% of the watershed to urbanization. These alterations in land cover typically result in reductions in rainfall interception and evapotranspiration



which lead to increases in runoff and water yield (Dunne and Leopold, 1978). A primary result of these changes is an increase in both peak flows and base flows. Initial increases in water yield usually change over time as vegetation regrows and crops are planted. Rapid changes and/or inconsistencies in watershed hydrology can alter the flooding regime of stream systems and impact floodplain wetland hydrology. There are no stream gages within this watershed and, thus, no way to know the degree to which clearing of the land affected this particular watershed other than to say that water yields have almost certainly increased. However, these changes primarily occurred several decades ago (prior to available aerial photography). Population growth in this watershed is expected to grow in the future. Therefore, future alteration to the land cover and associated effects on hydrology are expected. No measurements of existing hydrology have been made to date for this project.

A stream restoration project performed at a specific Site does not often result in uplift to hydrology (Harman, 2012). Even though buffer and wetland planting within the conservation easement will provide a localized lift to the hydrologic function, this will not result in improvements to the rainfall-runoff relationship at the watershed scale.

#### **4.2 Hydraulics**

The primary hydraulic stressors to Site streams are active scour on vertical stream banks, the lack of stabilizing stream bank and riparian vegetation due to active row crop farming up to the top of the stream bank, and incision on the tributaries. Existing bank height ratios on the EF1, WF1, and WF2 are 1.4, 3.4, and 1.4, respectively. With existing bank height ratios greater than 1.0 and a lack of adequate riparian vegetation, residence time in adjacent floodplain wetlands has decreased over time and negatively affected wetland hydraulics which offer storage during rainfall events. The proposed bank height ratio for EF1, WF1, and WF2 is 1.0, indicating that each reach will be reconnected to its floodplain. Bankfull flow velocities and shear stress will be improved to functioning levels and groundwater exchange and adjacent wetland hydrology will also be improved as a result of the increased frequency of floodplain inundation and higher water table elevations.

Functional uplift is expected due to the reconnection of EF1, WF1, and WF2 to their floodplains.

#### **4.3 Channel Geomorphology**

Channelization, incision, and on-going bank erosion place Meadow Branch in Stage VI, EF1 and WF1 in Stage III, and WF2 in Stage IV of the Simon Channel Evolution Model. Meadow Branch exhibits active scour erosion on at least one bank and often both banks along approximately 65% of its length. The stream bedform is dominated by long sluggish pools of varying depth with infrequent, short riffles. The pool to pool spacing ratio along EF1 ranges from 5.3 to 9.4, and 5.6 along WF2. Bank migration and lateral stability were not measured for this project due to its straightened status. Overall, the existing geomorphologic function ranges from moderate in areas where bedform diversity has formed, to very poor in the backwater section of Meadow Branch. The lack of riparian and wetland vegetation in the immediate floodplain of Meadow Branch has increased the amount of agricultural fines in the stream system; altering the sediment regime and channel geomorphology at the Site level.

There is a significant opportunity to improve the geomorphologic function on the Site. Large woody debris (LWD) will be added to the system through construction of instream structures and bank revetments, resulting in improved bedform diversity. Channel incision and bank erosion will be corrected. A riparian buffer will be planted and floodplain wetlands will be restored to reduce fine sediments entering the streams and resulting in improved long-term geomorphic function of Meadow Branch, EF1, WF1, and WF2.



#### 4.4 Physiochemical

While no water quality monitoring has occurred on the Site, its streams flow to Richardson Creek approximately 4 miles downstream. Richardson Creek is 303(d) listed for exceeding the acceptable level of copper for freshwater aquatic life. The 2008 DWR Yadkin-Pee Dee River Basin Plan noted general habitat degradation in the Rocky River watershed including sediment and erosion from construction and general agriculture in the upper portions of the watershed as stressors resulting in habitat degradation. The 2009 Lower Yadkin Pee Dee River Basin Restoration Priorities (RBRP) notes that the Lower Richardson Creek 03040105070060 HUC, which contains the Site, is a newly designated TLW. The RBRP cites goals of improving management of agriculture-related stressors and their sources and reducing levels of sediment, turbidity, and nutrients.

There are numerous instances throughout the Site of streambank erosion, bed scour, absence of riparian buffer, and concentrated runoff from agricultural fields. Each of these sources contribute to higher levels of sediment, turbidity, and nutrient runoff.

There is potential to improve the physicochemical functioning of the project streams. Water will flow over instream structures that will provide aeration, trees will be planted in the riparian zone to eventually shade and cool stream flow and help filter runoff, the stream will be reconnected to its floodplain and adjacent riparian wetlands to provide storage and treatment of overbank flows, and streambank erosion will be greatly reduced to nearly eliminate the source of sediment. Restoring adjacent floodplain wetlands will increase residence time and nutrient uptake through native wetland vegetation. However, the potential improvements to physicochemical functioning will not happen immediately and some aspects will not occur until a mature canopy is established. Therefore, physicochemical improvements will not be included in the project success criteria for the seven-year monitoring period and the functional uplift potential is not rated.

#### 4.5 Biology

There are no available biological data for the Site, however, the habitat conditions on the Site are poor. The channel substrate appears to be a bimodal distribution between small to medium gravels and fines. A few debris jams are present on the streams, which provide good woody debris habitat, and there are very few active depositional features in the channel to support diverse macroinvertebrate and fish communities. While the riparian wetlands provide habitat diversity in the floodplain, they are regularly cultivated for agriculture production, removing shade and refuge areas. Current agricultural ditching on-site is draining major portions of the riparian zone and degrading habitat for aquatic and terrestrial species.

While the overall Site habitat is generally poor, potential habitat was identified along Meadow Branch which may support the Carolina creekshell (*Villosa vaughaniana*) and the Savannah Lilliput (*Toxolasma pullus*). These species are usually found in clay, silty-sand, and mixed sand gravel substrate within the stream channel. There is opportunity to improve the instream, riparian, and wetland habitat in addition to the physicochemical function described in Section 4.4. Habitat uplift will be achieved by adding instream structures with a variety of rock and woody materials, adding woody bank revetments, reducing the abundance of nuisance macrophytes, providing a riparian buffer to shade the stream and improve terrestrial habitat, creating pools of variable depths, creating riparian wetland areas of varying inundation to provide a variety of aquatic and terrestrial habitat, and cutting of sources of fine sediments. Establishment of riffles and pools will help develop point bars, which provide habitat for the dense mussel beds of the Carolina creekshell and Savannah Lilliput. The culvert outlets will be addressed to improve aquatic organism passage. The biological response of the system will be tied to the physiochemical response post-restoration. As the physiochemical response may be delayed, the ultimate level of improvement in biology may not occur until after the completion of the seven-year





monitoring period. Although the biological response of the project will not be explicitly monitored, improvements in biologic activity of the Site will likely be noted during visual assessments of the project.

#### 4.6 Overall Functional Uplift Potential

Overall, the Deep Meadow Site has functional uplift potential in the following categories:

- *Hydraulics*: through reconnection of EF1, WF1, and WF2 to their floodplains and the restoration of wetland hydraulics;
- *Channel Geomorphology*: through improved sediment transport, improved sediment storage in riparian wetlands, improved bedform diversity, and improved bank stability;
- *Physiochemical*: through establishment of a native woody riparian buffer and native wetland habitat; and
- *Biology*: through improved habitat for targeted mussel species and native wetland species.

While hydraulics and channel geomorphology uplift is more immediately realized post-construction, physiochemical and biological uplift can sometimes take longer to be realized.

#### 4.7 Site Constraints to Functional Uplift

There are no known Site constraints that will affect the functional uplift of the project. The valley width on the Site will allow for the development of pattern and dimensions to restore stable, functioning streams and wetlands. The degree to which the physicochemical and biology functions can improve on the Site is limited by the watershed conditions beyond the project limits, upstream water quality, and the presence of source communities upstream and downstream of the Site.

## 5.0 Regulatory Considerations

Table 4, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 5.1-5.3.

**Table 4: Project Attribute Table Part 4**

Regulatory Considerations			
Parameters	Applicable?	Resolved?	Supporting Docs?
Water of the United States - Section 404	Yes	Yes	PCN <sup>1</sup>
Water of the United States - Section 401	Yes	Yes	PCN <sup>1</sup>
Endangered Species Act	Yes	Yes	Appendix 5
Historic Preservation Act	Yes	Yes	Appendix 5
Coastal Zone Management Act	No	N/A	N/A
FEMA Floodplain Compliance	Yes	No	N/A <sup>2</sup>
Essential Fisheries Habitat	No	N/A	N/A

1. PCN to be provided to IRT with Final Mitigation Plan.

2. A floodplain development permit application will be submitted to the local floodplain administrator.

#### 5.1 Biological and Cultural Resources

A Categorical Exclusion for the Deep Meadow Mitigation Site was submitted to DMS on October 20, 2016, and approved on December 1, 2016. This document included investigation into the presence of threatened and endangered species on Site protected under The Endangered Species Act of 1973, as well as any historical resources protected under The National Historic Preservation Act of 1966. The biological conclusion for the Site, according to the Categorical Exclusion research and response by US

Fish and Wildlife Service, is that based on the assessment conducted by Wildlands Engineering, Inc. on February 29, 2016 and August 10, 2016, it was determined that the proposed project will have “no effect” on the federally listed endangered or threatened species; therefore “we consider the requirements under the Act to be complete and require no further action at this time.” Each request made in the USFWS response letter will be addressed during construction and planting activities. Natural channel design methodologies will be used to develop parameters, work will be done in the dry unless absolutely unavoidable, the site will be stabilized at the end of each day, a riparian buffer will be planted, and invasives will be treated before, during and after construction. All correspondence with USFWS and a list of Threatened and Endangered Species in Union County, NC is included in Appendix 5. The conclusion for cultural resources according to the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. For additional information and regulatory communications please refer to the Categorical Exclusion document in Appendix 5.

## **5.2 FEMA Floodplain Compliance and Hydrologic Trespass**

The Site is represented on the Union County Flood Insurance Rate Map Panel 5466, with an Effective date of 10/16/2008. The Site is located within a Zone AE Special Flood Hazard Area (SFHA) regulatory floodplain associated with Meadow Branch and EF1. WF1 and WF2 are not mapped under the regulatory authority of FEMA. Current Effective FEMA mapping for the Site is overlain with project streams on Figure 7. The Effective hydraulic model for Meadow Branch has been obtained from the NC Floodplain Mapping Program. The stream, wetland, and floodplain grading within the regulatory floodplain of Meadow Branch and EF1 will be designed to achieve a no-rise condition and a floodplain development permit will be obtained from the Union County floodplain administrator.

Hydraulic trespass is not a concern with the proposed Site design. The proposed Enhancement II design on Meadow Branch includes primarily bank stabilization with minor channel bed modifications consisting of removing multiple beaver dams. A decrease in upstream flooding elevations is possible. The valley slope of EF1 coming out of the existing road culvert will be kept relatively steep (0.9%), so the risk of backwater into the culvert is negligible. WF1 and WF2 originate on-site and carry no risk of hydraulic trespass.

## **5.3 401/404**

As discussed in Section 3.4, the results of the on-site delineation of jurisdictional waters of the US indicates four jurisdictional channels including Meadow Branch and three unnamed tributaries within the proposed project area. In addition, two jurisdictional wetlands areas (Wetland A and B) were delineated within the proposed project area, totaling 0.58 acres. Table 3 summarizes existing project waters. The USACE issued a preliminary jurisdictional determination May 25, 2017 (SAW-2017-00241), included in Appendix 2.

Impacts to jurisdictional stream and wetlands will be necessary for restoration and enhancement activities but this project will result in an uplift of aquatic resources that have been historically impacted by agricultural practices. Wildlands evaluated existing stream stability and functionality to develop appropriate levels of intervention. Project streams with less instability and partial stream functionality (Meadow Branch and WF1) are proposed for stream enhancement which will involve bank stabilization and the installation of in-stream structures. Project streams with greater instability and less functionality (EF1 and WF2) are proposed for restoration which will involve the construction of new stream channels. Existing wetlands (A and B) are ditched swales installed to improve field drainage for row crops. Routine maintenance has left the wetlands devoid of woody vegetation. Impacts to existing wetlands will include structure installation (Wetland A) for wetland re-establishment floodplain grading (Wetland B) which is



expected to result in a net gain in wetland area. Table 5 estimates the anticipated impacts to existing streams and wetland on this project.

**Table 5: Estimated Impacts to Aquatic Resources**

Jurisdictional Feature	Classification	Existing		Permanent (P) Impact		Temporary (T) Impact	
		Length (LF)	Acreage (AC)	Type of Activity	Impacts (LF/AC)	Type of Activity	Impacts (LF/AC)
Meadow Branch	Perennial	2,570				Enhancement (E2)	2,266
EF1	Perennial	38		Bank Stabilization			38
EF1	Perennial	1,163		Restoration	1,163		
WF1	Perennial	136				Enhancement (E1)	136
WF2	Perennial	391		Restoration (P1 & P2)	391		
Wetland A	Riparian Riverine		0.28	Log sill installation for wetland re-establishment			0.01
				Construction access			0.01
Wetland B			0.30	Floodplain grading for wetland re-establishment			0.30
				<b>Total P Impact</b>	<b>1,554 LF</b>	<b>Total T Impact</b>	<b>2,440 LF and 0.32 AC</b>

## 6.0 Mitigation Site Goals and Objectives

The overarching goal of the project is to provide stream and wetland credits to be used as compensatory mitigation through the DMS In-Lieu Fee (ILF) program. This will be accomplished as described in Section 4 through stream restoration, stream enhancement, wetland re-establishment, wetland rehabilitation, and riparian buffer re-vegetation. Project goals are desired project outcomes and are verifiable through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 9 of this report. The project goals and related objectives are described in Table 6.

**Table 6: Mitigation Goals and Objectives**

Goal	Objective	Expected Outcomes	Function Supported
Improve stream channel stability.	Restore stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Create stable	Reduced bank erosion and sedimentation.	Hydraulic, Geomorphology, Physicochemical, Biology

Goal	Objective	Expected Outcomes	Function Supported
	in-stream structures to protect restored streams.		
Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the floodplain. Restore stream plan form on East Fork 1 and West Fork 2 to promote development of mutually beneficial stream/wetland complex.	A more frequently inundated floodplain and wetland area. A higher groundwater table elevation.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Install habitat features such as constructed riffles, cover logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Increased numbers of macroinvertebrates, fish, and amphibians, including Carolina creekshell ( <i>Villosa vaughaniana</i> ) and the Savannah Lilliput ( <i>Toxolasma pullus</i> ).	Geomorphology, Biology
Restore and enhance native floodplain and wetland vegetation.	Plant native tree and understory species in riparian zone and wetlands where currently insufficient. Remove invasive species within the riparian corridor.	Establishment of thriving native woody and herbaceous plant species.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.	A legally protected and well-marked riparian corridor.	Hydraulic, Geomorphic, Physicochemical, Biology

## 7.0 Design Approach and Mitigation Work Plan

### 7.1 Design Approach Overview

The design approach for this Site was developed to meet the goals and objectives described in Section 6 which were formulated based on the potential for uplift described in Section 4. The design is also intended to provide the expected outcomes in Section 6, though these are not tied to performance criteria. The project tributaries to Meadow Branch will be reconnected with an active floodplain and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. Meadow Branch will be enhanced through bank stabilization and in-stream structure placement. Riparian wetlands will be re-established and rehabilitated throughout the broad floodplain of Meadow Branch. The stream banks, floodplains, wetlands, and valley walls within the conservation easement will be planted with native tree species. Instream structures will be constructed in the channels to help maintain stable channel morphology and improve aquatic habitat. The entire project area will be protected in perpetuity by a conservation easement.

The stream restoration design for this Site utilized a combination of analog and analytical approaches, and also relied on empirical data and prior experiences and observations. Reference streams and wetlands were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment

transport analysis. Wetland hydrology was assessed with groundwater gages and modeled to predict hydrologic outcomes based on the proposed post-project conditions. These design approaches have been used on many successful Piedmont restoration projects and is appropriate for the goals and objectives for this Site.

## 7.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. Seven reference reaches were identified for this Site and used to support the design of EF1 and WF2 (Figure 9). These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. Geomorphic parameters for these reference reaches are summarized located in Appendix 4. The references to be used for the specific streams are shown in Table 7. A description of each reference reach is included below.

**Table 7: Stream Reference Data Used in Development of Design Parameters**

	Design Stream	East Fork 1	West Fork 1	West Fork 2
Reference Stream	Stream Type	E4	B4	E4
Foust Upstream Reference	C4	X		X
Long Branch	C4/E4	X		X
UT to Cane Creek	E4	X		X
Spencer Creek Reach 3	E4	X		X
UT to Rocky Creek	E4b		X	
Pilot Mountain Trib	B4		X	

### 7.2.1 Foust Upstream Reference

The Foust Creek reference reach is located approximately 600 feet upstream of the northernmost conservation easement boundary on the Foust Creek Mitigation Site in Alamance County, NC. It was identified by Wildlands in the Foust Creek Mitigation Site 2014 Mitigation Plan (Wildlands Engineering, 2014). Foust Creek has a gravel bed and a valley slope of 0.75%. The Foust Creek reference reach is classified as a Rosgen C4 stream type. This reach flows through a mature forest and although it is stable it lacks sinuosity. It was used in this project to inform the cross-section and profile parameters.

### 7.2.2 Long Branch

Long Branch is located in Orange County, northwest of Chapel Hill. Long Branch was previously identified as a reference and discussed in the Collins Creek Restoration Plan (KCI Technologies, 2007). The Long Branch watershed is low-density residential, agricultural, and forested land. The valley slope is 0.6% and channel slope is 0.4%. The stream maintains an entrenchment ratio above 2.5. Wildlands visited the reference site to verify the data presented in the KCI report. Two riffles were surveyed during the site visit. These riffles had a width to depth ratio of 9.4 and 8.0 with entrenchment ratios of 11.7 and 12.1, respectively. The cross-sections surveyed are more typical of E stream types, however KCI identified the stream as a C4 in their previous analysis. The stream likely varies between a C4 and E4.

### 7.2.3 UT to Cane Creek

The UT to Cane Creek reference is located in Northeastern Rutherford County. The dataset was used as a reference stream for the Cane Creek Restoration prepared by Restoration Systems and Axiom Environmental in 2007. The drainage area is 0.29 square miles and the land use within the drainage area is a semi-mature forest. The UT to Cane Creek reference site was classified as a C4/E4 stream type with a sinuosity of 1.4. The channel has a width to depth ratio ranging from 12.3 to 14.4 and an entrenchment ratio greater than 2.5. The reach has a valley slope of 2.6% while the channel slope is 1.5%.



#### 7.2.4 Spencer Creek Reach 3

Spencer Creek Reach 3 is located in central Montgomery County within the Uwharrie National Forest. This site was classified as an E4 stream type and has a drainage area of 0.37 square miles. This reach flows through a mature forest and has an average valley slope of 2.7% and an average channel slope of 2.1%. The morphological parameters reported for the riffle cross-section include a width to depth ratio from 7.9 to 9.3 and an entrenchment ratio of 1.7 to 4.3.

#### 7.2.5 UT to Rocky Creek

The UT to Rocky Branch reference site is located in Central Montgomery County within the Uwharrie National Forest. The stream was used as a reference stream in the Big Cedar Creek Restoration Plan by Baker Engineering NY, Inc. (2007). The drainage area is 1.10 square miles and the land use within the drainage area is a semi-mature forest. The UT to Rocky Creek Reference site was classified as an E4b stream type with a low sinuosity (1.1). The channel has a width to depth ratio of 9.1 and an entrenchment ratio of 6. The reach has a valley slope of 2.6% while the channel slope is 2.4%. The bed material  $d_{50}$  for the reach is 22.6 mm. Due to the low sinuosity, no pattern data were collected.

#### 7.2.6 Pilot Mountain Tributary

Pilot Mountain Tributary is a small, steep (3.8%) B4 stream channel in Surry County, NC. The stream flows through the northern side of Pilot Mountain State Park, just upstream of Black Mountain Road. The stream flows along the left valley wall, which is vegetated with rhododendron thickets, while the right valley has a single line of mature hardwoods with a maintained overhead utility easement corridor beyond. The stream is relatively straight as it flows through the 4.0% valley, and bedform is diverse with steep riffles, boulder steps, and in-line pools formed near roots and in backwater areas between steps.

### 7.3 Design Channel Morphological Parameters

Reference reaches were a primary source of information to develop the pattern and profile design parameters for the streams. Ranges of pattern parameters were developed within the reference reach parameter ranges with some exceptions based on best professional judgement and knowledge from previous projects. For example, for meandering C designs, radius of curvature ratio is kept above 1.8 on all reaches and meander width ratio is kept above a 2.4. Meandering designs have pool widths to be 1.2 to 1.5 times the width of riffles to provide adequate point bars and riffle pool transition zones. Wildlands has found these minimum ratios to support stable geometry. Designer experience was used for pool design as well. Pool depths were designed to be a minimum of 1.5 times deeper than riffles to provide habitat variation. Cross-section parameters such as area, depth, and width were designed based on the design discharge and stable bank slopes. In some cases, the width to depth ratio was increased beyond reference parameters as dictated by prior project experience to provide stable bank slopes prior to the development of a fully vegetated streambank. Key morphological parameters for the Site are listed in Tables 8 – 10 for restoration and enhancement I reaches. Complete morphological tables for existing, reference, and proposed conditions are in Appendix 4.

**Table 8: Summary of Morphological Parameters for EF1**

Parameter	EF1					
	Existing	Foust Upstream Reference	Long Branch	UT to Cane Creek	Spencer Creek Reach 3	Proposed
Valley Width (ft)	60	NA	NA	NA	NA	60
Contributing Drainage Area (acres)	226	896	954	186	237	226
Channel/Reach Classification	E4	C4	C4/E4	E4	E4	E4
Design Discharge Width (ft)	8.2	19.0	16.7	11.9	7.8	10.2

Parameter	EF1					
	Existing	Foust Upstream Reference	Long Branch	UT to Cane Creek	Spencer Creek Reach 3	Proposed
Design Discharge Depth (ft)	1.5	1.3	1.7	0.9	0.9	0.8
Design Discharge Area (ft <sup>2</sup> )	8.4	24.0	34.6	10.6	7.7	8.7
Design Discharge Velocity (ft/s)	4.1	4.0	4.0	3.8	5.3	3.4
Design Discharge (cfs)	30	95.2	124	40	35	30
Water Surface Slope (ft/ft)	0.0101	0.009	0.004	0.015	0.019	0.0095
Sinuosity	1.04	NA	1.30	1.4	1.3	1.3
Width/Depth Ratio	8.0	15.0	11.0	13.4	8.6	12.0
Bank Height Ratio	1.4	NA	1.2	1.4	1.0	1.0
Entrenchment Ratio	3.8	5.3	3.4	2.5	3.0	5.0

Table 9: Summary of Morphological Parameters for WF1

Parameter	WF1			
	Existing	UT to Rocky Creek	Pilot Mtn Trib	Proposed
Valley Width (ft)	>100	NA	NA	>100
Contributing Drainage Area (acres)	58	672	173	58
Channel/Reach Classification	G4	E4b	B4	C4b
Design Discharge Width (ft)	4.9	12.2	8.6	8.1
Design Discharge Depth (ft)	0.7	1.3	0.7	0.9
Design Discharge Area (ft <sup>2</sup> )	3.2	16.3	6.0	4.4
Design Discharge Velocity (ft/s)	4.1	5.5	5.3	3.3
Design Discharge (cfs)	10	85	32	10
Water Surface Slope (ft/ft)	0.0192	0.024	0.0378	0.016
Sinuosity	1.0	1.1	1.05	1.0
Width/Depth Ratio	7.3	9.1	12.5	15
Bank Height Ratio	3.4	1.0	1.0	1.0
Entrenchment Ratio	1.3	6.0	1.5	2.2

Table 10: Summary of Morphological Parameters for WF2

Parameter	WF2					
	Existing	Foust Upstream Reference	Long Branch	UT to Cane Creek	Spencer Creek Reach 3	Proposed
Valley Width (ft)	110	NA	NA	NA	NA	110
Contributing Drainage Area (acres)	131	896	954	186	237	131
Channel/Reach Classification	E4	C4	C4/E4	E4	E4	E4
Design Discharge Width (ft)	6.1	19.0	16.7	11.9	7.8	8.9
Design Discharge Depth (ft)	0.85	1.3	1.7	0.9	0.9	0.7
Design Discharge Area (ft <sup>2</sup> )	5.1	24.0	34.6	10.6	7.7	6.6



Parameter	WF2					
	Existing	Foust Upstream Reference	Long Branch	UT to Cane Creek	Spencer Creek Reach 3	Proposed
Design Discharge Velocity (ft/s)	4.5	4.0	4.0	3.8	5.3	3.2
Design Discharge (cfs)	20	95.2	124	40	35	20
Water Surface Slope (ft/ft)	0.0168	0.009	0.004	0.015	0.019	0.0133
Sinuosity	1.0	NA	1.30	1.4	1.3	1.4
Width/Depth Ratio	7.5	15.0	11.0	13.4	8.6	12.7
Bank Height Ratio	1.4	NA	1.2	1.4	1.0	1.0
Entrenchment Ratio	12	5.3	3.4	2.5	3.0	6.0

#### 7.4 Design Discharge Analysis

Multiple methods were used to develop bankfull discharge estimates for each of the project restoration reaches: the NC Rural Piedmont Regional Curve (Harman et al., 1999), NC Piedmont/Mountain Regional Curve (Walker, unpublished), a Wildlands Regional Flood Frequency Analysis, a site-specific Reference Reach Curve, and existing bankfull indicators using Manning’s Equation. The resulting values were compared and best professional judgment was used to determine the specific design discharge for each restoration reach. Each data source is plotted on Figure 10 to show the relationship of the data to the design discharge selections.

##### 7.4.1 Published Regional Curve Data

Discharge was estimated using the published NC Rural Piedmont Curve (Harman et al., 1999) as well as the updated curve for rural Piedmont and mountain streams, also known as the Walker Curve (Walker, unpublished).

##### 7.4.2 Wildlands Regional USGS Flood Frequency Analysis

Wildlands developed a regional flood frequency analysis tool that tailored the USGS 2009 publication *Magnitude and Frequency of Rural Floods in the Southeastern United States, through 2006* to the Piedmont of North Carolina and allowed for predictions of discharges with recurrence intervals less than 2 years. Of the 103 stations referenced in the publication, 23 were used in the development of the tool. To fill gaps in data, five additional stations were added by Wildlands to represent streams with drainage areas less than one square mile. The Hosking and Walls homogeneity test was performed in R<sup>®</sup> to identify a selection of hydrologically similar gages based on homogeneity (Hosking and Walls, 1993).

The data from these 28 gage stations were used to develop flood frequency curves for the 1.2-year and 1.5-year recurrence interval discharges. These relationships can be used to estimate discharge of those recurrence intervals for ungauged streams in the same hydrologic region, and were solved for each project reach’s discharge with the drainage area as the input.

##### 7.4.3 Site Specific Reference Reach Curve

Seven reference reaches were identified for this project. Each reference reach was surveyed to develop information for analyzing drainage area-discharge relationships as well as development of design parameters. Stable cross-sectional dimensions and channel slopes were used to compute a bankfull discharge with the Manning’s equation for each reference reach. The resulting discharge values were plotted with drainage area and compared the other discharge estimation methods.

#### 7.4.4 Maximum Discharge (Manning's Equation)

A riffle cross-section was surveyed on each design reach on the Site. Due to the existing impairments throughout Site streams, bankfull indicators were weak and not considered reliable for estimating a bankfull discharge. Instead, Manning's equation was used to calculate a discharge associated with the top of banks for all project streams. Stream slope was calculated from the surveyed channel slope, and roughness was estimated using guidelines from Chow (1959). This corresponding discharge was plotted on Figure 10 (Qmax – Existing Site Streams) and considered as an upper limit for potential bankfull discharge values throughout the Site.

#### 7.4.5 Design Discharge Analysis Summary

A primary design goal of Deep Meadow is to reconnect streams with their natural valleys and to restore riparian floodplain or wetland hydrology. EF1 and WF2 will be raised so that the bankfull profiles will closely match the invert of the floodplain and the restored channels will flow down the middle of the valleys. Because of the desire to achieve frequent floodplain interaction, design discharges were selected close to the lower end of the range of values produced by the estimation methods. Table 11 gives a summary of the discharge analysis, while Figure 10 illustrates the design discharge data.

**Table 11: Summary of Design Discharge Analysis**

		Meadow Branch	EF1	WF1	WF2
DA (acres)		4472	226	58	131
DA(sq. mi.)		6.99	0.35	0.09	0.20
NC Rural Piedmont Regional Curve (cfs)		363	42	16	28
Alan Walker Curve (cfs)		256	25	8	16
Wildlands Regional USGS Flood Frequency Analysis (cfs)	1.2-year event	326	36	13	24
	1.5-year event	450	52	19	34
Site Specific Reference Reach Curve		333	39	15	26
Max Q from Manning's Eq. from XS survey (cfs)		270	97	126	44
Selected Design Discharge		<b>260</b>	<b>30</b>	<b>10</b>	<b>20</b>

#### 7.5 Sediment Transport Analysis

EF1 and WF2 will be restored with bankfull depth relative to the valley floor. Buffers will be converted from agricultural fields to planted native woody tree and shrub species. The restored buffer will provide filtration for overland flow from remaining upland agricultural fields. On WF1, in-stream structures will protect the stream bed from further degradation while the banks will be graded to a stable slope. Bank grading on Meadow Branch will also provide stability to eroding stream banks. Stream restoration activities will address the primary sediment sources by protecting stream banks and reducing channel shear stress. There was no evidence of sediment deposition and accumulation throughout these reaches, indicating that aggradation within the reaches is not an issue. The watershed assessment verified that bedload supply is not high enough to result in capacity limited stream channels. The only major land disturbance noted within the watershed was the construction of the US 74 bypass approximately 1.8 miles upstream. The focus of sediment transport analysis for design was to verify that the designed channels will be stable over time and have the competence to pass the sediment that continues to be delivered by the watershed.

### 7.5.1 Competence Analysis

Competence analyses were performed during design for each of the restoration reaches by comparing shear stress associated with the design bankfull discharge, proposed channel dimensions, and proposed channel slopes with the size distribution of the existing bed load. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001). Channel slope and design dimensions were varied until the resulting design verified that the stream reach could move the bed load supplied to the stream. The results of the analysis are shown in Table 12.

**Table 12: Results of Competence Analysis**

	EF 1	WF 2
<b>Dbkf (ft)</b>	0.8	0.7
<b>Schan (ft/ft)</b>	0.0095	0.0133
<b>Bankfull Shear Stress, <math>\tau</math> (lb/sq ft)</b>	0.49	0.59
<b>Dmax Bar/Subpavement (mm)</b>	78.5	64.0
<b>Dcrit (ft)</b>	0.42	1.4
<b>Scrit (ft/ft)</b>	0.005	0.026
<b>Movable particle size (mm)</b>	90	103
<b>Predicted Shear Stress to move Dmax</b>	0.41	0.31

The results of the analysis in the table above indicates excess shear stress in each restoration reach. These results were used to develop the designed riffles. Rock and wood step structures were added to the designs to provide grade control and increase roughness within the channel. Riffles with larger materials, such as chunky riffles, were also integrated into the design as grade control. The proposed  $D_{50}$  and  $D_{100}$  for the constructed riffles on both stream reaches has been sized so that the reconstructed channels will not produce enough shear stress to entrain the largest particles in these structures. This will ensure a stable pavement while allowing for bed load material to be active within the system.

### 7.6 Stream Restoration and Enhancement Implementation

The primary stressors to streams on the Site are bank erosion, incision on the tributaries, the lack of riparian buffer, agricultural impact, and the lack of bedform diversity. Wildlands' focus is to restore the stream corridor through stream and wetland restoration, stream enhancement, and establishment of riparian buffers (Table 13).

Meadow Branch will be treated with an EII approach. Bank erosion along Meadow Branch will be addressed through bank grading and bank stabilization structures. Stable bank sections will be preserved to avoid unnecessary disturbance. Riffles and pools will be added to the channel to enhance habitat. Concentrated runoff ditches will be plugged or stabilized to reduce sedimentation inputs into the stream system. A 70-ft easement break will be implemented to allow for landowner access to the western agricultural fields.

EF1 will be raised through Priority 1 restoration and moved away from the hillside slope to the center of the valley. While Priority 1 restoration can be achieved at the upstream culvert outlet, a short section of Priority 2 restoration is necessary at the downstream section to tie it to Meadow Branch. Bedform diversity and habitat uplift will be achieved through riffle-pool sequences and woody cover structures. Landowner access will be provided with a 40-ft easement break near the downstream end of the reach.

WF1 will be improved through and EI approach. Bed and bank stability on WF1 will be achieved by installing in-stream grade control structures and grading the banks. Invasive plants will be removed from

the stream banks as part of the grading process. The bed elevation adjustments will tie in to an existing bedrock knickpoint at the upstream end of WF1 to achieve a more uniform profile.

Priority 1 restoration will be performed on WF2 beginning at the very upstream project limits. A short length of WF2 at the downstream end is designed to be incised as it drops to meet the invert Meadow Branch. Step height of drop structures in this section will be limited to no more than 0.5' to allow for aquatic species from Meadow Branch to navigate into the newly restored design reach. Riffle-pool sequences will be installed along with woody cover structures to provide bedform diversity and habitat.

The Site is connected to wooded parcels upstream and downstream. Once a riparian buffer is established on-site, a variety of wildlife species will likely migrate to the newly forested area.

In-stream structures will include various types of constructed riffles, log sills, boulder sills, lunger logs, and j-hooks. The structures will reinforce channel stability and serve as habitat features. The constructed riffles will be comprised of harvested on-site riffle material where possible, or quarry stone may be used if an on-site source cannot be found. The riffles will incorporate woody brush material and logs. The diverse range of constructed riffle types will provide grade control, diversity of habitat, and will create varied flow vectors. Log -j-hooks will deflect flow vectors away from banks while adding to habitat diversity. Log sills will be used to allow for small grade drops across pools. At select outer meander bends, the channel banks will be constructed with brush toe revetments to reduce erosion potential, encourage pool maintenance, and provide varied pool habitat.

The primary stressors to the wetlands on the Site are the lack of wetland vegetation, agricultural impact including ditching to drawdown the water table, and the lack of hydrologic connection to the floodplain tributaries and hillside seeps. The stressors will be mitigated by reconnecting the floodplain tributaries with the wetland areas through restoration, filling agricultural ditches to raise the groundwater table, reconnecting hydrology from upgradient hillsides, and revegetating wetlands with native vegetation to increase roughness and provide microtopography (Table 13).

The concept plan for Site restoration is illustrated in Figure 8.

**Table 13: Functional Impairments and Restoration Approach**

Resource	Functional Impairments	Restoration Approach
Meadow Branch	Erosion, lack of riparian vegetation, lack of habitat	Enhancement II
EF1	Incision, erosion, lack of riparian vegetation, lack of habitat	Restoration – Priority I
WF1	Incision, erosion, lack of habitat	Enhancement I
WF2	Incision, erosion, lack of riparian vegetation, lack of habitat	Restoration – Priority I
WH-1	Agricultural activities including ditching and a lack of wetland vegetation	Restoration - Rehabilitation
WH-2	Agricultural activities including ditching and a lack of wetland vegetation	Restoration - Rehabilitation
WE-1	Hydrologic disconnection due to agricultural ditching, lack of wetland vegetation	Restoration – Re-establishment
WE-2	Hydrologic disconnection from adjacent floodplain tributaries, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-3	Hydrologic disconnection from upgradient slopes, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-4	Hydrologic disconnection from upgradient slopes, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment

Resource	Functional Impairments	Restoration Approach
WE-5	Hydrologic disconnection from upgradient slopes, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-6	Hydrologic disconnection from upgradient slopes, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-7	Hydrologic disconnection from upgradient slopes, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-8	Hydrologic disconnection from upgradient slopes, adjacent floodplain tributaries, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-9	Hydrologic disconnection from upgradient slopes, adjacent floodplain tributaries, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment
WE-10	Hydrologic disconnection from upgradient slopes, adjacent floodplain tributaries, agricultural activities, lack of wetland vegetation	Restoration – Re-establishment

## 7.7 Proposed Wetland Design Overview

The proposed design includes the restoration of 8.8 acres (8.2 acres re-establishment and 0.6 acres rehabilitation) of historically altered wetlands. Proposed wetland areas are currently being drained by a series of ditches; preventing hydrology from the hillslope and adjacent stream hydrology from establishing an adequate hydroperiod. Wildlands analyzed the proposed wetland areas to understand farming and anthropogenic effects, current and proposed hydrologic conditions, and the potential for hydric soil development.

### 7.7.1 Hydric Soil Investigation

After reviewing the National Resources Conservation Service’s (NRCS) web soil survey mapping and performing site visits to evaluate potential for wetland restoration on-site, Wildlands contracted a licensed soil scientist (LSS) to perform a detailed hydric soil evaluation of the site to determine the site’s potential for hydric soil development. Twenty-eight soil borings were performed throughout the study area. Borings were located based on the existing topography, agricultural ditching, and initial estimates of wetland potential. Each soil boring was classified based on soil characteristics indicating the hydric soil status. Soils boring were placed into one of four general categories based on existing soils and site characteristics including hydric, hydric over hydric, non-hydric over hydric, and non-hydric.

Borings classified as hydric met the NRCS F3 hydric soils field Indicator (depleted matrix) and exhibited saturation, low chroma colors, and redoximorphic features. Borings rated hydric over hydric exhibited NRCS F3 depleted matrix or F6 redox dark surface indicators, but exhibited obvious overburden material ranging in depth across the site that generally also met either the F3 or F6 indicator noted above. Non-hydric over hydric borings exhibited overburden material over a hydric soil layer in which the overburden material did not meet any hydric indicator. Non-hydric borings did not exhibit any characteristics of hydric soils indicators. The report from the LSS (Appendix 4) supported Wildlands’ initial impressions that the site has been heavily altered for use as an agricultural field. Obvious evidence of soil manipulation was noted throughout the site. Areas where hydric, and hydric over hydric borings were observed were considered the best areas for potential wetland restoration. Additionally, areas with non-hydric over hydric borings were classified as potential wetland restoration if streams and seeps were hydrologically reconnected and minor soil removal was performed to offset anthropogenic modifications.

Based on the results from the LSS, existing groundwater gage data, and the existing hydrologic alterations made to the site; zones of potential wetland restoration were developed. Areas not currently jurisdictionally delineated where floodplain tributaries had been hydrologically disconnected, hillslope



seeps had been ditched, and/or swales had been used to re-route surface water towards Meadow Branch where classified as wetland re-establishment. Areas which currently jurisdictionally delineated but exhibited anthropogenic impacts through agriculture and hydrologic disconnection through ditching were classified as wetland rehabilitation.

### *7.7.2 Reference Wetland*

A reference wetland was identified approximately 1.3 miles upstream of the Site in the left floodplain of Meadow Branch near the Monroe Ansonville Rd crossing (Figure 3). This area most resembles a Piedmont Bottomland Forest (Typic low subtype) defined by Schafale (2012). The reference area is within a mature forest and does not appear to have been ditched or manipulated in recent history. The vegetation at the reference site will be used as a basis to develop the planting plan for the wetland restoration on the project site.

The system is located at the toe of an adjacent hillslope and the hydrology of the system is seasonally flooded. Hydrology sources include hillside seeps from the adjacent upgradient slope as well as intermittent out of bank events from Meadow Branch. Consistent with the project area, NRCS web soil survey mapping classifies the soils within the reference wetland area as Chewacla loams. A centrally located groundwater monitoring gage was installed within the reference wetland on May 4, 2017 to get a representative sample of the wetland hydrology and associated hydroperiod. The soil profile observed during installation indicated saturated silt loam soils with low chroma color soil surfaces and redoximorphic features within 12-inches of the soil surface indicative of hydric soils. Reference well observations were recorded during the growing season from May 4, 2017 to October 23, 2017. During the monitored period, 43 days of groundwater within 12 inches of the soil surface were observed and the longest period of consecutive inundation lasted 19.5 days or 8.6% of the defined growing season. Reference gage data and an associated hydrograph are provided in Appendix 4. Observations from the reference groundwater gage were considered when setting performance criteria for the proposed wetland restoration and will be used to provide comparison for re-established and rehabilitated wetland hydrology throughout the monitored period.

### *7.7.3 Groundwater Modeling*

To further inform the wetland restoration design, an analysis of the existing and proposed conditions for groundwater hydrology was performed using DrainMod (version 6.1). Existing and proposed groundwater hydrology conditions were simulated as water table depth over time. DrainMod was selected for this application because it is a well-documented modeling tool for assessing wetland hydrology (NCSU, 2010) and is commonly used in wetland restoration projects.

A representative groundwater gage model was developed and calibrated to evaluate the existing and proposed conditions within a potential wetland restoration zone that exhibited common functional impairments seen throughout the site. The locations and raw data from the pre-project monitoring wells are shown in Figure 6 and Appendix 4, respectively. Model output was used to validate the wetland restoration plan and estimate a basic water budget for the site.

DrainMod models are built using site hydrology, soil, and climate data. Temperature and precipitation data were obtained from nearby weather stations Monroe 2.4N (Station US1NCUN0001) and Monroe, NC (Station USC00315771) operated by the National Oceanic and Atmospheric Administration (NOAA) National Weather Service. The Monroe 2.4N and Monroe weather stations are located approximately 5.8 and 6.0 miles away from the proposed mitigation site, respectively. Observed hydrograph peaks align with the precipitation data, indicating that the precipitation trends are consistent between the weather station and the mitigation site. These data were used to calibrate the model and perform the long-term simulation.





The existing calibration and proposed models were developed using the conventional drainage option with the hydrologic analysis of wetlands feature incorporated to best simulate the drainage of the site. The analyzed gage was installed in June of 2016 and recorded groundwater depth twice per day with In-situ Level TROLL® pressure transducers. The entire recorded period is shown within the calibration plot provided in Appendix 4, but due to drought conditions, the calibration period prior to October 2016 was not considered as heavily during model calibration.

A baseline soil input file was developed using published soil survey data collected for the mapped soils found on-site (NRCS, 2017). The soil file was refined by adjusting certain parameters for the mapped soils using in-situ soil profiles and characterizations. To calibrate the model, soil parameters not measured in the field were adjusted within the limits typically encountered under similar soil and geomorphic conditions. After calibration of the model was complete, the calibrated model was used as the basis for the proposed conditions model. Plots showing the calibration result are included in Appendix 4.

Trends in the observed data are consistent with the results of the calibration simulations. Hydrograph peaks between plots are not identical, but groundwater drawdown rates, and general overall water table trends are well represented by the calibrated model. The calibrated model underestimates water levels during the winter and early spring, but periods within the growing season are consistent with observed groundwater data.

The proposed conditions model was developed based on the calibrated existing conditions model to predict whether wetland criteria would be met over a long period of historical climate data after site conditions have been modified. Proposed plans for the site include realigning floodplain tributaries and raising the stream bed inverts. As noted previously, Meadow Branch will not be re-aligned. However, minor grading is proposed within the wetland zones which will removed overburden material, restore natural topography variations to the site, and shallow the overall dimension of Meadow Branch which will improve stream and floodplain connection. The proposed minor grading will decrease the surface elevation of the existing site to bring hydric soils within the top 12 inches of the soil. Cut depth is limited to approximately 10 inches or less throughout the site. The proposed wetland areas will be disked and planted with native wetland plants. Additionally, ditches and swales which now carry upgradient hydrology directly to Meadow Branch will either be filled or smoothed during grading to hydrologically reconnect hillslope seeps to proposed wetland areas.

Settings for the proposed conditions model were altered to reflect the proposed design changes of the site. Based on existing groundwater gage data, and site observations, Meadow Branch is currently hydrologically controlling the majority of groundwater on the site. As such, ditch spacing and dimensions within the existing and proposed models were set to reflect the parameters of Meadow Branch and not of the adjacent ditches and tributaries. In the proposed conditions model down slope seepage was added to account for the filling of the toe of slope ditches and the resulting hydrologic change. Ditch spacing values were not edited between the existing and proposed models. Proposed grading was modeled by reducing the depth from the soil surface to the draining channel for the modeled well. Surface storage values were increased to account for proposed roughening and planting of herbaceous native wetland vegetation on site. Once the proposed conditions model was developed, the model was run for a 70-year period from January 1947 through December 2016 using temperature and precipitation data from the Monroe, NC weather station.

The calibrated existing conditions model was compared with the proposed conditions scenario to determine the effect of proposed practices on local site hydrology. Model simulations were then analyzed to predict the success of the groundwater hydrology function on the site. The wetland performance standard evaluated is that the water table must be within 12 inches of the ground surface



for a minimum of 10% (23 consecutive days) of the growing season (March 23 through November 6). Sources used to set the wetland performance standard for the site include discussions with the IRT and LSS, Table 1 (wetland saturation threshold values) within the Wilmington District Stream and Wetland Compensatory Mitigation Update dated October 24, 2016, and reference well data from an upstream floodplain wetland adjacent to Meadow Branch. Growing season dates were defined by the Monroe, North Carolina WETS table for 50% probability of soil temperatures greater than 28 degrees Fahrenheit.

The model run simulations indicate that the modeled groundwater gage (GWG2, Figure 6), would not meet the required wetland performance standard with the site in its current condition any of the 70 modeled years. Average periods of inundation for the site without any changes sustain for approximately 4 to 13 days. Once proposed design changes were incorporated into the model, 51 out of the 70 modeled years meet the wetland performance standard with periods of inundation lasting anywhere from 20 to 60 days depending on precipitation patterns.

DrainMod computes daily water balance information and outputs summaries that describe the loss pathways for rainfall over the model simulation period. Table 14 below summarizes the average annual amount of rainfall, infiltration, runoff, evapotranspiration, and sum of drainage and hillslope seepage estimated for the modeled location onsite. Infiltration represents the amount of water that percolates into the soil. The sum of drainage and seepage represents the difference between water entering the site from hillslope seepage and the amount of water that is infiltrated water through the soil profile and is discharged to the drainage ditches or streams. Runoff is water that flows overland and reaches the drainage ditches before infiltration. Evapotranspiration is water that is lost by the direct evaporation of water from the soil or through the transpiration of plants. The water balance results provided in the table show evapotranspiration increasing in the proposed condition when compared to the existing condition due to more standing surface water available to evaporation. Runoff remains virtually the same, as initial abstraction rates are changed minimally. The sum of drainage and seepage is reduced by approximately 18 cm of depth across the site by filling the onsite toe ditches which reconnects the hillslope seeps to the floodplain. Because little changes are being made to stream dimensions, the results show that seepage from the adjacent hillslope will increase by approximately 18 cm annually as a result of plugging the toe of slope ditches which direct water out of the current agricultural fields and directly into Meadow Branch.

**Table 14: Summary of Water Balance for Gage 2**

Hydrologic Parameter	Existing Conditions		Proposed Conditions	
	Average Annual Amount (cm of water)	Average Annual Amount (% of precip)	Average Annual Amount (cm of water)	Average Annual Amount (% of precip)
Precipitation	116	100%	116	100%
Infiltration	109	94%	110	95%
Evapotranspiration	71	61%	90	76%
Seepage + Drainage	38	33%	20	17%
Runoff	7.2	6%	6.3	5%



The model results and water budget, in concurrence with the hydric soils investigation, support that the proposed design changes to the Site will restore wetland hydrologic processes required for hydric soil development.

### **7.8 Vegetation and Planting Plan**

The objective of the planting plan is to establish, over time, a thriving riparian buffer composed of native tree species. The planting plan will be based on an appropriate nearby reference community and will be developed to restore appropriate strata (canopy, understory, shrub, and herbaceous layers). Based on initial observation of the Site, the Piedmont Bottomland Forest (Typic low subtype) defined by Schafale (2012) is the appropriate target community. The canopy will be restored through planting of bare root trees such as oaks (*Quercus sp.*) and hickory (*Carya sp.*) stems. The understory and shrub layers will be restored through a combination of planting bare root, low growth species and installing live stake shrub species. The herbaceous layer will be restored by seeding the disturbed area with a native seed mix with an emphasis placed on created good soil contact to encourage germination. Species chosen for the planting plan are listed on Sheet 4.1 of the Draft Plans located in Appendix 6. The Draft Plans also contain additional guidance on planting zones, Site preparation, and Site stabilization during construction.

As mentioned earlier, the presence of invasive species on the Deep Meadow Mitigation Site is found within the forested area around the confluence of Meadow Branch and WF1. Chinese privet (*Lagustrum sinense*) and multiflora rose (*Rosa multiflora*) are found mainly in the forested area, but are located in small quantities along stream banks.

A goal of this project is to treat and remove as much existing invasive species as possible before and during construction. The extent of invasive species coverage will be monitored, mapped, and controlled as necessary throughout the required monitoring period. Please refer to Appendix 7 for the invasive species plan. Post construction, the presence and extents of invasive species will be monitored. Treatment of invasive species will continue as necessary throughout the life of the project to ensure project stability and success of the riparian and streambank vegetation.

### **7.9 Project Risk and Uncertainties**

This project is low risk. The land use surrounding the project is currently in agricultural row crop production, so there is no potential for accidental livestock access. There are two breaks in the easement for agricultural crossings; one on Meadow Branch and one on East Fork 1. These crossings will be constructed with adequate approach stone to minimize disturbance adjacent to the stream. There is slight risk that predicted changes in watershed land use would alter the hydrology, but reconnecting the channels to their floodplains will help alleviate this new flow regime.

## **8.0 Performance Standards**

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The stream and wetland performance standards for the project will follow approved performance standards presented in the DMS Stream and Wetland Mitigation Plan Template and Guidance (October 2015) and the Stream Mitigation Guidelines issued April 2003 by the USACE and DWR. Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Wetland rehabilitation and re-establishment areas will be assigned specific performance criteria for wetland hydrology and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring. If all performance standards have been successfully met and two bankfull events have occurred during separate years, Wildlands may propose to terminate stream



and/or vegetation monitoring after monitoring year five pending little to no prevalent invasive species issues are occurring. An outline of the performance criteria components follows.

## **8.1 Streams**

### *8.1.1 Dimension*

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, bank height ratio, and width-to-depth ratio. In order to meet the objective of constructing stream channels that will maintain stable cross-sections, patterns, and profiles over time, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored channels. All riffle cross-sections should fall within the parameters defined for channels of the designed stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

### *8.1.2 Pattern and Profile*

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability. Longitudinal profile surveys will be conducted during the as-built survey, but will not be conducted during the seven-year monitoring period unless other indicators during the annual monitoring indicate a trend toward vertical and lateral instability. If a longitudinal profile is deemed necessary, monitoring will follow standards as described in the Stream Channel Reference Sites; An Illustrated Guide to Field Technique (Harrelson et.al., 1994) for the necessary reaches.

### *8.1.3 Substrate*

Substrate materials in the restoration reaches should indicate a progression towards the maintenance of coarser materials in the riffle features and smaller particles in the pool features. Successful substrate measurements show that the restored stream meet the objective of maintaining stable banks through reduced shear stress.

### *8.1.4 Photo Documentation*

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis to meet the objective of long-term stability. Cross-section photos looking upstream and downstream should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent of mid-channel bars or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected.

### *8.1.5 Bankfull Events*

Two bankfull flow events, occurring in separate years, must be documented on the restoration reaches with the seven-year monitoring period to meet the success criteria. Documentation of successful bankfull flow events support the objective of reconstructing stream channels with appropriate bankfull dimension and depth. Stream monitoring will continue until success criteria in the form of two bankfull events in separate years have been documented. These events will be documented using photographs and either a crest gage or a pressure transducer, as appropriate for Site conditions. The selected measurement device will be installed in the stream within a surveyed riffle cross-section. The device will be checked at each site visit to determine if a bankfull event has occurred. Photographs will also be used to document the occurrence of debris lines and sediment deposition.



## 8.2 Vegetation

The final vegetative success criteria for the Site will be the survival of 210 planted stems per acre in the riparian corridor at the end of the required monitoring period (year seven). This will successfully meet the objective of establishing native trees and understory species in the riparian and wetland zones. The interim measure of vegetative success for the Site will be the survival of at least 320 native species stems per acre at the end of the third monitoring year and at least 260 stems per acre at the end of the fifth year of monitoring.

The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

## 8.3 Wetlands

The final performance criteria for the wetland hydrology will be a groundwater level within 12 inches of the soil profile for a minimum of 10% (23 consecutive days) of the growing season (March 23 through November 6).

## 8.4 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

## 9.0 Monitoring Plan

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The Site monitoring plan has been developed to ensure that the required performance standards are met, and project goals and objectives are achieved. Annual monitoring data will be reported using the DMS Annual Monitoring Reporting Template (June 2017). The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes, and assist in close-out decision making.

Using the DMS As-Built Baseline Monitoring Report Template (February 2014), a baseline monitoring document and as-built record drawings of the project will be developed within 60 days of the planting completion and monitoring installation on the restored site. Monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS by December 1. These reports will be based on the DMS Annual Monitoring Template (June 2017) and Closeout Report Template (March 2015). Closeout monitoring period will be seven years beyond completion of construction or until performance standards have been met.

Vegetation monitoring quadrants will be installed across the Site to measure the survival of the planted trees. The number of monitoring quadrants required and frequency of monitoring will be based on the DMS monitoring guidance documents. Vegetation monitoring will occur in the fall and will follow the CVS-EEP Protocol for Recording Vegetation (2008) or another DMS approved protocol.

Groundwater monitoring gages will be established throughout the wetland rehabilitation and reestablishment areas. Generally, the gages will be installed at appropriate locations so that the data collected will provide an indication of groundwater levels throughout the wetland project area. Table 15, below, describes how the monitoring plan is set up in order to verify project goals and objectives have been achieved.



**Table 15: Monitoring Plan**

Goal	Treatment	Performance Standards	Monitoring Metric	Outcome	Likely Functional Uplift
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with designed bankfull dimensions and depth relative to the existing floodplain.	Two bankfull events in separate monitoring years during the seven-year monitoring period.	Crest gages and/or pressure transducers to record flow elevations.	Multiple bankfull events within monitoring period.	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands.
Improve stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Entrenchment ratio stays over 2.2 and bank height ratio below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring and visual inspections.	Stable stream channels with entrenchment ratios over 2.2 and bank height ratios below 1.2.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.
Restore and enhance native floodplain and streambank vegetation.	Plant native tree, understory shrub and herbaceous species.	210 planted stems per acre at MY7. Interim survival rate of 320 planted stems per acre at MY3 and 260 at MY5. For buffer credit areas, survival rate of 260 stems per acre at MY5.	One hundred square meter vegetation plots will be placed on 2% of the planted area of the project and monitored annually.	Planted stem densities will be at or above 210 planted stems per acre at MY7, with volunteer trees growing on Site as well.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased biogeochemical cycling in floodplain, and improved riparian habitat.
Permanently protect the Site from harmful uses.	Establish conservation easements on the Site.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	No harmful encroachment into the conservation easement.	Protection of the Site from encroachment into the conservation easement.

**9.1 Monitoring Components**

Project monitoring components are listed in more detail in Table 16. Approximate locations of the proposed vegetation plots and groundwater gage monitoring components are illustrated in Figure 11.

**Table 16: Monitoring Components**

Parameter	Monitoring Feature	Quantity/ Length by Reach				Wetlands	Frequency	Notes
		Meadow Branch	EF1	WF1	WF2			
Dimension	Riffle Cross Sections	n/a	2	1	1	n/a	Year 1, 2, 3, 5, and 7	
	Pool Cross Section	n/a	1	n/a	1	n/a		
Pattern	Pattern	n/a	n/a	n/a	n/a	n/a	Year 0	1
Profile	Longitudinal Profile	n/a	n/a	n/a	n/a	n/a	Year 0	
Substrate	Reach wide	n/a	1 RW	1 RW	1 RW	n/a	Year 1, 2, 3, 5, and 7	2
Stream Hydrology	Crest Gage/ Transducer	n/a	1	1	1	n/a	Quarterly	2
Wetland Hydrology	Groundwater Gages	n/a	n/a	n/a	n/a	11	Quarterly	
Vegetation	CVS Level 2	16					Year 1, 2, 3, 5, and 7	
Exotic and nuisance vegetation							Semi-Annual	3
Project Boundary							Semi-Annual	4
Reference Photos	Photographs	18					Annual	

Notes:

1. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate lack of stability and profile survey is warranted in additional years.
2. A reach-wide pebble count will be performed in each restoration reach each year for classification purposes. A wetted pebbled count will be performed during the baseline survey at surveyed riffles to characterize the pavement.
3. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every hour. Device will be inspected and downloaded semi-annually.
4. Locations of exotic and nuisance vegetation will be mapped.
5. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

## 10.0 Long-Term Management Plan

The site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program (*or 3<sup>rd</sup> party if approved*). This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statute GS 113A-232(d)(3). Interest gained by the endowment fund



may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

The Stewardship Program will periodically install signage as needed to identify boundary markings as needed. No livestock, fencing, or crossings are currently present or planned for the project area. Any future livestock or associated fencing or permanent crossings will be the responsibility of the owner of the underlying fee to maintain.

The Site Protection Instrument can be found in Appendix 1.

**Table 17: Long-term Management Plan**

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
Signage will be installed and maintained along the Site boundary to denote the area protected by the recorded conservation easement.	The long-term steward will be responsible for inspecting the Site boundary and for maintaining or replacing signage to ensure that the conservation easement area is clearly marked.	The landowner shall report damaged or missing signs to the long-term manager, as well as contact the long-term manager if a boundary needs to be marked, or clarification is needed regarding a boundary location. If land use changes in future and fencing is required to protect the easement, the landowner is responsible for installing fencing that meets the objectives of the mitigation project.
The Site will be protected in its entirety and managed under the terms outlined in the recorded conservation easement.	The long-term manager will be responsible for conducting annual inspections and for undertaking actions that are reasonably calculated to swiftly correct the conditions constituting a breach. The USACE, and their authorized agents, shall have the right to enter and inspect the Site and to take actions necessary to verify compliance with the conservation easement.	The landowner shall contact the long-term manager if clarification is needed regarding the restrictions associated with the recorded conservation easement.

## 11.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 9 and 10. Project maintenance will be performed during the monitoring years to address minor issues as necessary (Appendix 8). If, during annual monitoring it is determined the Site’s ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of the IRT and work with the IRT to develop contingency plans and remedial actions.

## 12.0 Determination of Credits

Mitigation credits presented in Table 18 are projections based upon the proposed design. Upon completion of the as-built survey, the project components and credits data will be revised if necessary



with explanations of how and why any adjustments occurred. As-built stream linear footage will be based on surveyed stream center lines for credit calculations.

Stream Restoration is requested at a ratio of 1:1. Enhancement I is requested at a ratio of 1.5:1. Enhancement II is requested at a ratio of 2.5:1. All proposed buffers meet, and in most cases exceed, the minimum 50-foot requirement for Piedmont streams. Appendix 9 contains a credit release schedule.



**Table 18: Project Asset Table**

Project Component	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	Restored Footage, Acreage, or SF	Creditible Footage, Acreage or SF	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
Meadow Branch		2,570	100+66 – 126+11	2,545.0	2,449.0	EII	-	2.5	979.6	Bank stabilization and in-stream structures with planted buffer. Creditable length accounts for 96 LF of stream within an easement break.
EF1		1,201	200+38 – 214+01	1,363.0	1,322.0	R	P1, P2	1	1,322.0	Full channel restoration and planted buffer. Creditable length accounts for 41 LF of stream within an easement break.
WF1		116	400+77 – 401+93	116.0	116.0	EI	-	1.5	77.3	Dimension and profile modified to provide stability.
WF1		20	400+57 – 400+77	20.0	20.0	P	-	10	2.0	
WF2		391	301+29 – 305+87	458.0	458.0	R	P1, P2	1	458.0	Full channel restoration and planted buffer.
WH-1	RR	0.28		0.28	0.28	R		1.5	0.19	Rehabilitation. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch.
WH-2	RR	0.3		0.30	0.30	R		1.5	0.20	Rehabilitation. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch.
WE-1	RR	0.40		0.40	0.40	R		1	0.40	Re-establishment. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch to increase area around jurisdictionally delineated wetland.
WE-2	RR	1.70		1.70	1.70	R		1	1.70	Re-establishment. Planted, removed agricultural activities, increased hydrology by reducing restoring adjacent tributary (EF-1)
WE-3	RR	0.40		0.40	0.40	R		1	0.40	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-4	RR	0.40		0.40	0.40	R		1	0.40	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-5	RR	0.40		0.40	0.40	R		1	0.40	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-6	RR	0.20		0.20	0.20	R		1	0.20	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-7	RR	1.50		1.50	1.50	R		1	1.50	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales and increasing connecting with upgradient hillslope hydrology
WE-8	RR	1.00		1.00	1.00	R		1	1.00	Re-establishment. Planted, removed agricultural activities, increased hydrology by reconnecting area with upgradient slope drainage and restoring adjacent tributary (WF-2)
WE-9	RR	0.50		0.50	0.50	R		1	0.50	Re-establishment. Planted, removed agricultural activities, increased hydrology by reconnecting area with upgradient slope drainage and reducing drainage to Meadow Branch.
WE-10	RR	1.70		1.70	1.70	R		1	1.70	Re-establishment. Planted, removed agricultural activities, increased hydrology by reconnecting area with upgradient slope drainage and reducing drainage to Meadow Branch.





### Length and Area Summations by Mitigation Category

Restoration Level	Stream	Riparian Wetland	
	(linear feet)	(acres)	
		Riverine	Non-Riverine
Restoration	1,780	8.8	
Enhancement			
Enhancement I	116		
Enhancement II	2,449		
Creation			
Preservation	20		
High Quality Pres			

### Overall Assets Summary

Asset Category	Overall Credits
Stream	2,838.9
RP Wetland	8.59
NR Wetland	-
Buffer	-

## 13.0 References

- Dunne, T. and L. B. Leopold. 1978. *Water in Environmental Planning*. W.H. Freeman and Company. New York.
- Giese, G.I and Robert R. Mason Jr. 1993. *Low-Flow Characteristics of Streams in North Carolina*. U.S. Geological Survey Water Supply Paper 2403.
- Harman, W.A. and C.J. Jones. 2016. *Functional Lift Quantification Tool for Stream Restoration Projects in North Carolina: Data Collection and Analysis Manual*. Environmental Defense Fund, Raleigh, NC.
- Harman, W.A. and C.J. Jones. 2016. *Functional Lift Quantification Tool for Stream Restoration Projects in North Carolina: Spreadsheet User Manual Version 2*. Environmental Defense Fund, Raleigh, NC.
- Harman, W. R. Starr, M. Carter, K. Tweedy, M. Clemmons, K. Suggs, C. Miller. 2012. *A Function Based Framework for Stream Assessment and Restoration Projects*. US Environmental Protection Agency, Office of Wetlands, Oceans, and Watersheds, Washington, DC EPA 843-K-12-006.
- Harman et al. 1999. *Bankfull Hydraulic Geometry Relationships for North Carolina Streams*. AWRA Wildland Hydrology Symposium Proceedings. Edited by: D. S. Olsen and J.P. Potyondy. AWRA Summer Symposium. Bozeman, MT.
- Montgomery County Department of Environmental Protection Division of Water Resources Management. 1996. *Rapid Stream Assessment Technique (RSAT) Field Methods*. Montgomery County, Maryland.
- Natural Resources Conservation Service (NRCS), 2017. *Web Soil Survey*. <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>
- North Carolina Division of Water Quality (NCDWQ), 2011. *Surface Water Classifications*. <http://portal.ncdenr.org/web/wq/ps/csu/classifications>
- North Carolina Geological Survey (NCGS), 1985. *Geologic map of North Carolina 1:500,000 scale*. Compiled by Philip M. Brown at el. Raleigh, NC, NCGS.
- North Carolina Natural Heritage Program (NHP), 2009. *Natural Heritage Element Occurrence Database*, Orange County, NC.
- North Carolina State University (NCSU), 2010. *DrainMod Related Publications*. [http://www.bae.ncsu.edu/soil\\_water/drainmod/drainmod\\_papers.html#wetland](http://www.bae.ncsu.edu/soil_water/drainmod/drainmod_papers.html#wetland)



- Rogers, John J.W., 2006. The Carolina Slate Belt. In Steponaitis, V.P., Irwin, J.D., McReynolds, T.E., and Moore, C.R. (Ed.), *Stone Quarries and Sourcing in the Carolina Slate Belt* (pp. 10 – 15). Retrieved from <http://rla.unc.edu/Publications/pdf/ResRep25/Ch2.pdf>
- Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.
- Rosgen, D.L. 2001. A stream channel stability assessment methodology. Proceedings of the Federal Interagency Sediment Conference, Reno, NV, March 2001.
- Schafale, M.P. 2012. Classification of the Natural Communities of North Carolina, Fourth Approximateion. North Carolina Natural Heritage Program, Raleigh, North Carolina.
- Simon, A. 1989. A model of channel response in disturbed alluvial channels. *Earth Surface Processes and Landforms* 14(1):11-26.
- Shields, D. F., Copeland, R. R, Klingman, P. C., Doyle, M. W., and Simon, A. 2003. Design for Stream Restoration. *Journal of Hydraulic Engineering* 129(8): 575-582.
- U.S. Army Corps of Engineers, Hydrologic Engineering Center (HEC), 2010. HEC-RAS River Analysis System User's Manual, Version 4.1. Accessed online at: [http://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS\\_4.1\\_Users\\_Manual.pdf](http://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS_4.1_Users_Manual.pdf)
- United States Environmental Protection Agency (EPA), 2010. Spreadsheet Tool for Estimating Pollutant Load, version 4.1. [http://it.tetrattech-ffx.com/steplweb/models\\$docs.htm](http://it.tetrattech-ffx.com/steplweb/models$docs.htm)
- United States Fish and Wildlife Service (USFWS), 2014. Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species, Orange County, NC. <http://www.fws.gov/raleigh/species/cntylist/orange.html>
- Walker, Alan, unpublished. NC Rural Mountain and Piedmont Regional Curve.



## FIGURES

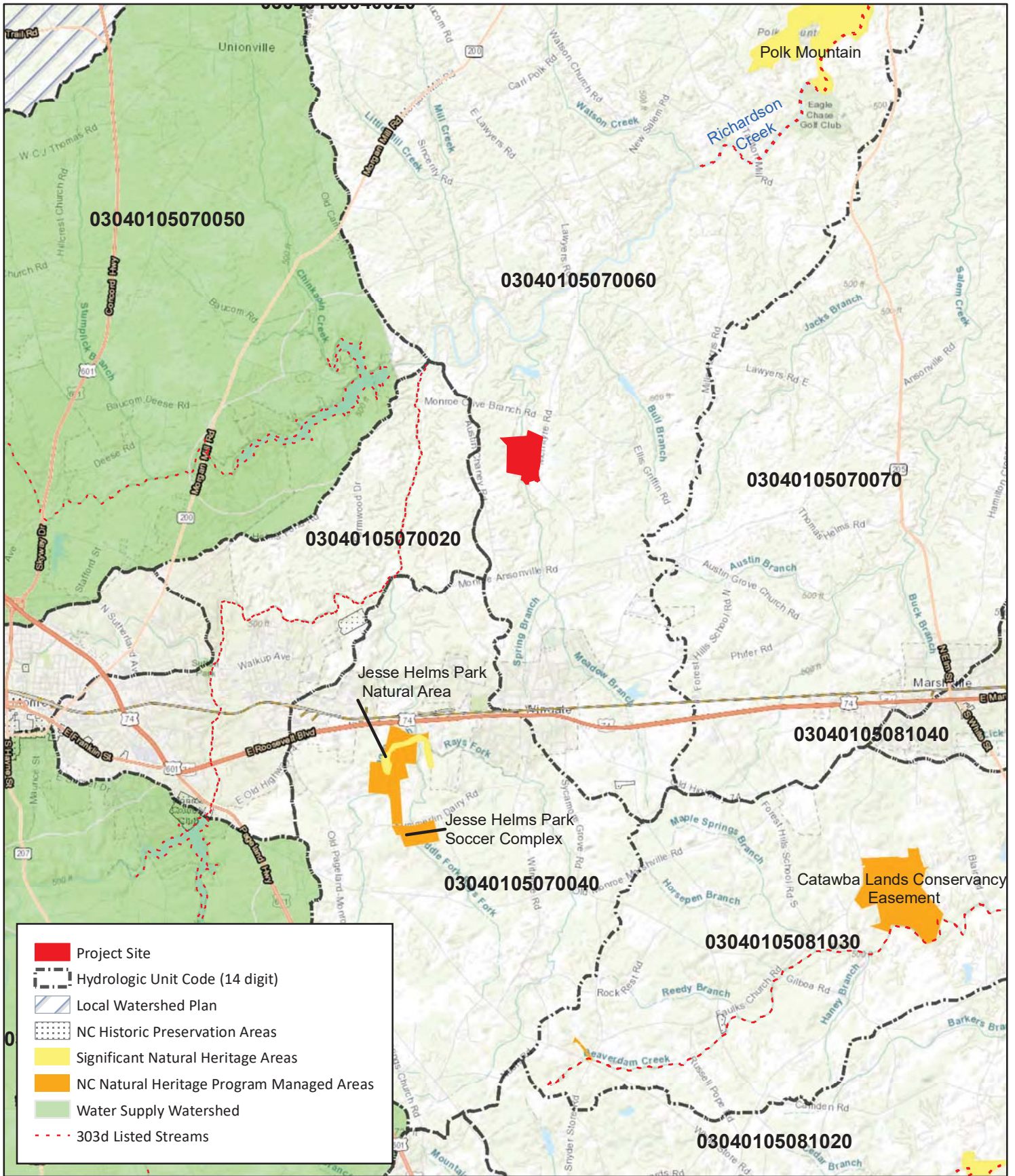


Figure 1 Vicinity Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)

Union County, NC



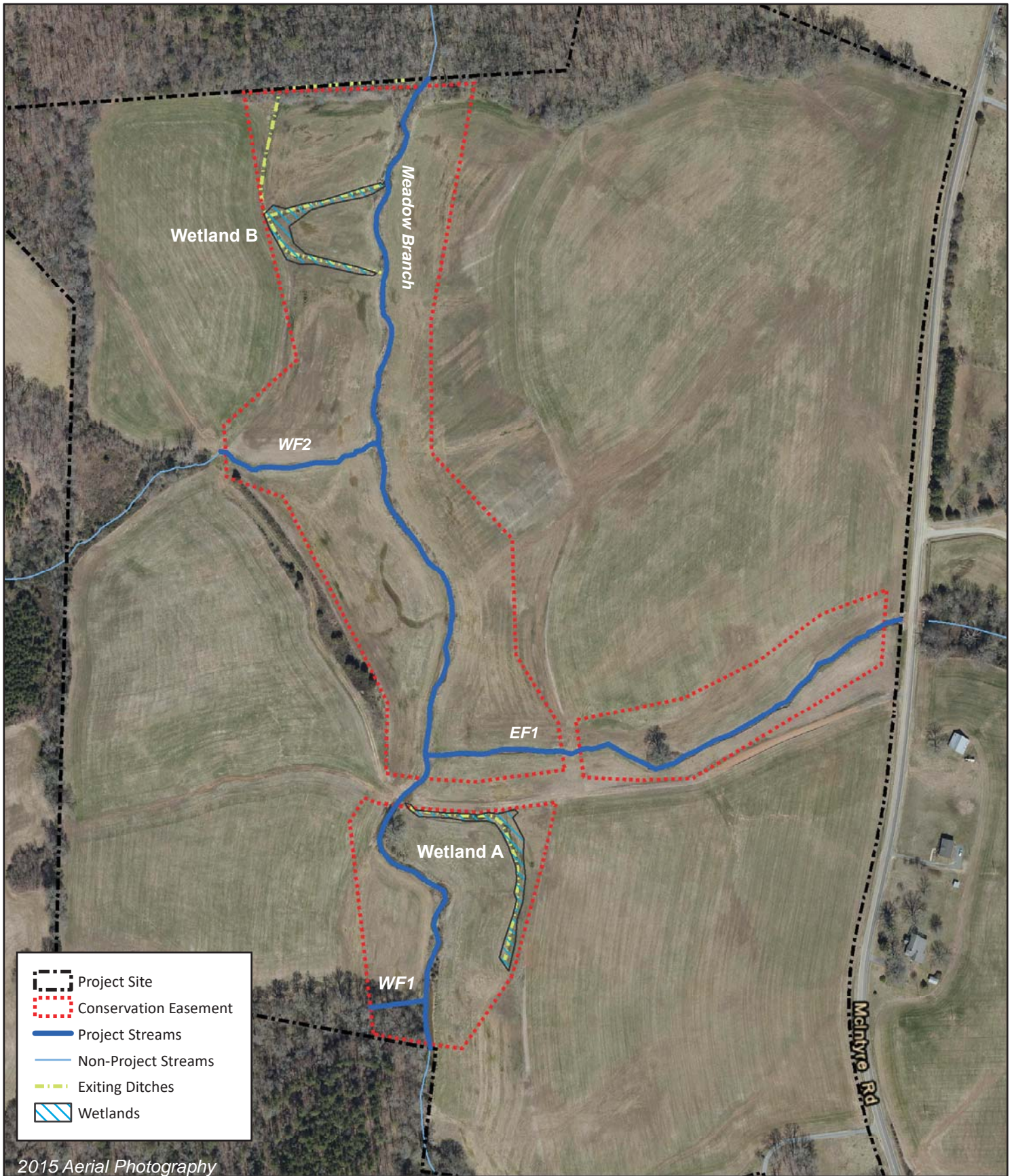


Figure 2 Site Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)

Union County, NC



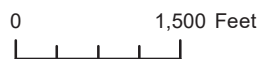
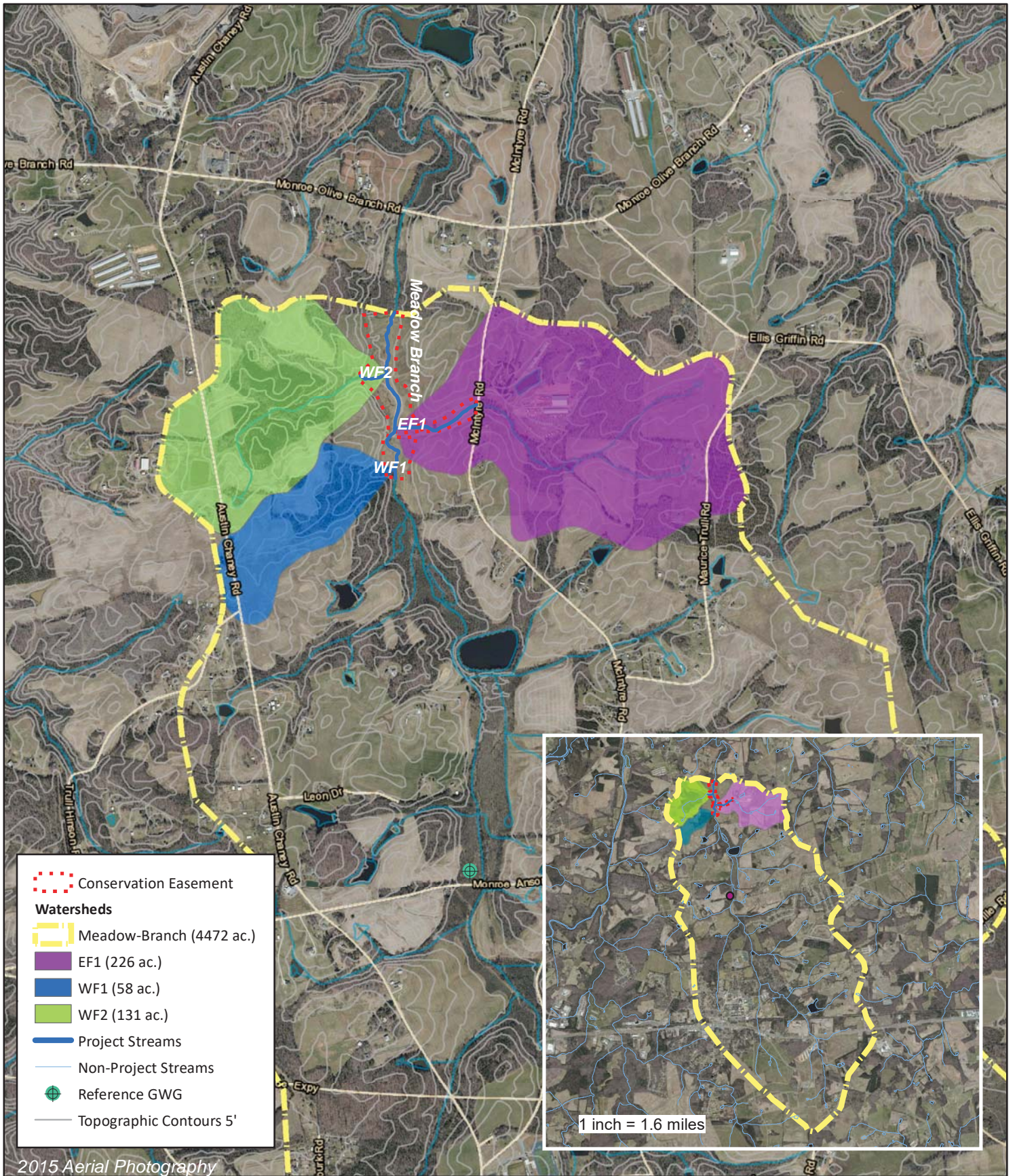


Figure 3 Watershed Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)



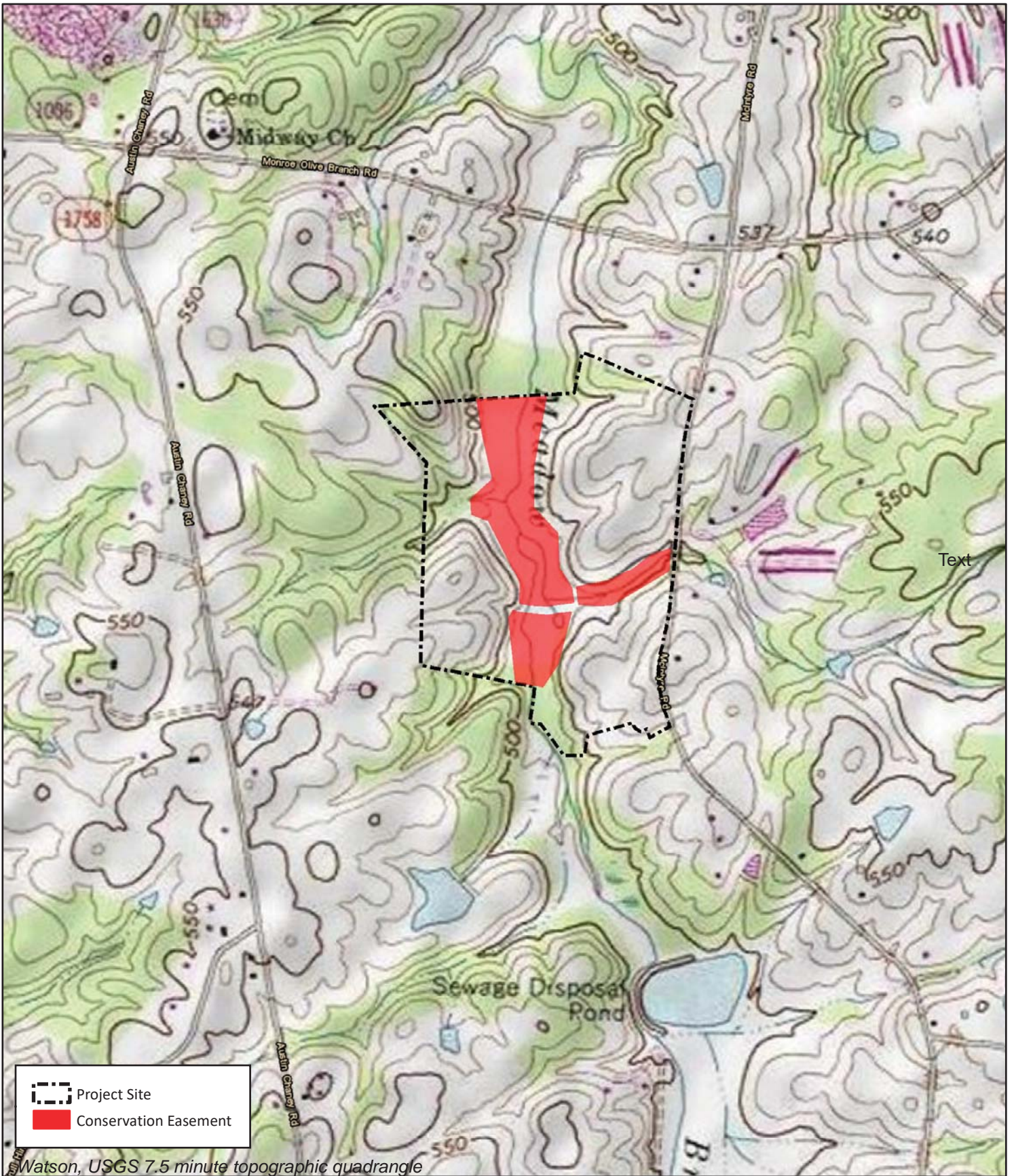


Figure 4 Topographic Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



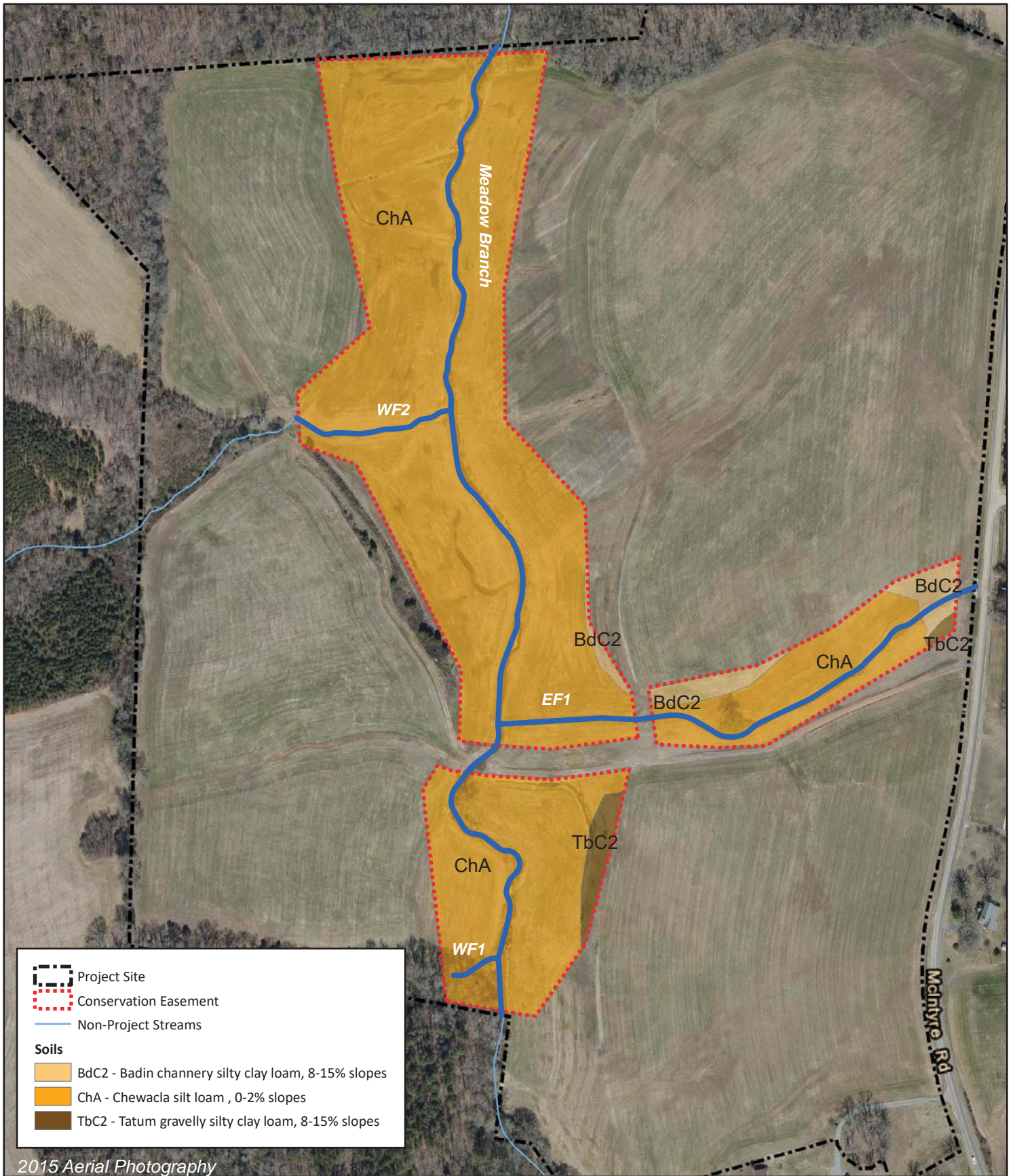


Figure 5 Soils Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



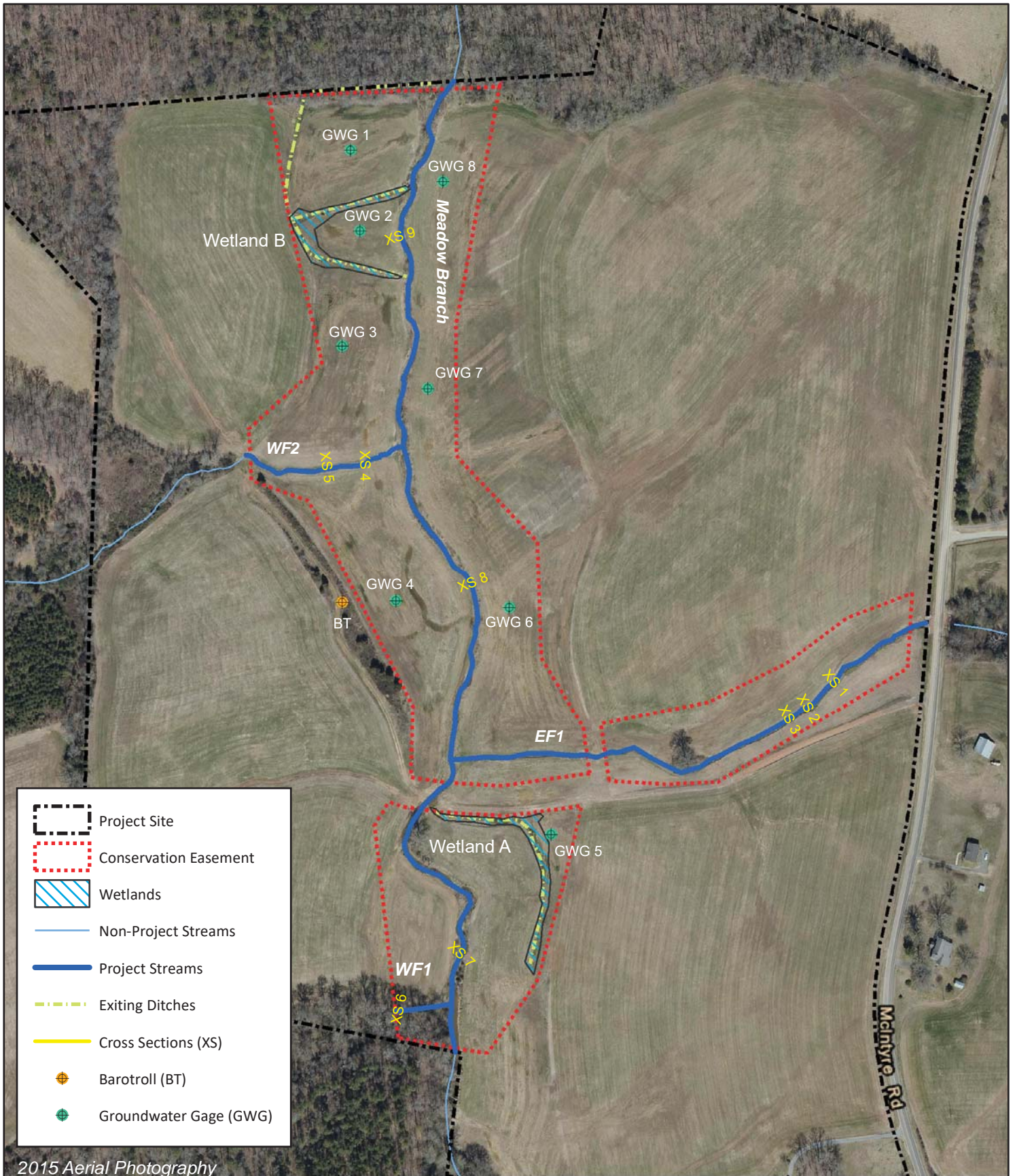
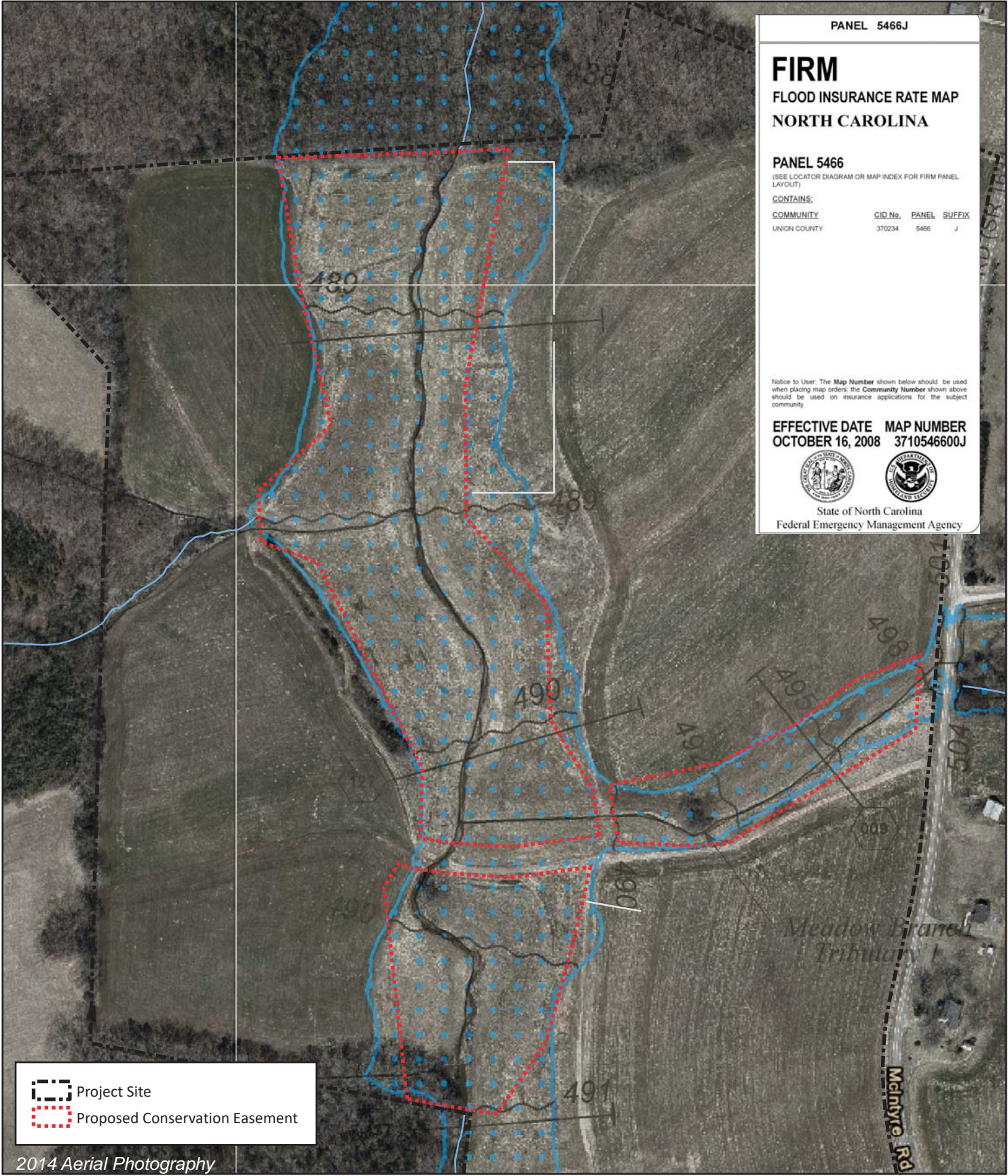


Figure 6 Existing Conditions Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)





PANEL 5466J

## FIRM

### FLOOD INSURANCE RATE MAP NORTH CAROLINA

**PANEL 5466**  
(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**



COMMUNITY	CID No.	PANEL	SUFFIX
UNION COUNTY	370234	5466	J

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

**EFFECTIVE DATE**    **MAP NUMBER**  
**OCTOBER 16, 2008**    **3710546600J**




State of North Carolina  
Federal Emergency Management Agency

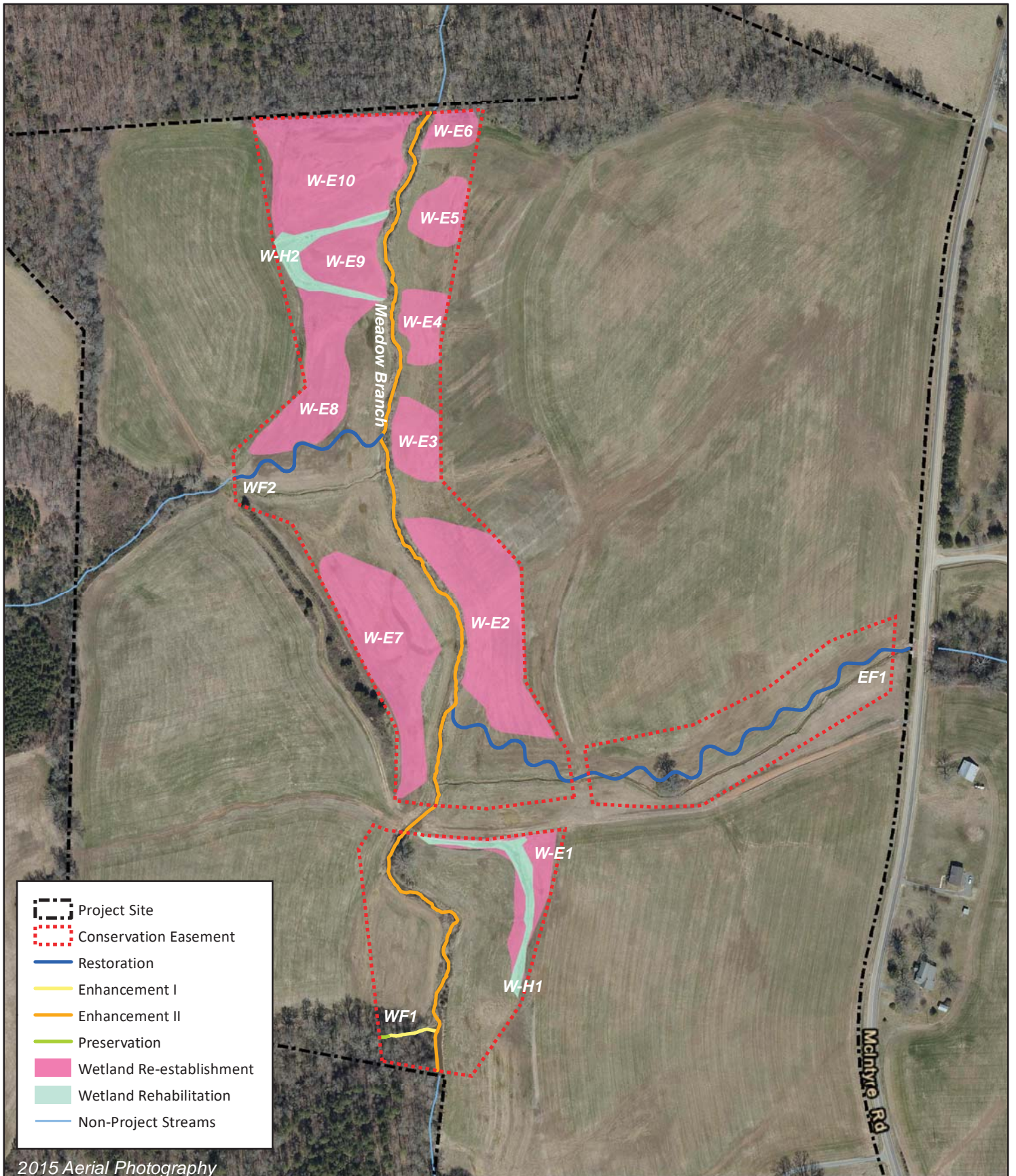
 Project Site  
 Proposed Conservation Easement

2014 Aerial Photography



Figure 7 FEMA Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)





- Project Site
- Conservation Easement
- Restoration
- Enhancement I
- Enhancement II
- Preservation
- Wetland Re-establishment
- Wetland Rehabilitation
- Non-Project Streams



Figure 8 Concept Design Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



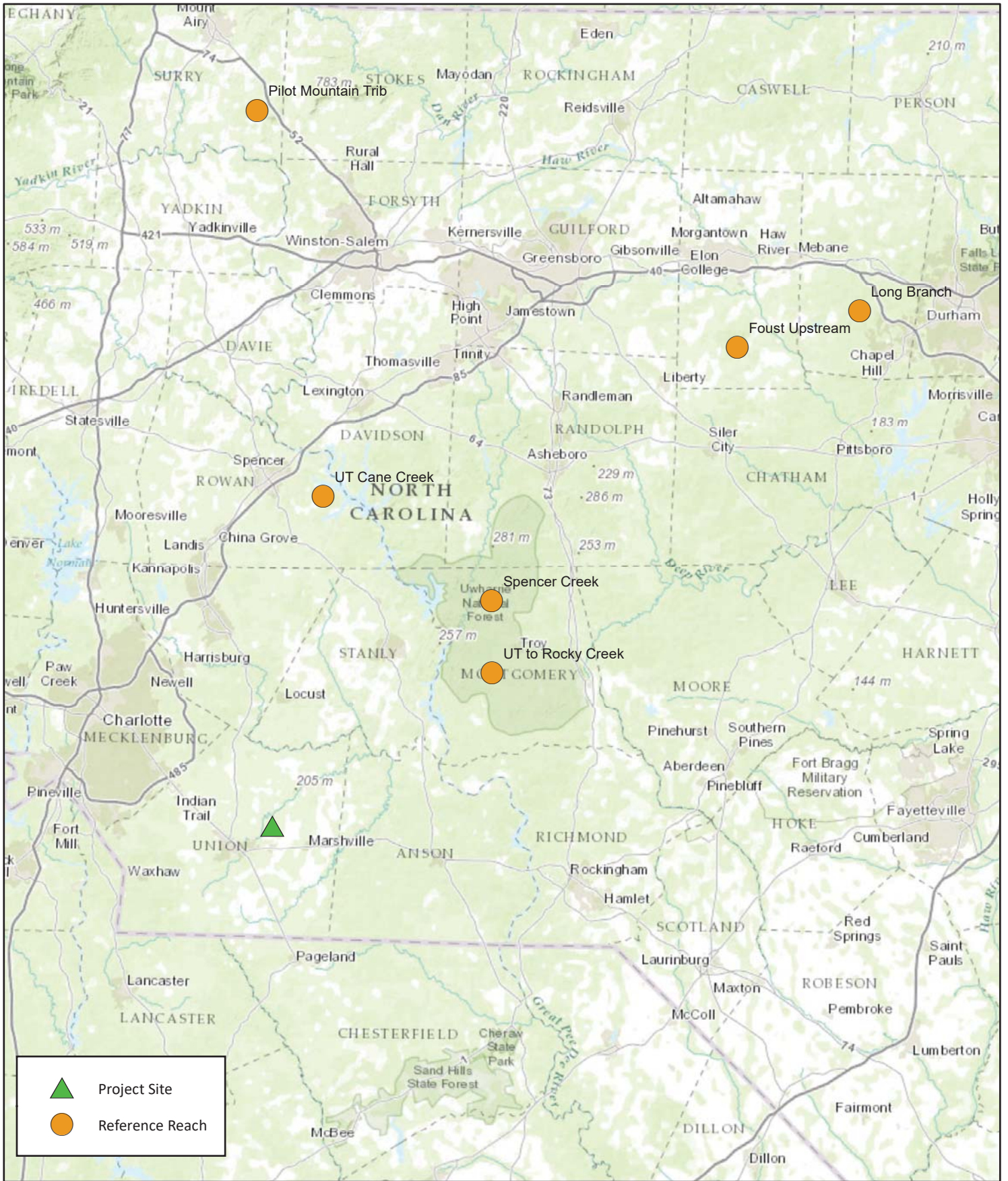


Figure 9 Reference Reach Vicinity Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)

Union County, NC

### Deep Meadow Design Discharge Plot

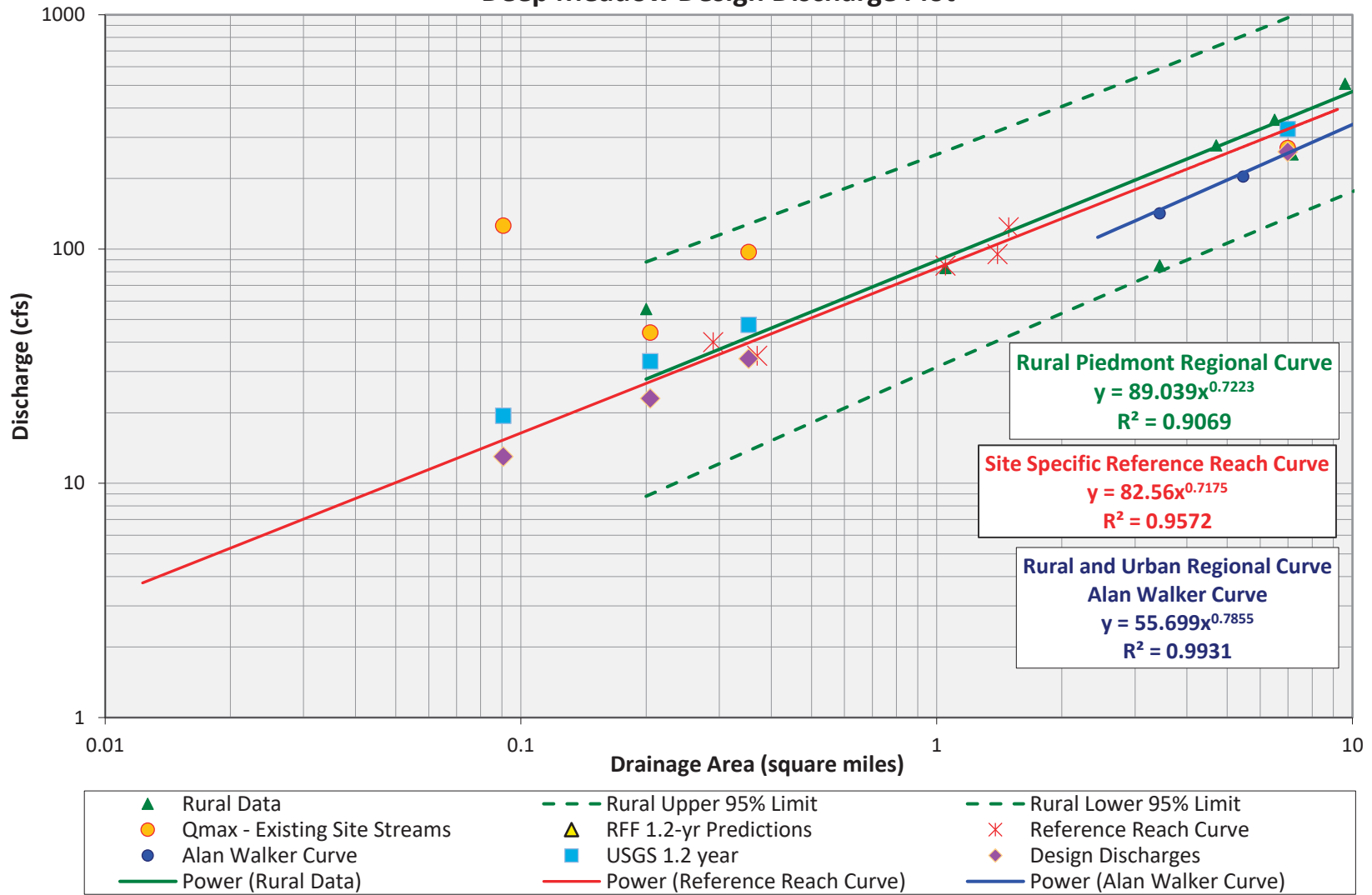


Figure 10 Discharge Analysis  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



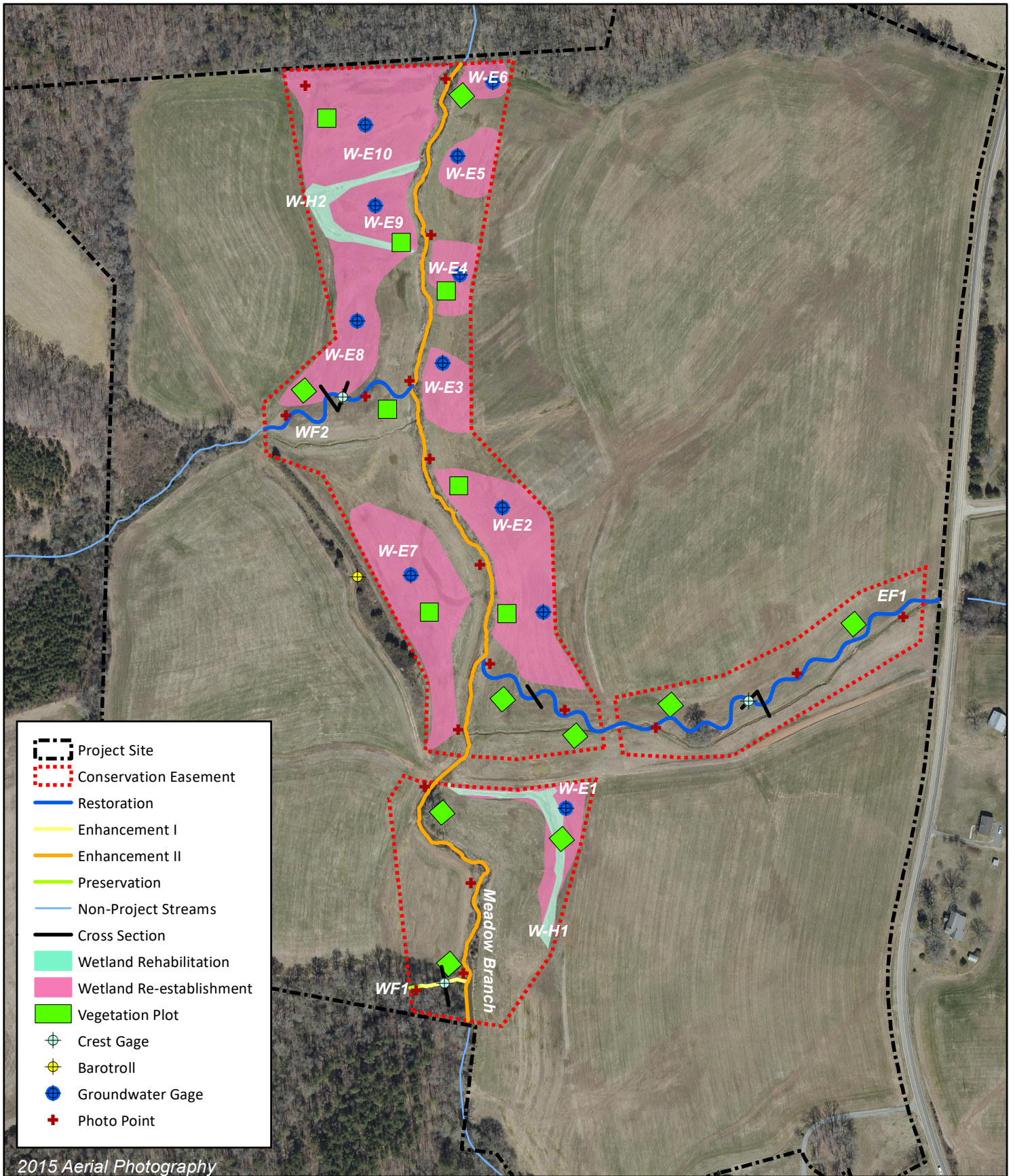


Figure 11 Monitoring Plan Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



APPENDIX 1  
SITE PROTECTION INSTRUMENT

## Appendix 1 Site Protection Instrument

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The land required for construction, management, and stewardship of this mitigation project includes portions of the parcels listed in Table 1. All parcels are optioned for purchase of a conservation easement by Wildlands Engineering, Inc. (Wildlands), which will encompass streams and wetlands being restored, enhanced, and preserved along with their corresponding riparian buffers.

The recorded options are included in this appendix.

**Table 1: Site Protection Instrument – Deep Meadow Mitigation Site**

Current Landowner	PIN	County	Under Option by Wildlands?	Memorandum of Option/ Conservation Easement Deed Book (DB) and Page Number (PG)	Acreage to be Protected
Baucom Farm and Milling	09009003	Union	Yes	DB: 06631 PG: 0167-0173	23.8

The conservation easement template that will be used for recordation is included in this appendix. All site protection instruments require 60-day advance notification to the USACE and or DMS prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.



STATE OF NORTH CAROLINA

**DEED OF CONSERVATION EASEMENT  
AND RIGHT OF ACCESS PROVIDED  
PURSUANT TO  
FULL DELIVERY  
MITIGATION CONTRACT**

\_\_\_\_\_ COUNTY

**SPO File Number:**

**DMS Project Number:**

Prepared by: Office of the Attorney General  
Property Control Section  
Return to: NC Department of Administration  
State Property Office  
1321 Mail Service Center  
Raleigh, NC 27699-1321

**THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS**, made this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_, by \_\_\_\_\_ *Landowner name goes here*, (“**Grantor**”), whose mailing address is \_\_\_\_\_ *Landowner address goes here* \_\_\_\_\_, to the State of North Carolina, (“**Grantee**”), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

**WITNESSETH:**

**WHEREAS**, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 *et seq.*, the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the

protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

**WHEREAS**, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between (insert name and address of full delivery contract provider) and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number \_\_\_\_\_.

**WHEREAS**, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

**WHEREAS**, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

**WHEREAS**, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

**WHEREAS**, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

**WHEREAS**, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8<sup>th</sup> day of February 2000; and

**WHEREAS**, the Division of Mitigation Services in the Department of Environmental Quality, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

**WHEREAS**, Grantor owns in fee simple certain real property situated, lying, and being in \_\_\_\_\_ Township, \_\_\_\_\_ County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately \_\_\_\_\_ acres and being conveyed to the Grantor by deed as recorded in **Deed Book** \_\_\_\_\_ **at Page** \_\_\_\_\_ of the \_\_\_\_\_ County Registry, North Carolina; and

**WHEREAS**, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of ***if known, insert name of stream, branch, river or waterway here.***

**NOW, THEREFORE**, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

Tracts Number \_\_\_\_\_ containing a total of \_\_\_\_\_ **acres** as shown on the plats of survey entitled "Final Plat, Conservation Easement for North Carolina Division of Mitigation Services, Project Name: \_\_\_\_\_, SPO File No. \_\_\_\_\_, EEP Site No. \_\_\_\_\_, Property of \_\_\_\_\_," dated \_\_\_\_\_, 20\_\_ by *name of surveyor,* PLS Number \_\_\_\_\_ and recorded in the \_\_\_\_\_ County, North Carolina Register of Deeds at **Plat Book** \_\_\_\_\_ **Pages** \_\_\_\_\_.

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

#### **I. DURATION OF EASEMENT**

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

## II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

**A. Recreational Uses.** Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

**B. Motorized Vehicle Use.** Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat.

**C. Educational Uses.** The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

**D. Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

**E. Industrial, Residential and Commercial Uses.** All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

**F. Agricultural Use.** All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

**G. New Construction.** There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

**H. Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

**I. Signs.** No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

**J. Dumping or Storing.** Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

**K. Grading, Mineral Use, Excavation, Dredging.** There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

**L. Water Quality and Drainage Patterns.** There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

**M. Subdivision and Conveyance.** Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

**N. Development Rights.** All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

**O. Disturbance of Natural Features.** Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.



### III. GRANTEE RESERVED USES

**A. Right of Access, Construction, and Inspection.** The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities on the property to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

**B. Restoration Activities.** These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterranean water flow.

**C. Signs.** The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

**D. Fences.** Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

**E. Crossing Area(s).** The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

### IV. ENFORCEMENT AND REMEDIES

**A. Enforcement.** To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the

power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

**B. Inspection.** The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

**C. Acts Beyond Grantor's Control.** Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

**D. Costs of Enforcement.** Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

**E. No Waiver.** Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

## V. MISCELLANEOUS

**A.** This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

**B.** Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the

obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

**C.** Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

**D.** Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

**E.** The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

**F.** This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager  
NC State Property Office  
1321 Mail Service Center  
Raleigh, NC 27699-1321

and

General Counsel  
US Army Corps of Engineers  
69 Darlington Avenue  
Wilmington, NC 28403

**G.** The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

## VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

**TO HAVE AND TO HOLD**, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

**AND** Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

**IN TESTIMONY WHEREOF**, the Grantor has hereunto set his hand and seal, the day and year first above written.

\_\_\_\_\_ (SEAL)

**NORTH CAROLINA**  
**COUNTY OF** \_\_\_\_\_

I, \_\_\_\_\_, a Notary Public in and for the County and State aforesaid, do hereby certify that \_\_\_\_\_, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

**IN WITNESS WHEREOF**, I have hereunto set my hand and Notary Seal this the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Notary Public

My commission expires:  
\_\_\_\_\_

# Exhibit A

**[INSERT LEGAL DESCRIPTION]**

APPENDIX 2  
WETLAND JD FORMS



**U.S. ARMY CORPS OF ENGINEERS**  
**WILMINGTON DISTRICT**

Action Id. SAW-2017-00241 County: Union U.S.G.S. Quad: NC-Watson

**NOTIFICATION OF JURISDICTIONAL DETERMINATION**

Property Owner: **Baucom Farm & Milling**  
**Kyle Herring**  
Address: **6510 Morgan Mill Road**  
**Monroe, NC 28110**  
Telephone Number: **704.226.2818**  
E-mail: **wkherrin09@yahoo.com**

Size (acres)	<u><b>23.1</b></u>	Nearest Town	<u><b>Wingate</b></u>
Nearest Waterway	<u><b>Meadow Branch</b></u>	River Basin	<u><b>Yadkin</b></u>
USGS HUC	<u><b>03040105</b></u>	Coordinates	Latitude: <u><b>35.023275</b></u> Longitude: <u><b>-80.451156</b></u>

Location description: **1812 McIntyre Road northeast of Monroe and approximately 2.2 miles north of Wingate, Union County, North Carolina**

**Indicate Which of the Following Apply:**

**A. Preliminary Determination**

- There appear to be **waters, including wetlands** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The approximate boundaries of these waters are shown on the enclosed delineation plan sheets that were included with your JD request package, dated 27 January 2017. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.
- There appear to be **waters, including wetlands** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the **waters, including wetlands** have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the **waters, including wetlands** at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the **waters, including wetlands** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

**B. Approved Determination**

- There are Navigable Waters of the United States within the above described project area/property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- There are **waters, including wetlands** on the above described project area/property subject to the permit requirements of Section 404 of the Clean Water Act (CWA) (33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.
- We recommend you have the **waters, including wetlands** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

The **waters, including wetlands** on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated **MAP DATE**. If you wish to have the delineation surveyed, the Corps can review and verify the survey upon completion. Once verified, this survey will provide an accurate depiction of all areas subject to CWA and/or RHA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

The **waters, including wetlands** have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on **SURVEY SIGNED DATE**. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

There are no waters of the U.S., to include wetlands, present on the above described project area/property which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in **Morehead City, NC, at (252) 808-2808** to determine their requirements.

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Jason Randolph at 704.510.1440 or [jason.d.randolph@usace.army.mil](mailto:jason.d.randolph@usace.army.mil)**.

**C. Basis for Determination: see preliminary jurisdictional determination, dated 23 May 2017**

**D. Remarks: The attached preliminary jurisdictional determination that your consultant requested should NOT be viewed as a “verification” of the presence/absence of potential wetlands or waters by this office and should NOT be viewed as a verification of the accuracy of the extent of potential wetlands and waters by this office. Only an approved jurisdictional determination can be used for those tasks.**

### **E. Attention USDA Program Participants**

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

### **F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)**

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers  
South Atlantic Division  
Attn: Jason Steele, Review Officer  
60 Forsyth Street SW, Room 10M15  
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **Not applicable**.

**\*\*It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.\*\***

Corps Regulatory Official: \_\_\_\_\_  \_\_\_\_\_

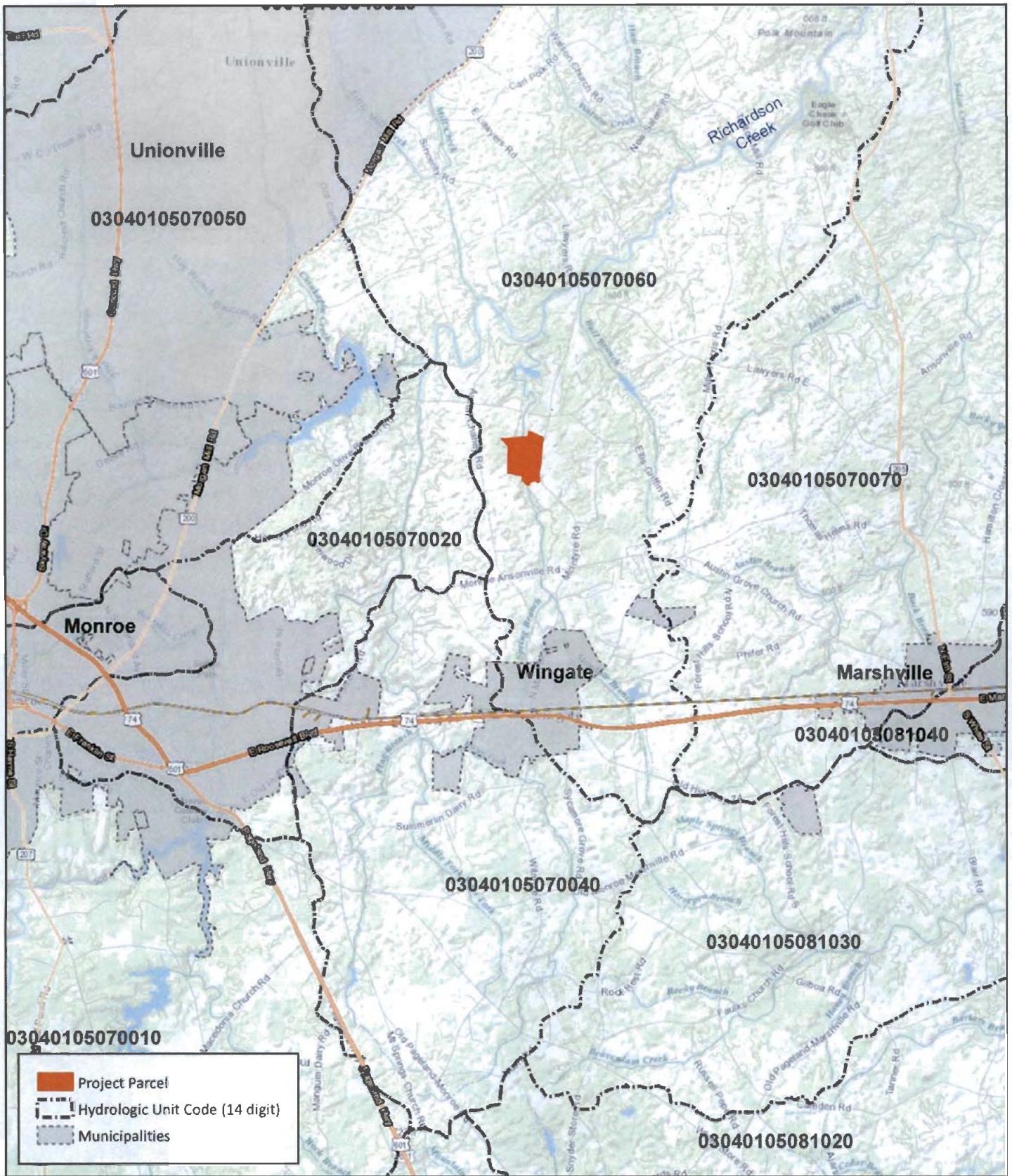
Date of JD: 5/23/2017      Expiration Date of JD: Not applicable

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at [http://corpsmapu.usace.army.mil/cm\\_apex/f?p=136:4:0](http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0).

Copy furnished:

Agent: **Wildland Engineering**  
**Ian Eckardt**  
Address: **1430 South Mint Street, Suite 104**  
**Charlotte, NC 28203**  
Telephone Number: **704.332.7754**  
E-mail: **ieckardt@wildlandseng.com**





0 1.5 Miles



Figure 1 Vicinity Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)

Union County, NC





Figure 2 Topographic Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)





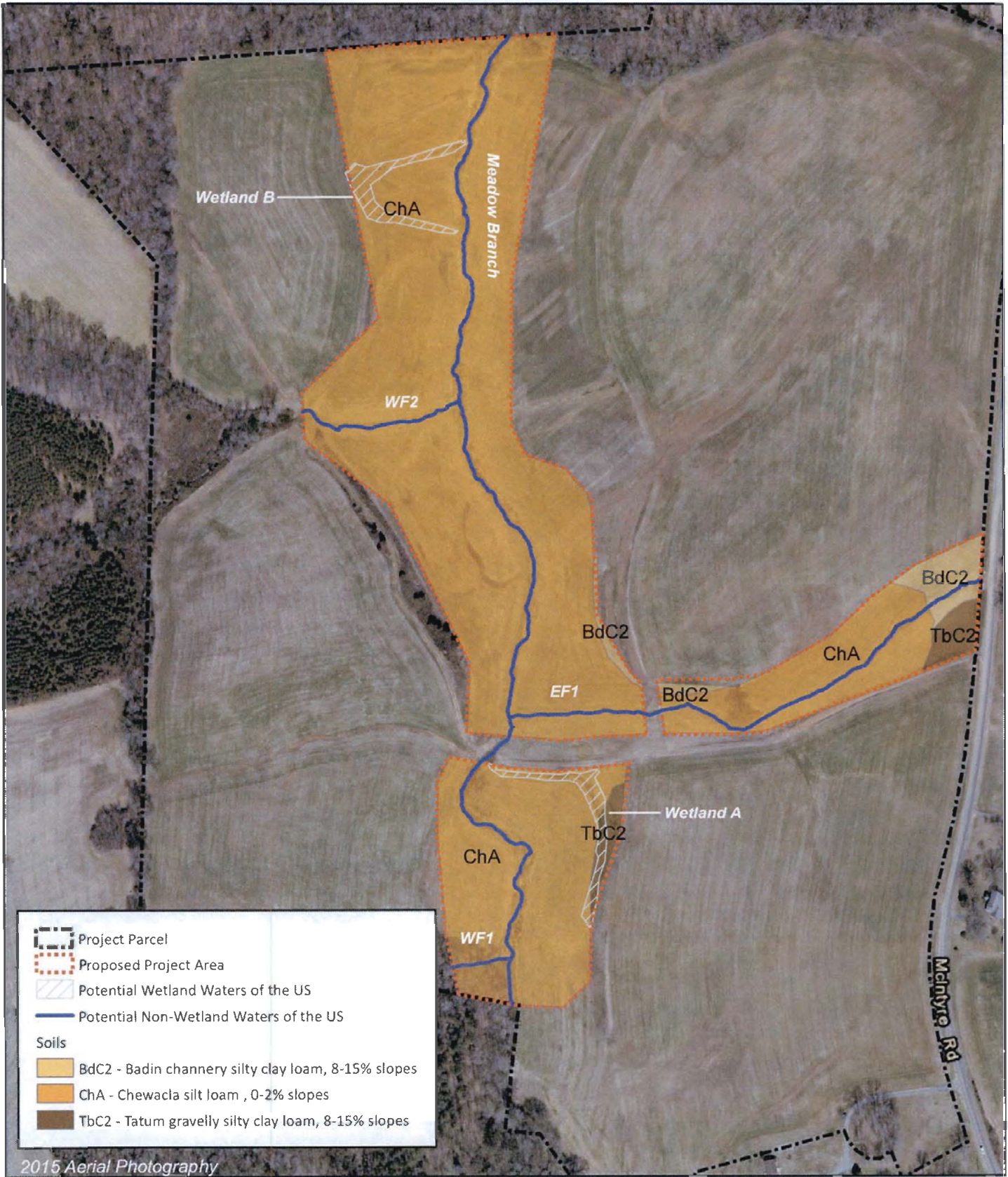
0 300 Feet



Figure 3 Site Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)

Union County, NC





	Project Parcel
	Proposed Project Area
	Potential Wetland Waters of the US
	Potential Non-Wetland Waters of the US
<b>Soils</b>	
	BdC2 - Badin channery silty clay loam, 8-15% slopes
	ChA - Chewacla silt loam, 0-2% slopes
	TbC2 - Tatum gravelly silty clay loam, 8-15% slopes



Figure 4 Soils Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)

**NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND  
REQUEST FOR APPEAL**

Applicant: <b>Baucom Farm &amp; Milling, Kyle Herring</b>	File Number: <b>SAW-2017-00241</b>	Date: <b>5/23/2017</b>
Attached is:	See Section below	
<input type="checkbox"/> INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A	
<input type="checkbox"/> PROFFERED PERMIT (Standard Permit or Letter of permission)	B	
<input type="checkbox"/> PERMIT DENIAL	C	
<input type="checkbox"/> APPROVED JURISDICTIONAL DETERMINATION	D	
<input checked="" type="checkbox"/> PRELIMINARY JURISDICTIONAL DETERMINATION	E	

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at or <http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx> or the Corps regulations at 33 CFR Part 331.

**A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.**

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

**B: PROFFERED PERMIT: You may accept or appeal the permit**

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

**C: PERMIT DENIAL:** You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

**D: APPROVED JURISDICTIONAL DETERMINATION:** You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

**E: PRELIMINARY JURISDICTIONAL DETERMINATION:** You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

**SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT**



REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

**POINT OF CONTACT FOR QUESTIONS OR INFORMATION:**

If you have questions regarding this decision and/or the appeal process you may contact:

**District Engineer, Wilmington Regulatory Division  
Attn: Jason Randolph  
Asheville Regulatory Office  
U.S Army Corps of Engineers  
151 Patton Avenue, Room 208  
Asheville, North Carolina 28801  
704.510.1440**

If you only have questions regarding the appeal process you may also contact:

**Mr. Jason Steele, Administrative Appeal Review Officer  
CESAD-PDO  
U.S. Army Corps of Engineers, South Atlantic Division  
60 Forsyth Street, Room 10M15  
Atlanta, Georgia 30303-8801  
Phone: (404) 562-5137**

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

<hr/> Signature of appellant or agent.	Date:	Telephone number:
---	-------	-------------------

*For appeals on Initial Proffered Permits send this form to:*

**District Engineer, Wilmington Regulatory Division, Attn: Jason Randolph , 69 Darlington Avenue, Wilmington, North Carolina 28403**

*For Permit denials, Proffered Permits and Approved Jurisdictional Determinations send this form to:*

**Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801  
Phone: (404) 562-5137**

**PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM**

**BACKGROUND INFORMATION**

**A. REPORT COMPLETION DATE FOR PJD:** 5/23/2017

**B. NAME AND ADDRESS OF PERSON REQUESTING PJD:** Baucom Farm & Milling, Kyle, Herring, 6510 Morgan Mill Road, Monroe, NC, 28110

**C. DISTRICT OFFICE, FILE NAME, AND NUMBER:** Wilmington District, Deep Meadow Mitigation Site, SAW-2017-00241

**D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:** 1812 McIntyre Road northeast of Monroe and approximately 2.2 miles north of Wingate, Union County, North Carolina

**(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)**

State: North Carolina County: Union City: Wingate  
Center coordinates of site (lat/long in degree decimal format): Latitude: 35.023275 Longitude: -80.451156

Universal Transverse Mercator:

Name of nearest waterbody: Meadow Branch

**E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):**

Office (Desk) Determination. Date: 23 May 2017

Field Determination. Date(s):

**TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.**

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resources in review area (acreage and linear feet, if applicable)	Type of aquatic resources (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
1. Meadow Branch	35.023473	-80.451173	2,608 LF	non-wetland waters	404
2. East Fork 1	35.022505	-80.449903	1,241 LF	non-wetland waters	404
3. West Fork 1	35.020858	-80.451511	137 LF	non-wetland waters	404
4. West Fork 2	35.024268	-80.452312	398 LF	non-wetland waters	404
5. Wetland A	35.022021	-80.450718	0.30 acre	PSS wetland	404
6. Wetland B	35.025860	-80.452388	0.28 acre	PEM wetland	404

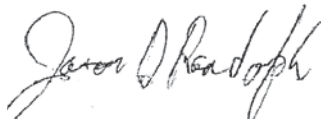
- 1) The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
  
- 2) In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre- construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there "*may be*" waters of the U.S. and/or that there "*may be*" navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

**SUPPORTING DATA. Data reviewed for PJD (check all that apply)**

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:  
Map: JD request package, dated 27 January 2017, from Wildlands Engineering
- Data sheets prepared/submitted by or on behalf of the PJD requestor: Dated 27 Oct 2016
  - Office concurs with data sheets/delineation report.
  - Office does not concur with data sheets/delineation report. Rationale: \_\_\_\_\_
- Data sheets prepared by the Corps: \_\_\_\_\_
- Corps navigable waters' study: \_\_\_\_\_
- U.S. Geological Survey Hydrologic Atlas: \_\_\_\_\_
- USGS NHD data.
- USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name: Watson Quad, Figure 2 in JD request package
- Natural Resources Conservation Service Soil Survey. Citation: Figure 4 in JD request package
- National wetlands inventory map(s). Cite name: \_\_\_\_\_
- State/local wetland inventory map(s): \_\_\_\_\_
- FEMA/FIRM maps: \_\_\_\_\_
- 100-year Floodplain Elevation is: \_\_\_\_\_ (National Geodetic Vertical Datum of 1929)
- Photographs:  Aerial (Name & Date): Figures 3 & 4 (2015) in JD request package  
or  Other (Name & Date): Several on-the-ground photos in delineation package
- Previous determination(s). File no. and date of response letter: \_\_\_\_\_
- Other information (please specify): \_\_\_\_\_

**IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.**



23 May 2017

Signature and date of Regulatory staff member completing PJD

Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)<sup>1</sup>

<sup>1</sup> Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP1 - Wetland A  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.022021 Long: W -80.450718 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology  significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____ Hydric Soil Present? Yes <input checked="" type="checkbox"/> No _____ Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No _____
Remarks: Sampling point located within a ditched field depression within an active row crop (corn). Small saplings are present but no mature trees are present because the area is actively maintained.	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1) <input checked="" type="checkbox"/> True Aquatic Plants (B14) ___ High Water Table (A2) ___ Hydrogen Sulfide Odor (C1) <input checked="" type="checkbox"/> Saturation (A3) ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1) ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2) ___ Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3) ___ Thin Muck Surface (C7) <input checked="" type="checkbox"/> Algal Mat or Crust (B4) ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> <input checked="" type="checkbox"/> Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) <input checked="" type="checkbox"/> Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
--	--

<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>-</u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>-</u> Saturation Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): <u>0-3</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP1 - Wetland A

<u>Tree Stratum</u> (Plot size: <u>30'</u> )	Absolute % Cover	Dominant Species?	Indicator Status	<b>Dominance Test worksheet:</b>
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: _____ (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
4. _____	_____	_____	_____	<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<u>Sapling/Shrub Stratum</u> (Plot size: <u>15'</u> )				
1. <u>Fraxinus pennsylvanica</u>	15	Yes	FACW	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
15 = Total Cover				
<u>Herb Stratum</u> (Plot size: <u>5'</u> )				
1. <u>Carex lurida</u>	30	Yes	OBL	
2. <u>Leersia oryzoides</u>	30	Yes	OBL	
3. <u>Myriophyllum aquaticum</u>	10	No	OBL	
4. <u>Vernonia noveboracensis</u>	5	No	FACW	
5. <u>Polygonum pensylvanicum</u>	5	No	FACW	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
80 = Total Cover				
<u>Woody Vine Stratum</u> (Plot size: <u>30'</u> )				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.)				<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
				<b>Hydrophytic Vegetation Indicators:</b> <input checked="" type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)
<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.				<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
				_____

**SOIL**

Sampling Point: DP1 - Wetland A

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-2	2.5Y 4/2	90	10YR 4/6	10	C	PL	silt loam	
2-8	2.5Y 5/2	65	5YR 4/6	35	C	PL	silt loam	
8-12	2.5Y 5/3	60	7.5YR 4/6	40	C	PL	silt loam	
12-14	2.5Y 6/2	65	10YR 5/8	35	C	PL	silt loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10) **(LRR N)**
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)

- Dark Surface (S7)
- Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- Thin Dark Surface (S9) **(MLRA 147, 148)**
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- Umbric Surface (F13) **(MLRA 136, 122)**
- Piedmont Floodplain Soils (F19) **(MLRA 148)**

**Indicators for Problematic Hydric Soils<sup>3</sup>:**

- 2 cm Muck (A10) **(MLRA 147)**
- Coast Prairie Redox (A16) **(MLRA 147, 148)**
- Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: \_\_\_\_\_  
 Depth (inches): \_\_\_\_\_

Hydric Soil Present?    Yes     No

Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP2 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.022015 Long: W -80.45051 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located within an active row crop field (corn).	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3)      ___ Thin Muck Surface (C7) <input checked="" type="checkbox"/> Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	



**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP2 - Upland

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across All Strata: _____ (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15'</u> )				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
_____ = Total Cover				
<b>Herb Stratum</b> (Plot size: <u>5'</u> )				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Zea mays</u>	90	Yes	NI	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
90 _____ = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: <u>30'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
Hydrophytic Vegetation Present?      Yes _____      No <input checked="" type="checkbox"/>				
Remarks: (Include photo numbers here or on a separate sheet.) The sampling location is entirely planted in corn which doesn't have an indicator (No indicator, NI).				

**SOIL**

Sampling Point: DP2 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-3	10YR 5/3	85	7.5YR 4/6	15	C	PL	loam	
3-14	10YR 5/4	90	7.5YR 4/6	10	C	PL	loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

<b>Hydric Soil Indicators:</b>		<b>Indicators for Problematic Hydric Soils<sup>3</sup>:</b>	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16) (MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136, 147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (TF2)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped Matrix (S6)			

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if observed):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes _____    No <input checked="" type="checkbox"/>
---	---

Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP3 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.022216 Long: W -80.450763 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located within an active row crop field (corn).	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3)      ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	

**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP3 - Upland

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across All Strata: _____ (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15'</u> )				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
_____ = Total Cover				
<b>Herb Stratum</b> (Plot size: <u>5'</u> )				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)
1. <u>Zea mays</u>	20	Yes	NI	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
_____ = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: <u>30'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
<b>Hydrophytic Vegetation Present?</b> Yes _____ No <input checked="" type="checkbox"/>				

Remarks: (Include photo numbers here or on a separate sheet.)

The sampling location is planted in corn which doesn't have an indicator (No indicator, NI).

**SOIL**

Sampling Point: DP3 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-4	10YR 5/4	85	7.5YR 4/6	15	C	PL	loam	
4-14	10YR 5/4	80	5YR 4/6	20	C	PL	loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:	Indicators for Problematic Hydric Soils <sup>3</sup> :
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Coast Prairie Redox (A16)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> (MLRA 147, 148)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Piedmont Floodplain Soils (F19)
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> (MLRA 136, 147)
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Red Parent Material (TF2)
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	
<input type="checkbox"/> Sandy Redox (S5)	
<input type="checkbox"/> Stripped Matrix (S6)	
<input type="checkbox"/> Dark Surface (S7)	
<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	
<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	
<input type="checkbox"/> Loamy Gleyed Matrix (F2)	
<input type="checkbox"/> Depleted Matrix (F3)	
<input type="checkbox"/> Redox Dark Surface (F6)	
<input type="checkbox"/> Depleted Dark Surface (F7)	
<input type="checkbox"/> Redox Depressions (F8)	
<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)	
<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)	
<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)	

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if observed):</b> Type: _____ Depth (inches): _____	Hydric Soil Present?    Yes _____    No <input checked="" type="checkbox"/>
---	---

Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP4 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.022869 Long: W -80.450869 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located within an active row crop field (corn).	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3)      ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	



**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP4 - Upland

	Absolute % Cover	Dominant Species?	Indicator Status	
<u>Tree Stratum</u> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b>
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: _____ (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
4. _____	_____	_____	_____	<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<u>Sapling/Shrub Stratum</u> (Plot size: <u>15'</u> )				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
<u>Herb Stratum</u> (Plot size: <u>5'</u> )				<b>Hydrophytic Vegetation Indicators:</b> ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 <sup>1</sup> ___ 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Zea mays</u>	60	Yes	NI	
2. <u>Festuca sp.</u>	20	Yes	Unknown	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
80 = Total Cover				
<u>Woody Vine Stratum</u> (Plot size: <u>30'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
<b>Hydrophytic Vegetation Present?</b> Yes _____ No <input checked="" type="checkbox"/>				

Remarks: (Include photo numbers here or on a separate sheet.)

The sampling location planted in corn which doesn't have an indicator (No indicator, NI). An unknown fescue grass is also present but unable to identify.

**SOIL**

Sampling Point: DP4 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-8	10YR 5/4						loam	
8-14	10YR 5/4	90	7.5YR 4/6	10	C	PL	loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils <sup>3</sup> :	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16) (MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136, 147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (TF2)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped Matrix (S6)			

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if observed):</b> Type: _____ Depth (inches): _____	Hydric Soil Present?    Yes _____    No <input checked="" type="checkbox"/>
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Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP5 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.024392 Long: W -80.451494 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located within an active row crop field (corn).	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3)      ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	

**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP5 - Upland

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across All Strata: _____ (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15'</u> )				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
<b>Herb Stratum</b> (Plot size: <u>5'</u> )				<b>Hydrophytic Vegetation Indicators:</b> ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 <sup>1</sup> ___ 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Zea mays</u>	40	Yes	NI	
2. <u>Festuca sp.</u>	25	Yes	Unknown	
3. <u>Commelina communis</u>	10	No	FAC	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
75 = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: <u>30'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.)  The sampling location planted in corn which doesn't have an indicator (No indicator, NI). The other dominant herbaceous species is an unknown fescue that isn't identifiable.				<b>Hydrophytic Vegetation Present?</b> Yes _____ No <input checked="" type="checkbox"/>



**SOIL**

Sampling Point: DP5 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-5	10YR 4/4						loam	
5-14	2.5Y 6/3	85	7.5YR 4/6	15	C	PL	loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10) **(LRR N)**
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)

- Dark Surface (S7)
- Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- Thin Dark Surface (S9) **(MLRA 147, 148)**
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- Umbric Surface (F13) **(MLRA 136, 122)**
- Piedmont Floodplain Soils (F19) **(MLRA 148)**

**Indicators for Problematic Hydric Soils<sup>3</sup>:**

- 2 cm Muck (A10) **(MLRA 147)**
- Coast Prairie Redox (A16) **(MLRA 147, 148)**
- Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: \_\_\_\_\_  
 Depth (inches): \_\_\_\_\_

Hydric Soil Present?    Yes \_\_\_\_\_    No

Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP6 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.023430 Long: W -80.451569 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located within a small depression in an active row crop field (corn). The depression isn't planted in corn.	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3)      ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  -  </u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	

**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP6 - Upland

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across All Strata: _____ (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15'</u> )				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
<b>Herb Stratum</b> (Plot size: <u>5'</u> )				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)
1. <u>Dactyloctenium Willd.</u>	<u>70</u>	<u>Yes</u>	<u>NI</u>	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
_____ = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: <u>30'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.)				<b>Hydrophytic Vegetation Present?</b> Yes _____ No <input checked="" type="checkbox"/>
The only vegetation present is crowsfoot grass ( <i>Dactyloctenium Willd.</i> ) that doesn't have an indicator status (NI).				

**SOIL**

Sampling Point: DP6 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-3	10YR 6/3						loam	
3-14	10YR 6/4	85	7.5YR 4/6	15	C	PL	loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

<b>Hydric Soil Indicators:</b>		<b>Indicators for Problematic Hydric Soils<sup>3</sup>:</b>	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16) (MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136, 147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (TF2)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped Matrix (S6)			

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if observed):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes _____    No <input checked="" type="checkbox"/>
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Remarks:



**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP7 - Wetland B  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.025860 Long: W -80.452388 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology  significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____ Hydric Soil Present? Yes <input checked="" type="checkbox"/> No _____ Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No _____
Remarks: Sampling point located within a ditched field depression in an active row crop (corn).	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1) <input checked="" type="checkbox"/> True Aquatic Plants (B14) <input checked="" type="checkbox"/> High Water Table (A2) ___ Hydrogen Sulfide Odor (C1) <input checked="" type="checkbox"/> Saturation (A3) ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1) ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2) ___ Recent Iron Reduction in Tilled Soils (C6) ___ Drift Deposits (B3) ___ Thin Muck Surface (C7) <input checked="" type="checkbox"/> Algal Mat or Crust (B4) ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) <input checked="" type="checkbox"/> Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>0</u> Water Table Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): <u>12</u> Saturation Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): <u>0-14</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	

**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP7 - Wetland B

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b>
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: _____ (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
4. _____	_____	_____	_____	<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15'</u> )				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
<b>Herb Stratum</b> (Plot size: <u>5'</u> )				<b>Hydrophytic Vegetation Indicators:</b> <input checked="" type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Leersia oryzoides</u>	15	Yes	OBL	
2. <u>Polygonum pensylvanicum</u>	10	Yes	FACW	
3. <u>Myriophyllum aquaticum</u>	10	Yes	OBL	
4. <u>Sagittaria sp.</u>	5	No	OBL	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
40 = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: <u>30'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.)				
<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				

**SOIL**

Sampling Point: DP7 - Wetland B

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-6	2.5Y 4/2						silt loam	
6-10	2.5Y 5/2	70	10YR 5/8	30	C	PL	silt loam	
10-14	2.5Y 5/2	50	10YR 5/8	50	C	PL	silt loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

<b>Hydric Soil Indicators:</b>		<b>Indicators for Problematic Hydric Soils<sup>3</sup>:</b>	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> (MLRA 147, 148)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Piedmont Floodplain Soils (F19)	
<input type="checkbox"/> Stratified Layers (A5)	<input checked="" type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> (MLRA 136, 147)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Red Parent Material (TF2)	
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped Matrix (S6)			

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if observed):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present?</b> Yes <input checked="" type="checkbox"/> No _____
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Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP8 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.025717 Long: W -80.452222 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation , Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No   
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located within an active row crop field (corn).	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) ___ Drift Deposits (B3)      ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>-</u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>-</u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>-</u> (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	



**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP8 - Upland

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30'</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)  Total Number of Dominant Species Across All Strata: _____ (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
1. _____	_____	_____	_____	<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				<b>Hydrophytic Vegetation Indicators:</b> ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 <sup>1</sup> ___ 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15'</u> )				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
<b>Herb Stratum</b> (Plot size: <u>5'</u> )				<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.   <b>Hydrophytic Vegetation Present?</b> Yes _____ No <input checked="" type="checkbox"/>
1. <u>Zea mays</u>	100	Yes	NI	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
_____ = Total Cover				
<b>Woody Vine Stratum</b> (Plot size: <u>30'</u> )				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.) The sampling location is entirely planted in corn which doesn't have an indicator (No indicator, NI).				

**SOIL**

Sampling Point: DP8 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-8	10YR 4/3	100					loam	
8-14	10YR 6/4	100					loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators:**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10) (**LRR N**)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1) (**LRR N, MLRA 147, 148**)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)

- Dark Surface (S7)
- Polyvalue Below Surface (S8) (**MLRA 147, 148**)
- Thin Dark Surface (S9) (**MLRA 147, 148**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12) (**LRR N, MLRA 136**)
- Umbric Surface (F13) (**MLRA 136, 122**)
- Piedmont Floodplain Soils (F19) (**MLRA 148**)

**Indicators for Problematic Hydric Soils<sup>3</sup>:**

- 2 cm Muck (A10) (**MLRA 147**)
- Coast Prairie Redox (A16) (**MLRA 147, 148**)
- Piedmont Floodplain Soils (F19) (**MLRA 136, 147**)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if observed):**

Type: \_\_\_\_\_  
Depth (inches): \_\_\_\_\_

Hydric Soil Present? Yes \_\_\_\_\_ No

Remarks:

**WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont**

Project/Site: Deep Meadow Mitigation Site City/County: Union Sampling Date: 10/27/16  
 Applicant/Owner: Wildlands Engineering State: NC Sampling Point: DP9 - Upland  
 Investigator(s): Ian Eckardt Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): 0  
 Subregion (LRR or MLRA): LRR P Lat: N 35.026538 Long: W -80.452565 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Chewacla silt loam (ChA) NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes  No \_\_\_\_\_  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____ Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: Sampling point located on the northern edge of an active row crop field (corn). The sampling location isn't farmed but is an edge area dominated by native saplings and herbaceous vegetation.	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1)      ___ True Aquatic Plants (B14) ___ High Water Table (A2)      ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3)      ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1)      ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2)      ___ Recent Iron Reduction in Tilled Soils (C6) ___ Drift Deposits (B3)      ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4)      ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  </u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  </u> Saturation Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>  </u> (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION (Four Strata) – Use scientific names of plants.**

Sampling Point: DP9 - Upland

<u>Tree Stratum</u> (Plot size: <u>30'</u> )	Absolute % Cover	Dominant Species?	Indicator Status	<b>Dominance Test worksheet:</b>
1. _____	_____	_____	_____	Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>4</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>75</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
_____ = Total Cover				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
<u>Sapling/Shrub Stratum</u> (Plot size: <u>15'</u> )	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Fraxinus pennsylvanica</u>	<u>5</u>	<u>Yes</u>	<u>FACW</u>	
2. <u>Liquidambar styraciflua</u>	<u>5</u>	<u>Yes</u>	<u>FAC</u>	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
<u>Herb Stratum</u> (Plot size: <u>5'</u> )	Absolute % Cover	Dominant Species?	Indicator Status	<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% <input type="checkbox"/> 3 - Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)
1. <u>Solidago sp.</u>	<u>40</u>	<u>Yes</u>	<u>NI</u>	
2. <u>Leersia oryzoides</u>	<u>30</u>	<u>Yes</u>	<u>OBL</u>	
3. <u>Polygonum pensylvanicum</u>	<u>10</u>	<u>No</u>	<u>FACW</u>	
4. <u>Polygonum sagittatum</u>	<u>5</u>	<u>No</u>	<u>OBL</u>	
5. <u>Vernonia noveboracensis</u>	<u>5</u>	<u>No</u>	<u>FACW</u>	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
11. _____	_____	_____	_____	
12. _____	_____	_____	_____	
_____ = Total Cover				
<u>Woody Vine Stratum</u> (Plot size: <u>30'</u> )	Absolute % Cover	Dominant Species?	Indicator Status	<b>Definitions of Four Vegetation Strata:</b>  <b>Tree</b> – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/Shrub</b> – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vine</b> – All woody vines greater than 3.28 ft in height.
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
_____ = Total Cover				
<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>				

Remarks: (Include photo numbers here or on a separate sheet.)

The sampling location is dominated by herbaceous ground cover with a few saplings present. The dominant herbaceous species is a goldenrod which can't be identified down to the species level to assign a indicator status and is therefore give a NI status.



**SOIL**

Sampling Point: DP9 - Upland

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-5	10YR 5/3	95	7.5YR 5/6	5	C	PL	loam	
5-14	10YR 6/3	80	7.5YR 5/6	20	C	PL	loam	

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

<b>Hydric Soil Indicators:</b>		<b>Indicators for Problematic Hydric Soils<sup>3</sup>:</b>	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16) (MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136, 147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (TF2)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped Matrix (S6)			

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

<b>Restrictive Layer (if observed):</b> Type: _____ Depth (inches): _____	Hydric Soil Present?    Yes _____    No <input checked="" type="checkbox"/>
---	---

Remarks:

APPENDIX 3  
DWR STREAM IDENTIFICATION FORMS

## Appendix 3 DWR Stream Identification Forms

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The results of the DWR Stream Identification Forms are listed in the table below. DWR forms can be found in this appendix and in the digital submission to DMS. DWR forms were completed by Wildlands for all project streams.

**Table 1: DWR Form Summary – Deep Meadow Mitigation Site**

Stream	Geomorphology Score	Hydrology Score	Biology Score	Total Score
Meadow Branch (SCP 1)	21	10	9.5	40.5
East Fork 1 (SCP2)	16	8.5	11	35.5
West Fork 2 (SCP 3)	15	8.5	7.5	31
West Fork 1 (SCP 4)	15	8.5	9.5	33

NC DWQ Stream Identification Form Version 4.11

Date: 3/2/16	Project/Site: Deep Meadow	Latitude: 35.022942°N
Evaluator: IE	County: Union	Longitude: -80.451216°W
Total Points: Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 40.5	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other Meadow Branch (SCP 1) e.g. Quad Name:

A. Geomorphology (Subtotal = 21)

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)

12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9.5)

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

\*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 2-29-16	Project/Site: Deep Meadow	Latitude: 35.022457°N
Evaluator: IE	County: Union	Longitude: -80.450462°W
Total Points: Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 35.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other East Fork 1 (SCP 2)

A. Geomorphology (Subtotal = 16)

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5)

12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 11)

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks left hand snail (1) very ill	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians eggs	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

\*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

midges  
riffle  
penny  
leech



### NC DWQ Stream Identification Form Version 4.11

Date: 2-29-16	Project/Site: Deep Meadow	Latitude: 35.024265°N
Evaluator: IE	County: Union	Longitude: -80.452486°W
<b>Total Points:</b> Stream is at least intermittent if $\geq 19$ or perennial if $\geq 30$ *	Stream Determination (circle one) Ephemeral Intermittent <b>Perennial</b>	Other West Fork 2 - SCP3 e.g. Quad Name:

**A. Geomorphology (Subtotal = 15)**

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

**B. Hydrology (Subtotal = 8.5)**

12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

**C. Biology (Subtotal = 7.5)**

18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macroinvertebrates (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 (Other = 0)			

\*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 2-29-16	Project/Site: Deep Meadow	Latitude: 35.020481°N
Evaluator: TE	County: Union	Longitude: -80.451683°W
Total Points: Stream is at least intermittent if ≥ 19 or perennial if ≥ 30* 33	Stream Determination (circle one) Ephemeral Intermittent <b>Perennial</b>	Other West Fork 1 - SCP 4 e.g. Quad Name:

A. Geomorphology (Subtotal = 15 )

	Absent	Weak	Moderate	Strong
1 <sup>a</sup> . Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = 3	

<sup>a</sup> artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8.5 )

12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9.5 )

18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macroinvertebrates (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	0	(0.5)	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	0	(0.5)	1	1.5
25. Algae	0	(0.5)	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

\*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

APPENDIX 4  
DATA, ANALYSIS, SUPPLEMENTARY INFORMATION, FIGURES AND MAPS

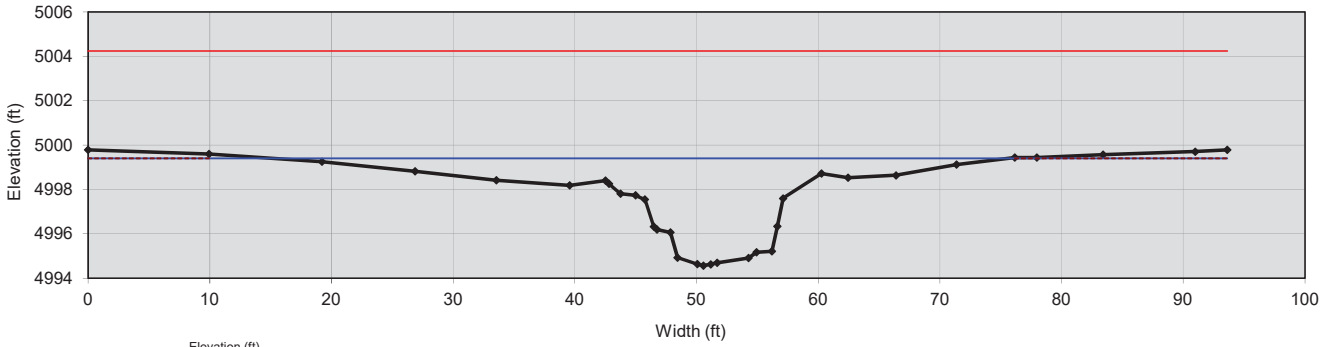
Existing Conditions Geomorphic Parameters						
Parameter	Notation	Units	Meadow Branch		East Fork	
			min	max	min	max
stream type			Cb		Straightened E4	
drainage area	DA	sq mi	7		0.35	
bankfull cross-sectional area	$A_{b\text{bkf}}$	SF	76.1	90.7	9.1	10.7
avg velocity during bankfull event	$v_{b\text{bkf}}$	fps	2.9	3.4	2.8	3.3
width at bankfull	$w_{b\text{bkf}}$	feet	52.4	66.7	7.6	9.7
maximum depth at bankfull	$d_{\text{max}}$	feet	4.1	5.1	1.6	
mean depth at bankfull	$d_{b\text{bkf}}$	feet	1.4	1.5	1.1	1.2
bankfull width to depth ratio	$w_{b\text{bkf}}/d_{b\text{bkf}}$		36.1	49.1	6.4	8.8
low bank height		feet	4.1	5.1	1.8	2.2
bank height ratio	BHR		1.0		1.1	1.4
floodprone area width	$w_{f\text{pa}}$	feet	360.0	390.0	29.0	>39
entrenchment ratio	ER		>6.0		3.8	>4.0
max pool depth at bankfull	$d_{\text{pool}}$	feet	N/A		2.2	
pool depth ratio	$d_{\text{pool}}/d_{b\text{bkf}}$		N/A		1.9	
pool width at bankfull	$w_{\text{pool}}$	feet	N/A		8.6	
pool width ratio	$w_{\text{pool}}/w_{b\text{bkf}}$		N/A		1.0	
Bkf pool cross-sectional area	$A_{\text{pool}}$	SF	N/A		13.3	
pool area ratio	$A_{\text{pool}}/A_{b\text{bkf}}$		N/A		1.3	
pool-pool pacing	p-p	feet	N/A		42	81
pool-pool spacing ratio	$p\text{-}p/w_{b\text{bkf}}$		N/A		4.9	9.3
valley slope	$S_{\text{valley}}$	feet/foot	0.0023		0.0094	
channel slope	$S_{\text{channel}}$	feet/foot	0.0022		0.0078	
sinuosity	K		1.15		1.06	
belt width	$w_{b\text{lt}}$	feet	N/A		N/A	
meander width ratio	$w_{b\text{lt}}/w_{b\text{bkf}}$		N/A		N/A	
meander length	$L_m$	feet	450.0		N/A	
meander length ratio	$L_m/w_{b\text{bkf}}$		7.6		N/A	
linear wavelength	LW		302.0		N/A	
linear wavelength ratio	$LW/w_{b\text{bkf}}$		5.1		N/A	
radius of curvature	$R_c$	feet	32.0	83.0	N/A	
radius of curvature ratio	$R_c/w_{b\text{bkf}}$		0.5	1.4	N/A	

Existing Conditions Geomorphic Parameters						
Parameter	Notation	Units	West Fork 1		West Fork 2	
			min	max	min	max
stream type			G		E6	
drainage area	DA	sq mi	0.09		0.20	
bankfull cross-sectional area	$A_{b\text{bkf}}$	SF	4.7		5	5.2
avg velocity during bankfull event	$v_{b\text{bkf}}$	fps	2.1		3.8	4
width at bankfull	$w_{b\text{bkf}}$	feet	5.1		5.5	6.7
maximum depth at bankfull	$d_{\text{max}}$	feet	1.1		1.1	
mean depth at bankfull	$d_{b\text{bkf}}$	feet	0.9		0.8	0.9
bankfull width to depth ratio	$w_{b\text{bkf}}/d_{b\text{bkf}}$		5.5		6.2	8.8
low bank height		feet	2.6		1.4	1.6
bank height ratio	BHR		2.5		1.3	1.5
floodprone area width	$w_{f\text{pa}}$	feet	6.0		>82	
entrenchment ratio	ER		1.2		12.1	
max pool depth at bankfull	$d_{\text{pool}}$	feet	N/A		N/A	
pool depth ratio	$d_{\text{pool}}/d_{b\text{bkf}}$		N/A		N/A	
pool width at bankfull	$w_{\text{pool}}$	feet	N/A		N/A	
pool width ratio	$w_{\text{pool}}/w_{b\text{bkf}}$		N/A		N/A	
Bkf pool cross-sectional area	$A_{\text{pool}}$	SF	N/A		N/A	
pool area ratio	$A_{\text{pool}}/A_{b\text{bkf}}$		N/A		N/A	
pool-pool pacing	p-p	feet	N/A		34	53
pool-pool spacing ratio	$p\text{-}p/w_{b\text{bkf}}$		N/A		5.6	8.6
valley slope	$S_{\text{valley}}$	feet/foot	0.0166		0.0107	
channel slope	$S_{\text{channel}}$	feet/foot	0.0278		0.0064	
sinuosity	K		1.07		1.10	
belt width	$w_{b\text{lt}}$	feet	N/A		N/A	
meander width ratio	$w_{b\text{lt}}/w_{b\text{bkf}}$		N/A		N/A	
meander length	$L_m$	feet	N/A		N/A	
meander length ratio	$L_m/w_{b\text{bkf}}$		N/A		N/A	
linear wavelength	LW		N/A		N/A	
linear wavelength ratio	$LW/w_{b\text{bkf}}$		N/A		N/A	
radius of curvature	$R_c$	feet	N/A		N/A	
radius of curvature ratio	$R_c/w_{b\text{bkf}}$		N/A		N/A	



Cross Section 7

Meadow Branch, riffle



Bankfull Dimensions	
82.0	x-section area (ft.sq.)
60.4	width (ft)
1.4	mean depth (ft)
4.8	max depth (ft)
64.0	wetted perimeter (ft)
1.3	hydraulic radius (ft)
44.5	width-depth ratio

Flood Dimensions	
93.6	W flood prone area (ft)
1.5	entrenchment ratio
4.8	low bank height (ft)
1.0	low bank height ratio

Materials	
---	D50 (mm)
---	D84 (mm)
8	threshold grain size (mm):

Rosgen Stream Type	
---	Missing: , , Sinuosity, D50, slope

Bankfull Flow	
2.2	velocity (ft/s)
183.5	discharge rate (cfs)
0.35	Froude number

Flow Resistance	
0.035	Manning's roughness
0.13	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power	
0.199	channel slope (%)
0.16	shear stress (lb/sq.ft.)
0.29	shear velocity (ft/s)
0.38	unit strm power (lb/ft/s)

Cross Section

reference ID

longitudinal station

alignment

feature

Bankfull Stage

elevation

Low Bank Height

elevation

Flood Prone Area

width fpa

Channel Slope

percent slope

Flow Resistance

Manning's "n"

D'Arcy - Weisbach "f"

For Stream Type:

Is braided channel?

Sinuosity, k

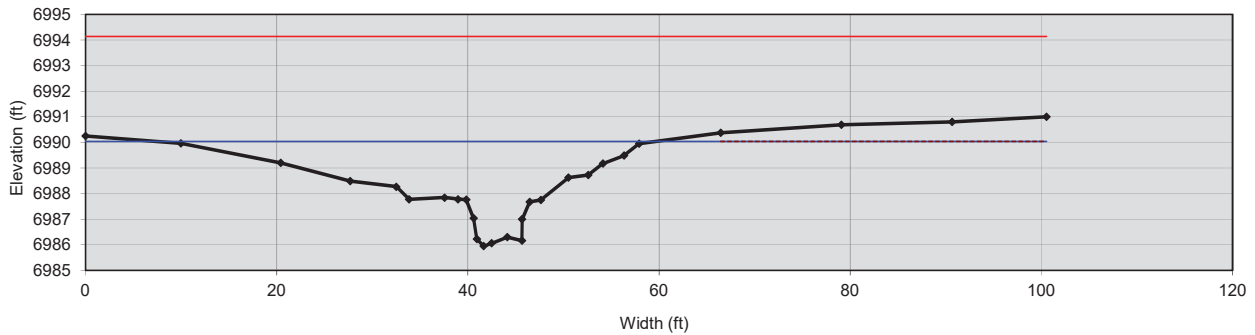
D<sub>50</sub>

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0	4999.782	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		9.95	4999.595	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		19.23	4999.245	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		26.88	4998.814	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		33.55	4998.418	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		39.58	4998.183	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		42.53	4998.398	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		42.8	4998.255	<input type="checkbox"/>	(MB XS7 R LTB)MB XS7 R LTB
		43.76	4997.805	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		45	4997.736	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		45.77	4997.545	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		46.49	4996.327	<input type="checkbox"/>	(MB XS7 R LEW)MB XS7 R LEW
		46.75	4996.191	<input type="checkbox"/>	(MB XS7 R LCH)MB XS7 R LCH
		47.85	4996.065	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		48.43	4994.929	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		50.08	4994.636	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		50.57	4994.562	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		51.18	4994.626	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		51.69	4994.695	<input type="checkbox"/>	(MB XS7 R TWG)MB XS7 R TWG
		54.28	4994.905	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		54.93	4995.166	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		56.2	4995.214	<input type="checkbox"/>	(MB XS7 R RCH)MB XS7 R RCH
		56.65	4996.338	<input type="checkbox"/>	(MB XS7 R REW)MB XS7 R REW
		57.12	4997.598	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		60.26	4998.71	<input type="checkbox"/>	(MB XS7 R RTB)MB XS7 R RTB
		62.45	4998.523	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		66.39	4998.637	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		71.37	4999.118	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		76.15	4999.441	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		77.96	4999.44	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		83.42	4999.571	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		90.98	4999.702	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
		93.62	4999.782	<input type="checkbox"/>	(MB XS7 R)MB XS7 R
				<input type="checkbox"/>	

Cross Section 8

Meadow Branch, riffle



Bankfull Dimensions

76.1	x-section area (ft.sq.)
52.4	width (ft)
1.5	mean depth (ft)
4.1	max depth (ft)
54.9	wetted perimeter (ft)
1.4	hydraulic radius (ft)
36.1	width-depth ratio

Flood Dimensions

100.5	W flood prone area (ft)
1.9	entrenchment ratio
4.1	low bank height (ft)
1.0	low bank height ratio

Materials

---	D50 (mm)
---	D84 (mm)
8	threshold grain size (mm):

Rosgen Stream Type

--- Missing: , , Sinuosity, D50, slope

Bankfull Flow

2.4	velocity (ft/s)
179.9	discharge rate (cfs)
0.35	Froude number

Flow Resistance

0.035	Manning's roughness
0.13	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.199	channel slope (%)
0.17	shear stress (lb/sq.ft.)
0.30	shear velocity (ft/s)
0.43	unit strm power (lb/ft/s)

Cross Section

reference ID   
 longitudinal station   
 alignment   
 feature

Bankfull Stage

elevation  --- 6990.035

Low Bank Height

elevation

Flood Prone Area

width fpa  100.5

Channel Slope

percent slope

Flow Resistance

Manning's "n"  ---  
 D'Arcy - Weisbach "f"

For Stream Type:

Is braided channel?   
 Sinuosity, k   
 D<sub>50</sub>

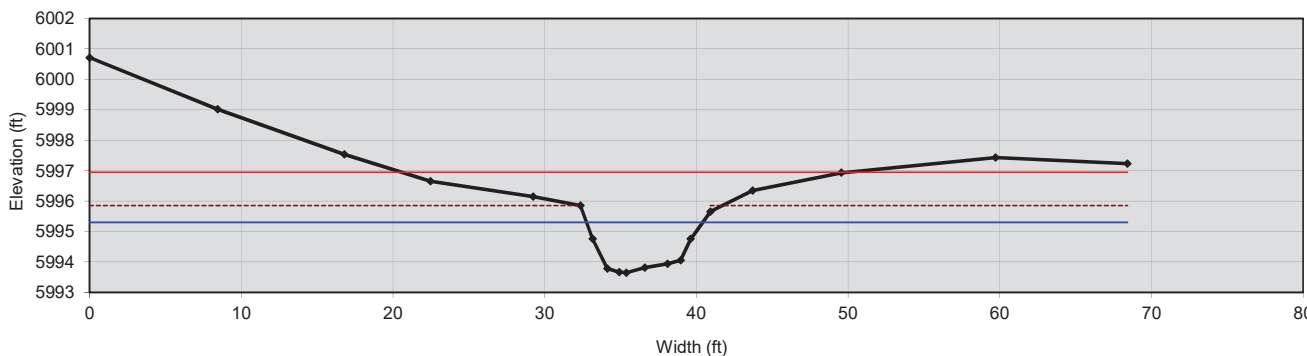
Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0	6990.252	<input type="checkbox"/>	(MB XS8 R)MB XS8 R
		9.98	6989.961	<input type="checkbox"/>	(XS8)XS8
		20.41	6989.202	<input type="checkbox"/>	(XS8)XS8
		27.69	6988.487	<input type="checkbox"/>	(XS8)XS8
		32.51	6988.268	<input type="checkbox"/>	(XS8)XS8
		33.86	6987.771	<input type="checkbox"/>	(XS8)XS8
		37.55	6987.843	<input type="checkbox"/>	(XS8)XS8
		38.98	6987.78	<input type="checkbox"/>	(XS8)XS8
		39.82	6987.761	<input type="checkbox"/>	(XS8 LTB)XS8 LTB
		40.6	6987.035	<input type="checkbox"/>	(XS8 LEW)XS8 LEW
		40.94	6986.231	<input type="checkbox"/>	(XS8 LCH)XS8 LCH
		41.63	6985.946	<input type="checkbox"/>	(XS8)XS8
		42.49	6986.058	<input type="checkbox"/>	(XS8 TWG)XS8 TWG
		44.12	6986.299	<input type="checkbox"/>	(XS8)XS8
		45.65	6986.161	<input type="checkbox"/>	(XS8 RCH)XS8 RCH
		45.67	6986.999	<input type="checkbox"/>	(XS8 REW)XS8 REW
		46.46	6987.67	<input type="checkbox"/>	(XS8)XS8
		47.63	6987.747	<input type="checkbox"/>	(XS8)XS8
		50.52	6988.627	<input type="checkbox"/>	(XS8)XS8
		52.58	6988.722	<input type="checkbox"/>	(XS8)XS8
		54.12	6989.178	<input type="checkbox"/>	(XS8 RTB)XS8 RTB
		56.34	6989.486	<input type="checkbox"/>	(XS8)XS8
		57.91	6989.951	<input type="checkbox"/>	(XS8)XS8
		66.46	6990.375	<input type="checkbox"/>	(XS8)XS8
		79.07	6990.683	<input type="checkbox"/>	(XS8)XS8
		90.65	6990.794	<input type="checkbox"/>	(XS8)XS8
		100.53	6990.995	<input type="checkbox"/>	(XS8)XS8
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	



Cross Section 1

East Fork 1, riffle



9.1	x-section area (ft.sq.)
7.6	width (ft)
1.2	mean depth (ft)
1.6	max depth (ft)
8.8	wetted perimeter (ft)
1.0	hydraulic radius (ft)
6.4	width-depth ratio

29.3	W flood prone area (ft)
3.8	entrenchment ratio
2.2	low bank height (ft)
1.3	low bank height ratio

---	D50 (mm)
---	D84 (mm)
32	threshold grain size (mm):

Rosgen Stream Type  
 --- Missing: , , Sinuosity, D50,

4.4	velocity (ft/s)
39.5	discharge rate (cfs)
0.76	Froude number

0.035	Manning's roughness
0.14	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

1.01	channel slope (%)
0.65	shear stress (lb/sq.ft.)
0.58	shear velocity (ft/s)
3.3	unit strm power (lb/ft/s)

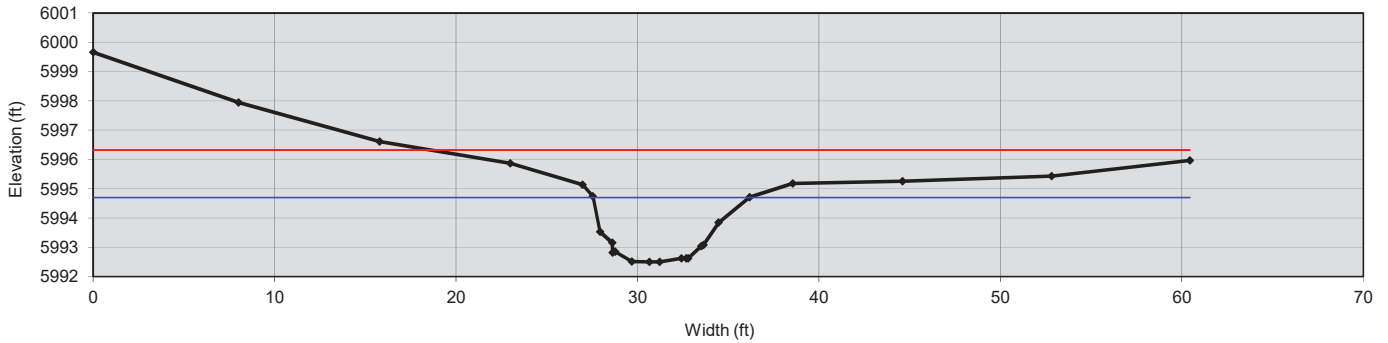
Cross Section	
reference ID	1
longitudinal station	---
alignment	straight line
feature	
Bankfull Stage	
elevation	5995.3
Low Bank Height	
elevation	5995.854
Flood Prone Area	
width fpa	29.3
Channel Slope	
percent slope	1.01
Flow Resistance	
Manning's "n"	0.035
D'Arcy - Weisbach "f"	
For Stream Type:	
Is braided channel?	<input type="checkbox"/>
Sinuosity, k	
D <sub>50</sub>	

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0	6000.713	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		8.44	5999.014	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1
		16.79	5997.538	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1
		22.47	5996.652	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		29.24	5996.152	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		32.37	5995.854	<input type="checkbox"/>	(UT1 XS1 R LTB)UT1 XS1 R L
		33.17	5994.758	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		34.13	5993.788	<input type="checkbox"/>	(UT1 XS1 R LCH)UT1 XS1 R L
		34.92	5993.668	<input type="checkbox"/>	(UT1 XS1 R TWG)UT1 XS1 R T
		35.39	5993.652	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		36.6	5993.815	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		38.1	5993.937	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		38.97	5994.061	<input type="checkbox"/>	(UT1 XS1 R RCH)UT1 XS1 R F
		39.63	5994.761	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		40.92	5995.651	<input type="checkbox"/>	(UT1 XS1 R RTB)UT1 XS1 R R
		43.72	5996.352	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		49.55	5996.932	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		59.73	5997.427	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R
		68.41	5997.23	<input type="checkbox"/>	(UT1 XS1 R)UT1 XS1 R

Note:

Cross Section 2

East Fork 1, pool



Bankfull Dimensions	
13.3	x-section area (ft.sq.)
8.6	width (ft)
1.5	mean depth (ft)
2.2	max depth (ft)
10.6	wetted perimeter (ft)
1.3	hydraulic radius (ft)
5.6	width-depth ratio

Flood Dimensions	
---	W flood prone area (ft)
---	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials	
---	D50 (mm)
---	D84 (mm)
39	threshold grain size (mm):

Rosgen Stream Type

---

Bankfull Flow	
5.0	velocity (ft/s)
66.3	discharge rate (cfs)
0.78	Froude number

Flow Resistance	
0.035	Manning's roughness
0.13	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power	
1.01	channel slope (%)
0.79	shear stress (lb/sq.ft.)
0.64	shear velocity (ft/s)
4.9	unit strm power (lb/ft/s)

Cross Section

reference ID

longitudinal station

alignment

feature

Bankfull Stage

elevation

1.540

Low Bank Height

elevation

Flood Prone Area

width fpa

Channel Slope

percent slope

Flow Resistance

Manning's "n"

D'Arcy - Weisbach "f"

For Stream Type:

Is braided channel?

Sinuosity, k

D<sub>50</sub>

Note:

easting (ft)	northing (ft)	Distance (ft)	Elevation (ft)	Omit Bkf	Notes
		0	5999.657	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		8.02	5997.946	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		15.79	5996.612	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		22.99	5995.871	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		26.98	5995.136	<input type="checkbox"/>	(UT1 XS2 P LTB)UT1 XS2 P LTB
		27.54	5994.741	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		27.94	5993.53	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		28.61	5993.16	<input type="checkbox"/>	(UT1 XS2 P LEW)UT1 XS2 P LEW
		28.63	5992.819	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		28.77	5992.85	<input type="checkbox"/>	(UT1 XS2 P LCH)UT1 XS2 P LCH
		29.69	5992.509	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		30.65	5992.502	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		31.23	5992.499	<input type="checkbox"/>	(UT1 XS2 P TWG)UT1 XS2 P TWG
		32.42	5992.625	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		32.69	5992.62	<input type="checkbox"/>	(UT1 XS2 P RCH)UT1 XS2 P RCH
		32.8	5992.62	<input type="checkbox"/>	(UT1 XS2 P RCH)UT1 XS2 P RCH
		33.52	5993.04	<input type="checkbox"/>	(UT1 XS2 P REW)UT1 XS2 P REW
		33.64	5993.081	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		34.47	5993.844	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		36.17	5994.704	<input type="checkbox"/>	(UT1 XS2 P RTB)UT1 XS2 P RTB
		38.56	5995.18	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		44.6	5995.256	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		52.83	5995.43	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
		60.44	5995.961	<input type="checkbox"/>	(UT1 XS2 P)UT1 XS2 P
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				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	
				<input type="checkbox"/>	











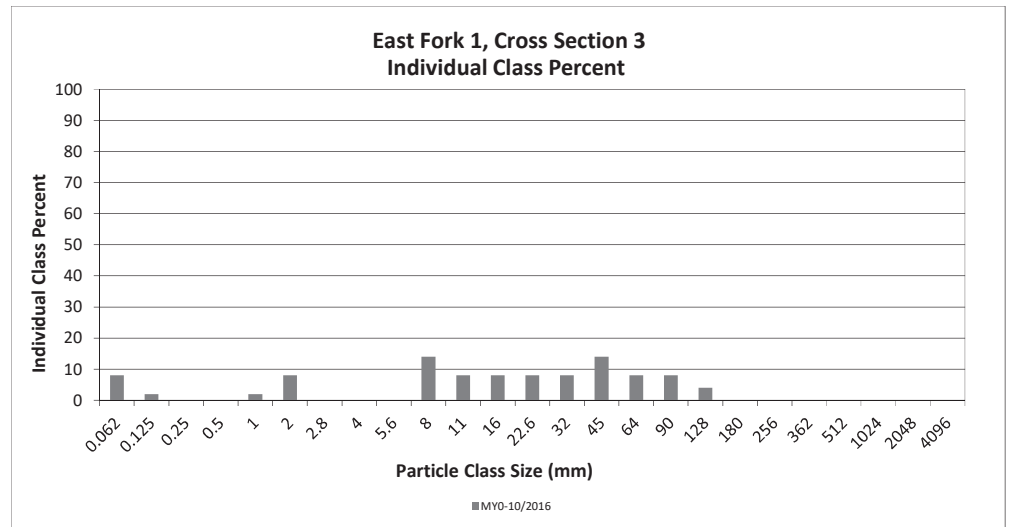
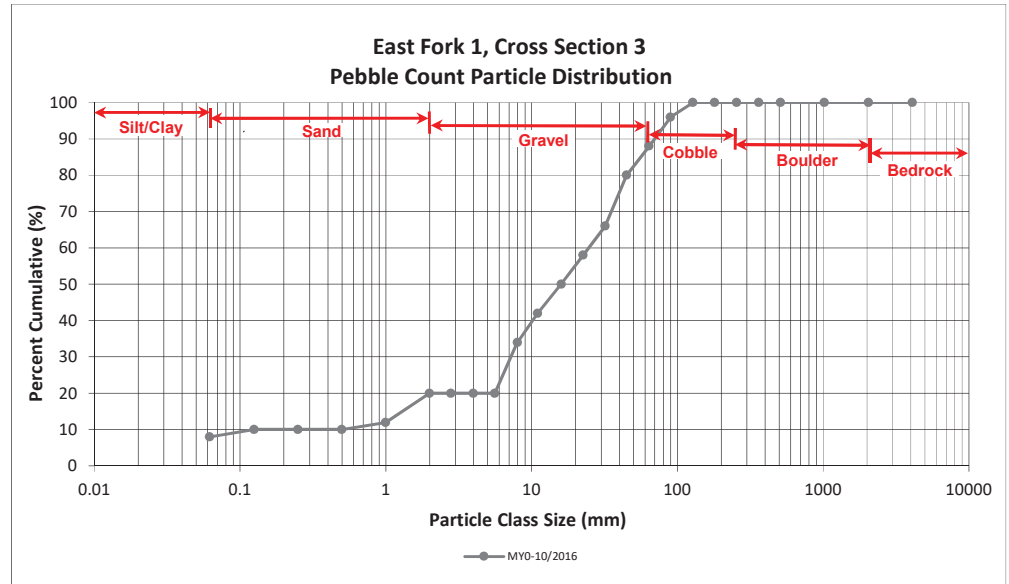
## Reachwide and Cross Section Pebble Count Plots

Deep Meadow Mitigation Site  
DMS Project No. 97131  
Existing Conditions - 2016

East Fork 1, Cross Section 3

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	4	8	8
<i>SAND</i>	Very fine	0.062	0.125	1	2	10
	Fine	0.125	0.250			10
	Medium	0.25	0.50			10
	Coarse	0.5	1.0	1	2	12
	Very Coarse	1.0	2.0	4	8	20
<i>GRAVEL</i>	Very Fine	2.0	2.8			20
	Very Fine	2.8	4.0			20
	Fine	4.0	5.6			20
	Fine	5.6	8.0	7	14	34
	Medium	8.0	11.0	4	8	42
	Medium	11.0	16.0	4	8	50
	Coarse	16.0	22.6	4	8	58
	Coarse	22.6	32	4	8	66
	Very Coarse	32	45	7	14	80
	Very Coarse	45	64	4	8	88
<i>COBBLE</i>	Small	64	90	4	8	96
	Small	90	128	2	4	100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>50</b>	<b>100</b>	<b>100</b>

Cross Section 3 Channel materials (mm)	
D <sub>16</sub> =	1.41
D <sub>35</sub> =	8.32
D <sub>50</sub> =	16.0
D <sub>84</sub> =	53.7
D <sub>95</sub> =	86.2
D <sub>100</sub> =	128.0





## Reachwide and Cross Section Pebble Count Plots

Deep Meadow Mitigation Site

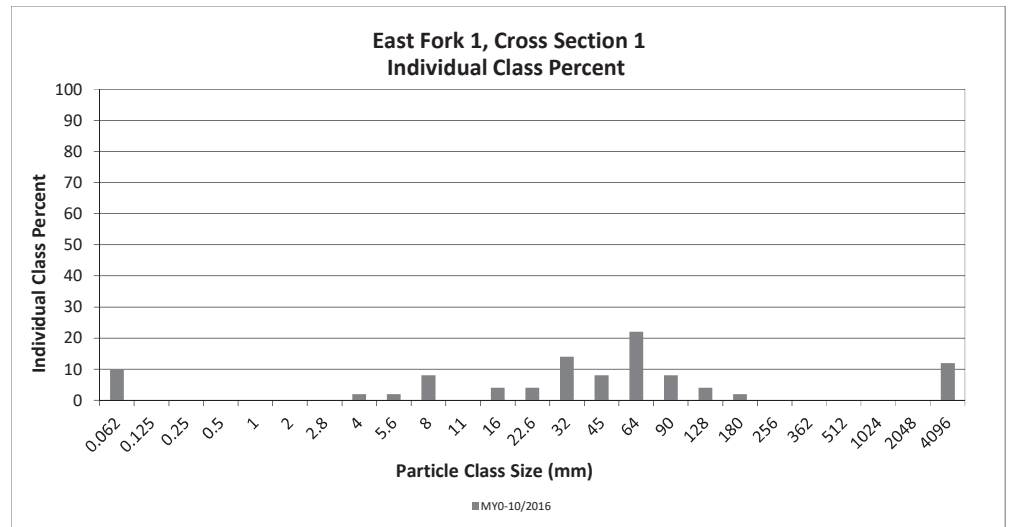
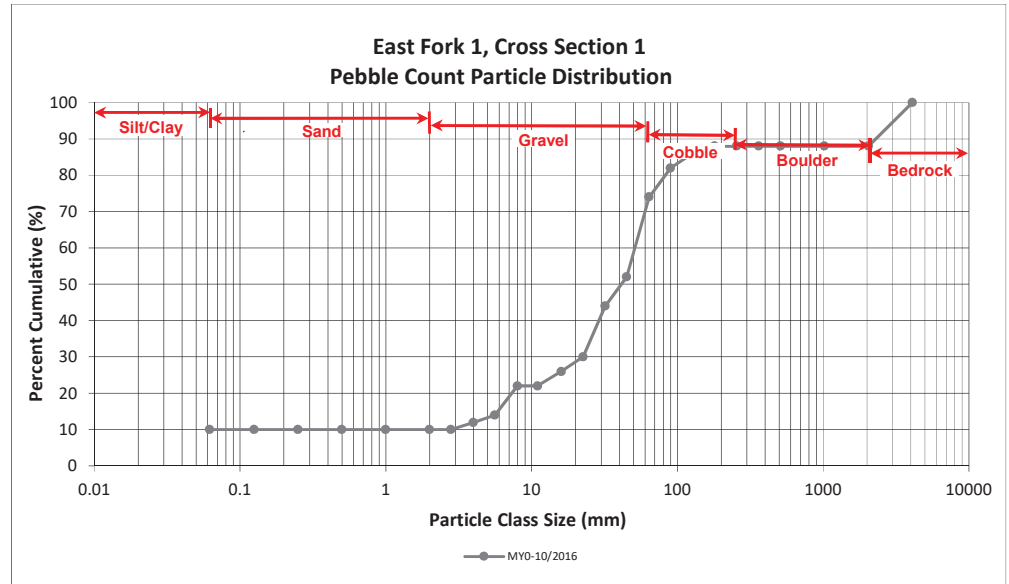
DMS Project No. 97131

Existing Conditions - 2016

East Fork 1, Cross Section 1

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	5	10	10
<i>SAND</i>	Very fine	0.062	0.125			10
	Fine	0.125	0.250			10
	Medium	0.25	0.50			10
	Coarse	0.5	1.0			10
	Very Coarse	1.0	2.0			10
<i>GRAVEL</i>	Very Fine	2.0	2.8			10
	Very Fine	2.8	4.0	1	2	12
	Fine	4.0	5.6	1	2	14
	Fine	5.6	8.0	4	8	22
	Medium	8.0	11.0			22
	Medium	11.0	16.0	2	4	26
	Coarse	16.0	22.6	2	4	30
	Coarse	22.6	32	7	14	44
	Very Coarse	32	45	4	8	52
	Very Coarse	45	64	11	22	74
<i>COBBLE</i>	Small	64	90	4	8	82
	Small	90	128	2	4	86
	Large	128	180	1	2	88
	Large	180	256			88
<i>BOULDER</i>	Small	256	362			88
	Small	362	512			88
	Medium	512	1024			88
	Large/Very Large	1024	2048			88
<i>BEDROCK</i>	Bedrock	2048	>2048	6	12	100
		<b>Total</b>		<b>50</b>	<b>100</b>	<b>100</b>

Cross Section 1	
Channel materials (mm)	
D <sub>16</sub> =	6.12
D <sub>35</sub> =	25.59
D <sub>50</sub> =	41.3
D <sub>84</sub> =	107.3
D <sub>95</sub> =	3068.5
D <sub>100</sub> =	>2048



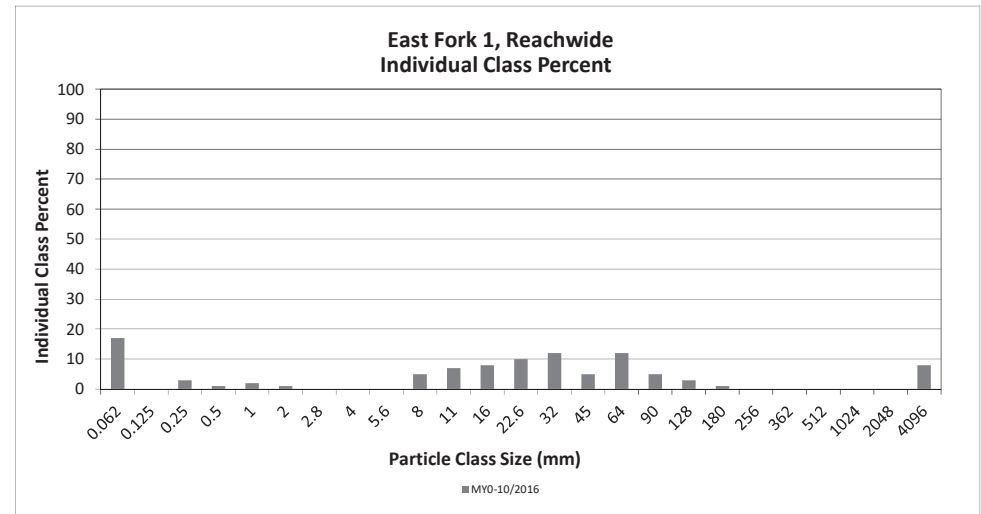
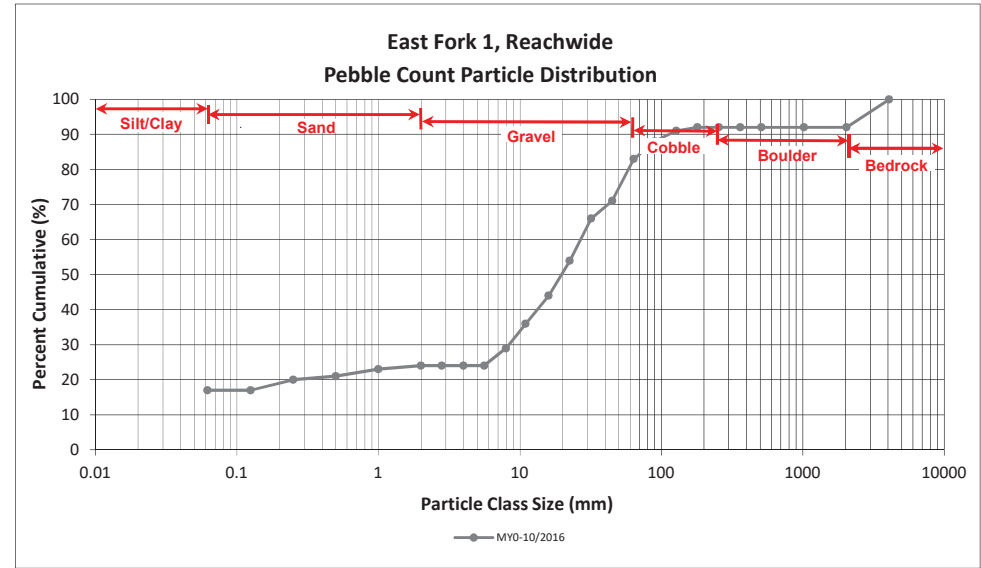
**Reachwide and Cross Section Pebble Count Plots**

Deep Meadow Mitigation Site  
 DMS Project No. 97131  
 Existing Conditions - 2016

East Fork 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	10	7	17	17	17
<b>SAND</b>	Very fine	0.062	0.125					17
	Fine	0.125	0.250		3	3	3	20
	Medium	0.25	0.50		1	1	1	21
	Coarse	0.5	1.0	2		2	2	23
	Very Coarse	1.0	2.0	1		1	1	24
<b>GRAVEL</b>	Very Fine	2.0	2.8					24
	Very Fine	2.8	4.0					24
	Fine	4.0	5.6					24
	Fine	5.6	8.0	4	1	5	5	29
	Medium	8.0	11.0	6	1	7	7	36
	Medium	11.0	16.0	5	3	8	8	44
	Coarse	16.0	22.6	5	5	10	10	54
	Coarse	22.6	32	7	5	12	12	66
	Very Coarse	32	45	3	2	5	5	71
	Very Coarse	45	64	4	8	12	12	83
<b>COBBLE</b>	Small	64	90	1	4	5	5	88
	Small	90	128		3	3	3	91
	Large	128	180	1		1	1	92
	Large	180	256					92
<b>BOULDER</b>	Small	256	362					92
	Small	362	512					92
	Medium	512	1024					92
	Large/Very Large	1024	2048					92
<b>BEDROCK</b>	Bedrock	2048	>2048	1	7	8	8	100
<b>Total</b>				<b>50</b>	<b>50</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	10.51
D <sub>50</sub> =	19.7
D <sub>84</sub> =	68.5
D <sub>95</sub> =	2655.9
D <sub>100</sub> =	>2048



## Reachwide and Cross Section Pebble Count Plots

Deep Meadow Mitigation Site

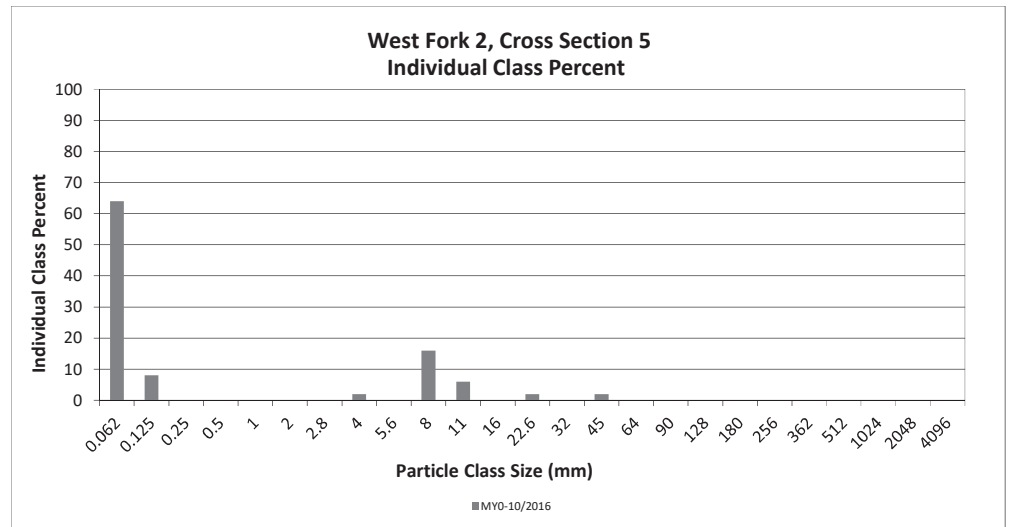
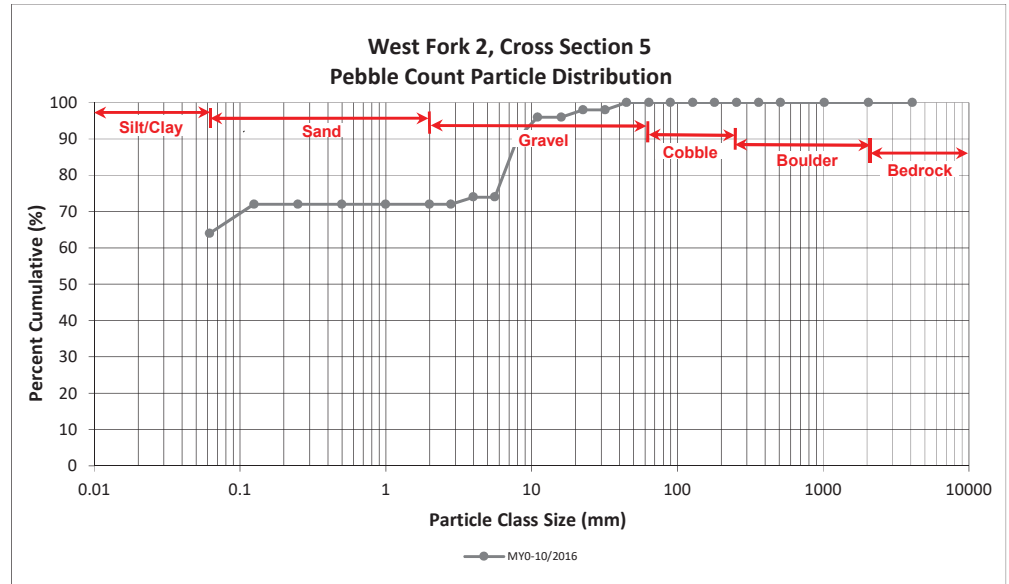
DMS Project No. 97131

Existing Conditions - 2016

West Fork 2, Cross Section 5

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	32	64	64
<i>SAND</i>	Very fine	0.062	0.125	4	8	72
	Fine	0.125	0.250			72
	Medium	0.25	0.50			72
	Coarse	0.5	1.0			72
	Very Coarse	1.0	2.0			72
<i>GRAVEL</i>	Very Fine	2.0	2.8			72
	Very Fine	2.8	4.0	1	2	74
	Fine	4.0	5.6			74
	Fine	5.6	8.0	8	16	90
	Medium	8.0	11.0	3	6	96
	Medium	11.0	16.0			96
	Coarse	16.0	22.6	1	2	98
	Coarse	22.6	32			98
	Very Coarse	32	45	1	2	100
	Very Coarse	45	64			100
<i>COBBLE</i>	Small	64	90			100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
<b>Total</b>				<b>50</b>	<b>100</b>	<b>100</b>

Cross Section 5 Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	Silt/Clay
D <sub>50</sub> =	Silt/Clay
D <sub>84</sub> =	7.0
D <sub>95</sub> =	10.4
D <sub>100</sub> =	45.0



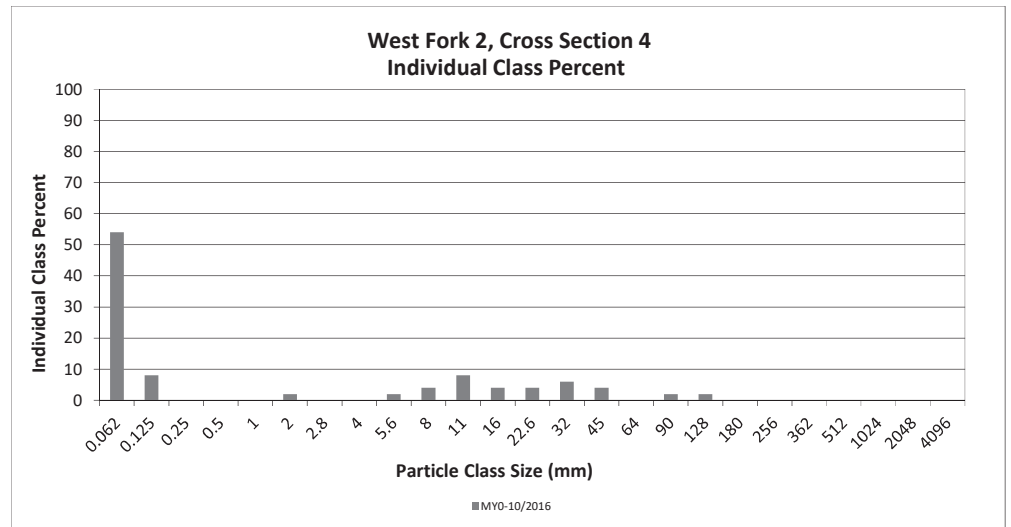
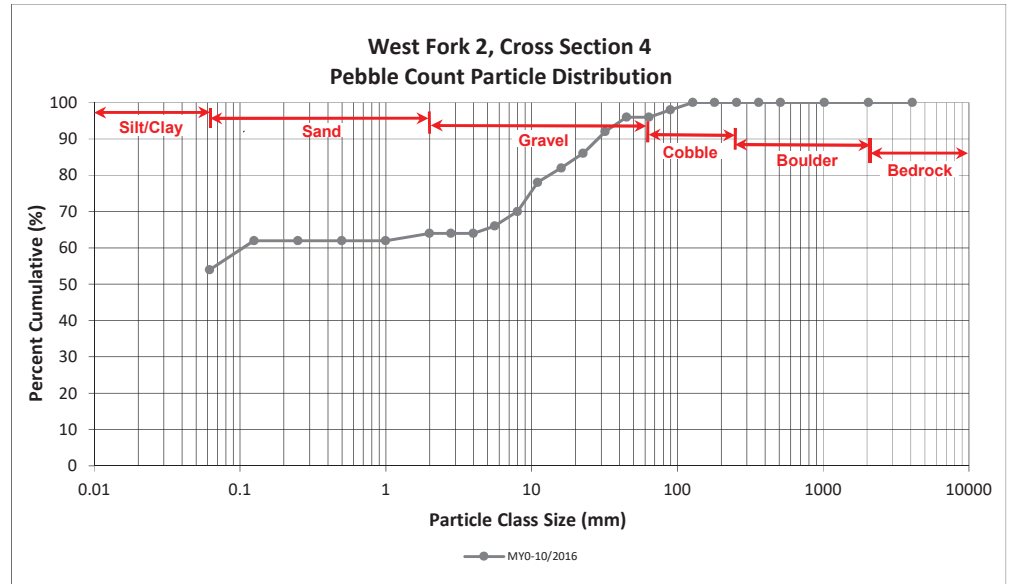
**Reachwide and Cross Section Pebble Count Plots**

Deep Meadow Mitigation Site  
 DMS Project No. 97131  
 Existing Conditions - 2016

West Fork 2, Cross Section 4

Particle Class		Diameter (mm)		Riffle 100-Count	Summary	
		min	max		Class Percentage	Percent Cumulative
<i>SILT/CLAY</i>	Silt/Clay	0.000	0.062	27	54	54
<i>SAND</i>	Very fine	0.062	0.125	4	8	62
	Fine	0.125	0.250			62
	Medium	0.25	0.50			62
	Coarse	0.5	1.0			62
	Very Coarse	1.0	2.0	1	2	64
<i>GRAVEL</i>	Very Fine	2.0	2.8			64
	Very Fine	2.8	4.0			64
	Fine	4.0	5.6	1	2	66
	Fine	5.6	8.0	2	4	70
	Medium	8.0	11.0	4	8	78
	Medium	11.0	16.0	2	4	82
	Coarse	16.0	22.6	2	4	86
	Coarse	22.6	32	3	6	92
	Very Coarse	32	45	2	4	96
	Very Coarse	45	64			96
<i>COBBLE</i>	Small	64	90	1	2	98
	Small	90	128	1	2	100
	Large	128	180			100
	Large	180	256			100
<i>BOULDER</i>	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
<i>BEDROCK</i>	Bedrock	2048	>2048			100
		<b>Total</b>		<b>50</b>	<b>100</b>	<b>100</b>

Cross Section 4 Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	Silt/Clay
D <sub>50</sub> =	Silt/Clay
D <sub>84</sub> =	19.0
D <sub>95</sub> =	41.3
D <sub>100</sub> =	128.0



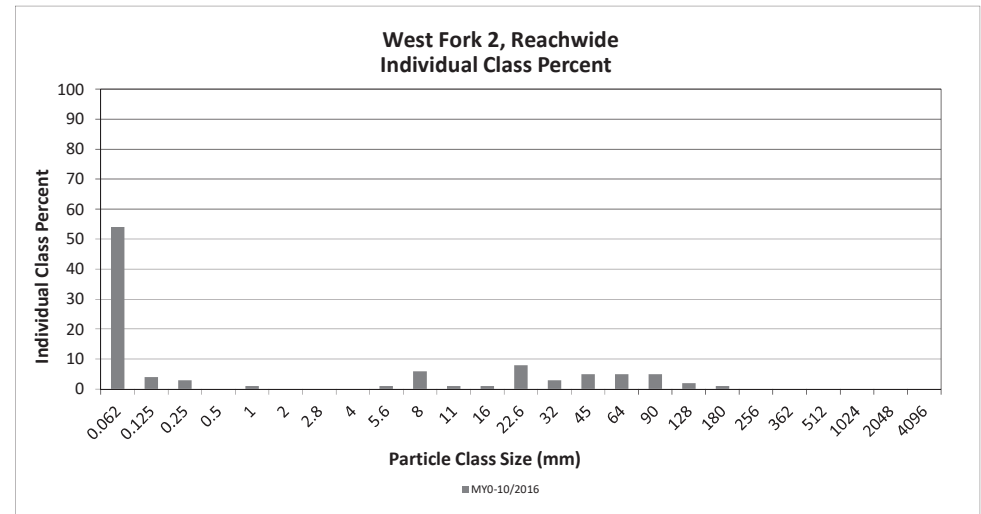
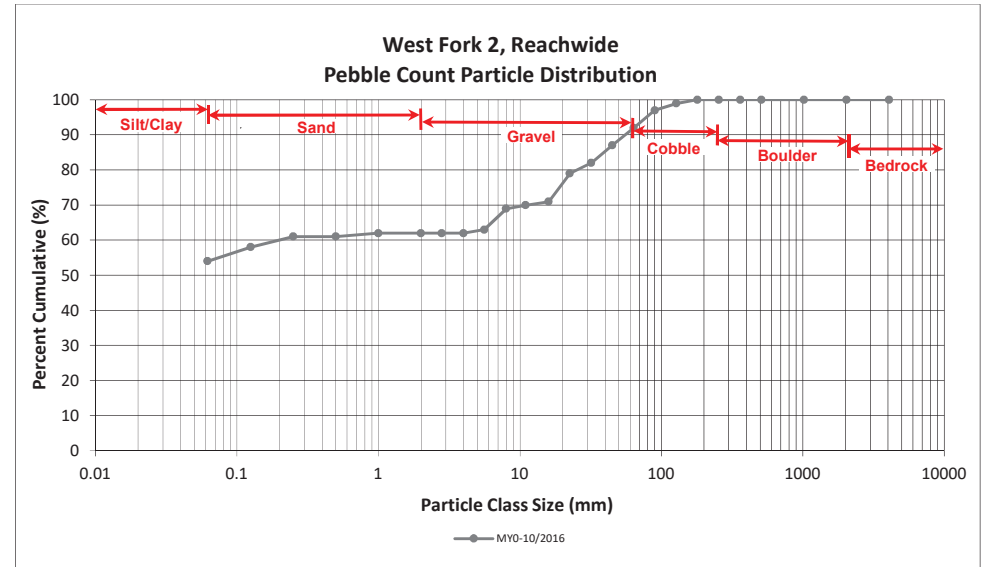
**Reachwide and Cross Section Pebble Count Plots**

Deep Meadow Mitigation Site  
 DMS Project No. 97131  
 Existing Conditions - 2016

West Fork 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
<b>SILT/CLAY</b>	Silt/Clay	0.000	0.062	34	20	54	54	54
<b>SAND</b>	Very fine	0.062	0.125	2	2	4	4	58
	Fine	0.125	0.250	3		3	3	61
	Medium	0.25	0.50					61
	Coarse	0.5	1.0		1	1	1	62
	Very Coarse	1.0	2.0					62
<b>GRAVEL</b>	Very Fine	2.0	2.8					62
	Very Fine	2.8	4.0					62
	Fine	4.0	5.6	1		1	1	63
	Fine	5.6	8.0	3	3	6	6	69
	Medium	8.0	11.0	1		1	1	70
	Medium	11.0	16.0	1		1	1	71
	Coarse	16.0	22.6	6	2	8	8	79
	Coarse	22.6	32	2	1	3	3	82
	Very Coarse	32	45	2	3	5	5	87
	Very Coarse	45	64		5	5	5	92
<b>COBBLE</b>	Small	64	90	3	2	5	5	97
	Small	90	128	1	1	2	2	99
	Large	128	180	1		1	1	100
	Large	180	256					100
<b>BOULDER</b>	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
<b>BEDROCK</b>	Bedrock	2048	>2048					100
<b>Total</b>				<b>60</b>	<b>40</b>	<b>100</b>	<b>100</b>	<b>100</b>

Reachwide	
Channel materials (mm)	
D <sub>16</sub> =	Silt/Clay
D <sub>35</sub> =	Silt/Clay
D <sub>50</sub> =	Silt/Clay
D <sub>84</sub> =	36.7
D <sub>95</sub> =	78.5
D <sub>100</sub> =	180.0







INQUIRY #: 4550401.1

YEAR: 1951

| = 500'







**INQUIRY #:** 4550401.1

**YEAR:** 1961

|—————| = 500'





INQUIRY #: 4550401.1  
YEAR: 1969  
| = 500'







INQUIRY #: 4550401.1

YEAR: 1983

| = 500'







INQUIRY #: 4550401.1

YEAR: 1993

| = 500'







INQUIRY #: 4550401.1

YEAR: 2005

| = 500'







INQUIRY #: 4550401.1

YEAR: 2009

| = 500'







INQUIRY #: 4550401.1

YEAR: 2012

| = 500'





Deep Meadow Mitigation Site – Reference Reach Geomorphic Parameters

Parameter	Notation	Units	UT to Cane Creek		Spencer Creek 3	
			min	max	min	max
stream type			E4		E4	
drainage area	DA	sq mi	0.29		0.37	
bankfull discharge	Q <sub>bkf</sub>	cfs	40		35	
bankfull cross-sectional area	A <sub>bkf</sub>	SF	8.9	12.2	6.6	8.7
average velocity during bankfull event	V <sub>bkf</sub>	fps	3.8		5	5.6
<b>Cross-Section</b>						
width at bankfull	W <sub>bkf</sub>	feet	11.5	12.3	6.3	9.3
maximum depth at bankfull	d <sub>max</sub>	feet	1.2	1.6	1	1.2
mean depth at bankfull	d <sub>bkf</sub>	feet	0.8	1.0	0.8	1.0
bankfull width to depth ratio	W <sub>bkf</sub> /d <sub>bkf</sub>		12.3	14.4	7.9	9.3
depth ratio	d <sub>max</sub> /d <sub>bkf</sub>				1.2	1.3
bank height ratio	BHR		1.4	2.5	1.0	1.0
floodprone area width	W <sub>fpa</sub>	feet	31		14	125
entrenchment ratio	ER		2.5	2.7	1.7	4.3
<b>Slope</b>						
valley slope	S <sub>valley</sub>	ft/ft	0.0260		0.022	0.031
channel slope	S <sub>channel</sub>	ft/ft	0.0150		0.019	0.022
<b>Profile</b>						
riffle slope	S <sub>riffle</sub>	ft/ft	0.015	0.035	0.0184	0.0343
riffle slope ratio	S <sub>riffle</sub> /S <sub>channel</sub>		1.7	3.9	1	1.6
pool slope	S <sub>pool</sub>	ft/ft	0.0008	0.003	0.0007	0.014
pool slope ratio	S <sub>pool</sub> /S <sub>channel</sub>		0.09	0.38	0.00	0.60
pool-to-pool spacing	L <sub>p-p</sub>	feet	49	91	9	46
pool spacing ratio	L <sub>p-p</sub> /W <sub>bkf</sub>		2.6	4.7	1.4	4.9
pool cross-sectional area at bankfull	A <sub>pool</sub>	SF	29.2		6.5	9.8
pool area ratio	A <sub>pool</sub> /A <sub>bkf</sub>		1.2	1.4	1	1.1
maximum pool depth at bankfull	d <sub>pool</sub>	feet	2.5	2.9	1.2	1.8
pool depth ratio	d <sub>pool</sub> /d <sub>bkf</sub>		1.9		1.5	1.8
pool width at bankfull	W <sub>pool</sub>	feet	15.3		6	12
pool width ratio	W <sub>pool</sub> /W <sub>bkf</sub>		0.8		1.0	1.3

Parameter	Notation	Units	UT to Cane Creek		Spencer Creek 3	
			min	max	min	max
<b>Pattern</b>						
sinuosity	K		1.40		1.0	1.3
belt width	$W_{blt}$	feet	102		10	50
meander width ratio	$W_{blt}/W_{bkf}$		8.3	8.9	1.6	5.4
linear wavelength (formerly meander length)	$L_m$	<i>feet</i>	45	81	55	142
linear wavelength ratio (formerly meander length ratio)	$L_m/W_{bkf}$		3.9	6.6	8.7	15.3
meander length	$L_m$	feet			53	178
meander length ratio	$L_m/W_{bkf}$				8.4	19.1
radius of curvature	$R_c$	feet	23	38	12	85
radius of curvature ratio	$R_c/W_{bkf}$		2.0	3.1	1.9	9.1
<b>Sediment</b>						
d <sub>50</sub> Description			Medium Gravel		Medium Gravel	
Reach Wide	d <sub>16</sub>	mm	0.6		1.866	
	d <sub>35</sub>	mm	12.2		8.85	
	d <sub>50</sub>	mm	27.8		11	
	d <sub>84</sub>	mm	74.5		64	
	d <sub>95</sub>	mm	128		128	



Deep Meadow Mitigation Site – Reference Reach Geomorphic Parameters

Parameter	Notation	Units	UT to Richland Creek 1		UT to Cane Creek		Spencer Creek 3	
			min	max	min	max	min	max
stream type			C4/E4		E4		E4	
drainage area	DA	sq mi	0.28		0.29		0.37	
bankfull discharge	Q <sub>bkf</sub>	cfs	32		40		35	
bankfull cross-sectional area	A <sub>bkf</sub>	SF	7.8	8.5	8.9	12.2	6.6	8.7
average velocity during bankfull event	V <sub>bkf</sub>	fps	4.1		3.8		5	5.6
<b>Cross-Section</b>								
width at bankfull	W <sub>bkf</sub>	feet	8.8	10.4	11.5	12.3	6.3	9.3
maximum depth at bankfull	d <sub>max</sub>	feet	1.1	1.3	1.2	1.6	1	1.2
mean depth at bankfull	d <sub>bkf</sub>	feet	0.8	0.9	0.8	1.0	0.8	1.0
bankfull width to depth ratio	W <sub>bkf</sub> /d <sub>bkf</sub>		10.0	12.8	12.3	14.4	7.9	9.3
depth ratio	d <sub>max</sub> /d <sub>bkf</sub>		1.4	1.4			1.2	1.3
bank height ratio	BHR		1.4	2.1	1.4	2.5	1.0	1.0
floodprone area width	W <sub>fpa</sub>	feet	28	31	31		14	125
entrenchment ratio	ER		2.5	4.0	2.5	2.7	1.7	4.3
<b>Slope</b>								
valley slope	S <sub>valley</sub>	ft/ft			0.0260		0.022	0.031
channel slope	S <sub>channel</sub>	ft/ft	0.0131	0.0178	0.0150		0.019	0.022
<b>Profile</b>								
riffle slope	S <sub>riffle</sub>	ft/ft	0.018	0.036	0.015	0.035	0.0184	0.0343
riffle slope ratio	S <sub>riffle</sub> /S <sub>channel</sub>		1.3	2.5	1.7	3.9	1	1.6
pool slope	S <sub>pool</sub>	ft/ft	0.000	0.004	0.0008	0.003	0.0007	0.014
pool slope ratio	S <sub>pool</sub> /S <sub>channel</sub>		0.00	0.27	0.09	0.38	0.00	0.60
pool-to-pool spacing	L <sub>p-p</sub>	feet	33	93	49	91	9	46
pool spacing ratio	L <sub>p-p</sub> /W <sub>bkf</sub>		2.5	6.1	2.6	4.7	1.4	4.9
pool cross-sectional area at bankfull	A <sub>pool</sub>	SF	1.8	1.8	29.2		6.5	9.8
pool area ratio	A <sub>pool</sub> /A <sub>bkf</sub>		1.4	1.6	1.2	1.4	1	1.1
maximum pool depth at bankfull	d <sub>pool</sub>	feet	14.7	16.0	2.5	2.9	1.2	1.8
pool depth ratio	d <sub>pool</sub> /d <sub>bkf</sub>		1.0	1.2	1.9		1.5	1.8
pool width at bankfull	W <sub>pool</sub>	feet	14.7	15.8	15.3		6	12
pool width ratio	W <sub>pool</sub> /W <sub>bkf</sub>		0.9	0.9	0.8		1.0	1.3



Parameter	Notation	Units	UT to Richland Creek 1		UT to Cane Creek		Spencer Creek 3	
			min	max	min	max	min	max
<b>Pattern</b>								
sinuosity	K		1.00		1.40		1.0	1.3
belt width	$W_{blt}$	feet			102		10	50
meander width ratio	$W_{blt}/W_{bkf}$				8.3	8.9	1.6	5.4
linear wavelength (formerly meander length)	$L_m$	feet			45	81	55	142
linear wavelength ratio (formerly meander length ratio)	$L_m/W_{bkf}$				3.9	6.6	8.7	15.3
meander length	$L_m$	feet					53	178
meander length ratio	$L_m/W_{bkf}$						8.4	19.1
radius of curvature	$R_c$	feet			23	38	12	85
radius of curvature ratio	$R_c/W_{bkf}$				2.0	3.1	1.9	9.1
<b>Sediment</b>								
d <sub>50</sub> Description					Medium Gravel		Medium Gravel	
Reach Wide	d <sub>16</sub>	mm			0.6		1.866	
	d <sub>35</sub>	mm			12.2		8.85	
	d <sub>50</sub>	mm			27.8		11	
	d <sub>84</sub>	mm			74.5		64	
	d <sub>95</sub>	mm			128		128	

Parameter	Notation	Units	UT to Rocky Creek		Foust Creek US		Long Branch	
			Min	Max	Min	Max	Min	Max
stream type			E4b		C4		C/E4	
drainage area	DA	sq mi	1.05		1.40		1.49	
bankfull discharge	Q <sub>bkf</sub>	cfs	85.0		95.2		124.0	
bankfull cross-sectional area	A <sub>bkf</sub>	SF	16.3		23.9	24.1	34.6	
average velocity during bankfull event	V <sub>bkf</sub>	fps	5.5		4.0		4.0	
<b>Cross-Section</b>								
width at bankfull	w <sub>bkf</sub>	feet	12.2		18.5	19.4	14.8	18.6
maximum depth at bankfull	d <sub>max</sub>	feet	1.8		1.8	2.1	1.9	2.9
mean depth at bankfull	d <sub>bkf</sub>	feet	1.3		1.2	1.3	1.3	2.1
bankfull width to depth ratio	w <sub>bkf</sub> /d <sub>bkf</sub>		9.1		14.3	15.7	7.9	13.8
depth ratio	d <sub>max</sub> /d <sub>bkf</sub>		1.3		1.4	1.7	1.4	1.5
bank height ratio	BHR		1.0		---	---	1.2	1.5
floodprone area width	w <sub>fpa</sub>	feet	72.4		55	101	>50	
entrenchment ratio	ER		6.0		2.9	5.3	>3.4	
<b>Slope</b>								
valley slope	S <sub>valley</sub>	ft/ft	0.026				0.006	
channel slope	S <sub>channel</sub>	ft/ft	0.024		0.0090		0.0040	
<b>Profile</b>								
riffle slope	S <sub>riffle</sub>	ft/ft	0.061	0.089			0.013	0.012
riffle slope ratio	S <sub>riffle</sub> /S <sub>channel</sub>		2.6		3.8		3.3	
pool slope	S <sub>pool</sub>	ft/ft	0.00		0.004		0.000	
pool slope ratio	S <sub>pool</sub> /S <sub>channel</sub>		0.00		0.16		0.10	
pool-to-pool spacing	L <sub>p-p</sub>	feet	26.3		81		50	
pool spacing ratio	L <sub>p-p</sub> /w <sub>bkf</sub>		2.2		6.7		3.4	
pool cross-sectional area at bankfull	A <sub>pool</sub>	SF	19.3		29.2	34.9	25.5	33.4
pool area ratio	A <sub>pool</sub> /A <sub>bkf</sub>		1.2		1.2	1.5	1.0	1.3
maximum pool depth at bankfull	d <sub>pool</sub>	feet	2.2		2.5	2.9	2.2	
pool depth ratio	d <sub>pool</sub> /d <sub>bkf</sub>		1.6		1.9	2.3	0.8	1.2
pool width at bankfull	w <sub>pool</sub>	feet	10.9		15.3	20.5	16.2	18.8
pool width ratio	w <sub>pool</sub> /w <sub>bkf</sub>		0.9		0.8	1.1	0.9	1.3



<b>Pattern</b>							
sinuosity	K		1.10			1.30	
belt width	$W_{blt}$	feet				60	
meander width ratio	$W_{blt}/W_{bkf}$					3.2	4.1
linear wavelength (formerly meander length)	$L_m$	feet				66	191
linear wavelength ratio (formerly meander length ratio)	$L_m/W_{bkf}$					4.5	10.3
meander length	$L_m$	feet				--	--
meander length ratio	$L_m/W_{bkf}$					--	--
radius of curvature	$R_c$	feet				16	87
radius of curvature ratio	$R_c/W_{bkf}$					1.10	4.7
<b>Sediment</b>							
d <sub>50</sub> Description			Coarse Gravel				
Reach Wide	d <sub>16</sub>	mm	<0.063	9.6		8.1	
	d <sub>35</sub>	mm	2.4	37		26.6	
	d <sub>50</sub>	mm	22.6	61		41.6	
	d <sub>84</sub>	mm	120	130		124.8	
	d <sub>95</sub>	mm	256	1100		225.5	



Deep Meadow Mitigation Site – Design Geomorphic Parameters

	Notation	Units	EF1		WF1		WF2	
			Min	Max	Min	Max	Min	Max
stream type			E4/1		C4/1		E4	
drainage area	DA	<i>sq mi</i>	0.35		0.09		0.20	
design discharge	Q	<i>cfs</i>	34		10		20	
bankfull cross-sectional area	A <sub>bkf</sub>	<i>SF</i>	8.7		4.4		6.6	
average velocity during bankfull event	V <sub>bkf</sub>	<i>fps</i>	3.4		3.3		3.2	
<b>Cross-Section</b>								
width at bankfull	W <sub>bkf</sub>	<i>feet</i>	10.2		8.1		8.9	
maximum depth at bankfull	d <sub>max</sub>	<i>feet</i>	1.0	1.3	0.5	0.9	0.8	1.2
mean depth at bankfull	d <sub>bkf</sub>	<i>feet</i>	0.8		0.5		0.7	
bankfull width to depth ratio	W <sub>bkf</sub> /d <sub>bkf</sub>		12		15		12.7	
max depth ratio	d <sub>max</sub> /d <sub>bkf</sub>	<i>feet</i>	1.4	1.4	1.0	1.7	1.1	1.7
bank height ratio	BHR		1.0	1.0	1.0	1.0	1.0	1.0
floodprone area width	W <sub>fpa</sub>	<i>feet</i>	30	68	18	36	26	70
entrenchment ratio	ER		2.2	5.0	2.2	4.5	2.2	6.0
<b>Slope</b>								
valley slope	S <sub>valley</sub>	<i>feet/foot</i>	0.0124		0.0167		0.0183	
channel slope	S <sub>chnl</sub>	<i>feet/foot</i>	0.0042	0.0182	0.0128	0.0192	0.0042	0.0264
<b>Profile</b>								
riffle slope	S <sub>riffle</sub>	<i>feet/foot</i>	0.007	0.031	NA	NA	0.014	0.036
riffle slope ratio	S <sub>riffle</sub> /S <sub>chnl</sub>		1	3.7	NA	NA	1.2	3.7
pool slope	S <sub>p</sub>	<i>feet/foot</i>	0.000	0.0000	NA	NA	0.000	0.0000
pool slope ratio	S <sub>p</sub> /S <sub>chnl</sub>		0.00	0.00	NA	NA	0.00	0.00
pool-to-pool spacing	L <sub>p-p</sub>	<i>feet</i>	41	75	NA	NA	22	69
pool spacing ratio	L <sub>p-p</sub> /W <sub>bkf</sub>		4.7	8.6	NA	NA	2.6	8.0
pool cross-sectional area	A <sub>pool</sub>	<i>SF</i>	11	12	NA	NA	8	9
pool area ratio	A <sub>pool</sub> /A <sub>bkf</sub>		1.3	1.4	NA	NA	1.2	1.4
maximum pool depth	d <sub>pool</sub>	<i>feet</i>	1.4	2	NA	NA	1.4	2.6



	Notation	Units	EF1		WF1		WF2	
			Min	Max	Min	Max	Min	Max
pool depth ratio	$d_{pool}/d_{bkf}$		1.9	2.8	NA	NA	1.9	3.6
pool width at bankfull	$w_{pool}$	<i>feet</i>	13.0	13.0	NA	NA	11.0	11.0
pool width ratio	$w_{pool}/w_{bkf}$		1.3	1.3	NA	NA	1.2	1.2
<b>Pattern</b>								
sinuosity	K		1.30		NA		1.40	
belt width	$w_{blt}$	<i>feet</i>	23	57	NA	NA	23	56
meander width ratio	$w_{blt}/w_{bkf}$		2.7	6.5	NA	NA	2.7	6.5
linear wavelength (formerly meander length)	LW	<i>feet</i>	79	121	NA	NA	66	120
linear wavelength ratio (formerly meander length ratio)	$LW/w_{bkf}$		9.1	13.9	NA	NA	7.6	13.8
meander length	$L_m$	<i>feet</i>	93	146	NA	NA	73	135
meander length ratio	$L_m/w_{bkf}$		10.7	16.8	NA	NA	8.4	15.5
radius of curvature	$R_c$	<i>feet</i>	20	35	NA	NA	18	27
radius of curvature ratio	$R_c/w_{bkf}$		2.3	4.0	NA	NA	2.1	3.1

# HYDRIC SOIL INVESTIGATION

Deep Meadow Project Site

Union County, North Carolina

Prepared for:

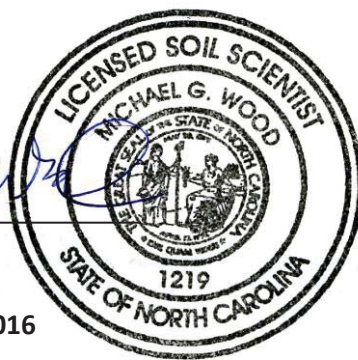
Mr. John Hutton  
Wildlands  
312 West Millbrook Road, Suite 225  
Raleigh, NC 27609

Prepared by:



1000 Corporate Drive, Suite 101  
Hillsborough, NC 27278  
Tel (919) 732-1300

*Michael G. Wood*



March 3, 2016

## INTRODUCTION

Wildlands is investigating the feasibility of on-site stream and wetland mitigation within the Yadkin River Subbasin. The study areas are located at 1812 McIntyre Road, Union County, NC. Three Oaks Engineering (Three Oaks) has been retained to perform a Hydric Soil Investigation that describes and classifies the soil throughout the study areas and to make a determination as to its hydric status.

There is a stream that generally bisects the site. It is primarily used for agriculture.

## METHODOLOGY

The field investigation was performed on February 26, 2016 by Michael Wood, LSS. Hand-turned soil auger borings were advanced throughout the study areas. Each soil boring was classified based on soil characteristics indicating the hydric soil status. Soil boring locations were located on a site map and are shown on the attached figure. A representative soil boring is appended. Hydric soil status is based upon the *NRCS Field Indicators of Hydric Soils in the United States - A Guide for Identifying and Delineating Hydric Soils (Version 7.0, 2010)*.

## RESULTS

Twenty-Eight (28) soil borings were advanced throughout the study area (Figures 1). Soil borings were placed into one of four general categories based on existing soil and site characteristics;

**Hydric.** – Borings rated as Hydric were visually saturated with low chroma color soil surfaces and redoximorphic features. Borings rated as Hydric met criteria for soil indicator F3, depleted matrix:

F3 Depleted Matrix. A layer that has a depleted matrix with 60 percent or more chroma of 2 or less and that has a minimum thickness of either:

- a. 5 cm (2 inches) if the 5 cm is entirely within the upper 15 cm (6 inches) of the soil, or
- b. 15 cm (6 inches), starting within 25 cm (10 inches) of the soil surface.

Borings 6, 9, 10, 14, 16, 17, 18, 19, 25, 26, and 27 were considered Hydric.

**Hydric over Hydric.** – Borings rated as Hydric over Hydric exhibited obvious overburden material overlying a buried hydric soil layer. The overburden material appeared to have originated from current and past anthropogenic practices. The overburden material appears to have been in place long enough that it has developed hydric indicators with clear evidence of active reduction and oxidation reactions and ranged in depth from 17 to 27 inches. Generally, both the existing surface and buried surface met indicator F3 Depleted Matrix or F6 Redox Dark Surface:

F6 Redox Dark Surface. A layer that is at least 10 cm (4 inches) thick, is entirely within the upper 30 cm (12 inches) of the mineral soil, and has:

- a. Matrix value of 3 or less and chroma of 1 or less and 2 percent or more distinct or prominent redox concentration occurring as soft masses or pore lining, or



b. Matrix value of 3 or less and chroma of 2 or less and 5 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.

Soil borings 1 and 24 were considered Hydric over Hydric.

**Non-Hydric over Hydric.** – Borings rated as Non-Hydric over Hydric exhibited obvious overburden material overlying a buried hydric soil layer. The overburden material appeared to have originated from current and past anthropogenic practices and ranged in depth from 8 to 35 inches. The buried surface typically met indicator F3 Depleted Matrix or F6 Redox Dark Surface.

Soil borings 12, 20, and 22 were considered Non-Hydric over Hydric.

**Non-Hydric.** – Borings rated as Non-Hydric did not exhibit characteristics for hydric soil indicators.

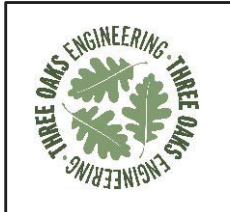
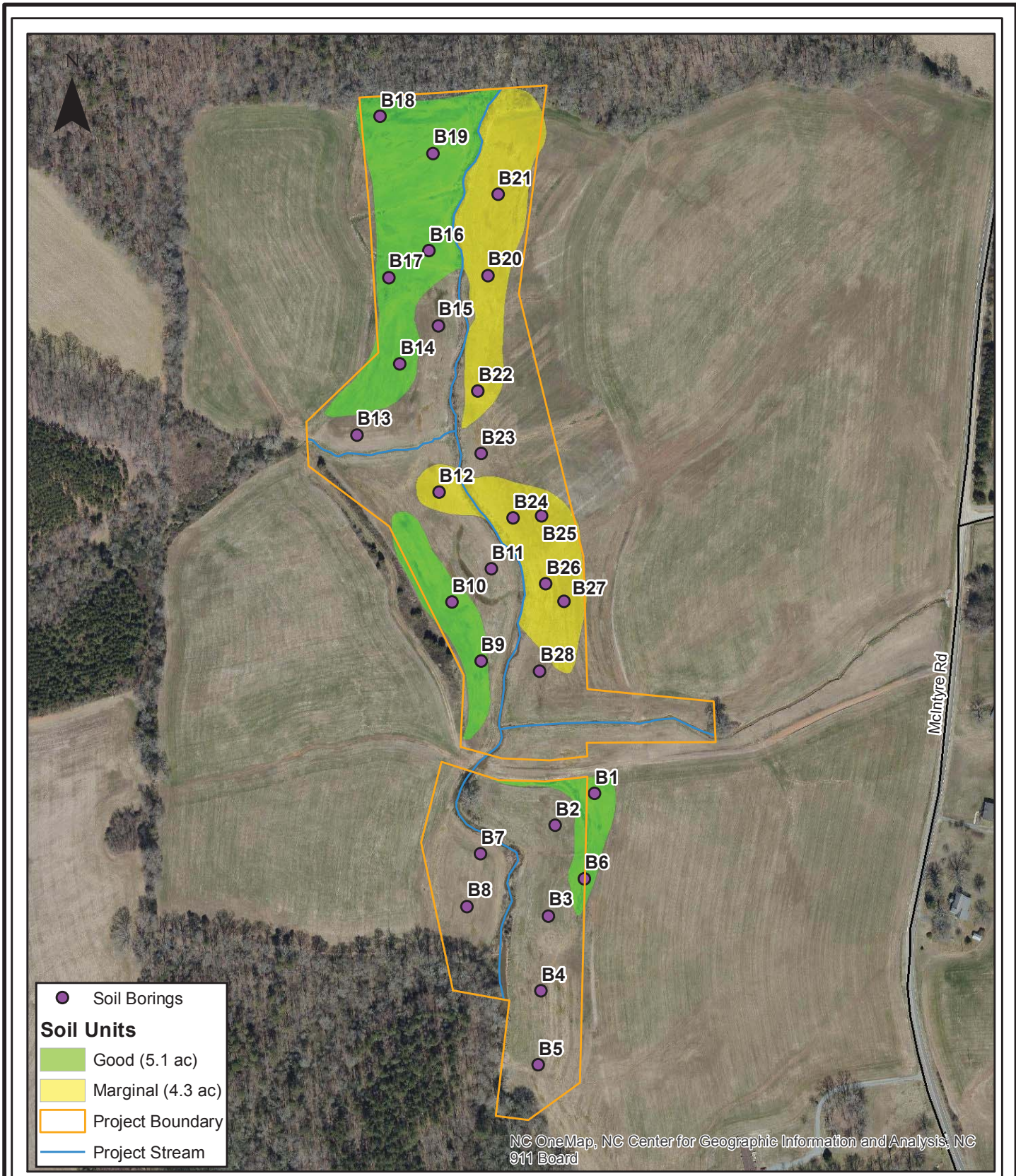
Borings 2, 3, 4, 5, 7, 8, 11, 13, 15, 21, 23, and 28 were considered Non-Hydric.

Evidence of a current and historic wetland presence was noted within the “Good” Hydric Soil Unit and consists of borings rated as Hydric and Hydric over Hydric (Figure 1). Evidence of historic wetland presence was noted within the “Marginal” Hydric Soil Unit and consists of borings rated as Hydric and Non-Hydric over Hydric. Combining hydraulic stream modifications with limited soil removal, if needed, qualifies the Hydric Soil Unit as a candidate for Wetland Re-establishment and/or Re-habilitation mitigation credit.

## CONCLUSION

There is obvious evidence of soil manipulation within the majority of the study areas. Soil borings were advanced and placed into one of the four categories; Hydric, Hydric over Hydric, Non-Hydric over Hydric, and Non-Hydric. A “Good” Hydric Soil Unit consists of borings rated as Hydric and Hydric over Hydric soil borings. A “Marginal” Hydric Soil Unit consists of borings rated as Hydric and Non-Hydric over Hydric. Combining hydraulic stream modifications with limited soil removal, if needed, qualifies both Hydric Soil Units as a candidate for Wetland Re-establishment and/or Re-habilitation mitigation credit, although alternative success criteria may need to be considered for each Unit.

The findings presented herein represent Three Oaks professional opinion based on our Hydric Soil Investigation and knowledge of the current regulations regarding wetland mitigation in North Carolina and national criteria for determining hydric soil.



Prepared For:

**WILDLANDS**  
ENGINEERING

**Hydric Soil Investigation**  
Deep Meadow Site

Union County, North Carolina

Date: February 2016	
Scale 0 100 200 Feet	
Job No.: 4180	
Drawn By: KMS	Checked By: MW

Figure  
**1**



# SOIL EVALUATION FORM

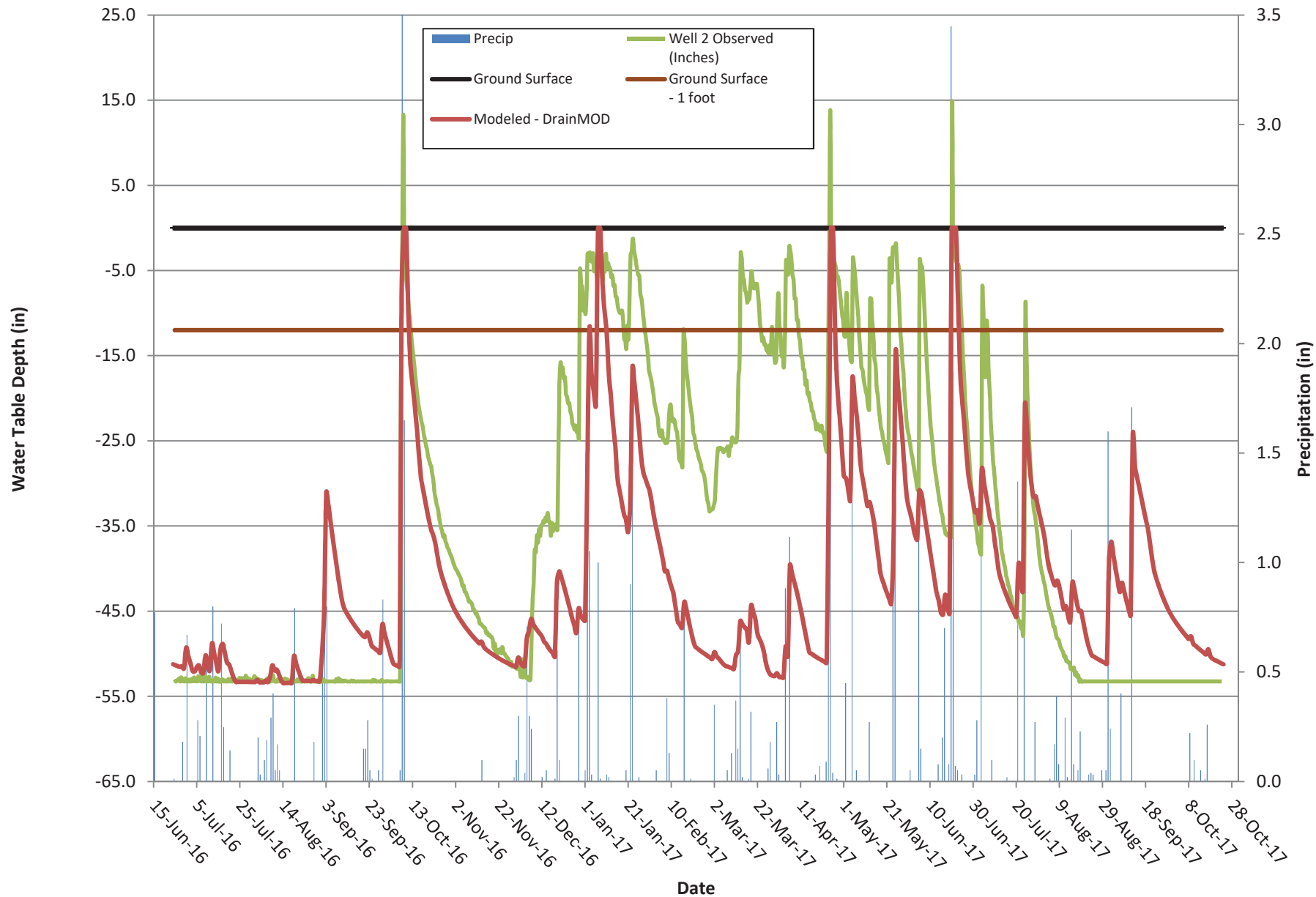
Three Oaks Engineering  
 1000 Corporate Drive, Suite 101  
 Hillsborough, NC 27278  
 919.732.1300

Job: DEEP MEADOW  
 County: UNION  
 Date: 2/26/16  
 Sheet: 1 of 1

Profile #	Horizon	Horizon Depth (in)	Structure / Texture	Consistence / Mineralogy	Matrix Color	Mottle Colors (Quantity, Size, Contrast, Color)
19	A <sub>p</sub>	0-9	GR / L	f <sub>r</sub> / N	2.5Y 3/2	Common Oxides. RHIZ (7.5YR 4/6)
	Bt <sub>g</sub> <sup>1</sup>	14	sbk / cl	f <sub>r</sub> / s	5Y 4/1	RTNY " " (7.5YR 4/6)
	Bt <sub>g</sub> <sup>2</sup>	29	sbk / cl	f <sub>r</sub> / s	2.5Y 4/2	m/d 2.5Y 5/6 and 2.5Y 5/4
	CB	35+	M / cl	f <sub>r</sub> / s	2.5Y 5/2	m/d 10YR 5/6 m/d 2.5Y 5/6
22	A <sub>p</sub>	0-5	GR / L	FR / NS MP	2.5Y 4/3	F, I, P 7.5YR 5/6
	Bt <sub>g</sub> <sup>1</sup>	5-15	SBK / CL	FI / SS, SP	5Y 4/3	F, I, P 7.5YR 5/6
	Bt <sub>g</sub> <sup>2</sup>	15-24	SBK / CL	FI / SS, SP	2.5Y 4/2	M, I, P 7.5YR 4/6 F, I, P 2.5Y 5/6
	CB	24-29+	M / CL	FI / SS, SP	2.5Y 5/1	F, I, P 7.5YR 4/6

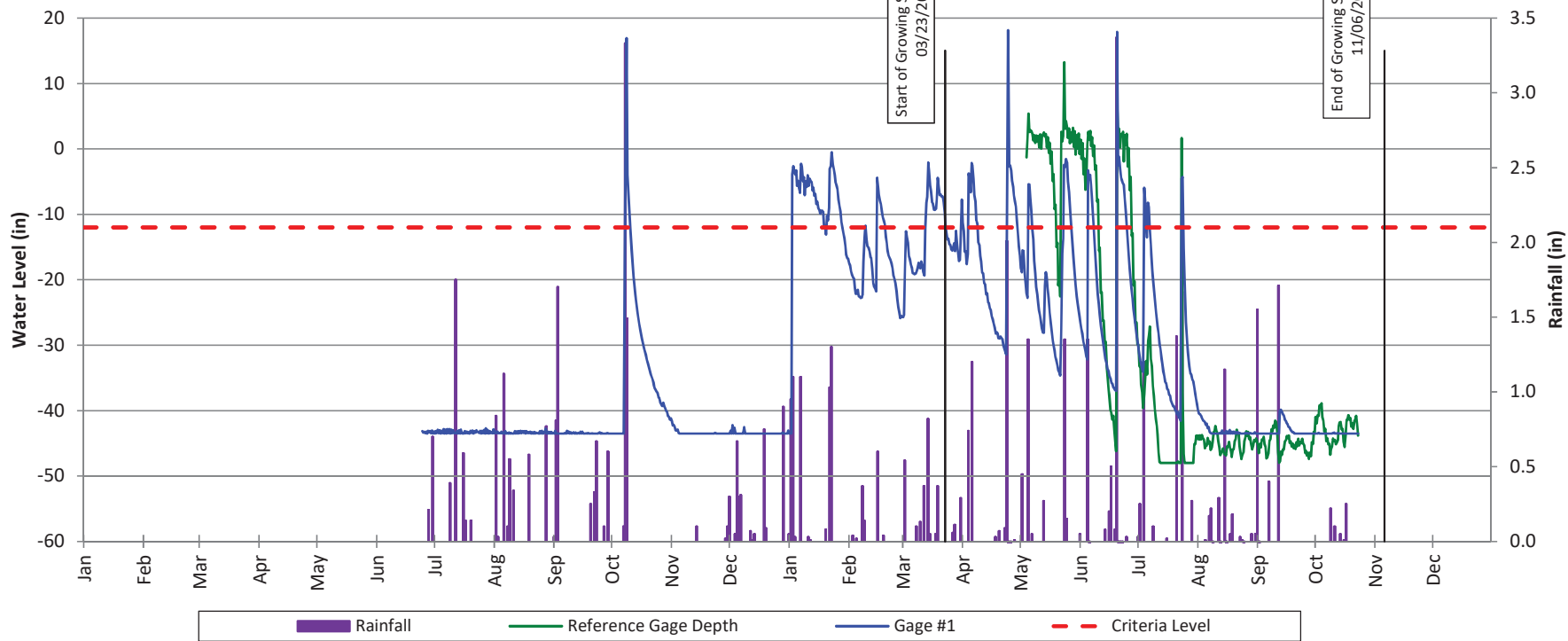
Evaluated by: M. WOOD

### Deep Meadow Drainmod Model:Well 2 Calibration

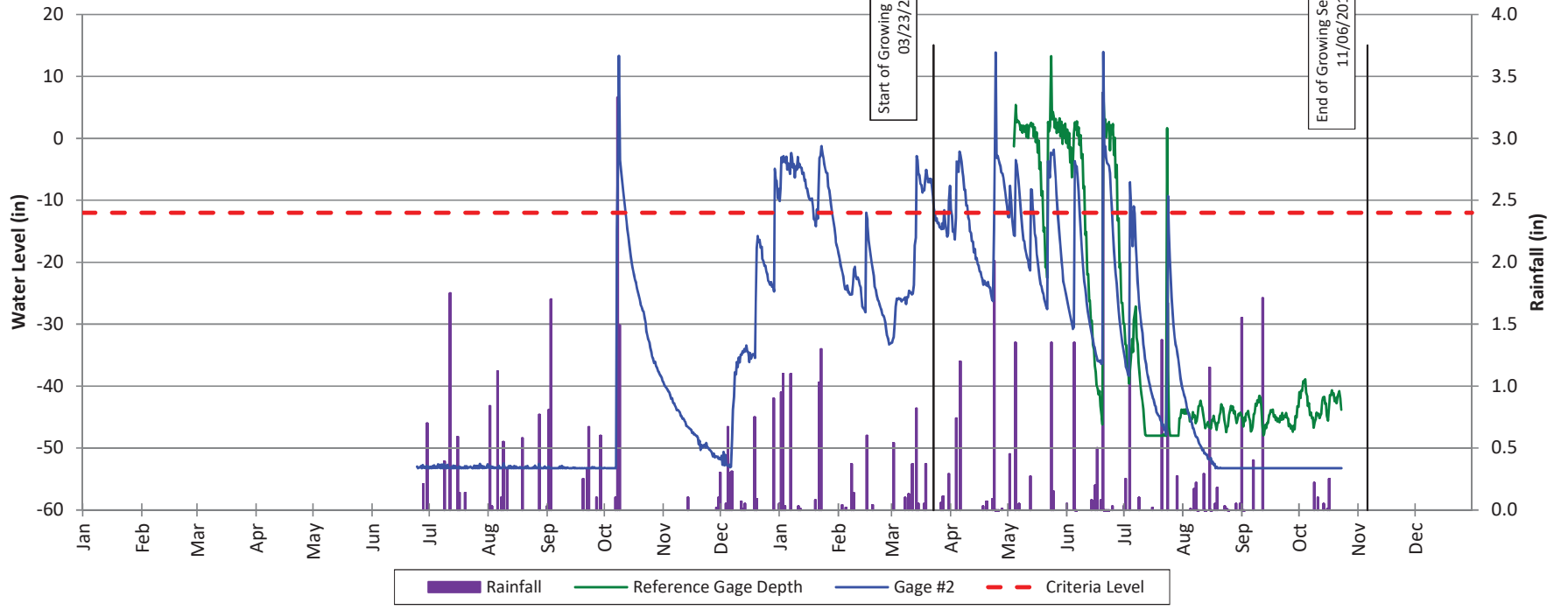




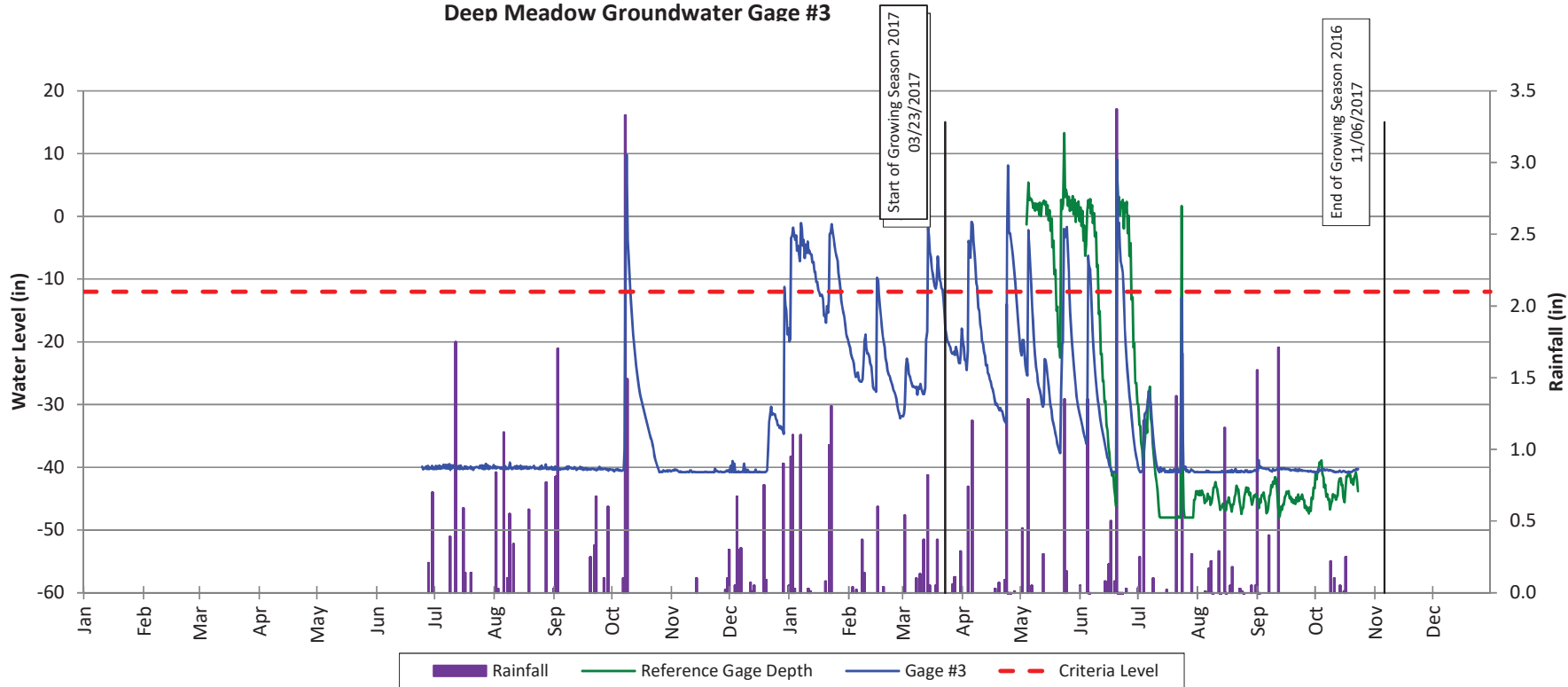
### Deep Meadow Groundwater Gage #1



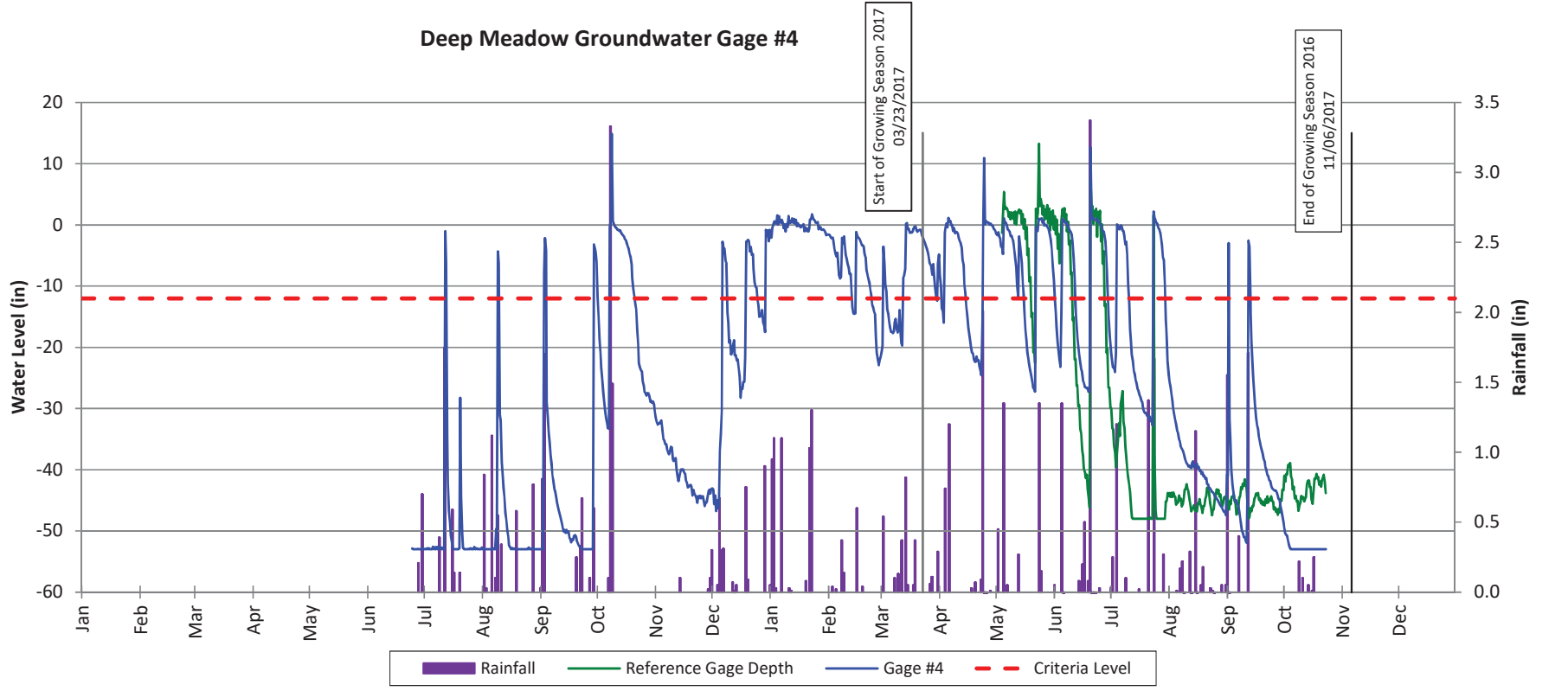
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### Deep Meadow Groundwater Gage #3

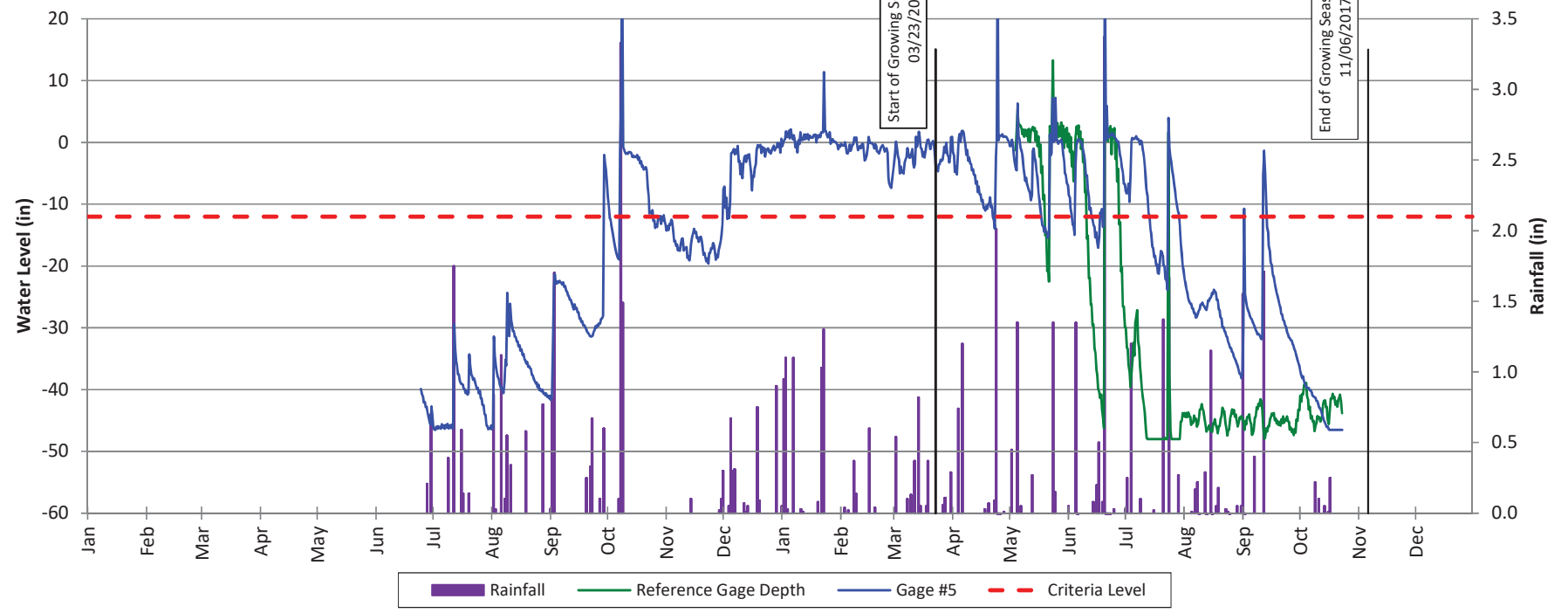


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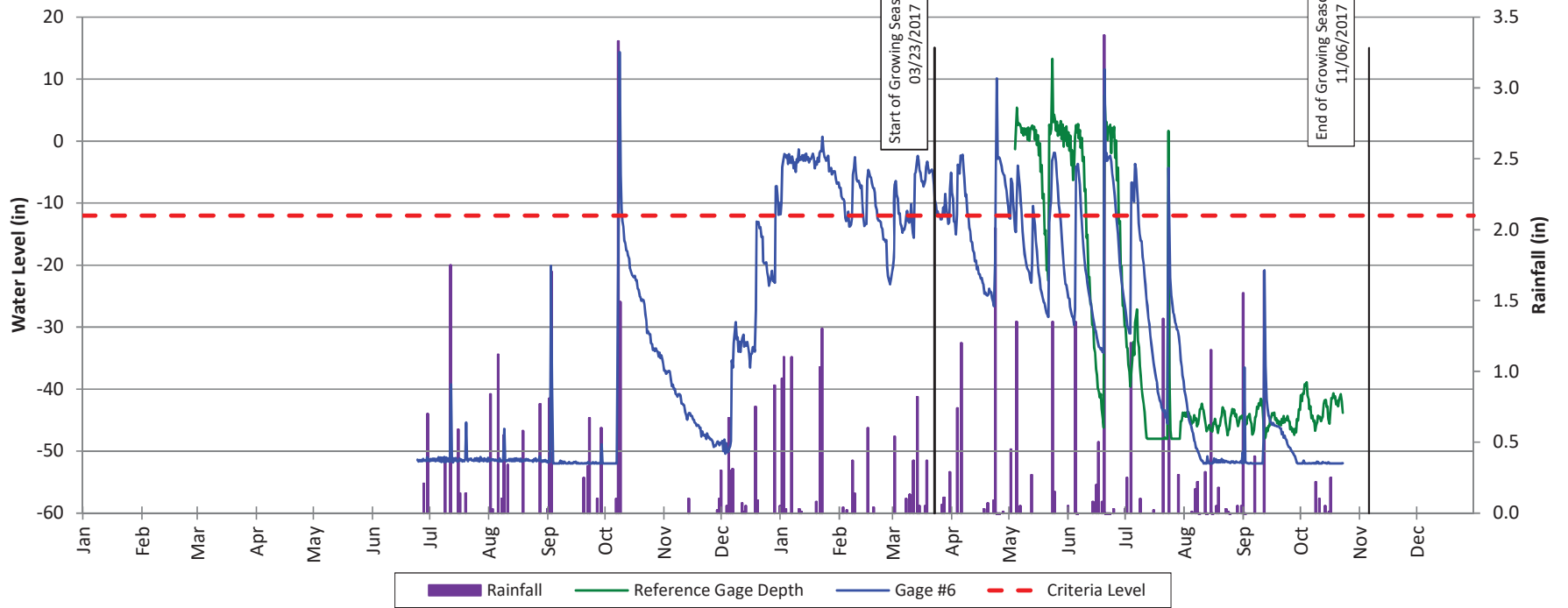




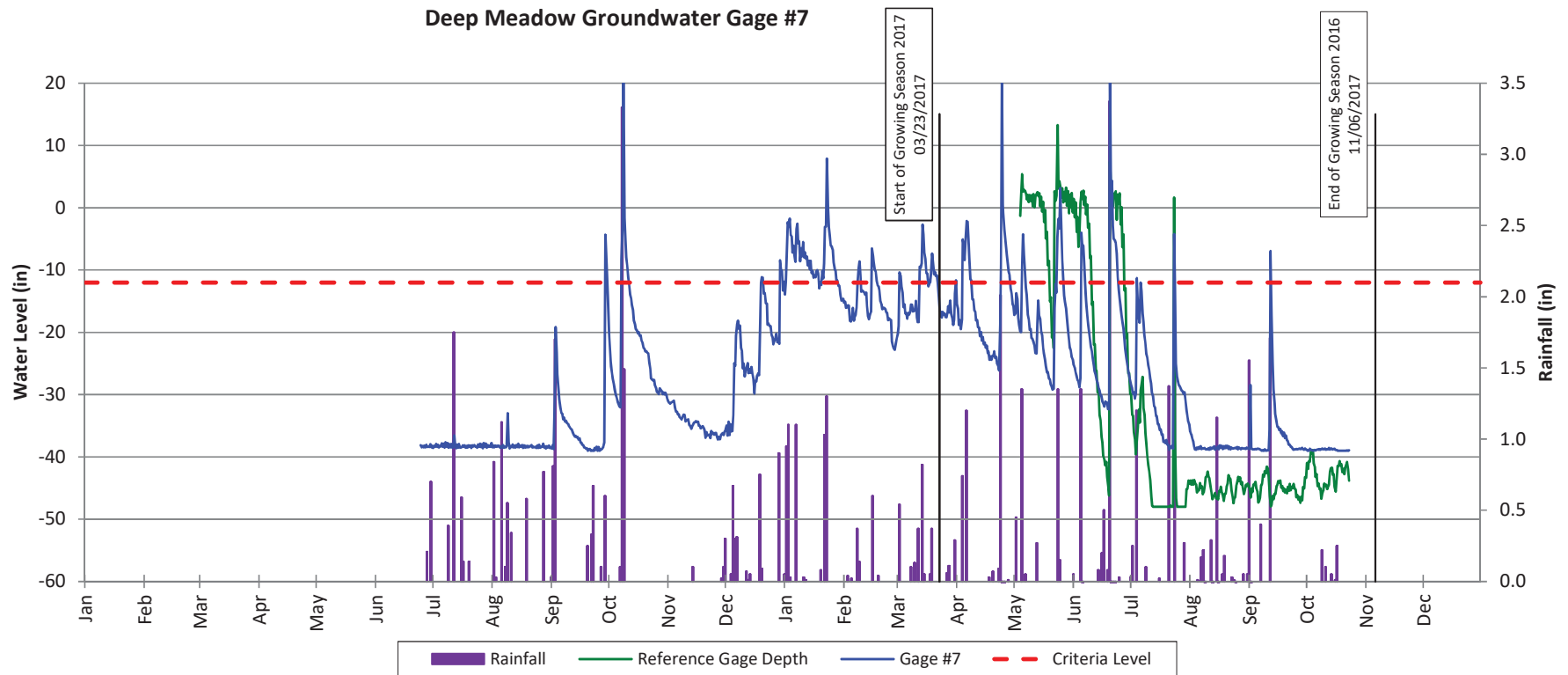
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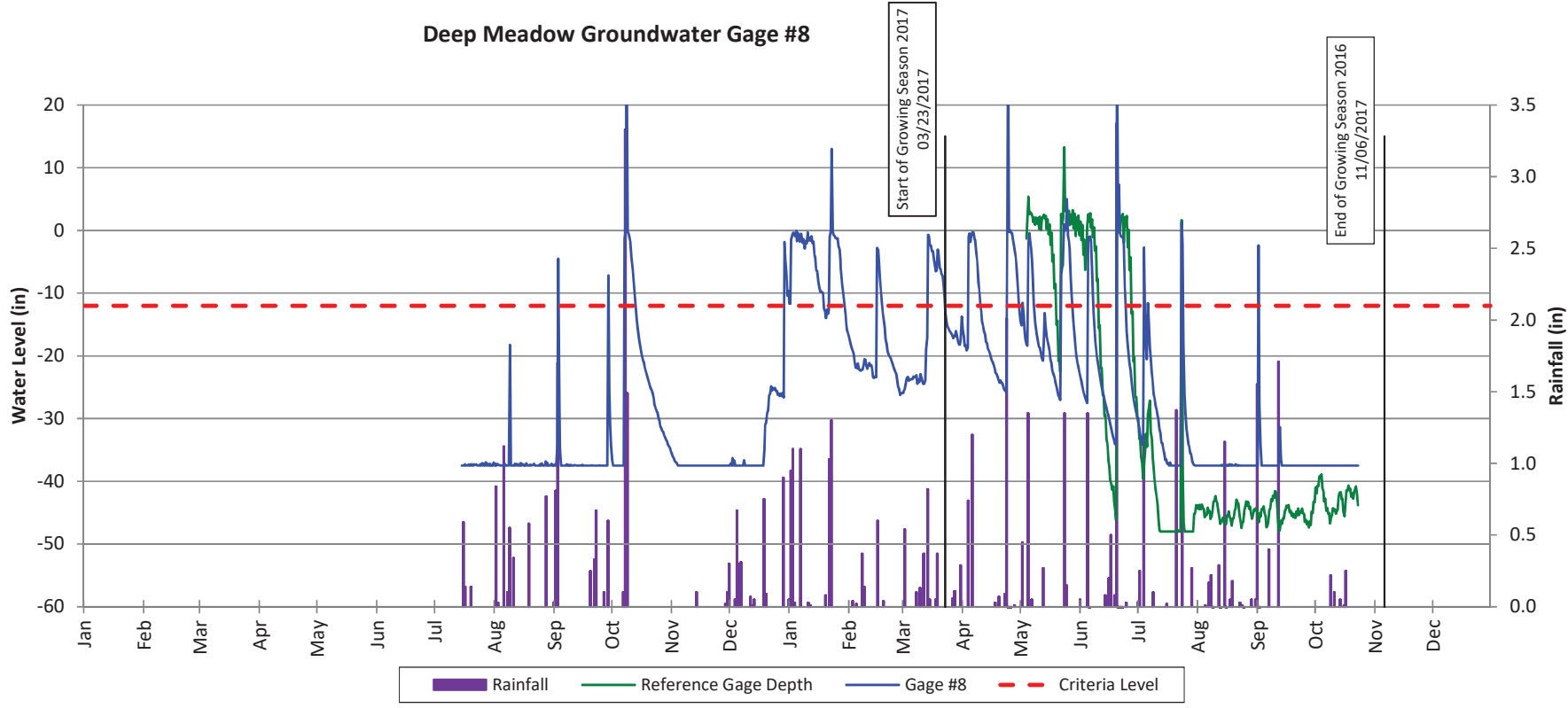
### Deep Meadow Groundwater Gage #6



### Deep Meadow Groundwater Gage #7

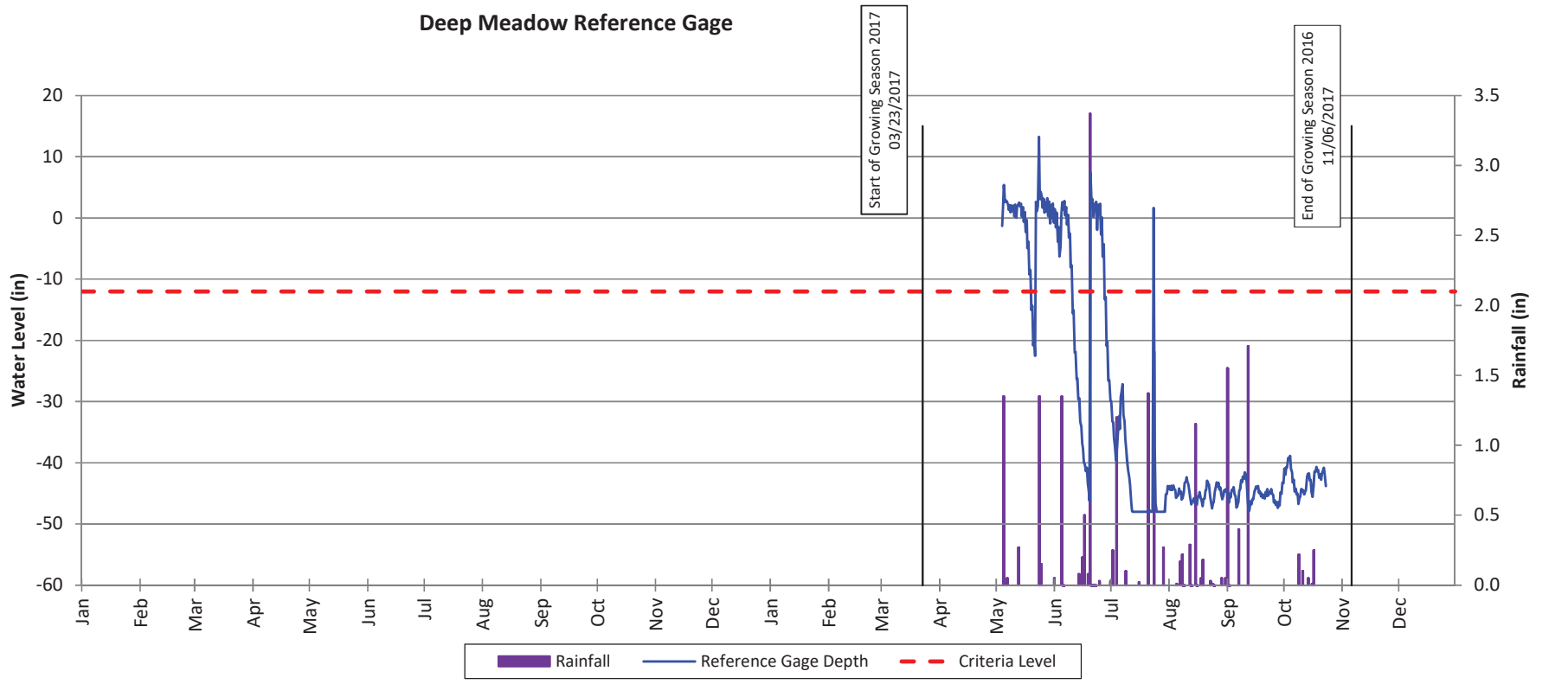


### Deep Meadow Groundwater Gage #8





### Deep Meadow Reference Gage





8/4/16 5:00 PM	-43.25	-53.14	-40.00	-53.00	-38.33	-51.39	-38.22	-37.44
8/5/16 5:00 AM	-43.47	-53.25	-40.25	-53.00	-39.14	-51.56	-38.53	-37.50
8/5/16 5:00 PM	-43.36	-53.17	-40.17	-53.00	-39.58	-51.58	-38.34	-37.50
8/6/16 5:00 AM	-43.50	-53.25	-40.11	-53.00	-39.97	-51.67	-38.53	-37.50
8/6/16 5:00 PM	-43.11	-52.86	-39.81	-52.86	-39.86	-51.17	-38.09	-37.28
8/7/16 5:00 AM	-43.50	-53.25	-40.28	-53.00	-40.55	-51.64	-38.53	-37.50
8/7/16 5:00 PM	-43.44	-53.17	-40.11	-53.00	-38.69	-51.56	-38.36	-37.50
8/8/16 5:00 AM	-43.50	-53.25	-40.25	-49.68	-35.20	-51.61	-38.45	-37.50
8/8/16 5:00 PM	-43.36	-53.14	-40.17	-53.00	-36.09	-51.42	-38.28	-37.47
8/9/16 5:00 AM	-43.50	-52.47	-39.26	-4.33	-24.35	-46.41	-32.99	-18.23
8/9/16 5:00 PM	-43.42	-53.11	-40.09	-6.32	-29.78	-51.39	-37.67	-37.50
8/10/16 5:00 AM	-43.50	-53.25	-40.31	-31.07	-31.33	-51.61	-38.67	-37.50
8/10/16 5:00 PM	-43.50	-53.22	-40.09	-31.99	-26.10	-51.50	-38.31	-37.50
8/11/16 5:00 AM	-43.50	-53.25	-40.14	-38.80	-28.78	-51.56	-38.42	-37.50
8/11/16 5:00 PM	-43.14	-52.95	-39.84	-40.51	-29.59	-51.28	-38.00	-37.22
8/12/16 5:00 AM	-43.50	-53.25	-40.20	-42.92	-30.50	-51.58	-38.47	-37.50
8/12/16 5:00 PM	-43.17	-52.86	-39.78	-44.42	-30.53	-51.25	-38.17	-37.25
8/13/16 5:00 AM	-43.50	-53.25	-40.20	-47.10	-31.44	-51.64	-38.50	-37.50
8/13/16 5:00 PM	-43.11	-53.06	-39.84	-48.18	-31.50	-51.25	-38.09	-37.31
8/14/16 5:00 AM	-43.44	-53.25	-40.11	-49.93	-32.22	-51.64	-38.42	-37.50
8/14/16 5:00 PM	-43.08	-52.89	-39.73	-50.95	-32.22	-51.20	-37.89	-37.08
8/15/16 5:00 AM	-43.44	-53.25	-40.31	-52.36	-32.99	-51.58	-38.45	-37.50
8/15/16 5:00 PM	-43.14	-52.97	-39.95	-52.61	-32.82	-51.17	-38.17	-37.25
8/16/16 5:00 AM	-43.39	-53.25	-40.22	-53.00	-33.71	-51.53	-38.39	-37.50
8/16/16 5:00 PM	-43.11	-53.14	-39.89	-52.78	-33.52	-51.25	-38.09	-37.36
8/17/16 5:00 AM	-43.50	-53.25	-40.14	-53.00	-34.40	-51.64	-38.56	-37.50
8/17/16 5:00 PM	-43.11	-53.06	-39.89	-52.86	-34.21	-51.22	-38.14	-37.14
8/18/16 5:00 AM	-43.42	-53.25	-40.25	-53.00	-35.09	-51.67	-38.50	-37.50
8/18/16 5:00 PM	-43.31	-53.14	-39.97	-53.00	-35.20	-51.42	-38.25	-37.50
8/19/16 5:00 AM	-43.42	-53.25	-40.22	-53.00	-35.73	-51.64	-38.45	-37.50
8/19/16 5:00 PM	-43.22	-53.17	-39.92	-53.00	-35.54	-51.34	-38.22	-37.33
8/20/16 5:00 AM	-43.50	-53.25	-40.14	-53.00	-36.31	-51.56	-38.45	-37.50
8/20/16 5:00 PM	-43.31	-53.00	-40.00	-53.00	-36.26	-51.28	-38.28	-37.44
8/21/16 5:00 AM	-43.50	-53.25	-40.00	-53.00	-36.53	-51.47	-38.31	-37.33
8/21/16 5:00 PM	-43.28	-52.92	-39.78	-53.00	-36.67	-51.31	-38.09	-37.22
8/22/16 5:00 AM	-43.50	-53.25	-40.25	-53.00	-37.56	-51.56	-38.47	-37.50
8/22/16 5:00 PM	-43.36	-53.25	-40.11	-53.00	-37.72	-51.56	-38.36	-37.50
8/23/16 5:00 AM	-43.44	-53.25	-40.17	-53.00	-38.31	-51.56	-38.45	-37.50
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8/26/16 5:00 AM	-43.50	-53.25	-40.20	-53.00	-40.08	-51.64	-38.53	-37.50
8/26/16 5:00 PM	-43.36	-53.17	-40.17	-53.00	-39.94	-51.45	-38.36	-37.50
8/27/16 5:00 AM	-43.36	-53.25	-40.14	-53.00	-40.27	-51.53	-38.39	-37.50
8/27/16 5:00 PM	-42.78	-52.56	-39.53	-52.70	-39.99	-50.84	-37.89	-36.81
8/28/16 5:00 AM	-43.50	-53.25	-40.28	-53.00	-40.66	-51.58	-38.50	-37.50
8/28/16 5:00 PM	-43.20	-53.19	-40.03	-53.00	-40.55	-51.47	-38.34	-37.08
8/29/16 5:00 AM	-43.50	-53.25	-40.28	-53.00	-40.88	-51.70	-38.64	-37.50
8/29/16 5:00 PM	-43.28	-53.25	-40.03	-53.00	-40.60	-51.50	-38.28	-37.50
8/30/16 5:00 AM	-43.50	-53.25	-40.25	-53.00	-41.18	-51.61	-38.50	-37.50
8/30/16 5:00 PM	-43.28	-53.00	-39.95	-52.97	-40.99	-51.45	-38.17	-37.22
8/31/16 5:00 AM	-43.50	-53.25	-40.36	-53.00	-41.41	-51.70	-38.58	-37.50
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9/1/16 5:00 PM	-43.08	-53.00	-39.84	-53.00	-41.32	-51.22	-38.14	-37.28
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9/2/16 5:00 PM	-43.50	-53.25	-40.22	-7.60	-23.63	-20.11	-30.72	-34.29
9/3/16 5:00 AM	-43.50	-53.25	-40.39	-2.17	-21.34	-39.21	-19.15	-4.50
9/3/16 5:00 PM	-43.50	-53.25	-40.22	-4.25	-22.61	-51.94	-23.19	-27.28
9/4/16 5:00 AM	-43.50	-53.25	-40.36	-28.91	-22.89	-52.00	-26.74	-34.76
9/4/16 5:00 PM	-43.50	-53.25	-40.28	-31.27	-22.47	-52.00	-29.01	-37.50
9/5/16 5:00 AM	-43.50	-53.25	-40.25	-33.76	-22.66	-52.00	-30.78	-37.50
9/5/16 5:00 PM	-43.50	-53.25	-40.28	-35.59	-22.39	-52.00	-32.11	-37.50
9/6/16 5:00 AM	-43.50	-53.25	-40.25	-37.52	-22.61	-52.00	-32.91	-37.50
9/6/16 5:00 PM	-43.42	-53.25	-40.14	-39.02	-22.77	-52.00	-33.10	-37.50
9/7/16 5:00 AM	-43.50	-53.25	-40.25	-40.90	-23.00	-52.00	-33.93	-37.50
9/7/16 5:00 PM	-43.08	-52.97	-39.89	-41.76	-22.64	-51.53	-33.71	-37.31
9/8/16 5:00 AM	-43.42	-53.25	-40.33	-43.09	-23.36	-52.00	-34.32	-37.50
9/8/16 5:00 PM	-43.20	-52.86	-39.86	-43.56	-23.25	-51.67	-34.24	-37.36
9/9/16 5:00 AM	-43.50	-53.25	-40.11	-44.61	-23.99	-51.97	-34.60	-37.50
9/9/16 5:00 PM	-43.31	-53.08	-40.03	-45.36	-24.16	-51.72	-34.71	-37.36
9/10/16 5:00 AM	-43.50	-53.25	-40.22	-46.30	-24.80	-51.86	-35.04	-37.50
9/10/16 5:00 PM	-43.42	-53.17	-40.11	-46.83	-24.88	-51.97	-35.21	-37.50
9/11/16 5:00 AM	-43.31	-53.25	-40.25	-47.38	-25.43	-52.00	-35.48	-37.50
9/11/16 5:00 PM	-43.50	-53.14	-39.97	-48.04	-25.49	-51.97	-35.62	-37.42
9/12/16 5:00 AM	-43.36	-53.22	-40.11	-48.65	-26.01	-51.75	-36.04	-37.47
9/12/16 5:00 PM	-43.50	-53.25	-40.42	-49.59	-26.60	-51.97	-36.45	-37.50
9/13/16 5:00 AM	-43.50	-53.25	-40.31	-50.09	-27.04	-52.00	-36.73	-37.50
9/13/16 5:00 PM	-43.39	-53.25	-40.17	-49.82	-26.18	-51.94	-36.62	-37.50
9/14/16 5:00 AM	-43.50	-53.25	-40.20	-50.31	-26.93	-52.00	-36.84	-37.50
9/14/16 5:00 PM	-43.25	-53.14	-39.92	-49.82	-26.79	-51.75	-36.76	-37.47
9/15/16 5:00 AM	-43.50	-53.25	-40.31	-50.29	-27.45	-51.86	-37.23	-37.50
9/15/16 5:00 PM	-43.25	-53.17	-40.03	-50.07	-27.48	-51.72	-37.01	-37.39
9/16/16 5:00 AM	-43.50	-53.25	-40.39	-51.09	-28.51	-52.00	-37.64	-37.50
9/16/16 5:00 PM	-43.50	-53.25	-40.20	-51.39	-28.42	-51.86	-37.73	-37.50
9/17/16 5:00 AM	-43.50	-53.25	-40.28	-51.86	-29.03	-51.97	-38.06	-37.50
9/17/16 5:00 PM	-43.47	-53.22	-40.11	-51.34	-28.92	-51.97	-38.14	-37.50
9/18/16 5:00 AM	-43.50	-53.25	-40.42	-51.48	-29.59	-52.00	-38.50	-37.50
9/18/16 5:00 PM	-43.44	-53.25	-40.22	-50.79	-29.56	-51.94	-38.53	-37.50
9/19/16 5:00 AM	-43.50	-53.25	-40.33	-50.67	-29.83	-52.00	-38.70	-37.50
9/19/16 5:00 PM	-43.50	-53.25	-40.28	-50.92	-30.14	-52.00	-38.64	-37.50
9/20/16 5:00 AM	-43.50	-53.25	-40.36	-51.59	-30.53	-52.00	-39.00	-37.50

9/20/16 5:00 PM	-43.47	-53.22	-40.20	-51.98	-30.75	-51.94	-38.78	-37.44
9/21/16 5:00 AM	-43.50	-53.25	-40.22	-52.34	-31.00	-52.00	-38.72	-37.50
9/21/16 5:00 PM	-43.50	-53.25	-40.33	-52.58	-31.30	-52.00	-39.00	-37.50
9/22/16 5:00 AM	-43.50	-53.25	-40.28	-52.75	-31.41	-51.75	-38.94	-37.50
9/22/16 5:00 PM	-43.50	-53.25	-40.45	-52.86	-31.38	-52.00	-39.00	-37.50
9/23/16 5:00 AM	-43.50	-53.25	-40.45	-53.00	-31.22	-52.00	-39.00	-37.50
9/23/16 5:00 PM	-43.50	-53.25	-40.25	-53.00	-30.75	-52.00	-38.56	-37.50
9/24/16 5:00 AM	-43.44	-53.25	-40.31	-53.00	-30.33	-52.00	-38.89	-37.50
9/24/16 5:00 PM	-43.31	-53.06	-39.95	-53.00	-29.75	-51.78	-38.39	-37.44
9/25/16 5:00 AM	-43.50	-53.25	-40.33	-53.00	-29.97	-52.00	-39.00	-37.50
9/25/16 5:00 PM	-43.42	-53.11	-40.17	-53.00	-29.50	-52.00	-38.42	-37.50
9/26/16 5:00 AM	-43.50	-53.25	-40.33	-53.00	-29.67	-51.78	-39.00	-37.50
9/26/16 5:00 PM	-43.50	-53.25	-40.28	-53.00	-29.28	-52.00	-38.81	-37.50
9/27/16 5:00 AM	-43.50	-53.25	-40.22	-53.00	-29.31	-52.00	-38.81	-37.50
9/27/16 5:00 PM	-43.50	-53.25	-40.22	-53.00	-28.53	-51.94	-38.64	-37.50
9/28/16 5:00 AM	-43.50	-53.25	-40.36	-53.00	-28.45	-52.00	-38.39	-37.50
9/28/16 5:00 PM	-43.44	-53.08	-40.31	-53.00	-28.03	-52.00	-37.67	-37.50
9/29/16 5:00 AM	-43.50	-53.25	-40.53	-3.20	-2.04	-48.90	-4.31	-7.19
9/29/16 5:00 PM	-43.50	-53.25	-40.33	-3.78	-3.34	-52.00	-7.72	-25.40
9/30/16 5:00 AM	-43.50	-53.25	-40.33	-4.47	-4.36	-52.00	-11.09	-30.97
9/30/16 5:00 PM	-43.50	-53.25	-40.36	-6.05	-6.05	-52.00	-14.97	-34.12
10/1/16 5:00 AM	-43.50	-53.19	-40.42	-11.81	-8.77	-52.00	-19.90	-36.56
10/1/16 5:00 PM	-43.50	-53.22	-40.36	-14.88	-10.29	-52.00	-23.00	-37.50
10/2/16 5:00 AM	-43.50	-53.25	-40.64	-18.67	-12.17	-52.00	-25.52	-37.50
10/2/16 5:00 PM	-43.50	-53.25	-40.45	-20.94	-12.67	-52.00	-26.60	-37.50
10/3/16 5:00 AM	-43.50	-53.25	-40.33	-23.32	-13.50	-52.00	-27.43	-37.50
10/3/16 5:00 PM	-43.50	-53.25	-40.45	-25.29	-14.41	-52.00	-28.29	-37.50
10/4/16 5:00 AM	-43.50	-53.25	-40.31	-27.25	-15.58	-52.00	-29.23	-37.50
10/4/16 5:00 PM	-43.50	-53.25	-40.53	-28.91	-16.32	-51.97	-30.03	-37.50
10/5/16 5:00 AM	-43.50	-53.25	-40.39	-30.27	-17.21	-52.00	-30.50	-37.50
10/5/16 5:00 PM	-43.50	-53.25	-40.58	-31.63	-17.99	-52.00	-31.19	-37.50
10/6/16 5:00 AM	-43.50	-53.25	-40.56	-32.46	-18.54	-52.00	-31.61	-37.50
10/6/16 5:00 PM	-43.50	-53.25	-40.47	-33.21	-18.76	-52.00	-31.89	-37.50
10/7/16 5:00 AM	-43.50	-53.25	-40.42	-33.32	-18.93	-52.00	-32.02	-37.50
10/7/16 5:00 PM	-15.51	-14.85	-37.07	-0.40	-1.68	-33.45	-8.35	-1.29
10/8/16 5:00 AM	-2.58	-2.70	-1.99	0.85	7.51	-8.62	-3.09	-0.13
10/8/16 5:00 PM	16.93	13.33	9.83	14.91	32.70	14.39	23.21	29.91
10/9/16 5:00 AM	-3.99	-3.47	-3.79	0.85	-0.74	-5.38	-1.63	-0.24
10/9/16 5:00 PM	-7.26	-4.89	-6.20	0.21	-1.15	-10.89	-5.00	-0.54
10/10/16 5:00 AM	-9.89	-6.44	-9.22	-0.04	-1.49	-12.88	-7.94	-1.10
10/10/16 5:00 PM	-12.36	-7.35	-11.57	-0.40	-1.85	-13.77	-9.32	-1.84
10/11/16 5:00 AM	-15.12	-9.32	-14.95	-0.43	-1.73	-16.07	-11.15	-4.28
10/11/16 5:00 PM	-17.34	-10.48	-17.05	-0.79	-1.85	-16.48	-12.42	-6.00
10/12/16 5:00 AM	-19.30	-12.14	-19.24	-0.76	-1.57	-17.62	-13.95	-7.60
10/12/16 5:00 PM	-20.91	-13.47	-20.87	-0.98	-1.54	-17.75	-14.58	-9.54
10/13/16 5:00 AM	-22.02	-14.60	-22.23	-0.90	-1.60	-18.50	-15.58	-11.03
10/13/16 5:00 PM	-23.40	-15.85	-23.84	-1.26	-1.76	-18.89	-16.41	-12.86
10/14/16 5:00 AM	-24.70	-17.26	-25.25	-1.54	-2.37	-20.58	-18.07	-14.63
10/14/16 5:00 PM	-25.67	-18.42	-26.41	-1.67	-2.15	-21.02	-18.68	-16.32
10/15/16 5:00 AM	-26.72	-19.59	-27.41	-1.90	-2.40	-21.58	-19.48	-17.43
10/15/16 5:00 PM	-27.61	-20.72	-28.46	-2.34	-2.29	-21.80	-19.68	-18.70
10/16/16 5:00 AM	-28.33	-21.47	-29.15	-2.50	-2.40	-21.96	-20.17	-19.28
10/16/16 5:00 PM	-28.99	-22.05	-29.65	-2.92	-2.04	-21.74	-19.95	-20.03
10/17/16 5:00 AM	-29.74	-22.83	-30.34	-3.42	-2.79	-22.41	-20.53	-20.64
10/17/16 5:00 PM	-30.29	-23.27	-30.81	-3.89	-2.40	-22.43	-20.48	-21.03
10/18/16 5:00 AM	-30.99	-24.24	-31.53	-4.72	-3.40	-23.71	-21.31	-21.91
10/18/16 5:00 PM	-31.49	-24.79	-32.14	-5.25	-3.04	-23.98	-21.73	-22.52
10/19/16 5:00 AM	-32.23	-25.51	-32.97	-6.49	-3.95	-24.95	-22.47	-22.99
10/19/16 5:00 PM	-32.76	-26.01	-33.47	-8.88	-3.81	-25.20	-22.61	-23.46
10/20/16 5:00 AM	-33.31	-26.84	-34.16	-10.51	-4.39	-25.76	-23.03	-24.18
10/20/16 5:00 PM	-33.87	-27.25	-34.71	-11.58	-4.25	-25.56	-23.05	-24.68
10/21/16 5:00 AM	-34.39	-27.78	-35.30	-12.83	-3.98	-25.64	-23.28	-25.15
10/21/16 5:00 PM	-34.81	-28.03	-35.68	-13.80	-4.56	-26.28	-23.39	-25.46
10/22/16 5:00 AM	-35.25	-28.97	-36.46	-17.07	-7.24	-27.89	-24.83	-26.01
10/22/16 5:00 PM	-35.75	-29.75	-37.18	-19.50	-8.77	-28.99	-25.82	-26.68
10/23/16 5:00 AM	-36.52	-31.10	-38.23	-22.58	-11.51	-30.93	-27.40	-27.73
10/23/16 5:00 PM	-36.83	-31.79	-38.87	-23.30	-11.29	-30.68	-27.59	-28.23
10/24/16 5:00 AM	-37.10	-32.49	-39.37	-23.74	-11.45	-31.10	-27.70	-28.75
10/24/16 5:00 PM	-37.30	-32.90	-39.81	-23.93	-10.98	-31.15	-27.65	-29.03
10/25/16 5:00 AM	-37.94	-33.79	-40.33	-25.57	-12.70	-32.59	-28.54	-29.75
10/25/16 5:00 PM	-38.13	-34.48	-40.75	-26.28	-12.64	-32.73	-28.92	-30.33
10/26/16 5:00 AM	-38.74	-35.23	-40.75	-27.28	-13.81	-33.65	-29.53	-31.13
10/26/16 5:00 PM	-39.02	-35.56	-40.67	-27.48	-13.31	-33.48	-29.56	-31.49
10/27/16 5:00 AM	-39.29	-36.25	-40.75	-27.86	-13.69	-33.87	-29.92	-31.94
10/27/16 5:00 PM	-38.79	-36.06	-40.50	-27.48	-12.37	-33.42	-29.01	-32.10
10/28/16 5:00 AM	-39.35	-36.72	-40.56	-27.53	-12.12	-33.81	-29.23	-32.66
10/28/16 5:00 PM	-39.68	-37.08	-40.69	-27.97	-11.90	-33.98	-29.42	-33.04
10/29/16 5:00 AM	-40.04	-37.53	-40.58	-28.86	-13.17	-34.78	-29.89	-33.43
10/29/16 5:00 PM	-40.15	-37.72	-40.47	-28.72	-12.03	-34.12	-29.62	-33.60
10/30/16 4:00 AM	-40.81	-38.11	-40.67	-29.05	-12.61	-34.97	-29.95	-34.18
10/30/16 4:00 PM	-40.95	-38.38	-40.47	-28.86	-11.78	-34.56	-29.70	-34.43
10/31/16 4:00 AM	-41.37	-38.86	-40.50	-29.39	-12.86	-35.31	-30.06	-34.70
10/31/16 4:00 PM	-41.20	-39.13	-40.64	-30.47	-13.25	-35.94	-30.61	-35.12
11/1/16 4:00 AM	-41.65	-39.46	-40.58	-31.49	-14.25	-37.00	-31.05	-35.53
11/1/16 4:00 PM	-42.25	-39.85	-40.47	-32.18	-13.56	-37.02	-31.30	-36.03
11/2/16 4:00 AM	-42.17	-40.07	-40.53	-32.62	-14.19	-37.52	-31.47	-36.34
11/2/16 4:00 PM	-42.48	-40.29	-40.33	-32.46	-13.22	-37.13	-31.28	-36.75
11/3/16 4:00 AM	-43.00	-40.54	-40.45	-32.43	-13.31	-37.22	-31.19	-36.95
11/3/16 4:00 PM	-43.06	-40.79	-40.42	-32.07	-12.50	-37.05	-31.08	-37.06
11/4/16 4:00 AM	-42.89	-40.99	-40.47	-31.96	-12.73	-37.24	-31.00	-37.39
11/4/16 4:00 PM	-43.44	-41.43	-40.64	-33.48	-14.22	-38.46	-32.02	-37.50
11/5/16 4:00 AM	-43.50	-42.04	-40.75	-34.95	-15.96	-39.51	-32.69	-37.50
11/5/16 4:00 PM	-43.50	-41.98	-40.64	-35.23	-15.94	-39.29	-32.74	-37.50
11/6/16 4:00 AM	-43.50	-42.67	-40.75	-35.84	-16.74	-40.01	-33.19	-37.50

11/6/16 4:00 PM	-43.50	-42.76	-40.75	-35.84	-16.52	-39.99	-33.19	-37.50
11/7/16 4:00 AM	-43.50	-43.09	-40.75	-36.61	-17.46	-40.76	-33.63	-37.50
11/7/16 4:00 PM	-43.50	-43.42	-40.75	-37.14	-17.15	-40.90	-33.77	-37.50
11/8/16 4:00 AM	-43.50	-43.87	-40.75	-37.47	-17.54	-41.20	-33.99	-37.50
11/8/16 4:00 PM	-43.50	-43.84	-40.75	-36.86	-16.55	-40.79	-33.55	-37.50
11/9/16 4:00 AM	-43.50	-44.00	-40.67	-36.25	-15.63	-40.79	-33.21	-37.50
11/9/16 4:00 PM	-43.50	-44.25	-40.75	-36.39	-15.52	-41.01	-33.24	-37.50
11/10/16 4:00 AM	-43.50	-44.81	-40.75	-38.27	-17.49	-42.34	-34.29	-37.50
11/10/16 4:00 PM	-43.50	-44.83	-40.47	-38.58	-17.15	-42.34	-34.16	-37.50
11/11/16 4:00 AM	-43.50	-45.25	-40.50	-38.36	-17.10	-42.48	-34.07	-37.50
11/11/16 4:00 PM	-43.50	-45.25	-40.75	-38.11	-16.93	-42.67	-33.96	-37.50
11/12/16 4:00 AM	-43.50	-45.61	-40.75	-39.88	-18.68	-43.67	-34.85	-37.50
11/12/16 4:00 PM	-43.50	-45.83	-40.69	-41.12	-18.48	-44.22	-35.07	-37.50
11/13/16 4:00 AM	-43.50	-46.44	-40.75	-41.84	-19.09	-44.91	-35.51	-37.50
11/13/16 4:00 PM	-43.50	-46.47	-40.75	-41.18	-18.12	-44.25	-35.12	-37.50
11/14/16 4:00 AM	-43.50	-46.63	-40.75	-40.43	-16.41	-43.83	-34.82	-37.50
11/14/16 4:00 PM	-43.50	-46.80	-40.75	-39.93	-15.27	-43.89	-34.49	-37.50
11/15/16 4:00 AM	-43.50	-46.91	-40.75	-40.04	-14.66	-44.30	-34.40	-37.50
11/15/16 4:00 PM	-43.50	-47.02	-40.75	-39.93	-13.97	-44.33	-34.27	-37.50
11/16/16 4:00 AM	-43.50	-47.55	-40.75	-40.43	-14.66	-44.86	-34.38	-37.50
11/16/16 4:00 PM	-43.50	-47.49	-40.75	-40.65	-14.50	-44.94	-34.32	-37.50
11/17/16 4:00 AM	-43.50	-47.80	-40.75	-41.68	-15.44	-45.38	-34.96	-37.50
11/17/16 4:00 PM	-43.50	-47.74	-40.75	-42.12	-15.38	-45.52	-34.99	-37.50
11/18/16 4:00 AM	-43.50	-47.99	-40.75	-42.90	-16.10	-45.91	-35.43	-37.50
11/18/16 4:00 PM	-43.50	-48.02	-40.67	-42.76	-15.36	-45.77	-35.21	-37.50
11/19/16 4:00 AM	-43.50	-48.32	-40.75	-42.56	-15.27	-45.83	-35.04	-37.50
11/19/16 4:00 PM	-43.50	-49.37	-40.75	-42.48	-15.85	-46.27	-35.37	-37.50
11/20/16 4:00 AM	-43.50	-48.82	-40.75	-42.81	-16.80	-46.19	-35.65	-37.50
11/20/16 4:00 PM	-43.50	-50.32	-40.75	-44.20	-18.15	-47.65	-36.92	-37.50
11/21/16 4:00 AM	-43.50	-49.51	-40.75	-43.28	-17.90	-46.85	-36.01	-37.50
11/21/16 4:00 PM	-43.50	-49.90	-40.75	-43.89	-18.65	-47.40	-36.56	-37.50
11/22/16 4:00 AM	-43.50	-49.71	-40.75	-44.25	-19.26	-47.52	-36.48	-37.50
11/22/16 4:00 PM	-43.50	-49.46	-40.75	-44.58	-18.76	-47.38	-36.43	-37.50
11/23/16 4:00 AM	-43.50	-49.93	-40.75	-45.39	-19.62	-48.01	-36.98	-37.50
11/23/16 4:00 PM	-43.39	-49.21	-40.20	-44.33	-17.83	-47.16	-35.84	-37.50
11/24/16 4:00 AM	-43.50	-49.90	-40.61	-44.61	-17.90	-47.74	-36.29	-37.50
11/24/16 4:00 PM	-43.50	-49.96	-40.56	-44.25	-17.13	-47.71	-36.15	-37.50
11/25/16 4:00 AM	-43.50	-50.23	-40.69	-44.67	-17.21	-48.07	-36.43	-37.50
11/25/16 4:00 PM	-43.50	-50.34	-40.75	-44.33	-16.30	-48.01	-36.18	-37.50
11/26/16 4:00 AM	-43.50	-50.54	-40.67	-44.33	-16.60	-48.26	-36.18	-37.50
11/26/16 4:00 PM	-43.50	-50.79	-40.69	-44.94	-17.46	-48.51	-36.70	-37.50
11/27/16 4:00 AM	-43.50	-51.34	-40.75	-45.91	-18.98	-49.31	-37.20	-37.50
11/27/16 4:00 PM	-43.50	-50.92	-40.75	-45.41	-18.21	-49.09	-36.79	-37.50
11/28/16 4:00 AM	-43.50	-51.51	-40.75	-45.33	-18.59	-49.15	-37.17	-37.50
11/28/16 4:00 PM	-43.50	-51.34	-40.72	-44.47	-17.46	-48.71	-36.54	-37.50
11/29/16 4:00 AM	-43.50	-51.42	-40.64	-43.53	-16.68	-48.43	-36.29	-37.50
11/29/16 4:00 PM	-43.50	-51.40	-40.50	-43.26	-15.94	-48.62	-36.18	-37.50
11/30/16 4:00 AM	-43.50	-51.73	-40.64	-43.89	-15.05	-49.04	-36.51	-37.50
11/30/16 4:00 PM	-43.50	-51.64	-40.45	-43.14	-13.25	-48.65	-35.95	-37.50
12/1/16 4:00 AM	-43.50	-51.81	-40.75	-43.03	-7.60	-48.68	-35.62	-37.50
12/1/16 4:00 PM	-43.08	-51.28	-39.75	-43.26	-7.13	-48.35	-34.96	-37.22
12/2/16 4:00 AM	-43.50	-52.70	-40.75	-45.61	-10.59	-50.01	-36.59	-37.50
12/2/16 4:00 PM	-42.23	-50.62	-39.01	-44.20	-8.96	-48.15	-34.32	-36.31
12/3/16 4:00 AM	-43.50	-52.78	-40.75	-46.74	-12.39	-50.39	-36.51	-37.50
12/3/16 4:00 PM	-42.64	-51.09	-39.99	-44.97	-10.68	-48.71	-34.74	-36.70
12/4/16 4:00 AM	-43.50	-52.61	-40.75	-46.33	-12.25	-50.17	-35.90	-37.50
12/4/16 4:00 PM	-43.50	-52.81	-40.75	-46.13	-9.65	-50.15	-35.84	-37.50
12/5/16 4:00 AM	-43.50	-52.89	-40.75	-36.89	-1.82	-49.65	-33.30	-37.50
12/5/16 4:00 PM	-43.50	-52.72	-40.64	-34.23	-1.65	-49.20	-24.94	-37.50
12/6/16 4:00 AM	-43.50	-53.11	-40.75	-30.38	-1.35	-48.35	-25.35	-37.50
12/6/16 4:00 PM	-43.50	-53.03	-40.75	-2.75	-1.07	-35.39	-20.51	-37.50
12/7/16 4:00 AM	-43.50	-48.54	-40.75	-3.81	-1.90	-36.52	-18.74	-37.50
12/7/16 4:00 PM	-43.50	-43.81	-40.69	-3.86	-1.21	-32.59	-18.13	-37.50
12/8/16 4:00 AM	-43.50	-41.73	-40.75	-5.74	-1.79	-30.63	-19.46	-37.50
12/8/16 4:00 PM	-42.50	-37.77	-39.42	-6.27	-0.57	-29.19	-18.93	-36.67
12/9/16 4:00 AM	-43.50	-38.08	-40.75	-14.35	-3.17	-31.98	-22.50	-37.50
12/9/16 4:00 PM	-43.50	-36.09	-40.36	-15.88	-2.98	-31.65	-23.05	-37.50
12/10/16 4:00 AM	-43.50	-36.94	-40.75	-19.23	-5.14	-33.92	-25.74	-37.50
12/10/16 4:00 PM	-43.50	-35.37	-40.42	-18.87	-3.48	-32.34	-25.05	-37.50
12/11/16 4:00 AM	-43.50	-36.17	-40.75	-21.16	-5.80	-33.98	-27.07	-37.50
12/11/16 4:00 PM	-43.50	-34.92	-40.75	-20.75	-3.56	-32.46	-26.10	-37.50
12/12/16 4:00 AM	-43.50	-34.92	-40.75	-19.70	-2.40	-31.76	-25.63	-37.50
12/12/16 4:00 PM	-43.50	-34.40	-40.75	-18.87	-2.18	-31.21	-24.96	-37.50
12/13/16 4:00 AM	-43.50	-34.56	-40.75	-21.30	-3.15	-33.15	-26.54	-37.50
12/13/16 4:00 PM	-43.50	-34.01	-40.75	-21.30	-2.09	-32.46	-25.91	-37.50
12/14/16 4:00 AM	-43.50	-34.37	-40.75	-22.13	-2.54	-32.98	-26.46	-37.50
12/14/16 4:00 PM	-43.50	-33.46	-40.36	-22.02	-1.93	-32.40	-25.57	-37.50
12/15/16 4:00 AM	-43.50	-34.42	-40.75	-23.41	-3.42	-33.23	-26.68	-37.50
12/15/16 4:00 PM	-43.50	-34.51	-40.75	-24.76	-4.81	-34.25	-27.48	-37.50
12/16/16 4:00 AM	-43.50	-36.14	-40.75	-28.22	-7.80	-36.55	-29.84	-37.50
12/16/16 4:00 PM	-43.50	-34.85	-40.67	-26.76	-5.47	-34.42	-27.84	-37.50
12/17/16 4:00 AM	-43.50	-35.56	-40.75	-26.78	-5.61	-34.25	-27.90	-37.50
12/17/16 4:00 PM	-43.50	-35.06	-40.75	-25.68	-4.25	-33.23	-26.96	-37.50
12/18/16 4:00 AM	-43.50	-34.81	-40.75	-25.59	-3.56	-33.20	-26.65	-37.50
12/18/16 4:00 PM	-43.50	-34.90	-40.75	-21.52	-1.18	-33.92	-26.87	-37.50
12/19/16 4:00 AM	-43.50	-35.45	-40.75	-2.73	-0.46	-27.25	-18.54	-34.95
12/19/16 4:00 PM	-43.50	-26.51	-40.75	-2.67	-0.77	-12.99	-12.01	-31.02
12/20/16 4:00 AM	-43.50	-17.70	-40.67	-2.45	-0.49	-13.33	-11.15	-30.58
12/20/16 4:00 PM	-43.50	-15.77	-40.50	-2.62	-0.41	-13.08	-11.26	-29.14
12/21/16 4:00 AM	-43.50	-16.76	-37.15	-4.30	-1.71	-14.07	-13.78	-28.67
12/21/16 4:00 PM	-43.50	-16.40	-32.75	-3.58	-0.74	-13.91	-13.70	-26.32
12/22/16 4:00 AM	-43.50	-17.65	-31.70	-4.89	-1.46	-15.46	-15.27	-26.04
12/22/16 4:00 PM	-43.50	-17.51	-30.34	-4.75	-0.90	-15.43	-15.41	-24.82
12/23/16 4:00 AM	-43.50	-19.50	-31.64	-7.18	-2.29	-19.44	-18.76	-25.51



12/23/16 4:00 PM	-43.50	-19.81	-31.37	-9.37	-1.38	-19.72	-18.62	-25.10
12/24/16 4:00 AM	-43.50	-20.58	-31.56	-10.09	-1.15	-19.72	-18.96	-25.37
12/24/16 4:00 PM	-43.50	-20.58	-31.56	-10.28	-0.96	-19.58	-19.01	-25.13
12/25/16 4:00 AM	-43.50	-21.52	-32.25	-12.19	-1.54	-21.19	-20.40	-25.54
12/25/16 4:00 PM	-43.50	-21.97	-32.53	-13.22	-1.35	-21.94	-20.76	-25.60
12/26/16 4:00 AM	-43.50	-22.94	-33.28	-15.02	-1.79	-23.32	-21.92	-26.20
12/26/16 4:00 PM	-43.50	-23.21	-33.36	-14.96	-1.32	-22.60	-21.42	-26.01
12/27/16 4:00 AM	-43.50	-23.66	-33.75	-14.69	-0.88	-22.02	-21.03	-26.40
12/27/16 4:00 PM	-43.50	-23.19	-33.47	-13.91	-0.52	-20.94	-20.26	-26.04
12/28/16 4:00 AM	-43.50	-23.96	-33.94	-15.90	-1.26	-22.54	-21.56	-26.40
12/28/16 4:00 PM	-43.36	-23.68	-33.64	-16.46	-0.88	-22.57	-21.39	-25.90
12/29/16 4:00 AM	-43.50	-24.74	-34.66	-17.48	-0.82	-22.85	-21.84	-26.65
12/29/16 4:00 PM	-43.50	-4.91	-11.27	-0.82	-0.07	-7.29	-8.41	-1.84
12/30/16 4:00 AM	-43.50	-6.66	-14.23	-1.78	-0.74	-7.26	-10.01	-4.94
12/30/16 4:00 PM	-43.50	-6.91	-15.00	-0.87	-0.16	-8.84	-10.10	-6.58
12/31/16 4:00 AM	-43.50	-9.68	-18.80	-2.67	-1.65	-11.89	-13.28	-10.37
12/31/16 4:00 PM	-43.06	-8.15	-17.86	-0.82	0.59	-10.00	-11.84	-9.68
1/1/17 4:00 AM	-43.50	-10.12	-19.93	-2.12	-0.60	-11.78	-13.89	-11.67
1/1/17 4:00 PM	-43.50	-8.01	-19.60	-2.03	-0.18	-9.98	-11.93	-11.70
1/2/17 4:00 AM	-43.50	-3.06	-3.40	-0.46	0.37	-4.19	-7.97	-1.43
1/2/17 4:00 PM	-3.86	-3.86	-3.07	0.13	0.56	-3.05	-2.32	-0.76
1/3/17 4:00 AM	-2.64	-2.87	-1.80	0.60	1.81	-2.09	-3.07	-0.38
1/3/17 4:00 PM	-3.44	-3.61	-2.99	0.87	0.87	-2.22	-1.77	-0.65
1/4/17 4:00 AM	-3.91	-3.92	-3.76	0.24	0.92	-2.64	-4.37	-0.93
1/4/17 4:00 PM	-3.28	-2.98	-3.04	1.54	1.86	-2.28	-4.62	-0.10
1/5/17 4:00 AM	-5.66	-5.05	-5.48	0.04	0.62	-3.69	-7.19	-1.73
1/5/17 4:00 PM	-4.88	-4.03	-4.73	1.43	2.11	-2.11	-6.06	-0.40
1/6/17 4:00 AM	-5.99	-4.91	-5.95	0.43	1.01	-2.89	-7.72	-1.29
1/6/17 4:00 PM	-6.71	-5.77	-7.14	0.35	0.54	-3.53	-8.69	-1.79
1/7/17 4:00 AM	-2.25	-2.34	-1.08	0.85	1.17	-2.47	-3.45	-0.54
1/7/17 4:00 PM	-2.80	-3.11	-2.05	0.26	0.40	-3.14	-2.57	-1.23
1/8/17 4:00 AM	-4.94	-4.69	-4.65	-0.51	-0.79	-4.38	-5.70	-2.01
1/8/17 4:00 PM	-4.33	-4.17	-3.74	0.13	-0.02	-3.47	-5.39	-1.40
1/9/17 4:00 AM	-7.04	-6.30	-6.62	-1.09	-1.60	-4.94	-8.60	-2.89
1/9/17 4:00 PM	-4.94	-4.53	-4.51	0.15	0.34	-2.92	-6.53	-1.70
1/10/17 4:00 AM	-5.79	-5.08	-5.84	-0.35	-0.30	-3.44	-7.77	-2.06
1/10/17 4:00 PM	-4.02	-3.00	-3.99	1.45	1.61	-1.31	-5.50	-0.29
1/11/17 4:00 AM	-5.63	-4.66	-5.84	0.26	0.37	-3.08	-7.94	-1.59
1/11/17 4:00 PM	-4.55	-4.11	-5.48	0.62	0.54	-2.61	-7.14	-1.15
1/12/17 4:00 AM	-4.94	-4.69	-6.03	0.40	0.45	-2.94	-8.13	-1.59
1/12/17 4:00 PM	-5.07	-4.75	-6.06	1.09	1.25	-2.28	-7.83	-0.93
1/13/17 4:00 AM	-6.38	-5.77	-7.36	0.35	0.51	-3.14	-9.27	-2.01
1/13/17 4:00 PM	-5.91	-5.55	-7.25	0.96	1.28	-2.25	-8.55	-1.82
1/14/17 4:00 AM	-7.15	-6.80	-8.86	0.18	0.65	-3.14	-9.90	-3.92
1/14/17 4:00 PM	-6.90	-6.66	-8.89	0.82	1.31	-2.06	-8.52	-4.33
1/15/17 4:00 AM	-8.40	-7.99	-10.41	-0.21	0.42	-2.94	-10.51	-6.33
1/15/17 4:00 PM	-8.06	-8.15	-10.41	0.26	1.09	-2.61	-10.13	-6.49
1/16/17 4:00 AM	-9.06	-9.15	-11.71	-0.15	0.76	-3.44	-11.23	-8.18
1/16/17 4:00 PM	-9.31	-9.68	-12.10	-0.07	0.84	-2.89	-10.87	-8.96
1/17/17 4:00 AM	-9.89	-9.95	-12.68	-0.40	0.76	-2.86	-11.15	-9.76
1/17/17 4:00 PM	-9.45	-9.87	-12.46	-0.23	1.20	-2.42	-10.15	-9.73
1/18/17 4:00 AM	-9.42	-9.70	-12.57	-0.21	1.17	-2.06	-10.04	-9.87
1/18/17 4:00 PM	-9.59	-10.95	-13.15	0.13	1.28	-2.69	-10.57	-9.98
1/19/17 4:00 AM	-11.75	-13.05	-15.81	-1.04	-0.02	-4.41	-12.92	-12.47
1/19/17 4:00 PM	-11.80	-13.16	-15.81	-0.40	1.17	-3.33	-11.95	-12.86
1/20/17 4:00 AM	-13.08	-14.16	-16.91	-1.01	0.78	-3.80	-12.40	-14.00
1/20/17 4:00 PM	-10.22	-11.45	-14.28	-0.62	1.20	-2.67	-10.13	-12.61
1/21/17 4:00 AM	-10.92	-13.00	-15.36	-1.06	0.87	-3.36	-11.34	-13.30
1/21/17 4:00 PM	-9.03	-7.63	-13.34	-0.70	1.59	-1.98	-8.94	-12.64
1/22/17 4:00 AM	-3.00	-3.11	-2.85	0.87	1.61	-1.62	-3.09	-1.04
1/22/17 4:00 PM	-2.64	-2.78	-2.57	0.96	1.64	-1.59	-2.98	-0.18
1/23/17 4:00 AM	-0.53	-1.23	-1.24	1.76	11.36	0.71	7.90	13.00
1/23/17 4:00 PM	-2.39	-2.51	-2.63	1.12	1.86	-1.56	0.01	-0.24
1/24/17 4:00 AM	-3.08	-3.23	-3.57	0.82	1.78	-2.53	-3.18	-0.76
1/24/17 4:00 PM	-3.97	-4.14	-4.54	0.71	1.31	-2.69	-4.34	-0.87
1/25/17 4:00 AM	-5.19	-4.91	-5.62	0.37	0.84	-3.17	-6.00	-1.21
1/25/17 4:00 PM	-5.71	-5.50	-6.34	0.35	0.95	-2.81	-6.22	-1.26
1/26/17 4:00 AM	-6.18	-5.58	-7.00	0.46	1.64	-2.36	-6.72	-1.23
1/26/17 4:00 PM	-7.79	-7.79	-9.08	-0.70	-0.21	-4.88	-8.80	-2.48
1/27/17 4:00 AM	-8.73	-8.29	-10.35	-0.29	0.42	-4.77	-9.82	-2.95
1/27/17 4:00 PM	-9.56	-9.43	-11.57	-0.40	0.51	-4.30	-10.18	-4.67
1/28/17 4:00 AM	-11.19	-10.67	-13.45	-0.76	0.15	-5.35	-11.76	-7.35
1/28/17 4:00 PM	-12.05	-11.97	-14.42	-0.79	0.15	-4.85	-11.70	-8.71
1/29/17 4:00 AM	-12.91	-12.69	-15.31	-0.73	0.06	-4.91	-12.51	-10.12
1/29/17 4:00 PM	-13.66	-13.77	-15.97	-0.87	-0.10	-4.88	-12.53	-11.39
1/30/17 4:00 AM	-14.87	-15.02	-17.30	-1.18	-0.38	-6.02	-13.95	-13.08
1/30/17 4:00 PM	-16.12	-16.76	-18.77	-1.67	-1.13	-6.88	-14.91	-14.88
1/31/17 4:00 AM	-16.65	-17.26	-19.21	-1.56	-0.46	-6.74	-14.83	-15.85
1/31/17 4:00 PM	-16.81	-17.79	-19.63	-1.59	-0.71	-6.68	-14.61	-16.38
2/1/17 4:00 AM	-17.45	-18.59	-20.35	-1.56	-0.21	-7.51	-15.25	-17.07
2/1/17 4:00 PM	-17.84	-19.36	-20.93	-1.67	-0.49	-7.57	-15.11	-17.51
2/2/17 4:00 AM	-18.72	-20.50	-21.92	-2.09	-0.49	-8.95	-16.05	-18.37
2/2/17 4:00 PM	-19.28	-21.08	-22.56	-2.20	-0.52	-9.31	-15.99	-18.87
2/3/17 4:00 AM	-19.64	-21.75	-22.95	-2.06	0.04	-9.37	-15.63	-19.31
2/3/17 4:00 PM	-19.89	-22.27	-23.42	-2.75	-0.43	-9.64	-15.72	-19.78
2/4/17 4:00 AM	-21.30	-23.68	-24.83	-3.97	-1.71	-12.36	-18.13	-21.14
2/4/17 4:00 PM	-22.16	-24.35	-25.58	-4.69	-1.79	-12.91	-18.24	-21.89
2/5/17 4:00 AM	-22.10	-24.43	-25.52	-5.13	-1.32	-12.72	-17.66	-21.97
2/5/17 4:00 PM	-21.55	-23.77	-24.89	-4.55	-0.38	-11.39	-16.11	-21.22
2/6/17 4:00 AM	-22.54	-24.87	-25.99	-6.99	-1.38	-13.77	-18.13	-22.02
2/6/17 4:00 PM	-22.60	-24.85	-26.22	-8.29	-0.96	-13.74	-17.60	-22.25
2/7/17 4:00 AM	-22.79	-25.23	-26.35	-8.73	-0.38	-13.49	-17.16	-22.36
2/7/17 4:00 PM	-22.71	-25.23	-26.35	-8.48	-0.30	-12.55	-15.99	-22.27
2/8/17 4:00 AM	-22.35	-25.18	-25.94	-2.12	0.78	-5.41	-12.12	-22.16

2/8/17 4:00 PM	-17.23	-23.55	-23.28	-2.98	0.45	-4.33	-9.65	-21.50
2/9/17 4:00 AM	-13.57	-21.22	-19.79	-1.90	0.78	-2.61	-8.63	-20.53
2/9/17 4:00 PM	-11.75	-20.72	-18.85	-3.58	-0.60	-4.91	-10.82	-20.61
2/10/17 4:00 AM	-13.93	-22.11	-20.96	-4.89	-1.24	-6.18	-13.45	-21.61
2/10/17 4:00 PM	-14.85	-22.71	-21.90	-5.63	-0.93	-6.52	-13.31	-22.02
2/11/17 4:00 AM	-15.10	-22.44	-21.87	-6.38	-0.54	-6.40	-13.42	-21.53
2/11/17 4:00 PM	-15.62	-22.83	-22.42	-6.99	-0.90	-6.93	-13.64	-21.14
2/12/17 4:00 AM	-16.51	-23.66	-23.48	-8.04	-0.24	-7.57	-13.97	-21.55
2/12/17 4:00 PM	-16.73	-24.02	-23.89	-7.99	-0.24	-7.18	-13.61	-21.50
2/13/17 4:00 AM	-18.34	-25.43	-25.27	-10.37	-1.32	-9.89	-15.77	-22.05
2/13/17 4:00 PM	-20.47	-27.14	-27.16	-13.41	-2.90	-12.25	-17.38	-23.41
2/14/17 4:00 AM	-21.08	-27.42	-27.57	-14.46	-2.68	-13.69	-17.90	-23.52
2/14/17 4:00 PM	-21.33	-27.53	-27.60	-14.52	-2.09	-13.35	-17.13	-23.27
2/15/17 4:00 AM	-21.77	-28.06	-27.96	-14.44	-0.77	-13.38	-16.74	-23.41
2/15/17 4:00 PM	-4.38	-12.00	-9.80	-1.15	0.90	-6.29	-6.55	-2.81
2/16/17 4:00 AM	-6.02	-13.08	-10.24	-1.67	0.04	-4.63	-7.77	-3.09
2/16/17 4:00 PM	-6.96	-15.43	-12.18	-2.03	-0.07	-4.94	-8.69	-4.47
2/17/17 4:00 AM	-7.90	-17.15	-14.34	-2.17	-0.13	-5.71	-9.93	-7.49
2/17/17 4:00 PM	-8.42	-18.09	-15.81	-2.42	-0.16	-5.88	-10.21	-9.51
2/18/17 4:00 AM	-9.56	-19.31	-17.63	-2.81	-0.38	-6.85	-11.76	-11.53
2/18/17 4:00 PM	-10.45	-20.47	-19.18	-3.31	-0.99	-7.51	-12.48	-13.19
2/19/17 4:00 AM	-10.97	-21.44	-20.13	-3.33	-0.27	-7.59	-12.67	-14.41
2/19/17 4:00 PM	-11.55	-22.19	-20.87	-3.53	-0.49	-8.31	-13.25	-15.41
2/20/17 4:00 AM	-13.46	-24.02	-22.62	-4.72	-1.49	-10.47	-15.03	-17.29
2/20/17 4:00 PM	-14.38	-24.40	-23.45	-5.27	-1.54	-11.08	-15.47	-18.15
2/21/17 4:00 AM	-15.57	-25.29	-24.58	-7.35	-1.79	-12.55	-16.30	-19.23
2/21/17 4:00 PM	-16.29	-25.98	-25.19	-8.29	-1.29	-12.80	-16.11	-19.81
2/22/17 4:00 AM	-16.70	-26.31	-25.44	-8.84	-0.82	-12.85	-16.11	-20.09
2/22/17 4:00 PM	-17.01	-26.89	-26.11	-9.48	-0.54	-13.02	-16.30	-20.31
2/23/17 4:00 AM	-17.48	-27.28	-26.44	-10.51	-0.46	-13.85	-16.71	-20.72
2/23/17 4:00 PM	-18.20	-27.70	-26.91	-11.36	-0.77	-14.18	-16.88	-21.17
2/24/17 4:00 AM	-19.41	-28.47	-27.63	-13.02	-1.49	-15.84	-18.04	-21.69
2/24/17 4:00 PM	-19.89	-28.64	-28.02	-13.44	-1.18	-15.82	-17.77	-22.14
2/25/17 4:00 AM	-20.49	-29.00	-28.40	-14.16	-0.96	-16.20	-17.99	-22.58
2/25/17 4:00 PM	-21.33	-29.72	-29.04	-14.60	-1.65	-15.96	-18.04	-22.94
2/26/17 4:00 AM	-22.82	-30.85	-30.01	-18.31	-5.72	-20.25	-21.45	-23.85
2/26/17 4:00 PM	-24.15	-31.88	-30.87	-20.86	-6.72	-21.80	-22.20	-24.82
2/27/17 4:00 AM	-24.87	-32.35	-31.37	-21.97	-7.13	-22.46	-22.58	-25.35
2/27/17 4:00 PM	-25.87	-33.26	-32.20	-22.94	-7.35	-22.94	-23.10	-26.23
2/28/17 4:00 AM	-25.53	-33.12	-31.86	-22.02	-5.75	-22.13	-21.75	-25.90
2/28/17 4:00 PM	-25.67	-33.07	-31.81	-21.52	-4.42	-21.10	-20.92	-25.96
3/1/17 4:00 AM	-25.70	-32.99	-31.86	-20.67	-3.04	-20.30	-20.23	-25.93
3/1/17 4:00 PM	-25.42	-32.54	-31.50	-19.70	-1.62	-18.78	-18.96	-25.60
3/2/17 4:00 AM	-18.11	-32.04	-29.93	-3.56	0.12	-7.04	-10.37	-25.15
3/2/17 4:00 PM	-12.58	-29.58	-24.06	-6.41	-1.10	-6.43	-10.87	-24.24
3/3/17 4:00 AM	-13.46	-27.17	-22.67	-9.73	-2.21	-8.62	-12.67	-23.52
3/3/17 4:00 PM	-14.38	-25.87	-23.59	-10.84	-2.87	-9.28	-13.64	-23.35
3/4/17 4:00 AM	-16.37	-26.01	-25.14	-13.77	-5.00	-11.72	-15.94	-23.96
3/4/17 4:00 PM	-16.90	-25.79	-25.50	-14.57	-3.92	-11.66	-15.52	-23.85
3/5/17 4:00 AM	-17.70	-25.95	-26.05	-15.68	-4.89	-13.30	-16.94	-23.71
3/5/17 4:00 PM	-18.20	-25.93	-26.60	-16.68	-4.59	-13.74	-16.88	-23.71
3/6/17 4:00 AM	-18.97	-26.31	-27.16	-17.45	-5.03	-14.77	-17.82	-23.69
3/6/17 4:00 PM	-19.03	-26.12	-27.07	-17.48	-3.26	-14.13	-16.91	-23.30
3/7/17 4:00 AM	-19.17	-26.04	-27.27	-17.70	-2.70	-14.24	-17.13	-23.44
3/7/17 4:00 PM	-19.08	-25.84	-27.32	-17.40	-2.29	-13.46	-16.69	-23.30
3/8/17 4:00 AM	-18.75	-25.68	-27.16	-15.88	-0.90	-12.16	-15.52	-23.08
3/8/17 4:00 PM	-18.25	-26.76	-28.43	-15.32	-1.76	-11.25	-15.58	-24.43
3/9/17 4:00 AM	-17.39	-25.62	-27.21	-16.93	-2.48	-12.83	-16.66	-23.85
3/9/17 4:00 PM	-17.95	-25.62	-27.49	-17.56	-2.43	-13.13	-16.63	-24.16
3/10/17 4:00 AM	-18.22	-24.60	-26.71	-17.15	-1.82	-12.91	-16.41	-22.94
3/10/17 4:00 PM	-17.23	-24.82	-27.52	-13.88	-1.07	-10.14	-14.94	-23.41
3/11/17 4:00 AM	-17.78	-24.90	-27.99	-17.56	-3.48	-13.46	-17.63	-24.07
3/11/17 4:00 PM	-18.81	-25.18	-28.35	-19.28	-4.09	-14.85	-18.38	-24.46
3/12/17 4:00 AM	-19.36	-25.07	-28.29	-19.70	-3.48	-15.57	-18.38	-24.43
3/12/17 4:00 PM	-12.19	-23.68	-27.30	-8.65	0.92	-5.32	-9.46	-24.02
3/13/17 4:00 AM	-8.23	-17.29	-19.68	-8.23	-0.68	-4.94	-9.63	-18.92
3/13/17 4:00 PM	-7.32	-16.07	-18.38	-7.21	0.23	-3.36	-8.91	-17.10
3/14/17 4:00 AM	-2.08	-2.89	-1.88	0.18	1.70	-2.39	-2.71	-0.68
3/14/17 4:00 PM	-3.30	-3.53	-3.16	0.32	0.84	-3.11	-4.28	-0.90
3/15/17 4:00 AM	-5.57	-5.69	-5.73	-0.68	-0.88	-4.66	-7.22	-2.29
3/15/17 4:00 PM	-6.35	-6.02	-6.50	-0.68	-1.04	-5.16	-8.24	-2.45
3/16/17 4:00 AM	-8.09	-7.35	-8.47	-1.29	-2.26	-6.46	-10.46	-3.31
3/16/17 4:00 PM	-8.40	-7.54	-9.25	-1.23	-1.54	-6.49	-10.60	-3.28
3/17/17 4:00 AM	-9.28	-8.73	-10.71	-1.26	-2.43	-7.29	-12.62	-4.69
3/17/17 4:00 PM	-9.31	-8.35	-11.21	-1.04	-1.35	-6.85	-12.15	-5.50
3/18/17 4:00 AM	-9.14	-8.37	-11.49	-0.57	-0.38	-6.27	-11.98	-6.49
3/18/17 4:00 PM	-7.82	-6.80	-10.60	-0.32	0.34	-4.19	-10.49	-6.38
3/19/17 4:00 AM	-4.44	-5.08	-6.39	-0.26	0.48	-3.33	-7.36	-3.03
3/19/17 4:00 PM	-5.71	-5.99	-8.17	-0.84	-0.35	-4.27	-8.77	-3.89
3/20/17 4:00 AM	-7.04	-10.08	-10.08	-1.12	-1.07	-5.16	-10.65	-6.00
3/20/17 4:00 PM	-6.98	-6.55	-10.55	-0.87	-0.27	-4.85	-10.29	-6.22
3/21/17 4:00 AM	-7.26	-7.07	-11.43	-0.84	-0.07	-4.77	-10.96	-6.91
3/21/17 4:00 PM	-7.29	-6.55	-11.65	-0.76	0.23	-4.60	-10.85	-7.19
3/22/17 4:00 AM	-8.09	-7.63	-12.93	-0.95	-0.32	-5.16	-12.06	-8.40
3/22/17 4:00 PM	-9.73	-9.32	-15.47	-1.76	-2.43	-7.12	-14.42	-10.54
3/23/17 4:00 AM	-11.58	-11.31	-17.97	-2.17	-4.36	-9.56	-16.55	-13.19
3/23/17 4:00 PM	-12.66	-12.19	-18.99	-2.53	-4.12	-10.28	-16.77	-14.55
3/24/17 4:00 AM	-13.85	-13.30	-20.01	-2.95	-4.67	-11.66	-17.63	-15.35
3/24/17 4:00 PM	-13.71	-12.89	-19.99	-3.33	-3.59	-11.36	-16.71	-15.55
3/25/17 4:00 AM	-14.54	-13.69	-20.54	-3.81	-3.53	-12.11	-17.16	-15.88
3/25/17 4:00 PM	-14.68	-13.63	-20.79	-4.36	-2.81	-11.86	-16.96	-16.18
3/26/17 4:00 AM	-15.35	-14.35	-21.56	-5.16	-3.01	-12.61	-17.54	-16.40
3/26/17 4:00 PM	-15.54	-14.41	-21.87	-6.24	-2.81	-12.61	-17.57	-16.68
3/27/17 4:00 AM	-15.18	-14.66	-21.92	-6.52	-1.71	-11.83	-16.83	-17.15



5/13/17 5:00 PM	-20.94	-8.32	-22.76	-3.09	-1.02	-10.47	-14.91	-13.17	1.89
5/14/17 5:00 AM	-18.83	-11.23	-22.92	-4.44	-2.32	-12.05	-17.32	-15.19	2.30
5/14/17 5:00 PM	-19.55	-12.61	-24.11	-6.21	-3.04	-13.52	-17.88	-16.88	0.25
5/15/17 5:00 AM	-21.30	-15.38	-25.55	-9.54	-4.84	-16.18	-19.79	-17.68	1.80
5/15/17 5:00 PM	-22.90	-16.04	-27.02	-11.45	-5.75	-17.70	-20.48	-18.43	-0.60
5/16/17 5:00 AM	-24.98	-18.67	-28.76	-15.10	-8.27	-20.05	-22.50	-19.31	0.97
5/16/17 5:00 PM	-26.45	-19.53	-30.01	-17.34	-9.15	-21.24	-23.36	-20.47	-2.27
5/17/17 5:00 AM	-27.61	-21.03	-30.84	-18.95	-10.46	-22.24	-24.36	-21.22	-0.36
5/17/17 5:00 PM	-29.19	-22.30	-32.31	-20.89	-11.90	-23.79	-25.41	-22.41	-4.90
5/18/17 5:00 AM	-29.99	-23.46	-33.05	-21.91	-13.33	-24.48	-26.38	-22.94	-3.87
5/18/17 5:00 PM	-30.85	-23.93	-33.77	-22.99	-13.61	-25.23	-26.38	-23.35	-9.21
5/19/17 5:00 AM	-31.73	-24.74	-34.66	-23.99	-14.44	-25.87	-27.40	-24.21	-8.52
5/19/17 5:00 PM	-32.26	-25.15	-35.30	-24.62	-13.72	-26.20	-27.54	-24.88	-15.00
5/20/17 5:00 AM	-32.98	-25.95	-36.21	-25.45	-14.55	-26.78	-28.26	-25.32	-14.36
5/20/17 5:00 PM	-33.81	-26.53	-36.82	-26.53	-14.61	-27.64	-28.70	-26.23	-20.84
5/21/17 5:00 AM	-34.17	-27.09	-37.26	-26.84	-15.47	-28.00	-29.17	-26.65	-19.24
5/21/17 5:00 PM	-34.64	-27.56	-37.73	-27.23	-15.02	-28.33	-29.06	-27.04	-22.53
5/22/17 5:00 AM	-27.47	-3.72	-27.74	-0.32	1.25	-13.13	-16.11	-7.08	2.63
5/22/17 5:00 PM	-15.95	-5.47	-20.21	-0.87	-2.09	-10.53	-12.23	-5.75	1.14
5/23/17 5:00 AM	-13.74	-6.30	-20.13	-0.98	-1.73	-9.70	-13.64	-5.55	2.00
5/23/17 5:00 PM	-2.47	-1.99	1.04	1.04	7.18	-3.19	-4.81	0.95	13.24
5/24/17 5:00 AM	-2.75	-2.64	-3.38	0.87	0.06	-2.61	-1.79	-0.02	3.08
5/24/17 5:00 PM	-1.56	-2.53	-2.52	0.96	0.45	-1.86	-3.29	0.07	4.27
5/25/17 5:00 AM	-2.03	-1.84	-1.66	1.07	7.21	-1.92	3.16	4.99	3.49
5/25/17 5:00 PM	-4.96	-4.44	-5.45	0.35	0.29	-3.36	-3.23	-0.79	1.67
5/26/17 5:00 AM	-6.62	-6.49	-8.94	0.71	0.37	-5.85	-8.41	-1.65	3.13
5/26/17 5:00 PM	-8.67	-8.96	-13.01	-0.07	-0.18	-7.21	-10.73	-2.90	0.86
5/27/17 5:00 AM	-11.28	-12.19	-17.38	0.01	0.18	-10.28	-14.11	-7.71	2.55
5/27/17 5:00 PM	-12.94	-13.66	-19.27	-0.01	0.20	-11.25	-15.14	-10.26	1.08
5/28/17 5:00 AM	-15.32	-15.82	-21.68	-0.29	0.45	-12.97	-16.16	-13.06	3.22
5/28/17 5:00 PM	-16.76	-17.18	-23.12	-0.54	-0.30	-15.12	-17.71	-15.13	0.31
5/29/17 5:00 AM	-19.03	-19.72	-25.50	-1.12	-1.90	-17.89	-19.70	-17.01	2.69
5/29/17 5:00 PM	-20.91	-21.30	-27.16	-1.95	-3.06	-20.00	-21.31	-18.95	-0.88
5/30/17 5:00 AM	-22.54	-23.07	-28.51	-2.62	-4.97	-21.38	-22.42	-20.03	2.11
5/30/17 5:00 PM	-23.54	-23.77	-29.65	-3.94	-5.33	-22.99	-22.89	-21.08	0.03
5/31/17 5:00 AM	-24.76	-24.54	-30.62	-6.82	-6.61	-23.24	-24.00	-21.80	2.36
5/31/17 5:00 PM	-25.64	-25.26	-31.28	-9.12	-6.91	-24.32	-24.36	-22.63	-0.77
6/1/17 5:00 AM	-26.70	-26.23	-32.06	-12.00	-8.55	-25.26	-25.27	-23.44	1.42
6/1/17 5:00 PM	-27.55	-26.84	-32.67	-14.35	-8.91	-25.42	-25.66	-24.13	-1.52
6/2/17 5:00 AM	-28.25	-27.61	-33.39	-16.51	-10.59	-26.72	-26.35	-24.68	0.89
6/2/17 5:00 PM	-29.46	-28.47	-34.19	-19.00	-11.67	-27.58	-26.96	-25.68	-3.87
6/3/17 5:00 AM	-30.18	-29.22	-34.94	-20.78	-13.25	-28.27	-27.62	-26.20	-1.46
6/3/17 5:00 PM	-30.90	-29.88	-35.38	-21.99	-13.45	-28.41	-27.90	-26.65	-6.25
6/4/17 5:00 AM	-31.71	-30.77	-36.21	-23.21	-14.97	-29.66	-28.84	-27.15	-4.62
6/4/17 5:00 PM	-32.18	-30.41	-34.60	-14.10	-3.70	-27.08	-27.35	-27.51	0.72
6/5/17 5:00 AM	-3.30	-3.70	-6.28	0.98	-0.54	-4.13	-3.98	-1.95	2.61
6/5/17 5:00 PM	-4.63	-4.44	-7.78	0.87	0.18	-4.60	-5.83	-1.01	1.39
6/6/17 5:00 AM	-3.97	-4.50	-8.36	0.68	0.54	-3.66	-6.08	-0.96	2.74
6/6/17 5:00 PM	-5.46	-6.08	-11.40	0.37	0.34	-5.19	-8.66	-1.59	0.42
6/7/17 5:00 AM	-7.84	-8.57	-16.00	0.49	0.15	-7.04	-12.45	-6.27	1.80
6/7/17 5:00 PM	-10.11	-11.39	-19.49	-0.12	0.09	-10.03	-14.91	-10.34	-1.08
6/8/17 5:00 AM	-13.08	-14.46	-22.28	0.01	-0.38	-13.08	-17.24	-14.27	0.53
6/8/17 5:00 PM	-15.46	-16.65	-23.97	-0.46	-1.10	-15.10	-18.21	-16.71	-3.18
6/9/17 5:00 AM	-17.92	-19.03	-26.19	-0.95	-1.90	-17.40	-19.73	-18.18	-2.54
6/9/17 5:00 PM	-20.13	-21.03	-27.49	-1.12	-2.84	-18.92	-21.01	-19.92	-8.05
6/10/17 5:00 AM	-22.18	-23.07	-29.21	-1.56	-5.33	-20.72	-22.28	-20.92	-7.75
6/10/17 5:00 PM	-23.73	-24.29	-30.37	-3.22	-5.31	-21.66	-23.05	-22.05	-15.58
6/11/17 5:00 AM	-25.26	-25.54	-31.50	-5.30	-7.63	-22.90	-24.24	-22.91	-15.08
6/11/17 5:00 PM	-26.92	-27.20	-32.86	-8.79	-8.85	-23.93	-25.38	-24.13	-21.95
6/12/17 5:00 AM	-27.86	-28.20	-33.47	-13.02	-10.90	-24.84	-26.18	-24.82	-21.92
6/12/17 5:00 PM	-29.22	-29.05	-34.41	-15.57	-10.59	-25.70	-26.76	-26.27	-25.68
6/13/17 5:00 AM	-30.18	-30.11	-35.27	-18.23	-12.12	-26.59	-27.68	-26.18	-26.24
6/13/17 5:00 PM	-31.10	-30.77	-35.82	-19.72	-12.48	-27.44	-28.12	-26.90	-29.62
6/14/17 5:00 AM	-32.09	-31.82	-36.85	-21.38	-13.39	-28.52	-28.92	-27.67	-29.48
6/14/17 5:00 PM	-32.73	-32.51	-37.65	-22.46	-13.64	-29.41	-29.39	-28.31	-33.30
6/15/17 5:00 AM	-33.64	-33.37	-38.42	-23.41	-15.38	-30.32	-30.06	-29.00	-34.10
6/15/17 5:00 PM	-33.92	-33.76	-38.70	-23.93	-14.52	-30.68	-30.14	-29.39	-36.79
6/16/17 5:00 AM	-34.70	-34.78	-39.64	-25.34	-16.16	-31.76	-31.08	-30.16	-37.67
6/16/17 5:00 PM	-35.06	-35.28	-39.97	-25.87	-17.04	-32.37	-31.41	-30.86	-39.89
6/17/17 5:00 AM	-35.75	-35.92	-40.58	-26.51	-15.24	-33.17	-31.91	-31.66	-40.39
6/17/17 5:00 PM	-35.91	-35.95	-40.69	-26.53	-11.40	-33.31	-31.11	-32.32	-41.38
6/18/17 5:00 AM	-36.39	-36.11	-40.75	-26.70	-11.26	-33.62	-31.22	-33.10	-40.80
6/18/17 5:00 PM	-36.58	-35.84	-40.75	-26.62	-10.79	-33.42	-31.30	-33.43	-43.21
6/19/17 5:00 AM	-36.86	-36.42	-40.75	-27.28	-13.64	-34.01	-32.30	-34.07	-44.76
6/19/17 5:00 PM	-36.99	-36.31	-40.75	-27.25	-13.50	-34.09	-32.33	-34.18	-46.20
6/20/17 5:00 AM	17.88	13.91	9.05	12.67	30.68	11.59	22.49	29.88	7.40
6/20/17 5:00 PM	-2.50	-2.87	-3.40	0.90	0.34	-3.19	-1.79	-0.24	2.36
6/21/17 5:00 AM	-1.20	-1.29	-1.05	1.32	5.91	-1.92	4.30	7.32	3.08
6/21/17 5:00 PM	-3.05	-3.17	-4.84	1.01	0.81	-3.17	-2.84	-0.38	0.20
6/22/17 5:00 AM	-4.41	-4.00	-7.28	0.90	0.81	-2.81	-4.98	-0.93	2.27
6/22/17 5:00 PM	-4.77	-4.14	-8.00	0.82	0.92	-2.56	-5.20	-0.98	2.00
6/23/17 5:00 AM	-5.24	-4.42	-9.00	0.82	1.23	-2.36	-5.64	-1.10	2.63
6/23/17 5:00 PM	-5.49	-5.61	-12.40	1.04	1.53	-3.28	-7.33	-2.18	-1.93
6/24/17 5:00 AM	-7.70	-9.04	-17.97	0.46	1.12	-5.21	-11.15	-8.99	2.14
6/24/17 5:00 PM	-9.59	-11.50	-20.82	0.54	1.37	-6.40	-13.03	-12.45	0.67
6/25/17 5:00 AM	-12.11	-14.99	-23.06	0.21	1.01	-7.71	-14.56	-16.07	2.33
6/25/17 5:00 PM	-14.04	-17.18	-24.64	-0.07	0.76	-8.90	-15.58	-17.82	-2.68
6/26/17 5:00 AM	-16.26	-19.89	-26.91	-0.32	0.51	-11.58	-17.30	-19.87	0.11
6/26/17 5:00 PM	-18.22	-21.88	-28.62	-0.98	0.06	-13.05	-18.24	-21.22	-6.31
6/27/17 5:00 AM	-19.64	-23.43	-30.12	-1.06	0.18	-14.88	-19.40	-22.33	-4.29
6/27/17 5:00 PM	-21.30	-25.46	-31.75	-1.87	-0.77	-17.06	-20.92	-23.80	-13.26
6/28/17 5:00 AM	-22.79	-27.23	-33.39	-2.73	-1.98	-19.42	-22.64	-25.13	-12.90
6/28/17 5:00 PM	-24.48	-29.11	-34.83	-5.44	-2.62	-21.27	-23.88	-26.54	-20.87
6/29/17 5:00 AM	-25.73	-30.58	-36.27	-10.15	-4.06	-22.68	-25.16	-27.53	-20.23

6/29/17 5:00 PM	-27.06	-31.96	-37.54	-13.49	-4.78	-23.79	-25.93	-28.42	-26.57
6/30/17 5:00 AM	-28.25	-33.04	-38.34	-17.26	-6.66	-25.12	-27.07	-28.97	-26.54
6/30/17 5:00 PM	-29.30	-33.98	-39.06	-19.47	-6.77	-26.12	-27.62	-29.75	-29.84
7/1/17 5:00 AM	-30.18	-34.92	-40.09	-21.02	-7.94	-27.28	-28.48	-30.61	-29.98
7/1/17 5:00 PM	-31.24	-35.70	-40.42	-22.24	-8.24	-28.41	-28.92	-31.41	-33.19
7/2/17 5:00 AM	-32.34	-36.97	-40.75	-23.30	-8.19	-29.83	-29.81	-32.46	-33.47
7/2/17 5:00 PM	-32.76	-37.39	-40.75	-23.27	-6.69	-30.16	-29.62	-33.10	-36.04
7/3/17 5:00 AM	-33.70	-38.16	-40.56	-24.04	-9.62	-30.99	-30.64	-33.85	-37.20
7/3/17 5:00 PM	-34.09	-38.33	-40.58	-20.89	-5.31	-31.04	-29.78	-34.21	-39.58
7/4/17 5:00 AM	-5.96	-7.07	-33.16	0.07	0.26	-6.71	-11.29	-2.70	-37.48
7/4/17 5:00 PM	-7.84	-9.87	-31.48	-0.01	0.70	-6.68	-14.58	-11.92	-35.24
7/5/17 5:00 AM	-11.14	-14.94	-31.28	-0.68	0.56	-8.62	-17.49	-18.43	-32.41
7/5/17 5:00 PM	-13.52	-17.40	-30.89	-0.73	0.56	-9.75	-18.43	-20.53	-34.49
7/6/17 5:00 AM	-8.23	-10.98	-29.54	-0.07	0.73	-3.69	-12.01	-11.59	-29.31
7/6/17 5:00 PM	-8.92	-12.14	-27.85	-0.18	1.01	-4.52	-13.42	-14.38	-28.43
7/7/17 5:00 AM	-12.36	-17.18	-29.18	-0.93	0.54	-7.65	-16.96	-18.79	-27.15
7/7/17 5:00 PM	-14.54	-19.34	-29.90	-1.01	0.56	-9.73	-18.35	-20.28	-32.14
7/8/17 5:00 AM	-17.73	-23.07	-32.11	-1.70	0.34	-13.24	-20.42	-22.36	-33.24
7/8/17 5:00 PM	-19.86	-25.01	-33.69	-3.14	-0.32	-15.01	-21.59	-23.91	-36.21
7/9/17 5:00 AM	-21.63	-27.42	-36.27	-2.75	0.29	-16.04	-23.44	-26.04	-37.78
7/9/17 5:00 PM	-22.68	-28.47	-37.21	-4.83	0.12	-16.18	-24.08	-26.76	-39.83
7/10/17 5:00 AM	-24.23	-30.27	-38.65	-9.70	-1.18	-18.72	-25.27	-27.95	-41.27
7/10/17 5:00 PM	-25.45	-31.41	-39.59	-12.75	-2.09	-19.75	-26.07	-28.50	-42.35
7/11/17 5:00 AM	-27.08	-33.26	-40.20	-17.09	-3.92	-21.91	-27.43	-29.50	-43.71
7/11/17 5:00 PM	-28.16	-34.20	-40.47	-18.95	-5.36	-23.13	-28.18	-30.14	-46.39
7/12/17 5:00 AM	-29.82	-35.62	-40.75	-21.19	-7.71	-25.42	-29.75	-31.49	-47.86
7/12/17 5:00 PM	-30.54	-36.45	-40.00	-22.19	-8.68	-26.56	-30.25	-32.30	-48.00
7/13/17 5:00 AM	-32.09	-37.94	-40.69	-23.82	-11.34	-28.58	-31.80	-33.82	-48.00
7/13/17 5:00 PM	-32.84	-38.52	-40.33	-24.40	-11.92	-29.52	-32.08	-33.96	-48.00
7/14/17 5:00 AM	-34.03	-39.27	-40.45	-25.43	-14.11	-31.40	-33.41	-34.90	-48.00
7/14/17 5:00 PM	-34.67	-39.82	-40.20	-25.81	-14.69	-32.26	-33.46	-35.42	-48.00
7/15/17 5:00 AM	-35.61	-40.71	-40.75	-26.76	-16.82	-34.01	-34.68	-36.56	-48.00
7/15/17 5:00 PM	-35.86	-41.24	-40.56	-27.06	-17.13	-34.95	-34.79	-36.48	-48.00
7/16/17 5:00 AM	-36.66	-41.90	-40.75	-27.78	-18.54	-36.36	-35.65	-37.17	-48.00
7/16/17 5:00 PM	-36.88	-42.23	-40.61	-28.11	-18.37	-37.22	-35.59	-37.11	-48.00
7/17/17 5:00 AM	-37.58	-43.03	-40.75	-28.72	-19.87	-38.30	-36.43	-37.50	-48.00
7/17/17 5:00 PM	-37.74	-43.31	-40.36	-29.00	-19.78	-38.99	-36.43	-37.03	-48.00
7/18/17 5:00 AM	-38.49	-44.20	-40.75	-29.99	-21.14	-40.46	-37.56	-37.50	-48.00
7/18/17 5:00 PM	-38.85	-44.47	-40.47	-30.52	-21.25	-41.09	-37.42	-37.50	-48.00
7/19/17 5:00 AM	-39.29	-44.78	-40.75	-30.74	-19.31	-41.78	-37.75	-37.50	-48.00
7/19/17 5:00 PM	-39.35	-44.89	-40.33	-30.71	-17.57	-42.14	-37.28	-37.50	-48.00
7/20/17 5:00 AM	-39.82	-45.47	-40.69	-31.13	-17.74	-43.03	-38.06	-37.50	-48.00
7/20/17 5:00 PM	-40.04	-45.78	-40.67	-31.19	-18.35	-43.42	-38.06	-37.50	-48.00
7/21/17 5:00 AM	-40.57	-46.36	-40.72	-31.43	-19.87	-43.58	-38.83	-37.50	-48.00
7/21/17 5:00 PM	-40.26	-46.19	-40.25	-31.30	-20.03	-43.42	-38.36	-37.50	-47.81
7/22/17 5:00 AM	-41.06	-47.02	-40.75	-32.07	-22.11	-44.53	-38.58	-37.50	-48.00
7/22/17 5:00 PM	-40.98	-46.94	-40.45	-32.04	-22.33	-44.58	-38.22	-37.50	-48.00
7/23/17 5:00 AM	-41.53	-47.82	-40.75	-32.74	-23.88	-45.55	-38.64	-37.50	-48.00
7/23/17 5:00 PM	-4.58	-9.27	-12.98	2.20	3.94	-4.33	-4.23	1.23	1.64
7/24/17 5:00 AM	-4.27	-9.32	-32.42	1.18	-0.74	-13.44	-13.09	-2.18	-37.34
7/24/17 5:00 PM	-15.21	-15.13	-39.81	0.85	-2.15	-22.05	-25.05	-17.96	-46.62
7/25/17 5:00 AM	-20.99	-19.84	-40.33	0.35	-3.20	-24.87	-27.07	-26.04	-48.00
7/25/17 5:00 PM	-24.59	-23.07	-39.89	0.24	-4.45	-25.95	-27.79	-28.86	-48.00
7/26/17 5:00 AM	-27.94	-26.45	-40.64	-0.40	-5.50	-27.61	-28.42	-31.60	-48.00
7/26/17 5:00 PM	-30.21	-28.75	-40.45	-0.70	-6.66	-28.08	-28.73	-32.68	-48.00
7/27/17 5:00 AM	-31.98	-30.63	-40.75	-1.26	-7.94	-29.19	-29.03	-34.04	-48.00
7/27/17 5:00 PM	-33.26	-32.02	-40.75	-2.01	-9.10	-29.49	-29.34	-34.37	-48.00
7/28/17 5:00 AM	-34.25	-33.26	-40.67	-3.25	-10.12	-30.35	-29.45	-35.48	-48.00
7/28/17 5:00 PM	-34.53	-33.82	-40.33	-5.27	-11.06	-30.54	-29.86	-35.65	-48.00
7/29/17 5:00 AM	-35.25	-34.95	-40.47	-5.74	-11.51	-31.51	-29.64	-36.72	-48.00
7/29/17 5:00 PM	-35.55	-35.98	-40.56	-9.59	-13.39	-32.98	-31.00	-37.20	-48.00
7/30/17 5:00 AM	-36.44	-37.19	-40.72	-15.57	-16.41	-35.39	-32.52	-37.42	-45.15
7/30/17 5:00 PM	-37.49	-38.63	-40.75	-19.28	-18.07	-36.39	-33.57	-37.50	-45.09
7/31/17 5:00 AM	-38.16	-39.55	-40.75	-22.13	-19.78	-37.83	-34.32	-37.50	-43.82
7/31/17 5:00 PM	-38.99	-40.32	-40.72	-24.07	-20.59	-38.68	-34.85	-37.50	-44.29
8/1/17 5:00 AM	-39.93	-40.82	-40.75	-25.59	-22.08	-40.21	-35.98	-37.50	-43.82
8/1/17 5:00 PM	-40.45	-41.51	-40.75	-26.42	-22.77	-41.04	-36.37	-37.50	-44.43
8/2/17 5:00 AM	-40.57	-41.95	-40.75	-27.67	-23.80	-42.12	-37.06	-37.50	-43.76
8/2/17 5:00 PM	-40.79	-42.79	-40.75	-28.78	-24.38	-43.11	-37.53	-37.50	-44.43
8/3/17 5:00 AM	-41.15	-43.45	-40.75	-29.91	-25.18	-44.22	-38.25	-37.50	-43.74
8/3/17 5:00 PM	-41.48	-44.20	-40.75	-30.96	-25.71	-45.02	-38.81	-37.50	-44.26
8/4/17 5:00 AM	-41.56	-44.70	-40.75	-31.79	-26.04	-45.55	-38.83	-37.50	-44.40
8/4/17 5:00 PM	-41.73	-45.03	-40.75	-32.49	-26.12	-45.94	-38.50	-37.50	-45.73
8/5/17 5:00 AM	-42.14	-45.53	-40.75	-33.57	-26.82	-46.77	-38.72	-37.50	-45.26
8/5/17 5:00 PM	-41.98	-45.94	-40.53	-34.04	-26.90	-47.18	-38.42	-37.50	-45.34
8/6/17 5:00 AM	-42.67	-46.80	-40.75	-35.03	-27.62	-48.26	-38.70	-37.50	-44.21
8/6/17 5:00 PM	-42.50	-46.83	-40.56	-35.28	-27.59	-48.54	-38.31	-37.50	-45.01
8/7/17 5:00 AM	-43.22	-47.52	-40.75	-36.20	-28.34	-49.48	-38.72	-37.50	-44.73
8/7/17 5:00 PM	-43.42	-48.07	-40.75	-36.53	-28.23	-49.62	-38.61	-37.50	-46.01
8/8/17 5:00 AM	-43.50	-48.24	-40.75	-36.80	-27.70	-50.03	-38.70	-37.50	-45.67
8/8/17 5:00 PM	-43.50	-48.41	-40.75	-37.28	-27.23	-50.42	-38.56	-37.50	-44.84
8/9/17 5:00 AM	-43.50	-48.96	-40.75	-37.94	-26.90	-50.89	-38.75	-37.50	-43.29
8/9/17 5:00 PM	-43.50	-49.29	-40.75	-38.36	-26.24	-51.25	-38.75	-37.50	-43.13
8/10/17 5:00 AM	-43.50	-49.57	-40.75	-38.91	-26.24	-51.53	-38.75	-37.50	-42.38
8/10/17 5:00 PM	-43.50	-49.82	-40.75	-39.05	-25.90	-51.58	-38.61	-37.50	-43.10
8/11/17 5:00 AM	-43.50	-50.34	-40.75	-39.46	-26.37	-52.00	-38.83	-37.50	-43.43
8/11/17 5:00 PM	-43.50	-50.26	-40.75	-39.32	-26.54	-51.92	-38.50	-37.50	-44.65
8/12/17 5:00 AM	-43.50	-50.87	-40.75	-39.63	-26.93	-52.00	-38.72	-37.50	-45.67
8/12/17 5:00 PM	-43.39	-50.84	-40.75	-39.68	-27.12	-52.00	-38.53	-37.50	-46.81
8/13/17 5:00 AM	-43.50	-51.04	-40.75	-38.88	-26.54	-50.84	-38.61	-37.50	-46.31
8/13/17 5:00 PM	-43.06	-51.06	-40.58	-38.60	-25.54	-51.67	-38.31	-37.36	-46.17
8/14/17 5:00 AM	-43.50	-51.76	-40.75	-39.60	-25.63	-52.00	-38.86	-37.50	-45.79
8/14/17 5:00 PM	-43.39	-51.73	-40.75	-39.41	-25.16	-52.00	-38.56	-37.50	-46.62
8/15/17 5:00 AM	-43.50	-51.92	-40.75	-39.24	-25.04	-52.00	-38.64	-37.50	-46.53





10/1/17 5:00 PM	-43.50	-53.25	-40.75	-50.34	-37.56	-52.00	-39.00	-37.50	-41.94
10/2/17 5:00 AM	-43.50	-53.25	-40.75	-50.62	-38.11	-52.00	-39.00	-37.50	-40.72
10/2/17 5:00 PM	-43.39	-53.25	-40.28	-50.79	-37.86	-51.50	-38.70	-37.50	-40.77
10/3/17 5:00 AM	-43.50	-53.25	-40.47	-51.64	-38.67	-52.00	-38.81	-37.50	-39.20
10/3/17 5:00 PM	-43.50	-53.25	-40.47	-52.31	-39.14	-52.00	-38.92	-37.50	-39.39
10/4/17 5:00 AM	-43.50	-53.25	-40.36	-52.72	-39.47	-52.00	-38.97	-37.50	-38.89
10/4/17 5:00 PM	-43.50	-53.25	-40.56	-53.00	-39.69	-52.00	-39.00	-37.50	-41.00
10/5/17 5:00 AM	-43.50	-53.25	-40.42	-53.00	-39.72	-52.00	-38.89	-37.50	-41.55
10/5/17 5:00 PM	-43.50	-53.25	-40.31	-52.97	-39.75	-51.94	-38.97	-37.50	-43.21
10/6/17 5:00 AM	-43.50	-53.25	-40.47	-53.00	-40.08	-52.00	-38.86	-37.50	-42.77
10/6/17 5:00 PM	-43.50	-53.25	-40.39	-53.00	-40.13	-51.97	-38.81	-37.50	-44.68
10/7/17 5:00 AM	-43.50	-53.25	-40.36	-53.00	-40.44	-51.94	-38.83	-37.50	-44.23
10/7/17 5:00 PM	-43.50	-53.25	-40.45	-53.00	-40.96	-51.92	-38.72	-37.50	-45.15
10/8/17 5:00 AM	-43.50	-53.25	-40.53	-53.00	-41.07	-52.00	-38.83	-37.50	-45.07
10/8/17 5:00 PM	-43.50	-53.25	-40.39	-53.00	-41.24	-51.89	-38.75	-37.50	-46.73
10/9/17 5:00 AM	-43.50	-53.25	-40.50	-53.00	-41.30	-51.97	-38.67	-37.50	-45.92
10/9/17 5:00 PM	-43.50	-53.25	-40.53	-53.00	-41.82	-51.72	-38.78	-37.50	-45.43
10/10/17 5:00 AM	-43.42	-53.25	-40.67	-53.00	-41.90	-51.75	-38.72	-37.50	-44.26
10/10/17 5:00 PM	-43.36	-53.25	-40.61	-53.00	-42.29	-52.00	-38.67	-37.50	-44.65
10/11/17 5:00 AM	-43.50	-53.25	-40.75	-53.00	-42.93	-52.00	-38.83	-37.50	-44.48
10/11/17 5:00 PM	-43.50	-53.25	-40.75	-53.00	-43.01	-52.00	-38.78	-37.50	-45.15
10/12/17 5:00 AM	-43.50	-53.25	-40.72	-53.00	-43.45	-52.00	-38.78	-37.50	-44.84
10/12/17 5:00 PM	-43.44	-53.25	-40.72	-53.00	-43.95	-51.75	-38.58	-37.50	-44.46
10/13/17 5:00 AM	-43.50	-53.25	-40.72	-53.00	-44.48	-51.86	-38.81	-37.50	-42.38
10/13/17 5:00 PM	-43.50	-53.25	-40.53	-53.00	-45.03	-51.89	-38.67	-37.50	-41.80
10/14/17 5:00 AM	-43.50	-53.25	-40.64	-53.00	-45.23	-51.86	-38.70	-37.50	-41.74
10/14/17 5:00 PM	-43.50	-53.25	-40.75	-53.00	-45.70	-51.97	-38.81	-37.50	-42.88
10/15/17 5:00 AM	-43.50	-53.25	-40.69	-53.00	-46.03	-52.00	-38.72	-37.50	-42.80
10/15/17 5:00 PM	-43.50	-53.25	-40.56	-53.00	-45.95	-51.78	-38.70	-37.50	-44.79
10/16/17 5:00 AM	-43.50	-53.25	-40.61	-53.00	-46.42	-52.00	-38.89	-37.50	-45.56
10/16/17 5:00 PM	-43.50	-53.25	-40.75	-53.00	-46.50	-52.00	-38.89	-37.50	-43.74
10/17/17 5:00 AM	-43.50	-53.25	-40.75	-53.00	-46.50	-52.00	-39.00	-37.50	-41.44
10/17/17 5:00 PM	-43.50	-53.25	-40.75	-53.00	-46.50	-52.00	-39.00	-37.50	-41.47
10/18/17 5:00 AM	-43.50	-53.25	-40.75	-53.00	-46.50	-52.00	-39.00	-37.50	-40.69
10/18/17 5:00 PM	-43.50	-53.25	-40.75	-53.00	-46.50	-52.00	-39.00	-37.50	-41.36
10/19/17 5:00 AM	-43.50	-53.25	-40.72	-53.00	-46.50	-52.00	-39.00	-37.50	-41.16
10/19/17 5:00 PM	-43.50	-53.25	-40.75	-53.00	-46.50	-52.00	-39.00	-37.50	-42.44
10/20/17 5:00 AM	-43.50	-53.25	-40.69	-53.00	-46.50	-52.00	-39.00	-37.50	-41.94
10/20/17 5:00 PM	-43.50	-53.25	-40.58	-53.00	-46.50	-52.00	-39.00	-37.50	-42.77
10/21/17 5:00 AM	-43.50	-53.25	-40.45	-53.00	-46.50	-52.00	-39.00	-37.50	-41.63
10/21/17 5:00 PM	-43.50	-53.25	-40.47	-53.00	-46.50	-52.00	-39.00	-37.50	-41.38
10/22/17 5:00 AM	-43.50	-53.25	-40.28	-53.00	-46.50	-52.00	-38.97	-37.50	-40.80
10/22/17 5:00 PM	-43.50	-53.25	-40.42	-53.00	-46.50	-52.00	-39.00	-37.50	-42.02
10/23/17 5:00 AM	-43.50	-53.25	-40.31	-53.00	-46.50	-51.94	-38.94	-37.50	-43.79

<b>Project:</b>	Deep Meadow MitigationSite		
<b>EEP Project ID:</b>	97131		
<b>Wetland Component:</b>	Pre-construction Rain Gage Data		
<b>Growing Season:</b>	March 23 to November 6		
<b>Units</b>	Inches		
<b>Gauge Type</b>	Rain		
	<b>Serial #</b>	N/A	
	<b>Gauge</b>	Rain	
	<b>Source:</b>	Monroe , NC; USC00315771	
<b>Date</b>	<b>Amount</b>	<b>Q</b>	<b>S</b>

January 1, 2016	0.15		
January 2, 2016	0.00		
January 3, 2016	0.00		
January 4, 2016	0.00		
January 5, 2016	0.00		
January 6, 2016	0.00		
January 7, 2016	0.00		
January 8, 2016	0.00		
January 9, 2016	0.00		
January 10, 2016	0.20		
January 11, 2016	0.00		
January 12, 2016	0.00		
January 13, 2016	0.00		
January 14, 2016	0.00		
January 15, 2016	0.00		
January 16, 2016	0.69		
January 17, 2016	0.03		
January 18, 2016	0.04		
January 19, 2016	0.00		
January 20, 2016	0.00		
January 21, 2016	0.00		
January 22, 2016	0.28		
January 23, 2016	0.70		
January 24, 2016	0.00		
January 25, 2016	0.00		
January 26, 2016	0.00		
January 27, 2016	0.00		
January 28, 2016	0.00		
January 29, 2016	0.00		
January 30, 2016	0.00		
January 31, 2016	0.00		
February 1, 2016	0.00		
February 2, 2016	0.00		
February 3, 2016	0.00		
February 4, 2016	0.88		
February 5, 2016	0.00		
February 6, 2016	0.00		
February 7, 2016	0.00		
February 8, 2016	0.00		
February 9, 2016	0.00		
February 10, 2016	0.00		
February 11, 2016	0.00		
February 12, 2016	0.00		
February 13, 2016	0.00		
February 14, 2016	0.00		
February 15, 2016	0.00		
February 16, 2016	1.00		
February 17, 2016	0.03		
February 18, 2016	0.00		
February 19, 2016	0.00		
February 20, 2016	0.00		
February 21, 2016	0.00		
February 22, 2016	0.00		
February 23, 2016	0.59		
February 24, 2016	0.35		
February 25, 2016	0.22		
February 26, 2016	0.00		
February 27, 2016	0.00		
February 28, 2016	0.00		
February 29, 2016	0.03		
March 1, 2016	0.00		
March 2, 2016	0.12		
March 3, 2016	0.00		
March 4, 2016	0.08		
March 5, 2016	0.00		
March 6, 2016	0.00		
March 7, 2016	0.00		
March 8, 2016	0.00		
March 9, 2016	0.00		
March 10, 2016	0.00		
March 11, 2016	0.00		
March 12, 2016	0.00		
March 13, 2016	0.00		
March 14, 2016	0.65		

March 15, 2016	0.20
March 16, 2016	0.00
March 17, 2016	0.00
March 18, 2016	0.00
March 19, 2016	0.00
March 20, 2016	0.07
March 21, 2016	0.10
March 22, 2016	0.00
March 23, 2016	0.00
March 24, 2016	0.00
March 25, 2016	0.00
March 26, 2016	0.00
March 27, 2016	0.60
March 28, 2016	0.60
March 29, 2016	0.00
March 30, 2016	0.00
March 31, 2016	0.00
April 1, 2016	0.30
April 2, 2016	0.12
April 3, 2016	0.04
April 4, 2016	0.00
April 5, 2016	0.00
April 6, 2016	0.00
April 7, 2016	0.10
April 8, 2016	0.00
April 9, 2016	0.00
April 10, 2016	0.00
April 11, 2016	0.00
April 12, 2016	0.00
April 13, 2016	0.13
April 14, 2016	0.00
April 15, 2016	0.00
April 16, 2016	0.00
April 17, 2016	0.00
April 18, 2016	0.00
April 19, 2016	0.00
April 20, 2016	0.00
April 21, 2016	0.00
April 22, 2016	0.00
April 23, 2016	0.10
April 24, 2016	0.00
April 25, 2016	0.00
April 26, 2016	0.00
April 27, 2016	0.00
April 28, 2016	0.00
April 29, 2016	0.00
April 30, 2016	0.00
May 1, 2016	0.08
May 2, 2016	1.00
May 3, 2016	1.10
May 4, 2016	0.02
May 5, 2016	0.00
May 6, 2016	0.17
May 7, 2016	0.00
May 8, 2016	0.00
May 9, 2016	0.00
May 10, 2016	0.00
May 11, 2016	0.00
May 12, 2016	0.00
May 13, 2016	0.65
May 14, 2016	0.00
May 15, 2016	0.00
May 16, 2016	0.00
May 17, 2016	0.00
May 18, 2016	0.28
May 19, 2016	0.53
May 20, 2016	0.53
May 21, 2016	0.53
May 22, 2016	0.15
May 23, 2016	0.00
May 24, 2016	0.00
May 25, 2016	0.00
May 26, 2016	0.00
May 27, 2016	0.00
May 28, 2016	0.00
May 29, 2016	0.08
May 30, 2016	0.12
May 31, 2016	0.00
June 1, 2016	0.00
June 2, 2016	0.00
June 3, 2016	0.12
June 4, 2016	0.00
June 5, 2016	1.30
June 6, 2016	0.30
June 7, 2016	0.20
June 8, 2016	0.00
June 9, 2016	0.00

June 10, 2016	0.00
June 11, 2016	0.00
June 12, 2016	0.00
June 13, 2016	0.00
June 14, 2016	0.00
June 15, 2016	0.77
June 16, 2016	0.00
June 17, 2016	0.00
June 18, 2016	0.00
June 19, 2016	0.00
June 20, 2016	0.00
June 21, 2016	0.00
June 22, 2016	0.00
June 23, 2016	0.00
June 24, 2016	0.01
June 25, 2016	0.00
June 26, 2016	0.00
June 27, 2016	0.00
June 28, 2016	0.18
June 29, 2016	0.00
June 30, 2016	0.67
July 1, 2016	0.00
July 2, 2016	0.00
July 3, 2016	0.00
July 4, 2016	0.00
July 5, 2016	0.28
July 6, 2016	0.21
July 7, 2016	0.00
July 8, 2016	0.00
July 9, 2016	0.58
July 10, 2016	0.00
July 11, 2016	0.00
July 12, 2016	0.80
July 13, 2016	0.00
July 14, 2016	0.00
July 15, 2016	0.00
July 16, 2016	0.72
July 17, 2016	0.25
July 18, 2016	0.00
July 19, 2016	0.00
July 20, 2016	0.14
July 21, 2016	0.00
July 22, 2016	0.00
July 23, 2016	0.00
July 24, 2016	0.00
July 25, 2016	0.00
July 26, 2016	0.00
July 27, 2016	0.00
July 28, 2016	0.00
July 29, 2016	0.00
July 30, 2016	0.00
July 31, 2016	0.00
August 1, 2016	0.00
August 2, 2016	0.20
August 3, 2016	0.03
August 4, 2016	0.00
August 5, 2016	0.10
August 6, 2016	0.19
August 7, 2016	0.00
August 8, 2016	0.29
August 9, 2016	0.40
August 10, 2016	0.05
August 11, 2016	0.17
August 12, 2016	0.05
August 13, 2016	0.00
August 14, 2016	0.00
August 15, 2016	0.00
August 16, 2016	0.00
August 17, 2016	0.00
August 18, 2016	0.00
August 19, 2016	0.79
August 20, 2016	0.00
August 21, 2016	0.00
August 22, 2016	0.00
August 23, 2016	0.00
August 24, 2016	0.00
August 25, 2016	0.00
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August 30, 2016	0.00
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September 3, 2016	0.80
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September 19, 2016	0.00
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September 22, 2016	0.28
September 23, 2016	0.05
September 24, 2016	0.01
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September 26, 2016	0.00
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September 30, 2016	0.00
October 1, 2016	0.00
October 2, 2016	0.00
October 3, 2016	0.00
October 4, 2016	0.00
October 5, 2016	0.00
October 6, 2016	0.00
October 7, 2016	0.05
October 8, 2016	4.10
October 9, 2016	1.65
October 10, 2016	0.00
October 11, 2016	0.00
October 12, 2016	0.00
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October 17, 2016	0.00
October 18, 2016	0.00
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October 20, 2016	0.00
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October 23, 2016	0.00
October 24, 2016	0.00
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November 3, 2016	0.00
November 4, 2016	0.00
November 5, 2016	0.00
November 6, 2016	0.00
November 7, 2016	0.00
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November 10, 2016	0.00
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November 21, 2016	0.00
November 22, 2016	0.00
November 23, 2016	0.00
November 24, 2016	0.00
November 25, 2016	0.00
November 26, 2016	0.00
November 27, 2016	0.00
November 28, 2016	0.00
November 29, 2016	0.02
November 30, 2016	0.10

December 1, 2016	0.30
December 2, 2016	0.00
December 3, 2016	0.00
December 4, 2016	0.04
December 5, 2016	0.71
December 6, 2016	0.30
December 7, 2016	0.24
December 8, 2016	0.00
December 9, 2016	0.00
December 10, 2016	0.00
December 11, 2016	0.00
December 12, 2016	0.02
December 13, 2016	0.00
December 14, 2016	0.05
December 15, 2016	0.00
December 16, 2016	0.00
December 17, 2016	0.00
December 18, 2016	0.01
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December 25, 2016	0.00
December 26, 2016	0.00
December 27, 2016	0.00
December 28, 2016	0.00
December 29, 2016	0.70
December 30, 2016	0.00
December 31, 2016	0.00
January 1, 2017	0.05
January 2, 2017	1.00
January 3, 2017	1.05
January 4, 2017	0.03
January 5, 2017	0.00
January 6, 2017	0.00
January 7, 2017	1.00
January 8, 2017	0.01
January 9, 2017	0.00
January 10, 2017	0.00
January 11, 2017	0.03
January 12, 2017	0.02
January 13, 2017	0.00
January 14, 2017	0.00
January 15, 2017	0.00
January 16, 2017	0.00
January 17, 2017	0.00
January 18, 2017	0.00
January 19, 2017	0.00
January 20, 2017	0.05
January 21, 2017	0.00
January 22, 2017	0.90
January 23, 2017	1.35
January 24, 2017	0.00
January 25, 2017	0.00
January 26, 2017	0.02
January 27, 2017	0.00
January 28, 2017	0.00
January 29, 2017	0.00
January 30, 2017	0.00
January 31, 2017	0.00
February 1, 2017	0.00
February 2, 2017	0.00
February 3, 2017	0.05
February 4, 2017	0.00
February 5, 2017	0.00
February 6, 2017	0.00
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February 9, 2017	0.13
February 10, 2017	0.00
February 11, 2017	0.00
February 12, 2017	0.00
February 13, 2017	0.00
February 14, 2017	0.00
February 15, 2017	0.00
February 16, 2017	0.74
February 17, 2017	0.00
February 18, 2017	0.00
February 19, 2017	0.01
February 20, 2017	0.00
February 21, 2017	0.00
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February 24, 2017	0.00
February 25, 2017	0.00

February 26, 2017	0.00
February 27, 2017	0.00
February 28, 2017	0.00
March 1, 2017	0.00
March 2, 2017	0.35
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March 4, 2017	0.00
March 5, 2017	0.00
March 6, 2017	0.00
March 7, 2017	0.00
March 8, 2017	0.05
March 9, 2017	0.00
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March 11, 2017	0.00
March 12, 2017	0.37
March 13, 2017	0.15
March 14, 2017	0.71
March 15, 2017	0.02
March 16, 2017	0.00
March 17, 2017	0.00
March 18, 2017	0.01
March 19, 2017	0.32
March 20, 2017	0.00
March 21, 2017	0.00
March 22, 2017	0.00
March 23, 2017	0.00
March 24, 2017	0.00
March 25, 2017	0.00
March 26, 2017	0.00
March 27, 2017	0.06
March 28, 2017	0.18
March 29, 2017	0.00
March 30, 2017	0.00
March 31, 2017	0.27
April 1, 2017	0.03
April 2, 2017	0.00
April 3, 2017	0.00
April 4, 2017	0.88
April 5, 2017	0.00
April 6, 2017	1.12
April 7, 2017	0.00
April 8, 2017	0.00
April 9, 2017	0.00
April 10, 2017	0.00
April 11, 2017	0.00
April 12, 2017	0.00
April 13, 2017	0.00
April 14, 2017	0.00
April 15, 2017	0.00
April 16, 2017	0.00
April 17, 2017	0.00
April 18, 2017	0.03
April 19, 2017	0.00
April 20, 2017	0.07
April 21, 2017	0.00
April 22, 2017	0.00
April 23, 2017	0.09
April 24, 2017	2.10
April 25, 2017	1.90
April 26, 2017	0.04
April 27, 2017	0.00
April 28, 2017	0.01
April 29, 2017	0.00
April 30, 2017	0.00
May 1, 2017	0.00
May 2, 2017	0.45
May 3, 2017	0.00
May 4, 2017	0.00
May 5, 2017	1.35
May 6, 2017	0.00
May 7, 2017	0.05
May 8, 2017	0.00
May 9, 2017	0.00
May 10, 2017	0.00
May 11, 2017	0.00
May 12, 2017	0.00
May 13, 2017	0.27
May 14, 2017	0.00
May 15, 2017	0.00
May 16, 2017	0.00
May 17, 2017	0.00
May 18, 2017	0.00
May 19, 2017	0.00
May 20, 2017	0.00
May 21, 2017	0.00
May 22, 2017	0.00
May 23, 2017	0.00

May 24, 2017	1.35
May 25, 2017	1.50
May 26, 2017	0.00
May 27, 2017	0.00
May 28, 2017	0.00
May 29, 2017	0.00
May 30, 2017	0.00
May 31, 2017	0.00
June 1, 2017	0.05
June 2, 2017	0.00
June 3, 2017	0.00
June 4, 2017	0.00
June 5, 2017	1.35
June 6, 2017	0.15
June 7, 2017	0.00
June 8, 2017	0.00
June 9, 2017	0.00
June 10, 2017	0.00
June 11, 2017	0.00
June 12, 2017	0.00
June 13, 2017	0.00
June 14, 2017	0.08
June 15, 2017	0.00
June 16, 2017	0.20
June 17, 2017	0.70
June 18, 2017	0.00
June 19, 2017	0.08
June 20, 2017	3.45
June 21, 2017	1.87
June 22, 2017	0.07
June 23, 2017	0.05
June 24, 2017	0.00
June 25, 2017	0.03
June 26, 2017	0.00
June 27, 2017	0.00
June 28, 2017	0.00
June 29, 2017	0.00
June 30, 2017	0.00
July 1, 2017	0.03
July 2, 2017	0.28
July 3, 2017	0.00
July 4, 2017	1.20
July 5, 2017	0.00
July 6, 2017	0.00
July 7, 2017	0.00
July 8, 2017	0.00
July 9, 2017	0.10
July 10, 2017	0.00
July 11, 2017	0.00
July 12, 2017	0.00
July 13, 2017	0.00
July 14, 2017	0.00
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July 23, 2017	0.00
July 24, 2017	1.67
July 25, 2017	0.00
July 26, 2017	0.00
July 27, 2017	0.00
July 28, 2017	0.00
July 29, 2017	0.27
July 30, 2017	0.00
July 31, 2017	0.00
August 1, 2017	0.00
August 2, 2017	0.00
August 3, 2017	0.00
August 4, 2017	0.00
August 5, 2017	0.01
August 6, 2017	0.00
August 7, 2017	0.17
August 8, 2017	0.39
August 9, 2017	0.08
August 10, 2017	0.00
August 11, 2017	0.00
August 12, 2017	0.29
August 13, 2017	0.02
August 14, 2017	0.00
August 15, 2017	1.15
August 16, 2017	0.08
August 17, 2017	0.00
August 18, 2017	0.05

August 19, 2017	0.23
August 20, 2017	0.00
August 21, 2017	0.00
August 22, 2017	0.00
August 23, 2017	0.03
August 24, 2017	0.04
August 25, 2017	0.03
August 26, 2017	0.00
August 27, 2017	0.00
August 28, 2017	0.00
August 29, 2017	0.05
August 30, 2017	0.00
August 31, 2017	0.05
September 1, 2017	1.60
September 2, 2017	0.24
September 3, 2017	0.00
September 4, 2017	0.00
September 5, 2017	0.00
September 6, 2017	0.00
September 7, 2017	0.40
September 8, 2017	0.00
September 9, 2017	0.00
September 10, 2017	0.00
September 11, 2017	0.00
September 12, 2017	1.71
September 13, 2017	0.00
September 14, 2017	0.00
September 15, 2017	0.00
September 16, 2017	0.00
September 17, 2017	0.00
September 18, 2017	0.00
September 19, 2017	0.00
September 20, 2017	0.00
September 21, 2017	0.00
September 22, 2017	0.00
September 23, 2017	0.00
September 24, 2017	0.00
September 25, 2017	0.00
September 26, 2017	0.00
September 27, 2017	0.00
September 28, 2017	0.00
September 29, 2017	0.00
September 30, 2017	0.00
October 1, 2017	0.00
October 2, 2017	0.00
October 3, 2017	0.00
October 4, 2017	0.00
October 5, 2017	0.00
October 6, 2017	0.00
October 7, 2017	0.00
October 8, 2017	0.00
October 9, 2017	0.22
October 10, 2017	0.00
October 11, 2017	0.10
October 12, 2017	0.00
October 13, 2017	0.00
October 14, 2017	0.05
October 15, 2017	0.00
October 16, 2017	0.01
October 17, 2017	0.26
October 18, 2017	0.00
October 19, 2017	0.00
October 20, 2017	0.00
October 21, 2017	0.00
October 22, 2017	0.00
October 23, 2017	0.00
October 24, 2017	0.00
October 25, 2017	0.00
October 26, 2017	0.00
October 27, 2017	0.00
October 28, 2017	0.00
October 29, 2017	0.00
October 30, 2017	0.00
October 31, 2017	0.00



APPENDIX 5  
APPROVED FHWA CATEGORICAL EXCLUSION FORM

# Categorical Exclusion Form for Ecosystem Enhancement Program Projects Version 1.4

**Note: Only Appendix A should be submitted (along with any supporting documentation) as the environmental document.**

Part 1: General Project Information	
<b>Project Name:</b>	Deep Meadow Mitigation Site
<b>County Name:</b>	Union County
<b>EEP Number:</b>	97131
<b>Project Sponsor:</b>	Wildlands Engineering, Inc
<b>Project Contact Name:</b>	Andrea S. Eckardt
<b>Project Contact Address:</b>	1430 South Mint Street, Suite 104, Charlotte, NC 28203
<b>Project Contact E-mail:</b>	aeckardt@wildlandseng.com
<b>EEP Project Manager:</b>	Harry Tsomides
Project Description	
<p>The Deep Meadow Mitigation Site is a stream and wetland mitigation project located 2 miles north of the Town of Wingate and approximately 6 miles northeast of the City of Monroe, in Union County, NC. The project contains Meadow Branch and its tributaries, which flow to Richardson Creek, for a total of more than 4,287 linear feet of stream. Historically, the agricultural parcel has been used for row crop production. The project will provide stream and wetland mitigation units to the Division of Mitigation Services in the Yadkin River Basin (03040105).</p>	
For Official Use Only	
<b>Reviewed By:</b>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="font-size: 1.2em; margin: 0;">4/30/2016</p> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <p>Date</p> </div> <div style="width: 45%; text-align: right;"> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <p>EEP Project Manager</p> </div> </div>	
<b>Conditional Approved By:</b>	
<hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <p>Date</p>	<hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <p>For Division Administrator FHWA</p>
<input type="checkbox"/> Check this box if there are outstanding issues	
<b>Final Approval By:</b>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="font-size: 1.2em; margin: 0;">12-1-16</p> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <p>Date</p> </div> <div style="width: 45%; text-align: right;"> <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> <p>For Division Administrator FHWA</p> </div> </div>	

<b>Part 2: All Projects</b>	
<b>Regulation/Question</b>	<b>Response</b>
<b>Coastal Zone Management Act (CZMA)</b>	
1. Is the project located in a CAMA county?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Has a CAMA permit been secured?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Has NCDCCM agreed that the project is consistent with the NC Coastal Management Program?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)</b>	
1. Is this a "full-delivery" project?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
6. Is there an approved hazardous mitigation plan?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>National Historic Preservation Act (Section 106)</b>	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Does the project affect such properties and does the SHPO/THPO concur?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. If the effects are adverse, have they been resolved?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)</b>	
1. Is this a "full-delivery" project?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Does the project require the acquisition of real estate?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

<b>Part 3: Ground-Disturbing Activities Regulation/Question</b>		<b>Response</b>
<b>American Indian Religious Freedom Act (AIRFA)</b>		
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
2. Is the site of religious importance to American Indians?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
4. Have the effects of the project on this site been considered?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
<b>Antiquities Act (AA)</b>		
1. Is the project located on Federal lands?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
3. Will a permit from the appropriate Federal agency be required?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
4. Has a permit been obtained?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
<b>Archaeological Resources Protection Act (ARPA)</b>		
1. Is the project located on federal or Indian lands (reservation)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
2. Will there be a loss or destruction of archaeological resources?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
3. Will a permit from the appropriate Federal agency be required?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
4. Has a permit been obtained?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
<b>Endangered Species Act (ESA)</b>		
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
2. Is Designated Critical Habitat or suitable habitat present for listed species?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A	
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	

<b>Executive Order 13007 (Indian Sacred Sites)</b>	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>Farmland Protection Policy Act (FPPA)</b>	
1. Will real estate be acquired?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
<b>Fish and Wildlife Coordination Act (FWCA)</b>	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Have the USFWS and the NCWRC been consulted?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
<b>Land and Water Conservation Fund Act (Section 6(f))</b>	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Has the NPS approved of the conversion?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)</b>	
1. Is the project located in an estuarine system?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Is suitable habitat present for EFH-protected species?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
4. Will the project adversely affect EFH?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
5. Has consultation with NOAA-Fisheries occurred?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>Migratory Bird Treaty Act (MBTA)</b>	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Have the USFWS recommendations been incorporated?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
<b>Wilderness Act</b>	
1. Is the project in a Wilderness area?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A



Deep Meadow Mitigation Site  
Categorical Exclusion  
**Summary**

### **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a Federal “Superfund” to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

As the Deep Meadow Mitigation Site is a full-delivery project; an EDR Radius Map Report with Geocheck was ordered for the site through Environmental Data Resources, Inc on August 16, 2016. While the target property was not listed in any of the Federal, State, or Tribal environmental databases searched by EDR, one North Carolina Hazardous Substance Disposal Site (NC HSDS) and one Leaking Aboveground Storage Tank (LAST) were identified within one mile of the project area. The NC HSDS site is the Union County landfill located at 2125 Austin Chaney Road which is 0.65 miles northwest of the Deep Meadow Creek project area. The landfill is located outside of the contributing watershed. The leaking aboveground storage tank site is described as a fuel spill on Olive Branch Road however no further information or site location was available. Olive Branch Road is located approximately 0.25 miles downstream of the project area.

Overall, the EDR assessment revealed no evidence of any “recognized environmental conditions” in connection with the target property. The Executive Summary of the EDR report is included in the Appendix. The full report is available if needed.

### **National Historic Preservation Act (Section 106)**

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

Wildlands Engineering, Inc. (Wildlands) requested review and comment from the State Historic Preservation Office (SHPO) with respect to any archeological and architectural resources related to the Deep Meadow Mitigation Site on August 10, 2016. SHPO responded on August 29, 2016 and stated they were aware of “no historic resources which would be affected by the project” and would have no further comment. All correspondence related to Section 106 is included in the Appendix.

### **Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)**

These acts, collectively known as the Uniform Act, provide for uniform and equitable treatment of persons displaced from their homes, businesses, non-profit associations, or farms by federal and federally-assisted programs, and establish uniform and equitable land acquisition policies.

Deep Meadow Mitigation Site is a full-delivery project that includes land acquisition. Notification of the fair market value of the project property and the lack of condemnation authority by Wildlands was included in the signed option agreements for the project properties. A copy of the relevant section of the option agreement is included in the Appendix.

### **Endangered Species Act (ESA)**

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.



The Union County listed federally endangered species includes the Carolina heelsplitter (*Lasmigona decorate*), the Michaux's sumac (*Rhus michauxii*) and the Schweinitz's sunflower (*Helianthus schweinitzii*). The United States Fish and Wildlands Service (USFWS) currently lists Critical Habitat Designations for the Carolina heelsplitter in Union County as well.

Mapped critical habitat for the Carolina heelsplitter is found in three locations in Union County: the main stem of Goose Creek (Pee Dee River system), from the N.C. Highway 218 Bridge downstream to its confluence with the Rocky River; the main stem of Duck Creek, from the Mecklenburg/Union County line downstream to its confluence with Goose Creek; and the main stem of Waxhaw Creek (Catawba River system), from the N.C. Highway 200 Bridge downstream to the North Carolina/South Carolina State line. As shown on the attached Heelsplitter Critical Habitat (Figure 2), the Deep Meadow Mitigation Site is over 10 miles from the mapped critical habitat locations and is not located upstream of any of the locations. Based on the proposed project's location, Wildlands determined that the Deep Meadow Site will have "no effect" on existing designated critical habitat.

As a result of pedestrian survey conducted on February 29, 2016 suitable habitat for the Schweinitz's sunflower was identified in small areas along the forest edges. There was no suitable habitat found in the project area for the other two listed species. A second survey, performed on August 10, 2016, found no individual species in the project area for the listed species. It was determined that the project would result in "no effect" on any of the listed species.

Wildlands requested review and comment from the USFWS on August 10, 2016 in respect to the Deep Meadow Mitigation Site and its potential impacts on federally listed species or critical habitat. USFWS provided comments on October 20, 2016 stating they consider "the requirements under the Act to be complete and require no further action at this time". Correspondence with USFWS is included in the Appendix.

#### **Farmland Protection Policy Act (FPPA)**

The FPPA requires that, before taking or approving any federal action that would result in conversion of farmland, the agency must examine the effects of the action using the criteria set forth in the FPPA, and, if there are adverse effects, must consider alternatives to lessen them.

The Deep Meadow Mitigation Site includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resources Conservation Service (NRCS). The completed form and correspondence documenting its submittal is included in the Appendix.

#### **Fish and Wildlife Coordination Act (FWCA)**

The FWCA requires consultation with the USFWS and the appropriate state wildlife agency on projects that alter or modify a water body. Reports and recommendations prepared by these agencies document project effects on wildlife and identify measures that may be adopted to prevent loss or damage to wildlife resources.

The Deep Meadow Mitigation Site includes stream restoration, as such Wildlands requested comment on the project from both the USFWS and the North Carolina Wildlife Resources Commission (NCWRC) on August 10, 2016. NCWRC responded on October 14, 2016 and had no objections to the proposed project. USFWS also had no objections to the proposed project and provided design recommendations related to stream channel restoration activities, stream buffers, and invasive exotic species in their October 20, 2016 response. Correspondence with the two agencies is included in the Appendix.



### **Migratory Bird Treaty Act (MBTA)**

The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute a taking.

Wildlands requested comment on the Deep Meadow Mitigation Site from the USFWS in regards to migratory birds on August 10, 2016. The USFWS response on October 20, 2016 did not include any comments related to migratory birds. Correspondence with USFWS is included in the Appendix.



Deep Meadow Mitigation Site

Categorical Exclusion

**Appendix**



**Deep Meadow Mitigation Site**

1812 McIntyre Road

Wingate, NC 28174

Inquiry Number: 4702626.2s

August 17, 2016

**The EDR Radius Map™ Report with GeoCheck®**



6 Armstrong Road, 4th floor  
Shelton, CT 06484  
Toll Free: 800.352.0050  
[www.edrnet.com](http://www.edrnet.com)

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*Thank you for your business.*  
Please contact EDR at 1-800-352-0050  
with any questions or comments.

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## EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

### TARGET PROPERTY INFORMATION

#### ADDRESS

1812 MCINTYRE ROAD  
WINGATE, NC 28174

#### COORDINATES

Latitude (North): 35.0234560 - 35° 1' 24.44"  
Longitude (West): 80.4512050 - 80° 27' 4.33"  
Universal Transverse Mercator: Zone 17  
UTM X (Meters): 550065.6  
UTM Y (Meters): 3875584.2  
Elevation: 504 ft. above sea level

### USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map: 5947250 WATSON, NC  
Version Date: 2013

### AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from: 20140517  
Source: USDA

MAPPED SITES SUMMARY

Target Property Address:  
1812 MCINTYRE ROAD  
WINGATE, NC 28174

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
<a href="#">Reg</a>	UNION CO LDFL		NC HSDS	Same	3439, 0.651, NW

# EXECUTIVE SUMMARY

## TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

## DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

## STANDARD ENVIRONMENTAL RECORDS

### ***Federal NPL site list***

NPL..... National Priority List  
Proposed NPL..... Proposed National Priority List Sites  
NPL LIENS..... Federal Superfund Liens

### ***Federal Delisted NPL site list***

Delisted NPL..... National Priority List Deletions

### ***Federal CERCLIS list***

FEDERAL FACILITY..... Federal Facility Site Information listing  
SEMS..... Superfund Enterprise Management System

### ***Federal CERCLIS NFRAP site list***

SEMS-ARCHIVE..... Superfund Enterprise Management System Archive

### ***Federal RCRA CORRACTS facilities list***

CORRACTS..... Corrective Action Report

### ***Federal RCRA non-CORRACTS TSD facilities list***

RCRA-TSDF..... RCRA - Treatment, Storage and Disposal

### ***Federal RCRA generators list***

RCRA-LQG..... RCRA - Large Quantity Generators  
RCRA-SQG..... RCRA - Small Quantity Generators  
RCRA-CESQG..... RCRA - Conditionally Exempt Small Quantity Generator

### ***Federal institutional controls / engineering controls registries***

LUCIS..... Land Use Control Information System  
US ENG CONTROLS..... Engineering Controls Sites List



## EXECUTIVE SUMMARY

US INST CONTROL..... Sites with Institutional Controls

### **Federal ERNS list**

ERNS..... Emergency Response Notification System

### **State- and tribal - equivalent CERCLIS**

SHWS..... Inactive Hazardous Sites Inventory

### **State and tribal landfill and/or solid waste disposal site lists**

SWF/LF..... List of Solid Waste Facilities

OLI..... Old Landfill Inventory

### **State and tribal leaking storage tank lists**

LUST..... Regional UST Database

LAST..... Leaking Aboveground Storage Tanks

INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land

LUST TRUST..... State Trust Fund Database

### **State and tribal registered storage tank lists**

FEMA UST..... Underground Storage Tank Listing

UST..... Petroleum Underground Storage Tank Database

AST..... AST Database

INDIAN UST..... Underground Storage Tanks on Indian Land

### **State and tribal institutional control / engineering control registries**

INST CONTROL..... No Further Action Sites With Land Use Restrictions Monitoring

### **State and tribal voluntary cleanup sites**

VCP..... Responsible Party Voluntary Action Sites

INDIAN VCP..... Voluntary Cleanup Priority Listing

### **State and tribal Brownfields sites**

BROWNFIELDS..... Brownfields Projects Inventory

### **ADDITIONAL ENVIRONMENTAL RECORDS**

#### **Local Brownfield lists**

US BROWNFIELDS..... A Listing of Brownfields Sites

#### **Local Lists of Landfill / Solid Waste Disposal Sites**

HIST LF..... Solid Waste Facility Listing

SWRCY..... Recycling Center Listing

INDIAN ODI..... Report on the Status of Open Dumps on Indian Lands

ODI..... Open Dump Inventory

## EXECUTIVE SUMMARY

DEBRIS REGION 9..... Torres Martinez Reservation Illegal Dump Site Locations

### **Local Lists of Hazardous waste / Contaminated Sites**

US HIST CDL..... Delisted National Clandestine Laboratory Register  
US CDL..... National Clandestine Laboratory Register

### **Local Land Records**

LIENS 2..... CERCLA Lien Information

### **Records of Emergency Release Reports**

HMIRS..... Hazardous Materials Information Reporting System  
SPILLS..... Spills Incident Listing  
IMD..... Incident Management Database  
SPILLS 90..... SPILLS 90 data from FirstSearch  
SPILLS 80..... SPILLS 80 data from FirstSearch

### **Other Ascertainable Records**

RCRA NonGen / NLR..... RCRA - Non Generators / No Longer Regulated  
FUDS..... Formerly Used Defense Sites  
DOD..... Department of Defense Sites  
SCRD DRYCLEANERS..... State Coalition for Remediation of Drycleaners Listing  
US FIN ASSUR..... Financial Assurance Information  
EPA WATCH LIST..... EPA WATCH LIST  
2020 COR ACTION..... 2020 Corrective Action Program List  
TSCA..... Toxic Substances Control Act  
TRIS..... Toxic Chemical Release Inventory System  
SSTS..... Section 7 Tracking Systems  
ROD..... Records Of Decision  
RMP..... Risk Management Plans  
RAATS..... RCRA Administrative Action Tracking System  
PRP..... Potentially Responsible Parties  
PADS..... PCB Activity Database System  
ICIS..... Integrated Compliance Information System  
FTTS..... FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)  
MLTS..... Material Licensing Tracking System  
COAL ASH DOE..... Steam-Electric Plant Operation Data  
COAL ASH EPA..... Coal Combustion Residues Surface Impoundments List  
PCB TRANSFORMER..... PCB Transformer Registration Database  
RADINFO..... Radiation Information Database  
HIST FTTS..... FIFRA/TSCA Tracking System Administrative Case Listing  
DOT OPS..... Incident and Accident Data  
CONSENT..... Superfund (CERCLA) Consent Decrees  
INDIAN RESERV..... Indian Reservations  
FUSRAP..... Formerly Utilized Sites Remedial Action Program  
UMTRA..... Uranium Mill Tailings Sites  
LEAD SMELTERS..... Lead Smelter Sites  
US AIRS..... Aerometric Information Retrieval System Facility Subsystem  
US MINES..... Mines Master Index File  
FINDS..... Facility Index System/Facility Registry System  
UXO..... Unexploded Ordnance Sites

## EXECUTIVE SUMMARY

DOCKET HWC.....	Hazardous Waste Compliance Docket Listing
COAL ASH.....	Coal Ash Disposal Sites
DRYCLEANERS.....	Drycleaning Sites
Financial Assurance.....	Financial Assurance Information Listing
NPDES.....	NPDES Facility Location Listing
UIC.....	Underground Injection Wells Listing
ECHO.....	Enforcement & Compliance History Information
FUELS PROGRAM.....	EPA Fuels Program Registered Listing

### EDR HIGH RISK HISTORICAL RECORDS

#### ***EDR Exclusive Records***

EDR MGP.....	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto.....	EDR Exclusive Historic Gas Stations
EDR Hist Cleaner.....	EDR Exclusive Historic Dry Cleaners

### EDR RECOVERED GOVERNMENT ARCHIVES

#### ***Exclusive Recovered Govt. Archives***

RGA HWS.....	Recovered Government Archive State Hazardous Waste Facilities List
RGA LF.....	Recovered Government Archive Solid Waste Facilities List
RGA LUST.....	Recovered Government Archive Leaking Underground Storage Tank

### SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.

Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

### STANDARD ENVIRONMENTAL RECORDS

#### ***State- and tribal - equivalent NPL***

NC HSDS: The Hazardous Substance Disposal Sites list contains locations of uncontrolled and unregulated hazardous waste sites. The file contains sites on the national priority list as well as the state priority list. The data source is the North Carolina Center for Geographic Information and Analysis.

A review of the NC HSDS list, as provided by EDR, and dated 08/09/2011 has revealed that there is 1 NC HSDS site within approximately 1 mile of the target property.

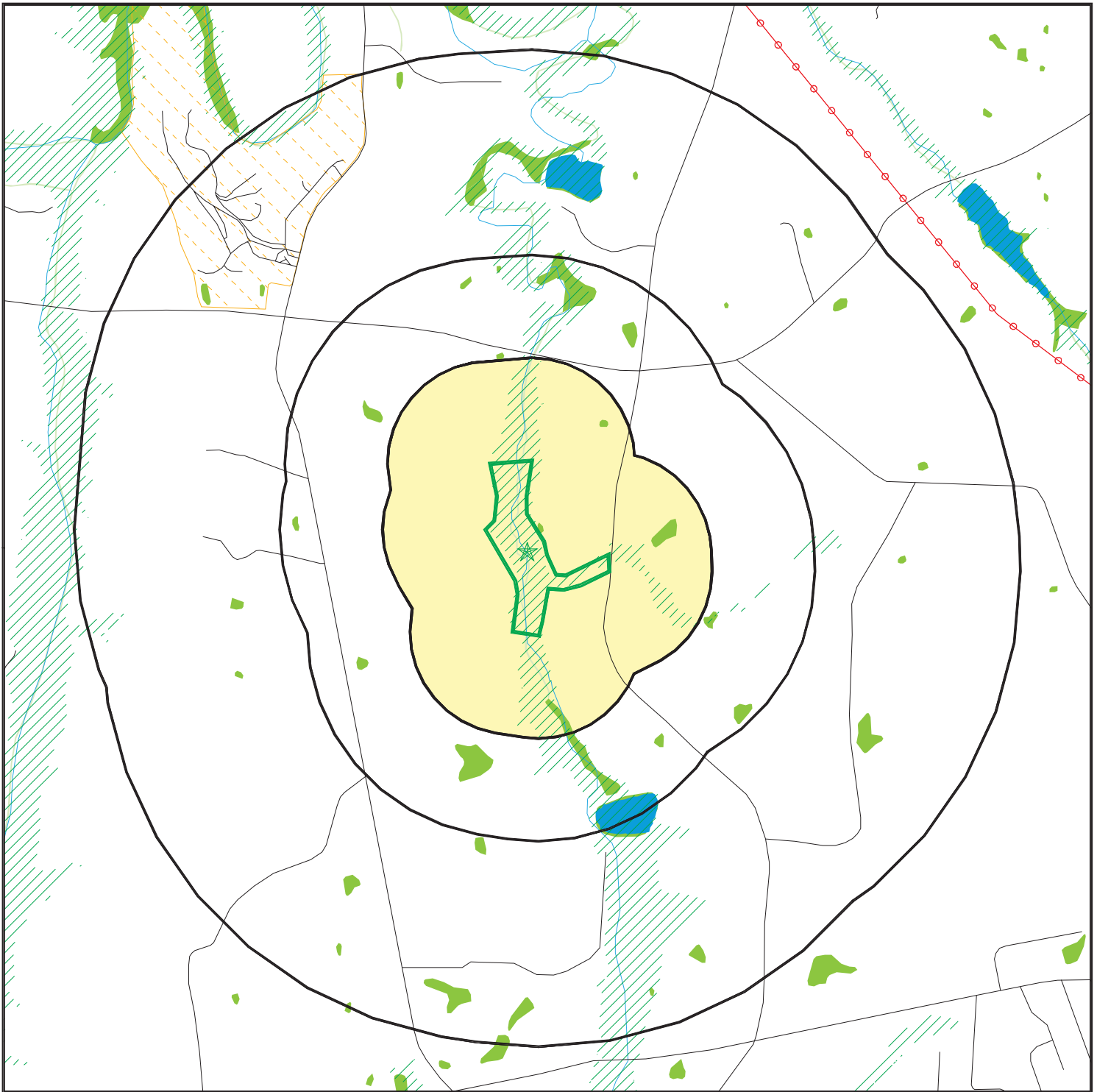
<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
UNION CO LDFL		NW 1/2 - 1 (0.651 mi.)	0	8

## EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 1 records.

<u>Site Name</u>	<u>Database(s)</u>
OLIVE BRANCH RD FUEL SPILL	LAST

# OVERVIEW MAP - 4702626.2S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

National Priority List Sites

Dept. Defense Sites



Indian Reservations BIA

Power transmission lines

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

Hazardous Substance Disposal Sites



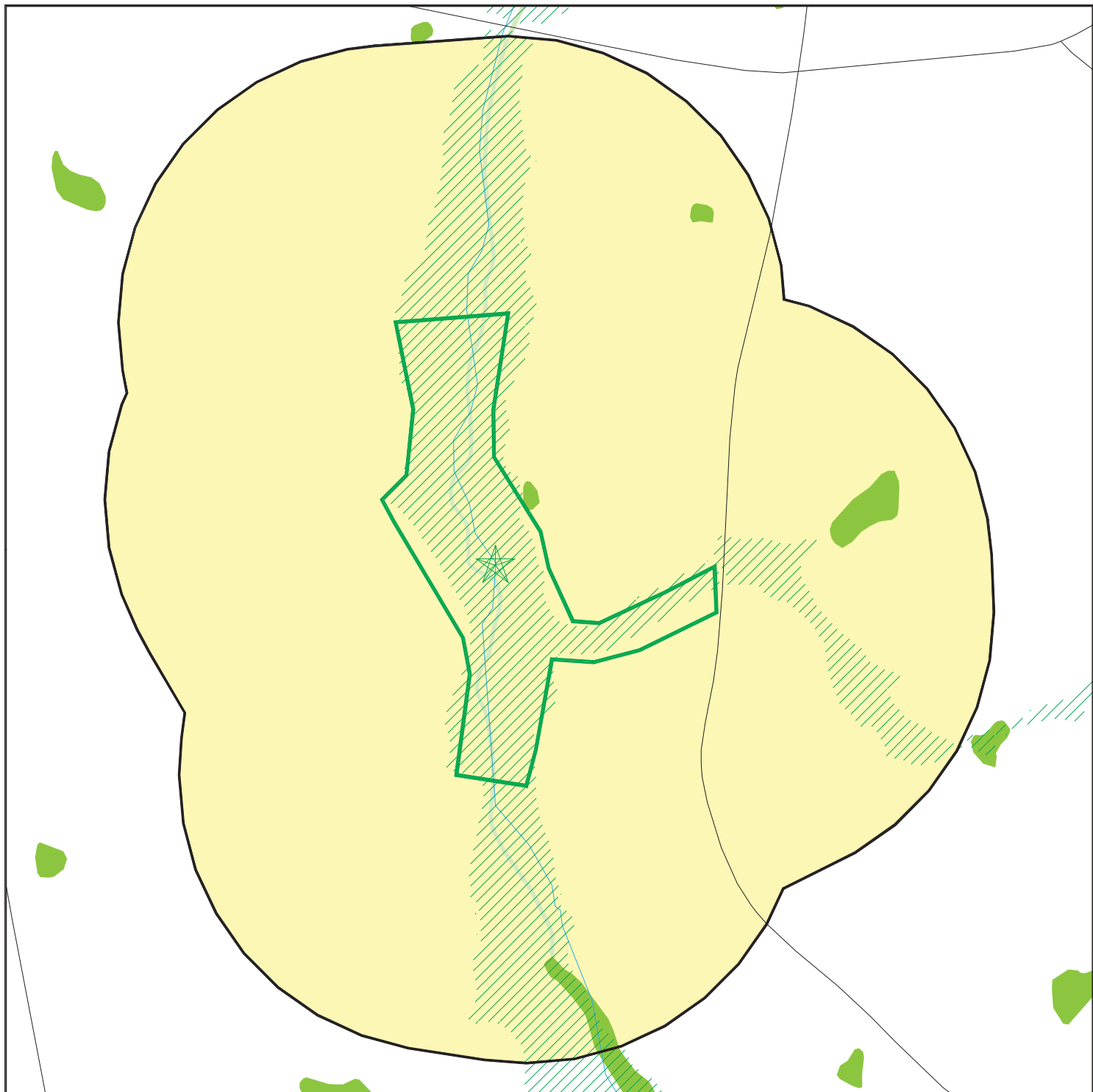
This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.














SITE NAME: Deep Meadow Mitigation Site  
 ADDRESS: 1812 McIntyre Road  
 Wingate NC 28174  
 LAT/LONG: 35.023456 / 80.451205

CLIENT: Wildlands Eng, Inc.  
 CONTACT: Ian Eckardt  
 INQUIRY #: 4702626.2S  
 DATE: August 17, 2016 9:47 am



# DETAIL MAP - 4702626.2S



-  Target Property
-  Sites at elevations higher than or equal to the target property
-  Sites at elevations lower than the target property
-  Manufactured Gas Plants
-  Sensitive Receptors
-  National Priority List Sites
-  Dept. Defense Sites
-  Indian Reservations BIA
-  100-year flood zone
-  500-year flood zone
-  National Wetland Inventory
-  State Wetlands
-  Hazardous Substance Disposal Sites



This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Deep Meadow Mitigation Site  
 ADDRESS: 1812 McIntyre Road  
 Wingate NC 28174  
 LAT/LONG: 35.023456 / 80.451205

CLIENT: Wildlands Eng, Inc.  
 CONTACT: Ian Eckardt  
 INQUIRY #: 4702626.2s  
 DATE: August 17, 2016 9:48 am

## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
<b>STANDARD ENVIRONMENTAL RECORDS</b>								
<b><i>Federal NPL site list</i></b>								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
<b><i>Federal Delisted NPL site list</i></b>								
Delisted NPL	1.000		0	0	0	0	NR	0
<b><i>Federal CERCLIS list</i></b>								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
<b><i>Federal CERCLIS NFRAP site list</i></b>								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
<b><i>Federal RCRA CORRACTS facilities list</i></b>								
CORRACTS	1.000		0	0	0	0	NR	0
<b><i>Federal RCRA non-CORRACTS TSD facilities list</i></b>								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
<b><i>Federal RCRA generators list</i></b>								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
<b><i>Federal institutional controls / engineering controls registries</i></b>								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
<b><i>Federal ERNS list</i></b>								
ERNS	TP		NR	NR	NR	NR	NR	0
<b><i>State- and tribal - equivalent NPL</i></b>								
NC HSDS	1.000		0	0	0	1	NR	1
<b><i>State- and tribal - equivalent CERCLIS</i></b>								
SHWS	1.000		0	0	0	0	NR	0
<b><i>State and tribal landfill and/or solid waste disposal site lists</i></b>								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
<b><i>State and tribal leaking storage tank lists</i></b>								
LUST	0.500		0	0	0	NR	NR	0

## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
<b>State and tribal registered storage tank lists</b>								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
<b>State and tribal institutional control / engineering control registries</b>								
INST CONTROL	0.500		0	0	0	NR	NR	0
<b>State and tribal voluntary cleanup sites</b>								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
<b>State and tribal Brownfields sites</b>								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
<b>ADDITIONAL ENVIRONMENTAL RECORDS</b>								
<b>Local Brownfield lists</b>								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
<b>Local Lists of Landfill / Solid Waste Disposal Sites</b>								
HIST LF	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
<b>Local Lists of Hazardous waste / Contaminated Sites</b>								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
<b>Local Land Records</b>								
LIENS 2	TP		NR	NR	NR	NR	NR	0
<b>Records of Emergency Release Reports</b>								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
<b>Other Ascertainable Records</b>								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0

## MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0

### EDR HIGH RISK HISTORICAL RECORDS

#### ***EDR Exclusive Records***

EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0

### EDR RECOVERED GOVERNMENT ARCHIVES

#### ***Exclusive Recovered Govt. Archives***

RGA HWS	TP		NR	NR	NR	NR	NR	0
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## MAP FINDINGS SUMMARY

<u>Database</u>	<u>Search Distance (Miles)</u>	<u>Target Property</u>	<u>&lt; 1/8</u>	<u>1/8 - 1/4</u>	<u>1/4 - 1/2</u>	<u>1/2 - 1</u>	<u>&gt; 1</u>	<u>Total Plotted</u>
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	0	0	1	0	1

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database



Map ID  
Direction  
Distance  
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number  
EPA ID Number

**HSDS**  
**Region**  
**NW**  
**1/2-1**  
**3439 ft.**

**UNION CO LDFL**  
**, NC**

**NC HSDS** **S102442875**  
**N/A**

HSDS:

Site Type:	Federal
Superfund ID:	980 503 163
Lat/Long:	35 2 11.132637 80 27 51.326601
Total area in coverage units:	619170.1875
Total perimeter in coverage units:	4221.60791015
X-value coordinate in feet:	1561706.125
Y-value coordinate in feet:	471404.9375
Sites designated as superfund cleanup sites:	771
Length of feature in internal units:	4221.60789385
Area of feature in internal units squared:	619170.176082

Count: 1 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
WINGATE	S110629270	OLIVE BRANCH RD FUEL SPILL	APPROX. 5300 OLIVE BRANCH RD	28174	LAST



August 10, 2016

Renee Gledhill-Earley  
State Historic Preservation Office  
4617 Mail Service Center  
Raleigh, NC 27699-4617

Subject: Deep Meadow Mitigation Site  
Union County, North Carolina

Dear Ms. Gledhill-Earley,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the Deep Meadow Mitigation Site. A USGS Topographic Map and an Overview Site Map with approximate project areas are enclosed.

The Deep Meadow Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. The Site contains Meadow Branch and three of its unnamed tributaries, which flow to Richardson Creek. Several sections of channel have been identified as significantly degraded. The project will include wetland restoration and the restoration, enhancement, and preservation of the project streams. The site has historically been disturbed due to agricultural use, primarily row crop production.

We ask that you review this site based on the attached information to determine the presence of any historic properties.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the project.

Sincerely,

A handwritten signature in blue ink that reads "Ruby M. Davis".

Ruby M. Davis  
Environmental Scientist  
[rdavis@wildlandseng.com](mailto:rdavis@wildlandseng.com)

Attachment:  
USGS Topographic Map  
Overview Site Map



**North Carolina Department of Natural and Cultural Resources**  
**State Historic Preservation Office**

Ramona M. Bartos, Administrator

Governor Pat McCrory  
Secretary Susan Kluttz

Office of Archives and History  
Deputy Secretary Kevin Cherry

August 29, 2016

Ruby Davis  
Wildlands Engineering, Inc.  
1430 South Mint Street, Suite 106  
Charlotte, NC 28203

Re: Deep Meadow Mitigation Site, Union County, ER 16-1461

Dear Ms. Davis:

Thank you for your letter of August 10, 2016, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or [environmental.review@ncdcr.gov](mailto:environmental.review@ncdcr.gov). In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

A handwritten signature in blue ink that reads "Renee Gledhill-Earley".

*for* Ramona M. Bartos

3.2 **Notices.** All notices required by this agreement shall be in writing, shall be given only in accordance with the provisions of this Section, shall be addressed to the Parties in the manner stated below, and shall be conclusively deemed properly delivered: (a) upon receipt when hand delivered during normal business hours; (b) upon the day of delivery if the notice has been deposited in an authorized receptacle of the United States Postal Service as first-class, registered or certified mail, postage prepaid, with a return receipt requested; (c) one business day after the notice has been deposited with either FedEx or United Parcel Service to be delivered by overnight delivery; or (d) if sent by email, upon receipt of an acknowledgement email sent to the sender's email address in which the party receiving the email notice acknowledges having received that email. An automatic "read receipt" is not acknowledgement for purposes of this section 3.2. The addresses of the parties to receive notices are as follows:

TO BUYER: Wildlands Engineering, Inc.  
1430 S. Mint Street, Suite 104  
Charlotte, North Carolina 28203  
Attention: Robert W. Bugg  
e-mail: rbugg@wildlandseng.com

TO SELLER: Baucom Farm and Milling  
7410 Morgan Mill Road  
Monroe, NC 28110  
Attention: Kyle Herring  
Wkherrin09@yahoo.com



Notice of change of address shall be given by written notice in the manner described in this paragraph.

3.3 **Assignment.** Buyer has the right to assign this agreement without the consent of Seller. No assignment shall be effective unless the assignee has delivered to Seller a written assumption of Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

3.4 **Value of Conservation Easement; No Power of Eminent Domain.** In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer hereby notifies Seller that: (i) Buyer believes that the fair market value of the Conservation Easement is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

3.5 **Modification; Waiver.** No amendment of this agreement will be effective unless it is in writing and signed by the parties. No waiver of satisfaction of a condition or failure to comply with an obligation under this agreement will be effective unless it is in writing and signed by the party granting the waiver, and no such waiver will constitute a waiver of satisfaction of any other condition or failure to comply with any other obligation.

3.6 **Attorneys' Fees.** If either party commences an action against the other to interpret or enforce any of the terms of this agreement or because of the breach by the other party of any of the terms of this agreement, the losing party shall pay to the prevailing party reasonable attorneys' fees, expenses, court costs, litigation costs and any other expenses incurred in connection with the prosecution or defense of such action, whether or not the action is prosecuted to a final judgment.

  
Buyer  Seller  
JKB Seller JKBT Seller





August 10, 2016

Marella Buncick  
US Fish and Wildlife Service  
Asheville Field Office  
PO Box 33726160 Zillicoa Street  
Asheville, NC 28801

**Subject:** Deep Meadow Mitigation Site  
Union County, North Carolina

Dear Ms. Buncick,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to endangered species, migratory birds or other trust resources associated with the proposed Deep Meadow Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Watson, 7.5-Minute USGS Topographic Quadrangles.

The Deep Meadow Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. The Site contains Meadow Branch and three of its unnamed tributaries, which flow to Richardson Creek. Several sections of channel have been identified as significantly degraded. The project will include wetland restoration and the restoration, enhancement, and preservation of the project streams. The site has historically been disturbed due to agricultural use, primarily row crop production.

According to your website (<https://www.fws.gov/raleigh/species/cntylist/union.html>), the Carolina heelsplitter (*Lasmigona decorate*), the Michaux's sumac (*Rhus michauxii*) and the Schweinitz's sunflower (*Helianthus schweinitzii*) are the federally-listed species in Union County.

If we have not heard from you in 30 days, we will assume that you do not have any comments regarding associated laws and that you do not have any information relevant to this projects at the current time.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

A handwritten signature in blue ink that reads "Ruby M. Davis".

Ruby M. Davis  
Environmental Scientist

Attachment:  
USGS Topographic Map and Overview Site Map



# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Asheville Field Office  
160 Zillicoa Street  
Asheville, North Carolina 28801

October 20, 2016

Andrea S. Eckhardt  
Wildlands Engineering  
1430 South Mint Street, Suite 104  
Charlotte, North Carolina 28203

Dear Ms. Eckhardt:

Subject: Deep Meadow Mitigation Project; Union County, North Carolina  
Log No. 4-2-17-003

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided in your correspondence dated August 10, 2016 (received via email October 13, 2016). You requested our comments on potential impacts to federal trust resources that may result from the proposed project. The Service submits the following comments in accordance with the provisions of the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act (42 U.S.C. §4321 et seq.); and section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act).

### Project Description

Based on the preliminary information provided, you intend to restore, enhance, or preserve 4,287 linear feet of Meadow Branch and three of its unnamed tributaries on approximately 23 acres of agricultural land (pasture/hay) near Wingate, North Carolina. Additionally, you propose to restore/re-establish 9.4 acres of wetlands on the property. As currently proposed, the project would generate 2,000 – 2,746 SMU's and 8.0 – 8.1 WMU's.

### Federally Listed Endangered and Threatened Species

On February 29, 2016, you conducted a pedestrian survey to assess the property for potential suitable habitat for federally protected species known from Union County. At that time suitable habitat was observed for the federally endangered Schweinitz's sunflower, (*Helianthus schweinitzii*) along the site's forest margins and transitional zones. These areas of suitable habitat were reassessed on August 10, 2016 and revealed no occurrences of the species. Based on your assessments, you determined that the proposed project will have "no effect" on federally protected species. Therefore, we consider the requirements under the Act to be complete and require no further action at this time. Please be aware that obligations under section 7 of the Act must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner that was not considered in this review, or (3) a new species is listed or critical habitat is determined that may be affected by the identified action.

In the interest of protecting fish, wildlife, and other natural resources we request that the following measures be incorporated into project plans:

#### Stream Channel and Bank Reconstruction/Restoration Activities

1. All reconstruction work should follow natural channel design methodologies that are based on the bank-full, or channel-forming, stage of the stream. Natural channel conditions should be identified using reference reaches (nearby stream reaches that exemplify restoration goals). Restoration design should match the pattern, dimension, and profile of the reference reach to ensure the project's success.
2. All work in or adjacent to stream waters should be conducted in a dry work area to the extent possible.
3. Equipment should not be operated in the stream unless absolutely necessary. Machinery should be operated from the banks in a fashion that minimizes disturbance. Equipment should be: (a) washed to remove any contaminant residue prior to project construction, (b) in good working order, and (c) checked to ensure there are no leaks of potential contaminants (such as oil or other lubricants) prior to and during construction.
4. Deep-rooting woody vegetation should be established along banks where any channel work is accomplished. Tree and shrub plantings should be spaced at intervals no greater than 10 feet along banks. Vegetated riparian zone widths should be as wide as practical but should extend at least 30 feet from the stream channel.
5. Reconstruction work should be staged such that disturbed areas are stabilized with seeding, mulch, and/or biodegradable (coir) erosion-control matting prior to the end of each workday. No erosion-control matting or blankets should contain synthetic (netting) materials. Matting should be secured in place with staples; stakes; or, wherever possible, live stakes of native trees. If rain is expected prior to temporary seed establishment, additional measures should be implemented to protect water quality along slopes and overburden stockpiles (for example, stockpiles may be covered with plastic or other geotextile material).
6. Cross-sections (at intervals based on restoration reach size), longitudinal profiles, and stream-pattern plans should be measured and mapped prior to and immediately following any channel work. In addition, photographs should be taken to document the condition of the project site prior to initiating the work and upon completion of the work. However, since a project's restoration success does not necessarily equate to biological success, the ecological goals of the project should be clearly defined and assessed for improvement after construction is completed.

#### Stream Buffers

Forested riparian buffers (a minimum 50 feet wide along intermittent streams and 100 feet wide along perennial streams [or the full extent of the 100-year floodplain, whichever is greater]) should be created and/or maintained along all aquatic areas. Impervious surfaces, ditches, pipes, roads, utility lines (sewer, water, gas, transmission, etc.), and other infrastructures that require

maintained, cleared rights-of-way and/or compromise the functions and values of the forested buffers should not occur within these riparian areas.

### Invasive Exotic Species

Without active management, including the revegetation of disturbed areas with native species, this project may become a corridor for the movement of invasive exotic plant species. Exotic species are a major contributor to species depletion and extinction, second only to habitat loss. Exotics are a factor contributing to the endangered or threatened status of more than 40 percent of the animals and plants on the *Federal List of Endangered and Threatened Wildlife and Plants*.<sup>1</sup> It is estimated that at least 4,000 exotic plant species and 2,300 exotic animal species are now established in the United States, costing more than \$130 billion a year to control.<sup>2</sup> Additionally, the U.S. Government has many programs and laws in place to combat invasive species (see [www.invasivespecies.gov](http://www.invasivespecies.gov)). Specifically, Section 2(a)(3) of Executive Order 13112 - Invasive Species (February 3, 1999) directs federal agencies to “not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere.” Despite their short-term erosion-control benefits, many exotic species used in soil stabilization seed mixes are persistent once they are established, thereby preventing the reestablishment of native vegetation. Many of these exotic plants<sup>3</sup> are also aggressive invaders of nearby natural areas, where they are capable of displacing already-established native species. Therefore, we strongly recommend that only species native to the natural communities within the project area be used in association with all aspects of this project.

The Service supports the restoration objectives of this project. Please contact Mr. Byron Hamstead of our staff at 828/258-3939, Ext. 225, if you have any questions. In any future correspondence concerning this project, please reference our Log Number 4-2-17-003.

Sincerely,

- - *original signed* - -

Janet A. Mizzi  
Field Supervisor

E.c. David Shaeffer, USACE  
Ruby Davis, Wildlands Engineering

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<sup>1</sup>D.S. Wilcove, D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. *BioScience* 48:607-615.

<sup>2</sup>D. Pimentel, L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and economic costs of nonindigenous species in the United States. *BioScience* 50:53-65.

<sup>3</sup>Lists of invasive exotic plants can be found at <http://www.tneppe.org/> and <http://www.invasive.org/eastern/srs/> (exotic wildlife links) on the Internet.

# FARMLAND CONVERSION IMPACT RATING

<b>PART I</b> (To be completed by Federal Agency)	Date Of Land Evaluation Request 8/16/16
Name Of Project Deep Meadow Mitigation Site	Federal Agency Involved FHWA - NCDMS
Proposed Land Use Stream & Wetland Restoration	County And State Union County, NC

<b>PART II</b> (To be completed by NRCS)		Date Request Received By NRCS 08/16/16 By Milton Cortes NRCS NC	
Does the site contain prime, unique, statewide or local important farmland? (If no, the FPPA does not apply -- do not complete additional parts of this form).		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Major Crop(s) CORN		Acres Irrigated none	Average Farm Size 190 acres
Name Of Land Evaluation System Used Union Co., NC LESA		Farmable Land In Govt. Jurisdiction Acres: 384,651 acres % 94 %	Amount Of Farmland As Defined in FPPA Acres: 291,581 acres % 77%
Name Of Local Site Assessment System none		Date Land Evaluation Returned By NRCS August 17, 2016 By email	

<b>PART III</b> (To be completed by Federal Agency)	Alternative Site Rating			
	Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	23.6			
B. Total Acres To Be Converted Indirectly	0.0			
C. Total Acres In Site	23.6	0.0	0.0	0.0

<b>PART IV</b> (To be completed by NRCS) Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	21.7			
B. Total Acres Statewide And Local Important Farmland	1.3			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0079			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	41.3			

<b>PART V</b> (To be completed by NRCS) Land Evaluation Criterion Relative Value Of Farmland To Be Converted (Scale of 0 to 100 Points)	88				
--	----	--	--	--	--

<b>PART VI</b> (To be completed by Federal Agency) Site Assessment Criteria (These criteria are explained in 7 CFR 658.5(b))	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	20			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	0	0			
6. Distance To Urban Support Services	0	0			
7. Size Of Present Farm Unit Compared To Average	10	0			
8. Creation Of Nonfarmable Farmland	25	0			
9. Availability Of Farm Support Services	5	5			
10. On-Farm Investments	20	10			
11. Effects Of Conversion On Farm Support Services	25	0			
12. Compatibility With Existing Agricultural Use	10	0			
<b>TOTAL SITE ASSESSMENT POINTS</b>	160	80	0	0	0

<b>PART VII</b> (To be completed by Federal Agency)					
Relative Value Of Farmland (From Part V)	100	88			
Total Site Assessment (From Part VI above or a local site assessment)	160	80	0	0	0
<b>TOTAL POINTS (Total of above 2 lines)</b>	260	168	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes <input type="checkbox"/> No <input type="checkbox"/>
----------------	-------------------	---

Reason For Selection:



**From:** Ian Eckardt  
**To:** ["Cortes, Milton - NRCS, Raleigh, NC"](#)  
**Subject:** RE: Request for AD1006 Form - Deep Meadow Mitigation Site - Union County, NC  
**Date:** Friday, August 19, 2016 10:10:00 AM  
**Attachments:** [image001.jpg](#)  
[NRCS AD1006 Deep Meadow Completed.pdf](#)

---

Milton,

Thank you for the prompt response and assistance with the AD1006 form. Please find attached the completed AD1006 form for the Deep Meadow Mitigation Site. Let me know if you need anything else for your records.

**Ian Eckardt** | *Environmental Scientist*  
**O:** 704.332.7754 x108 **M:** 704.517-4988

**[Wildlands Engineering, Inc.](#)**

1430 S. Mint St, Suite 104  
Charlotte, NC 28203

---

**From:** Cortes, Milton - NRCS, Raleigh, NC [mailto:[Milton.Cortes@nc.usda.gov](mailto:Milton.Cortes@nc.usda.gov)]  
**Sent:** Wednesday, August 17, 2016 7:52 PM  
**To:** Ian Eckardt <[ieckardt@wildlandseng.com](mailto:ieckardt@wildlandseng.com)>  
**Subject:** RE: Request for AD1006 Form - Deep Meadow Mitigation Site - Union County, NC  
**Importance:** High

Good evening Mr. Eckardt;

Please find attached the letter of response and AD1006 for the NCDENR Division of Mitigation Services (DMS) stream restoration project (Deep Meadow Mitigation Site) located in Union County.

If I can be of further assistance please feel free to contact us.

Cordially;

*Milton Cortés*

Assistant State Soil Scientist

**USDA Natural Resources Conservation Service**

4407 Bland Rd., Suite 117

Raleigh, NC

(919) 873-2171

[milton.cortes@nc.usda.gov](mailto:milton.cortes@nc.usda.gov)

Helping people help the land id.

---

**From:** Ian Eckardt [mailto:[ieckardt@wildlandseng.com](mailto:ieckardt@wildlandseng.com)]  
**Sent:** Tuesday, August 16, 2016 5:11 PM  
**To:** Cortes, Milton - NRCS, Raleigh, NC <[Milton.Cortes@nc.usda.gov](mailto:Milton.Cortes@nc.usda.gov)>



Natural Resources  
Conservation Service

North Carolina  
State Office

4407 Bland Road  
Suite 117  
Raleigh, NC 27609  
Voice 919-873-2171  
Fax 844-325-6833

August 17, 2016

Mr. Ian Eckardt  
Environmental Scientist  
Wildlands Engineering, Inc.  
1430 S. Mint St, Suite 104  
Charlotte, NC 28203

Dear Mr Eckardt:

Thank you for your letter dated August 16, 2016, Subject: Request for Comments – NCDENR Division of Mitigation Services (DMS) stream restoration project (Deep Meadow Mitigation Site) located in Union County. The following guidance is provided for your information.

Projects are subject to the Farmland Protection Policy Act (FPPA) requirements if they may irreversibly convert farmland (directly or indirectly) to non-agricultural use and are completed by a federal agency or with assistance from a federal agency. Farmland means prime or unique farmlands as defined in section 1540(c)(1) of the FPPA or farmland that is determined by the appropriate state or unit of local government agency or agencies with concurrence of the Secretary of Agriculture to be farmland of statewide local importance.

For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forestland, pastureland, cropland, or other land, but not water or urban built-up land.

*Farmland* does not include land already in or committed to urban development or water storage. Farmland *already in* urban development or water storage includes all such land with a density of 30 structures per 40-acre area. Farmland already in urban development also includes lands identified as *urbanized area* (UA) on the Census Bureau Map, or as urban area mapped with a *tint overprint* on the United States Geological Survey (USGS) topographical maps, or as *urban-built-up* on the United States Department of Agriculture (USDA) Important Farmland Maps.

The area in question meets one or more of the above criteria for Farmland. Farmland area will be affected or converted. Enclosed is the Farmland Conversion Impact Rating form AD1006 with PARTS II, IV and V completed by NRCS. The corresponding agency will need to complete the evaluation, according to the Code of Federal Regulation 7CFR 658, Farmland Protection Policy Act.

The Natural Resources Conservation Service  
is an agency of the Department of Agriculture's  
Natural Resources mission.

An Equal Opportunity Provider and Employer

Ian Eckardt

Page 2

If you have any questions, please contact Milton Cortes, Assistant State Soil Scientist at 919-873-2171 or by email: [milton.cortes@nc.usda.gov](mailto:milton.cortes@nc.usda.gov).

Again, thank you for inquiry. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

Milton Cortes  
Assistant State Soil Scientist

cc:

Kent Clary, State Soil Scientist, NRCS, Raleigh, NC



August 10, 2016

Shannon Deaton  
North Carolina Wildlife Resource Commission  
Division of Inland Fisheries  
1721 Mail Service Center  
Raleigh, NC 27699

Subject: Deep Meadow Mitigation Site  
Union County, North Carolina

Dear Ms. Deaton,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with the proposed Deep Meadow Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Watson, 7.5-Minute USGS Topographic Quadrangles.

The Deep Meadow Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. The Site contains Meadow Branch and three of its unnamed tributaries, which flow to Richardson Creek. Several sections of channel have been identified as significantly degraded. The project will include wetland restoration and the restoration, enhancement, and preservation of the project streams. The site has historically been disturbed due to agricultural use, primarily row crop production.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

A handwritten signature in blue ink that reads "Ruby M. Davis".

Ruby M. Davis  
Environmental Scientist

Attachment:  
USGS Topographic Map Overview Site Map



## ⊠ North Carolina Wildlife Resources Commission ⊠

---

Gordon Myers, Executive Director

October 14, 2016

Ms. Ruby Davis  
Wildlands Engineering, Inc.  
1430 S. Mint Street, Suite 104  
Charlotte, NC 28203

Subject: Request for Environmental Information for the Deep Meadow Mitigation Site, Union County, North Carolina.

Dear Ms. Davis,

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the proposed project description. Comments are provided in accordance with certain provisions of the Clean Water Act of 1977 (as amended), Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

Wildlands Engineering, Inc. proposes to complete a stream restoration project to provide in-kind mitigation for unavoidable stream channel impacts. The proposed project, referred to as the Deep Meadow Mitigation Site, is comprised of Meadow Branch and three associated tributaries. The proposed work will involve wetland restoration as well as stream restoration, enhancement and preservation. The site has been historically disturbed as a result of agricultural use, specifically row crop production. The project site is located west of McIntyre Road, south of its intersection with Olive Branch Road, northeast of Monroe.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats and provide a travel corridor for wildlife species. The NCWRC recommends the use of biodegradable and wildlife-friendly sediment and erosion control devices. Silt fencing, fiber rolls and/or other products should have loose-weave netting that is made of natural fiber materials with movable joints between the vertical and horizontal twines. Silt fencing and similar products that have been reinforced with plastic or metal mesh should be avoided as they impede the movement of terrestrial wildlife species. Excessive silt and sediment loads can have detrimental effects on aquatic resources including destruction of spawning habitat, suffocation of eggs and clogging of gills. Any invasive plant species that are found onsite should be removed.



Page 2

October 14, 2016  
Scoping – Deep Meadow Mitigation

Thank you for the opportunity to review and comment on this project. If I can be of further assistance, please contact me at (910) 409-7350 or [gabriela.garrison@ncwildlife.org](mailto:gabriela.garrison@ncwildlife.org).

Sincerely,

A handwritten signature in cursive script that reads "Gabriela Garrison".

Gabriela Garrison  
Eastern Piedmont Habitat Conservation Coordinator  
Habitat Conservation Program

Deep Meadow Mitigation Site

Categorical Exclusion

**Figures**

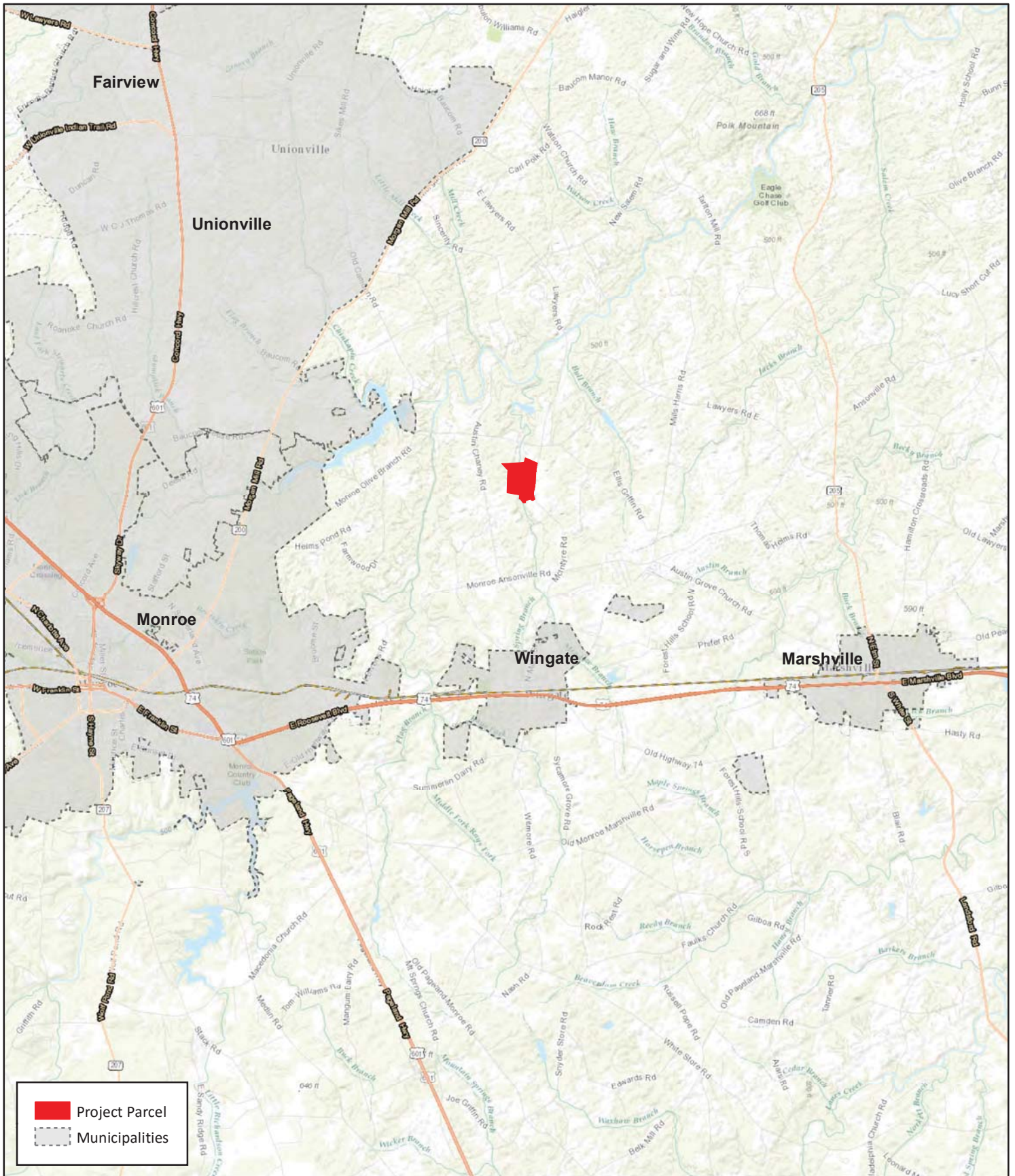


Figure 1  
Vicinity Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)

Union County, NC



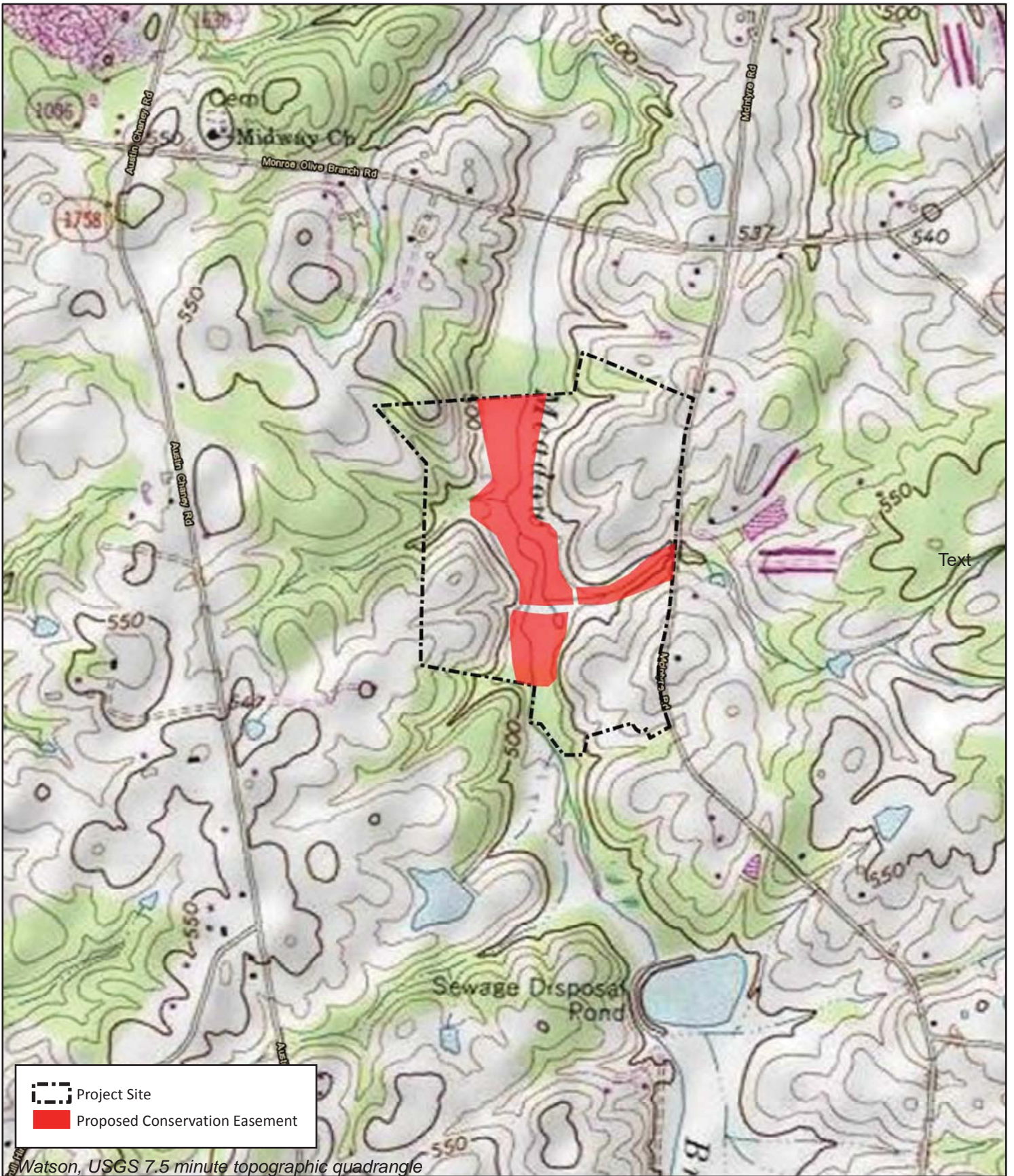
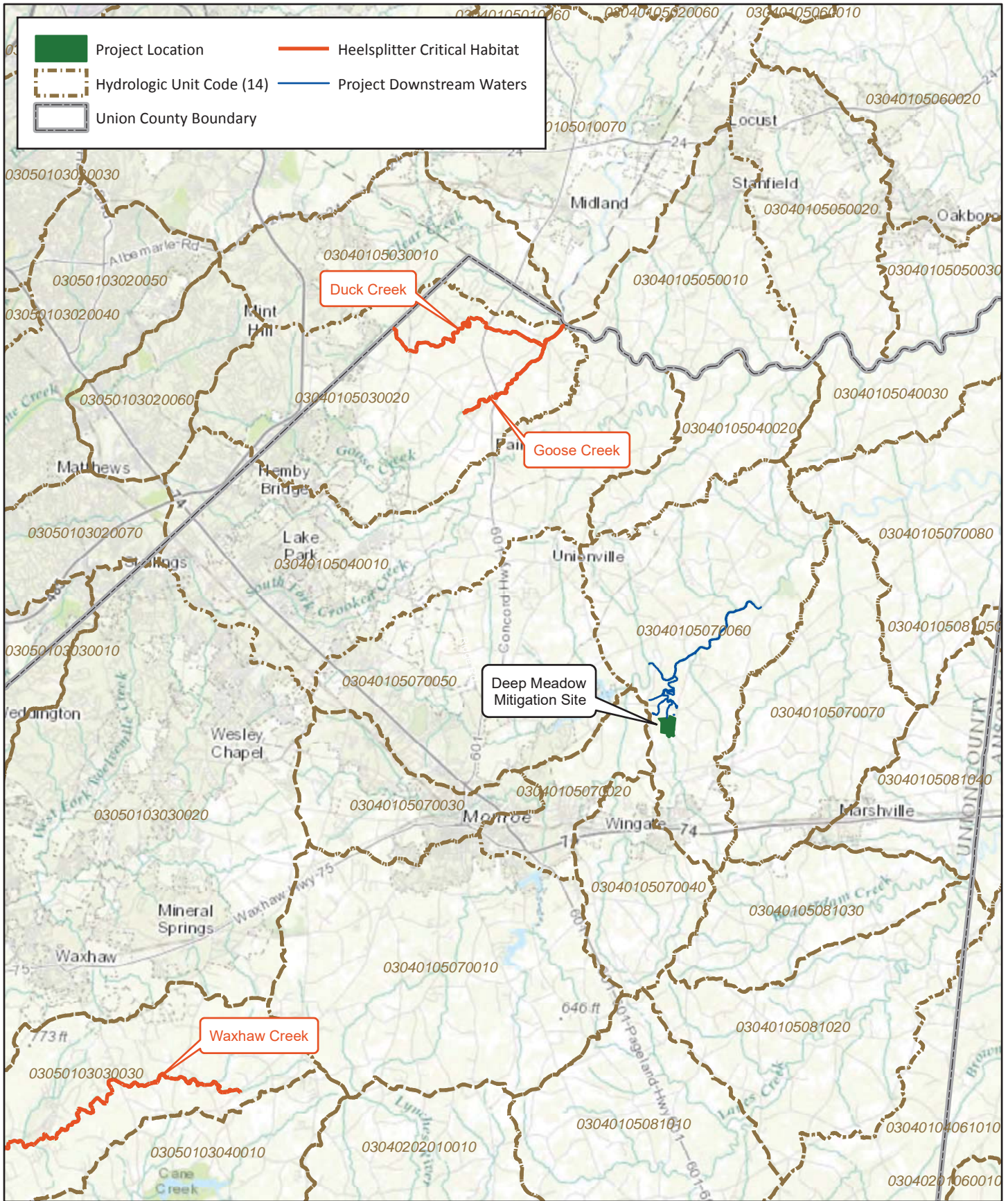


Figure 2  
 Topographic Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)  
 Union County, NC





0 2 4 Miles



Figure 3  
Heelsplitter Critical Habitat  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)



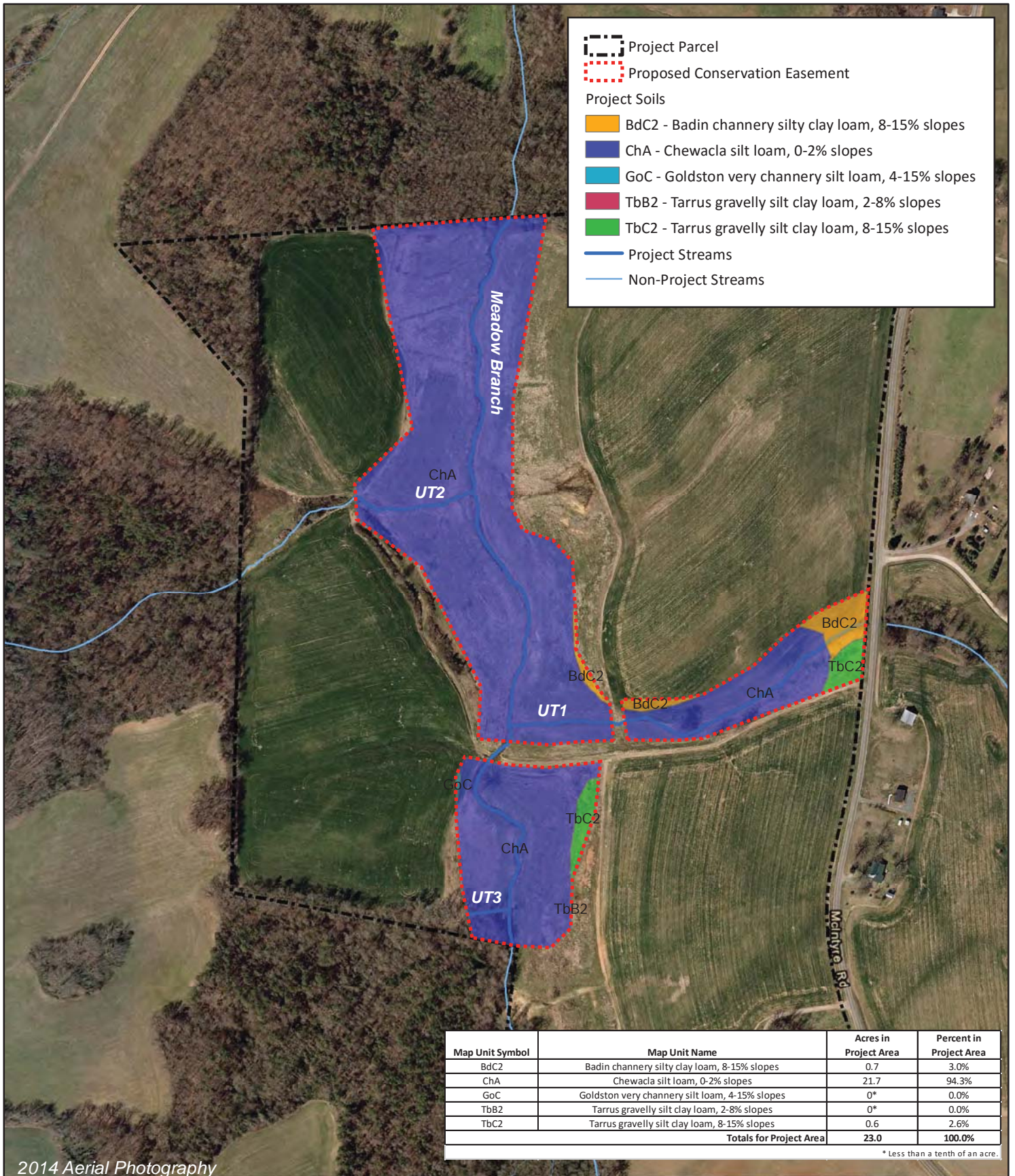


Figure 4  
Soils Map  
Deep Meadow Mitigation Site  
Yadkin River Basin (03040105)  
Union County, NC

APPENDIX 6  
PLAN SHEETS



# Deep Meadow Mitigation Site

## Union County, North Carolina

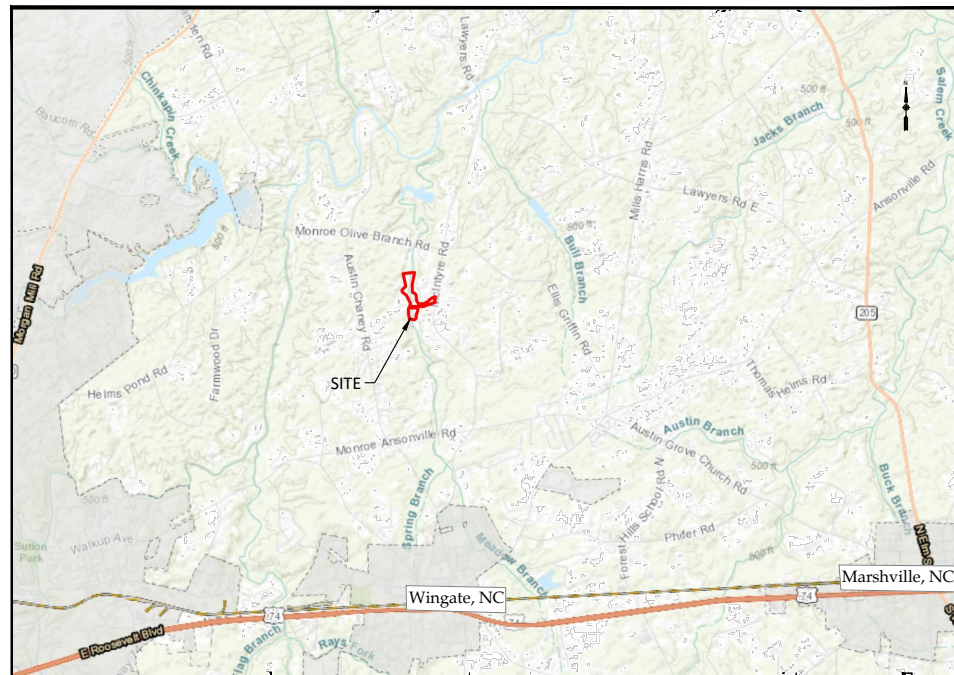
### Yadkin River Basin HUC 03040105

for  
NCDEQ  
Division of Mitigation Services

**WILDLANDS**  
ENGINEERING, INC.  
1430 S. MINT STREET, STE 104  
CHARLOTTE, NC 28203  
Tel: 704.332.7754  
Fax: 704.332.3306  
Firm License No. F-0831

#### Sheet Index

Title Sheet	0.1
General Notes and Symbols	0.2
Project Overview	0.3
Typical Sections	1.1-1.2
Stream Plan and Profile	2.1-2.11
Wetland Grading	3.1-3.2
Planting	4.1-4.4
Erosion and Sediment Control	5.1-5.10
Details	6.1-6.8



Vicinity Map  
Not to Scale

**PRELIMINARY PLANS  
ISSUED WITH FINAL MITIGATION PLAN  
JUNE 01, 2018**

#### Project Directory

**Engineering:**  
Wildlands Engineering, Inc.  
License No. F-0831  
1430 South Mint Street, Ste 104  
Charlotte, NC 28203  
Aaron S. Earley, PE  
704-332-7754

**Owner:**  
NCDEQ  
Division of Mitigation Services  
5 Ravenscroft Drive, Ste 102  
Asheville, NC 28801  
Harry Tsomides  
828-545-7057

**Surveying:**  
Turner Land Surveying  
PO Box 148  
Swannanoa, NC 28778  
Elisabeth G. Turner, PLS  
919-827-0745

DMS Project No. 97131  
Yadkin River Basin HUC 03040105

Deep Meadow Mitigation Site  
Union County, North Carolina

Title Sheet

Revisions:	

Date: January 23, 2018  
Job Number: 005-02162  
Project Engineer: ASE  
Drawn By: SID  
Checked By: JCK

0.1

Sheet














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

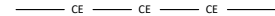
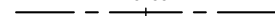










May 25, 2018

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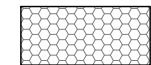


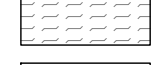




### Existing Features

-  Existing Property Line
-  Existing Major Contour (5' Interval)
-  Existing Minor Contour
-  Existing Fence
-  Existing Storm Pipe
-  Existing Farm Road
-  Existing Wetland
-  Existing Tree
-  Existing Treeline
-  Existing Bedrock
-  Existing Debris








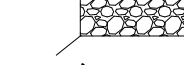
### Proposed Features

-  Recorded Conservation Easement
-  Proposed Thalweg Alignment
-  Proposed Bankfull
-  Proposed Major Contour (5' Interval)
-  Proposed Minor Contour
-  Proposed Back of Bench
-  Proposed Bank Grading Limits
-  Proposed Tree Removal
-  Proposed Tree Save
-  Proposed Safety Fence  
See Detail 3, Sheet 6.7
-  Proposed Silt Fence  
See Detail 2, Sheet 6.6
-  Proposed Temporary Rock Sediment Dam  
See Detail 3, Sheet 6.9

### Proposed Structures

-  Proposed Various Constructed Riffles Per Sheet 6.1 and 6.2
-  Proposed Brush Toe  
See Detail 4, Sheet 6.2
-  Proposed Boulder Cluster Riffle  
See Detail 2, Sheet 6.2
-  Proposed Wetland Rehabilitation
-  Proposed Wetland Re-establishment
-  Proposed Vegetated Soil Lift  
See Detail 3, Sheet 6.5
-  Deposition bars to be removed
-  Proposed Ditch Stabilization

### Proposed Structures

-  Proposed Log Sill  
See Detail 2, Sheet 6.3
-  Proposed Lunger Log  
See Detail 3, Sheet 6.2
-  Proposed Log Vane  
See Detail 1, Sheet 6.3
-  Proposed Rock Vane  
See Detail 1, Sheet 6.4
-  Proposed Rock Sill  
See Detail 3, Sheet 6.3
-  Proposed Permanent Crossing
-  Proposed Temporary Crossing
-  Proposed Temporary Construction Entrance  
See Detail 1, Sheet 6.8

#### PROJECT NOTES:

Topographic survey was completed by Turner Land Surveying in November 2016. Parcel boundary survey completed by Turner Land Surveying in February 2017.

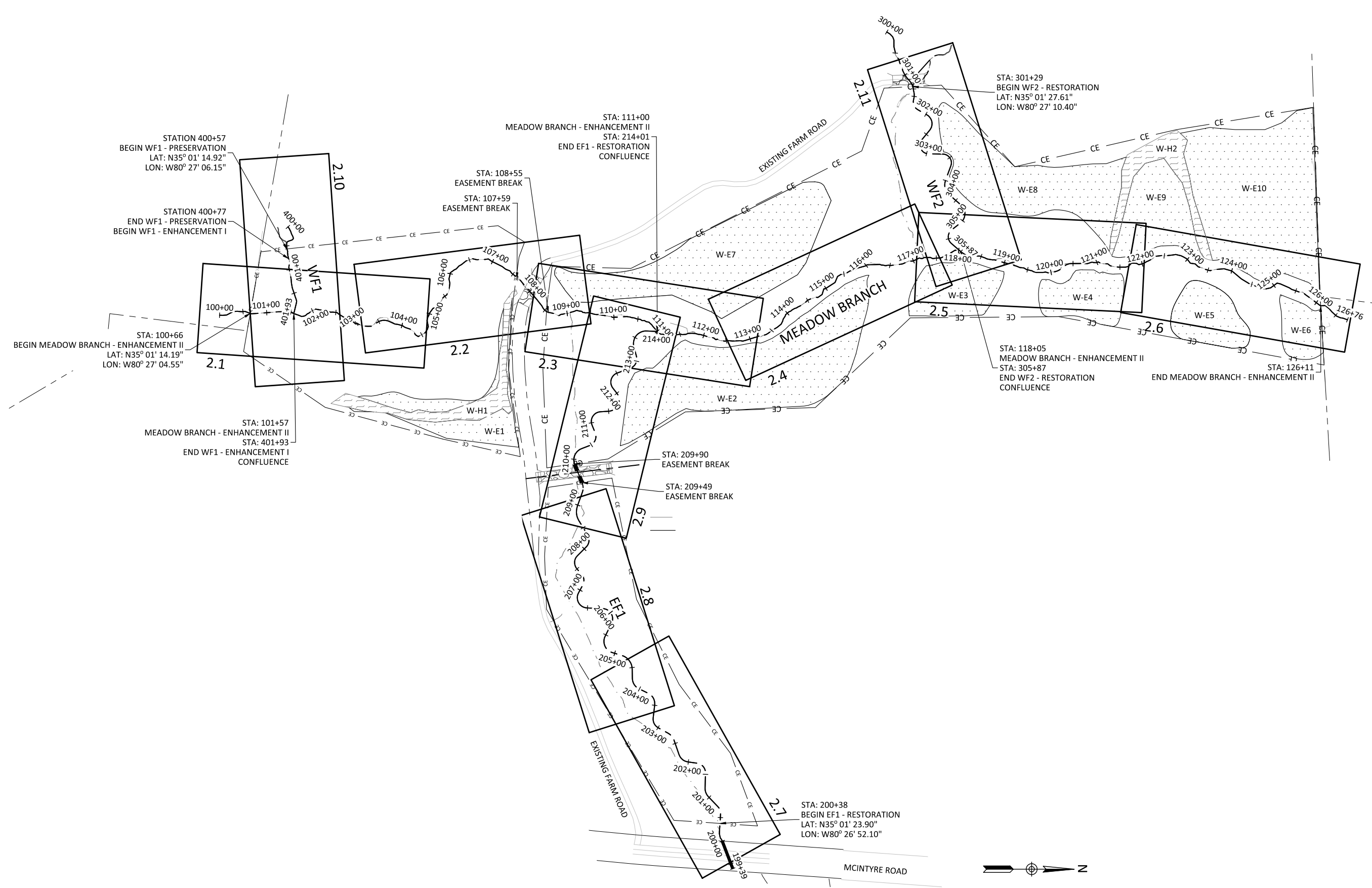
Riffle selection will be varied based on available materials at the Engineers' discretion. Field coordination will be required.

Deep Meadow Mitigation Site  
 Union County, North Carolina  
 General Notes and Symbols

Revisions:


Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

# 0.2



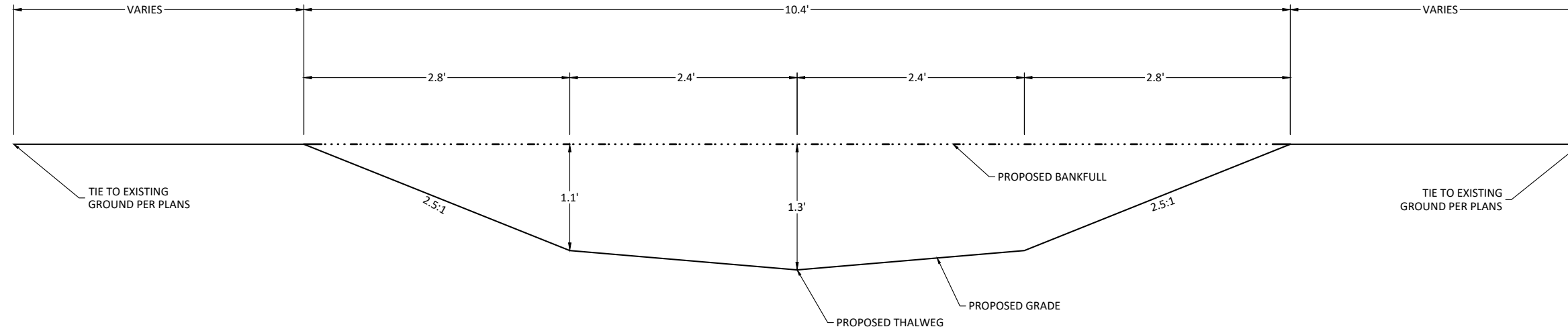
Deep Meadow Mitigation Site  
 Union County, North Carolina  
 Project Overview

Revisions:

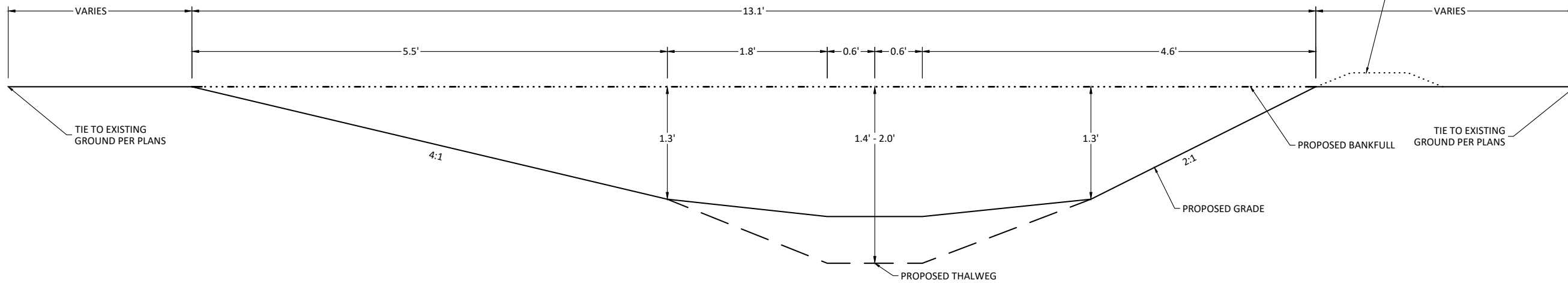

Date:	January 23, 2018
Job Number:	005-02162
Project Engineer:	ASE
Drawn By:	SJD
Checked By:	JCK

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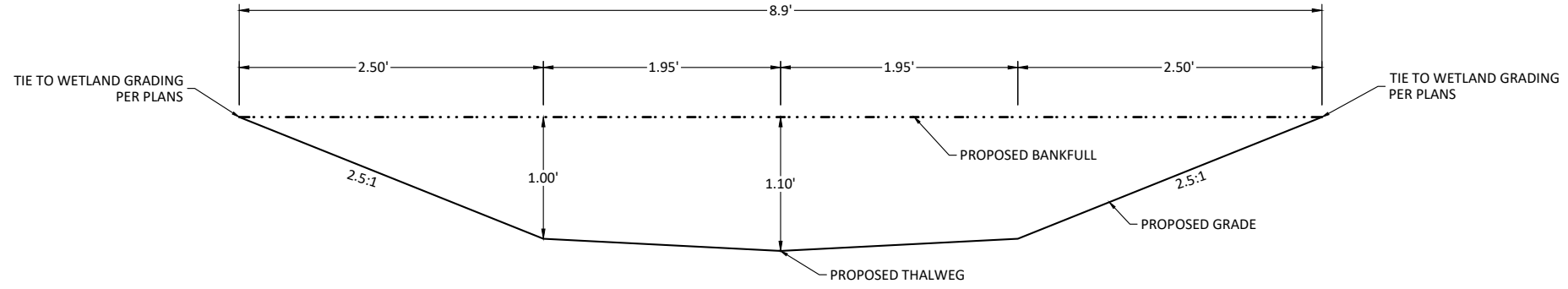
EF1 - Riffle  
 STA: 200+00 - 214+01



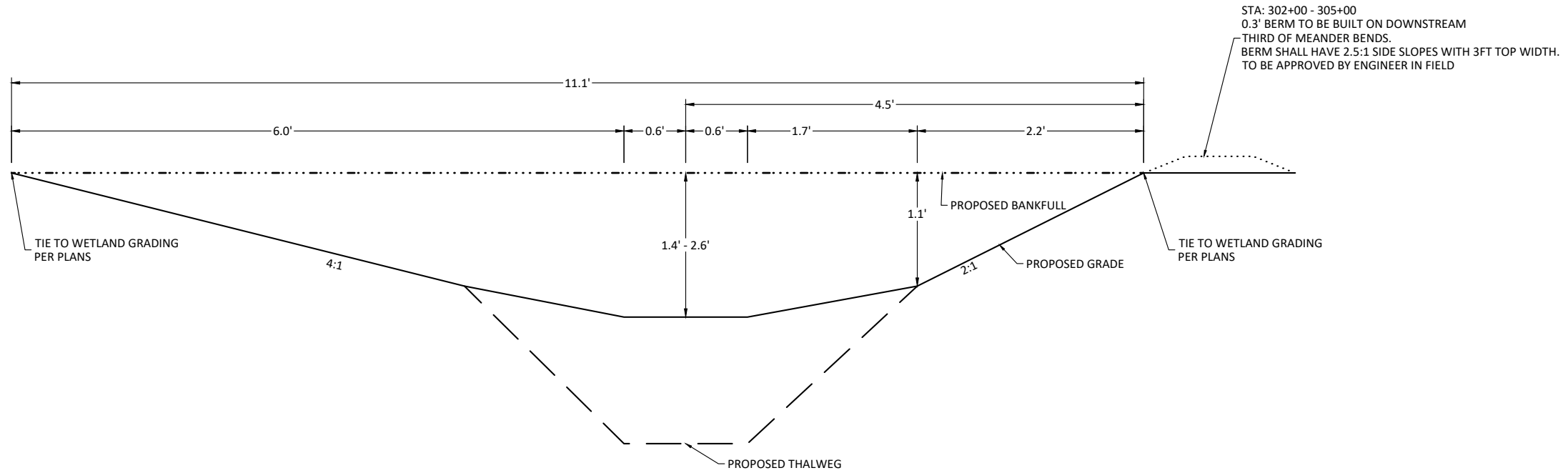
EF1 - Pool  
 STA: 200+00 - 214+01

Revisions:


Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SJL  
 Checked By: JCK



WF2 - Riffle  
 STA: 301+29 - 305+87



WF2 - Pool  
 STA: 301+29 - 305+87

Deep Meadow Mitigation Site  
 Union County, North Carolina

WF2

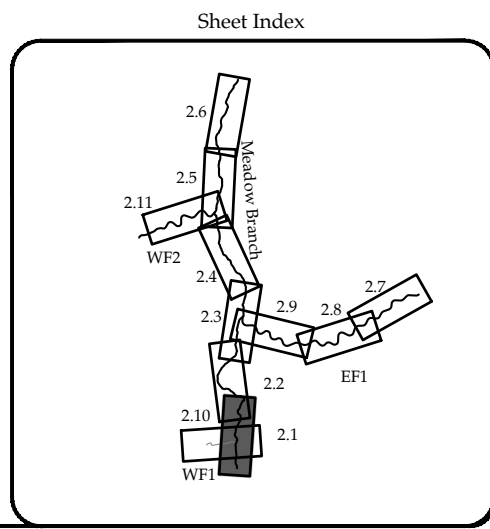
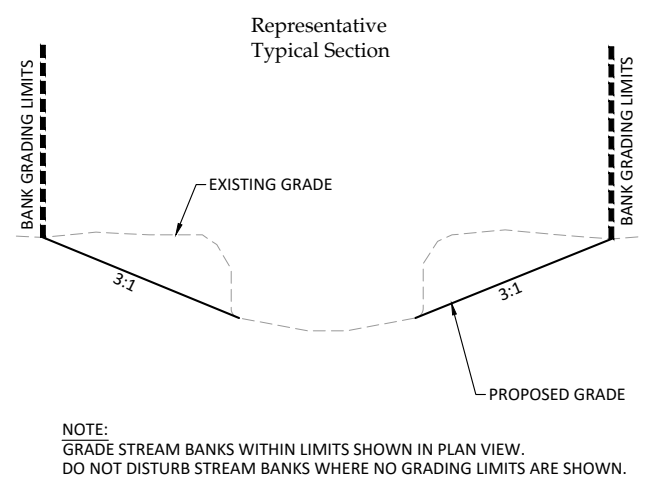
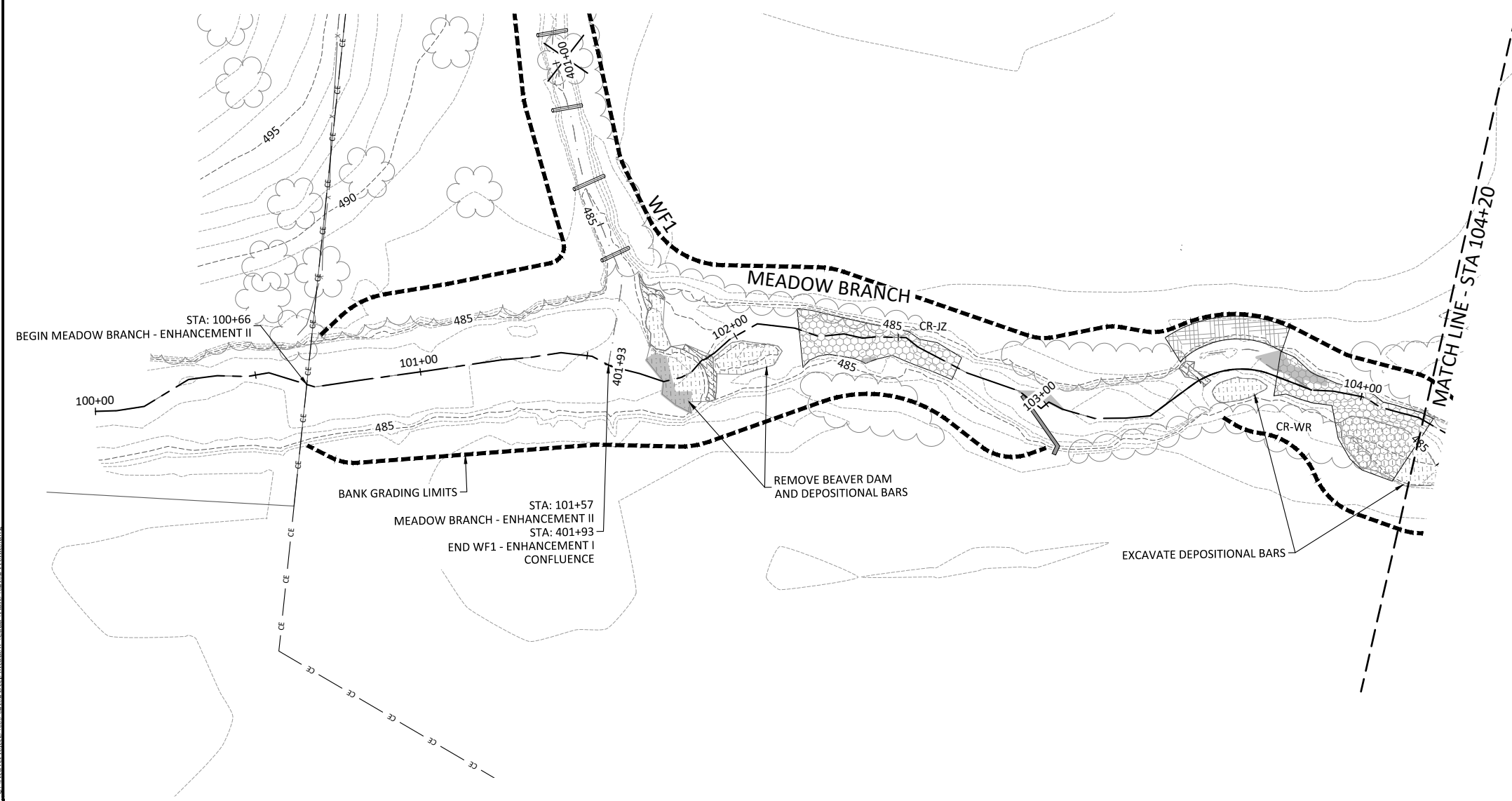
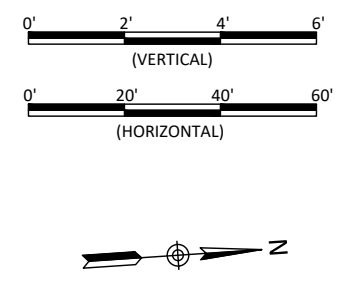
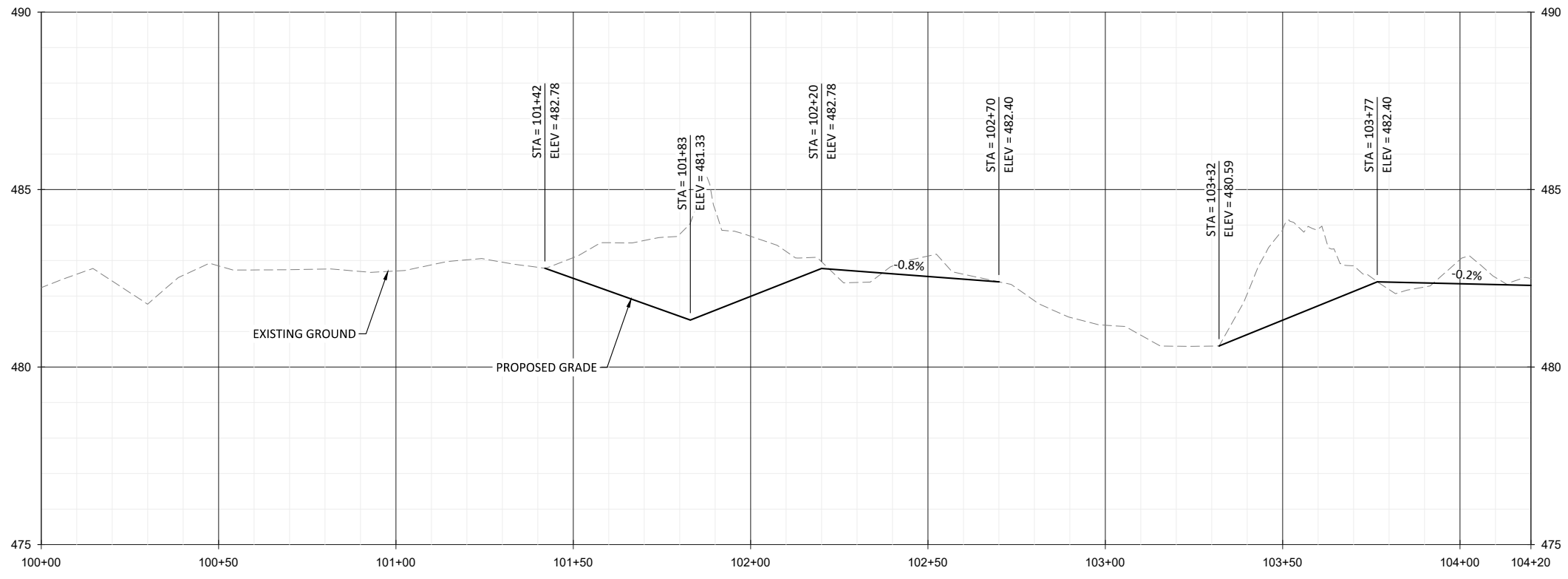
Typical Sections

Revisions:


Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SJL  
 Checked By: JCK

1.2

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 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 Meadow Branch  
 Stream Plan and Profile

Revisions:

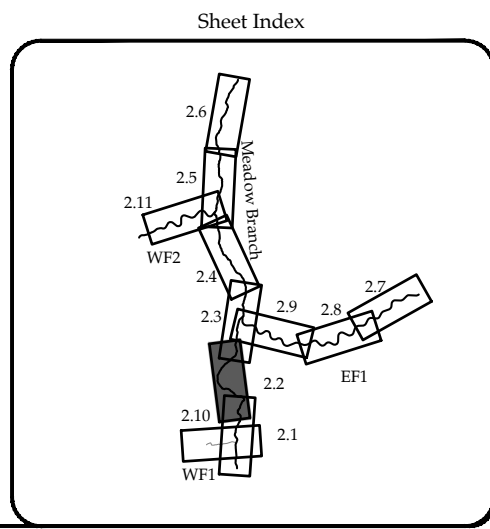
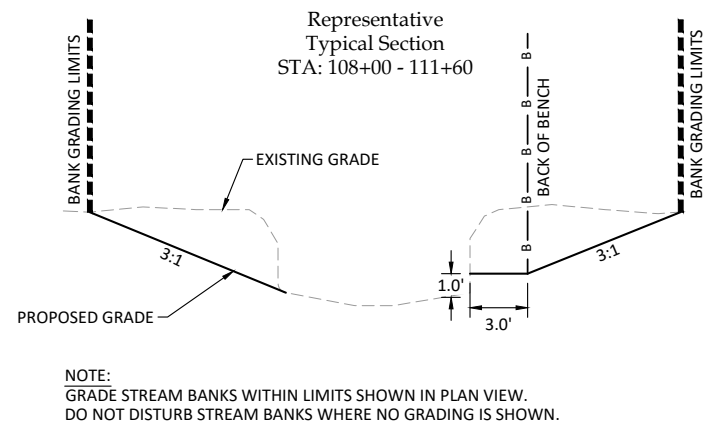
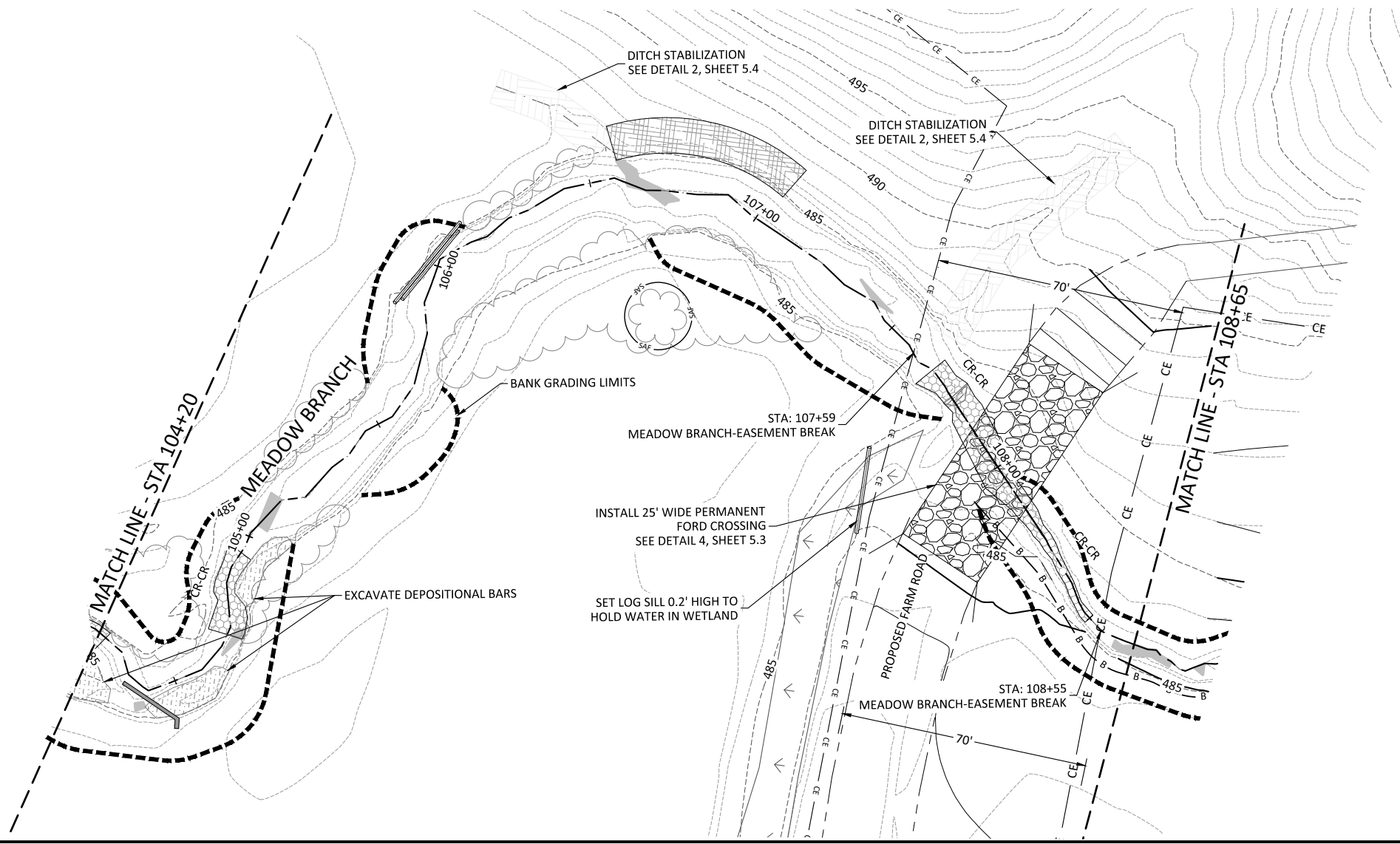
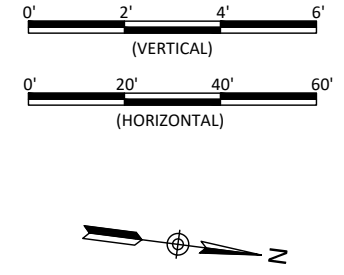
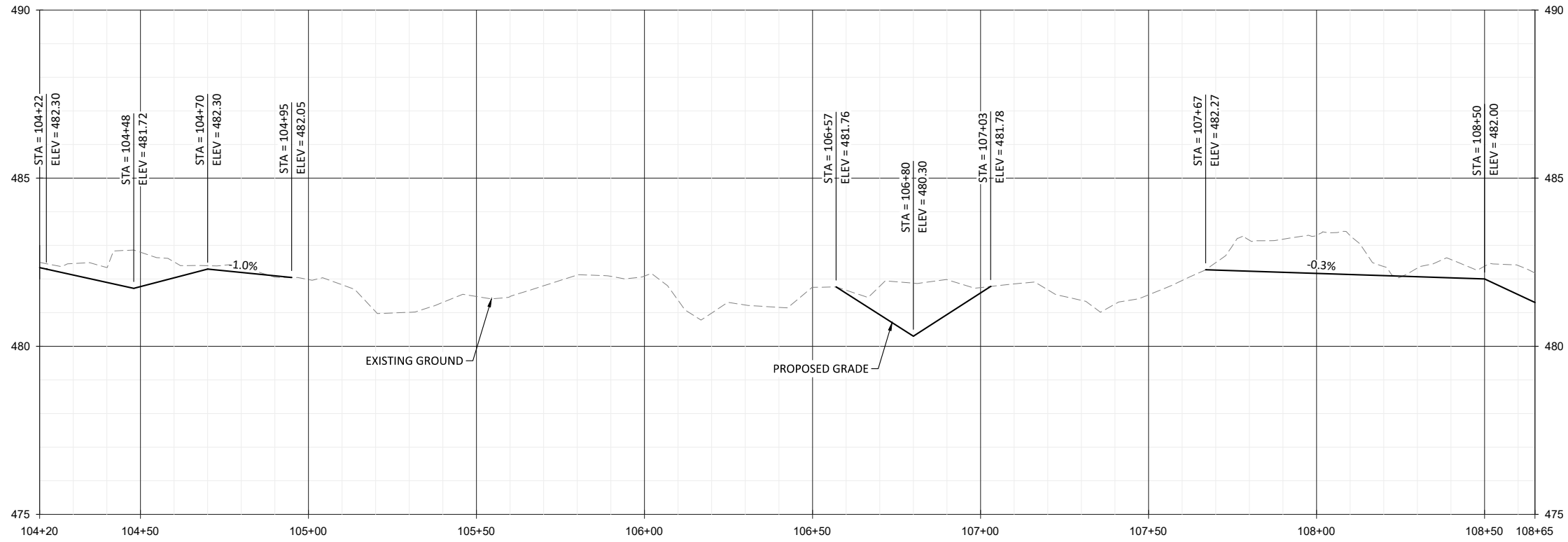

Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

2.1

Sheet

**WILDLANDS**  
 ENGINEERING  
 1490 N. GARDNER STREET, SUITE 104  
 CHARLOTTE, NC 28203  
 Tel: 704.332.7754  
 Fax: 704.332.3306  
 Firm License No. F-0831

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 Job Number: 005-02182  
 Project Engineer: ASE  
 Drawn By: JCK  
 Checked By: JCK



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 Meadow Branch  
 Stream Plan and Profile

Revisions	

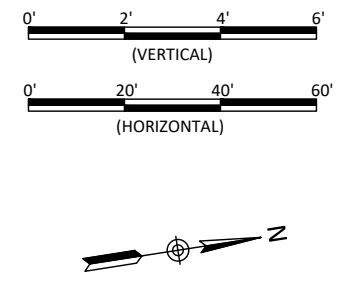
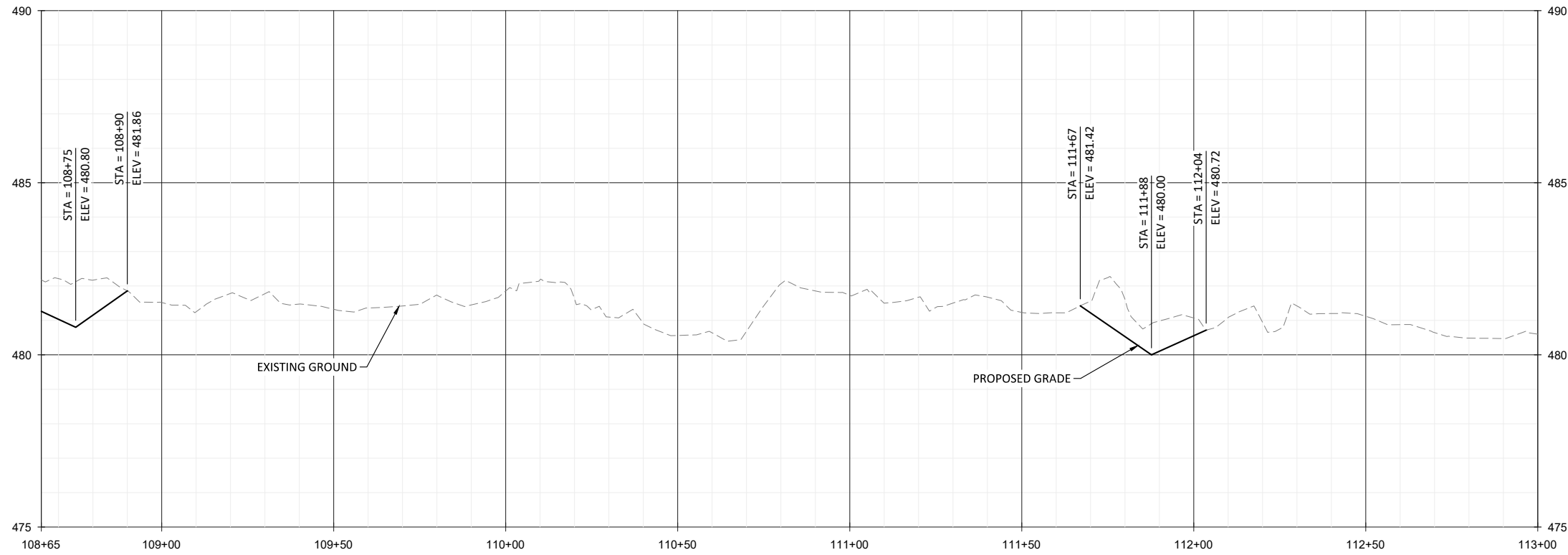
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 Checked By: JCK

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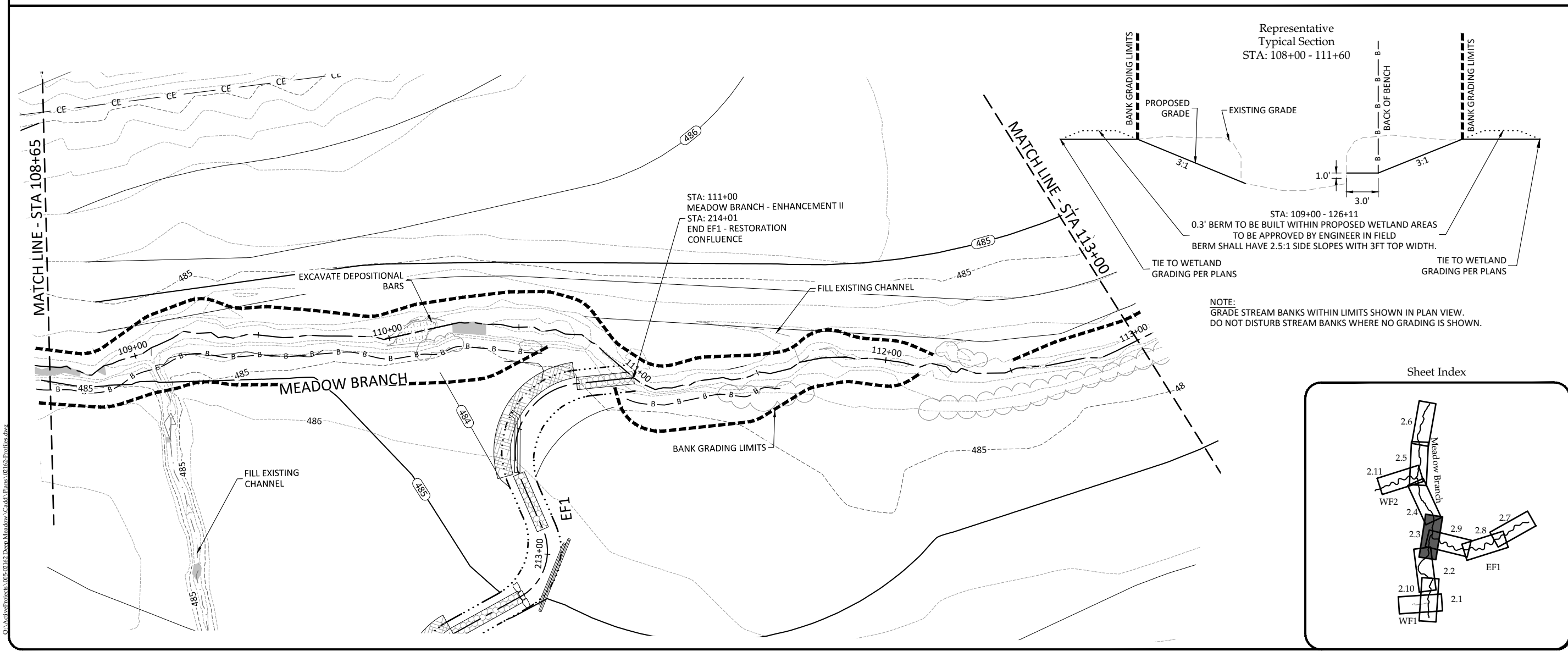
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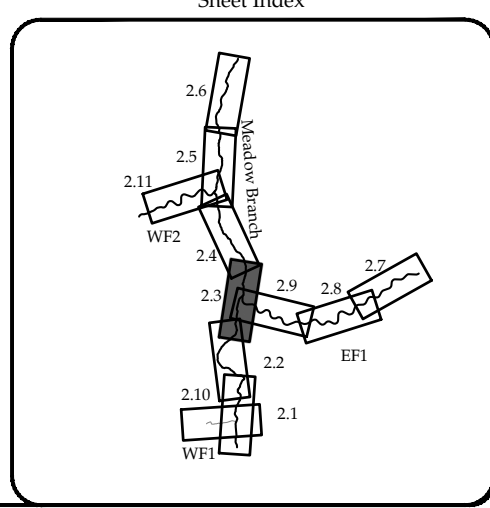
Nov 25, 2018



**WILDLANDS**  
 CONSULTING ENGINEERS  
 1495 N. GARDNER ROAD  
 CHARLOTTE, NC 28203  
 Tel: 704.332.7754  
 Fax: 704.332.3306  
 Firm License No. F-0831



**Deep Meadow Mitigation Site**  
 Union County, North Carolina  
 Meadow Branch  
 Stream Plan and Profile



Revisions	

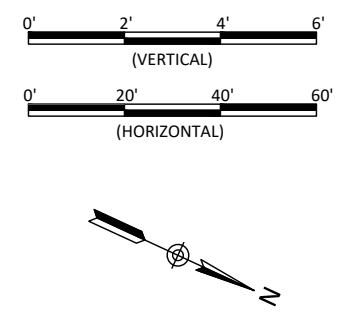
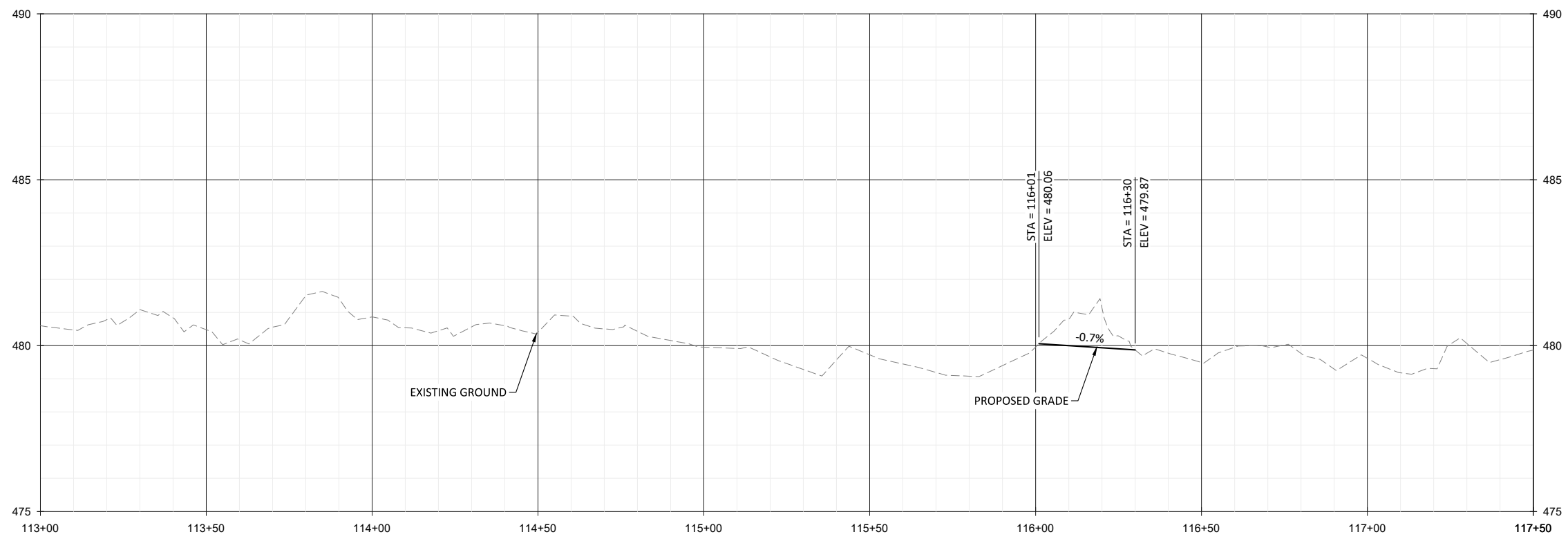
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Job Number:	005-02162
Project Engineer:	ASE
Drawn By:	SJD
Checked By:	JCK

**2.3**  
 Sheet

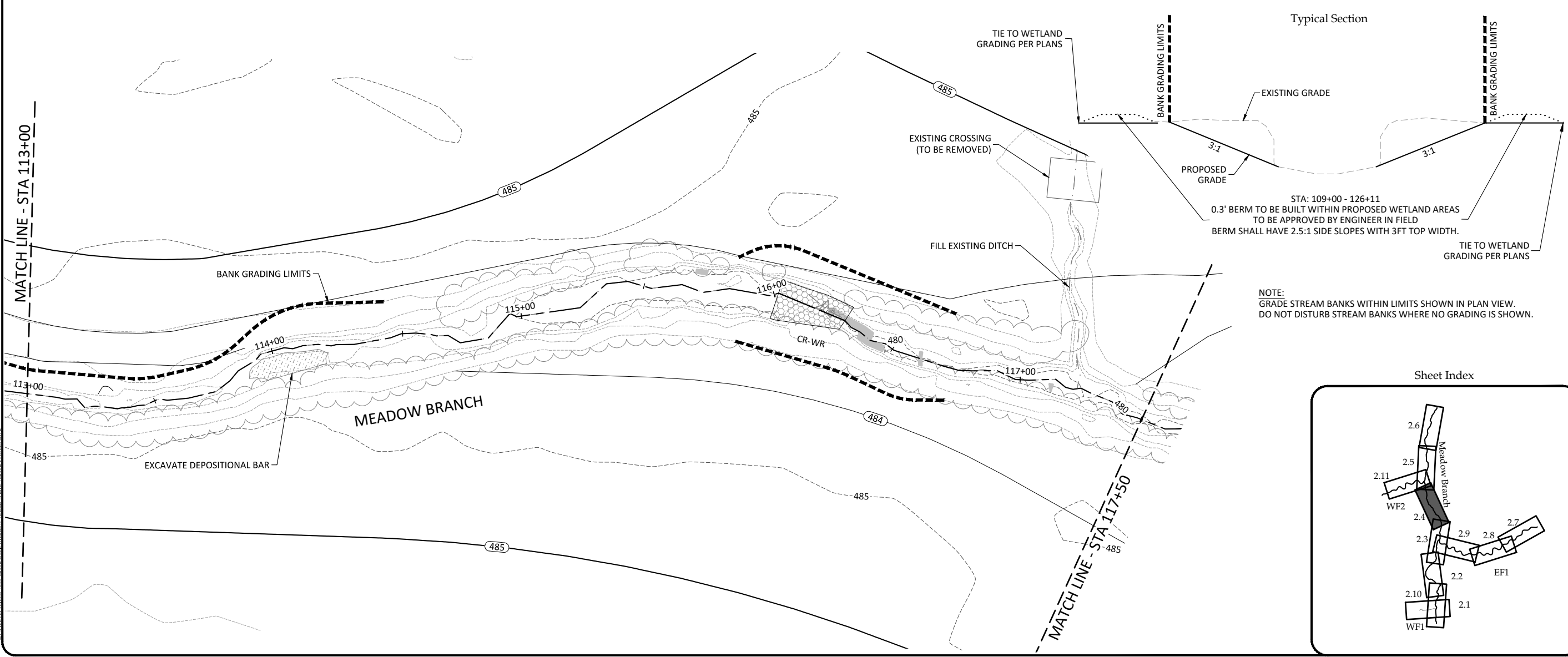
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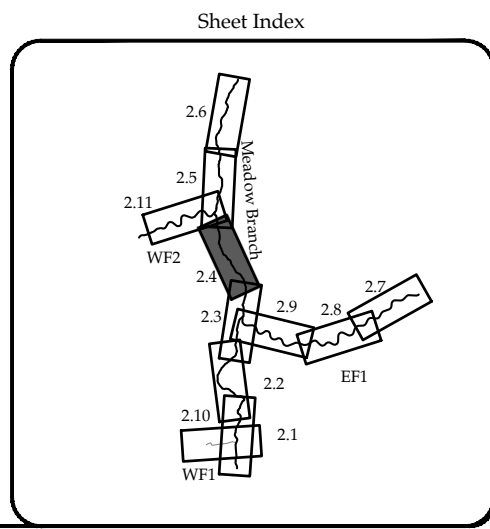
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 Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK



**WILDLANDS**  
 ENGINEERING  
 1490 N. GARDNER  
 CHARLOTTE, NC 28203  
 Tel: 704.332.7754  
 Fax: 704.332.3306  
 Firm License No. F-0831



**NOTE:**  
 GRADE STREAM BANKS WITHIN LIMITS SHOWN IN PLAN VIEW.  
 DO NOT DISTURB STREAM BANKS WHERE NO GRADING IS SHOWN.



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 Meadow Branch  
 Stream Plan and Profile

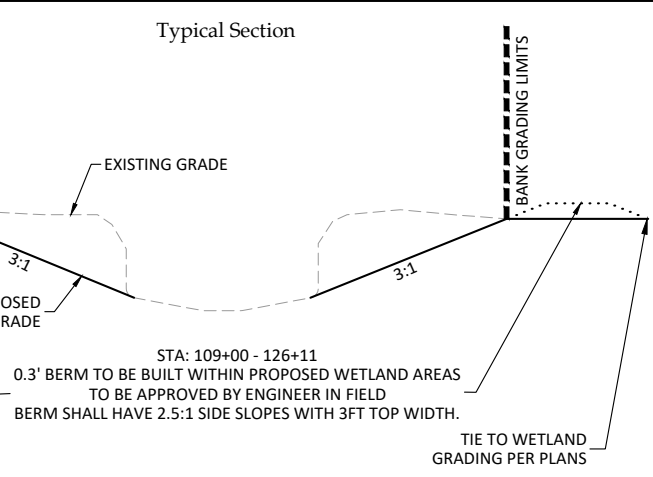
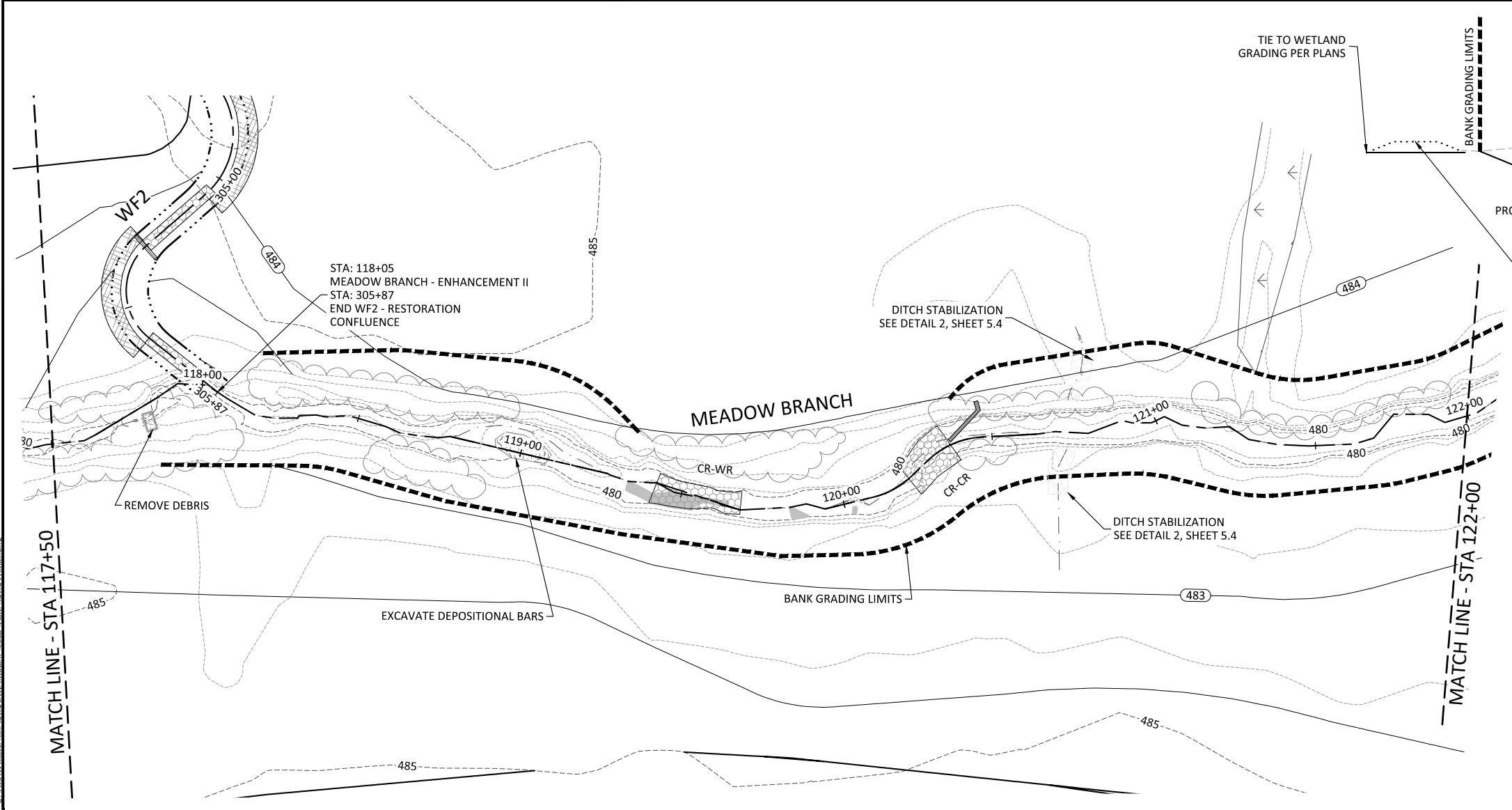
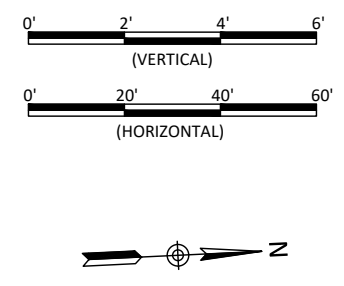
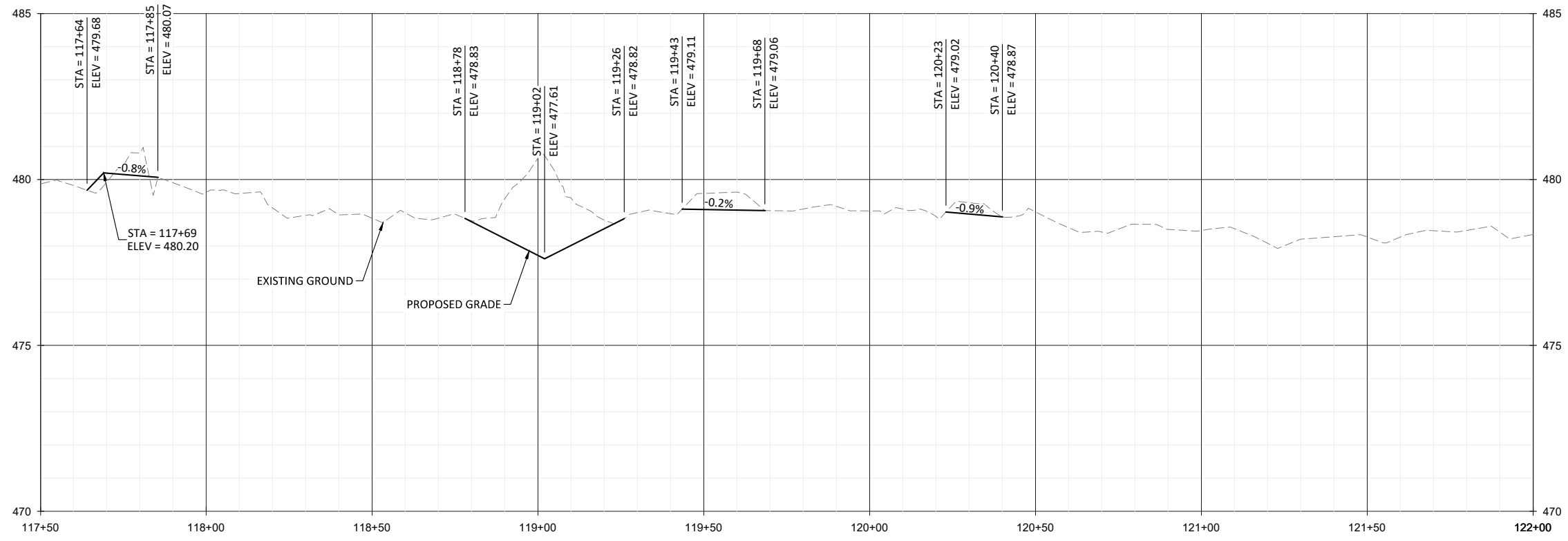
Revisions:


Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

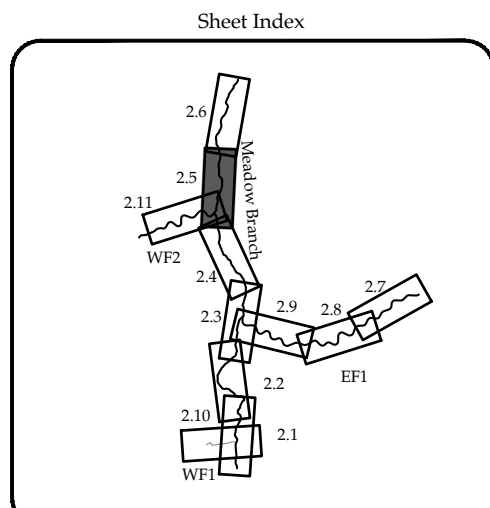
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Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK  
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NOTE:  
 GRADE STREAM BANKS WITHIN LIMITS SHOWN IN PLAN VIEW.  
 DO NOT DISTURB STREAM BANKS WHERE NO GRADING IS SHOWN.



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 Meadow Branch  
 Stream Plan and Profile

Revisions:

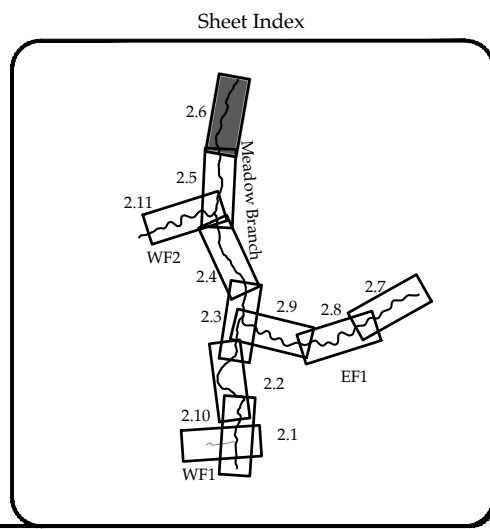
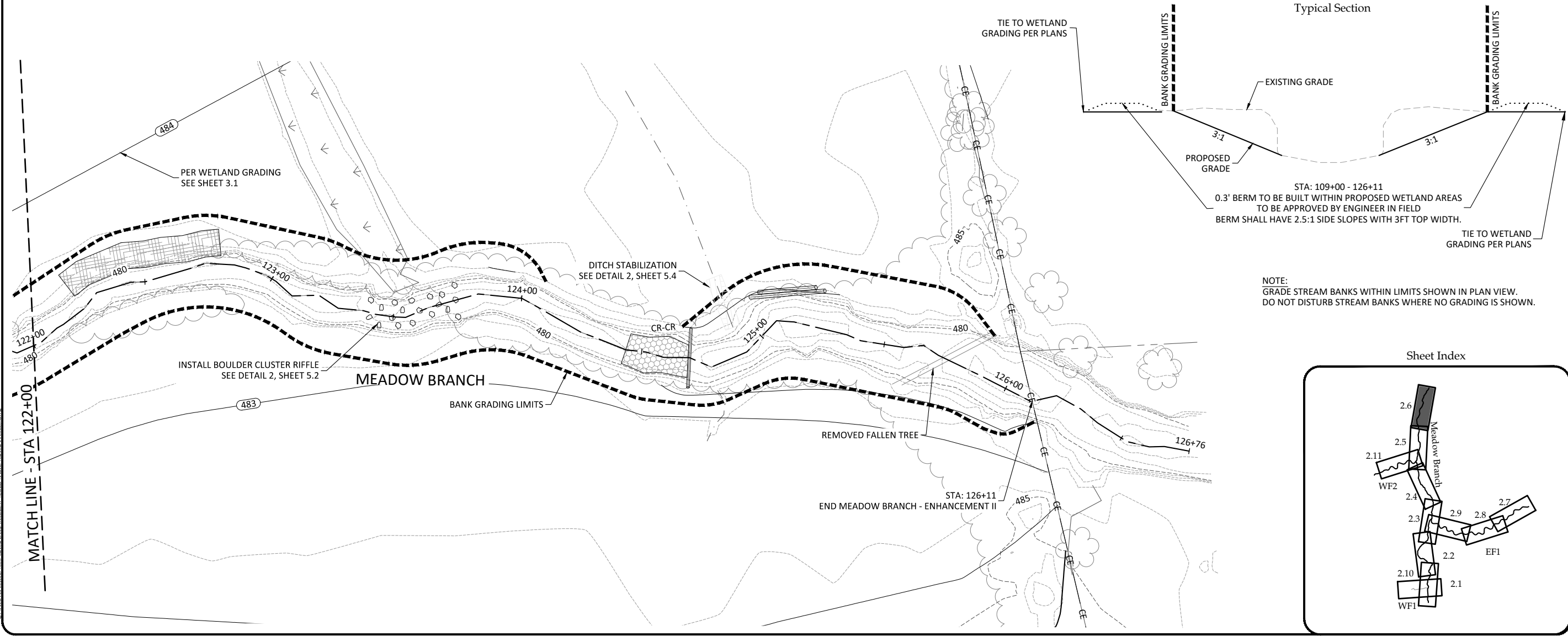
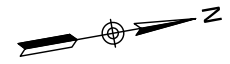
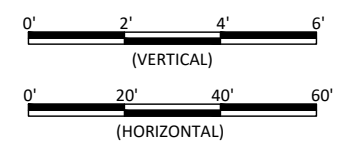
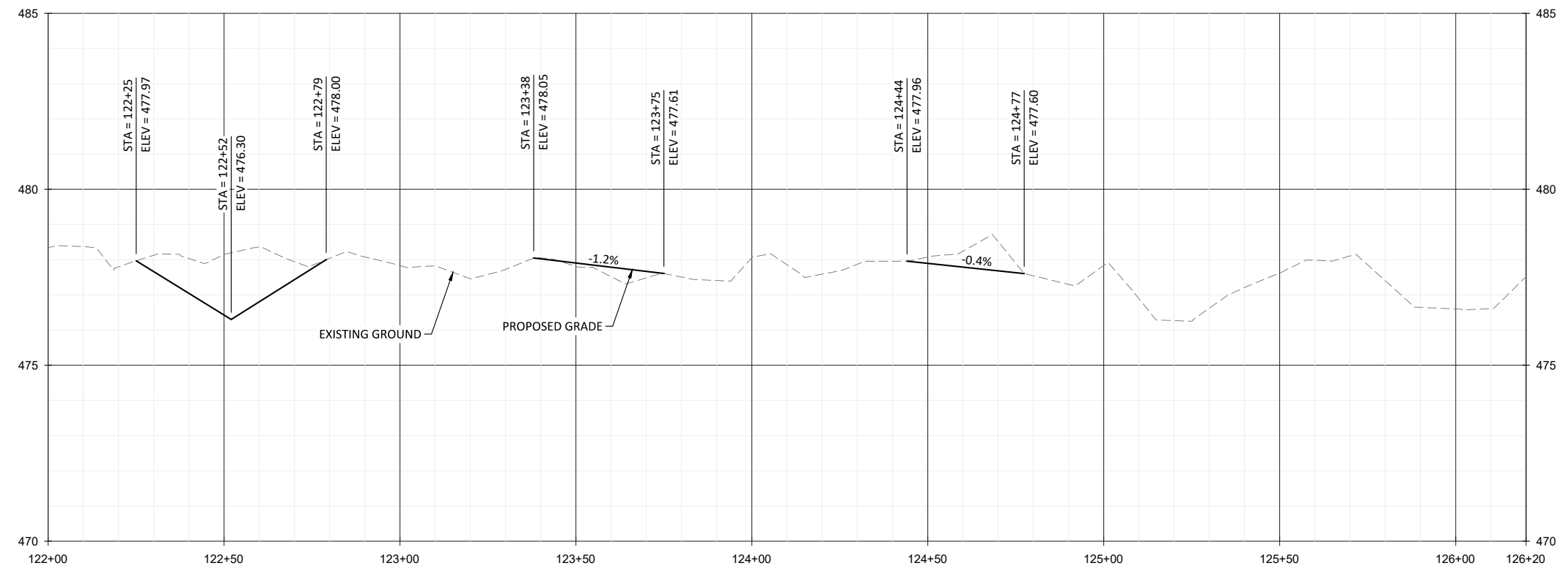

Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

**2.5**

Sheet

**WILDLANDS**  
 ENGINEERING  
 1490 N. GARDNER ST.  
 CHARLOTTE, NC 28203  
 Tel: 704.332.7754  
 Fax: 704.332.3306  
 Firm License No. F-0831

D:\ActiveProjects\005-02162-DeepMeadow-Credit\Drawings\02162-Profile.dwg  
 Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: JCK  
 Checked By: JCK



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 Meadow Branch  
 Stream Plan and Profile

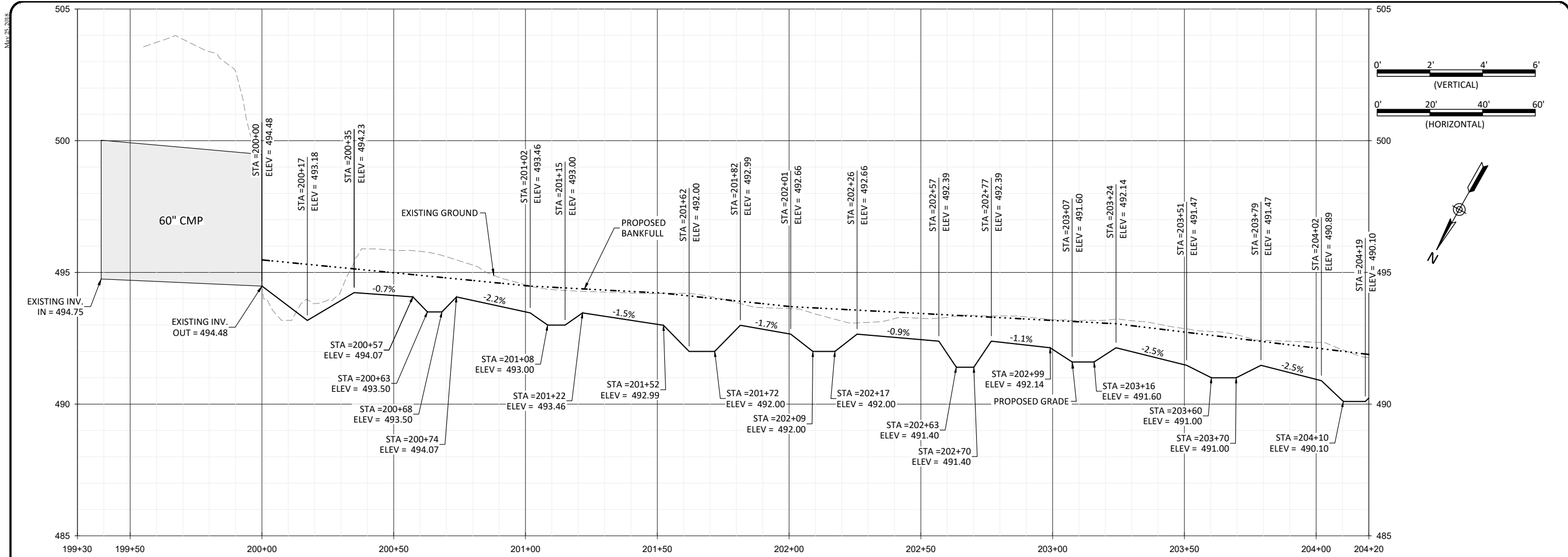
**WILDLANDS**  
 ENGINEERING  
 1490 N. GARDNER ST., SUITE 104  
 CHARLOTTE, NC 28203  
 TEL: 704.332.7754  
 FAX: 704.332.3306  
 FIRM LICENSE NO. F-0831

Revisions:

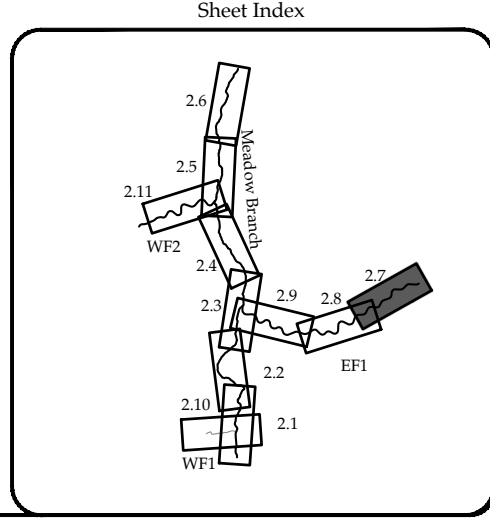
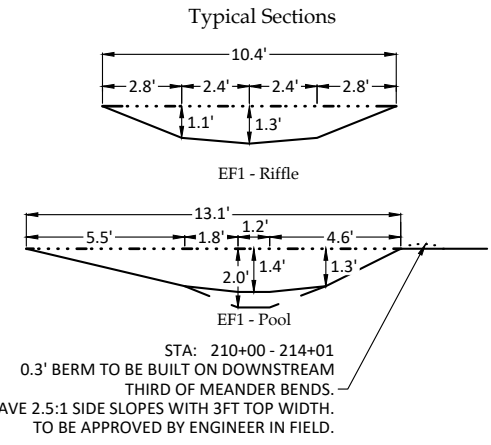
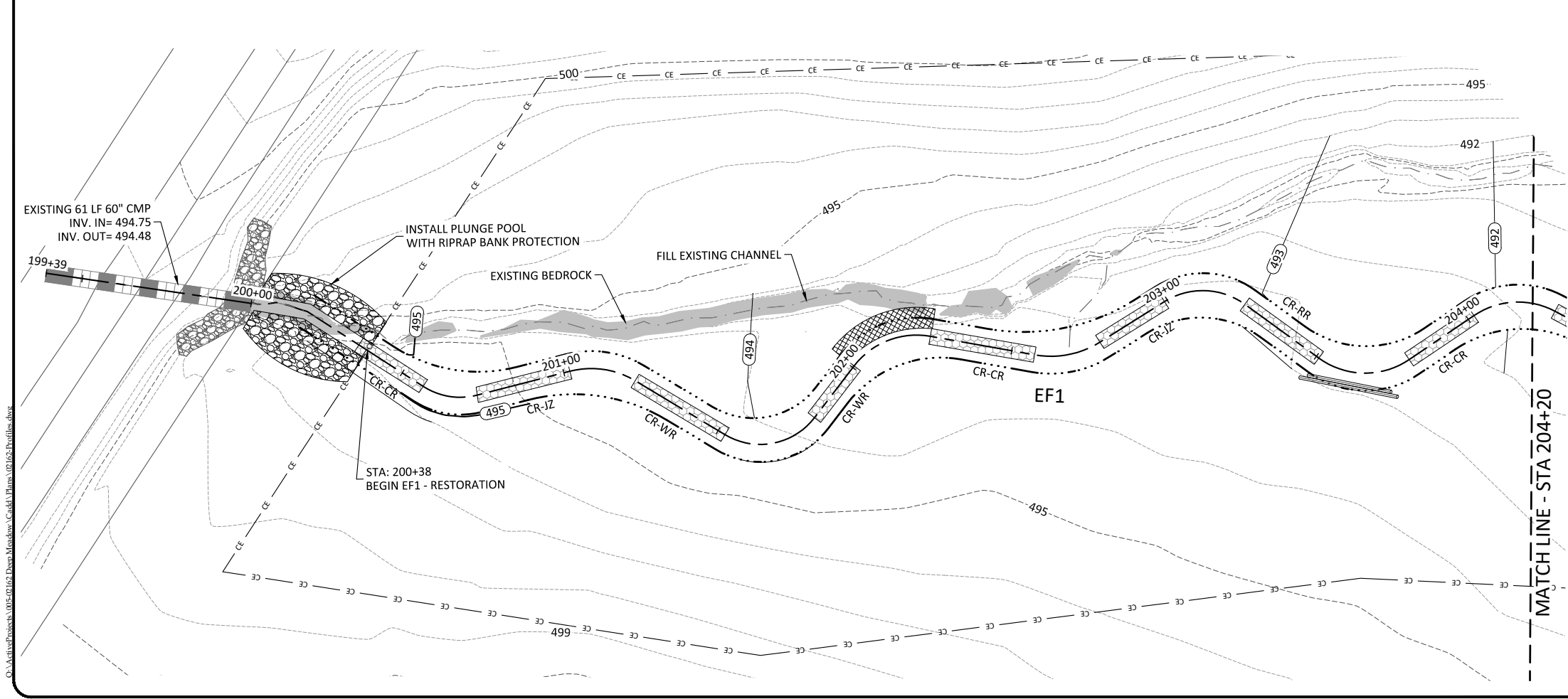
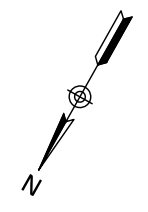
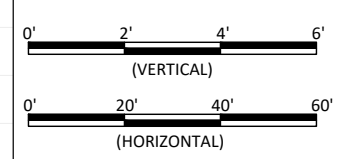

Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: JCK  
 Checked By: JCK

2.6

Sheet



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 Fax: 704.332.3306
   
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**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 EF1  
 Stream Plan and Profile

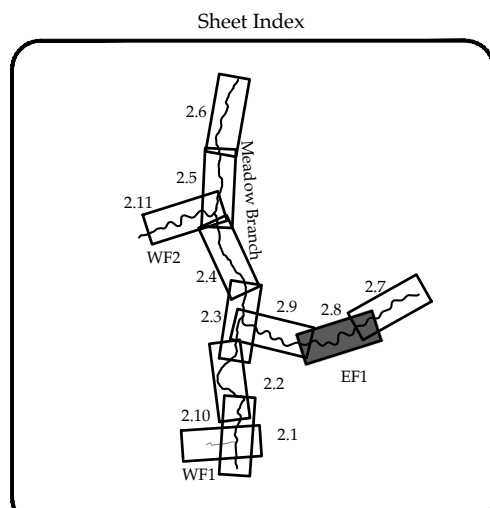
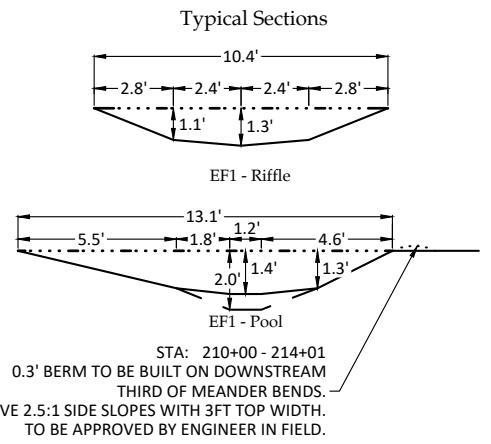
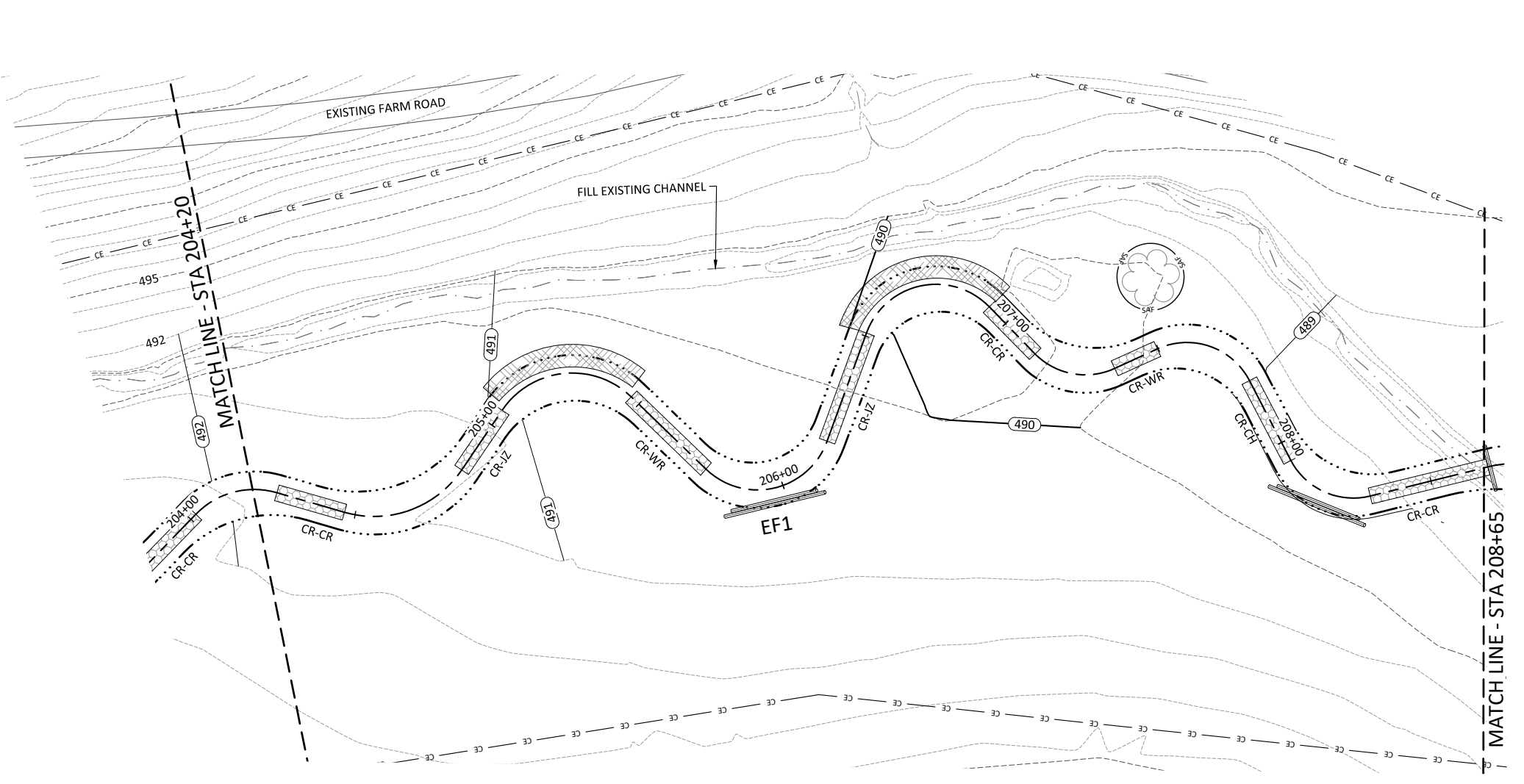
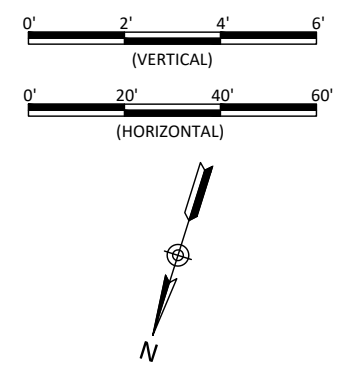
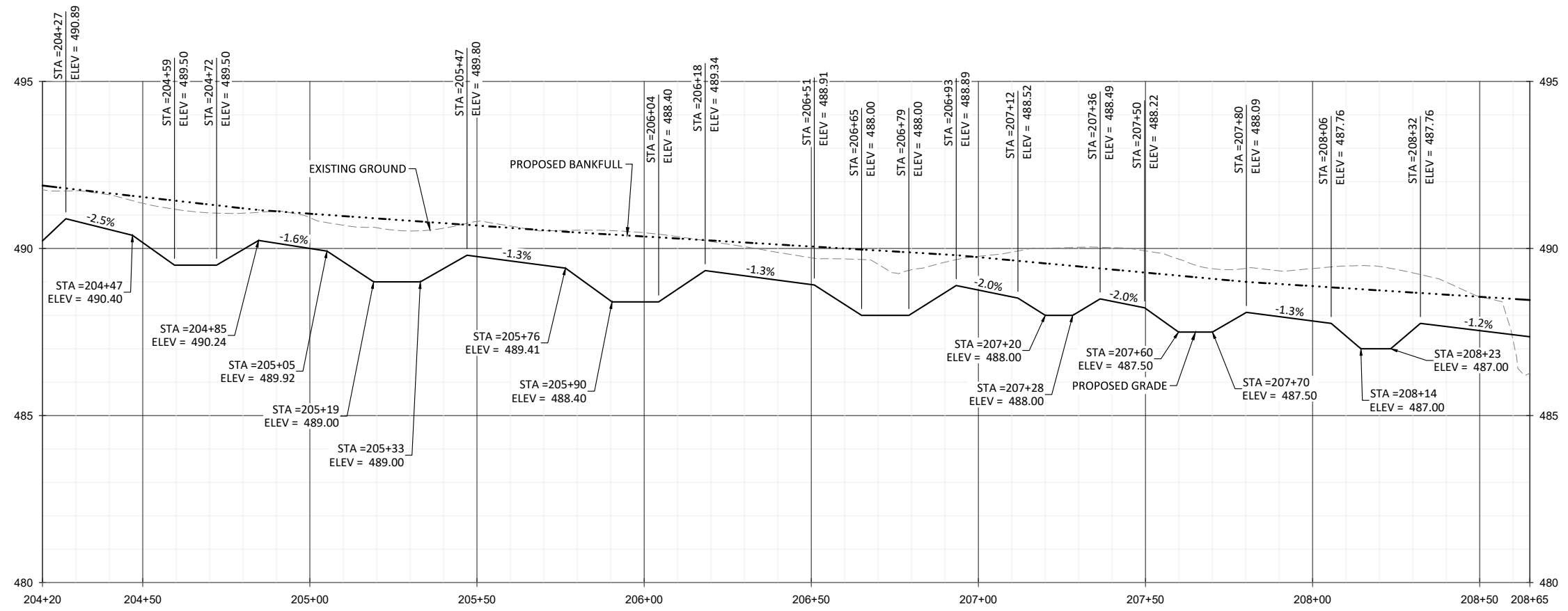
Revisions:


Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

**2.7**

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 Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: JCK  
 Checked By: JCK



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**

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 Firm License No. F-0831

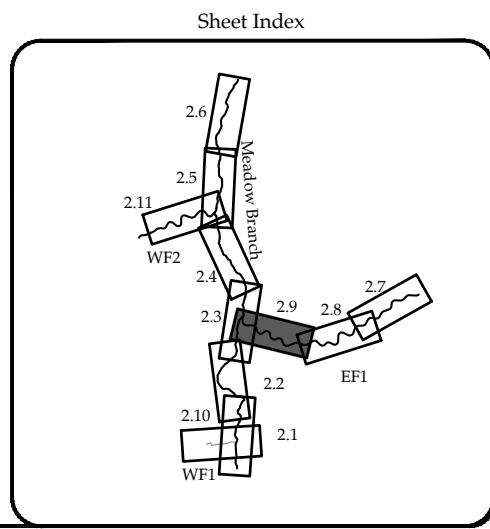
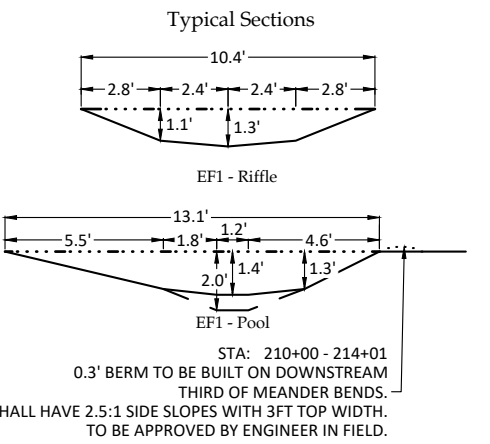
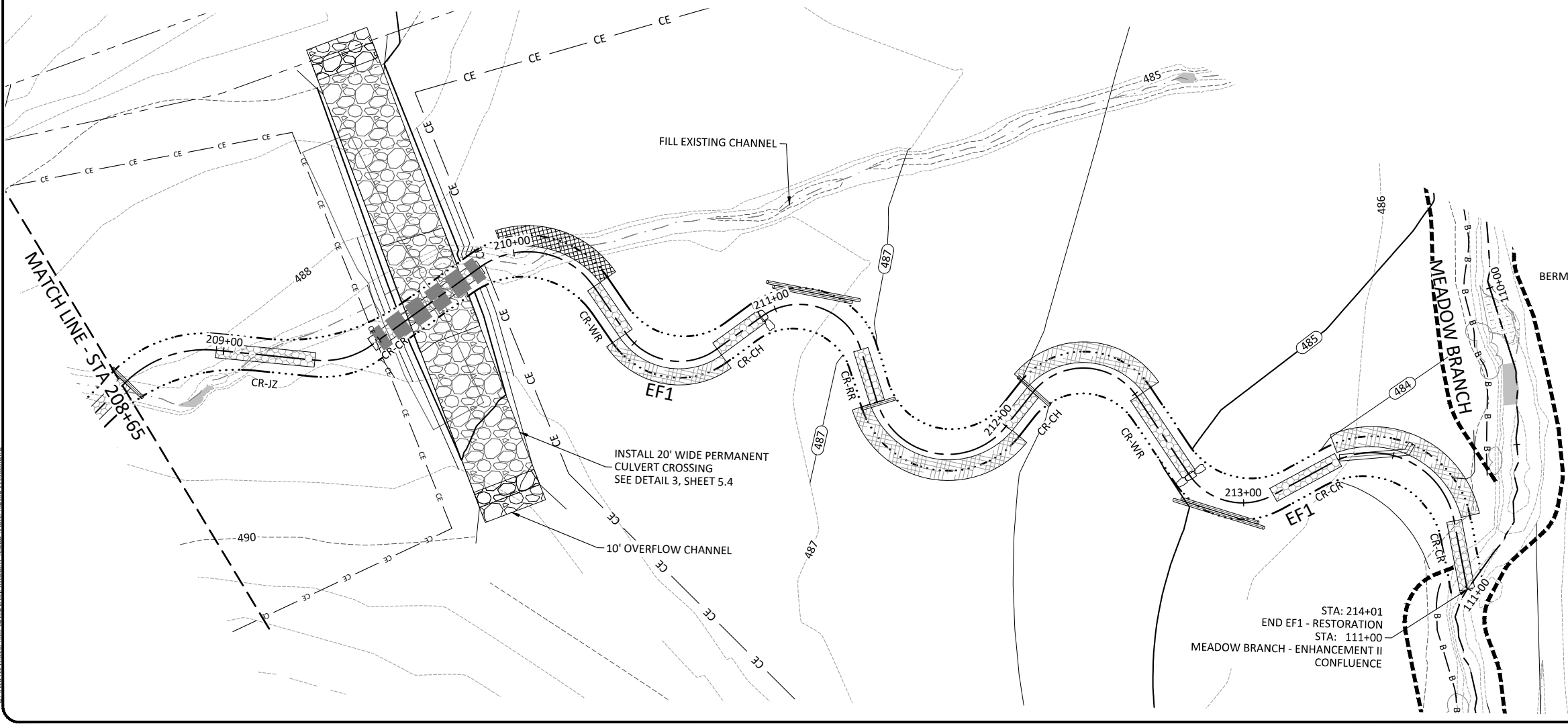
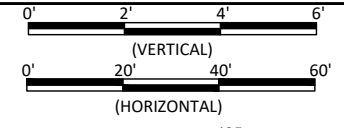
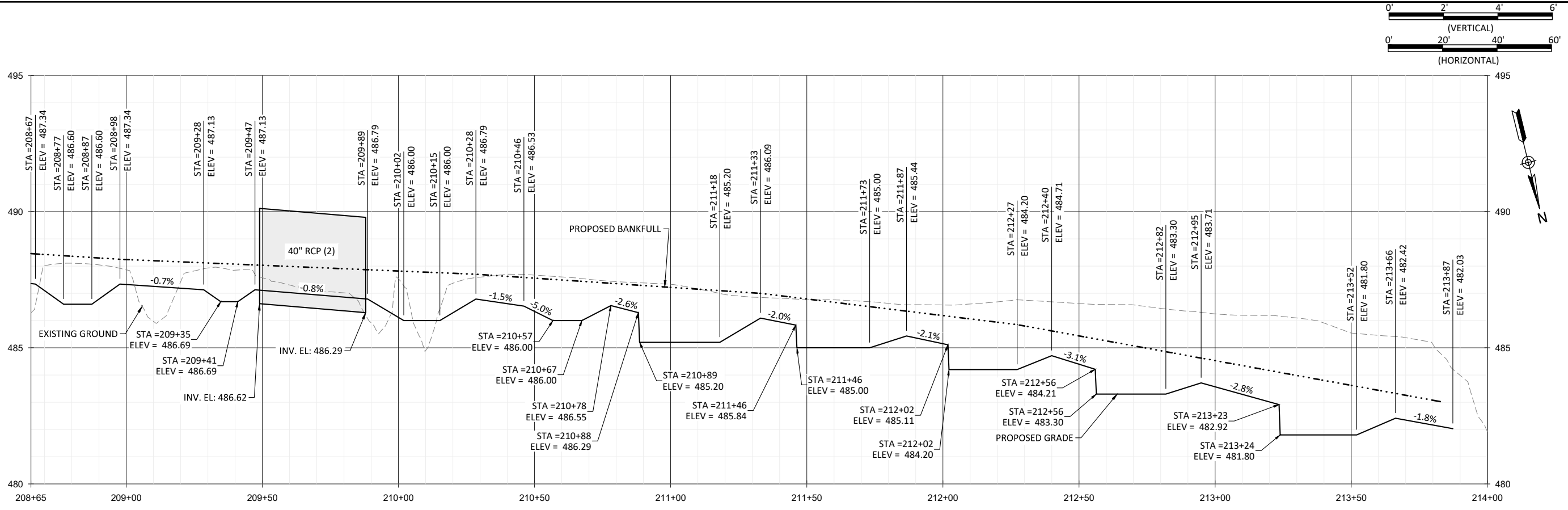
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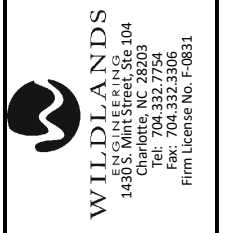
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 Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: JCK  
 Checked By: JCK



**Deep Meadow Mitigation Site**  
**Union County, North Carolina**

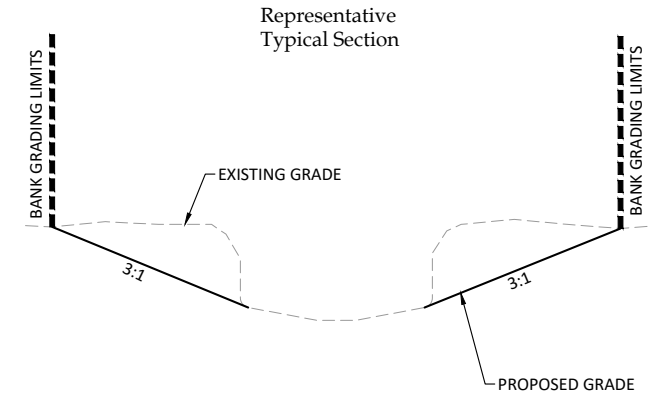
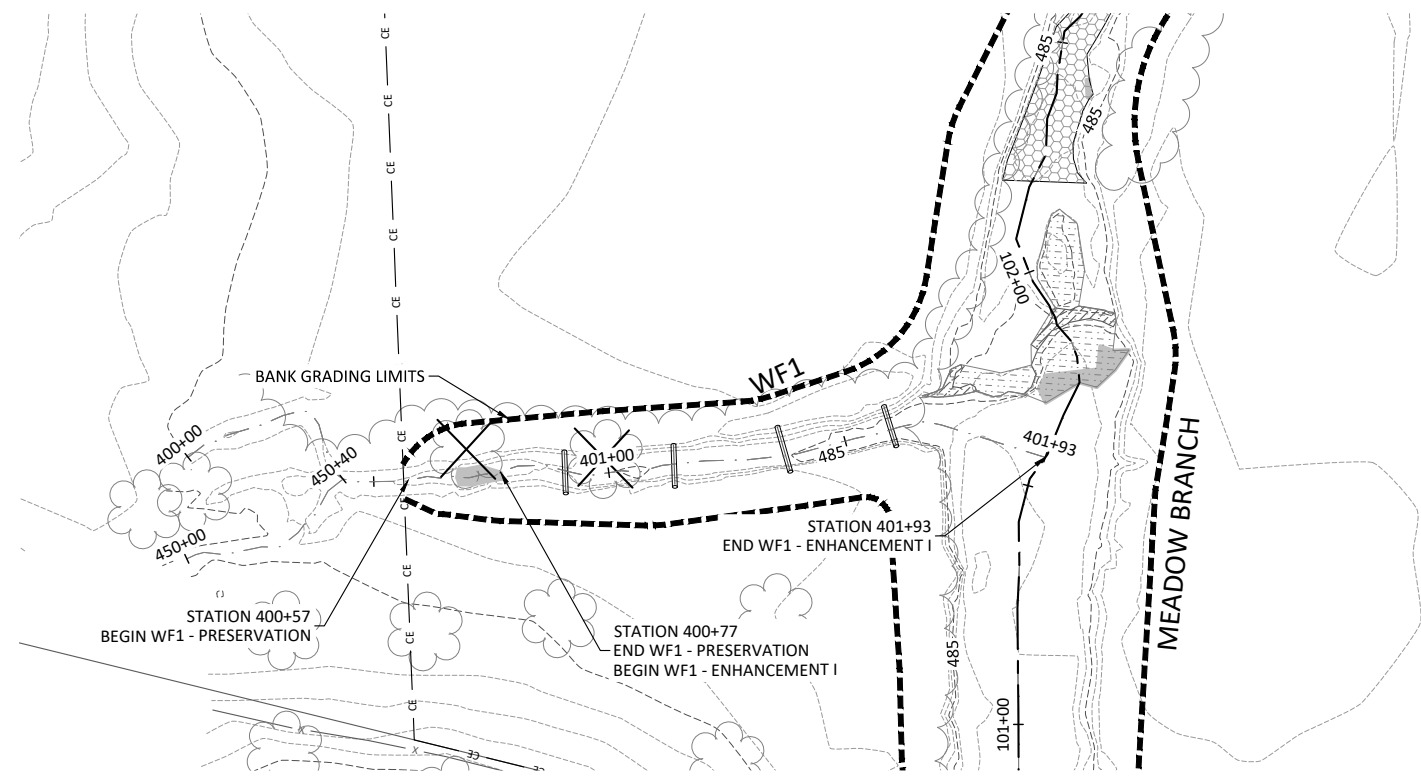
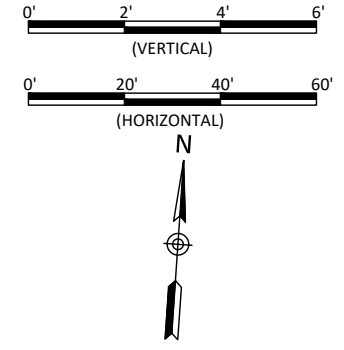
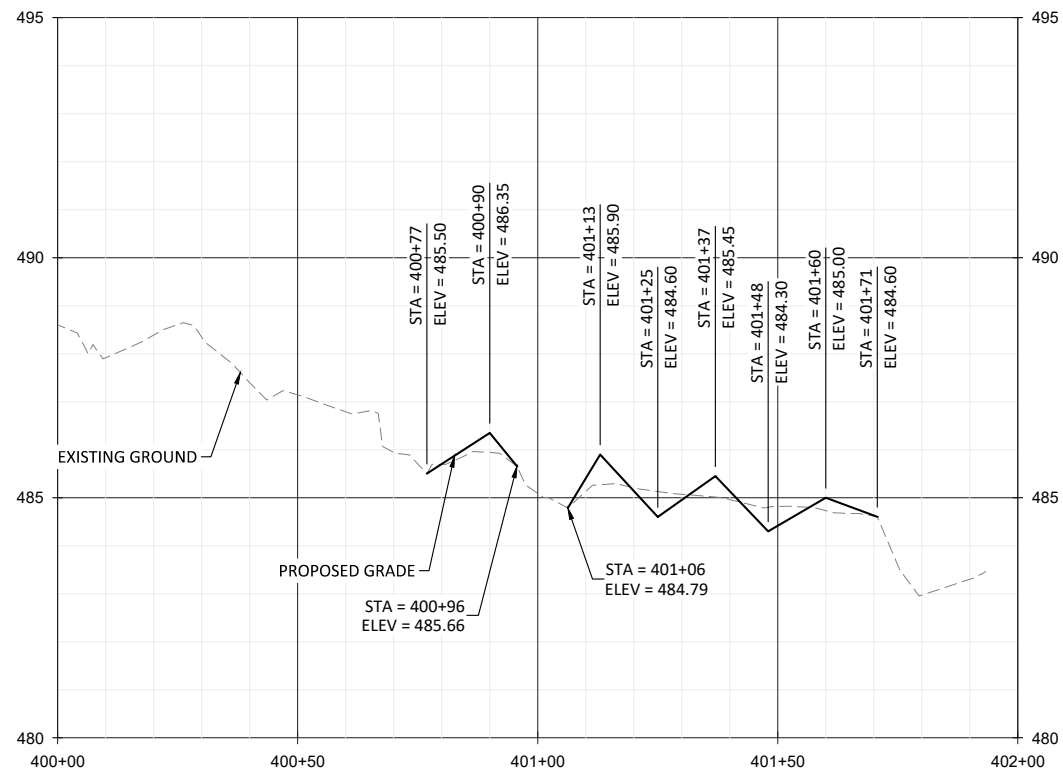


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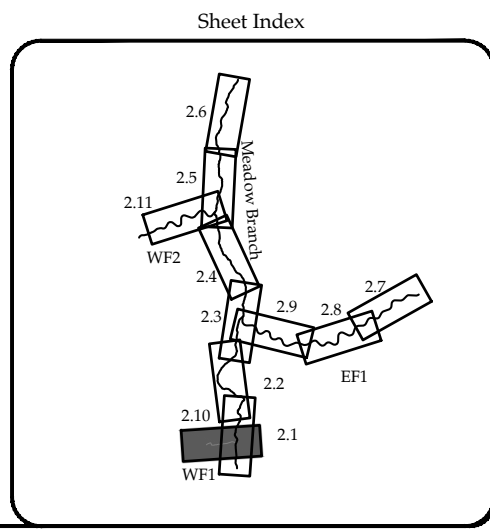
Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: JCK  
 Checked By: JCK

Nov 25, 2018

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NOTE:  
GRADE STREAM BANKS WITHIN LIMITS SHOWN IN PLAN VIEW.  
DO NOT DISTURB STREAM BANKS WHERE NO GRADING LIMITS ARE SHOWN.



Deep Meadow Mitigation Site  
Union County, North Carolina

WF1  
Stream Plan and Profile

Revisions:

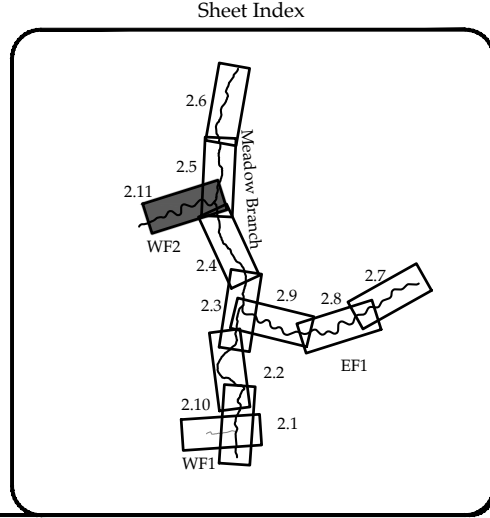
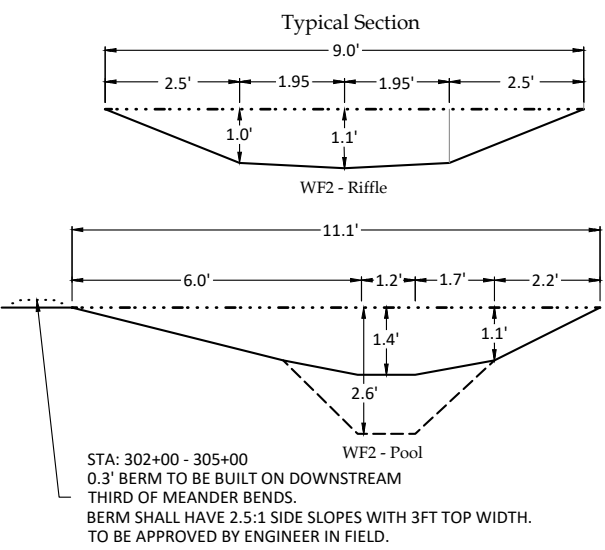
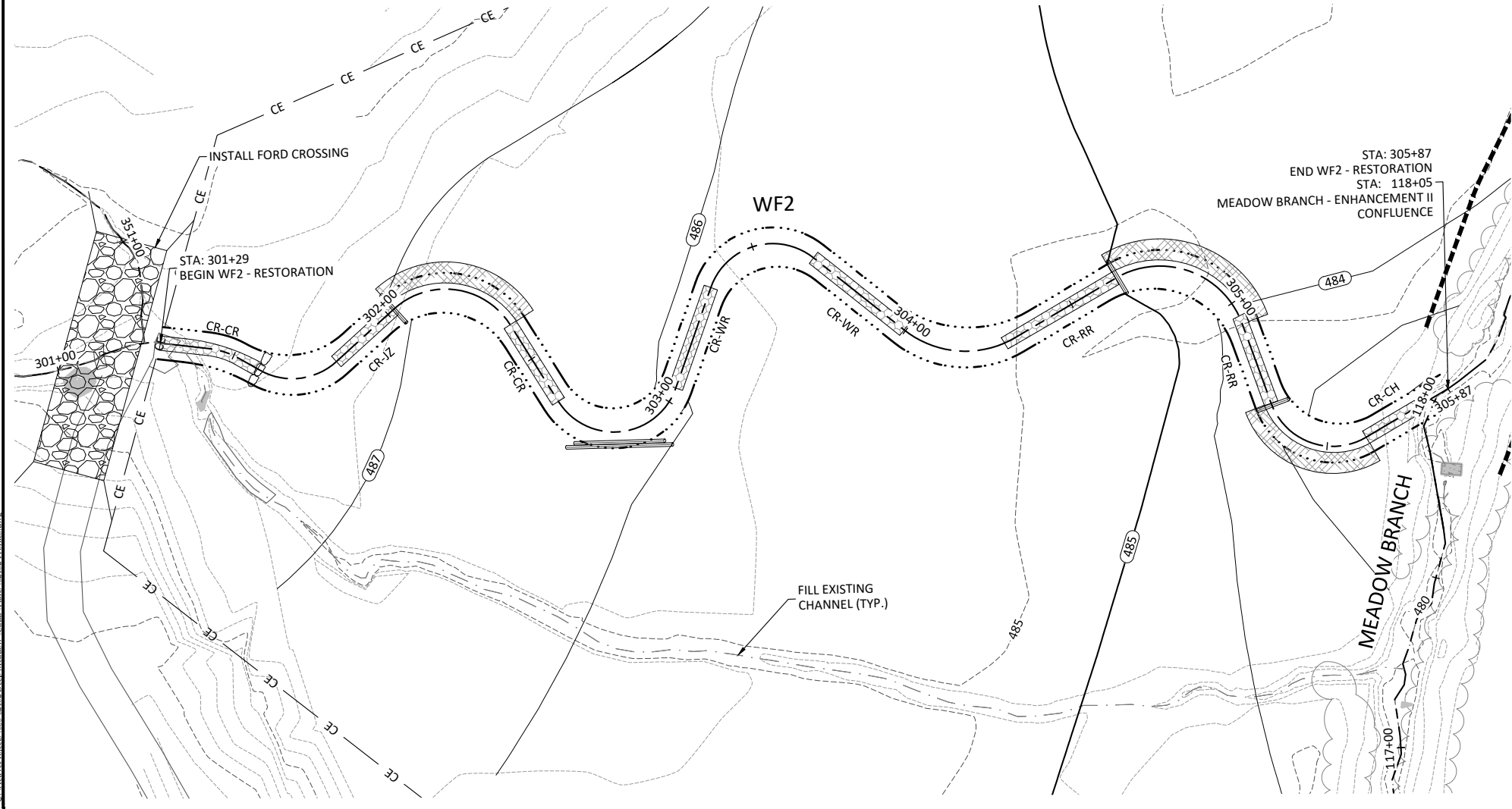
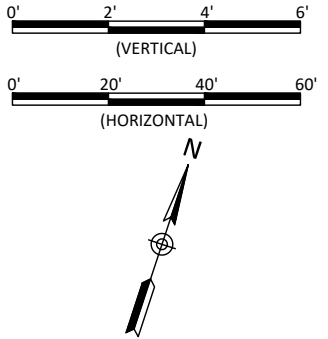
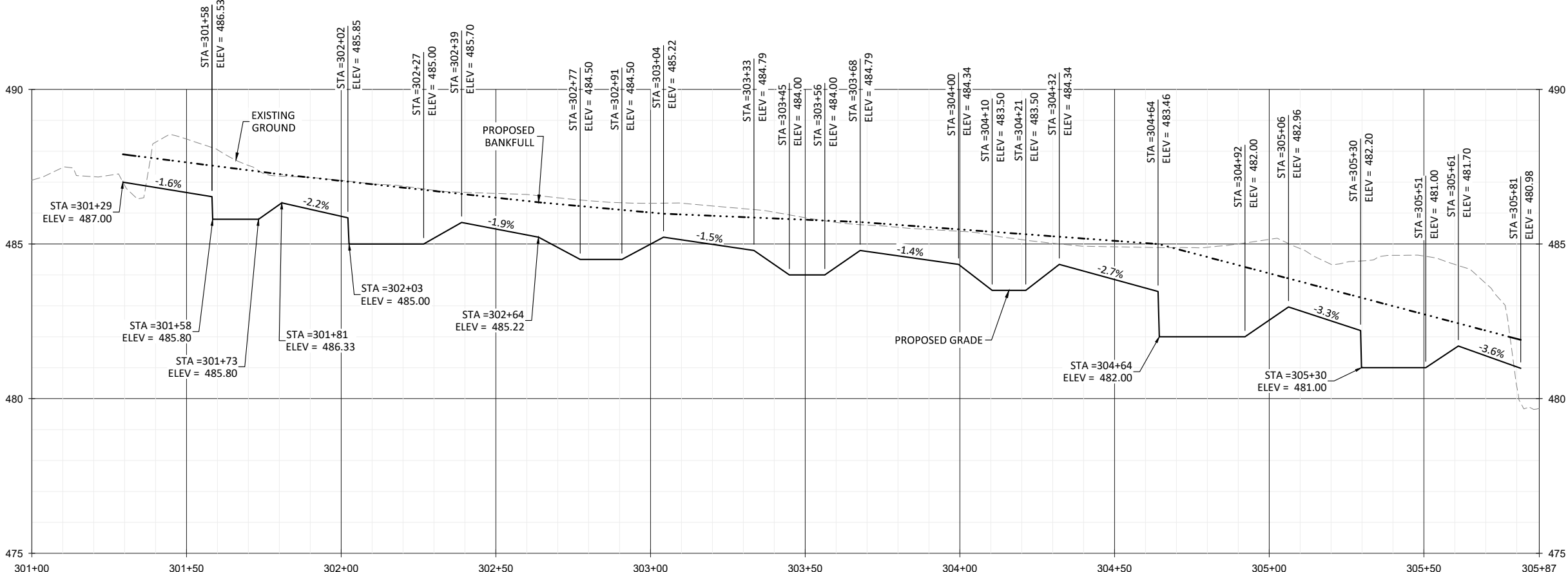

Date: January 23, 2018  
Job Number: 005-02102  
Project Engineer: ASE  
Drawn By: SID  
Checked By: JCK

2.10

Sheet

**WILDLANDS**  
ENGINEERING  
1490 N. GARDNER  
CHARLOTTE, NC 28203  
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Fax: 704.332.3306  
Firm License No. F-0831

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 Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK  
 WILDLANDS ENGINEERING, INC.  
 1490 N. GARDNER ST., SUITE 104  
 CHARLOTTE, NC 28203  
 TEL: 704.332.7754  
 FAX: 704.332.3306  
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Deep Meadow Mitigation Site  
 Union County, North Carolina

WF2  
 Stream Plan and Profile

Revisions:

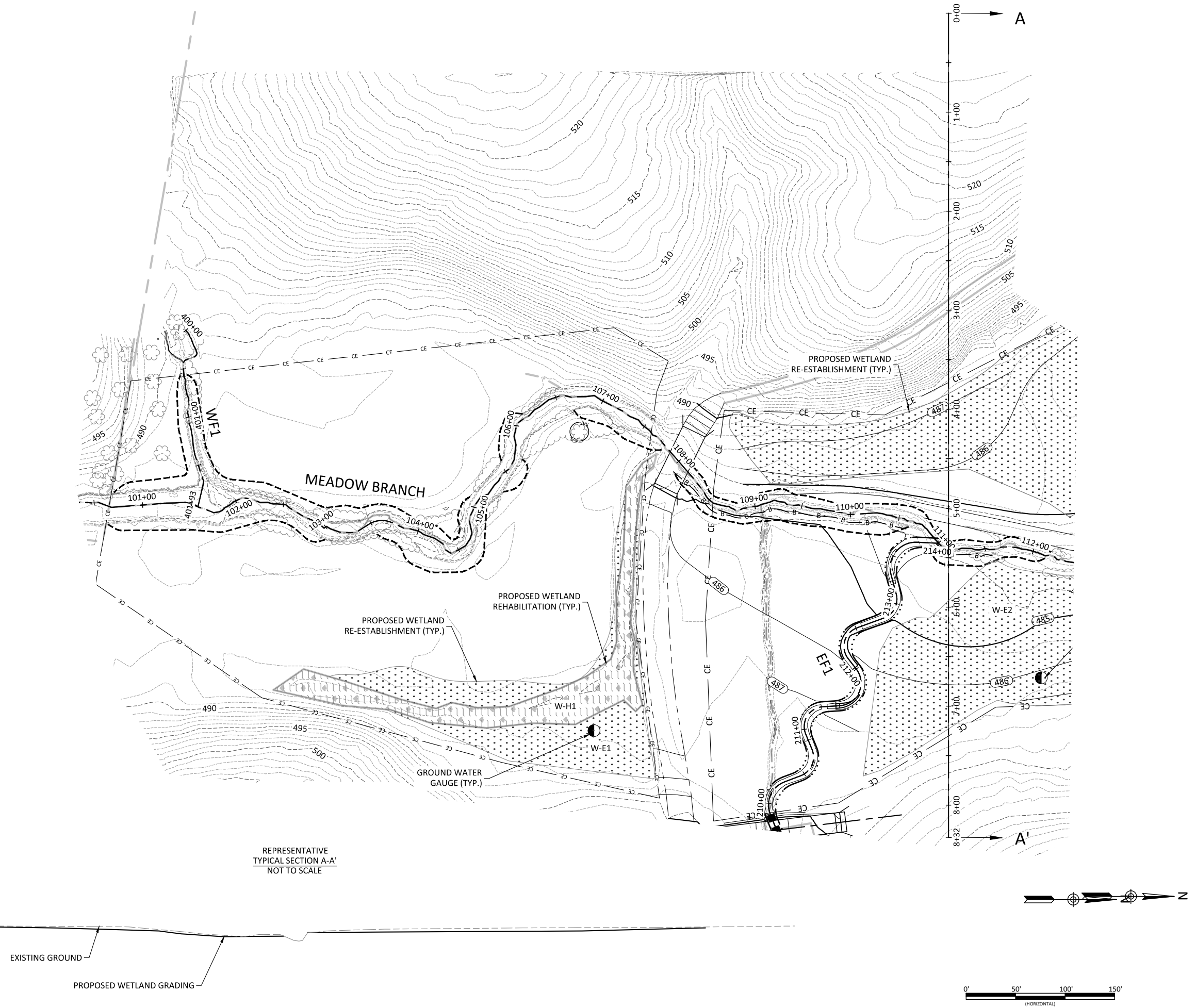

Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

2.11

Sheet

May 25, 2018

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Deep Meadow Mitigation Site  
 Union County, North Carolina  
 Wetland Grading

Revisions:

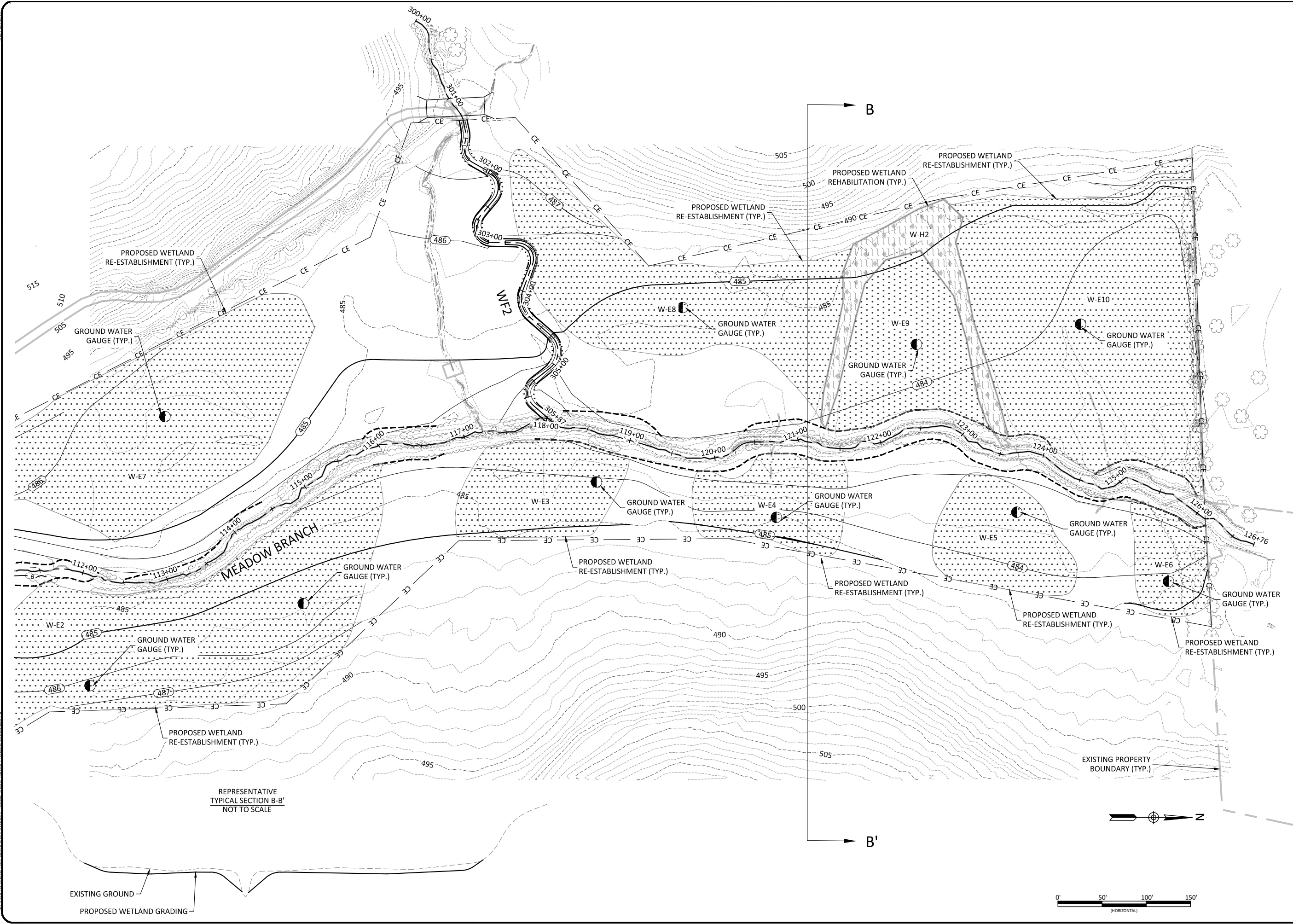

Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

3.1

Sheet

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**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
Wetland Grading



Revisions:

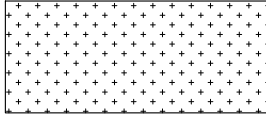
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Date: January 23, 2018  
Job Number: 005-02162  
Project Engineer: ASE  
Drawn By: SID  
Checked By: JCK

**3.2**

Sheet

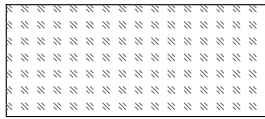




Buffer Planting Zone			
Bare Root			
Species	Common Name	Spacing	% of Stems
<i>Quercus phellos</i>	Willow Oak	12 ft.	10%
<i>Platanus occidentalis</i>	Sycamore	12 ft.	20%
<i>Betula nigra</i>	River Birch	12 ft.	15%
<i>Liriodendron tulipifera</i>	Tulip Poplar	12 ft.	15%
<i>Fraxinus pennsylvanica</i>	Green Ash	12 ft.	10%
			<b>70%</b>
Alternatives			
<i>Alnus serrulata</i>	Tag Alder	12 ft.	10%
<i>Quercus pagoda</i>	Cherrybark Oak	12 ft.	10%
<i>Quercus michauxii</i>	Swamp Chestnut Oak	12 ft.	10%

Note:  
Permanent Riparian seeding in all disturbed areas within Conservation Easement

Permanent Riparian Seeding				
Pure Live Seed (20 lbs/ acre)				
Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
All Year	<i>Panicum rigidulum</i>	Redtop Panicgrass	Herb	1.5
All Year	<i>Agrostis hyemalis</i>	Winter Bentgrass	Herb	4.0
All Year	<i>Chasmanthium latifolium</i>	River Oats	Herb	2.0
All Year	<i>Rudbeckia hirta</i>	Blackeyed Susan	Herb	1.0
All Year	<i>Coreopsis lanceolata</i>	Lanceleaf Coreopsis	Herb	1.0
All Year	<i>Carex vulpinoidea</i>	Fox Sedge	Herb	3.0
All Year	<i>Panicum clandestinum</i>	Deertongue	Herb	3.5
All Year	<i>Elymus virginicus</i>	Virginia Wild Rye	Herb	2.0
All Year	<i>Asclepias syrica</i>	Common Milkweed	Herb	0.2
All Year	<i>Baptisia australis</i>	Blue False Indigo	Herb	0.2
All Year	<i>Gaillardia pulchella</i>	Annual Gaillardia	Herb	1.0
All Year	<i>Echinacea purpurea</i>	Pale Purple Coneflower	Herb	0.6



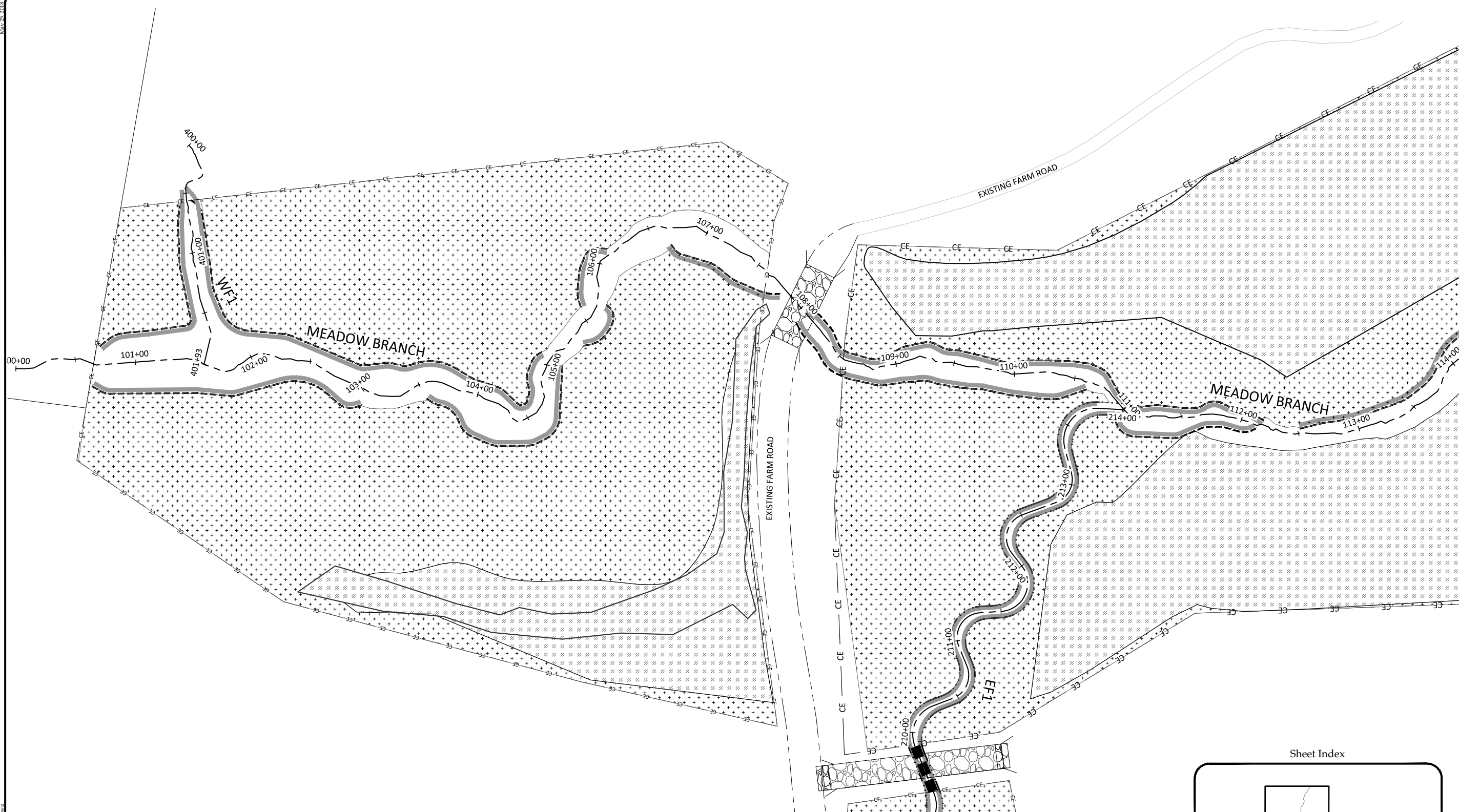
Wetland Bare Root Planting			
Scientific Name	Common Name	Spacing	%
<i>Platanus occidentalis</i>	Sycamore	12 ft.	15
<i>Quercus phellos</i>	Willow Oak	12 ft.	15
<i>Betula nigra</i>	River Birch	12 ft.	10
<i>Quercus michauxii</i>	Swamp Chestnut Oak	12 ft.	10
<i>Diospyros virginiana</i>	Persimmon	12 ft.	10
<i>Populus deltoides</i>	Eastern Cottonwood	12 ft.	10
<i>Cephalanthus occidentalis</i>	Button Bush	12 ft.	10
<i>Lindera benzoin</i>	Spice Bush	12 ft.	10
<i>Cornus amomum</i>	Silky Dogwood	12 ft.	10

TEMPORARY SEEDING		
APPROVED DATE	TYPE	PLANTING RATE (lbs/acre)
Jan 1 – May 1	Rye Grain (Secale Cereale)	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
May 1 – Aug 15	German Millet (Setaria italica)	40
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	750
	Straw Mulch	4,000
Aug 15 – Dec 30	Rye Grain (Secale Cereale)	120
	Ground Agricultural Limestone	2,000
	10-10-10 Fertilizer	1,000
	Straw Mulch	4,000

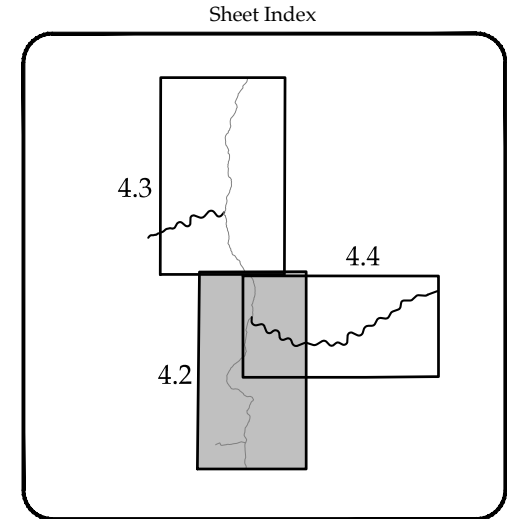


Streambank Planting Zone			
Live Stakes			
Species	Common Name	Spacing	% of Stems
<i>Salix nigra</i>	Black Willow	6 ft.	10%
<i>Cornus amomum</i>	Silky Dogwood	6 ft.	35%
<i>Salix sericea</i>	Silky Willow	6 ft.	40%
<i>Physocarpus opulifolius</i>	Ninebark	6 ft.	15%
			<b>100%</b>
Herbaceous Plugs			
<i>Juncus effusus</i>	Common Rush	5 ft.	40%
<i>Carex alata</i>	Broadwing Sedge	5 ft.	40%
<i>Panicum virgatum</i>	Switchgrass	5 ft.	20%
			<b>100%</b>

Revisions:

Note:  
Permanent Riparian seeding in  
all disturbed areas within  
Conservation Easement.



Deep Meadow Mitigation Site  
Union County, North Carolina

Meadow Branch and WF1  
Planting

Revisions:


Date:	January 23, 2018
Job Number:	005-02162
Project Engineer:	ASE
Drawn By:	SJD
Checked By:	JCK

4.2

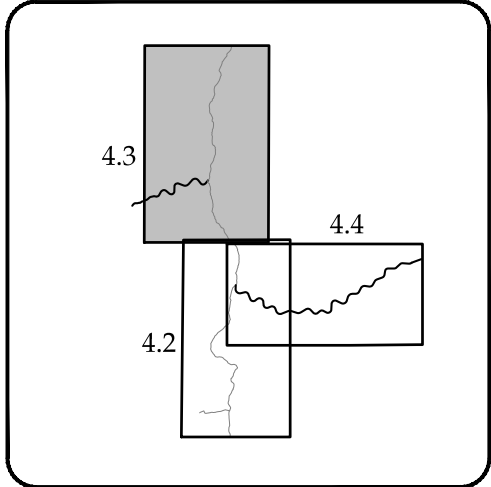
Nov 25, 2018

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**Note:**  
 Permanent Riparian seeding in  
 all disturbed areas within  
 Conservation Easement.

Sheet Index



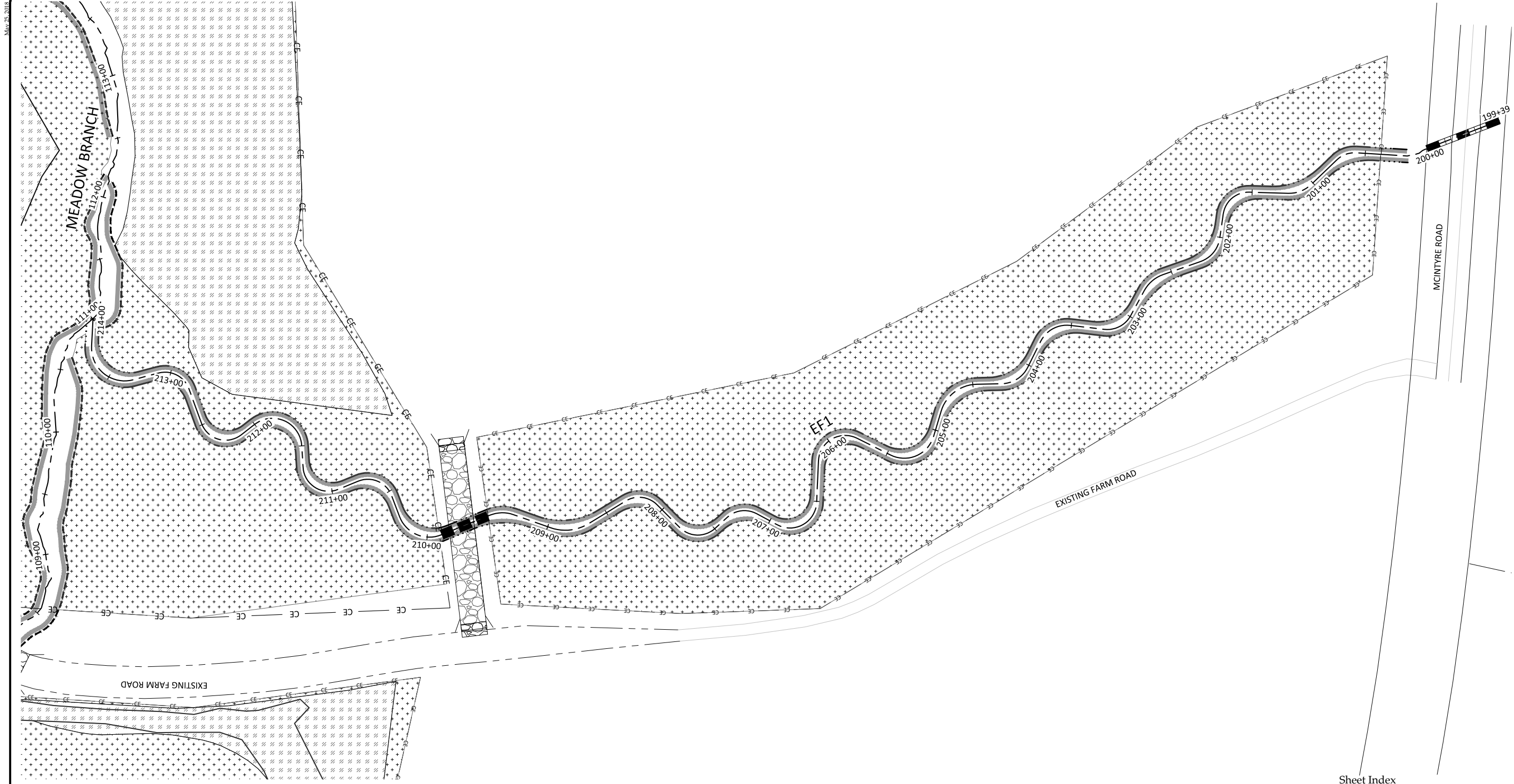
**Deep Meadow Mitigation Site**  
**Union County, North Carolina**  
 Meadow Branch and WF2  
 Planting

Revisions:

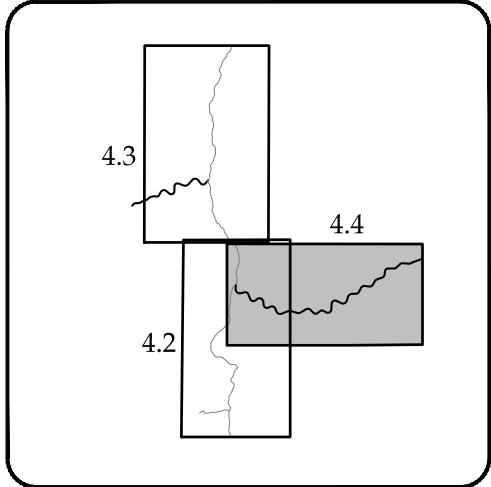
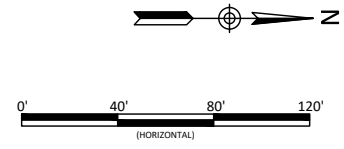

Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

4.3

Sheet



Note:  
Permanent Riparian seeding in  
all disturbed areas within  
Conservation Easement.



Date: January 23, 2018  
 Job Number: 005-02162  
 Project Engineer: ASE  
 Drawn By: SID  
 Checked By: JCK

Revisions:

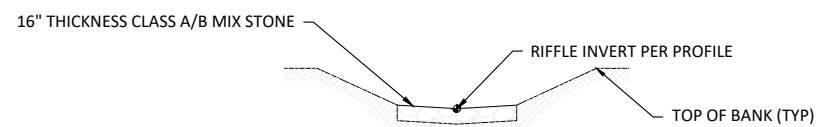
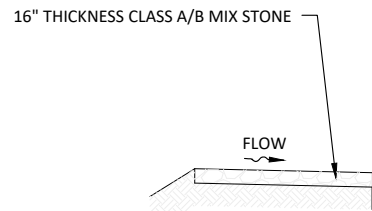
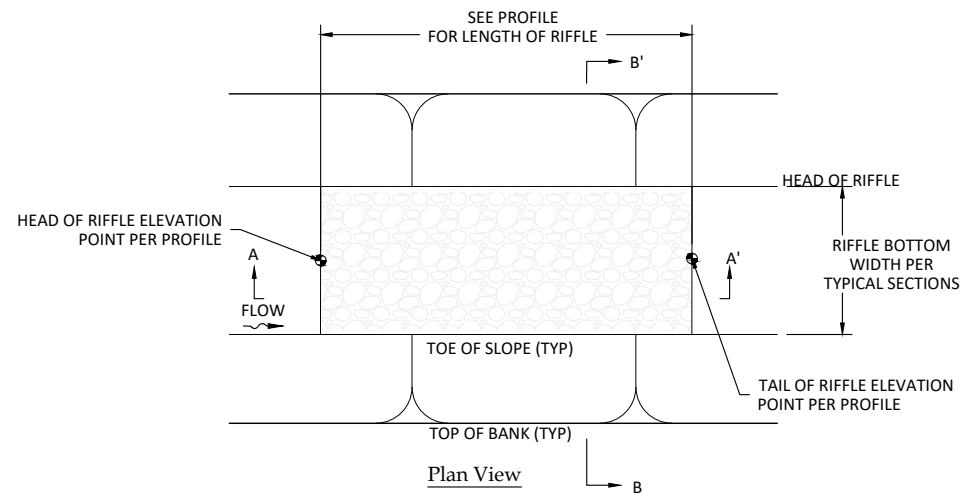

Deep Meadow Mitigation Site  
 Union County, North Carolina

EF1  
 Planting

**WILDLANDS**  
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 1490 N. GARDNER  
 Charlotte, NC 28203  
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 Firm License No. F-0831

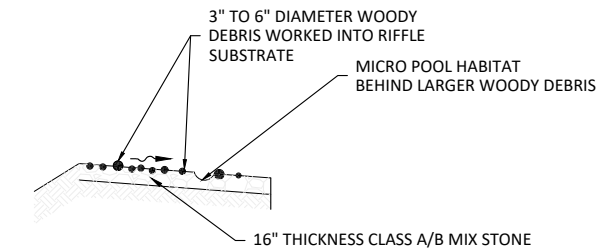
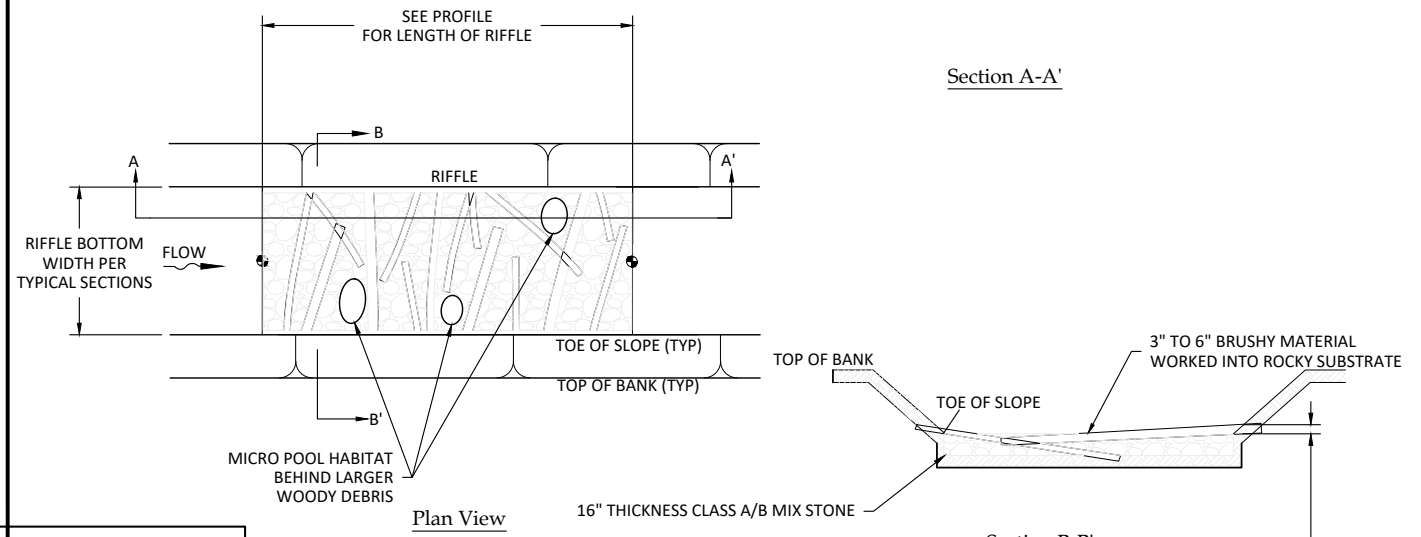
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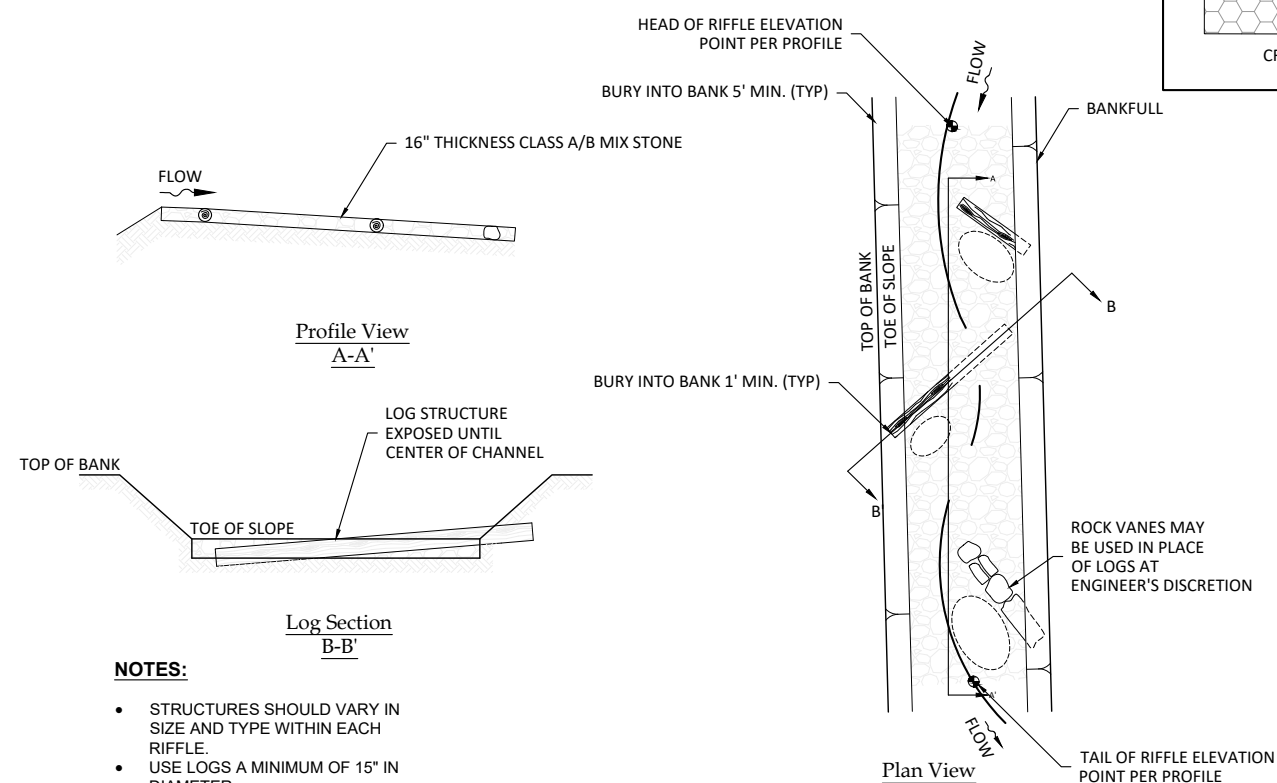


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6.1  
Constructed Riffle  
Not to Scale

CR-CR	CR-WR
CR-JZ	CR-CH

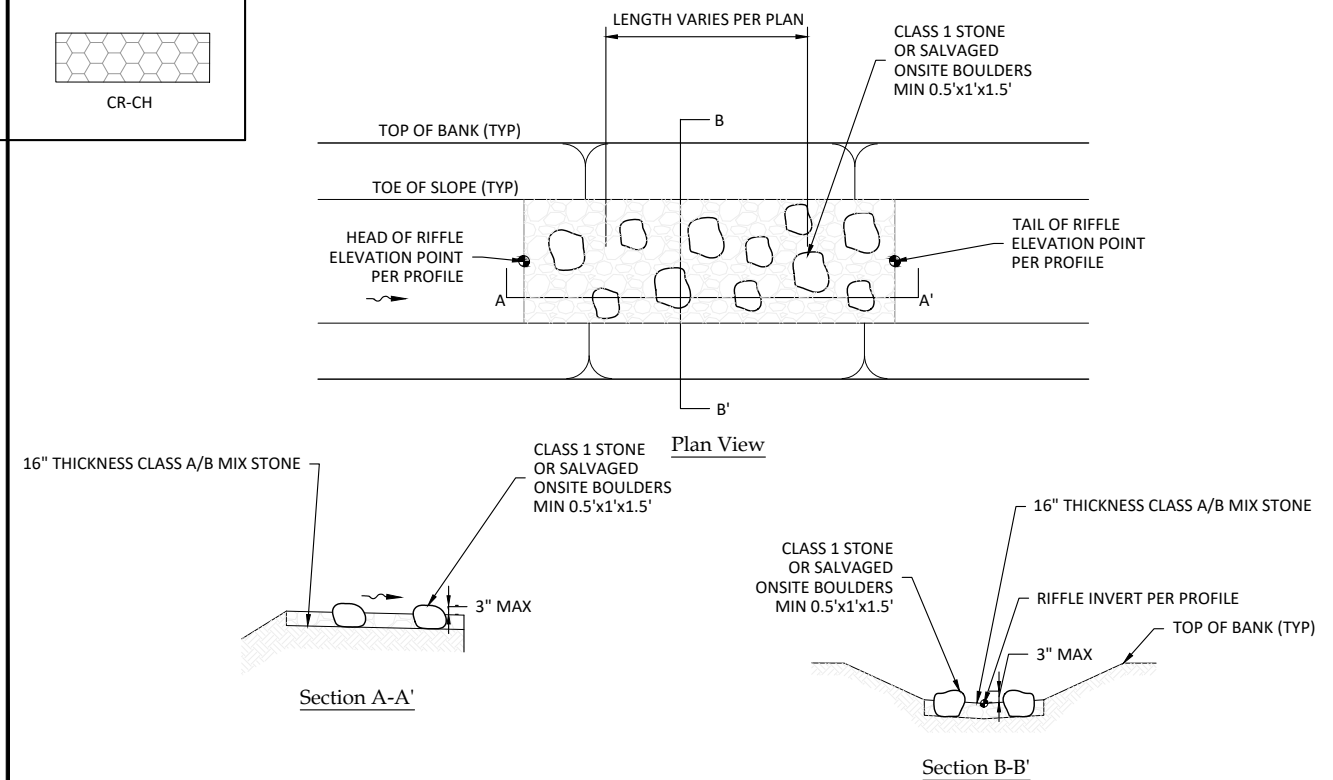


2  
6.1  
Woody Riffle  
Not to Scale



- NOTES:**
- STRUCTURES SHOULD VARY IN SIZE AND TYPE WITHIN EACH RIFFLE.
  - USE LOGS A MINIMUM OF 15" IN DIAMETER
  - ROCK MAY BE SUBSTITUTED FOR LOGS AT ENGINEER'S DISCRETION.

3  
6.1  
Jazz Riffle Structure  
Not to Scale



4  
6.1  
Chunky Riffle  
Not to Scale

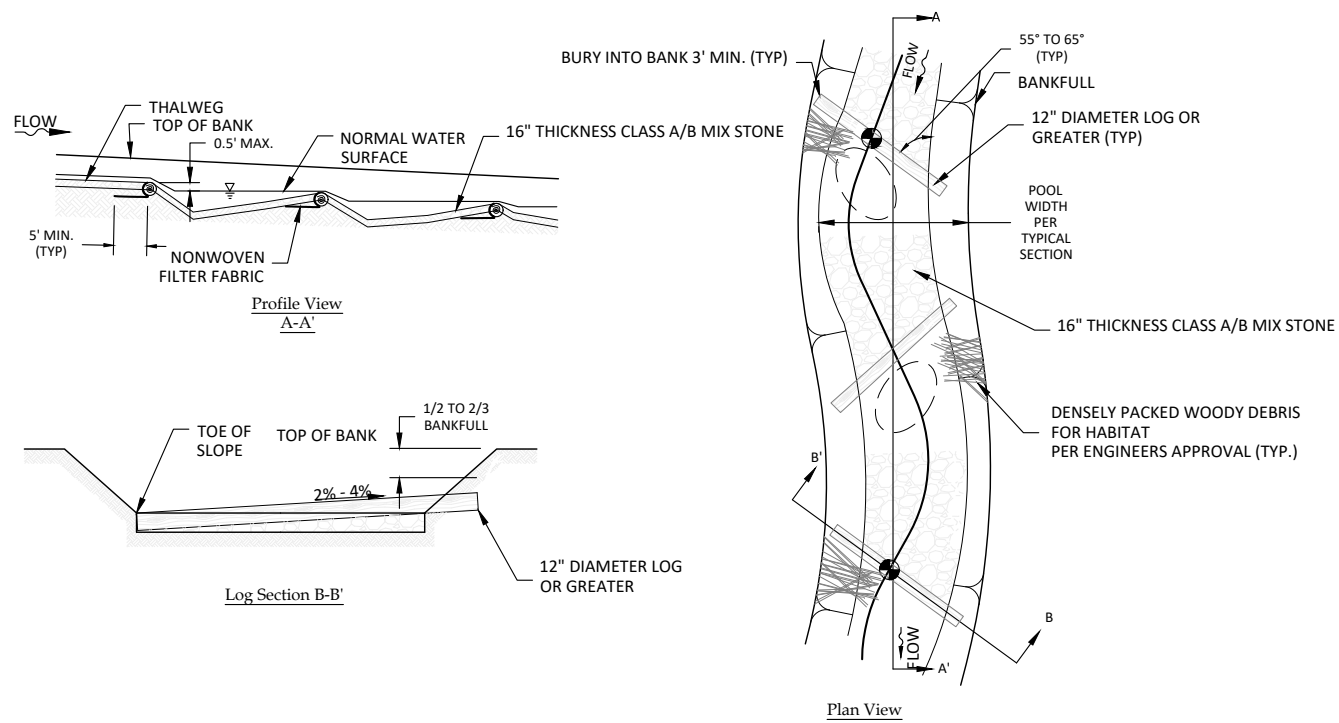
- NOTES:**
- IF ONSITE LARGE STONE IS NOT AVAILABLE FOR BOULDERS RIFFLE SHOULD BE CHANGED TO JAZZ RIFFLE OR OTHER PER ENGINEER'S DIRECTION.

Revisions:


Date: January 23, 2018  
Job Number: 005-02102  
Project Engineer: ASE  
Drawn By: SJD  
Checked By: JCK



March 2, 2012  
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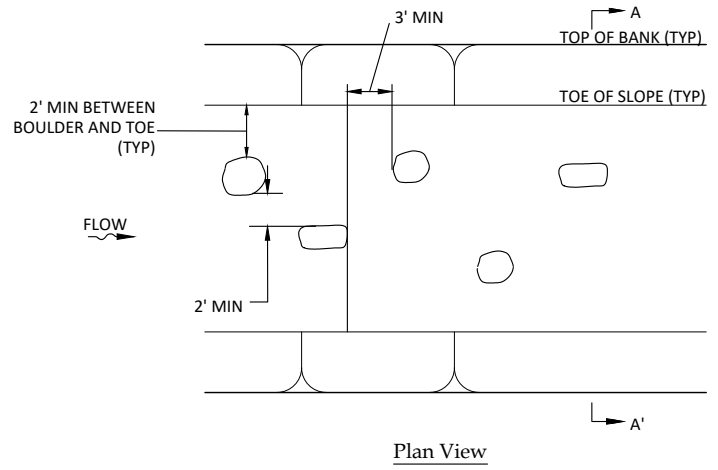


**NOTES:**

- BOULDER MATERIAL CAN BE SUBSTITUTED IN PLACE OF ANGLED LOGS WITH APPROVAL OF ENGINEER.

1  
6.2 **Angled Log Riffle**  
Not to Scale

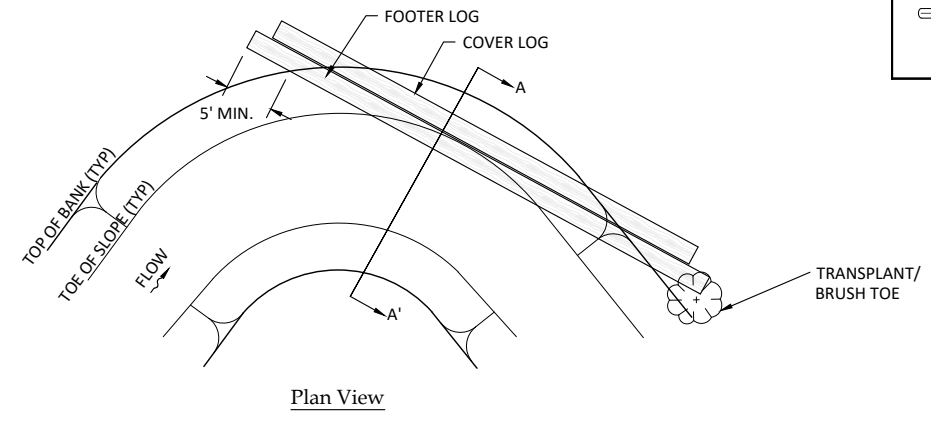
CR-AL	



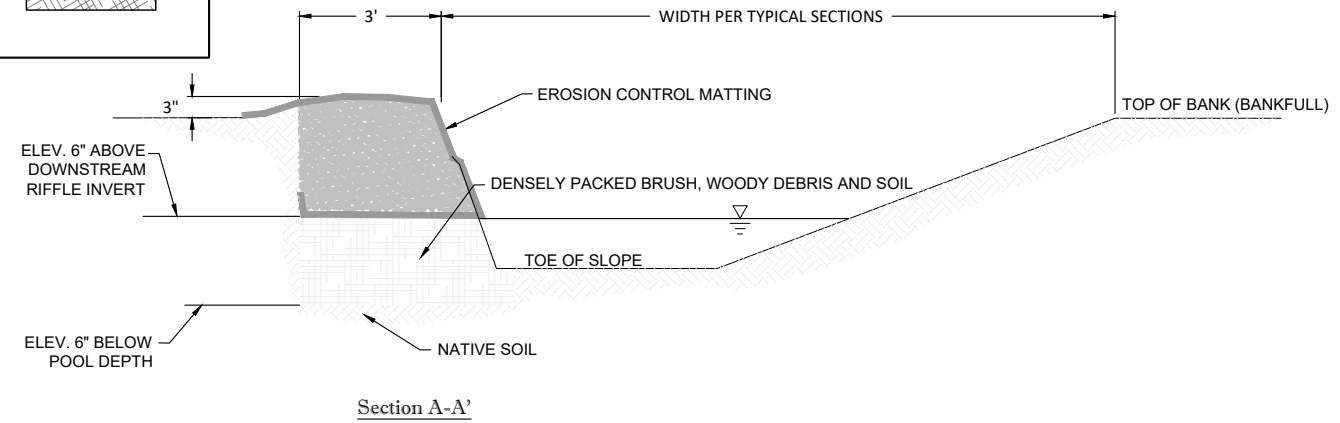
**NOTES:**

- MAX BOULDER SIZE: 1' x 1.5' x 2'

2  
6.2 **Boulder Cluster Riffle**  
Not to Scale



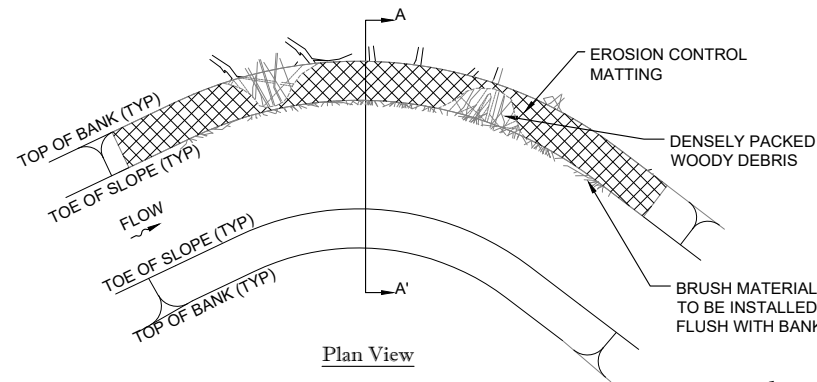
3  
6.2 **Lunker Log**  
Not to Scale



**NOTES:**

- OVER EXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
- INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE AND SOIL TO FILL ANY VOID SPACE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
- BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
- INSTALL MATTING OVER BRUSH/WOODY DEBRIS.
- INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
- SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.

4  
6.2 **Brush Toe**  
Not to Scale



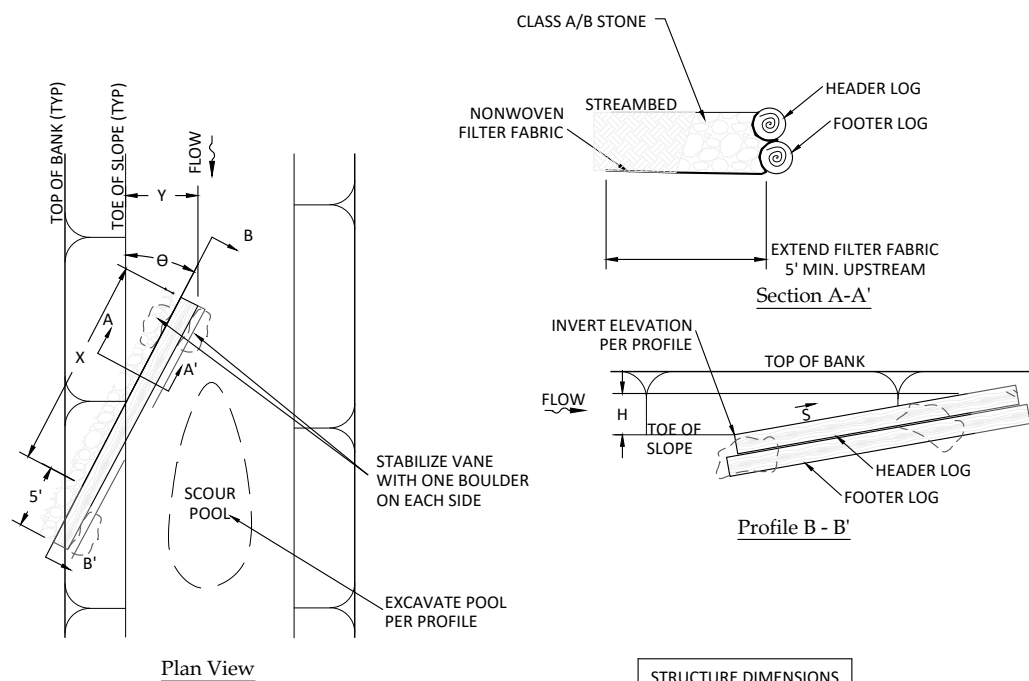
Revisions:	

Date: January 23, 2018  
Job Number: 005-02162  
Project Engineer: ASE  
Drawn By: SID  
Checked By: JCK

Date:	January 23, 2018
Job Number:	005-02162
Project Engineer:	ASE
Drawn By:	SD
Checked By:	JCK

6.3

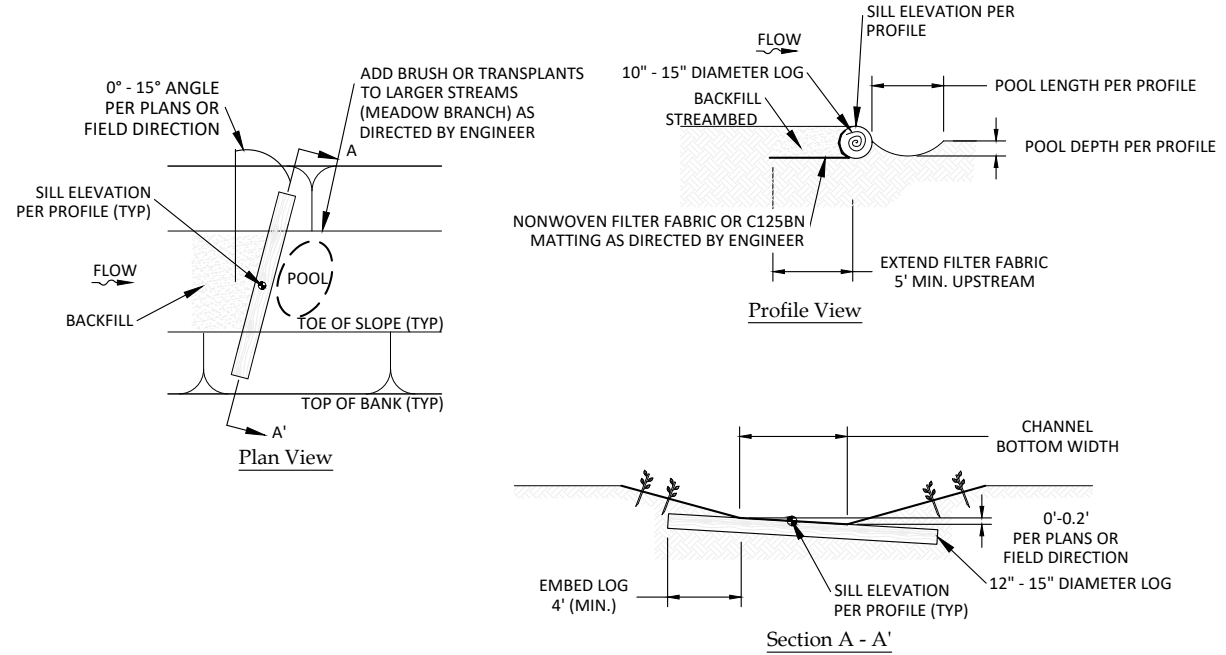
Sheet



STRUCTURE DIMENSIONS	
X (FT)	22.5
Y (FT)	4.5
H (FT)	1.3
S (%)	5.6
Θ (°)	25

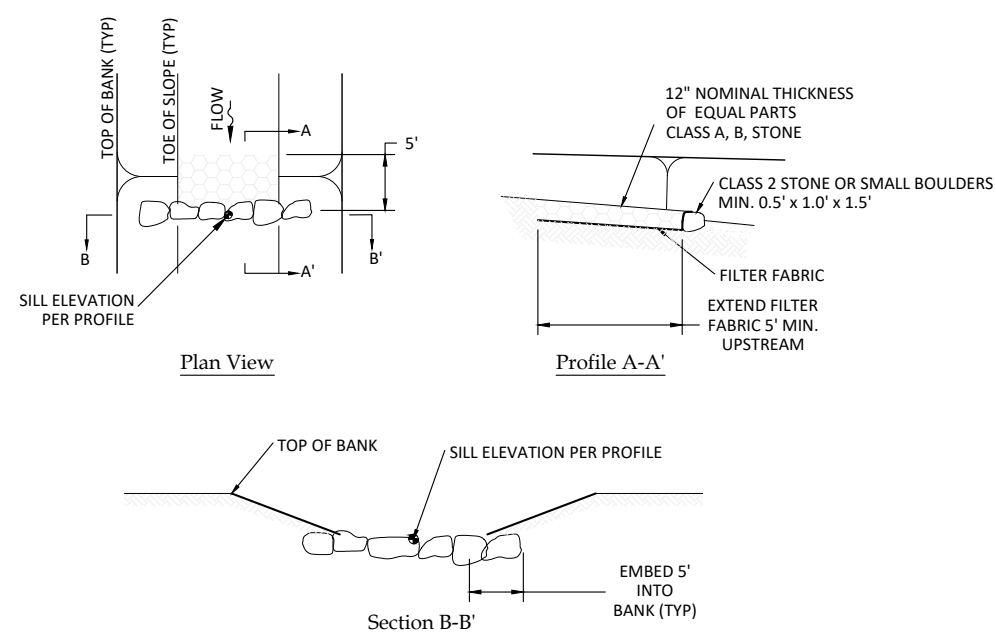
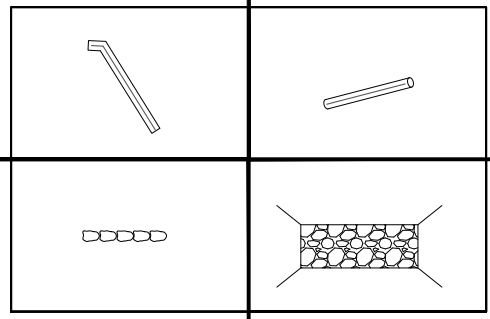
1 Log Vane  
 6.3 Not to Scale

**NOTES:**  
 • ON SMALLER STREAMS THE STABILIZATION BOULDER MAY BE REMOVED PER ENGINEER'S DISCRETION.

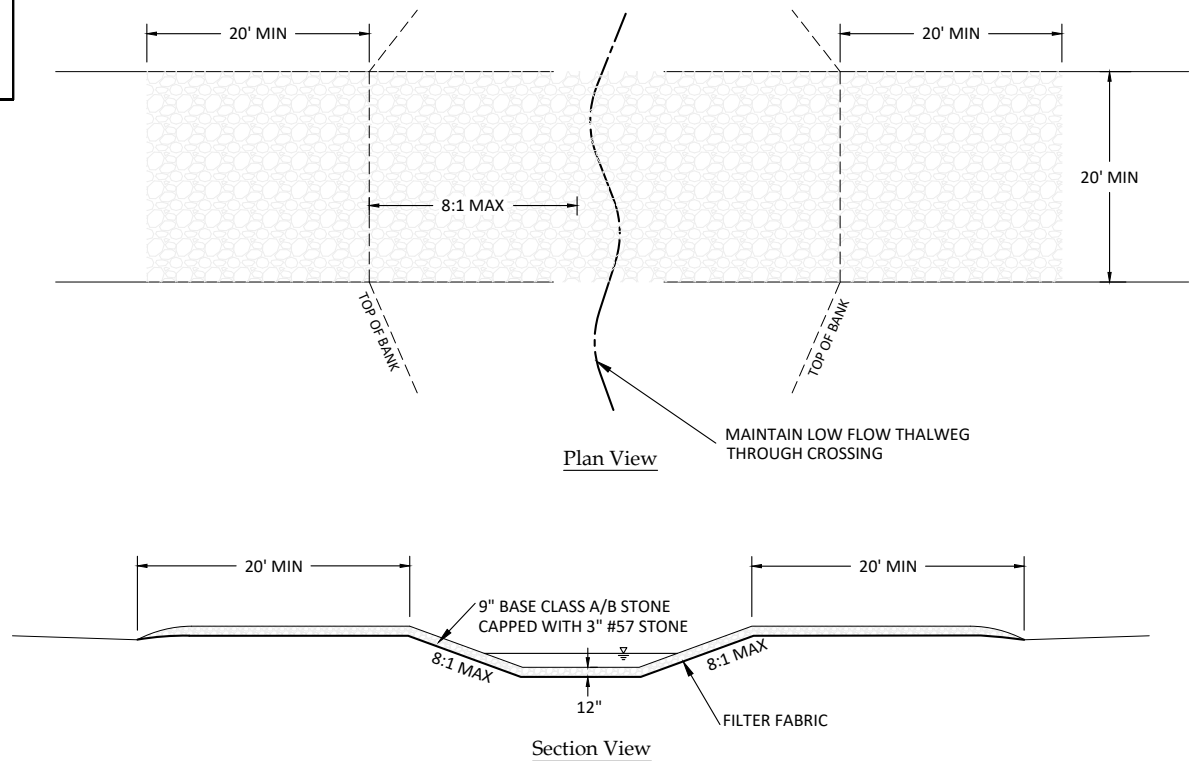


2 Log Sill  
 6.3 Not to Scale

**NOTES:**  
 • FOOTER LOG TO BE ADDED IF DROP IS MORE THAN HEADER LOG DIAMETER.



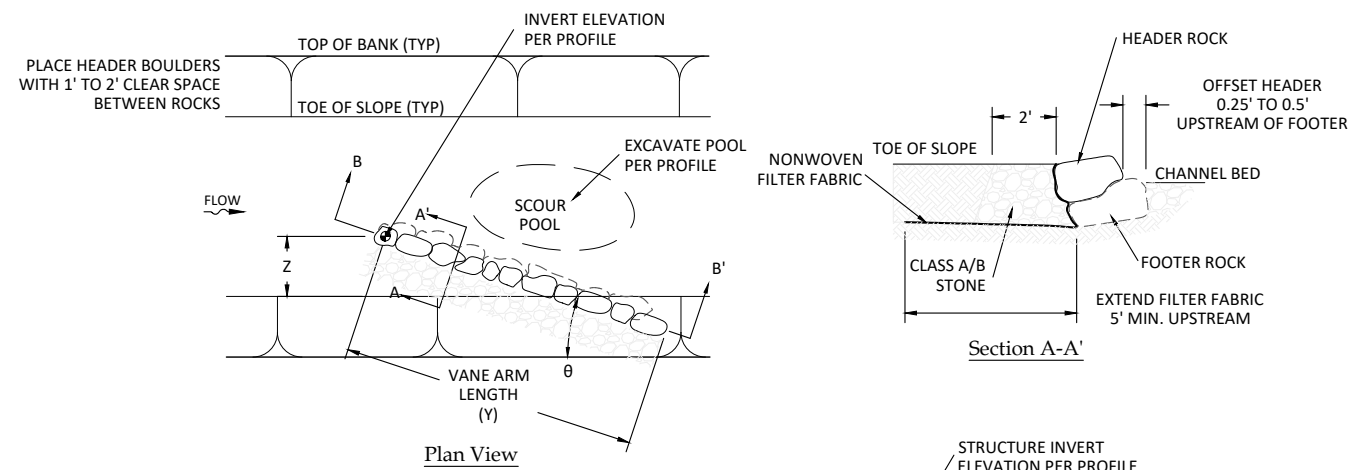
3 Rock Sill  
 6.3 Not to Scale



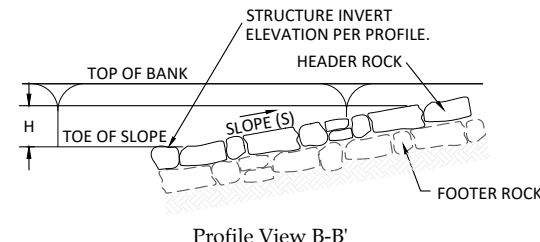
**NOTES:**  
 • FORD CROSSING SHALL BE INSTALLED PERPENDICULAR TO CHANNEL BANKS.

4 Permanent Ford Crossing  
 6.3 Not to Scale

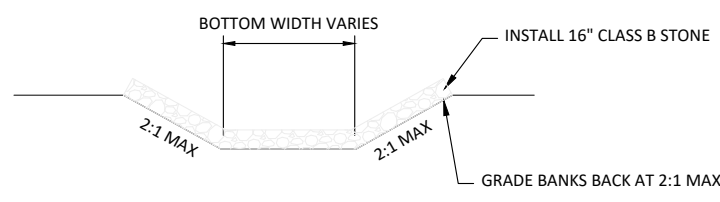
March 2, 2018  
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1  
6.4 Rock Vane  
Not to Scale

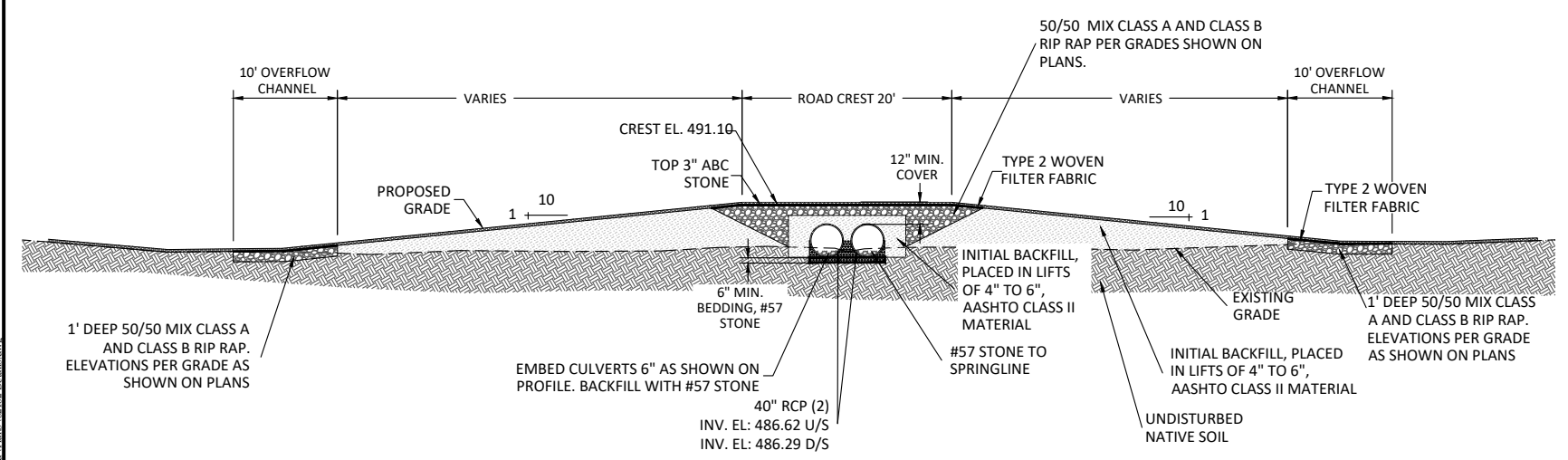
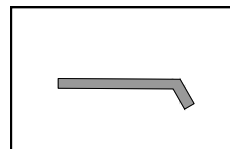


Profile View B-B'

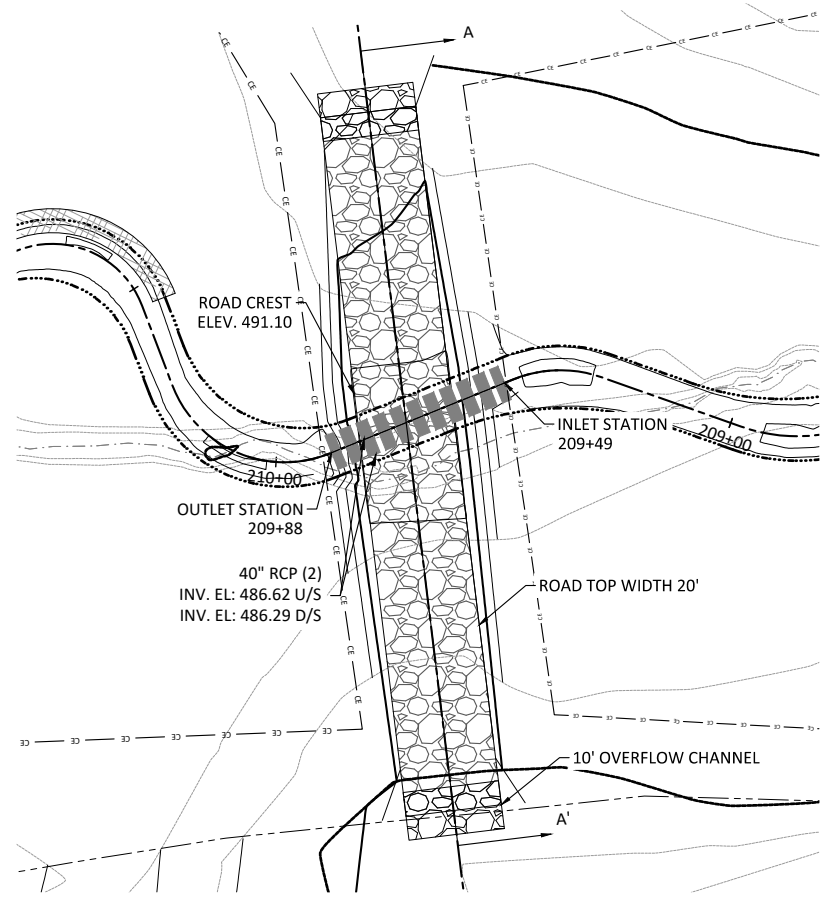


2  
6.4 Ditch Stabilization  
Not to Scale

- NOTES:
- POSITIVE DRAINAGE TO BE MAINTAINED FOR FLOODPLAIN DRAINAGES.
  - PROPOSED GRADING IN DRAINAGES PER PLAN.
  - GRADE BANKS BACK AT 2:1 MAX.



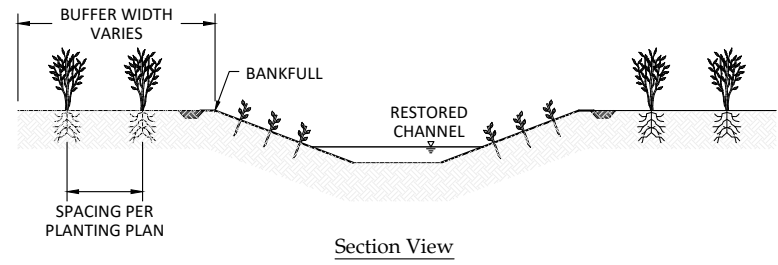
3  
6.4 Permanent Culvert Crossing  
(EF1 STA: 209+71)  
Not to Scale



Revisions:


Date: January 23, 2018  
Job Number: 005-02162  
Project Engineer: ASE  
Drawn By: SID  
Checked By: JCK

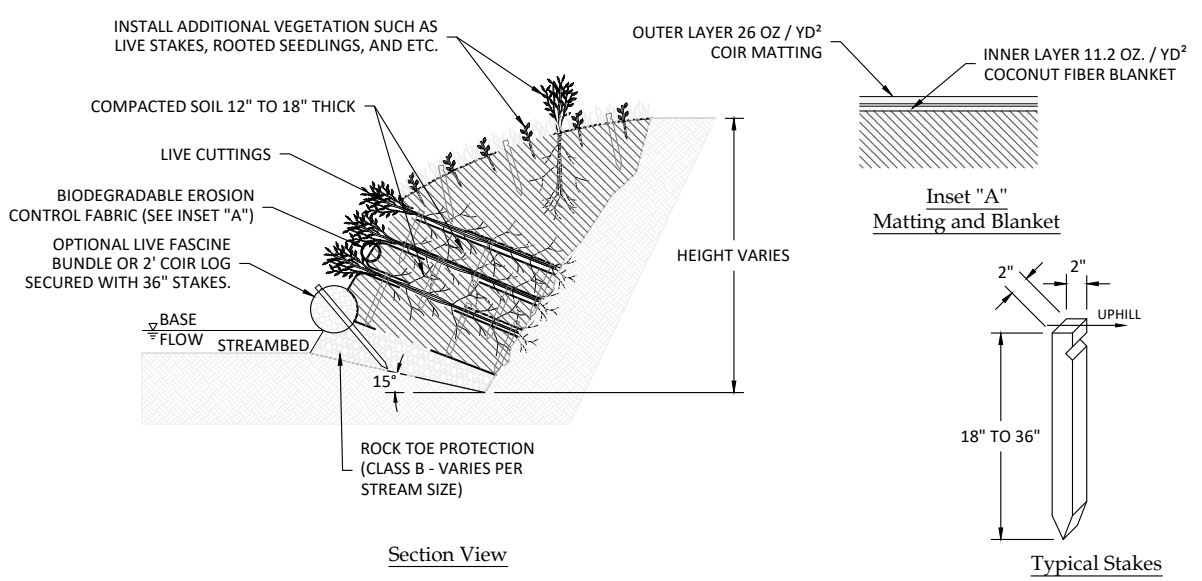
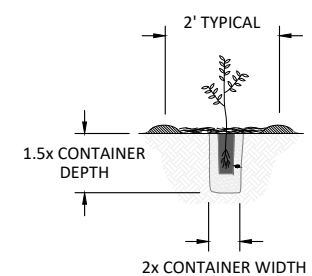
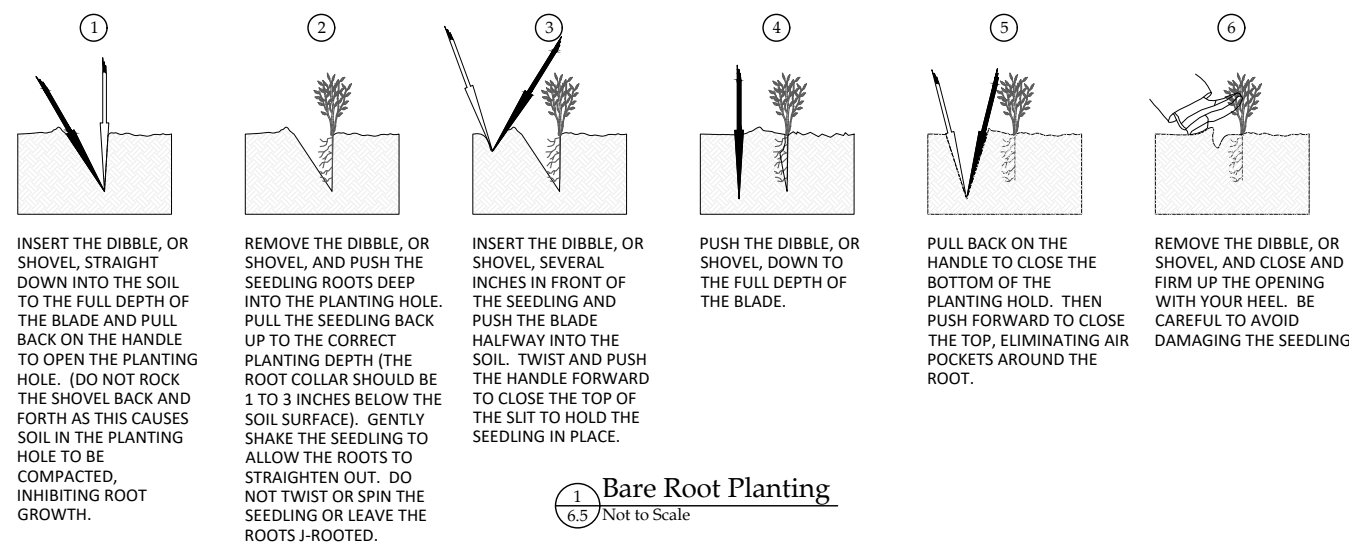
March 7, 2012  
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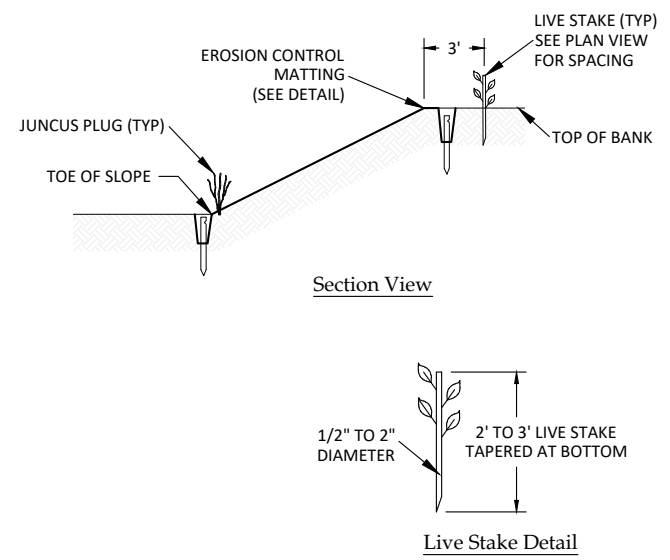
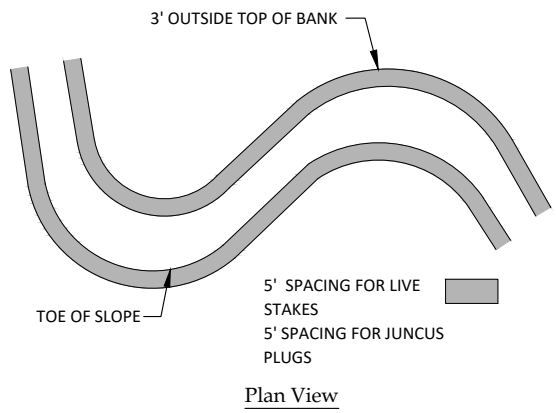
**DIBBLE BAR**  
PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS-SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.

**ROOTING PRUNING**  
ALL ROOTS SHALL BE PRUNED TO AN APPROPRIATE LENGTH TO PREVENT J-ROOTING.

- NOTES:**
1. ALL SOILS WITHIN THE BUFFER PLANTING AREA SHALL BE DISKED, AS REQUIRED, PRIOR TO PLANTING.
  2. ALL PLANTS SHALL BE PROPERLY HANDLED PRIOR TO INSTALLATION TO INSURE SURVIVAL.

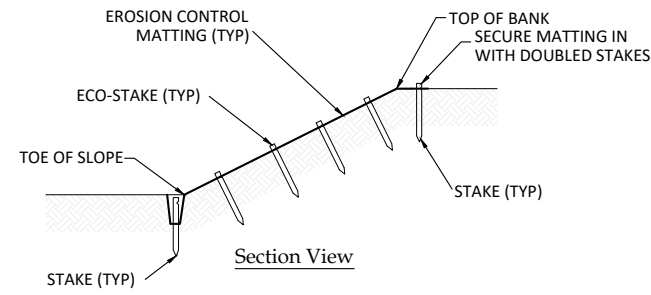
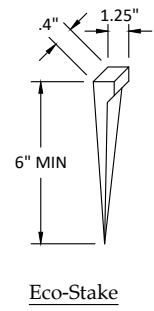
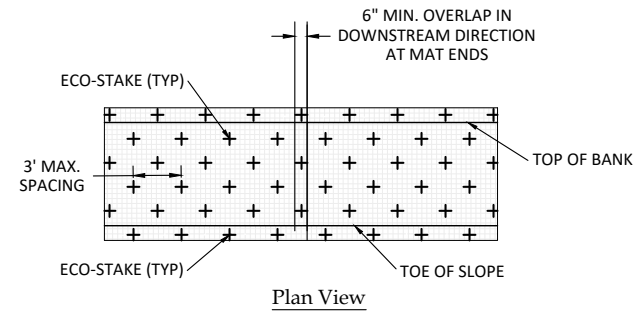


- NOTES:**
1. ROOTED/LEAFED CONDITION OF THE LIVING PLANT MATERIAL IS NOT REPRESENTATIVE OF THE TIME OF INSTALLATION.
  2. BOTTOM OF FIRST COMPACTED EARTH LIFT TO BE PLACED 6" ABOVE NORMAL BASEFLOW.
  3. NUMBER OF COMPACTED EARTH LIFTS TO VARY DEPENDING ON DESIGN TOP OF BANK HEIGHT.
- 3 Vegetated Soil Lift**  
6.5 Not to Scale

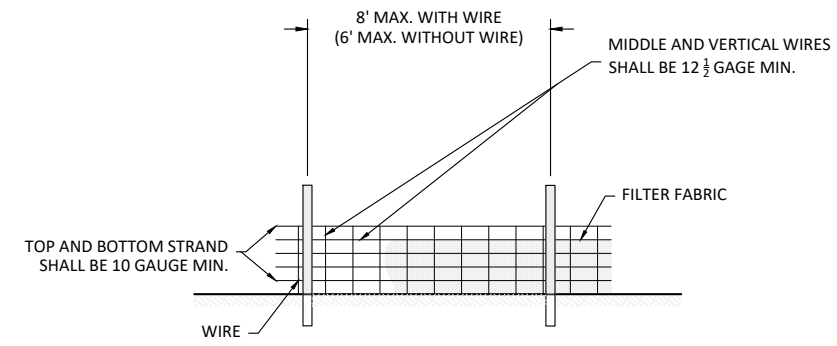


**4 Live Staking & Juncus Plugs**  
6.5 Not to Scale

- NOTES:**
- 1. LIVE STAKES TO BE PLANTED IN AREAS AS SHOWN ON PLANS AND DIRECTED BY THE ENGINEER.

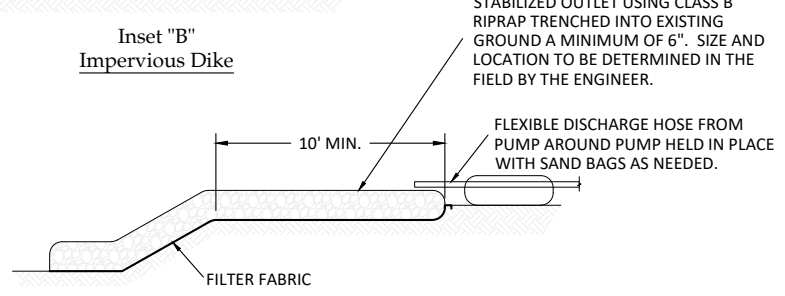
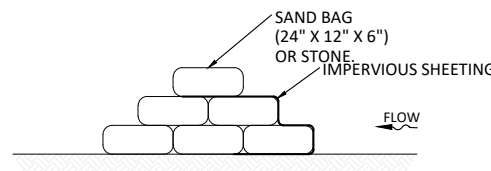
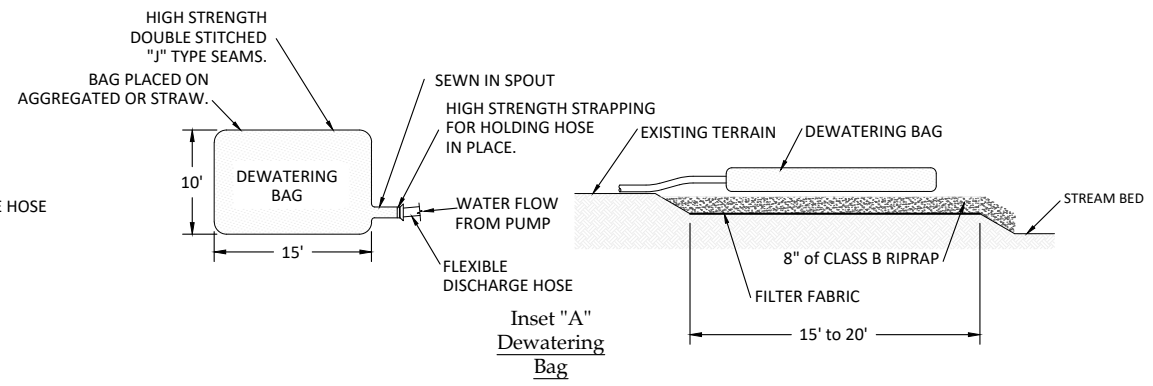
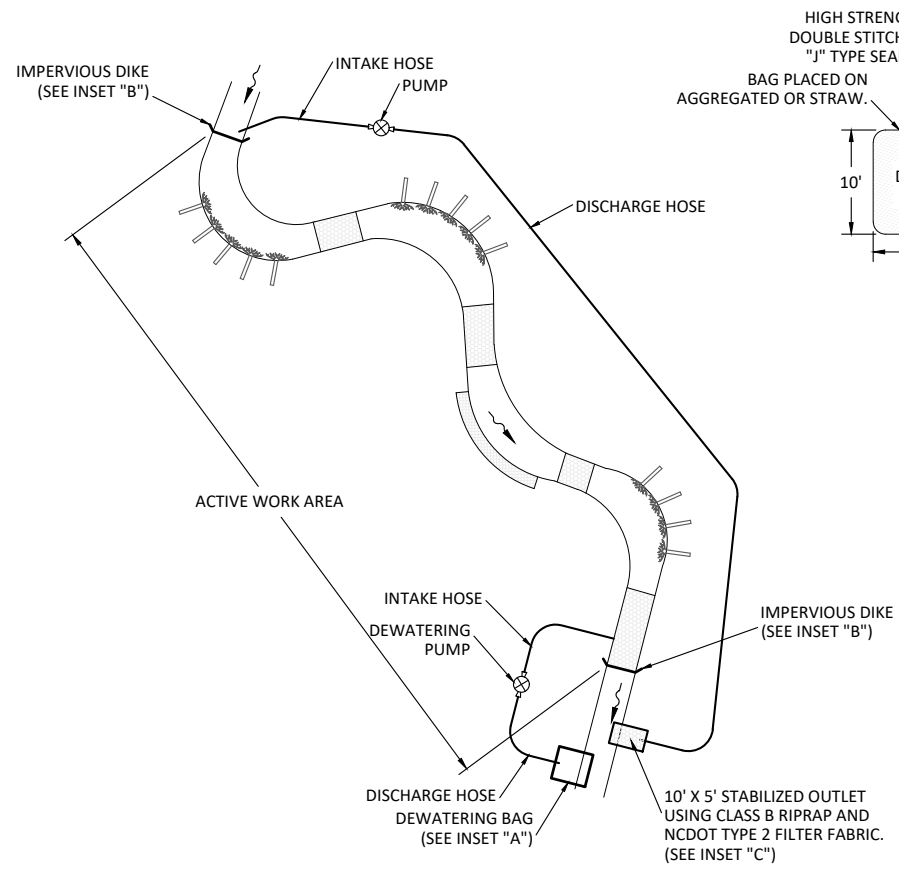


1  
6.6 Erosion Control Matting  
Not to Scale



2  
6.6 Temporary Silt Fence  
Not to Scale

- NOTES:**
- USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINES OF WIRES WITH 12" STAY SPACING.
  - USE FILTER FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE WIRES AS DIRECTED BY THE ENGINEER.
  - PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE. ANGLE STEEL TYPE.



STABILIZED OUTLET USING CLASS B RIPRAP TRENCHED INTO EXISTING GROUND A MINIMUM OF 6". SIZE AND LOCATION TO BE DETERMINED IN THE FIELD BY THE ENGINEER.

3  
6.6 Pump Around System  
Not to Scale

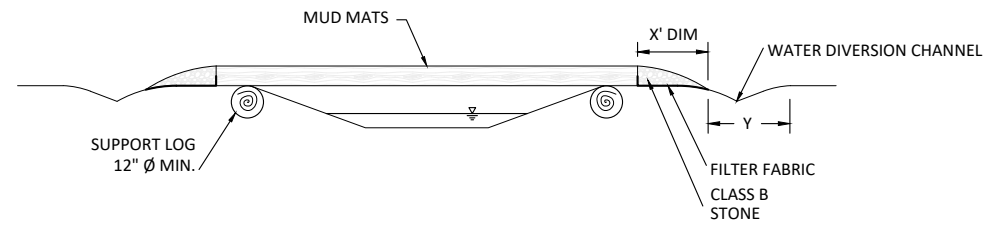
- NOTES:**
- PROVIDE STABILIZED OUTLET TO STREAMBED.

Revisions:


Date: January 23, 2018

Job Number:	005-02162
Project Engineer:	ASE
Drawn By:	SD
Checked By:	JCK



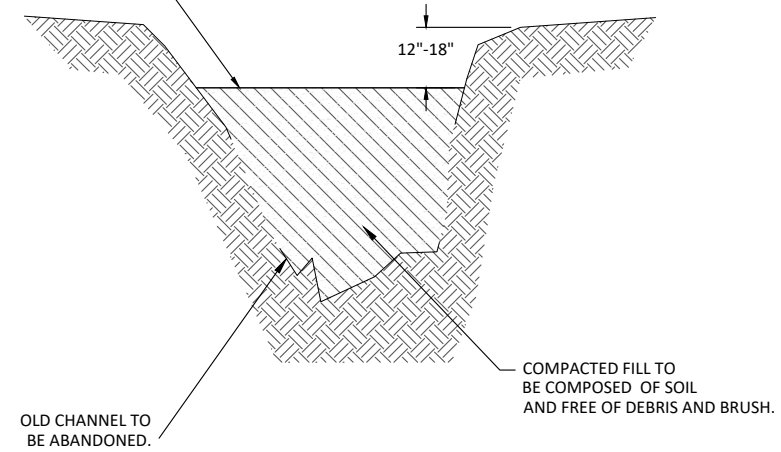


1  
6.7 Temporary Stream Crossing - Mud Mat  
Not to Scale

**NOTES:**

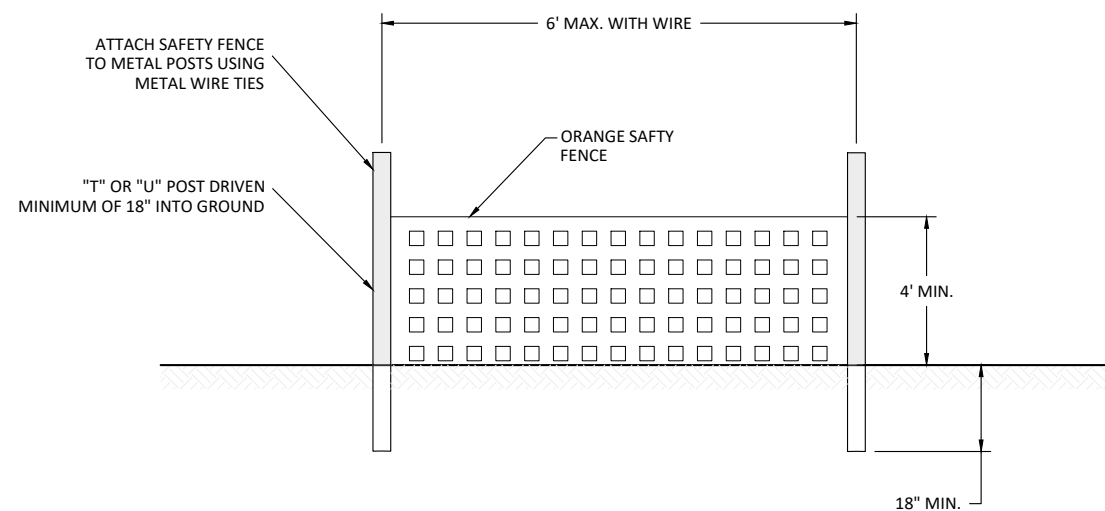
- CONSTRUCT STREAM CROSSING WHEN FLOW IS AT NORMAL BASEFLOW.
- MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
- INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
- MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
- STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
- CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.

SEED AND PLAN AS PER  
BUFFER RESTORATION SHEET



2  
6.7 Ephemeral Pool  
Not to Scale

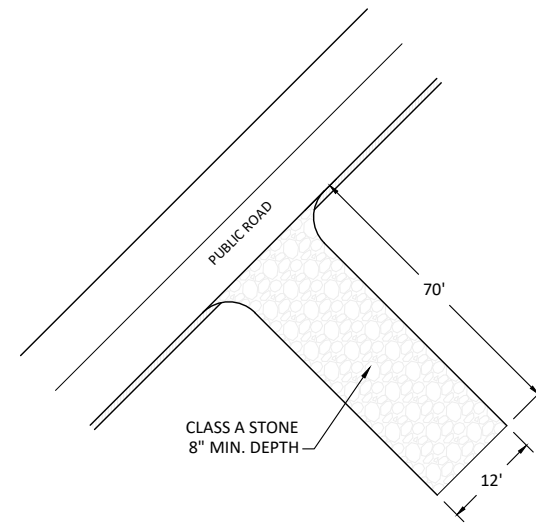
MATERIAL SPECIFICATIONS		
PHYSICAL PROPERTY	TESTS	REQUIREMENTS
MATERIAL	N/A	POLYETHYLENE
RECOMENDED COLOR	N/A	"INTERNATIONAL ORANGE"
TENSILE YIELD	ASTM D638	AVE. 2000 LBS. PER 4' WIDE
ULTIMATE TENSILE STRENGTH	ASTM D638	AVE. 2900 LBS. PER 4' WIDE
ELONGATION AT BREAK (%)	ASTM D638	GREATER THAN 1000%
CHEMICAL RESISTANCE	N/A	INERT TO MOST CHEMICALS AND ACIDS



3  
6.7 Safety Fence  
Not to Scale

Revisions:

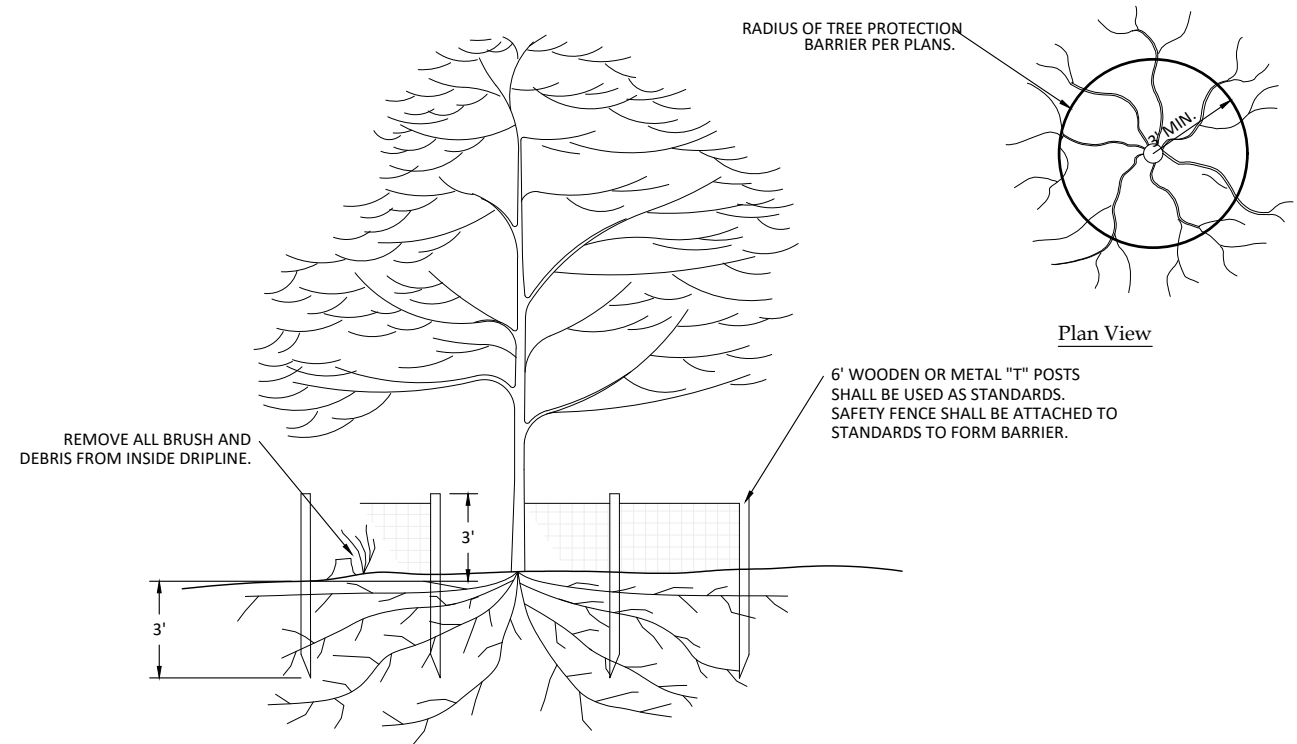

Date: January 23, 2018  
Job Number: 005-02162  
Project Engineer: ASE  
Drawn By: STD  
Checked By: JCK



1  
6.8 Construction Entrance  
Not to Scale

**NOTES:**

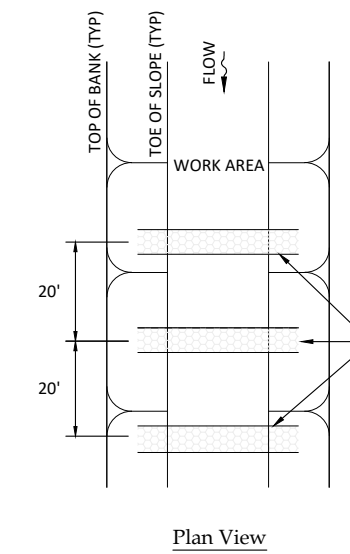
- PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
- LOCATE CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
- MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
- ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED IMMEDIATELY.
- USE CLASS A STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
- PLACE FILTER FABRIC BENEATH STONE.



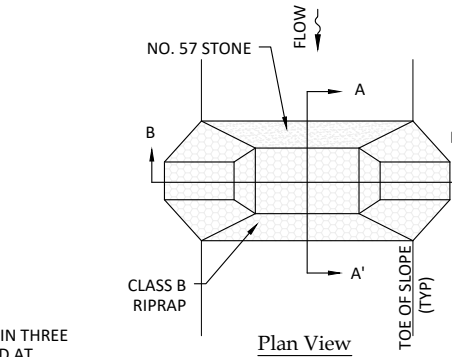
2  
6.8 Tree Protection  
Not to Scale

**NOTES:**

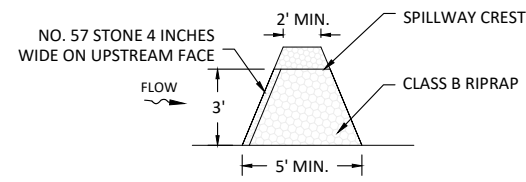
- ALL TREE PROTECTION BARRIERS SHALL BE REMOVED PRIOR TO CONTRACTOR DEMOBILIZATION.
- SEE PLANS FOR LOCATION OF ALL TREE PROTECTION BARRIERS.



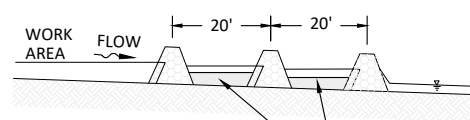
Plan View



Plan View

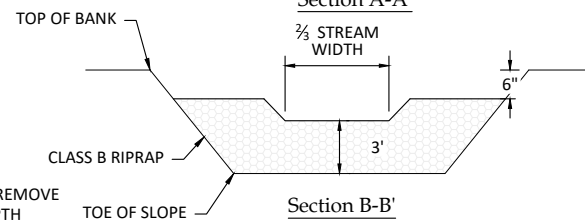


Section A-A'



Profile View

CONTRACTOR SHALL REMOVE SEDIMENT WHEN DEPTH REACHES 12".



Section B-B'

3  
6.8 Temporary Rock Sediment Dam  
Not to Scale

Revisions:


Date: January 23, 2018

Job Number:	005-02162
Project Engineer:	ASE
Drawn By:	SD
Checked By:	JCK

APPENDIX 7  
INVASIVE SPECIES PLAN

## Appendix 7 Invasive Species Plan

Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. These site inspections may identify the presence of invasive vegetation. If, during the monitoring period, invasive species threaten the survivability of planted woody vegetation in an area that exceeds 1% of the planted easement acreage, the invasive species shall be treated. Smaller areas may be treated at the discretion of the project engineer and biologist, if deemed in the best interest of the Site. Generally, the treatment plan shall follow the below guidelines in Table 1 for common invasive species found in riparian areas; however, the treatment may be changed based on the professional judgement of the project engineer and biologist. For invasive species not listed in the below table that threaten the survivability of the planted woody vegetation, Wildlands shall notify DMS of the invasive species observed and the plan for treatment prior to treating the species. All invasive species treatment will be reported in the following year's monitoring plan.

**Table 1. Invasive Species Treatment – Deep Meadow Mitigation Site**

Invasive Species	Recommended Removal Technique
<p>Honeysuckle (<i>Lonicera japonica</i>)</p>	<p>Small infestations of <i>L. japonica</i> can be pulled by hand. Monitor to remove any re-sprouts. Care should be taken to bag and remove the plants, including mature fruits to prevent re-establishment. Large infestations of <i>L. japonica</i> will usually require a combination of cut stump and foliar herbicide treatments. Where vines have grown into the tree canopy, cut each stem as close to the ground as possible. Treat the freshly cut surface of the rooted stem with a 25 percent solution of glyphosate or triclopyr. Remove the twining vines to prevent them from girdling and killing desirable vegetation. Groundcovers of <i>L. japonica</i> can be treated with a foliar solution of 2 percent glyphosate or triclopyr plus a 0.5 percent non-ionic surfactant to thoroughly wet all the leaves.</p>
<p>Bradford pear (<i>Pyrus calleryana</i>)</p>	<p>Depending on the maturity of the <i>P. calleryana</i>, the easiest method to use and does not require any cutting is the basal bark method. The process uses of a mixed solution of 20-percent concentration of Garlon 4 (5 pints per 3-gallon mix) in 80-percent (20 pints per 3-gallon mix) mineral or vegetable oil, with a dye for observation purposes. Adding a 10-percent (2.5 pints per 1.5-gallon mix) pine oil-based additive such as Cide-Kick II, will help penetrate the bark. Applying a ready-to-use triclopyr, such as Pathfinder II, by spraying or painting the mixture on the tree trunk at least 12-24" in height around the entire circumference of the tree base alleviates potential damage to surrounding plants. This method is most effective during late winter-early spring months but the ground cannot be frozen and the bark must not be wet. Subsequent rain is inconsequential. The foliage method is effective by applying a 2-percent (8 ounces per 3-gallon mix) of glyphosate mixed with water and 0.5-percent (2 ounces per 3-gallon mix or per label) of a non-ionic surfactant to help penetrate the leaves. Using a 1.5-percent (8 ounces per 3-gallon mix) of Garlon 4 may also be used. This mixture must be applied to dry leaves and green stems; however, spray-drift damage to non-target species may occur. The air temperature should be between 65-85°F to ensure herbicide absorption and no precipitation for 12 hours. Another method, to avoid damage to surrounding stems and vegetation, requires cutting the tree as close to the base as possible and immediately apply a 25-percent (7.5 pints per 4.5-gallon mix) solution of glyphosate mixed with water or 20-percent (5 pints per 3-gallon mix) Garlon 4 plus 80-percent (20 pints per 3-gallon mix) oil dilutant, to the entire cut stump. Timing of the application is key since the tree will seal the cut area to attempt new growth; therefore, the application must be applied within 5-15 minutes after the cut. If cutting the tree is not an option, use a hand axe to make downward-angled cut into the sapwood around the tree trunk and apply a tablespoon of the prepare herbicide into the cut. With moist soil, young saplings and roots may be hand pulled.</p>



Invasive Species	Recommended Removal Technique
<p>Chinese Privet (<i>Ligustrum sinense</i>)</p>	<p>Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a glyphosate herbicide as a 3-percent solution (12 ounces per 3-gallon mix) in the late fall or early winter when safety to surrounding vegetation is desired, or elsewhere, Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix). Backpack mist blowers can broadcast glyphosate as a 3-percent solution (12 ounces per 3-gallon mix) or Escort XP* at 1 ounce per acre (0.2 dry ounces per 3-gallon mix and 10 gallons per acre) during winter for safety to dormant hardwoods. Summer applications of glyphosate may not be as effective as other times and require a higher percent solution. The best time for Arsenal AC* and Escort XP* is summer to fall. For stems too tall for foliar sprays and when safety to surrounding vegetation is desired, apply a basal spray of Garlon 4 as a 20-percent solution (5 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted); or undiluted Pathfinder II. Elsewhere, apply Stalker* as a 6- to 9-percent solution (1.5 to 2 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted) to young bark as a basal spray making certain to treat all stems in a clump; or cut and immediately treat the stump tops with Arsenal AC* as a 5-percent solution (20 ounces per 3-gallon mix) or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stump tops and sides with Garlon 3A or with a glyphosate herbicide as a 20-percent solution (5 pints per 3-gallon mix) in water with a surfactant. ORTHO Brush-B-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps and available in retail garden stores (safe to surrounding plants). For large stems, make stem injections using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or a glyphosate herbicide using dilutions and cut-spacings specified on the herbicide label (anytime except March and April). An EZ-Ject tree injector can help to reach the lower part of the main stem; otherwise, every branching trunk must be hack-and-squirt injected.</p>
<p>Johnson Grass (<i>Sorghum halepense</i>)</p>	<p>Recommended control procedures: Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (June to October with multiple applications applied to regrowth).</p> <ul style="list-style-type: none"> <li>• Recommendation for mature grass control: apply Outrider* as a broadcast spray at 0.75 to 2 ounces per acre (0.2 to 0.6 dry ounce per 3-gallon mix) plus a nonionic surfactant to actively growing Johnsongrass. For handheld and high-volume sprayers, apply 1 ounce of Outrider per 100 gallons of water plus a nonionic surfactant at 0.25 percent. Outrider is a selective herbicide that can be applied over the top of certain other grasses to kill Johnsongrass, or apply Plateau as a 0.25-percent solution (1 ounce per 3-gallon mix) when plants are 18 to 24 inches (45 to 60 cm) tall or larger.</li> <li>• Recommendation for seedling control: apply Journey as a 0.3-percent solution (1.2 ounces per 3-gallon mix) before Johnsongrass sprouts and when desirable species are dormant or apply a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) directed at the infestation.</li> </ul>





APPENDIX 8  
MAINTENANCE PLAN

## Appendix 8 Maintenance Plan

The site shall be visited semi-annually and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

**Table 1. Maintenance Plan – Deep Meadow Mitigation Site**

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Beaver activity will be monitored and beaver dams on project streams will typically be removed, at the discretion of the Designer, during the monitoring period to allow for bank stabilization and stream development outside of this type of influence.
Wetlands	Routine wetland maintenance and repair activities may include supplemental installations of target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour that adversely and persistently threatens wetland habitat or function.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species requiring treatment per the Invasive Species Treatment Plan (Appendix 9) shall be treated in accordance with that plan and with NC Department of Agriculture (NCDCA) rules and regulations.
Site boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.



APPENDIX 9  
CREDITING INFORMATION

## Appendix 9 - Credit Release Schedule

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

**Table A: Credit Release Schedule – Stream Credits – Deep Meadow Mitigation Site**

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met (additional 10% released at second bankfull event in a separate year)	10%	50% (60%)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	90% (100%)

**Table B: Credit Release Schedule – Wetland Credits – Deep Meadow Mitigation Site**

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70%



5	Fifth year monitoring report demonstrates performance standards are being met; Provided that all performance standards are met, the IRT may allow the DMS to discontinue hydrologic monitoring after the fifth year, but vegetation monitoring must continue for an additional two years after the fifth year for a total of seven years.	10%	80%
6	Sixth year monitoring report demonstrates performance standards are being met	10%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval	10%	100%

### 1.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by DMS without prior written approval of the DE upon satisfactory completion of the following activities:

- a. Approval of the final Mitigation Plan.
- b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
- c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
- d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

### 1.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.







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## MEETING NOTES

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MEETING: Post-Contract IRT Site Walk  
**DEEP MEADOW Mitigation Site**  
Yadkin 03040105; Union County, NC  
DEQ Contract No. 6887  
Wildlands Project No. 005-02162

DATE: Wednesday, July 20, 2016 @ 10:00 AM – 12:00 PM

LOCATION: McIntyre Road  
Wingate, NC 28174

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### Attendees

Todd Tugwell, USACE  
David Shaeffer, USACE  
Harry Tsomides, DMS Project Manager  
Paul Wiesner, DMS  
Shawn Wilkerson, Wildlands Engineering  
John Hutton, Wildlands Engineering  
Eric Neuhaus, Wildlands Engineering Assistant Project Manager

### Materials

- Wildlands Engineering Technical Proposal dated 3/15/2016 in response to DMS RFP 16-006785

### Meeting Notes

1. Overview of project from farm road entrance off of McIntyre Road in Wingate, NC.
2. Discussed proposed project approach for both wetland rehabilitation and re-establishment and stream enhancement and restoration. Site includes stream enhancement on Meadow Branch and UT3, stream restoration on UT1 and UT2, and wetland re-establishment and rehabilitation in the floodplain of Meadow Branch.
3. There was general discussion about the Hydric Soil Investigation done for the proposal stage by Michael Wood and Three Oaks Engineering. Soil units including hydric, hydric over hydric, non-hydric over hydric, and non-hydric were defined for potential wetland restoration areas on-site. IRT agreed with the overall information presented in the report and Wildlands noted this information would be used to guide overburden removal and delineation of wetland restoration areas during design.
4. The field walk began at the existing ford crossing along Meadow Branch. The group crossed Meadow Branch at the existing ford and observed high flow in the reach from precipitation the night before the meeting. The overall condition of Meadow Branch was discussed as well as the proposed enhancement. Wildlands noted that more significant bank repair work than might be typical of an enhancement two approach may be necessary on Meadow Branch.

5. The Meadow Branch floodplain was planted in corn approximately 8 to 10 feet tall. Wildlands extended an invitation to the IRT to set up another site visit in the fall after the corn in the floodplain has been harvested.
6. Wildlands was asked about the potential for drain tiles on the site. Currently it is difficult to tell with the floodplain in corn, but this winter after the corn is harvested a detailed inspection will be done for drain tiles.
7. The group continued along the perimeter farm road that follows the western proposed easement boundary to get an overview of topography and landscape position of the wetland restoration areas.
8. The group stopped at the upstream easement boundary for UT2 (just before the stream enters the active corn field) to look at the flow and overall condition of the channel. Todd, Shawn, and Harry walked upstream of project limits to look at the condition of UT2 in the wooded area upstream of the agricultural fields. UT2 had steady flow in the channel the day of the meeting.
9. There was general discussion around intermittent channels and swales. The IRT prefers that these do not comprise more than 20% of mitigation sites. Wildlands discussed our approach on limiting the amount of intermittent channels in projects, but also noted the benefit of including these areas if there is potential to eliminate major water quality stressors.
10. The field walk continued north along the western boundary of the proposed easement. The group looked at the current ditch network and area proposed for wetland re-establishment in the left floodplain of Meadow Branch. It was noted by both Wildlands and IRT that the ditch at the toe of slope is negatively effecting wetland hydrology in this area.
11. The group entered the corn field in the left floodplain of Deep Meadow and took a soil boring to look at in-situ soils and the possibility for wetland restoration. Overall, it was agreed upon by Wildlands and IRT that the soil in wetland 1 was hydric and that the proposed approach of wetland re-establishment is valid based on the existing ditch network, landscape position, and soil classification.
12. Overall the soils on-site are mapped as Chewacla but wetter areas are indicative of wehadkee inclusions.
13. The group continued into the potential reference wetland area on the parcel north of the proposed project parcel in the left floodplain of Meadow Branch (PIN 09043010). Wildlands plans to install a groundwater monitoring gage in this area for use during wetland design and monitoring but is waiting on landowner approval. The group observed established vegetation and in-situ soils and confirmed that the area was suitable for use as a reference wetland area for the project. The IRT noted that Meadow Branch in this area was not in a reference condition. Wildlands agreed and maintained that the stream would not be used as a reference for design.
14. Within the reference wetland area, there was general discussion about wetland design approach. Wildlands noted that hydrology performance criteria will be set based on an iterative process using a DRAINMOD hydrologic model and hydrology data from the proposed wetland reference area. Additionally, Wildlands noted one other potential reference wetland upstream of the project that will be considered as additional information for establishing hydrology performance criteria. The range of wetland hydroperiod for performance criteria was listed between 7.5% and 12% in the proposal documentation. Todd stated that the IRT would likely expect a higher hydroperiod for the proposed project area.
15. There was general discussion about the use of soil temperature probes to set the growing season for wetland hydroperiod. Wildlands and IRT agreed that the use of soil temperature probes can be valuable for obtaining information about the growing season, however, regardless of recorded soil temperatures, the beginning of the growing season should be set at a minimum of March 1.
16. Todd asked about anticipated grading for the removal of overburden material for wetland restoration. Wildlands noted that hydrology data will affect the amount of overburden removal, but it is anticipated that overburden removal would be required in wetland 1 (wetland in left floodplain at the downstream end of the project) but that grading in depressional wetland areas such as wetland 2 would not be

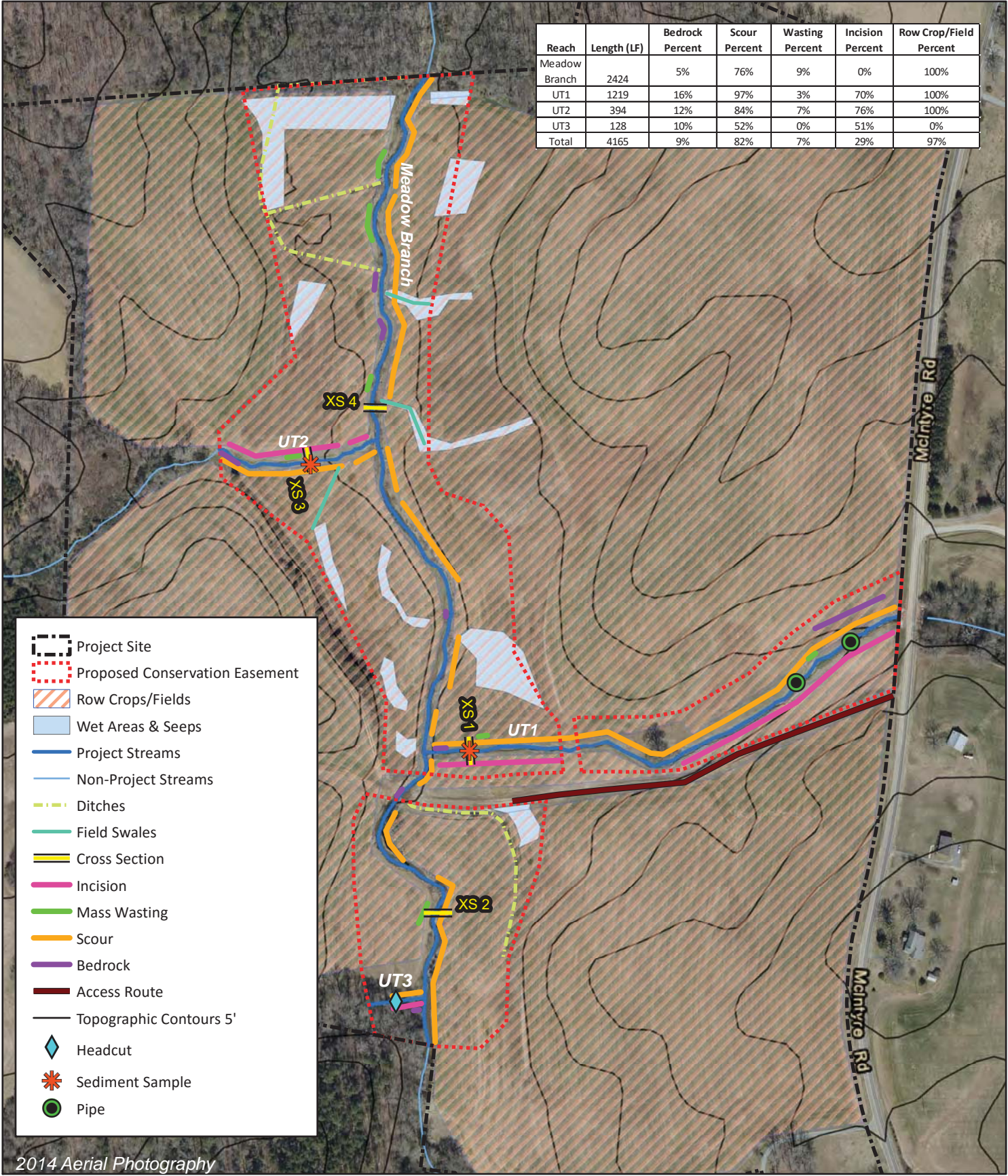


necessary. Generally, depressional wetland areas will not be graded but ditch networks will be plugged and depressional topography left. Corn growth in isolated depressional areas was stunted indicating a high water table.

17. The group walked back over to the east side of the site to observe the current condition of UT1. On the day of the site walk, UT1 had steady flow. Wildlands discussed why restoration was proposed on UT1 and it was agreed that this approach was appropriate. Wildlands noted that in some areas along UT1 the proposed channel may tie to the exiting channel to take advantage of existing grade control.
18. There was general discussion about the use of wood in slate belt streams, and how low flows could affect the longevity of grade control. Wildlands noted the concern and will consider this issue during design.
19. It was noted that easement breaks will remain at existing crossing locations along Meadow Branch and UT1.
20. David Shaeffer noted that Wildlands needs to ensure that Landowner Authorization forms are submitted with Jurisdictional Determination requests to ensure that USACE has all the proper paperwork for right of entry prior to site review. Additionally, it was discussed that the JD requests should be submitted via hardcopy to the Asheville office and that the Asheville office will pass it on to David within 7 to 10 business days. Once David receives the package from the Asheville office, a time and date for site review will be sent to Wildlands via email.







2014 Aerial Photography



Figure 2 Site Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



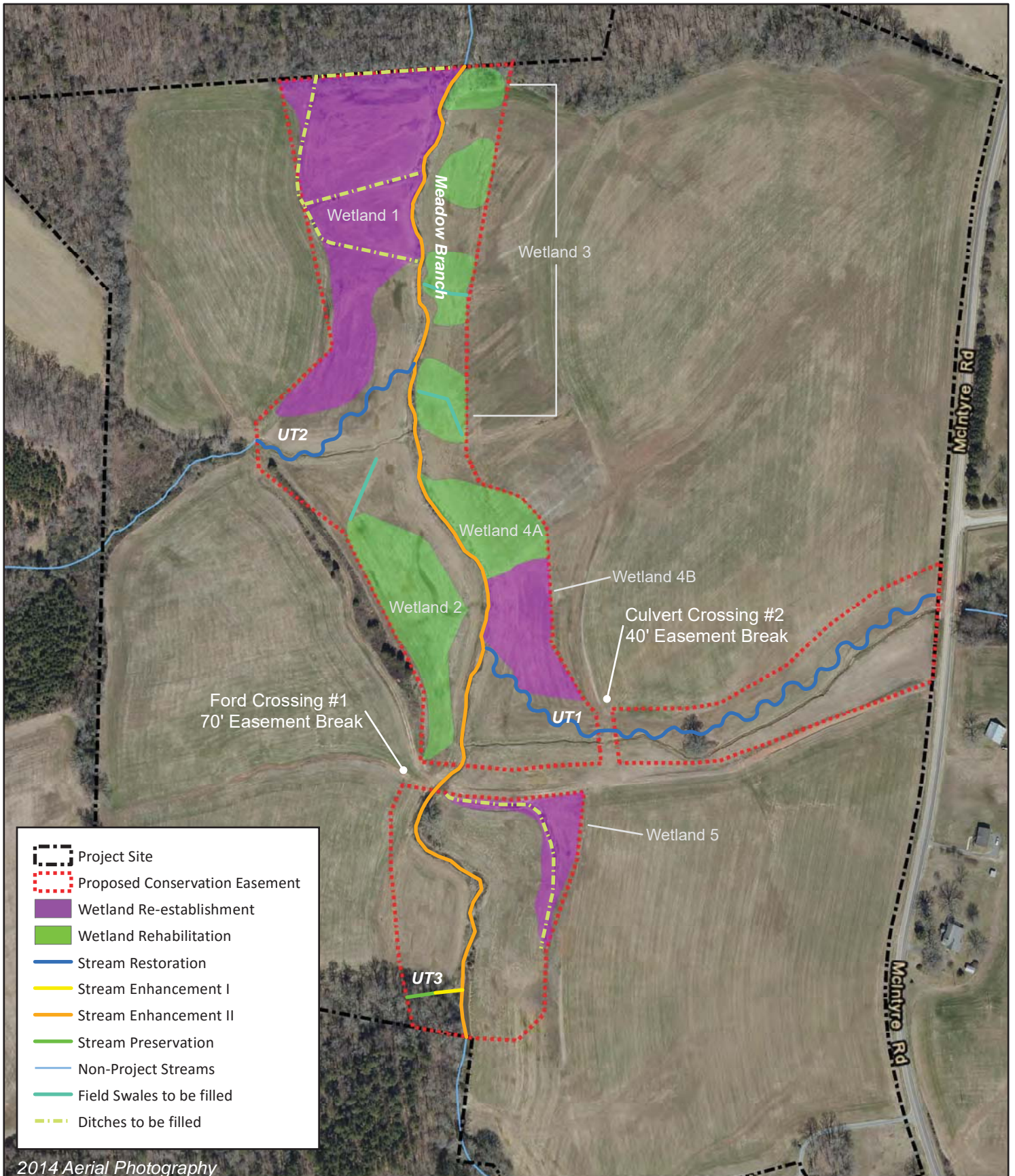


Figure 6 Concept Map  
 Deep Meadow Mitigation Site  
 Yadkin River Basin (03040105)



APPENDIX 10  
FINANCIAL ASSURANCE

## **Appendix 10      Financial Assurances**

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Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the US Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.



APPENDIX 11  
DMS FLOODPLAIN REQUIREMENTS CHECKLIST



## EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all DMS projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC DMS.

### Project Location

Name of project:	Deep Meadow Mitigation Site
Name if stream or feature:	Meadow Branch
County:	Union County
Name of river basin:	Yadkin
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Union County
DFIRM panel number for entire site:	5466
Consultant name:	Wildlands Engineering
Phone number:	704-332-7754
Address:	1430 S. Mint Street, Suite 104 Charlotte, NC 28203

## Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500".

Summarize stream reaches or wetland areas according to their restoration priority.

Wildlands Engineering, Inc. (Wildlands) is completing a full-delivery project for the North Carolina Division of Mitigation Services (DMS) to restore or enhance 4,298 linear feet (LF) of perennial streams, rehabilitate 0.6 acres of existing wetlands, and re-establish 8.2 acres of wetlands in Union County, NC. The project streams are summarized below.

Reach	Length
Meadow Branch	2,570 LF
Meadow Branch Tributary 1	1,201 LF
WF1	136 LF
WF2	391 LF

Meadow Branch and Meadow Branch Tributary 1 are mapped in a Zone AE Special Flood Hazard Area (SFHA) on Union County Flood Insurance Rate Map Panel 5466. Base flood elevations have been defined but non-encroachment limits have not been established. WF1 and WF2 do not have designated SFHAs but do lie within the SFHA of Meadow Branch.

## Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)? <input checked="" type="radio"/> Yes <input type="radio"/> No
If project is located in a SFHA, check how it was determined: <input type="checkbox"/> Redelineation <input type="checkbox"/> Detailed Study <input checked="" type="checkbox"/> Limited Detail Study <input type="checkbox"/> Approximate Study <input type="checkbox"/> Don't know
List flood zone designation:
Check if applies: <input checked="" type="checkbox"/> AE Zone <input type="radio"/> Floodway <input checked="" type="radio"/> Non-Encroachment <input type="radio"/> None



<input type="checkbox"/> A Zone <input type="radio"/> Local Setbacks Required <input type="radio"/> No Local Setbacks Required
<p>If local setbacks are required, list how many feet:</p>
<p>Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?</p> <p><input type="radio"/> Yes                      <input checked="" type="radio"/> No</p>
<p>Land Acquisition (Check)</p> <input type="checkbox"/> State owned (fee simple) <input type="checkbox"/> Conservation easement (Design Bid Build) <input checked="" type="checkbox"/> Conservation Easement (Full Delivery Project) <p>Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)</p>
<p>Is community/county participating in the NFIP program?</p> <p><input checked="" type="radio"/> Yes                      <input type="radio"/> No</p> <p>Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000)</p>
<p>Name of Local Floodplain Administrator: Mr. Brian Hawkins  Phone Number: 704.283.3642</p>

**Floodplain Requirements**

This section to be filled by designer/applicant following verification with the LFPA

- No Action
- No Rise
- Letter of Map Revision
- Conditional Letter of Map Revision
- Other Requirements

<p>List other requirements: Local floodplain development permit application to be filed with no-impact certification and flood impact assessment report.</p>
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Comments:

Name: Aaron Earley, PE, CFM Signature: *Aaron S. Earley*

Title: Senior Water Resources Engineer Date: 01/25/2018