MONITORING YEAR 1 ANNUAL REPORT

FINAL

DEEP MEADOW MITIGATION SITE

Union County, NC
DEQ Contract No. 6887
DMS Project No. 97131
USACE Action ID No. SAW-2012-01107
NCDEQ DWR Certification No. 18-0264

Yadkin River Basin
HUC 03040105

Data Collection Period: August 2020 – November 2020
FINAL Submission Date: January 8, 2021

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street; 3rd Floor
Raleigh, NC 27603

Mitigation Project Name	**Deep Meadow Mitigation Site**	**USACE Action ID**	**2012-01107**
DMS ID	**97131**	**DWR Permit**	**2018-0264**
River Basin	**Yadkin**	**Date Project Instituted**	**5/3/2016**
Cataloging Unit	**03040105**	**Date Prepared**	**4/24/2020**
County	**Union**	**Stream/Wet. Service Area**	**Yadkin 03040105**

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Date: 2020.06.03 10:26:02 -04'00'

Signature of Official Approving Credit Release

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the initial credit release milestone occurs when the as-built report (baseline monitoring report) has been approved by the NCIRT and posted to the NCDMS Portal, provided the following criteria have been met:

1) Approved of Final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.
4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	**Warm Stream Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	851.680	0.000	851.680	2020	4/24/2020
3 - Year 1 Monitoring	10.00%					2021	
4 - Year 2 Monitoring	10.00%					2022	
5 - Year 3 Monitoring	10.00%					2023	
6 - Year 4 Monitoring	5.00%					2024	
7 - Year 5 Monitoring	10.00%					2025	
8 - Year 6 Monitoring	5.00%					2026	
9 - Year 7 Monitoring	10.00%					2027	
Stream Bankfull Standard	10.00%						
			Totals		851.680		

Total Gross Credits	2,838.933
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	851.680
Total Percentage Released	30.00%
Remaining Unreleased Credits	1,987.253

Credit Release Milestone	**Riparian Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	2.576	0.000	2.576	2020	4/24/2020
3 - Year 1 Monitoring	10.00%					2021	
4 - Year 2 Monitoring	10.00%					2022	
5 - Year 3 Monitoring	15.00%					2023	
6 - Year 4 Monitoring	5.00%					2024	
7 - Year 5 Monitoring	15.00%					2025	
8 - Year 6 Monitoring	5.00%					2026	
9 - Year 7 Monitoring	10.00%					2027	
Stream Bankfull Standard	N/A	N/A	N/A	N/A		N/A	N/A
			Totals		2.576		

Total Gross Credits	8.587
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2.576
Total Percentage Released	30.00%
Remaining Unreleased Credits	6.011

December 30, 2020

Mr. Harry Tsomides
NC Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Dr., Suite 102
Asheville, NC 28801

RE: Deep Meadow Mitigation Site-Year 1 Monitoring Report
Final Submittal for DMS
Contract Number 006887, DMS# 97131
Yadkin River Basin – HUC 03040105; Union County, NC

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments and observations from the Deep Meadow Mitigation Site Draft Year 1 Monitoring Report. The report text has been revised for the final draft to reflect the most current condition of the site. The following are your comments and observations from the report and are noted in **Bold**. Wildlands' response to those comments are noted in *Italics*.

DMS Comment: Appendix 6- Please include written responses to the IRT comments from the 6/3/2020 IRT email indicating Initial Credit Release approval. These are referenced in the text however there should be a response letter coupled with the comment letter.

Wildlands Response: A comment response to the IRT email indicating Initial Credit Release approval has been included in Appendix 6.

DMS Comment: Please update the asset tables to reflect the MY0/baseline report format. (Project Components, Length and Area Summations, and Overall Assets Summary).

Wildlands Response: The asset table matches the MY0/baseline report format.

DMS Comment: If the annual mean for the permanent plots is 482, and the annual mean for the mobile plots is 465, how could the overall annual mean be higher (559) as indicated? Please QAQC the table numbers.

Wildlands Response: The overall site annual mean was not calculated correctly in the draft report. The calculations have been QAQC'ed. The overall site annual mean for MY1 was 478. The text and appendices have been updated to reflect this change.

DMS Comment: Wildlands notes 10 bankfull events for 2020. While it was a wetter than normal year, if there an explanation of why such an unexpected number of apparent bankfull events occurred in 2020? Please consider confirming bankfull elevations in the field in MY2 due to so many recorded bankfull events.

Wildlands Response: While the occurrence of such a large number of bankfull events is uncommon, a definitive explanation, other than it being an unusually wet year and that systems lying in the slate belt tend to be flashier than those in other areas of the Piedmont, is unknown. In order to verify the above average bankfull occurrences at the Site, we reviewed the number of bankfull events that occurred at our other restoration sites located in Union County. Each of them also experienced an unusually high number of gaged bankfull events in 2020, ranging from 8 – 10+ occurrences. We feel confident that our results are accurate due to similar results experienced at other restoration sites in Union County and a similar pattern of bankfull occurrences among the stream gages on-site. In addition, there were multiple visual verifications of wrack lines, down vegetation, and alluvial deposition. However, we will re-confirm bankfull elevations at each gaged on-site riffle cross-section during the MY2 survey collection.

DMS Comment: Digital Support File Comments: Please submit monitoring photos as JPEGS.

Wildlands Response: The photographs have been converted to JPEGS.

DMS Comment: Digital Support File Comments: Please add the figure for Stream Gage #1 to the report.

Wildlands Response: The figure for Stream Gage #1 has been added to the report. Please note that the gage was accidentally installed above the bankfull elevation as reflected in the plot. Gage #1 will be lowered in the winter of 2020 to capture all events in MY2.

Enclosed please find two (2) hard copies of the Year 1 Final Monitoring Report and one (1) CD with all the final corrected electronic files for DMS distribution. Please contact me at 704-332-7754 x101 if you have any questions.

Sincerely,

Kristi Suggs
Senior Environmental Scientist
ksuggs@wildlandseng.com

PREPARED BY:

Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Phone: 704.332.7754
Fax: 704.332.3306

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) implemented a full-delivery stream and wetland mitigation project at the Deep Meadow Mitigation Site (Site) for the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS). The project restored, enhanced, and preserved a total of 4,365 linear feet (LF) of perennial stream in Union County, NC. In addition, the project rehabilitated 0.58 acres and re-established 8.26 acres of riparian wetlands. The Site is located within the DMS targeted watershed for the Yadkin River Basin HUC 03040105070060 and the NC Division of Water Resources (DWR) Subbasin 03-07-14. The project is providing 2,838.933 stream mitigation units (SMUs) and 8.647 wetland mitigation units (WMUs) for the Yadkin River Basin Hydrologic Unit Code (HUC) 03040105 (Yadkin 05).

The Site's immediate drainage area as well as the surrounding watershed has a long history of agricultural activity. Stream and wetland functional stressors for the Site were related to both historic and current land use practices. Major stream stressors for the Site included channel incision and widening, a lack of stabilizing riparian vegetation, a lack of bedform diversity and aquatic habitat, and agricultural related impacts such as channel manipulation or straightening and concentrated run-off inputs from agricultural fields. The primary stressors to the wetlands on the Site were 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 effects of these stressors resulted in channel instability, loss of floodplain connection, degraded water quality, and the loss of both aquatic and riparian habitat throughout the Site's watershed when compared to reference conditions. The project approach for the Site focused on evaluating the Site's existing functional condition and evaluating its potential for recovery and need for intervention.

The project goals defined in the Mitigation Plan (Wildlands, 2018) were established with careful consideration of 2009 Lower Yadkin Pee Dee River Basin Restoration Priorities (RBRP) goals and objectives to address stressors identified in the watershed through the implementation of stream restoration and enhancement activities and wetland re-establishment and rehabilitation activities, as well as riparian buffer re-vegetation. The established project goals include:

- Improve stream channel stability,
- Reconnect channels with historic floodplains and re-establish wetland hydrology and function in relic wetland areas,
- Improve in-stream habitat,
- Reduce sediment and nutrient inputs from adjacent agricultural fields,
- Restore and enhance native floodplain and wetland vegetation, and
- Permanently protect the project site from harmful uses.

The Site construction and as-built surveys were completed between September 2019 and November 2020. Monitoring Year (MY) 1 assessments and site visits were completed between August and November 2020 to assess the conditions of the project.

Overall, the Site has met the required stream and vegetation success criteria for MY1. The overall average planted stem density for the Site is 478 stems per acre and is on track to meet the MY3 requirement of 320 stems per acre. Geomorphic surveys indicate that cross-section bankfull dimensions closely match the baseline monitoring with some minor adjustments, and streams are functioning as intended. At least one bankfull event was documented on EF1, WF1, and WF2 since the completion of construction. Ten of the eleven groundwater gages met the wetland hydrology success criteria. The MY1 visual assessment identified a few areas of concern including populations of invasive plant species and

isolated areas of bank scour. Wildlands will continue to monitor these areas, and an adaptive management plan will be implemented as necessary throughout the seven-year monitoring period to benefit the ecological health of the Site.

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APPENDICES

Section 1: PROJECT OVERVIEW

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 Code (HUC) 03040105070060 and NC Division of Water Resources (DWR) Subbasin 03-07-14. Located in the Slate Belt within the Piedmont physiographic province (NCGS, 1985), the project watershed is dominated by agricultural and forested land.

The site contains Meadow Branch, three unnamed tributaries of Meadow Branch, two existing riparian wetlands and ten proposed riparian wetlands. The unnamed tributaries are referred to by Wildlands as West Fork 1 (WF1), West Fork 2 (WF2), and East Fork 1 (EF1). The existing wetlands are referred to as W-H1 and W-H2, while the proposed wetlands are named W-E1 through W-E10. 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. WF1 and WF2 are also located in unconfined valleys within the project. The two existing riparian wetlands are located in the floodplain of Meadow Branch at the toe of slope. The Site drains approximately 6.99 square miles of rural land.

Prior to construction activities, the Site had a history of crop production with on-site stream's adjacent floodplains altered for agricultural uses. These practices resulted in degraded in-stream habitat, sedimentation, and erosion. EF1 was re-routed to the edge of the valley and shortened to join Meadow Branch at a perpendicular angle. Existing wetlands were ditched to improve field drainage and cleared for row crops. Riparian buffers also exhibited a lack of stabilizing streamside vegetation due to agricultural practices. Pre-construction conditions are outlined in Table 4 of Appendix 1 and Table 6 of Appendix 2.

The final mitigation plan was submitted and accepted by DMS in January of 2018 and the IRT in May of 2018. Construction activities were completed in September 2019 by Land Mechanic Designs, Inc. Kee Mapping and Surveying completed the as-built survey in December 2019. Planting was completed following construction in January 2020 by Bruton Natural Systems, Inc. A conservation easement has been recorded and is in place on 23.8 acres. The project is providing 2,838.933 stream mitigation units (SMUs) and 8.590 wetland mitigation units (WMUs) for the Yadkin River Basin HUC 03040105. Annual monitoring will be conducted for seven years with close-out anticipated to commence in 2027 given the success criteria are met.

Directions and a map of the Site are provided in Figure 1 and project components are illustrated for the Site in Figure 2.

1.1 Project Goals and Objectives

The Site is providing numerous ecological benefits within the Yadkin Valley Basin. The project goals were established with careful consideration to address stressors that were identified in the DWR 2008 Yadkin River Basinwide Plan (NCDWR, 2008).

The following project specific goals and objectives outlined in the Mitigation Plan (Wildlands, 2018) include:

Goals	Objectives
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 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 steam plan form on East Fork 1 and West Fork 2 to promote development of mutually beneficial stream/wetland complex.
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.
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.
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.

1.2 Monitoring Year 1 Data Assessment

Annual monitoring for MY1 was conducted between August and November 2020, with hydrology data collected between January and mid-November 2020, to assess the condition of the project. The stream, vegetation, and hydrologic success criteria for the Site follows the approved success criteria presented in the Deep Meadow Mitigation Plan (Wildlands, 2018).

1.2.1 Vegetation Assessment

Vegetation plot monitoring is being conducted in post-construction monitoring years 1, 2, 3, 5, and 7. Permanent plots are monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008) and the 2016 USACE Stream and Wetland Mitigation Guidance to assess the vegetation success. A total of 12 permanent vegetation plots were established within the project easement area using 10-meter by 10-meter square plots. In addition, 4 mobile vegetation plots were established in monitoring year 1 throughout the planted conservation easement to evaluate the random vegetation performance for the Site. These plots will be subsequently reestablished in different random locations in monitoring years 2, 3, 5, and 7. Mobile vegetation plot assessments will document stems, species, and height using 100-meter^2 circular, square, or rectangular plots. The final vegetative performance standard will be the survival of 210 planted stems per acre in the planted riparian areas at the end of the required seven-year monitoring period. The interim measure of vegetative success for the Site will be the survival of at least 320 planted stems per acre at the end of MY3 and at least 260 stems per acre at the end of MY5.

The MY1 vegetation survey was completed in August 2020, resulting in an average planted stem density of 478 stems per acre for all monitored permanent and mobile vegetation plots. The Site is on track to meet the interim MY3 requirement of 320 planted stems per acre, with all plots (100%) individually exceeding this requirement with densities ranging from 364 to 567 planted stems per acre. In the permanent vegetation plots and mobile vegetation plots stems appear to be thriving with a vigor of 3 or

greater indicating that they have good or better plant health and damage is rare. Please refer to Appendix 2 for vegetation plot photographs and Appendix 3 for vegetation data tables.

1.2.2 Vegetation Areas of Concern and Management Activity

Overall, the herbaceous cover is becoming well established throughout the site and wetland vegetation has filled in nicely in wet seeps preventing the potential for rills or gullies from forming. No bare areas or areas of low woody stem density were noted. There are isolated areas of native in-stream vegetation on EF1, but this will likely be shaded out as the stream channel develops a stream canopy. The MY1 visual assessments did indicate that some invasive plant populations are present within the conservation easement. The predominant invasive species found on the Site is Johnson grass (*Sorghum halepense*) totaling 7.2% of the conservation easement acreage in MY1. Though these areas of Johnson grass had previously been treated before construction, they re-sprouted during MY1. Adaptive management activities will occur in MY2 to treat invasive plant areas, as needed. These vegetation areas of concern are documented on Table 7 and shown on the Current Condition Plan View (CCPV) Figures 3.0 – 3.2 in Appendix 2.

1.2.3 Stream Assessment

Riffle cross-sections on the restoration and enhancement I reaches should be stable and show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. All riffle cross-sections should fall within the parameters defined for the designated 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 and/or eroding channel banks. Remedial action would not be taken if channel changes indicate a movement toward stability.

Morphological surveys for MY1 were conducted in August 2020. Cross-section survey results indicate that channel dimensions are stable and functioning as designed on all restoration and enhancement I reaches with minimal adjustments. Minor changes occurring within some cross-sections include downcutting, narrowing of riffles, and alluvial deposition at the top of bank.

All cross-sections on EF1 and WF1 are stable with minor adjustments to bankfull area, bankfull width and bankfull depth in MY1. Cross-section 6 has had a slight decrease in cross-sectional area and channel depth since MY0 likely due to migration of sediment and gravels form the upstream crossing. See section 1.2.5 for additional information about the upstream crossing.

Reachwide pebble counts along all restoration and enhancement I reaches indicate maintenance of coarser materials in riffle features and finer particles in the pool features. Please refer to Appendix 2 for the visual stability assessment tables, CCPV Figures 3.0 – 3.2, and stream photographs, and Appendix 4 for the morphological tables and plots.

1.2.4 Stream Hydrology Assessment

Automated pressure transducers were installed to document stream hydrology and used on mitigation reaches that implement restoration and/or enhancement level I approaches throughout the seven-year monitoring period. Henceforth, these devices are referred to as “crest gages (CG)” for those recording bankfull events. At the end of the seven-year monitoring period, four or more bankfull flow events must have occurred in separate years within the restoration reaches. A total of 3 CGs were installed along restoration and enhancement I reaches, were programmed to record data every 3 hours, and captured many high flow events throughout the first year of monitoring.

In MY1, at least one bankfull event was recorded on all monitored reaches (EF1, WF1, and WF2), with multiple events being documented on EF1 and WF2 by automated crest gages. Because the automated

pressure transducer, CG1, was accidentally installed above the bankfull elevation along channel WF1 in MY0, only one bankfull event verified with photo documentation was included for Reach WF1 in Table 14. The photos capture deposition on plant material and wrack material around CG1 on WF1. CG1 will be lowered in the winter of 2020 to capture all events in MY2. Please refer to Appendix 5 for hydrology summary data, plots, and photographic evidence of bankfull events.

1.2.5 Stream Areas of Concern and Management Activity

All streams on the Site remained stable during multiple large storm events that occurred during 2020. The Site's visual assessment was conducted the day after a 1.7-inch storm event that occurred on 11/13/2020 and the majority of the structures were still intact, and the channels had remained stable. However, MY1 visual stream assessments did reveal a few areas of concern and include localized instances of bank scour on WF2 and EF1. Currently, WF2 and EF1 are 96% and 97% stable, respectively, and performing as intended. Also, in the left floodplain, just upstream of the Meadow Branch ford crossing, an ephemeral drainage that begins outside of the conservation easement and leads to Meadow Branch is scouring the floodplain.

The issues mapped on the CCPV figures are as follows: WF2 is experiencing slight aggradation from large storm events washing gravel from the upstream crossing into the channel. EF1 has one brush-toe structure issue located at station 212+00 where floodplain flows are washing behind the structure creating a scour pocket. On Meadow Branch the structure at 103+50 appears to have been washed out entirely. This area appears stable and will be monitored in future years for signs of instability. Wildlands will continue to monitor these areas and remedial actions will be implemented if areas of concern begin to threaten the stability of the project.

Stream areas of concern that are noted in this report and on the CCPV figures will continue to be monitored in future years for signs of accelerated instability. If instability is observed, the area will be addressed and evaluated for effectiveness in the MY2 report. Please refer to Appendix 2 for stream stability tables, area of concern photos, and CCPV Figures 3.0 – 3.2.

1.2.6 Wetland Assessment

Eleven groundwater monitoring gages (GWGs) were installed during baseline monitoring within the wetland re-establishment area using In-situ Level TROLL® 100 pressure transducers. A reference gage was established in a nearby reference wetland and will be utilized to compare the hydrologic response within the restored wetland areas at the Site. All monitoring gages are downloaded on a quarterly basis and maintained as needed. Calibration was completed by manually measuring water levels on all gages which confirmed the downloaded data. The Site does not contain a rainfall gage; therefore, the daily precipitation data was collected from closest USGS gage, 3506270804 10645 CRN-39, located at the NCDOT facility in Matthews NC.

The final performance standard for wetland hydrology will be a free groundwater surface within 12 inches of the ground surface for 23 consecutive days (10% percent) of the defined growing season for Union County (March 23 through November 6) under typical precipitation conditions. If a gage does not meet the performance standard for a given monitoring year, rainfall patterns will be analyzed, and the hydrograph will be compared to that of the reference wetlands analyzed in the Deep Meadow Mitigation Plan (2018) to assess whether atypical weather conditions occurred during the monitoring period.

Of the eleven GWGs that were installed during baseline monitoring, all, except GWG 11 located in W-E6, met the success criteria for MY1 with a range of 10.9% to 100% of the growing season. GWG11 missed

meeting the success criteria by 3 days this year. Monthly rainfall data in 2020 indicated higher than normal rainfall amounts occurred during the months of February, April, May, July and October.

In response to a comment received from the Interagency Review Team (IRT) in reference to well locations documented in the Baseline Monitoring Report (Wildlands, 2020), GWGs 3 and 11 are located just outside of the wetland establishment areas for W-E6 and W-E8, respectively. The current location of these wells is as close to the Mitigation Plan's proposed gage location as possible. Multiple holes were bored in the areas surrounding the Mitigation Plan's proposed gage locations; however, installation was difficult due to a shallow layer of bedrock where refusal was reached at approximately 3 - 4 feet. Though the resulting locations for GWG3 and GWG11, at the edge of the proposed wetland boundary, is not optimal, it is the assumption that if the wetland meets criteria on the edge wetland boundary, the remainder of the wetland will also meet. This was the case for GWG3; however, GWG 11 just barely missed meeting the success criteria of 10% with a rate of 8.7%. If GWG11 continues to not meet the success criteria for wetland hydrology in subsequent monitoring years, Wildlands will install another well closer to the center of W-E6.

Please refer to Appendix 2 for the groundwater gage locations on figures 3.0-3.2 and the groundwater gage photographs. Please refer to Appendix 5 for groundwater hydrology data and plots and Appendix 6 for documentation of IRT correspondence.

1.3 Monitoring Year 1 Summary

Overall, the Site has met the required stream, vegetation, and hydrology success criteria for MY1. The overall average planted stem density for the Site is 478 stems per acre and is on track to meet the MY3 requirement of 320 stems per acre. Geomorphic surveys indicate that cross-section bankfull dimensions closely match the baseline monitoring with some minor adjustments, and the streams are functioning as intended. At least one bankfull event was documented on all project streams since the completion of construction. The MY1 visual assessment identified a few areas of concern including populations of invasive plant species and isolated areas of bank scour and aggradation. Wildlands will continue to monitor these areas, and an adaptive management plan will be implemented as necessary throughout the seven-year monitoring period to benefit the ecological health of the Site.

Section 2: METHODOLOGY

Geomorphic data were collected following the standards outlined in The Stream Channel Reference Site: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration: A Natural Channel Design Handbook (Doll et al., 2003). All Integrated Current Condition Mapping was recorded using a Trimble handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Stream gages were installed in riffles and monitored quarterly. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers (USACE, 2003) standards. Vegetation monitoring protocols followed the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2008).

Section 3: REFERENCES

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

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

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

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North Carolina Division of Mitigation Services (DMS), April 2015. DMS Annual Monitoring and Closeout Reporting Template.

North Carolina Division of Mitigation Services (DMS), October 2015. DMS Stream and Wetland Mitigation Plan Template and Guidance.

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

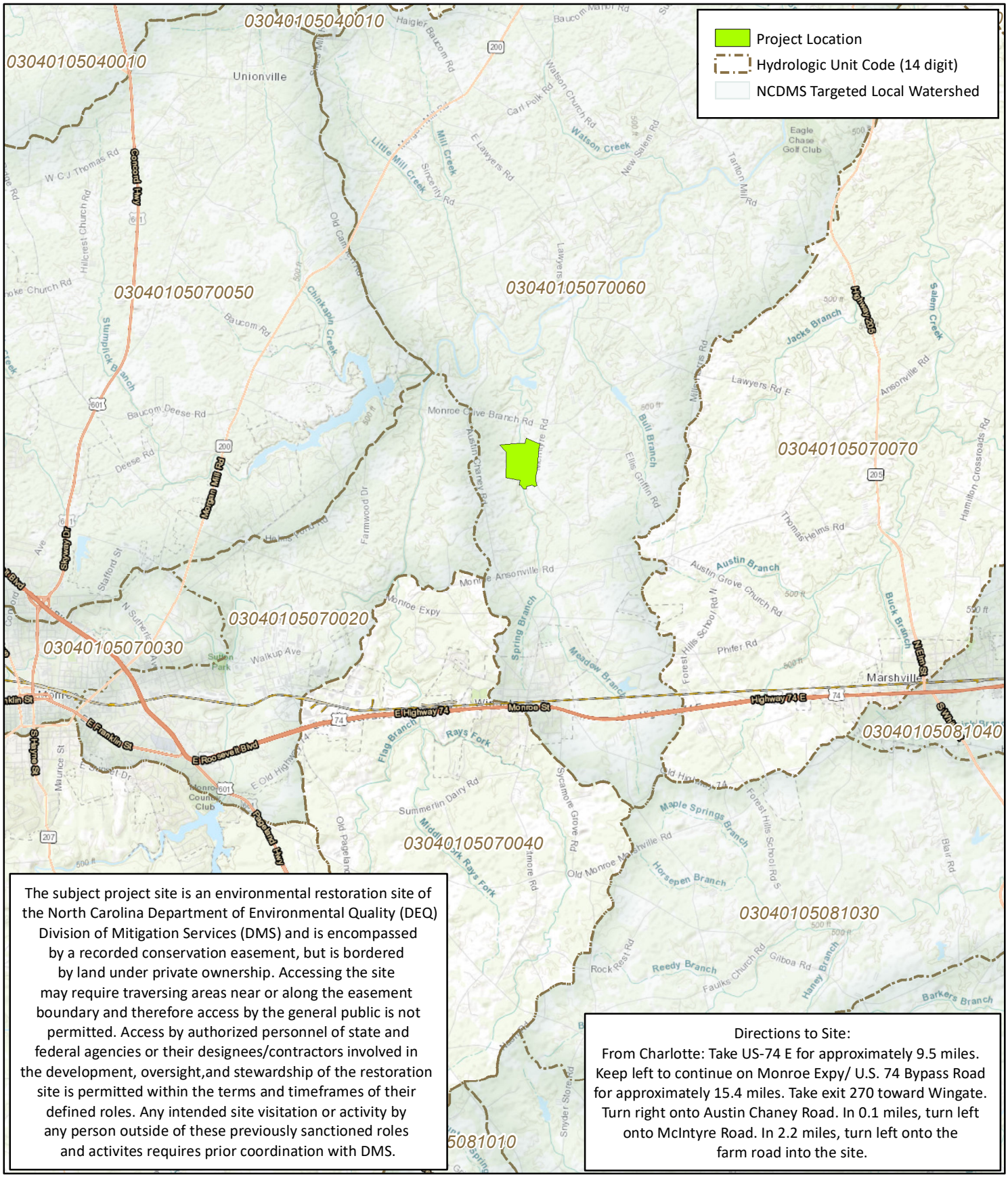
Rosgen, D.L. 1996. Applied River Morphology. Pagosa Springs, CO: Wildland Hydrology Books.

United States Army Corps of Engineers (USACE), October 2016. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Wildlands Engineering, Inc (Wildlands), 2020. Deep Meadow Mitigation Site As-built Baseline Monitoring Report. DMS, Raleigh, NC.

Wildlands, 2018. Deep Meadow Site Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables



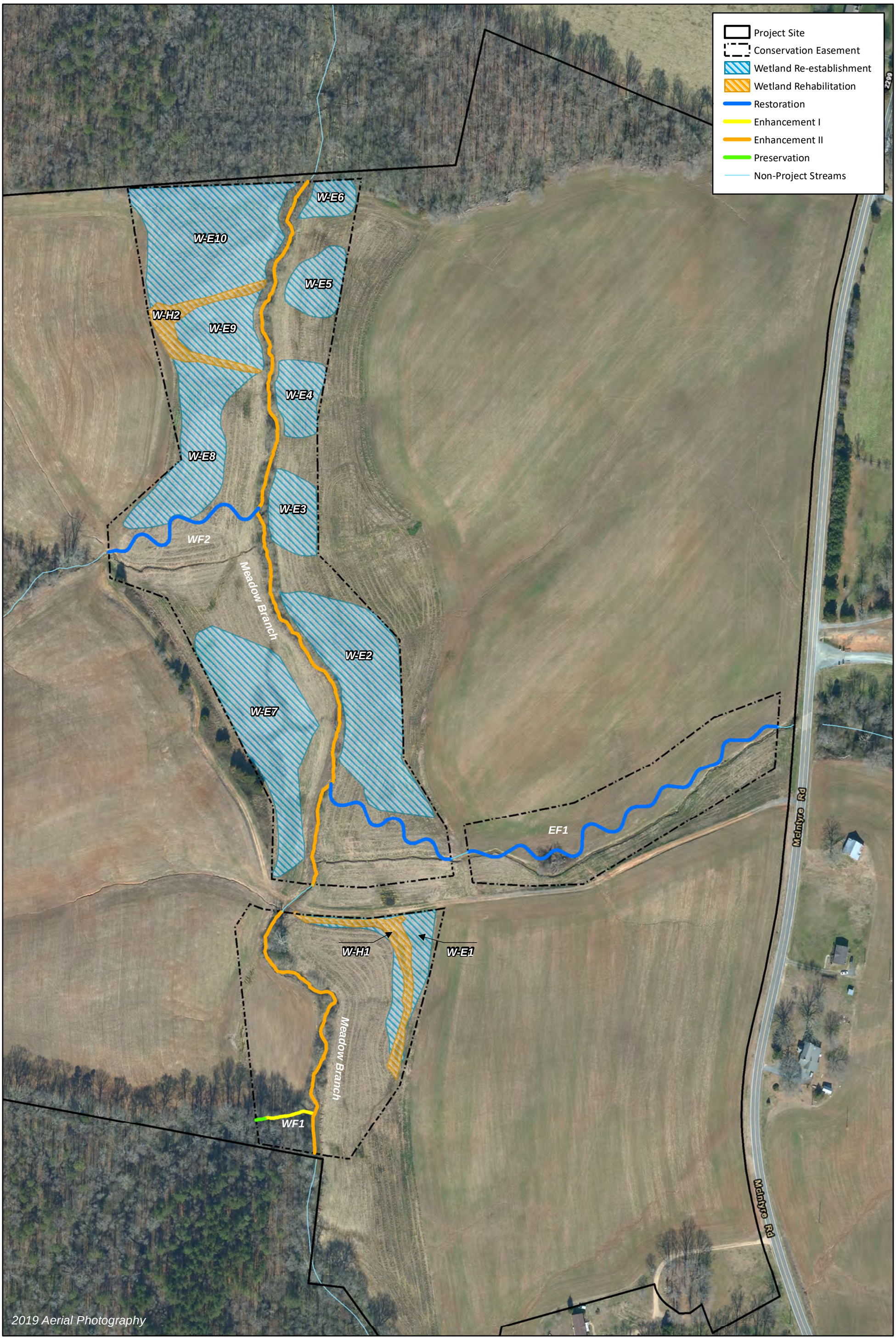
The subject project site is an environmental restoration site of the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing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

Directions to Site:
From Charlotte: Take US-74 E for approximately 9.5 miles. Keep left to continue on Monroe Expy/ U.S. 74 Bypass Road for approximately 15.4 miles. Take exit 270 toward Wingate. Turn right onto Austin Chaney Road. In 0.1 miles, turn left onto McIntyre Road. In 2.2 miles, turn left onto the farm road into the site.

WILDLANDS ENGINEERING

Figure 1 Project Vicinity Map
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Union County, NC



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 2 Project Component/ Asset Map
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Union County, NC

Table 1. Mitigation Assets and Components

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Project Components									
Project Area/Reach	**Existing Footage (LF) or Acreage**	**Mitigation Plan Footage/ Acreage**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio (X:1)**	**As-Built Footage/ Acreage**	**Project Credit**	**Notes/Comments**
Medow Branch	2,507	2,449	Warm	Enhancement II	N/A	2.500	2,449	979.600	Bank stabilization and in-stream structures with planted buffer. Creditable length accounts for 96 LF of stream within an easement break.
EF1	1,201	1,322	Warm	Restoration	P1, P2	1.000	1,322	1,322.000	Full channel restoration and planted buffer. Creditable length accounts for 41 LF of stream within an easement break
WF1	116	116	Warm	Enhancement I	N/A	1.500	116	77.333	Dimension and profile modified to provide stability.
WF1	20	20	Warm	Preservation	N/A	10.000	20	2.000	
WF2	391	458	Warm	Restoration	P1, P2	1.000	458	458.000	Full channel restoration and planted buffer.
WH-1	0.28	0.28	Warm	Rehabilitation		1.500	0.28	0.190*	Rehabilitation. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch.
WH-2	0.30	0.30	Warm	Rehabilitation		1.500	0.30	0.200	Rehabilitation. Planted, removed agricultural activities, increased hydrology by reducing drainage to Meadow Branch.
WE-1	0.40	0.40	Warm	Re-establishment		1.000	0.37	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-2	1.70	1.70	Warm	Re-establishment		1.000	1.72	1.700*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-3	0.40	0.40	Warm	Re-establishment		1.000	0.41	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-4	0.40	0.40	Warm	Re-establishment		1.000	0.36	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-5	0.40	0.40	Warm	Re-establishment		1.000	0.37	0.400*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-6	0.20	0.20	Warm	Re-establishment		1.000	0.20	0.200	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-7	1.50	1.50	Warm	Re-establishment		1.000	1.53	1.500*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-8	1.00	1.00	Warm	Re-establishment		1.000	1.04	1.000*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-9	0.50	0.50	Warm	Re-establishment		1.000	0.53	0.500*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.
WE-10	1.70	1.70	Warm	Re-establishment		1.000	1.73	1.700*	Re-establishment. Planted, removed agricultural activities, increased hydrology by eliminating adjacent drainage swales.

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Riparian Wetland**	**Coastal Marsh**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**		
Restoration	1,780.000	N/A	N/A	N/A	N/A	N/A	N/A
Re-establishment				0.390*	N/A	N/A	N/A
Rehabilitation				8.200*	N/A	N/A	N/A
Enhancement				N/A	N/A	N/A	N/A
Enhancement I	77.333	N/A	N/A				
Enhancement II	979.600	N/A	N/A				
Creation				N/A	N/A	N/A	N/A
Preservation	2.000	N/A	N/A	N/A	N/A	N/A	
Totals	**2,838.933**	**N/A**	**N/A**	**8.590***	**N/A**	**N/A**	**N/A**

* Actual as-built wetland acreage/potential crediting slightly differs (excess or loss) that of the Mitigation Plan, the project credit assets listed reflect those of the approved Mitigation Plan.

Table 2. Project Activity and Reporting History

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Activity or Report		Data Collection Complete	Completion or Delivery
404 Permit		July 2018	July 2018
Mitigation Plan		June 2016 - October 2017	May/June 2018
Final Design - Construction Plans		January 2019	January 2019
Construction		July - September 2019	September 2019
Temporary S&E mix applied to entire project area[1]		July - September 2019	September 2019
Permanent seed mix applied to reach/segments[1]		July - September 2019	September 2019
Bare root and live stake plantings for reach/segments		December 2019 - January 2020	January 2020
Baseline Monitoring Document (Year 0)		October 2019 - January 2020	March 2020
Year 1 Monitoring	Invasive treatment	May- September 2020	November 2020
	Stream Survey	August 2020	
	Vegetation Survey	August 2020	
Year 2 Monitoring	Stream Survey		
	Vegetation Survey		
Year 3 Monitoring	Stream Survey		
	Vegetation Survey		
Year 4 Monitoring	Stream Survey		
	Vegetation Survey		
Year 5 Monitoring	Stream Survey		
	Vegetation Survey		
Year 6 Monitoring	Stream Survey		
	Vegetation Survey		
Year 7 Monitoring	Stream Survey		
	Vegetation Survey		

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

Table 3. Project Contact Table

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Designers Aaron Earley, PE, CFM	**Wildlands Engineering, Inc.** 1430 South Mint Street, Suite 104 Charlotte, NC 28203 704.332.7754
Construction Contractors	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc.** PO Box 1197 Freymont, NC 27830
Seeding Contractor	**Land Mechanic Designs, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Land Mechanic Designs, Inc.**
Nursery Stock Suppliers Bare Roots Live Stakes Herbaceous Plugs	**Bruton Natural Systems, Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kristi Suggs (704) 332.7754 x.110

Table 4. Project Information and Attributes

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

Project Information				
Project Name	Deep Meadow Mitigation Site			
	Union County			
Project Area (acres)	23.800			
Project Coordinates (latitude and longitude)	35° 1' 24.44"N 80° 27' 4.33"W			
Planted Acreage (Acre of Woody Stems Planted)	21.480			
Project Watershed Summary Information				
Physiographic Province	Piedmont Physiographic Province			
River Basin	Yadkin River			
USGS Hydrologic Unit 8-digit	3040105			
USGS Hydrologic Unit 14-digit	3040105070060			
DWR Sub-basin	03-07-14			
Project Drainage Area (acres)	EF1 226, WF1 58, WF2 131, Meadow Branch 4,472			
Project Drainage Area Percentage of Impervious Area	4%			
2011 NLCD Land Use Classification	Meadow Branch- Forest (25%), Cultivated (50%), Grassland (3%), Shrubland (< 1%), Urban (21%), Open Water (< 1%) EF1 - Forest (27%), Cultivated (65%), Grassland (4%), Shrubland (2%), Urban (2%), Open Water (0%) WF1 - Forest (28%), Cultivated (70%), Grassland (0%), Shrubland (0%), Urban (2%), Open Water (0%) WF2 - Forest (16%), Cultivated (57%), Grassland (20%), Shrubland (4%), Urban (3%), Open Water (0%)			
Reach Summary Information				
Parameters	**Meadow Branch**	**EF1**	**WF1**	**WF2**
Length of reach (linear feet) - Post-Restoration	2,449	1,322	136	458
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Moderatley Confined	Unconfined	Unconfined
Drainage area (acres)	4,472	226	58	131
Perennial, Intermittent, Ephemeral	P	P	P	P
NCDWR Water Quality Classification	C			
Morphological Description (stream type) - Pre-Restoration	C4/5	Incised and Straightened E4	G4	Incised and straighteded E4
Morphological Description (stream type) - Post-Restoration	C4/5	C4	C4	C4
Evolutionary trend (Simon's Model) - Pre- Restoration	VI	III	III	IV
FEMA classification	Zone AE			
Wetland Summary Information				
Parameters	**Wetlands**			
	W-H1		W-H2	
Size of Wetland (acres)	0.28		0.30	
Wetland Type	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-habilitation (hydrologic, vegetative)			
Regulatory Considerations				
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**	
Waters of the United States - Section 404	Yes	Yes	USACE Action ID #SAW-2012-01107	
Waters of the United States - Section 401	Yes	Yes	DWR# 18-0264	
Division of Land Quality (Erosion and Sediment Control)	Yes	Yes	NPDES Construction Stormwater General Permit NCG010000	
Endangered Species Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan	
Historic Preservation Act	Yes	Yes	Categorical Exclusion Document in Mitigation Plan	
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	Yes	Yes	Union County Floodplain Development Permit #20180991	
Essential Fisheries Habitat	No	N/A	N/A	

Table 5. Monitoring Component Summary

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Parameter	Monitoring Feature	Quantity / Length by Reach				Wetlands	Frequency	Notes
		Meadow Branch	EF1	WF1	WF2			
Dimension	Riffle Cross-Section	N/A	2	1	1	N/A	Year 1, 2, 3, 5, and 7	1
	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	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	Year 0	
Substrate	Reach Wide (RW) Pebble Count	N/A	1 RW	1 RW	1 RW	N/A	Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG) and or/Transducer (SG)	N/A	1 CG	1 CG	1 CG	N/A	Quarterly	4
Wetland Hydrology	Groundwater Gages	N/A	N/A	N/A	N/A	11	Quarterly	
Vegetation	CVS Level 2/Mobile plots	16 (12 permanent, 4 mobile)					Year 1, 2, 3, 5, and 7	5
Visual Assessment		Yes					Semi-Annual	
Exotic and Nuisance Vegetation							Semi-Annual	6
Project Boundary							Semi-Annual	7
Reference Photos	Photographs	18					Annual	

Notes:

1. Cross-sections were permanently marked with rebar to establish location. Surveys include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile was collected during the as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Riffle 100-count substrate sampling were collected during the baseline monitoring only. A reach-wide pebble count will be performed on each restoration or enhancement I reach each year for classification purposes.
4. Crest gages and/or transducers will be inspected and downloaded quarterly or semi-annually. Evidence of bankfull events such as rack lines or floodplain deposition will be documented with a photo when possible. Transducers, if used, will be set to record stage once every three hours.
5. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems, height, and species using a circular or 100 m2 square/rectangular plot.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

APPENDIX 2. Visual Assessment Data

Figure 3.1

Figure 3.2

Project Site
Conservation Easement
Wetland Re-establishment
Wetland Rehabilitation
Restoration
Enhancement I
Enhancement II
Preservation
Non-Project Streams
Bankfull
Cross Sections
Photo Points
Barotroll
Crest Gage

Groundwater Gage (GWG) - MY1

Criteria Not Met
Criteria Met

Vegetation Plot Conditions - MY1

Criteria Met (Permanent)
Criteria Met (Mobile)

Vegetation Areas of Concern - MY1

In-stream Veg
Johnsongrass

Stream Areas of Concern - MY1

Aggradation
Erosion/Incision
Issue

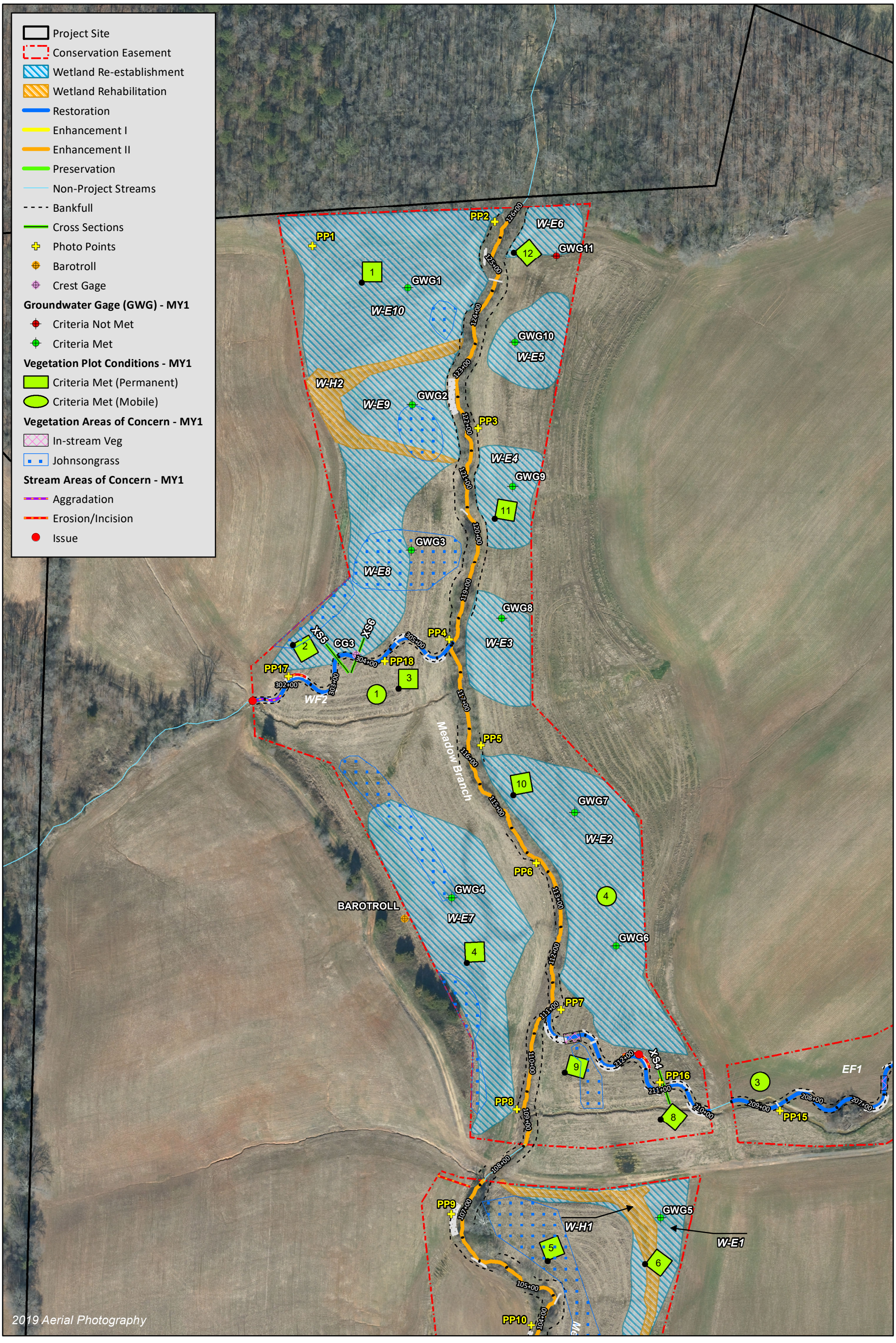
PP1 PP2 PP3 PP4 PP5 PP6 PP7 PP8 PP9 PP10 PP11 PP12 PP13 PP14 PP15 PP16 PP17 PP18
GWG1 GWG2 GWG3 GWG4 GWG5 GWG6 GWG7 GWG8 GWG9 GWG10 GWG11
CG1 CG2 CG3
BAROTROLL
XS1 XS2 XS3 XS4 XS5
W-E1 W-E2 W-E3 W-E4 W-E5 W-E6 W-E7 W-E8 W-E9 W-E10
W-H1 W-H2
WF1 WF2
EF1
Meadow Branch
McIntyre Rd

2019 Aerial Photography

WILDLANDS ENGINEERING

0 250 500 Feet

Figure 3.0 Current Condition Plan View (Key)
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Union County, NC



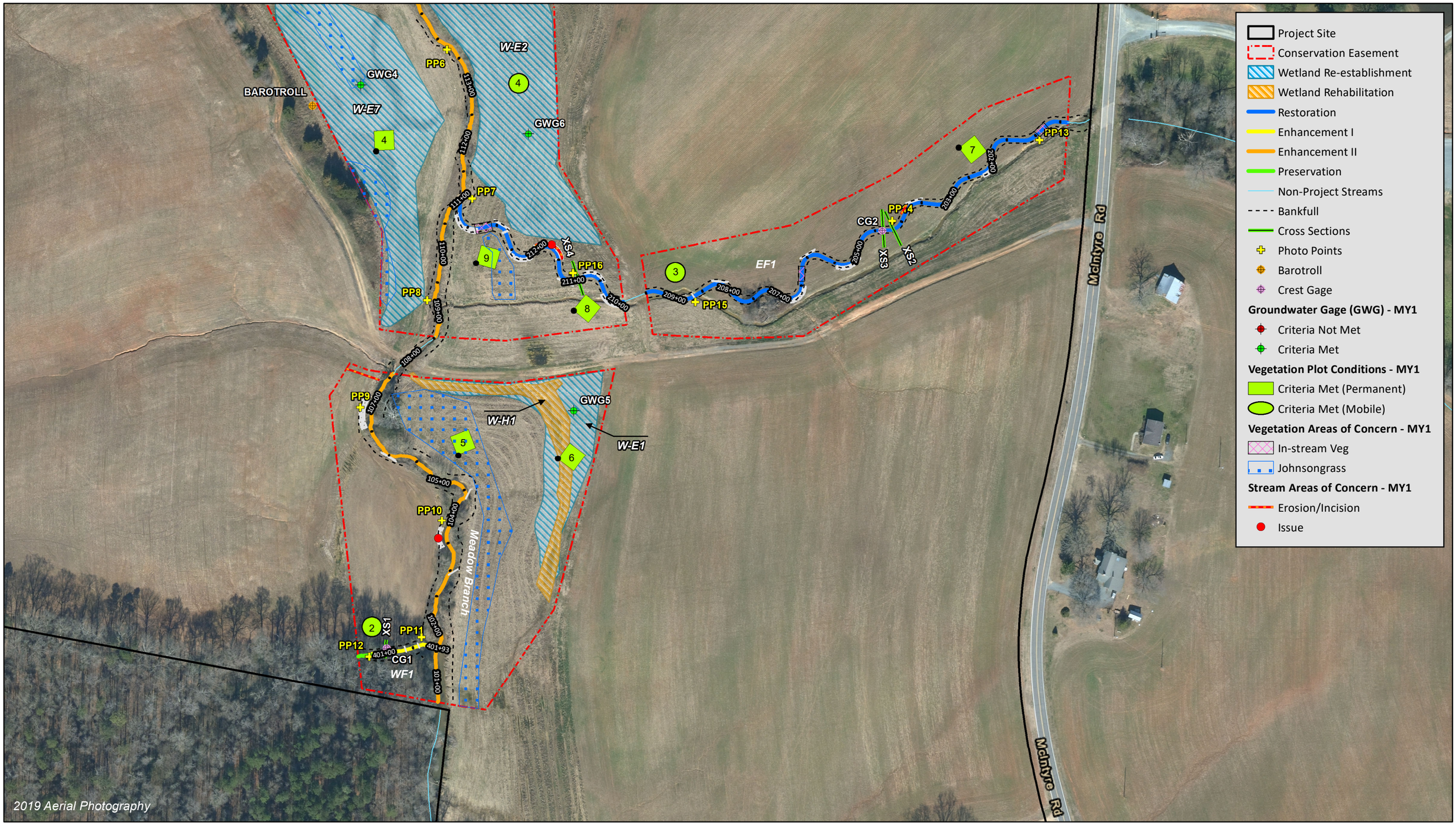
WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.1 Current Condition Plan View
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Union County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 3.2 Current Condition Plan View
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Union County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

Reach: EF1

Assessed Length: 1,322

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	23	23			100%			
	3. Meander Pool Condition	Depth Sufficient	23	23			100%			
		Length Appropriate	23	23			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	23	23			100%			
		Thalweg centering at downstream of meander bend (Glide)	23	23			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			2	77	97%	0	0	97%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	2	77	97%	0	0	97%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	21	21			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	6	6			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	6	6			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	1	15			7%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	15	15			100%			

Table 6b. Visual Stream Morphology Stability Assessment Table

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

Reach: WF1

Assessed Length: 116

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	4	4			100%			
	3. Step Pool Condition	Depth Sufficient	4	4			100%			
		Length Appropriate	4	4			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	N/A	N/A			N/A			
		Thalweg centering at downstream of meander bend (Glide)	N/A	N/A			N/A			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	4	4			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	N/A	N/A			N/A			

Table 6c. Visual Stream Morphology Stability Assessment Table

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

Reach: WF2

Assessed Length: 458

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			1	51	94%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	8	8			100%			
	3. Meander Pool Condition	Depth Sufficient	7	7			100%			
		Length Appropriate	7	7			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	7	7			N/A			
		Thalweg centering at downstream of meander bend (Glide)	7	7			N/A			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	36	96%	0	0	96%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	1	36	96%	0	0	96%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	4	4			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	4	4			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	4	4			100%			

Table 7. Vegetation Condition Assessment Table

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

Planted Acreage **21.5**

Vegetation Category	Definitions	Mapping Threshold (acres)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 5, or 7 stem count criteria.	0.1	0	0.0	0.0%
		Total	**0**	**0.0**	**0.0%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.1	0	0.0	0.0%
		Cumulative Total	**0**	**0.0**	**0.0%**

Easement Acreage **23.8**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	8	1.7	7.2%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	0	0.00	0.0%

Stream Photographs
Monitoring Year 1

Photo Point 1 – W-E10, North *(08/25/2020)*

Photo Point 1 – W-E10, South *(08/25/2020)*

Photo Point 1 – W-E10, East *(08/25/2020)*

Photo Point 1 – W-E10, West *(08/25/2020)*

Photo Point 2 – MB outlet, view upstream *(08/25/2020)*

Photo Point 2 – MB outlet, view downstream *(08/25/2020)*

Photo Point 3 – Meadow Branch, view upstream *(08/25/2020)*

Photo Point 3 – Meadow Branch, view downstream *(08/25/2020)*

Photo Point 4 – Meadow Branch, view upstream *(08/25/2020)*

Photo Point 4 – Meadow Branch, view downstream *(08/25/2020)*

Photo Point 4 – WF2 Confluence, view upstream *(09/03/2020)*

	
Photo Point 5 – Meadow Branch, view upstream *(09/03/2020)*	**Photo Point 5** – Meadow Branch, view downstream *(09/03/2020)*
	
Photo Point 6 – Meadow Branch, view upstream *(08/25/2020)*	**Photo Point 6** – Meadow Branch, view downstream *(08/25/2020)*
	
Photo Point 7 – Meadow Branch, view upstream *(08/25/2020)*	**Photo Point 7** – Meadow Branch, view downstream *(08/25/2020)*

	
Photo Point 8 – Meadow Branch, view upstream *(08/25/2020)*	**Photo Point 8** – Meadow Branch, view downstream *(08/25/2020)*
	
Photo Point 9 – Meadow Branch, view upstream *(08/25/2020)*	**Photo Point 9** – Meadow Branch, view downstream *(08/25/2020)*
	
Photo Point 10 – Meadow Branch, view upstream *(08/25/2020)*	**Photo Point 10** –Meadow Branch, view downstream *(08/25/2020)*

Photo Point 11 – Meadow Branch Inlet, view upstream *(08/25/2020)*

Photo Point 11 – Meadow Branch Inlet, view downstream *(08/25/2020)*

Photo Point 11 –WF1 Confluence, view upstream *(09/03/2020)*

Photo Point 12 – WF1 Start, view upstream *(08/25/2020)*

Photo Point 12 – WF1 Start, view downstream *(09/03/2020)*

	
Photo Point 13 – EF1 Start, view upstream *(09/03/2020)*	**Photo Point 13** – EF1 Start, view downstream *(08/25/2020)*
	
Photo Point 14 – EF1, view upstream *(08/25/2020)*	**Photo Point 14** – EF1, view downstream *(09/03/2020)*
	
Photo Point 15 – EF1, view upstream *(08/25/2020)*	**Photo Point 15** – EF1, view downstream *(08/25/2020)*

Photo Point 16 – EF1, view upstream *(08/25/2020)*

Photo Point 16 – EF1, view downstream *(08/25/2020)*

Photo Point 17 – WF2 Start, view upstream *(08/25/2020)*

Photo Point 17 – WF2 Start, view downstream *(08/25/2020)*

Photo Point 18 – WF2, view upstream *(09/03/2020)*

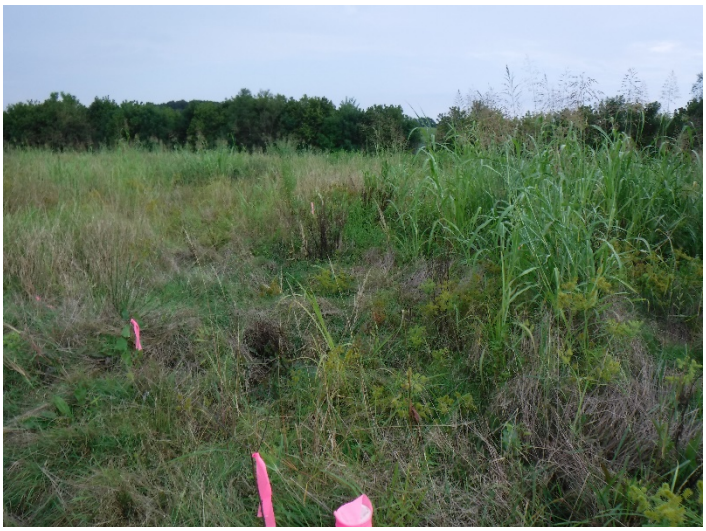
Photo Point 18 – WF2, view downstream *(09/03/2020)*

Vegetation Photographs
Monitoring Year 1

Vegetation Plot 1 - *(08/26/2020)*

Vegetation Plot 2 - *(08/26/2020)*

Vegetation Plot 3 - *(08/26/2020)*



Vegetation Plot 4 - *(08/26/2020)*

Vegetation Plot 5 - *(08/26/2020)*

Vegetation Plot 6 - *(08/26/2020)*

Vegetation Plot 7 - *(08/26/2020)*

Vegetation Plot 8 - *(08/26/2020)*

Vegetation Plot 9 - *(08/26/2020)*

Vegetation Plot 10 - *(08/26/2020)*

Vegetation Plot 11 - *(08/26/2020)*

Vegetation Plot 12 - *(08/26/2020)*

Mobile Vegetation Plot Photographs
Monitoring Year 1

Mobile Vegetation Plot 1 - North *(09/03/2020)*

Mobile Vegetation Plot 2 – North *(09/03/2020)*

Mobile Vegetation Plot 3 - North *(08/26/2020)*

Mobile Vegetation Plot 4 - North *(08/26/2020)*

Area of Concern Photographs

EF1 Vegetation in Channel at PP13 (11/13/2020)

EF1 Slight Scour Right Bank Station 203+50 (11/13/2020)

EF1 Issue: Bank Eroding behind structure 211+70- 212+00 (11/13/2020)

EF1 Vegetation in Channel at Station 212+70 (11/13/2020)

Scoured channel running from agricultural field into CE before flowing into Meadow Branch near station 107+50 (11/13/2020)

Issue: Structure washed out on Meadow Branch at station 103+50 (11/13/2020)

Issue: WF2 channel crossing being washed down stream causing aggradation (11/13/2020)

Groundwater Gage Photographs
Monitoring Year 1

Groundwater Gage 1 - *(11/13/2020)*

Groundwater Gage 2 - *(11/13/2020)*

Groundwater Gage 3 - *(11/13/2020)*

Groundwater Gage 4 - *(11/13/2020)*

Groundwater Gage 5 - *(11/13/2020)*

Groundwater Gage 6 - *(11/13/2020)*

Groundwater Gage 7 - *(11/13/2020)*

Groundwater Gage 8 - *(11/13/2020)*

Groundwater Gage 9 - *(11/13/2020)*

Groundwater Gage 10 - *(11/13/2020)*

Groundwater Gage 11 - *(11/13/2020)*

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Permanent Vegetation Plot	MY0 Success Criteria Met (Y/N)	Tract Mean (MY0 - 2020)	
1	Y	100%	100%
2	Y		
3	Y		
4	Y		
5	Y		
6	Y		
7	Y		
8	Y		
9	Y		
10	Y		
11	Y		
12	Y		
Mobile Vegetation Plot	**MY0 Success Criteria Met (Y/N)**		
1	Y	100%	
2	Y		
3	Y		
4	Y		

Table 9. CVS Permanent Vegetation Plot Metadata

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

Report Prepared By	Sara Thompson
Date Prepared	9/1/2020 11:52
Database Name	cvs-eep-entrytool-v2.5.0_Deep Meadow (MY0).mdb
Database Location	Q:\ActiveProjects\005-02162 Deep Meadow\Monitoring\Monitoring Year 1_2020\Vegetation Assessment
Computer Name	SARA2020
File Size	76816384
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	97131
Project Name	Deep Meadow Mitigation Site
Description	Stream and wetland mitigation project in Union County, NC.
Sampled Plots	12

Table 10a. Planted and Total Stem Counts
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Current Permanent Vegetation Plot Data (MY1 2020)													
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 1**			**Permanent Plot 2**			**Permanent Plot 3**			**Permanent Plot 4**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder Maple	Tree						7						4
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree							1	1	1			
Betula nigra	River Birch, Red Birch	Tree	1	1	1	3	3	3	2	2	2	1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree										1	1	1
Cornus amomum	Silky Dogwood	Shrub Tree	2	2	2	1	1	1				1	1	1
Diospyros virginiana	American Persimmon, Possumwood	Tree	2	2	2	1	1	1				2	2	2
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree							3	3	3			
Lindera benzoin	Northern Spicebush	Shrub Tree	1	1	1	1	1	1						
Liriodendron tulipifera	Tulip Poplar	Tree												
Platanus occidentalis	Sycamore, Plane-tree	Tree	2	2	2	3	3	3	1	1	1	2	2	2
Populus deltoides	Eastern Cottonwood	Tree	1	1	1	2	2	2				1	1	1
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	2	2	2	1	1	1	3	3	3	2	2	2
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree												
Quercus phellos	Willow Oak	Tree	1	1	1	1	1	1	2	2	2	2	2	2
		Stem count	12	12	12	13	13	20	12	12	12	12	12	16
		size (ares)		1			1			1			1	
				0.0247			0.0247			0.0247			0.0247	
		Species count	8	8	8	8	8	9	6	6	6	8	8	9
		Stems per ACRE	486	486	486	526	526	809	486	486	486	486	486	647

Current Permanent Vegetation Plot Data (MY1 2020)													
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 5**			**Permanent Plot 6**			**Permanent Plot 7**			**Permanent Plot 8**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder Maple	Tree			20						2			3
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	1	1	1				1	1	1	1	1	1
Betula nigra	River Birch, Red Birch	Tree	3	3	3	2	2	2	3	3	3	3	3	3
Cephalanthus occidentalis	Buttonbush	Shrub Tree				2	2	2						
Cornus amomum	Silky Dogwood	Shrub Tree				2	2	2						
Diospyros virginiana	American Persimmon, Possumwood	Tree				2	2	2						
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	1	1	1				1	1	1	1	1	1
Lindera benzoin	Northern Spicebush	Shrub Tree												
Liriodendron tulipifera	Tulip Poplar	Tree	2	2	2				1	1	1			
Platanus occidentalis	Sycamore, Plane-tree	Tree	2	2	2	2	2	2	3	3	3	2	2	2
Populus deltoides	Eastern Cottonwood	Tree												
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	2	2	2							2	2	2
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree												
Quercus phellos	Willow Oak	Tree	2	2	2	1	1	1	1	1	1	2	2	2
		Stem count	13	13	33	11	11	11	10	10	12	11	11	14
		size (ares)		1			1			1			1	
		size (ACRES)		0.0247			0.0247			0.0247			0.0247	
		Species count	7	7	8	6	6	6	6	6	7	6	6	7
		Stems per ACRE	526	526	1335	445	445	445	405	405	486	445	445	567

Color for Density

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

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

Table 10b. Planted and Total Stem Counts
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Current Permanent Vegetation Plot Data (MY1 2020)														
Scientific Name	**Common Name**	**Species Type**	**Permanent Plot 9**			**Permanent Plot 10**			**Permanent Plot 11**			**Permanent Plot 12**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder Maple	Tree			16			300						4
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree												
Betula nigra	River Birch, Red Birch	Tree	2	2	2	1	1	1	3	3	3			
Cephalanthus occidentalis	Buttonbush	Shrub Tree							2	2	2	2	2	2
Cornus amomum	Silky Dogwood	Shrub Tree							1	1	1	2	2	2
Diospyros virginiana	American Persimmon, Possumwood	Tree							2	2	2	4	4	4
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	1	1	1									3
Lindera benzoin	Northern Spicebush	Shrub Tree												
Liriodendron tulipifera	Tulip Poplar	Tree	3	3	3									
Platanus occidentalis	Sycamore, Plane-tree	Tree	3	3	3	5	5	5	2	2	2			
Populus deltoides	Eastern Cottonwood	Tree				2	2	2				2	2	2
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	4	4	4	1	1	1	1	1	1			
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree												
Quercus phellos	Willow Oak	Tree	1	1	1	3	3	3	1	1	1	1	1	1
		Stem count	14	14	30	12	12	312	12	12	12	11	11	18
		size (ares)	1			1			1			1		
		size (ACRES)	0.0247			0.0247			0.0247			0.0247		
		Species count	6	6	7	5	5	6	7	7	7	5	5	7
		Stems per ACRE	567	567	1214	486	486	12626	486	486	486	445	445	728

Permanent Vegetation Plot Annual Mean								
Scientific Name	**Common Name**	**Species Type**	**MY1 (2020)**			**MY0 (2020)**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder Maple	Tree			356			
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	4	4	4	6	6	6
Betula nigra	River Birch, Red Birch	Tree	24	24	24	26	26	26
Cephalanthus occidentalis	Buttonbush	Shrub Tree	7	7	7	8	8	8
Cornus amomum	Silky Dogwood	Shrub Tree	9	9	9	10	10	10
Diospyros virginiana	American Persimmon, Possumwood	Tree	13	13	13	13	13	13
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	7	7	10	7	7	7
Lindera benzoin	Northern Spicebush	Shrub Tree	2	2	2	12	12	12
Liriodendron tulipifera	Tulip Poplar	Tree	6	6	6	17	17	17
Platanus occidentalis	Sycamore, Plane-tree	Tree	27	27	27	27	27	27
Populus deltoides	Eastern Cottonwood	Tree	8	8	8	13	13	13
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	18	18	18	18	18	18
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree				1	1	1
Quercus phellos	Willow Oak	Tree	18	18	18	22	22	22
		Stem count	143	143	502	180	180	180
		size (ares)	12			12		
		size (ACRES)	0.2965			0.2965		
		Species count	12	12	13	13	13	13
		Stems per ACRE	482	482	1693	607	607	607

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

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

Table 10c. Planted and Total Stem Counts
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

Current Mobile Vegetation Plot (MP) Data (MY0 2020)						
Scientific Name	**Common Name**	**Species Type**	**MP1**	**MP2**	**MP3**	**MP4**
			PnoLS	**PnoLS**	**PnoLS**	**PnoLS**
Acer negundo						
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree				
Betula nigra	River Birch, Red Birch	Tree			5	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree				
Cornus amomum	Silky Dogwood	Shrub Tree				
Diospyros virginiana	Persimmon			4		1
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	3	2	1	
Lindera benzoin	Northern Spicebush	Shrub Tree				
Liriodendron tulipifera	Tulip Poplar	Tree		2		
Platanus occidentalis	Sycamore, Plane-tree	Tree	7		7	1
Populus deltoides	Eastern Cottonwood	Tree	1	2		5
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree		3		1
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree				
Quercus phellos	Willow Oak	Tree				
		Stem count	11	13	13	9
		size (ares)	1	1	1	1
		size (ACRES)	0.0247	0.0247	0.0247	0.0247
		Species count	3	5	3	5
		Stems per ACRE	445	526	526	364

Current Mobile Vegetation Plot (MP) Data (MY1 2020) Total Stem Counts & Annual Means				
Scientific Name	**Common Name**	**Species Type**	**MY1 (2020)**	**MY0 (2020)**
			PnoLS	**PnoLS**
Acer negundo			0	
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	0	1
Betula nigra	River Birch, Red Birch	Tree	6	9
Cephalanthus occidentalis	Buttonbush	Shrub Tree	0	2
Cornus amomum	Silky Dogwood	Shrub Tree	0	1
Diospyros virginiana	American Persimmon, Possumwood	Tree	5	0
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	6	3
Lindera benzoin	Northern Spicebush	Shrub Tree	0	1
Liriodendron tulipifera	Tulip Poplar	Tree	2	5
Platanus occidentalis	Sycamore, Plane-tree	Tree	15	20
Populus deltoides	Eastern Cottonwood	Tree	8	4
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	4	2
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree	0	5
Quercus phellos	Willow Oak	Tree	0	9
		Stem count	46	62
		size (ares)	4	4
		size (ACRES)	0.0988	0.0988
		Species count	13	13
		Stems per ACRE	465	627

Overall Site Annual Mean	
MY1 (2020)	**MY0 (2020)**
PnoLS	**PnoLS**
4	7
30	35
7	10
9	11
18	13
13	10
2	13
8	22
42	48
16	16
22	20
0	6
18	31
189	242
16	16
0.3954	0.3954
13	13
478	612

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

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

APPENDIX 4. Morphological Summary Data and Plots

Table 11a. Baseline Stream Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

		Pre-Restoration Condition						Design						As-Built/Baseline					
Parameter	**Gage**	**WF1**		**WF2**		**EF1**		**WF1**		**WF2**		**EF1**		**WF1**		**WF2**		**EF1**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle																			
Bankfull Width (ft)	N/A	4.9		6.1		8.2		8.1		8.9		10.2		9.3		9.8		10.3	13.1
Floodprone Width (ft)		6.0		>82		29	>39	18	36	26	70	30	68	13.3		64.5		57.0	64.9
Bankfull Mean Depth (ft)		0.7		0.9		1.5		0.9		0.7		0.8		0.4		0.7		0.5	0.6
Bankfull Max Depth (ft)		1.1		1.1		1.6		0.5	0.9	0.8	1.2	1.0	1.3	0.7		1.2		0.8	1.0
Bankfull Cross-sectional Area (ft^2)[1]		3.2		5.1		8.4		4.4		6.6		8.7		4.0		7.1		5.0	7.9
Width/Depth Ratio		7.3		7.5		8.0		15.0		12.7		12.0		21.3		13.6		21.3	21.9
Entrenchment Ratio[3]		1.3		12.0		3.8		2.2		6.0		5.0		1.4		6.6		4.9	5.5
Bank Height Ratio		3.4		1.4		1.4		1.0		1.0		1.0		1.0		1.0		1.0	
D_{50} (mm)		---		SC		16.0	41.3	---		---		---		24.4		37.5		37.4	51.8
Profile																			
Riffle Length[1] (ft)	N/A																		
Riffle Slope (ft/ft)[1]		---		---	---	---	---	---	---	0.014	0.036	0.007	0.031	---	---	0.00963	0.04802	0.00191	0.07879
Pool Length (ft)																			
Pool Max Depth (ft)		N/A		N/A		2.2		---		1.4	2.6	1.4	2	---		1.5	2.8	1.3	2.3
Pool Spacing (ft)		N/A		34	53	42	81	---	---	22	69	41	75	---	---	57	87	38	73
Pool Volume (ft^3)[1]																			
Pattern																			
Channel Beltwidth (ft)	N/A	---		---		---		N/A[2]		23	56	23	57	N/A[2]		23	56	23	57
Radius of Curvature (ft)		---		---		---		N/A[2]		18	27	20	35	N/A[2]		18	27	20	35
Rc/Bankfull Width		---		---		---		N/A[2]		2.1	3.1	2.3	4.0	N/A[2]		2.1	3.1	2.3	4.0
Meander Length (ft)		---		---		---		N/A[2]		73	135	93	146	N/A[2]		73	135	93	146
Meander Width Ratio		---		---		---		N/A[2]		2.7	6.5	2.7	6.5	N/A[2]		2.7	6.5	2.7	6.5
Substrate, Bed and Transport Parameters																			
Ri%/Ru%/P%/G%/S%	N/A																		
SC%/Sa%/G%/C%/B%/Be%																			
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$		---		SC/SC/SC/36.7/78 .5/180.0		SC/10.5/19.7/68.5/ >2048/>2048		---		---		---		0.1/18.0/35.9/98.3/ 160.7/256.0		SC/0.2/8.0/67.2/ 128.0/256.0		SC/0.3/12.1/81.3/1 37.0/256.0	
Reach Shear Stress (Competency) lb/ft^2		---		---		---		---		0.59		0.49		0.68		0.59		0.24	0.29
Max part size (mm) mobilized at bankfull		---		---		---		---		103		90		---		---		---	
Stream Power (Capacity) W/m^2																			
Additional Reach Parameters																			
Drainage Area (SM)	N/A	0.09		0.20		0.35		0.09		0.20		0.35		0.09		0.20		0.35	
Watershed Impervious Cover Estimate (%)		4%						4%						4%					
Rosgen Classification		G4		E4		E4		C4b		E4		E4		B4		C4		C3/4	
Bankfull Velocity (fps)		4.1		4.5		4.1		3.3		3.2		3.4		3.3		3.4		2.1	2.3
Bankfull Discharge (cfs)		10		20		30		10		20		30		13		24		10	18
Q-NFF regression (2-yr)																			
Q-USGS extrapolation (1.2-yr)		---		---		---		13		24		36		---		---		---	
Max Q-Mannings		---		---		---		126		44		97		---		---		---	
Valley Slope (ft/ft)		0.0166		0.0170		0.0094		0.0167		0.0183		0.0124		---		---		---	
Channel Thalweg Length (ft)		136		391		1,201		136		458		1,322		136		458		1,322	
Sinuosity		1.00		1.00		1.04		1.00		1.40		1.30		---		1.40		1.30	
Bankfull/Channel Slope[1] (ft/ft)		0.0192		0.0168		0.0101		0.0160		0.0133		0.0095		0.0274		0.0135		0.0078	

1. As-Built/ Baseline channel slope (ft/ft) was measured from channel bed rather than water surface slope due to a dry channel during survey data collection
2. Pattern data is not applicable for A-type and B-type channels
3. ER is based on the width of the cross-section, in lieu of assuming the width across the floodplain.
SC: Silt/Clay <0.062 mm diameter particles
(---): Data was not provided
N/A: Not Applicable

Table 11b. Reference Reach Data Summary

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

		Reference Reach Data											
Parameter	**Gage**	**UT to Richland Creek**		**UT to Cane Creek**		**Spencer Creek 3**		**UT to Rocky Creek**		**Foust Creek US**		**Long Branch**	
		Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Dimension and Substrate - Riffle													
Bankfull Width (ft)	N/A	8.8	10.4	11.5	12.3	6.3	9.3	12.2		18.5	19.4	14.8	18.6
Floodprone Width (ft)		28.0	31.0	31.0		14.0	125.0	72.4		55.0	101.0	>50.0	
Bankfull Mean Depth		0.8	0.9	0.8	1.0	0.8	1.0	1.3		1.2	1.3	1.3	2.1
Bankfull Max Depth		1.1	1.3	1.2	1.6	1.0	1.2	1.8		1.8	2.1	1.9	2.9
Bankfull Cross-sectional Area (ft^2)		7.8	8.5	8.9	12.2	6.6	8.7	16.3		23.9	24.1	34.6	
Width/Depth Ratio		10.0	12.8	12.3	14.4	7.9	9.3	9.1		14.3	15.7	7.9	13.8
Entrenchment Ratio		2.5	4.0	2.5	2.7	1.7	4.3	6.0		2.9	5.3	>3.4	
Bank Height Ratio		1.4	2.1	1.4	2.5	1.0		1.0		---	---	1.2	1.5
D50 (mm)		---		27.8		11.0		22.6		61.0		41.6	
Profile													
Riffle Length (ft)	N/A	---		---		---		---		---		---	
Riffle Slope (ft/ft)		0.018	0.036	0.015	0.035	0.018	0.034	0.061	0.089	---	---	0.012	0.013
Pool Length (ft)		---		---		---		---		---		---	
Pool Max Depth (ft)		14.7	16.0	2.5	2.9	1.2	1.8	2.2		2.5	2.9	2.2	
Pool Spacing (ft)		33	93	49	91	9	46	26	81	---	---	50	105
Pool Volume (ft^3)		---		---		---		---		---		---	
Pattern													
Channel Beltwidth (ft)	N/A	---		102		10	50	---		---		60	
Radius of Curvature (ft)		---		23	38	12	85	---		---		16	87
Rc/Bankfull Width		---		2.0	3.1	1.9	9.1	---		---		1.1	4.7
Meander Length (ft)		---		---		53	178	---		---		---	---
Meander Width Ratio		---		8.3	8.9	1.6	5.4	---		---		3.2	4.1
Substrate, Bed and Transport Parameters													
Ri%/Ru%/P%/G%/S%	N/A												
SC%/Sa%/G%/C%/B%/Be%													
d16/d35/d50/d84/d95/d100		---		0.6/12.2/27.8/74.5/128		1.9/8.9/11/64/128		<0.063/2.4/22.6/120/256		9.6/37/61/130/1100		8.1/26.6/41.6/124.8/225.5	
Reach Shear Stress (Competency) lb/ft^2													
Max part size (mm) mobilized at bankfull													
Stream Power (Capacity) W/m^2													
Additional Reach Parameters													
Drainage Area (SM)	N/A	0.28		0.29		0.37		1.05		1.40		1.49	
Watershed Impervious Cover Estimate (%)		---		---		---		---		---		---	
Rosgen Classification		C4/E4		E4		E4		E4b		C4		C/E4	
Bankfull Velocity (fps)		4.1		3.8		5.0	5.6	5.5		4.0		4.0	
Bankfull Discharge (cfs)		32		40		35		85		95		124	
Q-NFF regression (2-yr)													
Q-USGS extrapolation (1.2-yr)													
Q-Mannings													
Valley Length (ft)		---		---		---		---		---		---	
Channel Thalweg Length (ft)		---		---		---		---		---		---	
Sinuosity		1.00		1.40		1.00	1.30	1.10		---		1.30	
Water Surface Slope (ft/ft)		---		---		---		---		---		---	
Bankfull/Channel Slope (ft/ft)		0.0131	0.0178	0.0150		0.0190	0.0220	0.0240		0.0090		0.0040	

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided N/A: Not Applicable

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

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

	WF1 Cross-Section 1, Riffle								EF1 Cross-Section 2, Pool								EF1 Cross-Section 3, Riffle							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation [1]	485.90	485.96							491.66	491.66							491.48	491.52						
Low Bank Elevation	485.90	485.89							491.66	491.69							491.48	491.48						
Bankfull Width (ft)	9.3	9.0							11.6	11.4							10.3	10.2						
Floodprone Width (ft)[2]	13.3	13.2							---	---							57.0	57.0						
Bankfull Mean Depth (ft)	0.4	0.4							1.0	1.1							0.5	0.5						
Bankfull Max Depth (ft)	0.7	0.7							1.8	2.1							0.8	0.8						
Bankfull Cross-Sectional Area (ft^2)	4.0	3.3							11.1	12.7							5.0	4.6						
Bankfull Width/Depth Ratio	21.3	24.7							12.1	10.2							21.3	22.5						
Bankfull Entrenchment Ratio	1.4	1.5							---	---							5.5	5.6						
Bankfull Bank Height Ratio	1.0	0.9							---	---							1.0	1.0						

	EF1 Cross-Section 4, Riffle								WF2 Cross-Section 5, Pool								WF2 Cross-Section 6, Riffle							
Dimension and Substrate	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
Bankfull Elevation [1]	487.26	487.20							485.68	485.68							485.50	485.63						
Low Bank Elevation	487.26	487.21							485.68	485.71							485.50	485.58						
Bankfull Width (ft)	13.1	13.1							11.3	10.5							9.8	10.6						
Floodprone Width (ft)[2]	64.9	65.9							---	---							64.5	63.7						
Bankfull Mean Depth (ft)	0.6	0.6							0.9	1.0							0.7	0.6						
Bankfull Max Depth (ft)	1.0	1.0							1.8	2.0							1.2	1.0						
Bankfull Cross-Sectional Area (ft^2)	7.9	8.0							9.9	10.5							7.1	6.6						
Bankfull Width/Depth Ratio	21.9	21.4							13.0	10.6							13.6	17.1						
Bankfull Entrenchment Ratio	4.9	5.0							---	---							6.6	6.0						
Bankfull Bank Height Ratio	1.0	1.0							---	---							1.0	0.9						

[1]MY1-MY7 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current low bank height.

[2]Floodprone width is calculated from the width of cross-section but may valley width may extend further.

Table 13a. Monitoring Data - Stream Reach Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

WF1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle[2]																
Bankfull Width (ft)	10.0		9.0													
Floodprone Width (ft)	16.1		13.2													
Bankfull Mean Depth (ft)	0.7		0.4													
Bankfull Max Depth (ft)	1.0		0.7													
Bankfull Cross-sectional Area (ft^2)	6.5		3.3													
Width/Depth Ratio	15.3		24.7													
Entrenchment Ratio	1.6		1.5													
Bank Height Ratio	2.1		0.9													
D_{50} (mm)	24.4															
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)	---	---														
Pool Length (ft)																
Pool Max Depth (ft)	---															
Pool Spacing (ft)	---	---														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	N/A[1]															
Radius of Curvature (ft)	N/A[1]															
Rc/Bankfull Width (ft/ft)	N/A[1]															
Meander Length (ft)	N/A[1]															
Meander Width Ratio	N/A[1]															
Substrate, Bed and Transport Parameters																
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$	0.1/18.0/35.9/98.3/ 160.7/256.0		2.0/10.1/26.2/80.3/ 151.8/256.0													
Reach Shear Stress (Competency) lb/ft^2	0.68															
Max part size (mm) mobilized at bankfull	---															
Stream Power (Capacity) W/m^2																
Additional Reach Parameters																
Drainage Area (SM)	0.09															
Watershed Impervious Cover Estimate (%)	4%															
Rosgen Classification	B4															
Bankfull Velocity (fps)	3.3															
Bankfull Discharge (cfs)	13															
Valley Slope (ft/ft)	---															
Channel Thalweg Length (ft)	136															
Sinuosity	---															
Bankfull/Channel Slope (ft/ft)	0.0274															

[1]Pattern data is not applicable for A-type and B-type channels

[2]MY1-MY7 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current low bank height.

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 13b. Monitoring Data - Stream Reach Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

EF1

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle[1]																
Bankfull Width (ft)	10.3	13.1	10.20	13.10												
Floodprone Width (ft)	57.0	64.9	57.00	65.90												
Bankfull Mean Depth (ft)	0.5	0.6	0.50	0.60												
Bankfull Max Depth (ft)	0.8	1.0	0.80	1.00												
Bankfull Cross-sectional Area (ft^2)	5.0	7.9	4.60	8.00												
Width/Depth Ratio	21.3	21.9	21.40	22.50												
Entrenchment Ratio	4.9	5.5	5.00	5.60												
Bank Height Ratio	1.0		1.0													
D_{50} (mm)	37.4	51.8														
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)	0.001911	0.078794														
Pool Length (ft)																
Pool Max Depth (ft)	1.3	2.3														
Pool Spacing (ft)	38	73														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	23	57														
Radius of Curvature (ft)	20	35														
Rc/Bankfull Width (ft/ft)	2.3	4.0														
Meander Length (ft)	93	146														
Meander Width Ratio	2.7	6.5														
Substrate, Bed and Transport Parameters																
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$	SC/0.3/12.1/81.3/137.0/256.0		4.73/12.2/20.5/71.7/104.7/180.0/													
Reach Shear Stress (Competency) lb/ft^2	0.24	0.29														
Max part size (mm) mobilized at bankfull	---															
Stream Power (Capacity) W/m^2																
Additional Reach Parameters																
Drainage Area (SM)	0.35															
Watershed Impervious Cover Estimate (%)	0															
Rosgen Classification	C3/4															
Bankfull Velocity (fps)	2.1	2.3														
Bankfull Discharge (cfs)	10	18														
Valley Slope (ft/ft)	---															
Channel Thalweg Length (ft)	1,322															
Sinuosity	1.30															
Bankfull/Channel Slope (ft/ft)	0.0078															

[1]MY1-MY7 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current low bank height.

SC: Silt/Clay <0.062 mm diameter particles

(---): Data was not provided

N/A: Not Applicable

Table 13c. Monitoring Data - Stream Reach Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

WF2

Parameter	As-Built/Baseline		MY1		MY2		MY3		MY4		MY5		MY6		MY7	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle[1]																
Bankfull Width (ft)	9.8		10.6													
Floodprone Width (ft)	64.5		63.7													
Bankfull Mean Depth (ft)	0.7		0.6													
Bankfull Max Depth (ft)	1.2		1.0													
Bankfull Cross-sectional Area (ft^2)	7.1		6.6													
Width/Depth Ratio	13.6		17.1													
Entrenchment Ratio	6.6		6.0													
Bank Height Ratio	1.0		0.9													
D_{50} (mm)	37.5															
Profile																
Riffle Length (ft)																
Riffle Slope (ft/ft)	0.009632	0.04802														
Pool Length (ft)																
Pool Max Depth (ft)	1.5	2.8														
Pool Spacing (ft)	57	87														
Pool Volume (ft^3)																
Pattern																
Channel Beltwidth (ft)	23	56														
Radius of Curvature (ft)	18	27														
Rc/Bankfull Width (ft/ft)	2.1	3.1														
Meander Length (ft)	73	135														
Meander Width Ratio	2.7	6.5														
Substrate, Bed and Transport Parameters																
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
$D_{16}/D_{35}/D_{50}/D_{84}/D_{95}/D_{100}$	SC/0.2/8.0/67.2/ 128.0/256.0		SC/1.6/14.7/70.9/ 110.1/256.0													
Reach Shear Stress (Competency) lb/ft^2	0.59															
Max part size (mm) mobilized at bankfull	---															
Stream Power (Capacity) W/m^2																
Additional Reach Parameters																
Drainage Area (SM)	0.20															
Watershed Impervious Cover Estimate (%)	4%															
Rosgen Classification	C4															
Bankfull Velocity (fps)	3.4															
Bankfull Discharge (cfs)	24															
Valley Slope (ft/ft)	---															
Channel Thalweg Length (ft)	458															
Sinuosity	1.40															
Bankfull/Channel Slope (ft/ft)	0.0135															

[1]MY1-MY7 Bank Height Ratio is calculated based on the As-built (MY0) cross-sectional area as described in the Standard Measurement of the BHR Monitoring Parameter document provided by the NCIRT and NCDMS (9/2018). The remainder of the cross-section dimension parameters were calculated based on the current low bank height.

SC: Silt/Clay <0.062 mm diameter particles

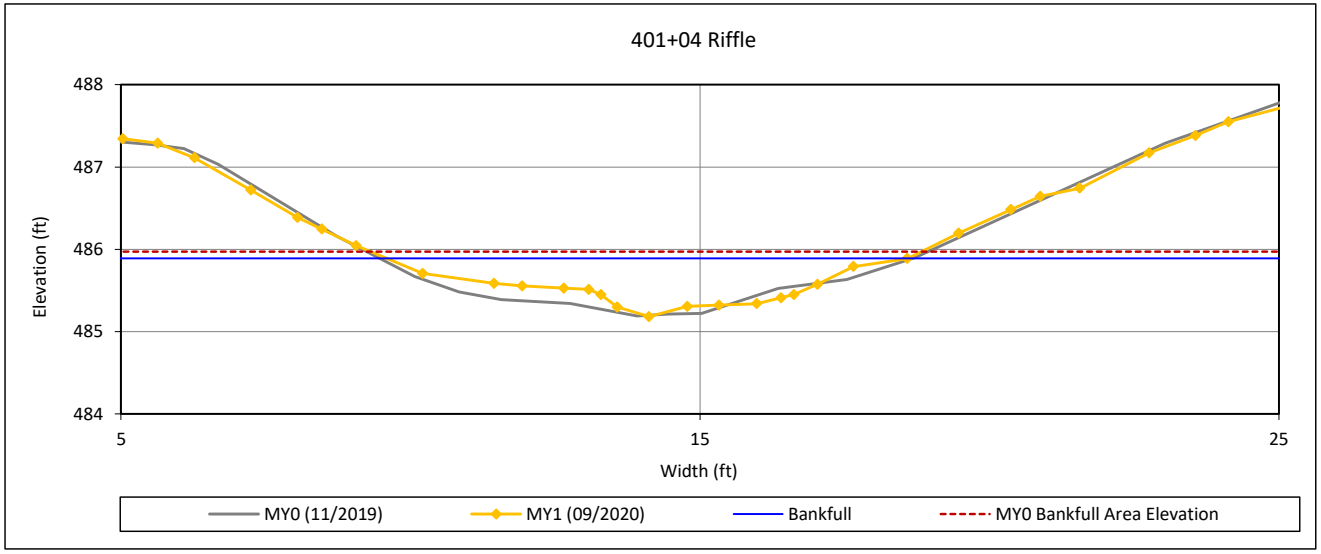
(---): Data was not provided

N/A: Not Applicable

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 1 - 2020

Cross-Section 1 - WF1



Bankfull Dimensions	
3.3	x-section area (ft.sq.)
9.0	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
9.2	wetted perimeter (ft)
0.4	hydraulic radius (ft)
24.7	width-depth ratio
13.2	W flood prone area (ft)
1.5	entrenchment ratio
0.9	low bank height ratio

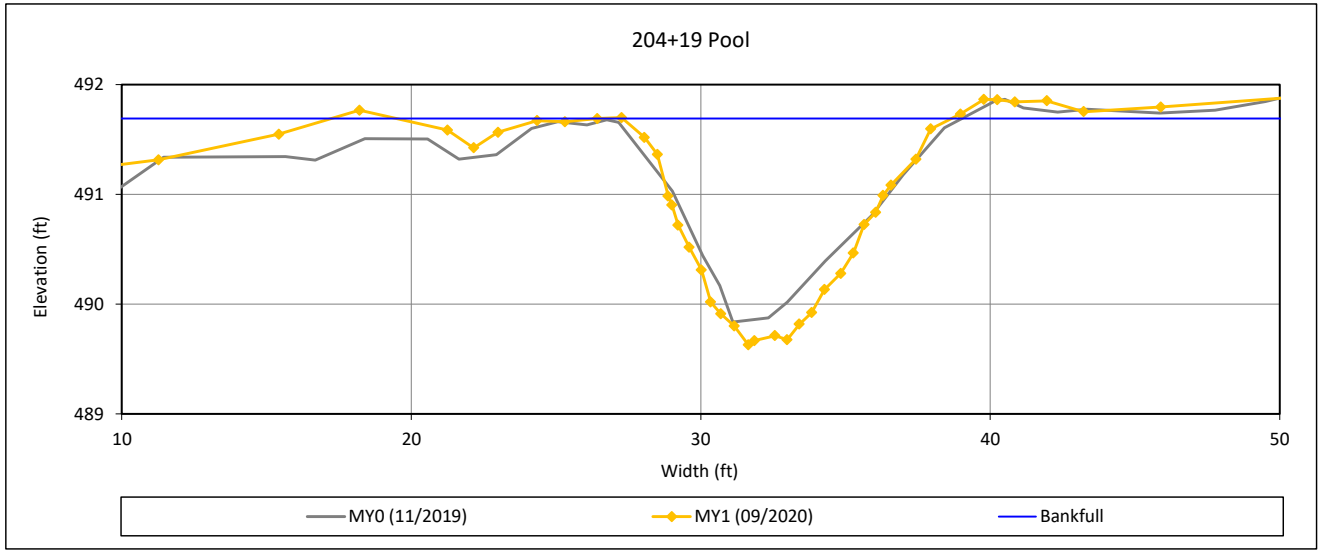
Survey Date: 09/2020
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 1 - 2020

Cross-Section 2 - EF1



Bankfull Dimensions	
12.7	x-section area (ft.sq.)
11.4	width (ft)
1.1	mean depth (ft)
2.1	max depth (ft)
12.3	wetted perimeter (ft)
1.0	hydraulic radius (ft)
10.2	width-depth ratio

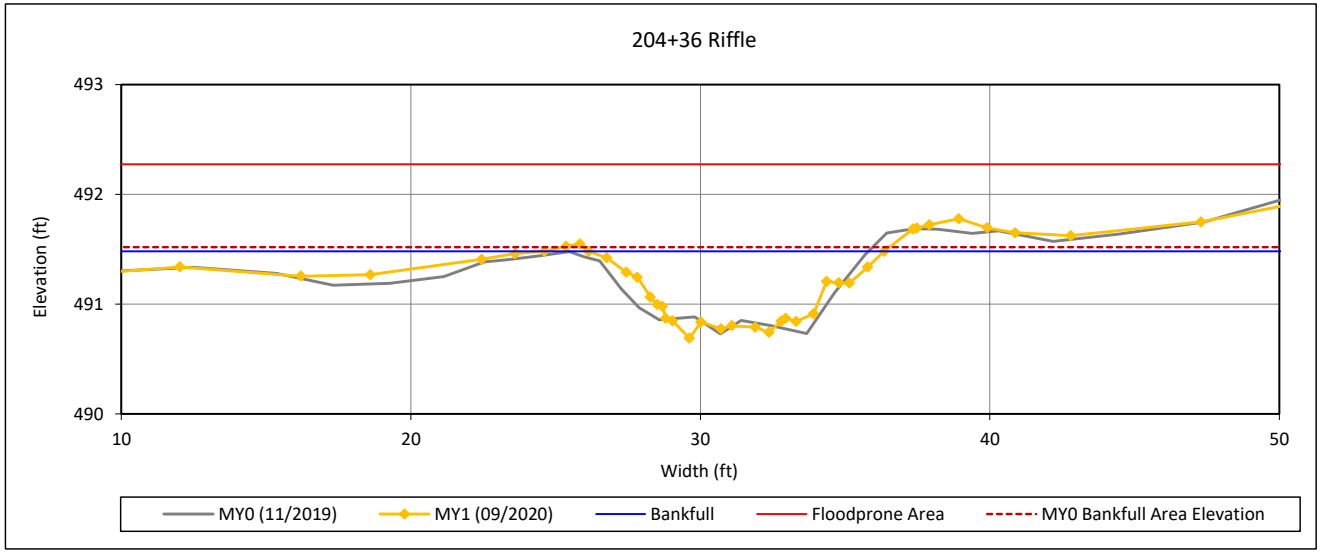
Survey Date: 09/2020
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 1 - 2020

Cross-Section 3 - EF1



Bankfull Dimensions	
4.6	x-section area (ft.sq.)
10.2	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
10.5	wetted perimeter (ft)
0.4	hydraulic radius (ft)
22.5	width-depth ratio
57.0	W flood prone area (ft)
5.6	entrenchment ratio
1.0	low bank height ratio

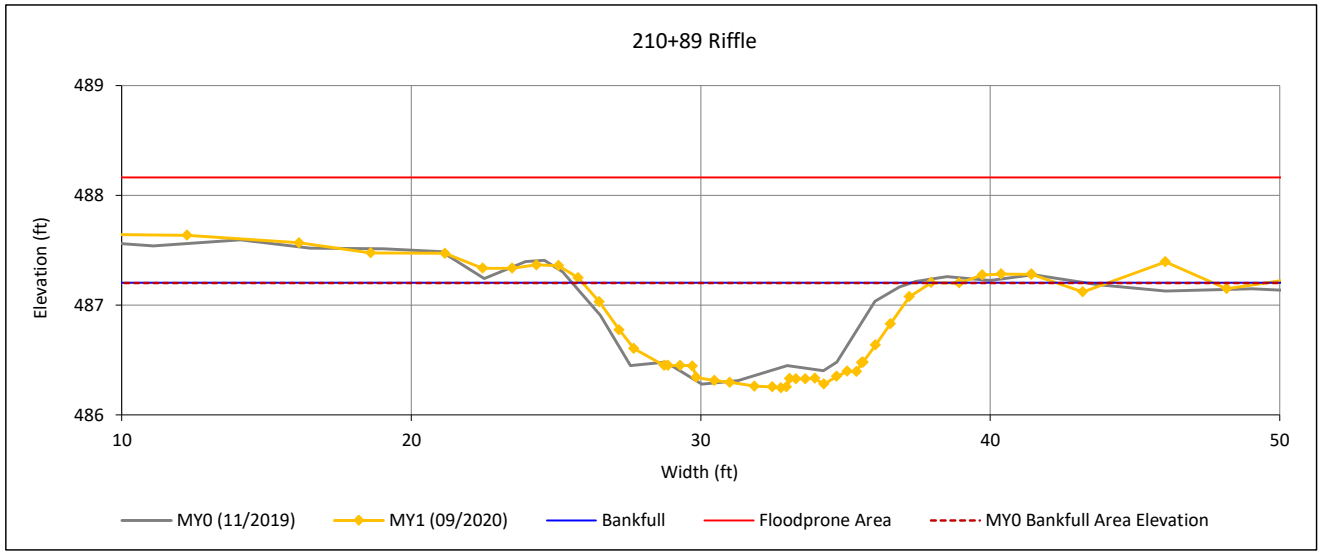
Survey Date: 09/2020
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 1 - 2020

Cross-Section 4 - EF1



Bankfull Dimensions	
8.0	x-section area (ft.sq.)
13.1	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
13.4	wetted perimeter (ft)
0.6	hydraulic radius (ft)
21.4	width-depth ratio
65.9	W flood prone area (ft)
5.0	entrenchment ratio
1.0	low bank height ratio

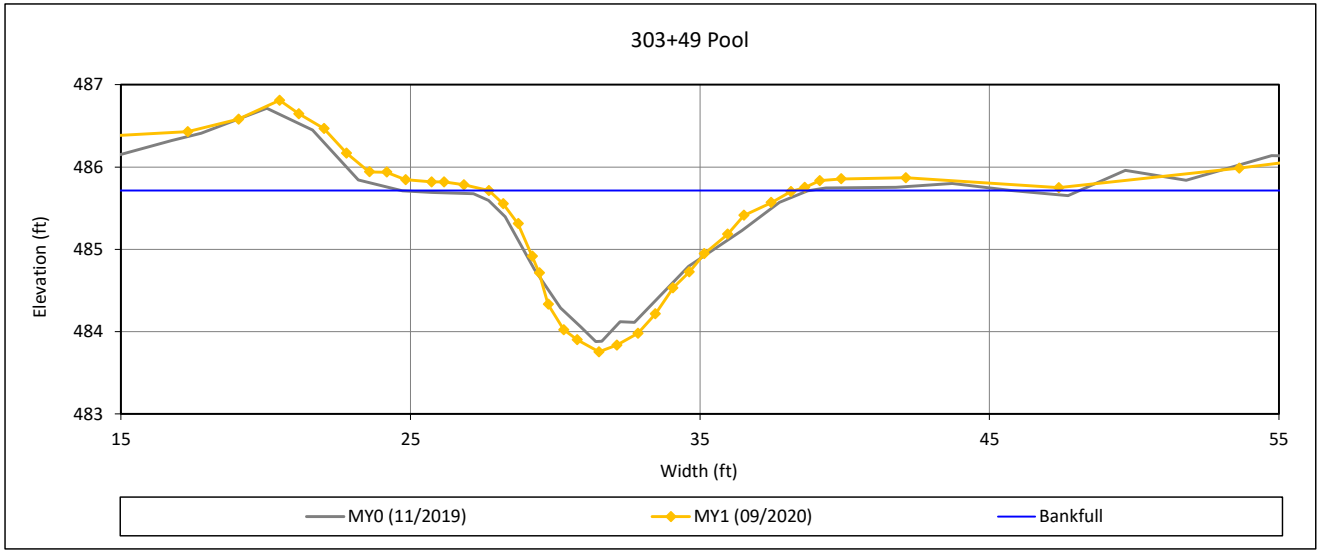
Survey Date: 09/2020
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 1 - 2020

Cross-Section 5 - WF2



Bankfull Dimensions	
10.5	x-section area (ft.sq.)
10.5	width (ft)
1.0	mean depth (ft)
2.0	max depth (ft)
11.4	wetted perimeter (ft)
0.9	hydraulic radius (ft)
10.6	width-depth ratio

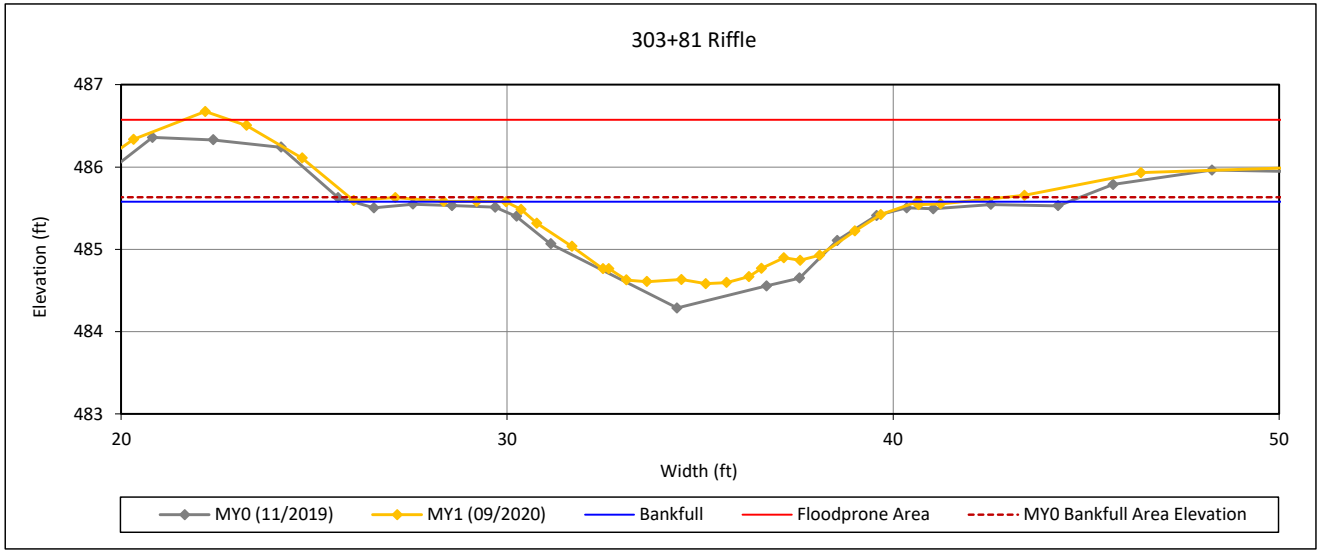
Survey Date: 09/2020
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 1 - 2020

Cross-Section 6 - WF2



Bankfull Dimensions	
6.6	x-section area (ft.sq.)
10.6	width (ft)
0.6	mean depth (ft)
1.0	max depth (ft)
10.9	wetted perimeter (ft)
0.6	hydraulic radius (ft)
17.1	width-depth ratio
63.7	W flood prone area (ft)
6.0	entrenchment ratio
0.9	low bank height ratio

Survey Date: 09/2020
Field Crew: Wildlands Engineering

View Downstream

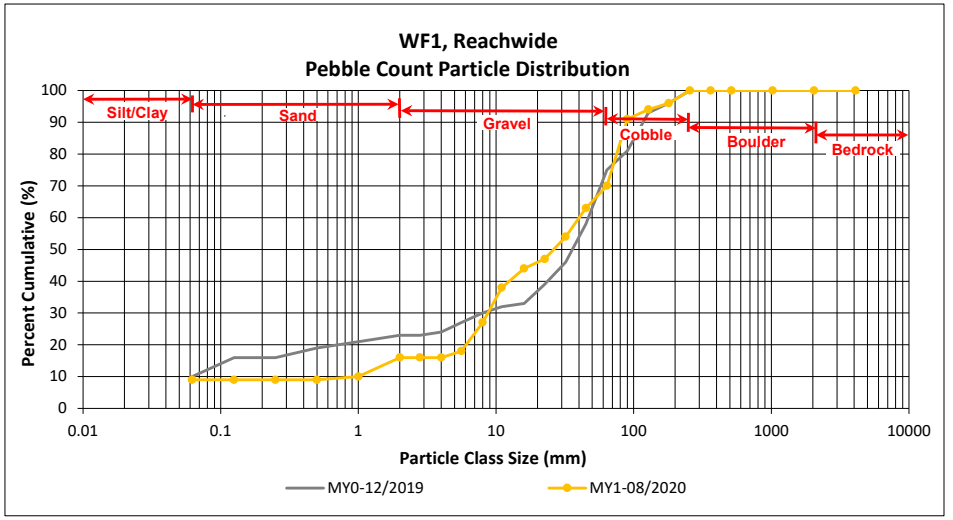
Reachwide Pebble Count Plots

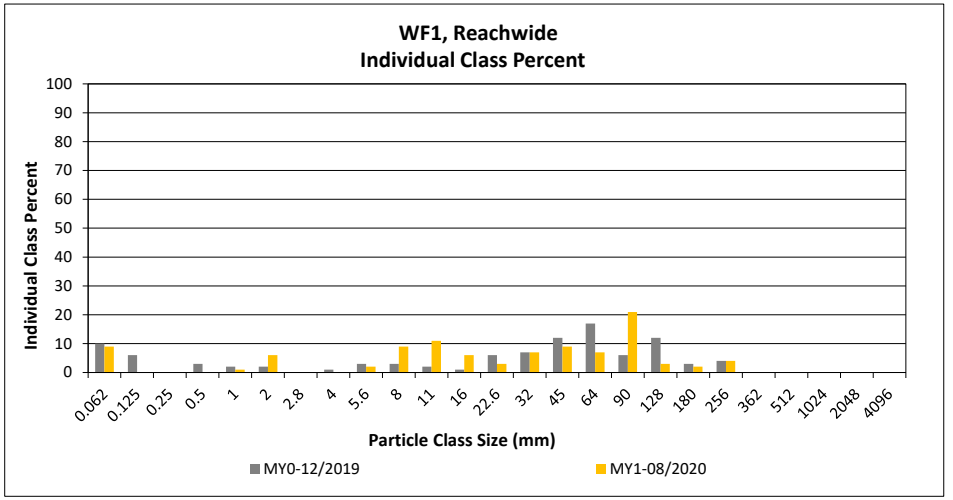
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

WF1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	7	9	9	9
SAND	Very fine	0.062	0.125					9
	Fine	0.125	0.250					9
	Medium	0.25	0.50					9
	Coarse	0.5	1.0		1	1	1	10
	Very Coarse	1.0	2.0	2	4	6	6	16
GRAVEL	Very Fine	2.0	2.8					16
	Very Fine	2.8	4.0					16
	Fine	4.0	5.6		2	2	2	18
	Fine	5.6	8.0	4	5	9	9	27
	Medium	8.0	11.0	5	6	11	11	38
	Medium	11.0	16.0	3	3	6	6	44
	Coarse	16.0	22.6	1	2	3	3	47
	Coarse	22.6	32	5	2	7	7	54
	Very Coarse	32	45	5	4	9	9	63
	Very Coarse	45	64	4	3	7	7	70
COBBLE	Small	64	90	12	9	21	21	91
	Small	90	128	3		3	3	94
	Large	128	180	2		2	2	96
	Large	180	256	2	2	4	4	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	2.0
D_{35} =	10.1
D_{50} =	26.2
D_{84} =	80.3
D_{95} =	151.8
D_{100} =	256.0





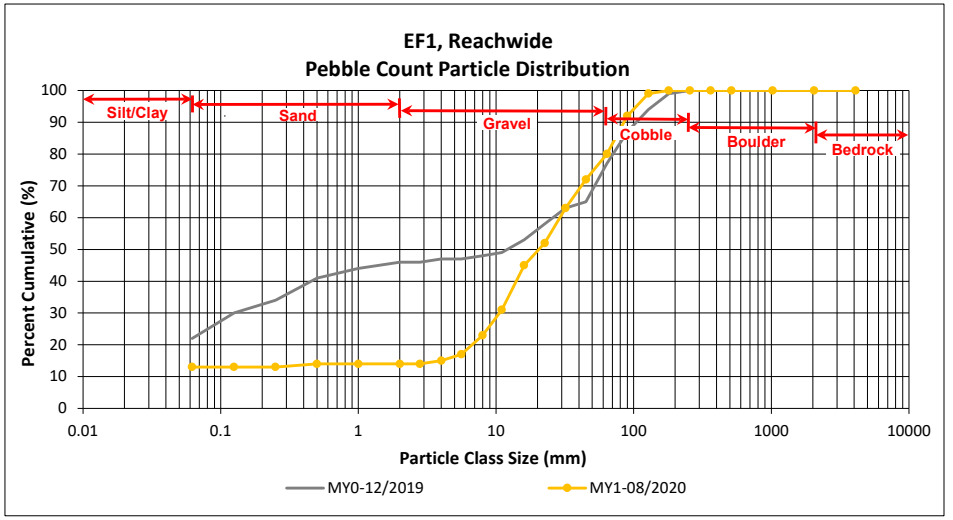
Reachwide Pebble Count Plots

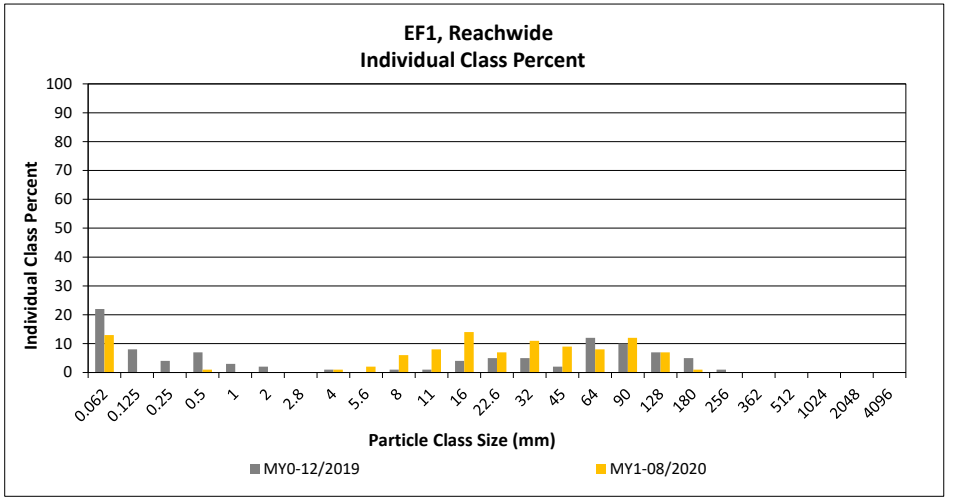
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

EF1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	12	13	13	13
SAND	Very fine	0.062	0.125					13
	Fine	0.125	0.250					13
	Medium	0.25	0.50	1		1	1	14
	Coarse	0.5	1.0					14
	Very Coarse	1.0	2.0					14
GRAVEL	Very Fine	2.0	2.8					14
	Very Fine	2.8	4.0		1	1	1	15
	Fine	4.0	5.6		2	2	2	17
	Fine	5.6	8.0		6	6	6	23
	Medium	8.0	11.0	3	5	8	8	31
	Medium	11.0	16.0	9	5	14	14	45
	Coarse	16.0	22.6	5	2	7	7	52
	Coarse	22.6	32	4	7	11	11	63
	Very Coarse	32	45	5	4	9	9	72
	Very Coarse	45	64	6	2	8	8	80
COBBLE	Small	64	90	10	2	12	12	92
	Small	90	128	6	1	7	7	99
	Large	128	180		1	1	1	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	4.7
D_{35} =	12.2
D_{50} =	20.5
D_{84} =	71.7
D_{95} =	104.7
D_{100} =	180.0





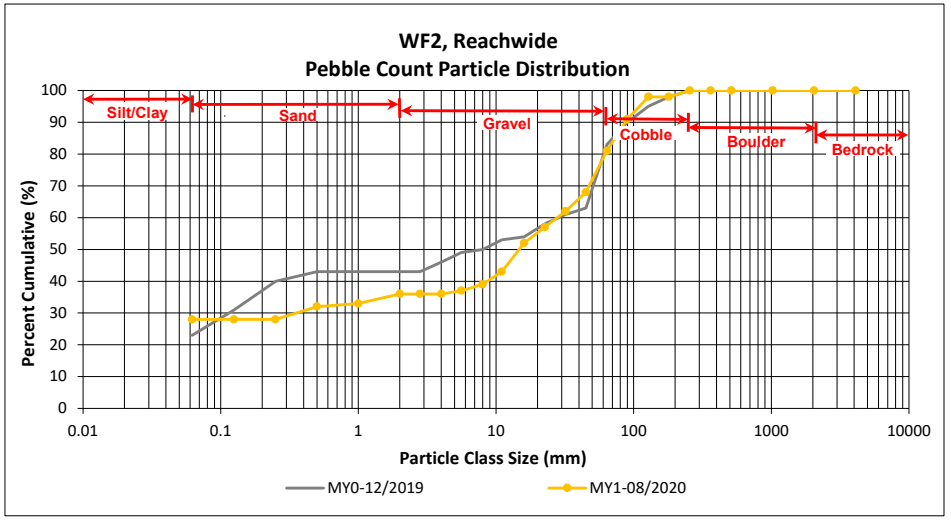
Reachwide Pebble Count Plots

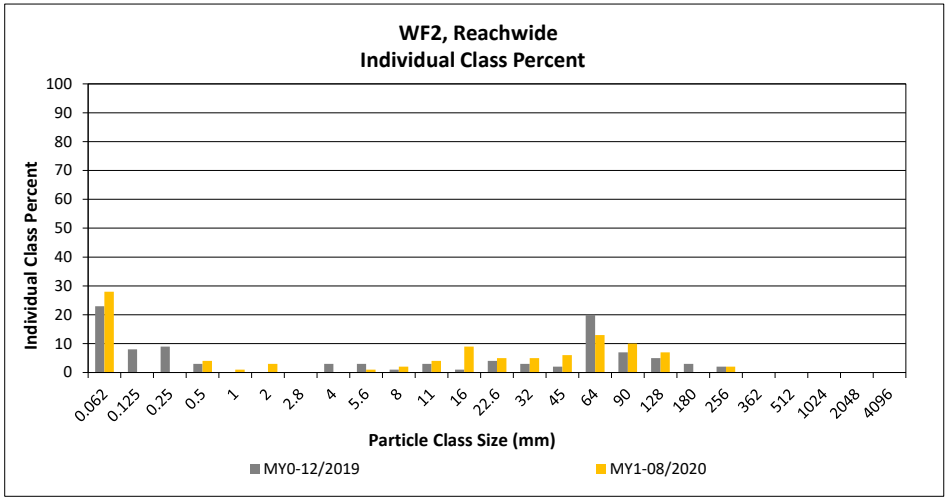
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

WF2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		28	28	28	28
SAND	Very fine	0.062	0.125					28
	Fine	0.125	0.250					28
	Medium	0.25	0.50	1	3	4	4	32
	Coarse	0.5	1.0		1	1	1	33
	Very Coarse	1.0	2.0	2	1	3	3	36
GRAVEL	Very Fine	2.0	2.8					36
	Very Fine	2.8	4.0					36
	Fine	4.0	5.6	1		1	1	37
	Fine	5.6	8.0	1	1	2	2	39
	Medium	8.0	11.0		4	4	4	43
	Medium	11.0	16.0	3	6	9	9	52
	Coarse	16.0	22.6	3	2	5	5	57
	Coarse	22.6	32	4	1	5	5	62
	Very Coarse	32	45	6		6	6	68
	Very Coarse	45	64	11	2	13	13	81
COBBLE	Small	64	90	9	1	10	10	91
	Small	90	128	7		7	7	98
	Large	128	180					98
	Large	180	256	2		2	2	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	Silt/Clay
D_{35} =	1.6
D_{50} =	14.7
D_{84} =	70.9
D_{95} =	110.1
D_{100} =	256.0





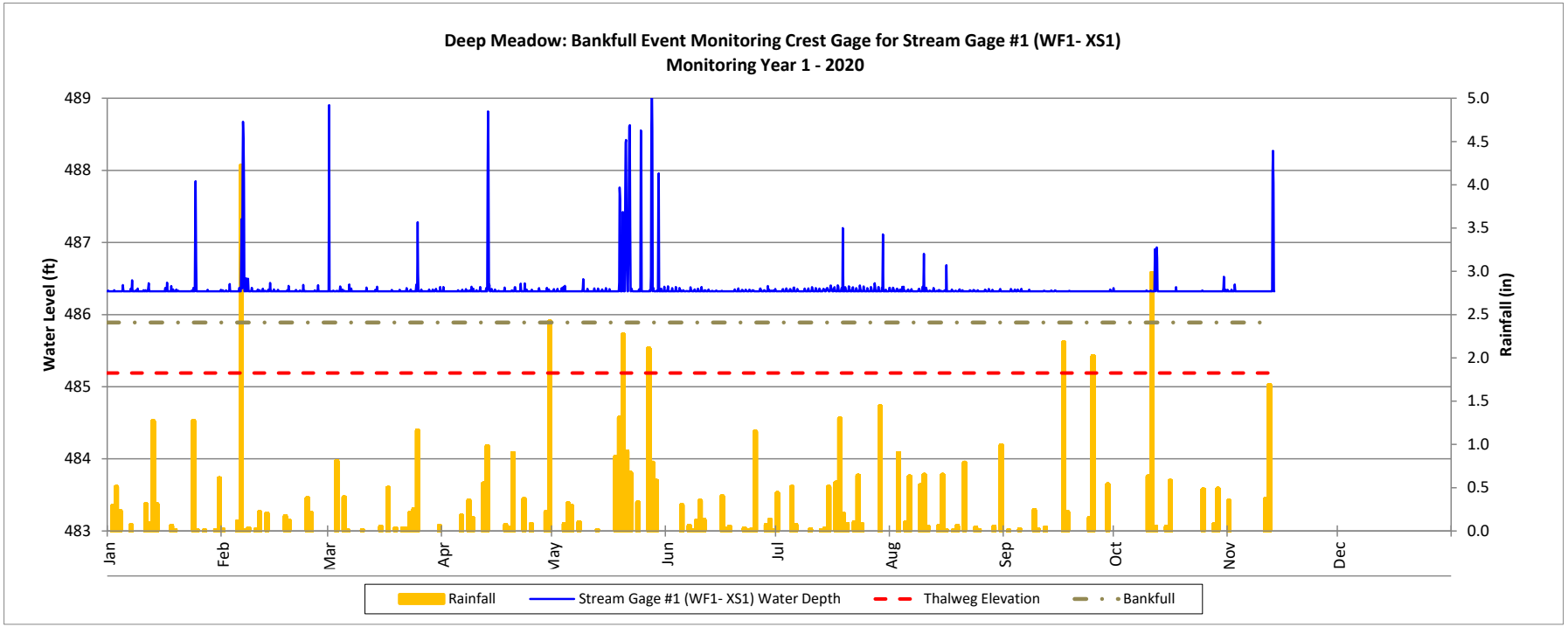
APPENDIX 5. Hydrology Summary Data and Plots

Table 14. Verification of Bankfull Events
Deep Meadow Mitigation Site
DMS Project No. 97135
Monitoring Year 1 - 2020

Reach	MY	Date of Occurrence	Date of Data Collection	Method
WF1		11/12/2020	11/13/2020	Photographic Documentation
EF1		2/6/2020	2/6/2020	Crest Gage
		4/13/2020	4/13/2020	Crest Gage
		5/21/2020	5/21/2020	Crest Gage
		5/27/2020	5/27/2020	Crest Gage
		8/9/2020	8/9/2020	Crest Gage
		8/15/2020	8/15/2020	Crest Gage
		10/11/2020	10/11/2020	Crest Gage
		11/12/2020	11/13/2020	Crest Gage
WF2		1/25/2020	1/25/2020	Crest Gage
		2/6/2020	2/6/2020	Crest Gage
		4/13/2020	4/13/2020	Crest Gage
		5/21/2020	5/21/2020	Crest Gage
		5/27/2020	5/27/2020	Crest Gage
		8/9/2020	8/9/2020	Crest Gage
		8/15/2020	8/15/2020	Crest Gage
		10/11/2020	10/11/2020	Crest Gage
		10/30/2020	10/30/2020	Crest Gage
		11/12/2020	11/13/2020	Crest gage and photographs

Recorded Bankfull Flow Events

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

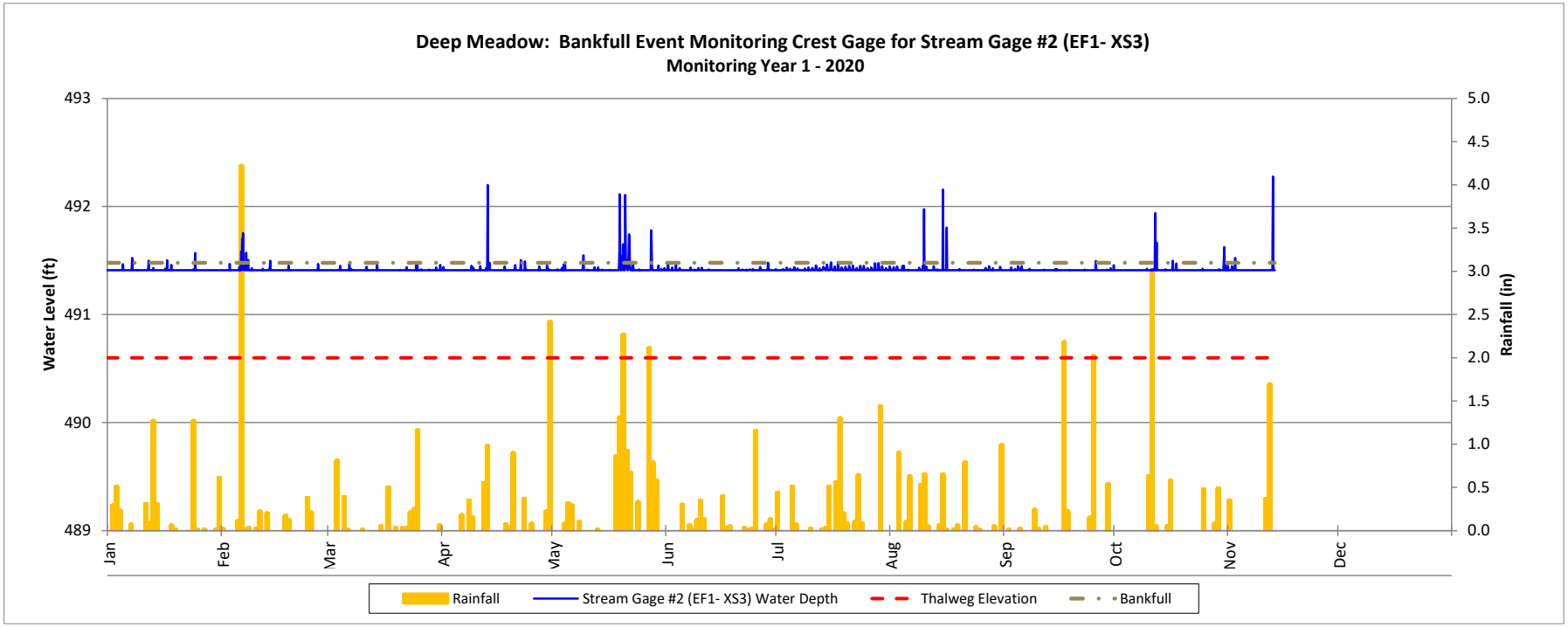


Recorded Bankfull Flow Events

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020



Recorded Bankfull Flow Events

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020

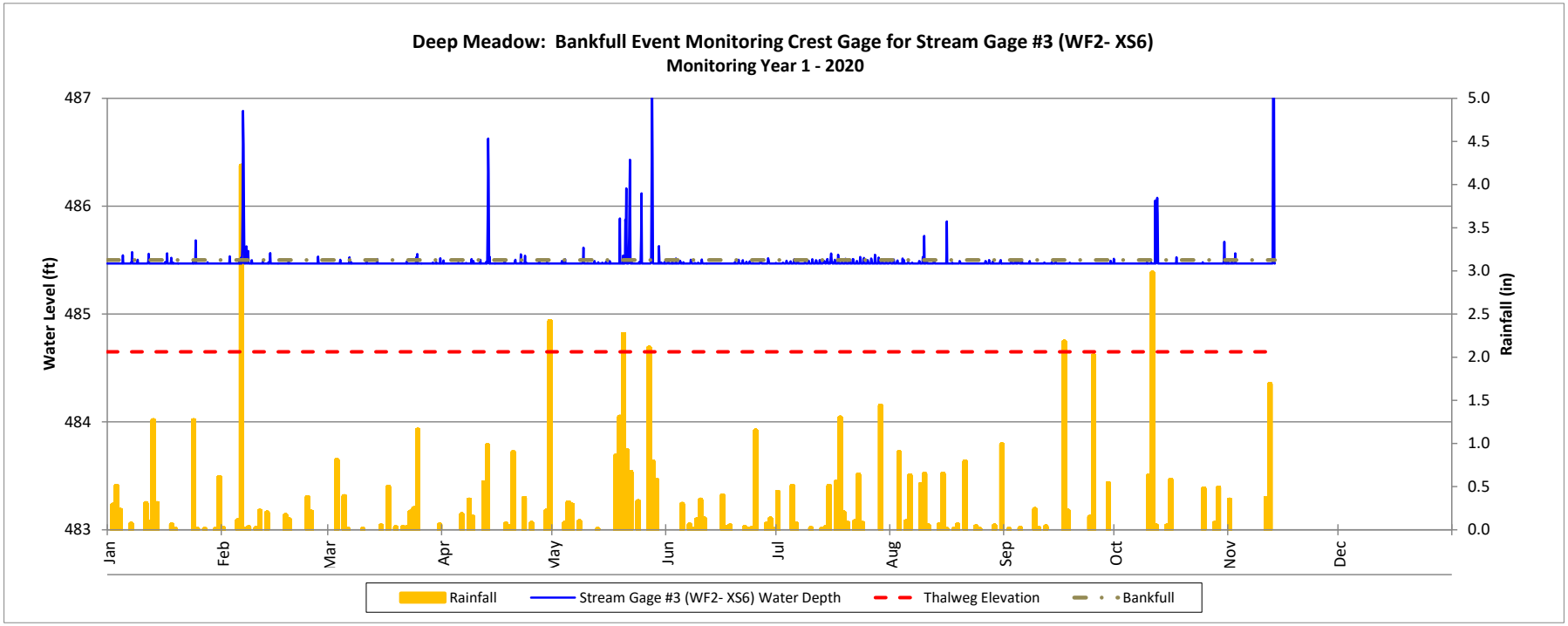


Table 15. Wetland Gage Attainment Summary

Deep Meadow Mitigation Site

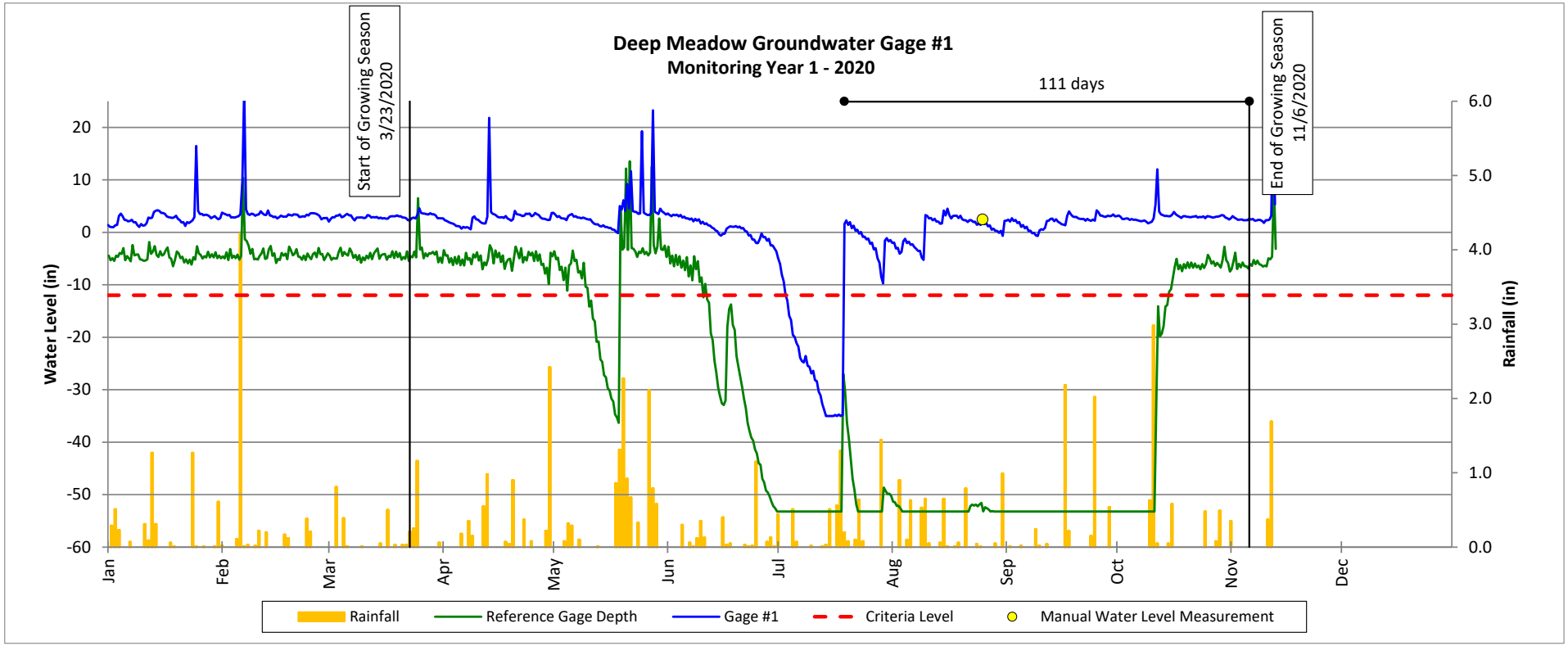
DMS Project No. 97135

Monitoring Year 1 - 2020

Summary of Groundwater Gage Results for Monitoring Years 1 through 7							
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	MY1	MY2	MY3	MY4	MY5	MY6	MY7
1	Yes/111 days (48.5%)						
2	Yes/58 days (25.3%)						
3	Yes/25 days (10.9%)						
4	Yes/63 days (27.5%)						
5	Yes/229 days (100%)						
6	Yes/51 days (22.3%)						
7	Yes/58 days (25.3%)						
8	Yes/51 days (22.3%)						
9	Yes/27 days (11.8%)						
10	Yes/26 days (11.4%)						
11	No/20 days (8.7%)						

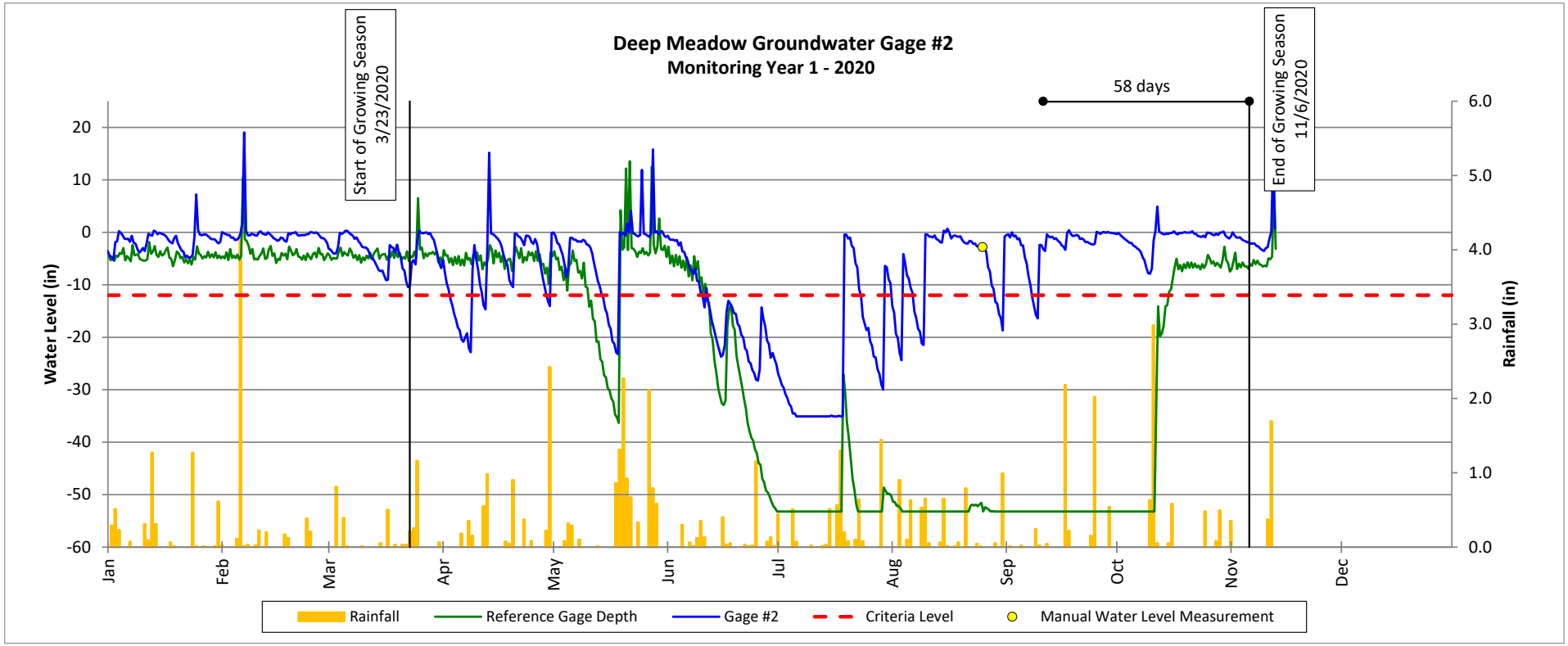
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E10



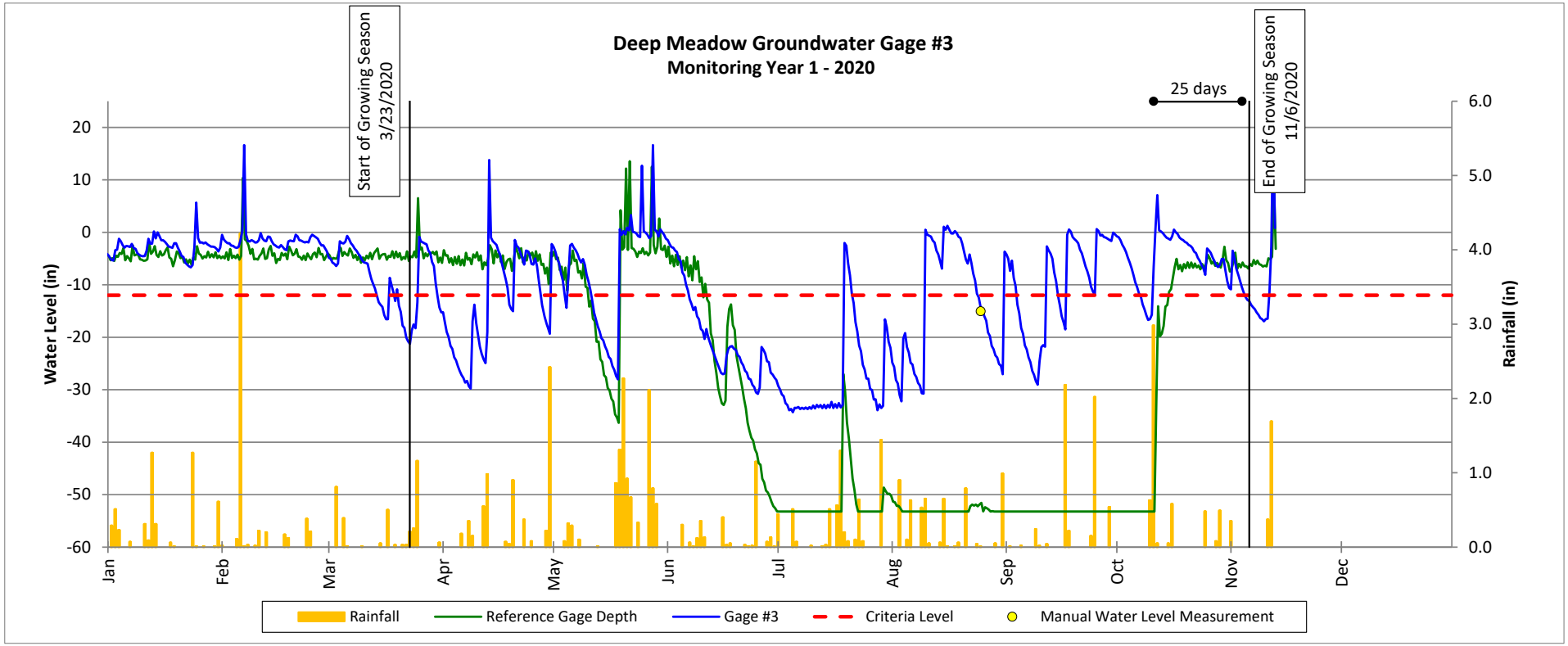
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E9



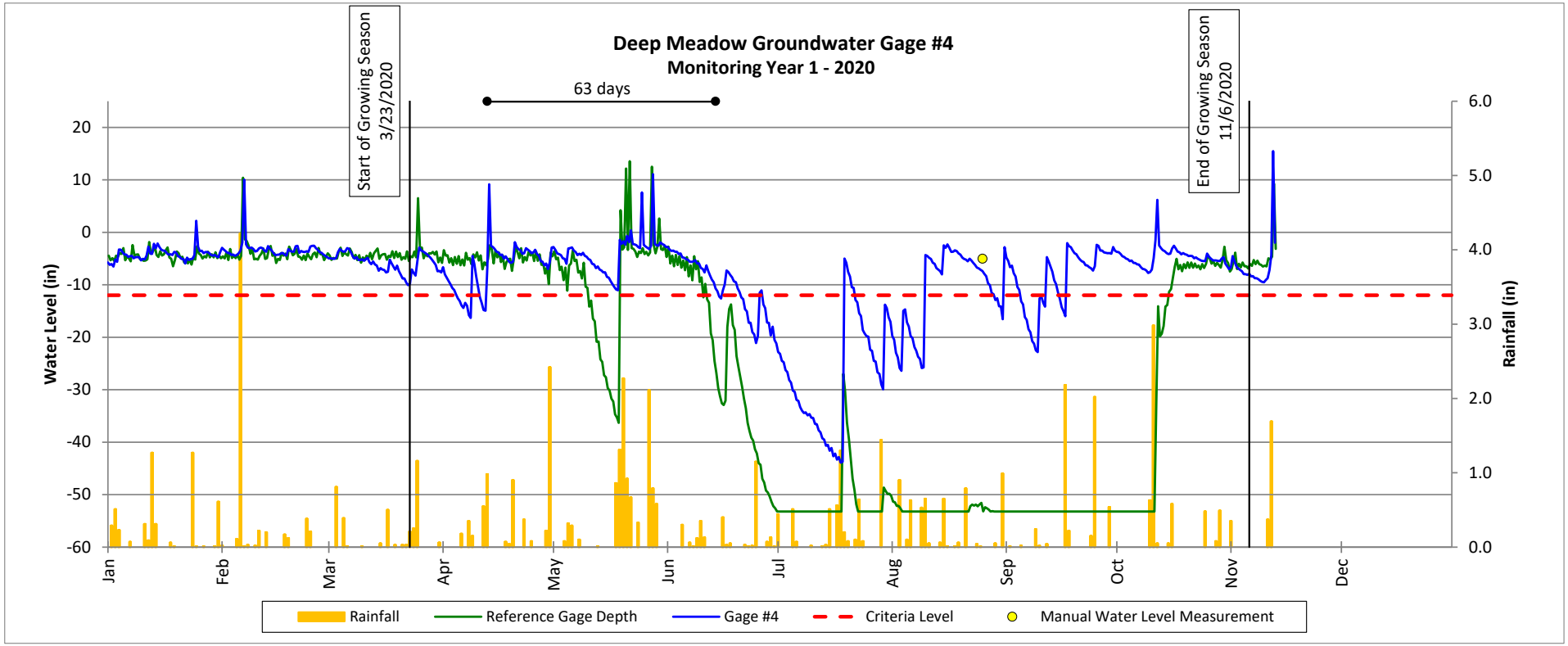
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E8



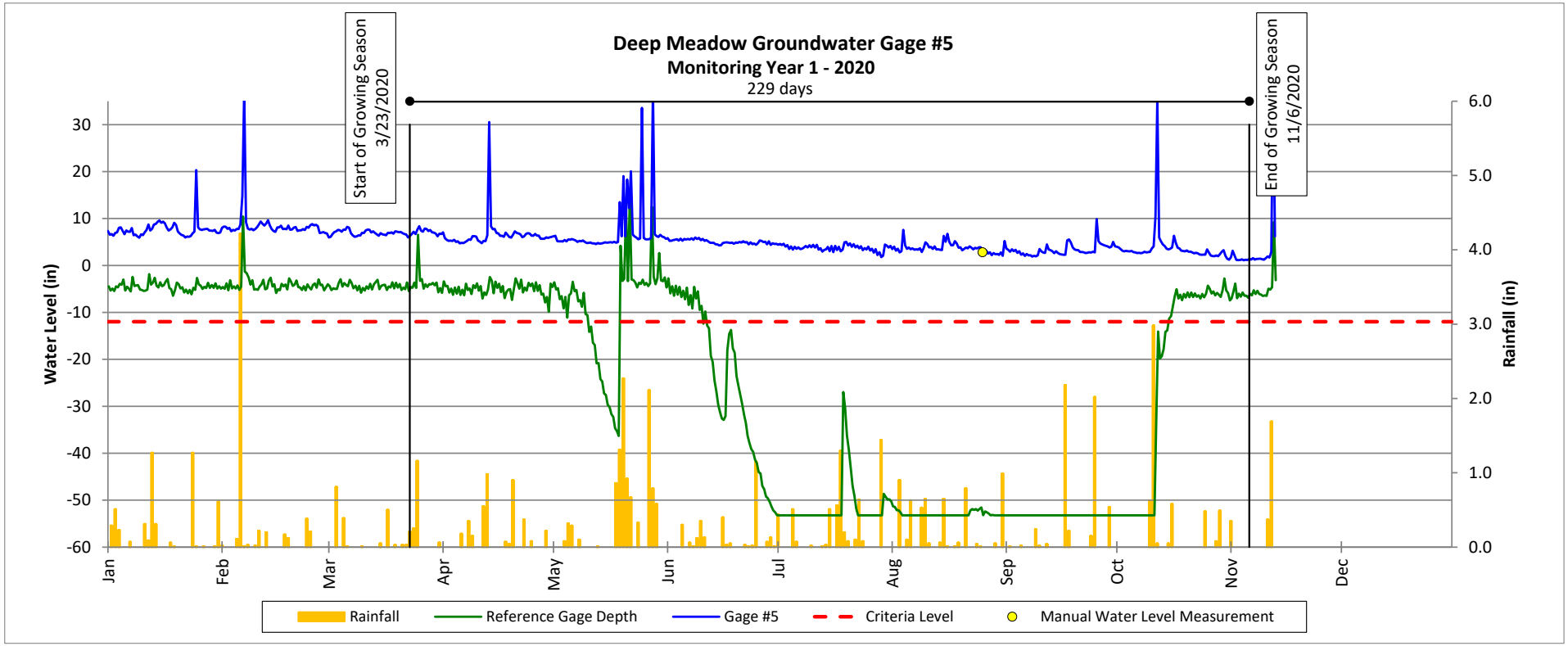
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E7



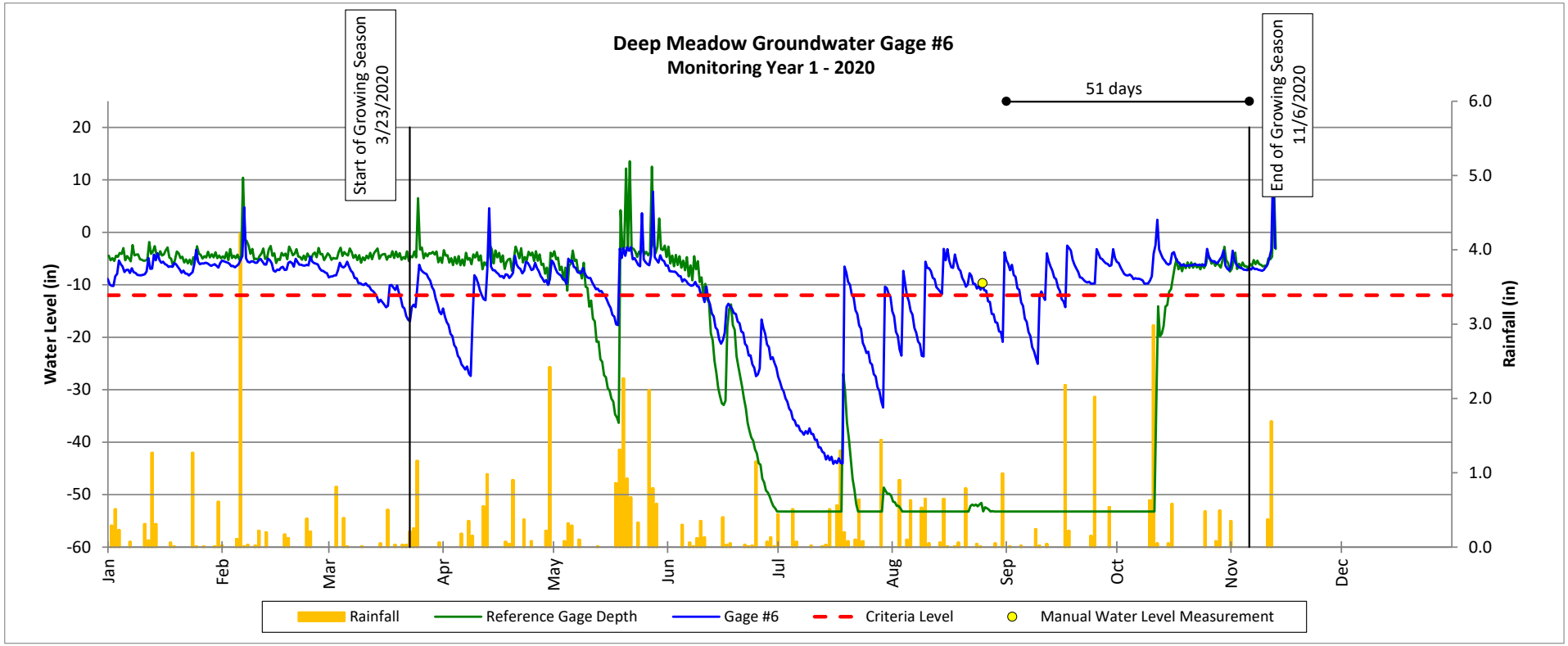
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E1



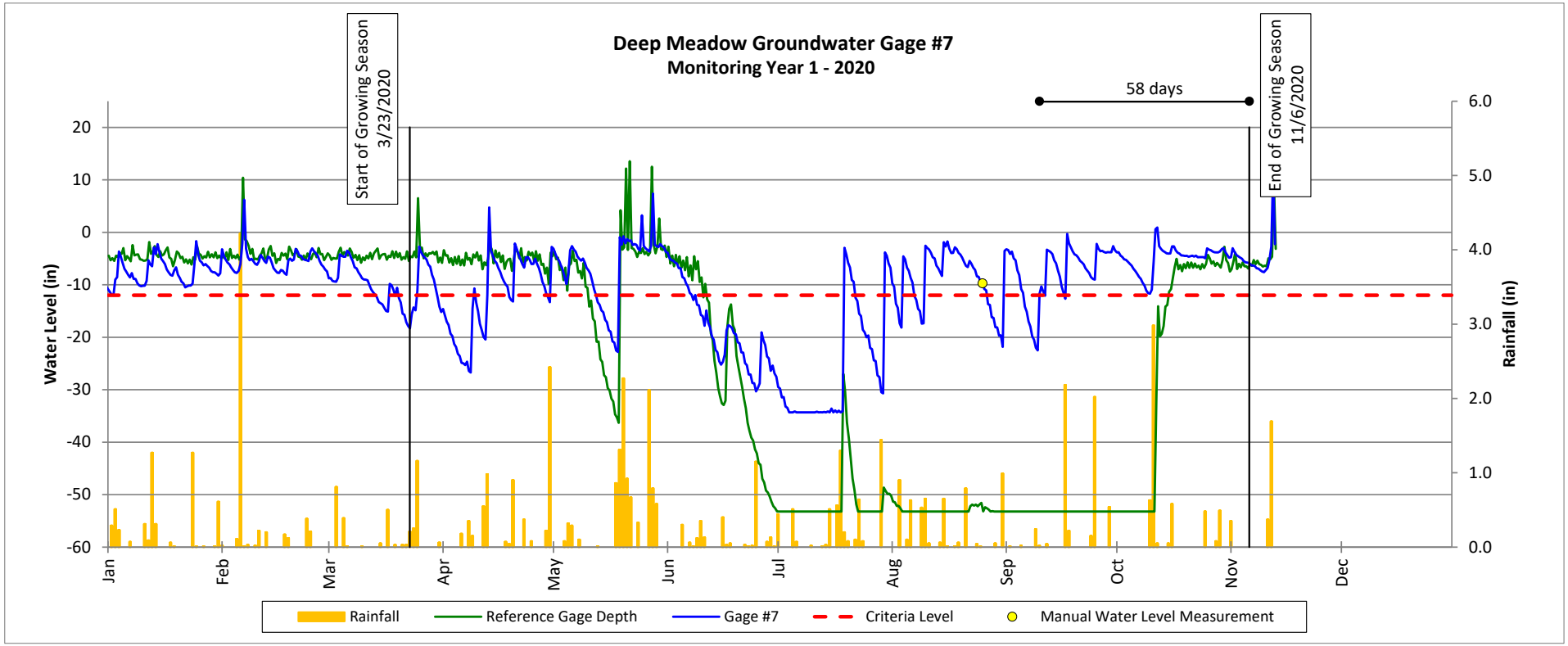
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E2



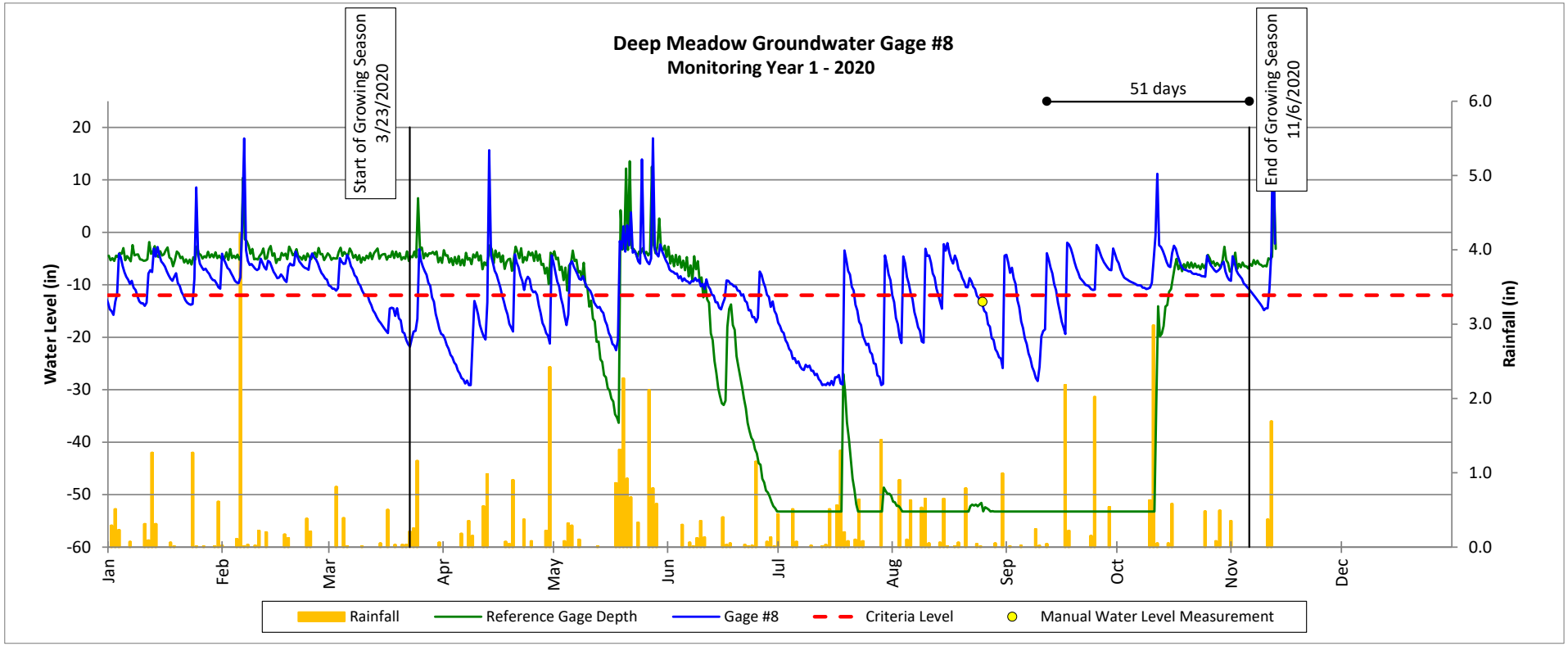
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E2



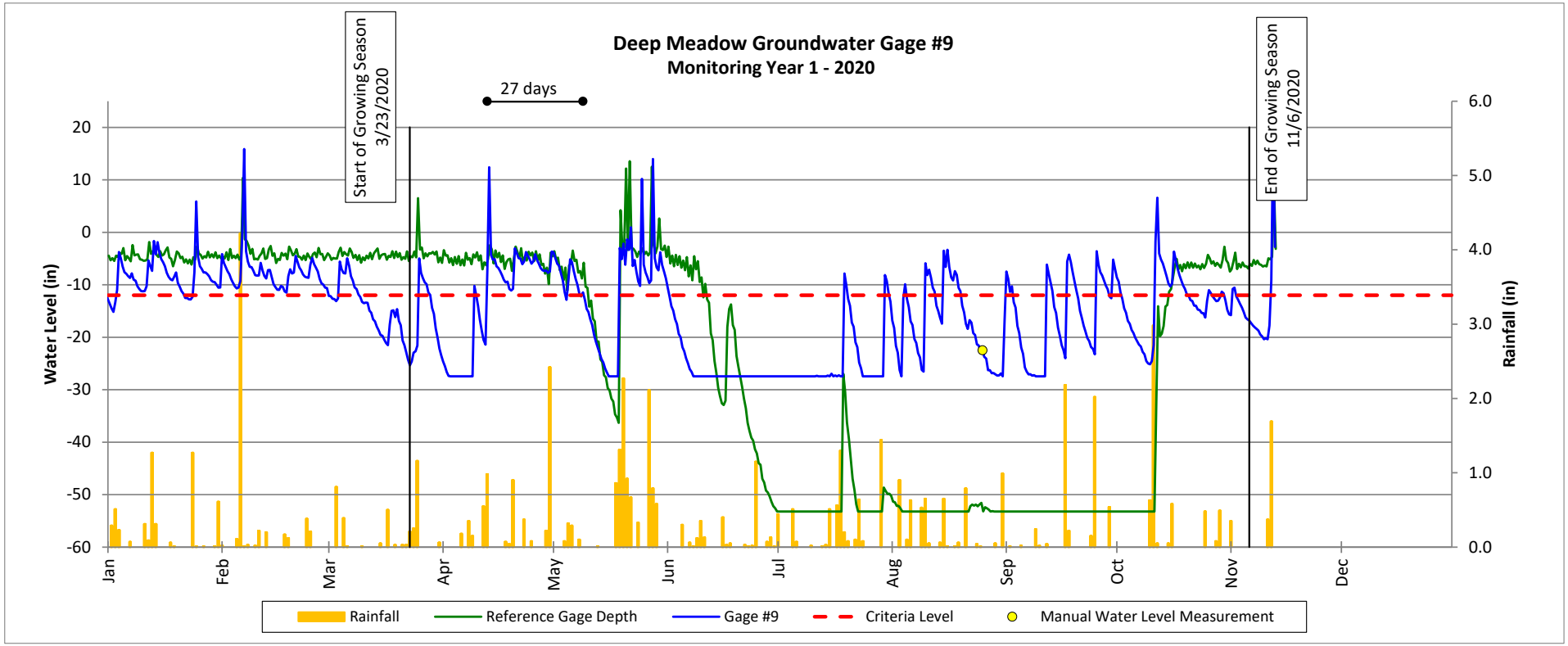
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E3



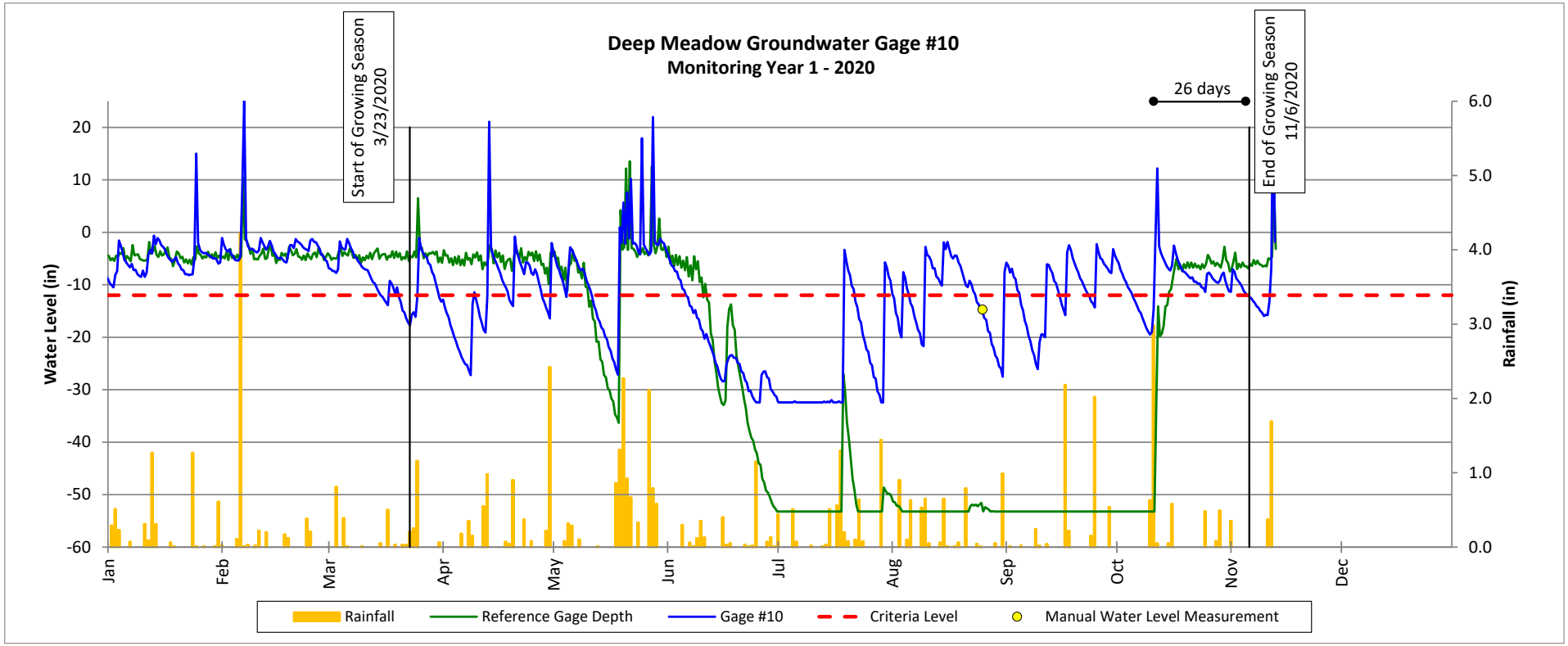
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E4



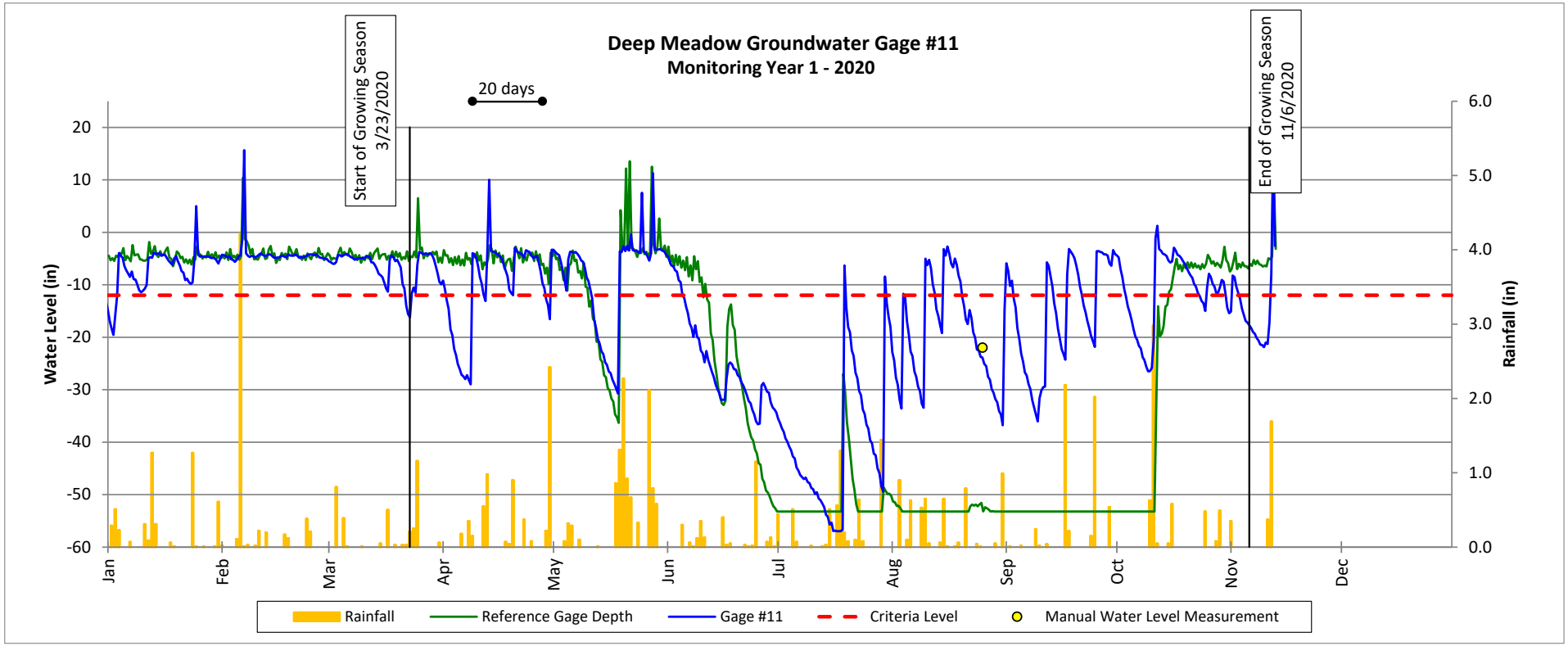
Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E5



Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 1 - 2020
Wetland W-E6

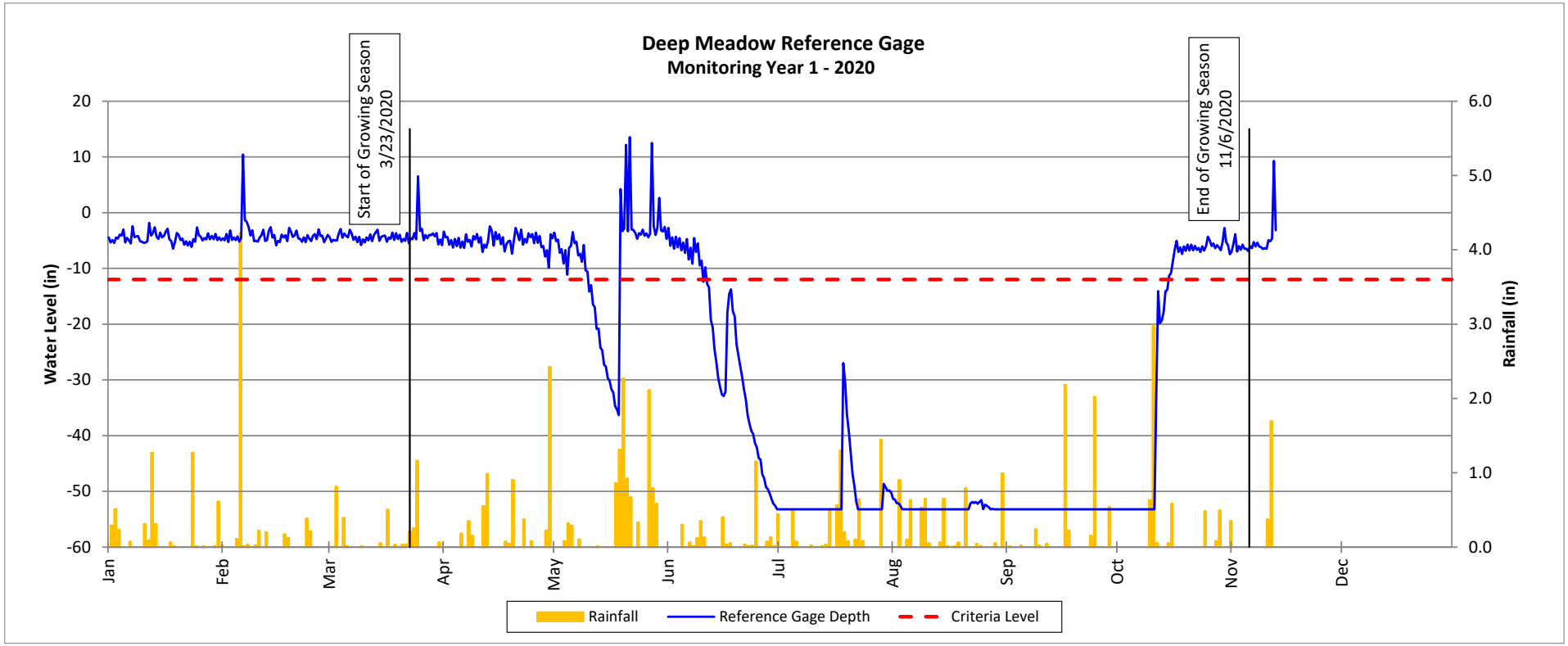


Groundwater Gage Plots

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 1 - 2020

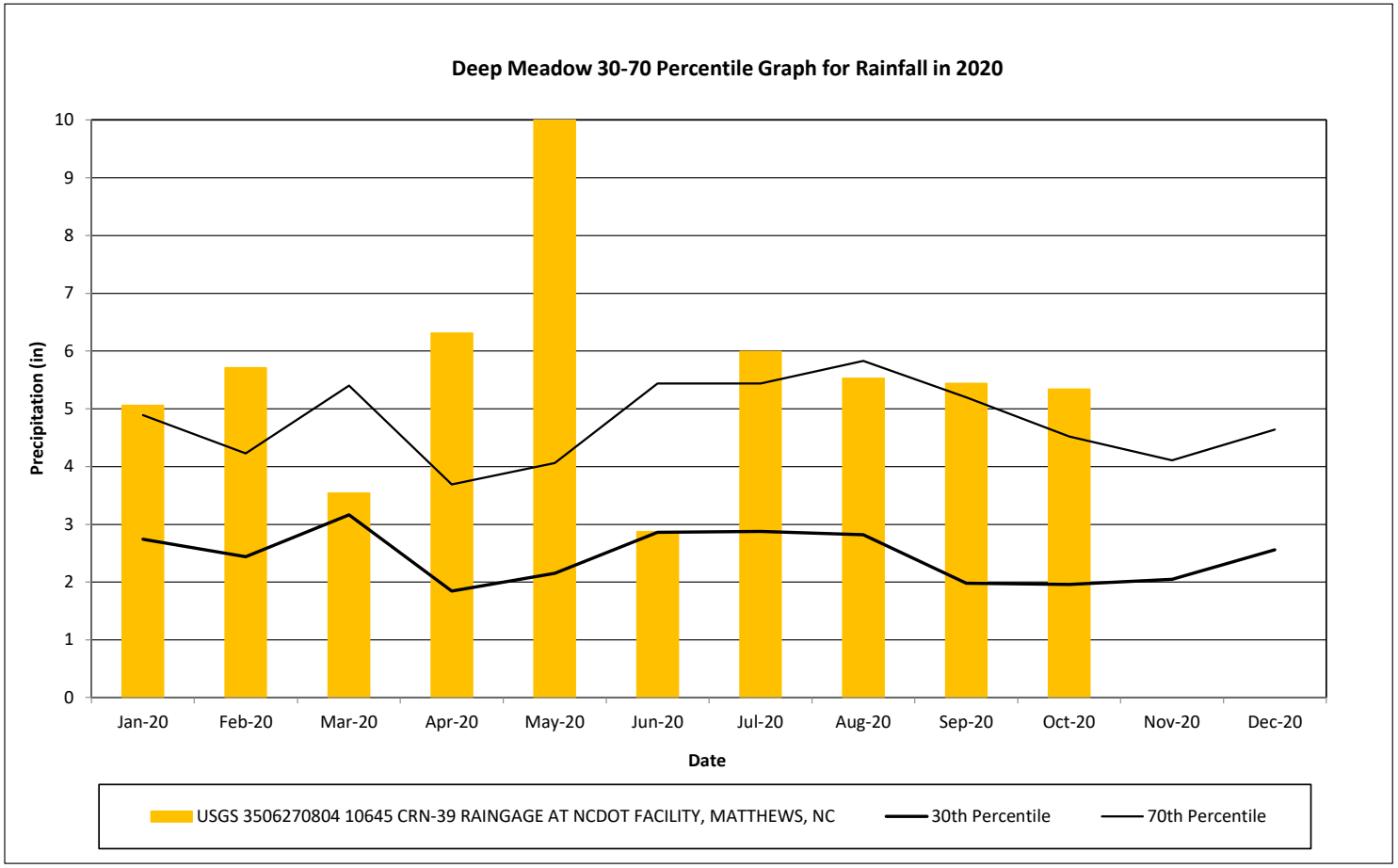


Monthly Rainfall Data

Deep Meadow Mitigation Site

DMS Project No. 97135

Monitoring Year 1 - 2020



Annual Rainfall collected by USGS 3506270804 10645 CRN-39 RAINGAGE AT NCDOT FACILITY, MATTHEWS, NC (Downloaded 11/19/2020)

30th and 70th percentile rainfall data collected from WETS station Monroe 2 SE, NC

Bankfull Photographs

EF1 Wrackline (11/13/2020)

EF1 at bankfull (11/13/2020

EF1 Crest Gage 2 Wrackline (11/13/2020)

Meadow Branch at Bankfull (11/13/2020)

Meadow Branch wracklines (11/13/2020)

WF1 Stream Gage Wrackline (11/13/2020)

Sediment deposit on bank of WF1 (11/13/2020)

WF1 Crest Gage 1 Wrackline/ Sediment Deposit (11/13/2020)

WF2 Wrackline (11/13/2020)

WF2 at Bankfull (11/13/2020)

APPENDIX 6. Agency Correspondence

Ella Wickliff

To: Ella Wickliff
Cc: Aaron Earley
Subject: FW: Notice of Initial Credit Release/ NCDMS Deep Meadow Mitigation Site/ SAW-2012-01077/ Union Co.
Attachments: Deep Meadow_97131_YD 105_Initial Release signed.pdf

---

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Wednesday, June 3, 2020 10:28 AM
To: Tsomides, Harry <harry.tsomides@ncdenr.gov>; Aaron Earley <aearley@wildlandseng.com>; Shawn Wilkerson <swilkerson@wildlandseng.com>; Stanfill, Jim <jim.stanfill@ncdenr.gov>; Wiesner, Paul <paul.wiesner@ncdenr.gov>; Baumgartner, Tim <tim.baumgartner@ncdenr.gov>
Cc: Haupt, Mac <mac.haupt@ncdenr.gov>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; 'Wilson, Travis W. (travis.wilson@ncwildlife.org)' <travis.wilson@ncwildlife.org>; Munzer, Olivia <olivia.munzer@ncwildlife.org>; Merritt, Katie <katie.merritt@ncdenr.gov>; 'Bowers, Todd (bowers.todd@epa.gov)' <bowers.todd@epa.gov>; Byron Hamstead (byron_hamstead@fws.gov) <byron_hamstead@fws.gov>; Crumbley, Tyler A CIV USARMY CESAW (USA) <Tyler.A.Crumbley@usace.army.mil>; McLendon, C S CIV USARMY CESAW (USA) <Scott.C.McLendon@usace.army.mil>; Haywood, Casey M CIV USARMY CESAW (USA) <Casey.M.Haywood@usace.army.mil>
Subject: Notice of Initial Credit Release/ NCDMS Deep Meadow Mitigation Site/ SAW-2012-01077/ Union Co.

Good morning,
The 15-Day Record Drawing review for the Deep Meadow Mitigation Site (SAW-2012-01077) ended May 30, 2020. Per Section 332.8(o)(9) of the 2008 Mitigation Rule, this review followed the streamlined review process. All comments received from the NCIRT are incorporated in this email. Please address IRT concerns in the MY1 Report. There were no objections to issuing the initial credit release. Please find attached the current signed ledger.

DWR Comments, Erin Davis:
Groundwater gauges 3 and 11 appear to be located outside of wetland reestablishment credit areas. If these gauges were placed to demonstrate additional wetland area, that's fine. But DWR would like groundwater gauges installed within the reestablishment areas W-E6 and W-E8 as specified in the approved mitigation plan to demonstrate success of the wetland hydroperiod performance standard.

EPA Comments, Todd Bowers:
Thank you for the opportunity to review and provide feedback on the Deep Meadow Mitigation Site MY 0/As-Built Report as a component of the North Carolina Division of Mitigation Services In-Lieu Fee program modification (SAW-2012-01077). The project, located in Union County NC, restored, enhanced and preserved a total of 4,365 linear feet of perennial stream and rehabilitated 0.58 acres and re-established 8.26 acres of riparian wetlands. The project is providing 2,838.933 stream mitigation units and 8.590 wetland mitigation units for the Yadkin River Basin Hydrologic Unit Code 03040105 (Yadkin 05). The Site construction and as-built surveys were completed between September and November 2019 and planting and baseline vegetation data collection occurred between November 2019 and January 2020. After a thorough review, the EPA Region 4 Oceans, Wetlands and Stream Protection Branch has no comments or concerns with the MY0 Report for the Deep Meadow mitigation site. The report appears to be in order and presents a well built and thus far, well performing site with much potential for functional uplift of aquatic resources.

Please contact the mitigation office if you have any questions.
Thanks
Kim

December 21, 2020

Kim Browning
Mitigation Project Manager
Regulatory Division, U.S. Army Corp of Engineers
Kimberly.D.Browing@usace.army.mil

RE: IRT Review Comments: 15-Day Record Drawing Review / Notice of Initial Credit Release
Deep Meadow Mitigation Site, Union County, NC (SAW-2012-01077)
Yadkin River Basin – HUC 03040105
DMS Project ID No. 97131 / DEQ Contract #006887

Dear Ms. Browning:

Wildlands Engineering, Inc. (Wildlands) has reviewed the 15-Day Record Drawing review comments from the NC Interagency Review Team (IRT) associated with the Deep Meadow Mitigation Site Initial Credit Release. The MY1 report text includes responses to the IRT comments. Responses are also included below. The following are your comments and observations from the report and are noted in **Bold**. Wildlands' response to those comments are noted in *Italics*.

DWR Comment, Erin Davis: Groundwater gauges 3 and 11 appear to be located outside of wetland reestablishment credit areas. If these gauges were placed to demonstrate additional wetland area, that's fine. But DWR would like groundwater gauges installed within reestablishment areas W-E6 and W-E8 as specified in the approved mitigation plan to demonstrate success of the wetland hydroperiod performance standard.

Wildlands Response: The current location of these wells is as close to the Mitigation Plan's proposed gage location as possible. Multiple holes were bored in the areas surrounding the Mitigation Plan's proposed gage locations; however, installation was difficult due to a shallow layer of bedrock where refusal was reached at approximately 3 - 4 feet. Though the resulting locations for GWG3 and GWG11, at the edge of the proposed wetland boundary, is not optimal, it is the assumption that if the wetland meets criteria on the edge wetland boundary, the remainder of the wetland will also meet. Results from groundwater monitoring from MY1 are reflective of this assumption with GWG3 meeting the performance criteria and GWG11 just barely missing the success criteria of 10% with a rate of 8.7%. If GWG11 continues to not meet the success criteria for wetland hydrology in subsequent monitoring years, Wildlands will install another well closer to the center of W-E6.

EPA Comment, Todd Bowers: Thank you for the opportunity to review and provide feedback on the Deep Meadow Mitigation Site MY0/ As-Built Report as a component of the North Carolina Division of Mitigation Services In-Lieu Fee program modification (SAW-2012-01077). The project, located in Union County NC, restored, enhanced and preserved a total of 4,354 linear feet of perennial stream and rehabilitated 0.58 acres and re-established 8.26 acres of riparian wetlands. The project is providing 2,838.933 stream mitigation units and 8.590 wetland mitigation units for the Yadkin River Basin Hydrologic Unit Code 03040105 (Yadkin 05). The Site construction and as-built survey were completed between September and November 2019 and planting and baseline vegetation data collection

occurred between November 2019 and January 2020. After a thorough review, the EPA Region 4 Oceans, Wetlands and Stream Protection Branch has no comments or concerns with the MY0 Report for the Deep Meadow mitigation site. The report appears to be in order and presents a well built and thus far, well performing site with much potential for functional uplift of aquatic resources.

Wildlands Response: Thank you for reviewing the report.

Sincerely,

Kristi Suggs
ksuggs@wildlandseng.com