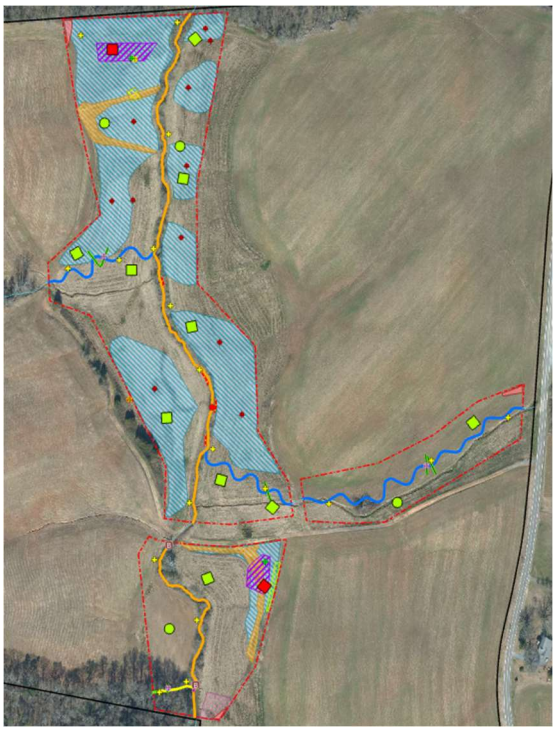

MONITORING YEAR 3 ANNUAL REPORT

FINAL

DEEP MEADOW MITIGATION SITE

Union County, NC
Yadkin River Basin
HUC 03040105

DMS Project No. 97131
NC DEQ Contract No. 6887
DWR Certification No. 18-0264
USACE Action ID No. SAW-2012-01107
Data Collection Period: March 2022 – November 2022
Final Submission Date: February 2023

PREPARED FOR:

NC Department of Environmental Quality
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Phone: 704.332.7754
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February 10th, 2023

Mr. Harry Tsomides
Western Regional Supervisor
NCDEQ – Division of Mitigation Services
Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

RE: Deep Meadow Stream and Wetland Mitigation Site – Draft Monitoring Year 3 Report
Yadkin River Basin – HUC 03040105
Union County, NC
DMS Project ID No. 97131
Contract # 006887

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments and observations from the Deep Meadow Stream and Wetland Mitigation Site Monitoring Year 3, received on January 30th, 2023. The report text has been revised for the final submittal to reflect the most current condition of the site. Your comments and observations from the report are noted below in **Bold**. Wildlands' response to those comments are noted in *Italics*.

DMS' Comment: The asset table shows the sum of rounded numbers for wetland credits; please correct the wetland credit totals to reflect the prior year's accurate final monitoring report (difference of minus 0.003).
Wildlands' Response: Table 1 has been updated accordingly.

DMS' Comment: DMS project crossing and culvert photos must be included in all monitoring reports; please include close-up photos for the installed crossings and culverts along EF1 and WF2, in order to show if any erosion, debris jamming, infilling, perching etc. are occurring.
Wildlands' Response: Photos of crossings and culverts have been added to Appendix 2.

DMS' Comment: The report documents some areas of scour and aggradation however the visual assessment tables indicate 100% performance across the site for all stream visual monitoring metrics; please update the tables if necessary.
Wildlands' Response: Areas of scour and aggradation are located on Meadow Branch, which consists of Enhancement II level mitigation. The visual assessment tables are only required for restoration reaches.

DMS' Comment: Wildlands describes the erosional gully repairs performed in 2022 but does not provide any photos. If possible, please provide photos of the repaired gully.
Wildlands' Response: Photos of the repaired gully have been added to Appendix 2.

DMS' Comment: Thank you for the thorough and clear CCPV mapping, and the report quality in general.
Wildlands' Response: Thank you for the comment.

Enclosed please find two (2) hard copies of the Year 3 Final Monitoring Report and one (1) USB with all the electronic files for DMS distribution. Wildlands has ordered the monitoring bond for MY4; however, we have not received confirmation from Kristie Corson at DMS that it was received or approved. Please contact me at 704-332-7754 x101 if you have any questions.

Sincerely,

Kristi Suggs
Senior Environmental Scientist

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 Hydrologic Unit Code (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 8.587 wetland mitigation units (WMUs) for the Yadkin River Basin HUC 03040105 (Yadkin 05).

The immediate drainage area of the Site and the larger surrounding watershed have a long history of agricultural activity. Stream and wetland functional stressors to the Site were related to these historic and current land use practices. Major stream stressors included channel incision and widening, an absence 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 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 watershed of the Site when compared to reference conditions. The project approach for the Site focused on evaluating existing functional condition, 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.

Site construction and as-built surveys were completed between September 2019 and November 2020. Monitoring Year (MY) 3 assessments and Site visits were completed between March and November 2022 to assess the conditions of the project.

Overall, the Site has met most of the required stream, vegetation, and hydrologic success criteria for MY3. With an average planted stem density of 397 stems per acre, the Site has met the MY3 requirement of 320 stems per acre and is on track to meet both the MY5 and MY7 planted stem density requirements. 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 in MY3. The Site has met the hydrologic requirement of 2 bankfull events in separate years for all restored and enhancement I reaches. Two of the thirteen groundwater gages met the wetland hydrology success criteria with the revised growing

season (March 1st to November 28th). The MY3 visual assessment identified a few areas of concern including minor easement encroachment, two areas of low stem density, populations of invasive plant species accounting for 1.0% of the Site, and minimal areas of aggradation and bank scour. Wildlands will continue to monitor these areas and adaptive management will be implemented as necessary throughout the seven-year monitoring period to benefit the ecological health of the Site.

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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 in the floodplain of Meadow Branch at the toe of slope. The Site drains approximately 6.99 square miles of rural land.

1.1 Project Quantities and Credits

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 8.587 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.

Table 1: Project Quantities and Credits

PROJECT MITIGATION QUANTITIES							
Project Segment	**Mitigation Plan Footage**	**As-Built Footage**	**Mitigation Category**	**Restoration Level**	**Mitigation Ratio (X:1)**	**Credits**	**Comments**
Stream							
Meadow Branch	2,449	2,449	Warm	EII	2.5	979.600	Bank stabilization and in-stream structures with planted buffer
EF1	1,322	1,322	Warm	R	1.0	1,322.000	Full channel restoration, planted buffer
WF1	116	116	Warm	EI	1.5	77.333	Bank stabilization
WF1	20	20	Warm	P	10.0	2.000	No work proposed
WF2	391	458	Warm	R	1.0	458.000	Full channel restoration, planted buffer
					Total:	**2,838.933**	**Stream Mitigation Units**

PROJECT MITIGATION QUANTITIES							
Project Segment	**Mitigation Plan Footage**	**As-Built Footage**	**Mitigation Category**	**Restoration Level**	**Mitigation Ratio (X:1)**	**Credits**	**Comments**
Wetland							
W-H1	0.28	0.28	Warm	Rehabilitation	1.5	0.187	Planted, removed agriculture activities, reduced drainage to Meadow Branch
W-H2	0.30	0.30	Warm	Rehabilitation	1.5	0.200	Planted, removed agriculture activities, reduced drainage to Meadow Branch
W-E1	0.40	0.37	Warm	Re-establishment	1.0	0.400	Planted, removed agriculture activities, removed adjacent drainage swales
W-E2	1.70	1.72	Warm	Re-establishment	1.0	1.700	Planted, removed agriculture activities, removed adjacent drainage swales
W-E3	0.40	0.41	Warm	Re-establishment	1.0	0.400	Planted, removed agriculture activities, removed adjacent drainage swales
W-E4	0.40	0.36	Warm	Re-establishment	1.0	0.400	Planted, removed agriculture activities, removed adjacent drainage swales
W-E5	0.40	0.37	Warm	Re-establishment	1.0	0.400	Planted, removed agriculture activities, removed adjacent drainage swales
W-E6	0.20	0.20	Warm	Re-establishment	1.0	0.200	Planted, removed agriculture activities, removed adjacent drainage swales
W-E7	1.50	1.53	Warm	Re-establishment	1.0	1.500	Planted, removed agriculture activities, removed adjacent drainage swales
W-E8	1.00	1.04	Warm	Re-establishment	1.0	1.000	Planted, removed agriculture activities, removed adjacent drainage swales
W-E9	0.50	0.53	Warm	Re-establishment	1.0	0.500	Planted, removed agriculture activities, removed adjacent drainage swales
W-E10	1.70	1.73	Warm	Re-establishment	1.0	1.700	Planted, removed agriculture activities, removed adjacent drainage swales
					Total:	**8.587**	**Wetland Mitigation Units**

Table 1.1: Credit Summary Table

Restoration Level	Stream			Riparian	Non-Rip	Coastal
	Warm	Cool	Cold	Wetland	Wetland	Marsh
Restoration	1,780.000			--		
Re-establishment	--			8.200		
Rehabilitation	--			0.387		
Enhancement I	77.333			--		
Enhancement II	979.600			--		
Preservation	2.000			--		
Total:	**2838.933**			**8.587**		

*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.

1.2 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). Table 2 below describes expected outcomes to water quality and ecological processes and provides project goals and objectives.

Table 2: Goals, Performance Criteria, and Functional Improvements

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments show progression towards stability.	3 reachwide sediment surveys (not required after MY2); 6 cross-section surveys	All cross sections have a BHR <1.2. Channels are stable and have maintained the constructed riffle and pool sequence.
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain. Remove overburden to reconnect with adjacent wetlands.	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands.	Two bankfull events over the cumulative monitoring period.	Crest gages on EF1, WF1, WF2. 11 groundwater gages installed in MY0. 2 groundwater gages added in MY3.	Reaches meeting bankfull criteria: MY1: 3/3 reaches MY2: 2/3 reaches MY3: 3/3 reaches Groundwater gages meeting wetland success criteria: MY1: 10/11 gages MY2: 2/11 gages MY3: 2/13 gages

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
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.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians leading to colonization and an increase in biodiversity over time.	There is no required performance standard for this metric.	N/A	N/A
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams	210 planted stems per acre at MY7. Interim survival rate of 320 planted stems per acre at MY3 and 260 at MY5.	12 permanent vegetation plots, and 4 mobile vegetation plots.	Vegetation plots meeting the MY3 success criteria of 320 stems per acre. MY1: 16/16 (100%) MY2: 12/16 (75%) MY3: 14/16 (88%)
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	A missing monument was re-surveyed and replaced by Turner Surveyors in August 2022. Horse tape was added to areas of encroachment to deter future occurrences.

1.3 Project Attributes

Prior to construction activities, the Site had a history of crop production with adjacent floodplains altered for agricultural uses. These practices resulted in sedimentation, erosion, and degraded in-stream habitat. EF1 was re-routed to the edge of the valley and shortened to perpendicularly join Meadow Branch. 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 3 and Table 6 of Appendix 2.

The final mitigation plan was submitted and accepted by DMS in January of 2018 and the NC Interagency Review Team (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. Directions and a map of the Site are provided in Figure 1 and project components are illustrated for the Site in Figure 2.

Table 3: Project Attributes

PROJECT INFORMATION	
Project Name	Deep Meadow Mitigation Site
Project Area (acres)	23.8
County	Union County
Project Coordinates	35.022333, -80.447611
PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Piedmont Physiographic Province
USGS HUC 8-digit	3040105
River Basin	Yadkin River
USGS HUC 14-digit	3040105070060
DWR Sub-basin	03-07-14
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%)
Project Drainage Area (acres)	5,024
Percentage of Impervious Area	4%

REACH SUMMARY INFORMATION				
Parameters	**Meadow Branch**	**EF1**	**WF1**	**WF2**
Pre-project length (feet)	2,570	1,201	136	391
Post-project (feet)	2,499	1,322	136	458
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Moderately Confined	Unconfined	Unconfined
Drainage area (acres)	4,472	25	26	41.25
Perennial, Intermittent, Ephemeral	Perennial			
DWR Water Quality Classification	C			
Dominant Stream Classification (existing)	C4/5	Incised and straightened E4	G4	Incised and straightened E4
Dominant Stream Classification (proposed)	C4/5	C4	C4	C4
Dominant Evolutionary class (Simon) if applicable	Stage VI	Stage III	Stage III	Stage IV

WETLAND SUMMARY INFORMATION		
Parameters	**WH-1**	**WH-2**
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 bankfull events	
Restoration or enhancement method	Rehabilitation (hydrologic, vegetative)	

REGULATORY CONSIDERATIONS			
Parameters	**Applicable?**	**Resolved?**	**Supporting Documentation**
Water of the United States - Section 404	Yes	Yes	USACE Action ID #SAW-2012-01107
Water 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 in Mitigation Plan
Historic Preservation Act	Yes	Yes	
Coastal Zone Management Act (CZMA or 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

1.4 Monitoring Year 3 Data Assessment

Annual monitoring for MY3 was conducted between March and November 2022, with hydrology data collected between January and November 2022, 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).

1.4.1 Vegetation Assessment

The MY3 vegetation survey was completed in August 2022, resulting in an average planted stem density of 397 stems per acre for all monitored permanent and mobile vegetation plots. The Site has met the interim MY3 requirement of 320 planted stems per acre and is on track to meet both the MY5 and MY7 performance criteria, with 14 out of 16 vegetation plots individually exceeding this requirement. Stem density in permanent and mobile vegetation plots on Site ranges from 121 to 567 planted stems per acre. Vegetation appears to be thriving, with an average vigor of 3 or greater, indicating robust overall health and minimal stem damage. The two permanent vegetation plots (1 and 6) not meeting MY3 criteria are in wetland areas where soils have continued to be saturated for large portions of the monitored growing seasons. Please refer to Appendix 2 for vegetation plot photographs and Appendix 3 for vegetation data tables.

1.4.2 Vegetation Areas of Concern and Management Activity

Overall, herbaceous cover has become well-established throughout the Site. Several invasive species continue to be monitored and treated throughout the monitoring year. Floodplain species which have undergone targeted treatment in MY3 include Johnson grass (*Sorghum halepense*), Japanese honeysuckle (*Lonicera japonica*), and Morning glory (*Ipomoea purpurea*). Water primrose (*Ludwigia peploides*) and water smartweed (*Polygonum amphibium*) were observed growing in a few isolated areas on Meadow Branch and were treated in July of 2022. Isolated areas of in-stream vegetation will likely be shaded out as riparian corridors develop a robust canopy. In total, 99% of the Site is free of invasive and undesirable species. As needed, invasive species will be treated throughout the post-construction monitoring period. 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.

As discussed above in Section 1.4.1, two permanent vegetation plots (1 and 6) have experienced higher stem mortality due to saturated soil conditions. In these areas of low stem density, upland and facultative upland species have been inundated by standing water resulting in a high mortality rate. Additionally, hydrophytic common rush (*Juncus effusus*) and switchgrass (*Panicum virgatum*) are very dense in these areas and have outcompeted some planted stems. Wildlands plans to supplementally plant approximately 0.38 acres or 1.7% of the entire planted area, with approved facultative species subject to availability in winter of 2022 - 2023.

In MY2, box elder (*Acer negundo*) populations on Site were beginning to form a monoculture in several areas throughout the project. Box elder populations are most dense in the right floodplain of Meadow Branch from station 114+00 to 124+00, where Wildlands did not disturb mature box elders along the banks of Meadow Branch during construction. In September 2022, Wildlands re-assessed the vegetative conditions and determined that competition has started to suppress the proliferation of box elder within certain areas of the Site. Therefore, Wildlands will selectively prune box elders in phases beginning in MY4.

During the MY3 visual assessment, Wildlands observed minor encroachments attributable to bent or missing signposts. Encroachments consisted of minimal easement scalloping associated with the management of the adjacent agriculture fields. However, the Site has maintained an adequate buffer as the encroachments caused inconsequential damage to planted stems. To resolve the issue, the missing corner monument near the upstream end of Meadow Branch was re-surveyed and replaced by Turner Surveyors in August 2022. Wildlands also added additional signage, PVC markers, and horse tape throughout the Site, and is currently working with the landowner to address these encroachment issues. These areas will continue to be monitored closely in MY4 and throughout the remainder of the monitoring period.

1.4.3 Stream Assessment

Morphological surveys for MY3 were conducted in March 2022. Cross-section survey results indicate that channel dimensions are stable and functioning as designed on all Restoration and Enhancement I reaches. In general, cross-sections on EF1, WF1, and WF2 show little to no change in the bankfull area, maximum depth ratio, or width-to-depth ratio. Moreover, all 6 cross-sections on EF1, WF1 and WF2 are stable with bank height ratios less than 1.2, and cross-sectional areas that closely match the baseline cross-sectional area. Refer to Appendix 2 for the visual stability assessment tables, CCPV Figures 3.0 – 3.2, and reference photographs, and Appendix 4 for the morphological tables and plots.

1.4.4 Stream Hydrology Assessment

In MY3, crest gages documented at least one bankfull event on WF1, WF2, and EF1. All restoration and enhancement I reaches have recorded at least two bankfull events in separate years; therefore, the stream hydrological success criteria has been met. Wildlands will continue to collect stream hydrology data in subsequent monitoring years. Please refer to Appendix 5 for hydrology summary and data plots.

1.4.5 Stream Areas of Concern and Management Activity

Based on MY3 visual assessments, restoration reaches WF2 and EF1 are 100% stable and performing as intended. Minimal areas of concern including instances of scour and localized aggradation on the enhancement II stream, Meadow Branch were revealed in MY3. Minor bank scour was observed on Meadow Branch at stations 111+20, 113+50 and station 117+00. A large debris jam at station 112+40 is facilitating scour in this area. Currently, these areas are not negatively impacting overall stream function or stability; however, Wildlands plans to remove the debris jam and restabilize these areas by adding additional live stakes to the banks in MY4. These areas will continue to be monitored in subsequent years for signs of accelerated instability. On the upstream section of Meadow Branch near station 101+80, a mid-channel bar has developed where a recurring beaver dam used to be. The dam was removed several times in MY2 and MY3, but the remnant sediment aggradation due to the dams persists. Wildlands expects winter storms to transport accumulated sediment through the system. 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.

In MY3, repairs were completed on an erosion gully near the ford crossing on Meadow Branch. In December 2021, the property owner partially filled in the portion of the gully that lies outside of the easement. Wildlands resumed this floodplain stabilization work within the easement boundary in May 2022. Repairs consisted of laying back the banks of the gully and installing a series of stone check dams to prevent gully reformation and excess sediment from entering the stream.

Several beaver dams were also identified and removed from Meadow Branch. Dams on the Site have not impeded stream flow, but APHIS has been contacted regarding safe and sustainable dam removal. Wildlands will continue to monitor all areas of concern in future years for signs of accelerated instability. If instability is observed, the area will be addressed and evaluated for effectiveness in the MY4 report. Please refer to Appendix 2 for stream stability tables, area of concern photos, and CCPV Figures 3.0 – 3.2.

1.4.6 Wetland Assessment

Eleven groundwater gages (GWG) were initially installed during baseline monitoring across the wetland re-establishment and rehabilitation areas. As discussed in the MY2 report, two additional groundwater gages (GWG 3a and GWG 11a) were installed in February 2022 before the onset of the MY3 growing season. GWG 3a and GWG 11a were installed in the center of the wetland re-establishment areas for W-E6 and W-E8, respectively.

On May 11th, 2022, Wildlands attended an MY2 Credit Release Site Evaluation with the IRT. During the meeting, attendees had an in-depth discussion about the groundwater gage data for MY2. The IRT made several suggestions regarding the proposed wetland re-establishment and rehabilitation areas on the Site. Wildlands will implement these items in the current and/or subsequent monitoring years. Refer to Appendix 6 for MY2 Credit Release Site Evaluation meeting notes.

- **Cumulative versus Consecutive Gage Data:** Due to the number of groundwater gages not meeting criteria in MY2, the IRT suggested that Wildlands include a comparison of the consecutive versus cumulative day gage data for MY3. Results of the comparison showed that

for cumulative day results, 12 out of 13 gages met the success criteria in MY3, compared to 2 out of 13 gages that met with consecutive days. Refer to Table 16 in Appendix 5 for a comparison of the data.

- **Revised Growing Season:** Due to soil temperature data and seasonal vegetation indicators, the IRT approved a revised growing season of March 1st – November 28th for the project. Soil temperatures in MY1 and MY2 were above the 40-degree threshold from March 1st – November 28th. (Refer to vii in the Meeting Minutes located in Appendix 6 for the MY1 and MY2 soil temperature data.) Soil temperature data was also collected for MY3 and revealed a range of 43.4 °F to 90.0 °F from March 1st – November 28th, which supports the revision of the growing season. See Appendix 5 MY3 for soil temperature data.
- **On-Site Rain Gage:** After reviewing the MY2 hydrographs, Wildlands suspected that the precipitation data recorded at the Monroe 2 SE, NC station was not representative of the rainfall received on Site. An on-site rain gage was installed in August of 2022 to address this concern. From August to November, the Site's rain gage recorded 0.45 inches of rainfall less than the Monroe 2 SE, NC station (12.03 vs. 12.48 inches, respectively). Therefore, the on-site rain gage will be the primary source of precipitation data starting in MY4. Refer to Table 15 in Appendix 5 for a comparison of the rain gage data.
- **Additional Wetland Assessment Area:** To offset potentially lost credit for the failing groundwater gages, the IRT suggested that additional gages be installed along restoration reaches in areas not currently proposed for wetland credit. Wildlands plans to further investigate the installation of additional gages during the winter between MY3 and MY4. Wildlands will verify the presence of hydric soils within the study areas to outline reestablishment versus creation sub-areas. Refer to the map attached in the Meeting Minutes located in Appendix 6 for the location of the study areas.

As defined in the Site's Mitigation Plan (Wildlands, 2018), the original performance standard for wetland hydrology is a free groundwater surface within 12 inches of the ground surface for 23 consecutive days (10% percent) of the originally defined growing season for Union County (March 23rd through November 6th) under typical precipitation conditions. If a groundwater 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 Mitigation Plan to assess whether atypical weather conditions occurred during the monitoring period. Using the original growing season, two of the thirteen groundwater gages (GWG 1 and GWG 5) met the success criteria with the percentage of the growing season ranging from 29 to 37.8%. The remaining eleven GWGs did not meet the original success criteria with percentage of the growing season ranging from 4.1 to 7.9%.

As described above in the MY2 credit release meeting notes, the revised growing season dates is March 1st to November 28th which is supported by soil temperature data and seasonal vegetation indicators. Using the revised growing season dates, two GWGs (GWG 1 and GWG 5) met success criteria with the percentage of the growing season ranging from 29.3 to 37.0%. The remaining eleven GWGs did not meet the success criteria with a percentage of the growing season ranging from 4.4 to 9.9%. GWG 2 fell one day short of meeting the 28-day success criteria, and GWGs 3a and 6, would have met the success criteria if the groundwater level did not drop slightly below the 12-inch threshold on 03/08/2022. Refer to Appendix 2 for the GWG locations on CCPV Figures 3.0 – 3.2 and the GWG photographs and Appendix 5 for hydrology data, soil temperature data and seasonal vegetation indicators.

1.5 Monitoring Year 3 Summary

Overall, the Site has met most of the required stream, vegetation, and hydrologic success criteria for MY3. With an average planted stem density of 397 stems per acre, the Site has met the MY3

requirement of 320 stems per acre and is on track to meet both the MY5 and MY7 planted stem density requirements. 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 in MY3. The Site has met the hydrologic requirement of 2 bankfull events in separate years for all restored and enhancement I reaches. Two of the thirteen groundwater gages met the wetland hydrology success criteria with the revised growing season (March 1st to November 28th). The MY3 visual assessment identified a few areas of concern including minor easement encroachment, two areas of low stem density, populations of invasive plant species accounting for 1.0% of the Site, and minimal areas of aggradation and bank scour. Wildlands will continue to monitor these areas and adaptive management 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.

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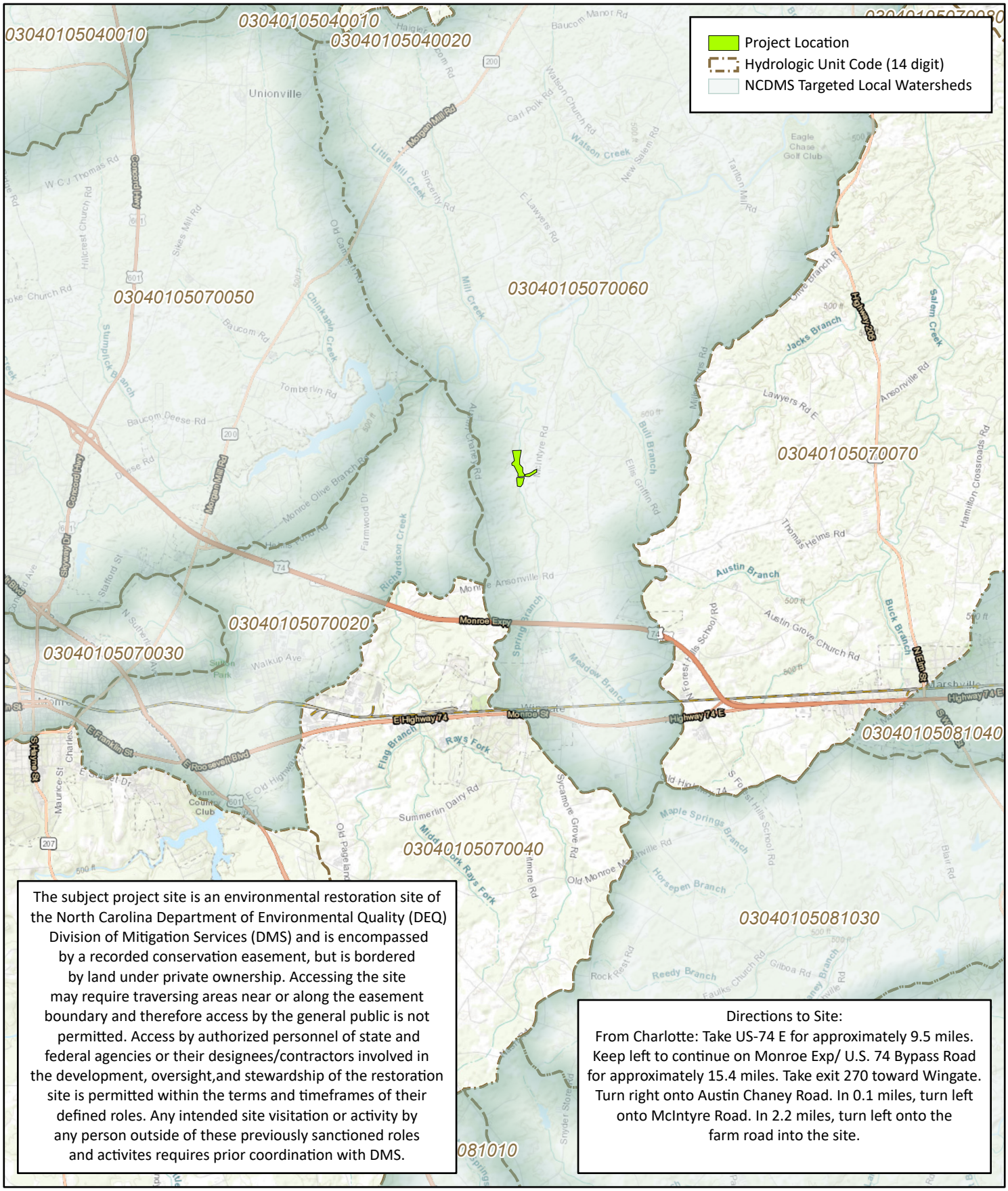
Wildlands, 2018. Deep Meadow Site Mitigation Plan. DMS, Raleigh, NC.

APPENDIX 1. General Figures and Tables



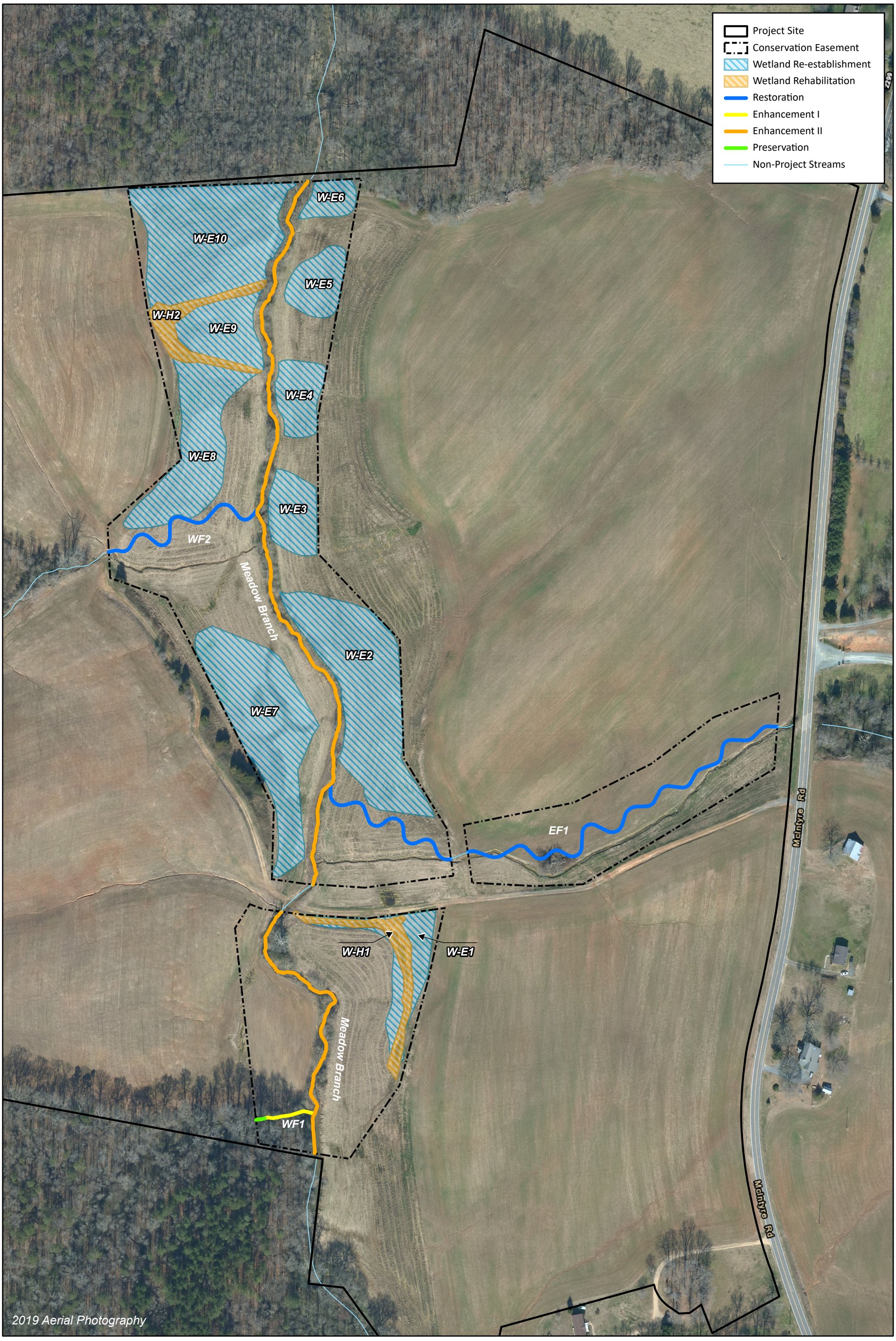
The subject project site is an environmental restoration site of the North Carolina Department of Environmental Quality (DEQ) Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing 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 Exp/ 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 3 - 2022

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 3 - 2022

Union County, NC

Table 4. Project Activity and Reporting History

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

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	May 2021	November 2021
	Invasive treatment	August 2021	
	Vegetation Survey	September 2021	
	Beaver Dam Removal	October 2021	
Year 3 Monitoring	Stream Survey	March 2022	November 2022
	Vegetation Survey	August 2022	
	Invasive treatment	June - September 2022	
	Beaver Dam Removal	September 2022	
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		

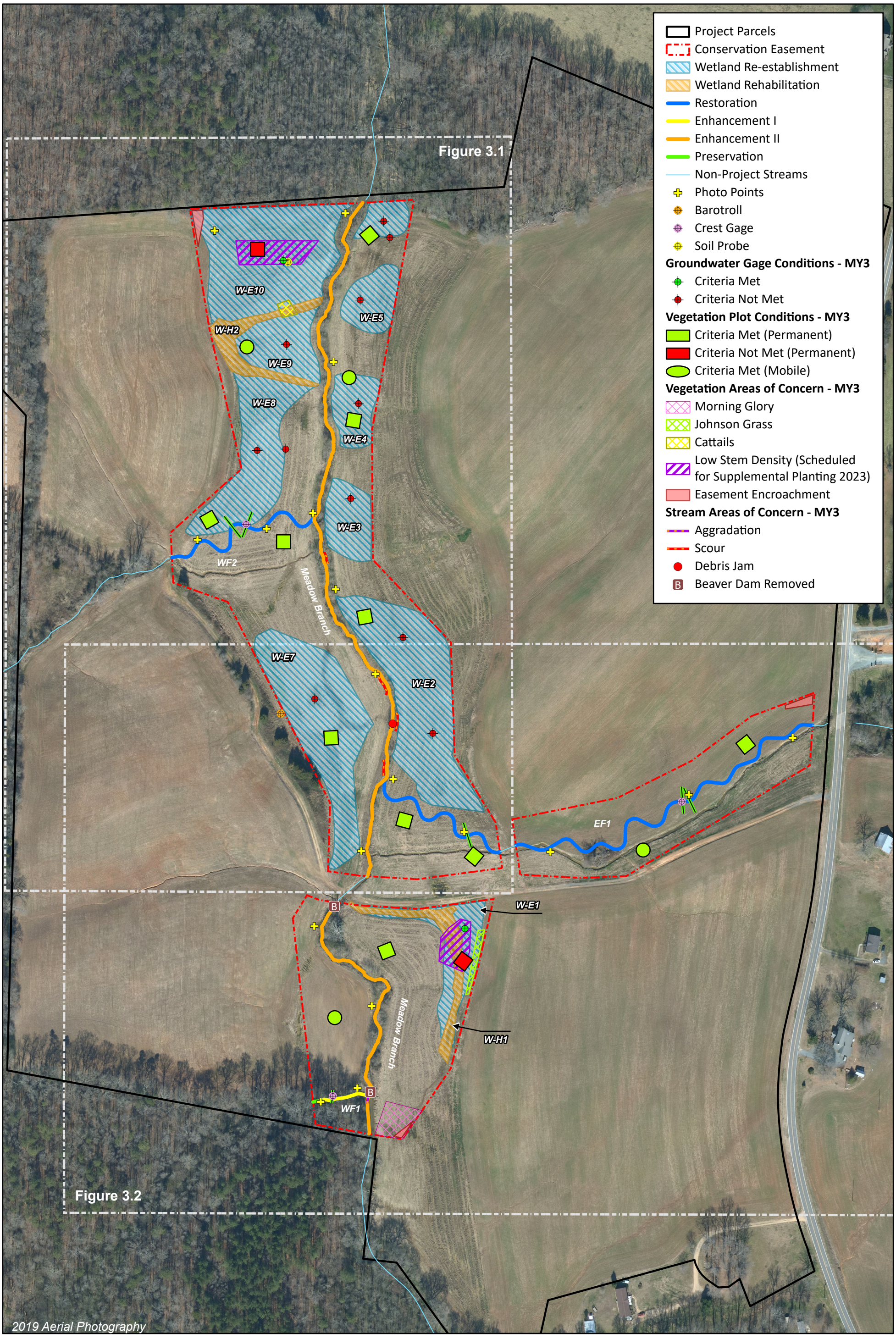
[1]Seed and mulch is added as each section of construction is completed.

Table 5. Project Contact Table

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

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

APPENDIX 2. Visual Assessment Data



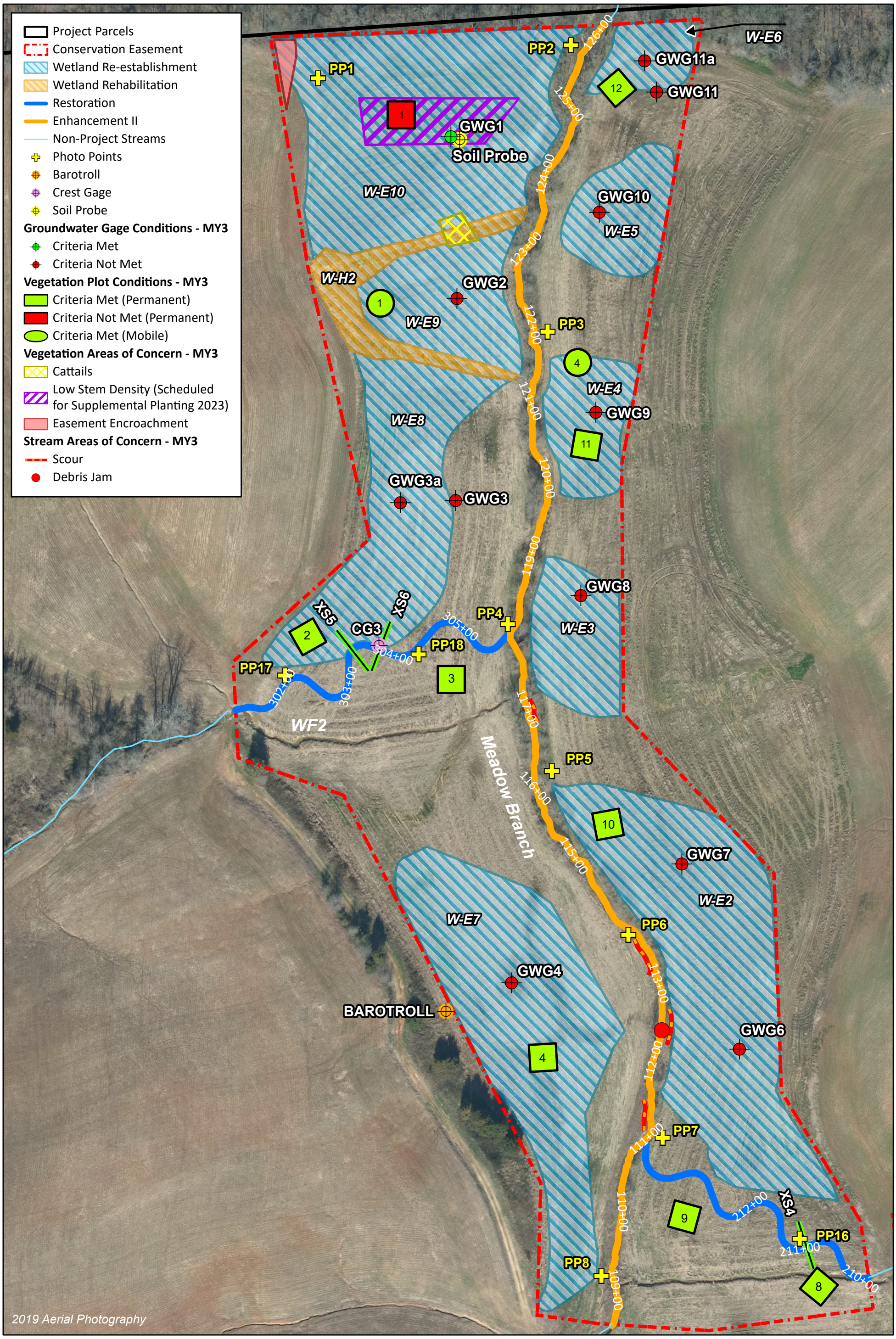
WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 3.0 Current Condition Plan View - Key
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Union County, NC

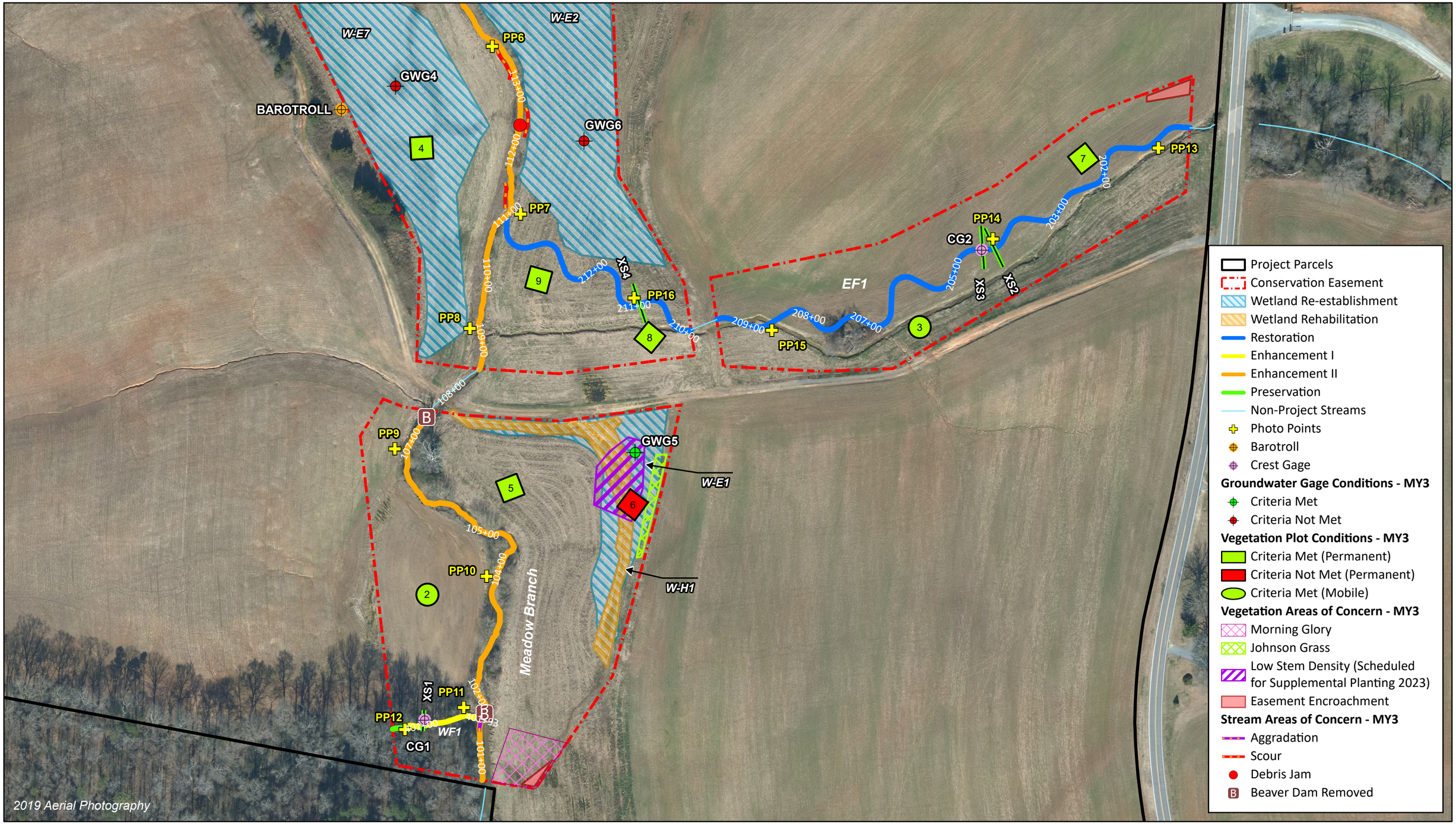


WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.1 Current Condition Plan View
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
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 3 - 2022

Union County, NC

Table 6a. Visual Stream Morphology Stability Assessment Table

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Reach: EF1										
Assessed Length:	**1,322**	**Date of Last Assessment: 11/29/2022**								
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%			
		Date of Last Assessment: 11/28/2022	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			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.	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%.	15	15			100%			
	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 3 - 2022

Reach: WF1										
Assessed Length:	**116**	**Date of Last Assessment: 11/29/2022**								
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%			
		Date of Last Assessment: 11/28/2022	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 3 - 2022

Reach: WF2										
Assessed Length:	**458**	**Date of Last Assessment: 11/29/2022**								
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	8	8			100%			
	3. Meander Pool Condition	Depth Sufficient	7	7			100%			
		Date of Last Assessment: 11/28/2022	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			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.	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 3 - 2022

Planted Acreage:	**21.5**	**Date of Last Assessment: 11/28/2022**			
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	2	0.4	1.7%
		Total	**2**	**0.4**	**1.7%**
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	**2**	**0.4**	**1.7%**

Easement Acreage:	**23.8**	**Date of Last Assessment: 11/28/2022**			
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	3	0.2	1.0%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	3	0.04	0.2%

Stream Photographs

Monitoring Year 3

Photo Point 1 – W-E10, North *(03/10/2022)*

Photo Point 1 – W-E10, South *(03/10/2022)*

Photo Point 1 – W-E10, East *(03/10/2022)*

Photo Point 1 – W-E10, West *(03/10/2022)*

Photo Point 2 – MB outlet, view upstream *(03/10/2022)*

Photo Point 2 – MB outlet, view downstream *(03/10/2022)*

Photo Point 3 – Meadow Branch, view upstream *(03/10/2022)*

Photo Point 3 – Meadow Branch, view downstream *(03/10/2022)*

Photo Point 4 – Meadow Branch, view upstream *(03/10/2022)*

Photo Point 4 – Meadow Branch, view downstream *(03/10/2022)*

Photo Point 4 – WF2 Confluence, view upstream *(03/10/2022)*

	
Photo Point 5 – Meadow Branch, view upstream *(03/10/2022)*	**Photo Point 5** – Meadow Branch, view downstream *(03/10/2022)*
	
Photo Point 6 – Meadow Branch, view upstream *(03/10/2022)*	**Photo Point 6** – Meadow Branch, view downstream *(03/10/2022)*
	
Photo Point 7 – Meadow Branch, view upstream *(03/10/2022)*	**Photo Point 7** – Meadow Branch, view downstream *(03/10/2022)*

Photo Point 8 – Meadow Branch, view upstream *(03/10/2022)*

Photo Point 8 – Meadow Branch, view downstream *(03/10/2022)*

Photo Point 9 – Meadow Branch, view upstream *(03/10/2022)*

Photo Point 9 – Meadow Branch, view downstream *(03/10/2022)*

Photo Point 10 – Meadow Branch, view upstream *(03/10/2022)*

Photo Point 10 –Meadow Branch, view downstream *(03/10/2022)*

Photo Point 11 – Meadow Branch, view upstream *(03/10/2022)*

Photo Point 11 – Meadow Branch, view downstream *(03/10/2022)*

Photo Point 11 –WF1 Confluence, view upstream *(03/10/2022)*

Photo Point 12 – WF1 Start, view upstream *(03/10/2022)*

Photo Point 12 – WF1 Start, view downstream *(03/10/2022)*

Photo Point 13 – EF1 Start, view upstream *(03/10/2022)*

Photo Point 13 – EF1 Start, view downstream *(03/10/2022)*

Photo Point 14 – EF1, view upstream *(03/10/2022)*

Photo Point 14 – EF1, view downstream *(03/10/2022)*

Photo Point 15 – EF1, view upstream *(03/10/2022)*

Photo Point 15 – EF1, view downstream *(03/10/2022)*

Photo Point 16 – EF1, view upstream *(03/10/2022)*

Photo Point 16 – EF1, view downstream *(03/10/2022)*

Photo Point 17 – WF2 Start, view upstream *(03/10/2022)*

Photo Point 17 – WF2 Start, view downstream *(03/10/2022)*

Photo Point 18 – WF2, view upstream *(03/10/2022)*

Photo Point 18 – WF2, view downstream *(03/10/2022)*

Culvert/Crossing Photographs

Monitoring Year 3

Culvert Photo – EF1, inlet *(02/06/2023)*

Culvert Photo – EF1 outlet *(02/06/2023)*

Ford Crossing Photo – WF2, looking northwest *(02/06/2023)*

Ford Crossing Photo – WF2, looking southeast *(02/06/2023)*

Ford Crossing Photo – Meadow Branch, looking east *(02/06/2023)*

Ford Crossing Photo – Meadow Branch, looking west *(02/06/2023)*

Permanent Vegetation Plot Photographs

Monitoring Year 3

Permanent Vegetation Plot 1 - *(08/02/2022)*

Permanent Vegetation Plot 2 - *(07/28/2022)*

Permanent Vegetation Plot 3 - *(07/29/2022)*

Permanent Vegetation Plot 4 - *(08/02/2022)*

Permanent Vegetation Plot 5 - *(07/28/2022)*

Permanent Vegetation Plot 6 - *(07/28/2022)*

Permanent Vegetation Plot 7 - *(07/28/2022)*

Permanent Vegetation Plot 8 - *(07/29/2022)*

Permanent Vegetation Plot 9 - *(07/29/2022)*

Permanent Vegetation Plot 10 - *(07/29/2022)*

Permanent Vegetation Plot 11 - *(07/29/2022)*

Permanent Vegetation Plot 12 - *(07/29/2022)*

Mobile Vegetation Plot Photographs

Monitoring Year 3

	
Mobile Vegetation Plot 1 - North *(08/02/2022)*	**Mobile Vegetation Plot 2** – North *(08/02/2022)*
	
Mobile Vegetation Plot 3 - North *(08/02/2022)*	**Mobile Vegetation Plot 4** - North *(09/29/2022)*

Groundwater Gage Photographs

Monitoring Year 3

Groundwater Gage 1 - *(09/28/2022)*

Groundwater Gage 2 - *(09/28/2022)*

Groundwater Gage 3 - *(09/28/2022)*

Groundwater Gage 3a - *(09/28/2022)*

Groundwater Gage 4 - *(09/28/2022)*

Groundwater Gage 5 - *(09/28/2022)*

	
Groundwater Gage 6 - *(09/28/2022)*	**Groundwater Gage 7** - *(09/28/2022)*
	
Groundwater Gage 8 - *(09/28/2022)*	**Groundwater Gage 9** - *(09/28/2022)*
	
Groundwater Gage 10 - (09/28/2022)	**Groundwater Gage 11 -** (09/28/2022)

Groundwater Gage 11a - (09/28/2022)

Bankfull Evidence Photographs

Monitoring Year 3

	
Bankfull Evidence on Meadow Branch *(11/29/2022)*	Bankfull Evidence on EF1 *(11/29/2022)*
	
Bankfull Evidence on WF1 *(11/29/2022)*	Bankfull Evidence on WF2 *(11/29/2022)*

Areas of Concern Photographs

Monitoring Year 3

Meadow Branch, station 101+80 – Aggradation (*11/02/2022)*

Meadow Branch, station 111+20 – Bank scour *(11/02/2022)*

Meadow Branch, station 112+40 – Debris jam *(11/02/2022)*

Meadow Branch, station 112+50 – Bank scour *(11/02/2022)*

Meadow Branch, station 113+50 – Bank scour *(11/02/2022)*

Meadow Branch, station 117+00 – Bank scour *(11/02/2022)*

EF1, easement boundary – Encroachment *(11/02/2022)*

Meadow Branch, easement boundary – Encroachment *(11/02/2022)*

Meadow Branch, easement boundary – Encroachment *(11/02/2022)*

Repair Photographs

Monitoring Year 3

	
Meadow Branch, station 107+10 – Repaired gully (02/06/2023*)*	**Meadow Branch, station 107+10** – Repaired gully (02/06/2023*)*
	
Meadow Branch, station 107+10 – Repaired gully (02/06/2023*)*	**Meadow Branch, station 107+10** – Repaired gully (02/06/2023*)*

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Permanent Vegetation Plot	MY3 Success Criteria Met (Y/N)	Tract Mean (MY3 - 2022)	
1	N	83%	88%
2	Y		
3	Y		
4	Y		
5	Y		
6	N		
7	Y		
8	Y		
9	Y		
10	Y		
11	Y		
12	Y		
Mobile Vegetation Plot	**MY3 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 3 - 2022

Report Prepared By	Sara Thompson
Date Prepared	9/20/2022 11:52
Database Name	cvs-eep-entrytool-v2.5.0_Deep Meadow (MY3).mdb
Database Location	Z:\ActiveProjects\005-02162 Deep Meadow\Monitoring\Monitoring Year 3_2022\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 3 - 2022

Current Permanent Vegetation Plot Data (MY3 2022)															
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			9			10			27			23	
Acer rubrum	Red Maple	Tree			14			4			1				
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree													
Betula nigra	River Birch, Red Birch	Tree	1	1	1	3	3	3	2	2	2				
Cephalanthus occidentalis	Buttonbush	Shrub Tree						2				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				1	1	1	
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree			1				3	3	4	1	1	1	
Lindera benzoin	Northern Spicebush	Shrub Tree													
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree			15			9			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			7	2	2	2	1	1	8	2	2	3	
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree				1	1	1				1	1	1	
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree													
Quercus phellos	Willow Oak	Tree				1	1	1	1	1	1	1	1	1	
Salix sericea	Silky Willow	Shrub Tree													
		Stem count	7	7	53	12	12	37	8	8	45	10	10	34	
		size (ares)		1			1			1			1		
		size (ACRES)		0.0247			0.0247			0.0247			0.0247		
		Species count	4	4	9	7	7	11	5	5	8	8	8	9	
		Stems per ACRE	283	283	2145	486	486	1497	324	324	1821	405	405	1376	

Current Permanent Vegetation Plot Data (MY3 2022)															
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			135						2			16	
Acer rubrum	Red Maple	Tree													
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	1	1	1							1	1	1	
Betula nigra	River Birch, Red Birch	Tree	3	3	3				3	3	3	3	3	3	
Cephalanthus occidentalis	Buttonbush	Shrub Tree				2	2	2							
Cornus amomum	Silky Dogwood	Shrub Tree													
Diospyros virginiana	American Persimmon, Possumwood	Tree													
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	1	1	5				3	3	7	1	1	3	
Lindera benzoin	Northern Spicebush	Shrub Tree													
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree			7										
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1										
Platanus occidentalis	Sycamore, Plane-tree	Tree	2	2	2	1	1	1	3	3	3	2	2	2	
Populus deltoides	Eastern Cottonwood	Tree													
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	2	2	2							1	1	1	
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree													
Quercus phellos	Willow Oak	Tree	2	2	2							1	1	1	
Salix sericea	Silky Willow	Shrub Tree													
		Stem count	12	12	158	3	3	3	9	9	15	9	9	27	
		size (ares)		1			1			1			1		
		size (ACRES)		0.0247			0.0247			0.0247			0.0247		
		Species count	7	7	9	2	2	2	3	3	4	6	6	7	
		Stems per ACRE	486	486	6394	121	121	121	364	364	607	364	364	1093	

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 3 - 2022

Current Permanent Vegetation Plot Data (MY3 2022)														
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			62			133			25			37
Acer rubrum	Red Maple	Tree												
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	4			2						19
Lindera benzoin	Northern Spicebush	Shrub Tree												
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree						10						
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			51	2	2	14				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	2	2	2	1	1	1	2	2	2
Salix sericea	Silky Willow	Shrub Tree												
		Stem count	14	14	130	11	11	168	12	12	37	12	12	68
		size (ares)		1			1			1			1	
		size (ACRES)		0.0247			0.0247			0.0247			0.0247	
		Species count	6	6	8	5	5	8	7	7	8	5	5	7
		Stems per ACRE	567	567	5261	445	445	6799	486	486	1497	486	486	2752

Permanent Vegetation Plot Annual Mean														
Scientific Name	**Common Name**	**Species Type**	**MY3 (2022)**			**MY2 (2021)**			**MY1 (2020)**			**MY0 (2020)**		
			PnoLS	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Acer negundo	Boxelder Maple	Tree			479			585			356			
Acer rubrum	Red Maple	Tree			19									
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree	2	2	2	2	2	2	4	4	4	6	6	6
Betula nigra	River Birch, Red Birch	Tree	21	21	21	21	21	21	24	24	24	26	26	26
Cephalanthus occidentalis	Buttonbush	Shrub Tree	7	7	9	7	7	7	7	7	7	8	8	8
Cornus amomum	Silky Dogwood	Shrub Tree	7	7	7	7	7	8	9	9	9	10	10	10
Diospyros virginiana	American Persimmon, Possumwood	Tree	10	10	10	10	10	10	13	13	13	13	13	13
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	10	10	46	7	13	23	7	7	10	7	7	7
Lindera benzoin	Northern Spicebush	Shrub Tree							2	2	2	12	12	12
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree			42			16						
Liriodendron tulipifera	Tulip Poplar	Tree	4	4	4	4	4	4	6	6	6	17	17	17
Platanus occidentalis	Sycamore, Plane-tree	Tree	26	26	26	26	26	27	27	27	27	27	27	27
Populus deltoides	Eastern Cottonwood	Tree	9	9	87	7	8	25	8	8	8	13	13	13
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	11	11	11	11	11	11	18	18	18	18	18	18
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree										1	1	1
Quercus phellos	Willow Oak	Tree	12	12	12	12	12	12	18	18	18	22	22	22
Salix sericea	Silky Willow	Shrub Tree						1						
		Stem count	119	119	775	114	121	752	143	143	502	180	180	180
		size (ares)		12			12			12			12	
		size (ACRES)		0.2965			0.2965			0.2965			0.2965	
		Species count	11	11	14	11	11	14	12	12	13	13	13	13
		Stems per ACRE	401	401	2614	384	408	2536	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 3 - 2022

Current Mobile Vegetation Plot (MP) Data (MY3 2022)						
Scientific Name	**Common Name**	**Species Type**	**MP1**	**MP2**	**MP3**	**MP4**
			PnoLS	**PnoLS**	**PnoLS**	**PnoLS**
Acer negundo	Box Elder Maple	Tree				
Acer rubrum	Red Maple	Tree				
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree				
Betula nigra	River Birch, Red Birch	Tree		1	1	
Cephalanthus occidentalis	Buttonbush	Shrub Tree	2			1
Cornus amomum	Silky Dogwood	Shrub Tree	1		1	1
Diospyros virginiana	Persimmon	Tree				1
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree		4	4	5
Lindera benzoin	Northern Spicebush	Shrub Tree				
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree				
Liriodendron tulipifera	Tulip Poplar	Tree				
Platanus occidentalis	Sycamore, Plane-tree	Tree	1	4		1
Populus deltoides	Eastern Cottonwood	Tree	4		1	1
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree		1		
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree			1	
Quercus phellos	Willow Oak	Tree			1	1
Salix sericea	Silky Willow	Shrub Tree				
		Stem count	8	10	9	11
		size (ares)	1	1	1	1
		size (ACRES)	0.02	0.02	0.02	0.02
		Species count	4	4	6	7
		Stems per ACRE	324	405	364	445

Current Mobile Vegetation Plot (MP) Data (MY3 2022) Total Stem Counts & Annual Means							Overall Site Annual Mean			
Scientific Name	**Common Name**	**Species Type**	**MY3 (2022)**	**MY2 (2021)**	**MY1 (2020)**	**MY0 (2020)**	**MY3 (2022)**	**MY2 (2021)**	**MY1 (2020)**	**MY0 (2020)**
			PnoLS	**PnoLS**	**PnoLS**	**PnoLS**	**PnoLS**	**PnoLS**	**PnoLS**	**PnoLS**
Acer negundo	Box Elder Maple	Tree								
Acer rubrum	Red Maple	Tree								
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree		3	3	1	2	5	4	7
Betula nigra	River Birch, Red Birch	Tree	2	4	4	9	23	29	30	35
Cephalanthus occidentalis	Buttonbush	Shrub Tree	3	3	3	2	10	10	7	10
Cornus amomum	Silky Dogwood	Shrub Tree	3			1	10	7	9	11
Diospyros virginiana	American Persimmon, Possumwood	Tree	1	1	1		11	11	18	13
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	13	12	10	3	23	19	13	10
Lindera benzoin	Northern Spicebush	Shrub Tree				1			2	13
Liquidambar styraciflua	Sweet Gum, Red Gum	Tree								
Liriodendron tulipifera	Tulip Poplar	Tree		3	3	5	4	7	8	22
Platanus occidentalis	Sycamore, Plane-tree	Tree	6	11	8	20	32	37	42	48
Populus deltoides	Eastern Cottonwood	Tree	6	2	2	4	15	9	16	16
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree	1			2	12	11	22	20
Quercus pagoda	Cherrybark Oak, Swamp Spanish Oak	Tree	1	2	2	5	1	2	2	6
Quercus phellos	Willow Oak	Tree	2	1	1	9	14	13	18	31
Salix sericea	Silky Willow	Shrub Tree								
		Stem count	38	42	37	62	157	160	189	242
		size (ares)	4	4	4	4	16	16	16	16
		size (ACRES)	0.10	0.10	0.10	0.10	0.40	0.40	0.40	0.40
		Species count	10	10	10	12	12	12	13	13
		Stems per ACRE	384	425	374	627	397	405	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 3 - 2022

		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/0.3/12.1/81.3/137.0/256.0	
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 3 - 2022

		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 3 - 2022

	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	486.02	486.04					491.66	491.66	491.62	491.61					491.48	491.52	491.56	491.54				
Low Bank Elevation	485.90	485.89	485.97	486.05					491.66	491.69	491.62	491.61					491.48	491.48	491.62	491.57				
Bankfull Width (ft)	9.3	9.0	7.7	9.6					11.6	11.4	9.6	10.2					10.3	10.2	10.3	10.2				
Floodprone Width (ft)[2]	13.3	13.2	13.6	14.5					---	---	---	---					57.0	57.0	62.6	60.1				
Bankfull Mean Depth (ft)	0.4	0.4	0.4	0.4					1.0	1.1	1.2	1.0					0.5	0.5	0.5	0.5				
Bankfull Max Depth (ft)	0.7	0.7	0.7	0.7					1.8	2.1	2.1	1.8					0.8	0.8	0.9	0.9				
Bankfull Cross-Sectional Area (ft^2)	4.0	3.3	3.4	4.3					11.1	12.7	11.8	10.5					5.0	4.6	5.6	5.3				
Bankfull Width/Depth Ratio	21.3	24.7	17.4	21.6					12.1	10.2	7.8	9.9					21.3	22.5	19.0	19.6				
Bankfull Entrenchment Ratio	1.4	1.5	1.8	1.5					---	---	---	---					5.5	5.6	6.1	5.9				
Bankfull Bank Height Ratio	1.0	0.9	0.9	1.0					---	---	---	---					1.0	1.0	1.1	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	487.31	487.27					485.68	485.68	485.68	485.65					485.50	485.63	485.69	485.67				
Low Bank Elevation	487.26	487.21	487.28	487.22					485.68	485.71	485.68	485.65					485.50	485.58	485.58	485.58				
Bankfull Width (ft)	13.1	13.1	11.1	11.1					11.3	10.5	9.8	9.5					9.8	10.6	10.0	9.3				
Floodprone Width (ft)[2]	64.9	65.9	64.8	63.4					---	---	---	---					64.5	63.7	64.9	62.6				
Bankfull Mean Depth (ft)	0.6	0.6	0.7	0.7					0.9	1.0	1.1	1.0					0.7	0.6	0.6	0.7				
Bankfull Max Depth (ft)	1.0	1.0	1.1	1.0					1.8	2.0	2.0	1.8					1.2	1.0	1.0	1.0				
Bankfull Cross-Sectional Area (ft^2)	7.9	8.0	7.6	7.3					9.9	10.5	10.6	9.6					7.1	6.6	6.1	6.1				
Bankfull Width/Depth Ratio	21.9	21.4	16.4	17.0					13.0	10.6	9.0	9.3					13.6	17.1	16.5	14.1				
Bankfull Entrenchment Ratio	4.9	5.0	5.8	5.7					---	---	---	---					6.6	6.0	6.5	6.8				
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0					---	---	---	---					1.0	0.9	0.9	1.0				

[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 valley width may extend further.

Table 13a. Monitoring Data - Stream Reach Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

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)	9.3		9.0		7.7		9.6									
Floodprone Width (ft)	13.3		13.2		13.6		14.5									
Bankfull Mean Depth (ft)	0.4		0.4		0.4		0.4									
Bankfull Max Depth (ft)	0.7		0.7		0.7		0.7									
Bankfull Cross-sectional Area (ft^2)	4.0		3.3		3.4		4.3									
Width/Depth Ratio	21.3		24.7		17.4		21.6									
Entrenchment Ratio	1.4		1.5		1.8		1.5									
Bank Height Ratio	1.0		0.9		0.9		1.0									
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		7.3/14.9/26.9/107.4/ 162.1/362.0											
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

Table 13b. Monitoring Data - Stream Reach Data Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

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	10.2	13.1	10.3	11.1	10.2	11.1								
Floodprone Width (ft)	57.0	64.9	57.0	65.9	62.6	64.8	60.1	63.4								
Bankfull Mean Depth (ft)	0.5	0.6	0.5	0.6	0.5	0.7	0.5	0.7								
Bankfull Max Depth (ft)	0.8	1.0	0.8	1.0	0.9	1.1	0.9	1.0								
Bankfull Cross-sectional Area (ft^2)	5.0	7.9	4.6	8.0	5.6	7.6	5.3	7.3								
Width/Depth Ratio	21.3	21.9	21.4	22.5	16.4	19.0	17.0	19.6								
Entrenchment Ratio	4.9	5.5	5.0	5.6	5.8	6.1	5.7	5.9								
Bank Height Ratio	1.0		1.0		1.0	1.1	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/		SC/20.7/49.5/120.7/196.6/512.0											
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 3 - 2022

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		10.0		9.3									
Floodprone Width (ft)	64.5		63.7		64.9		62.6									
Bankfull Mean Depth (ft)	0.7		0.6		0.6		0.7									
Bankfull Max Depth (ft)	1.2		1.0		1.0		1.0									
Bankfull Cross-sectional Area (ft^2)	7.1		6.6		6.1		6.1									
Width/Depth Ratio	13.6		17.1		16.5		14.1									
Entrenchment Ratio	6.6		6.0		6.5		6.8									
Bank Height Ratio	1.0		0.9		0.9		1.0									
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		SC/9.4/19.4/79.2/ 128.0/180.0											
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

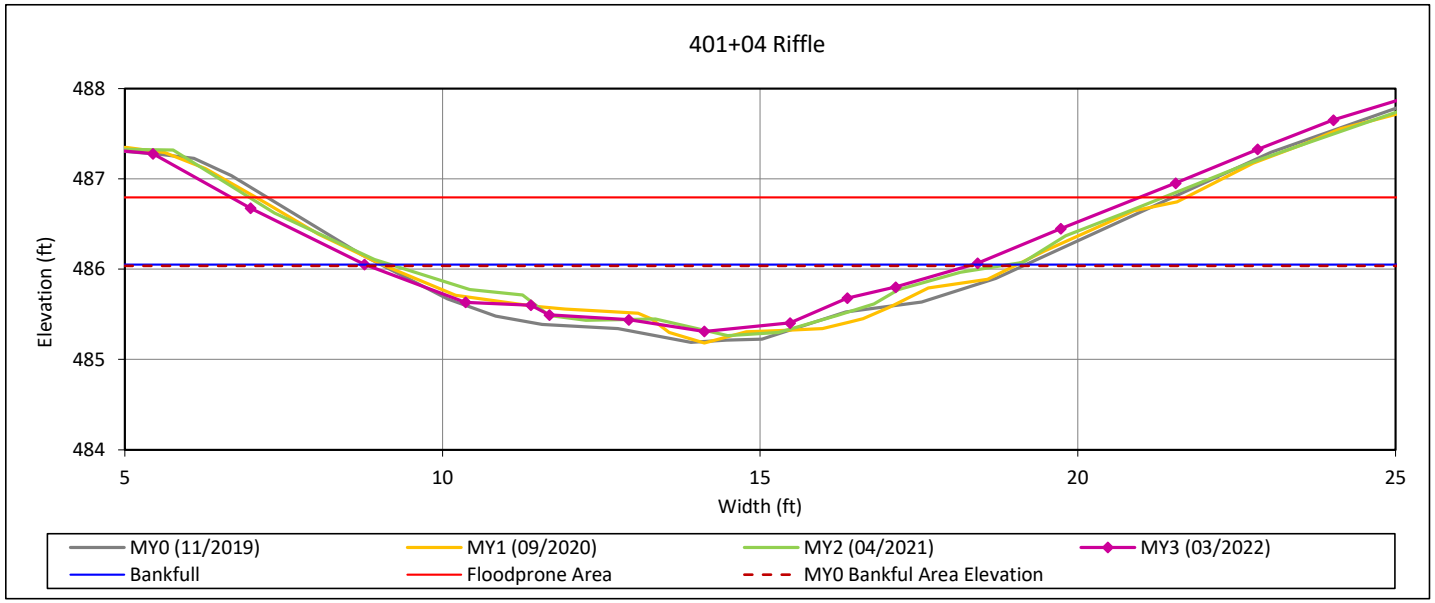
(---): Data was not provided

N/A: Not Applicable

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 3 - 2022

Cross-Section 1 - WF1



Bankfull Dimensions	
4.3	x-section area (ft.sq.)
9.6	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
9.8	wetted perimeter (ft)
0.4	hydraulic radius (ft)
21.6	width-depth ratio
14.5	W flood prone area (ft)
1.5	entrenchment ratio
1.0	low bank height ratio

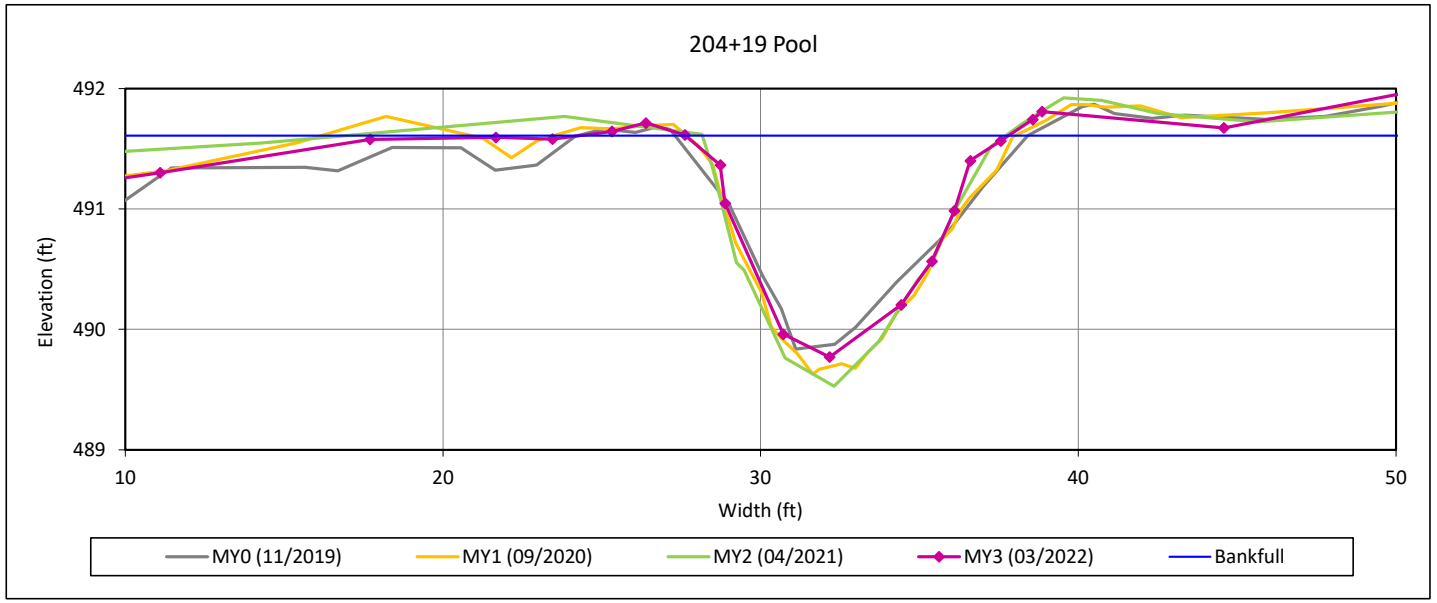
Survey Date: 03/2022
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 3 - 2022

Cross-Section 2 - EF1



Bankfull Dimensions	
10.5	x-section area (ft.sq.)
10.2	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
11.1	wetted perimeter (ft)
0.9	hydraulic radius (ft)
9.9	width-depth ratio

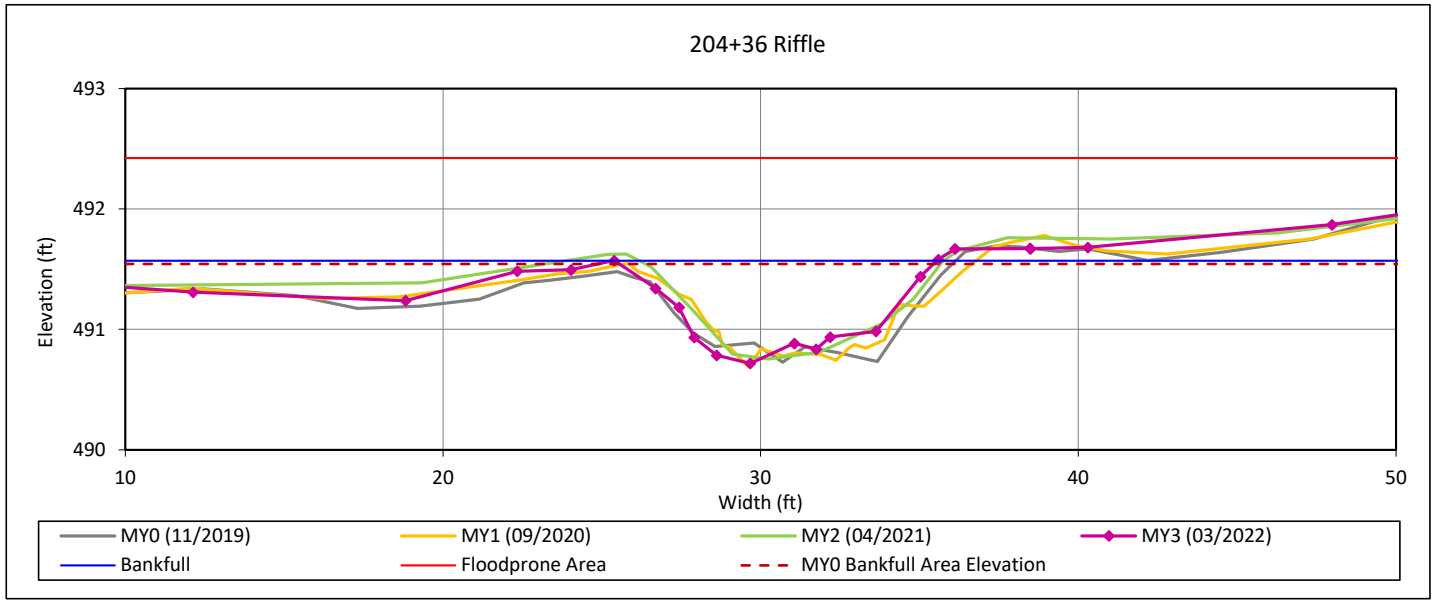
Survey Date: 03/2022
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 3 - 2022

Cross-Section 3 - EF1



Bankfull Dimensions	
5.3	x-section area (ft.sq.)
10.2	width (ft)
0.5	mean depth (ft)
0.9	max depth (ft)
10.4	wetted perimeter (ft)
0.5	hydraulic radius (ft)
19.6	width-depth ratio
60.1	W flood prone area (ft)
5.9	entrenchment ratio
1.0	low bank height ratio

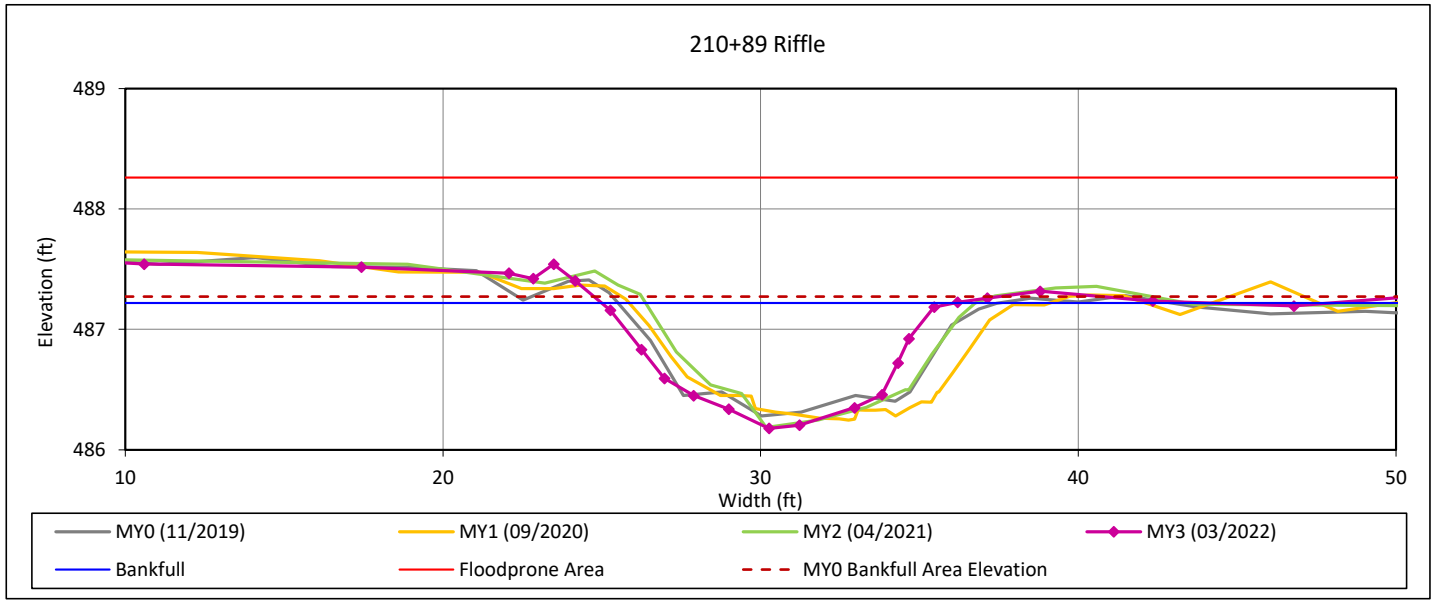
Survey Date: 03/2022
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 3 - 2022

Cross-Section 4 - EF1



Bankfull Dimensions	
7.3	x-section area (ft.sq.)
11.1	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
11.4	wetted perimeter (ft)
0.6	hydraulic radius (ft)
17.0	width-depth ratio
63.4	W flood prone area (ft)
5.7	entrenchment ratio
1.0	low bank height ratio

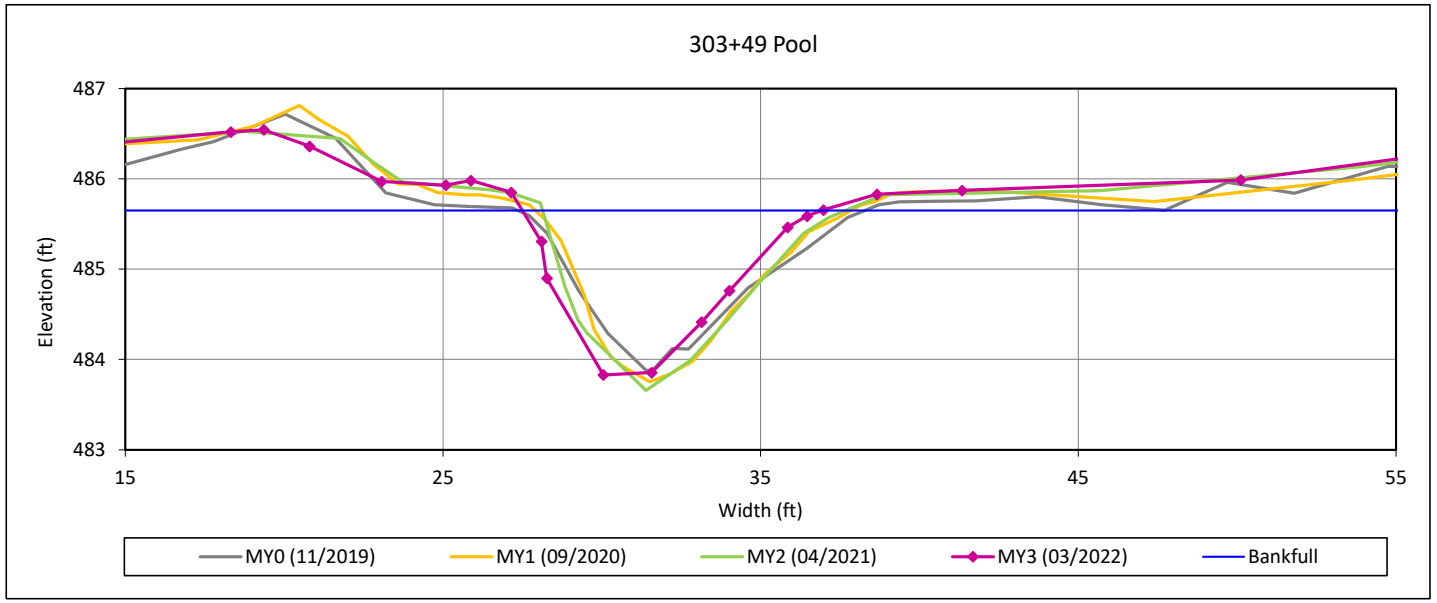
Survey Date: 03/2022
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 3 - 2022

Cross-Section 5 - WF2



Bankfull Dimensions	
9.6	x-section area (ft.sq.)
9.5	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
10.4	wetted perimeter (ft)
0.9	hydraulic radius (ft)
9.3	width-depth ratio

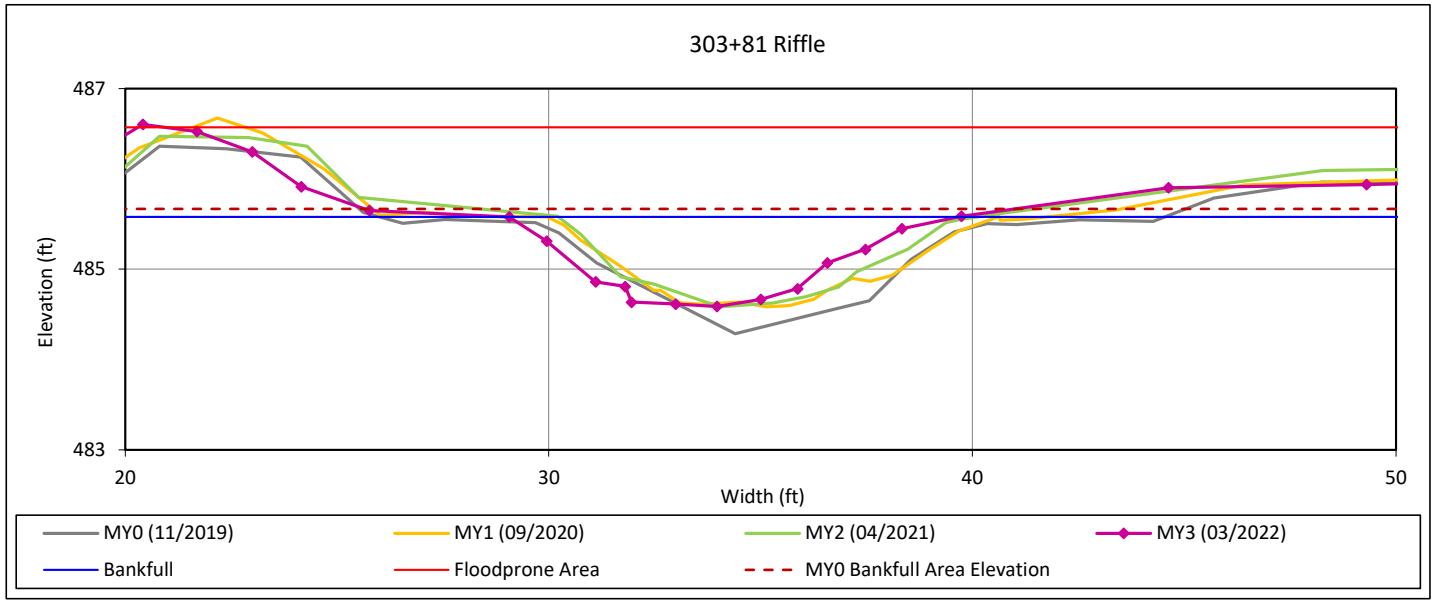
Survey Date: 03/2022
Field Crew: Wildlands Engineering

View Downstream

Cross-Section Plots

Deep Meadow Mitigation Site
NCDMS Project No. 97131
Monitoring Year 3 - 2022

Cross-Section 6 - WF2



Bankfull Dimensions	
6.1	x-section area (ft.sq.)
9.3	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
9.6	wetted perimeter (ft)
0.6	hydraulic radius (ft)
14.1	width-depth ratio
62.6	W flood prone area (ft)
6.8	entrenchment ratio
1.0	low bank height ratio

Survey Date: 03/2022
Field Crew: Wildlands Engineering

View Downstream

APPENDIX 5. Hydrology Summary Data and Plots

Table 14a. Verification of Bankfull Events

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Reach	MY	Date of Occurrence	Date of Data Collection	Method
WF1	MY1	11/12/2020	11/13/2020	Photographic Documentation
	MY2	1/1/2021	1/1/2021	Crest Gage
		1/3/2021	1/3/2021	
		1/28/2021 - 1/29/2021	1/28/2021 - 1/29/2021	
		2/4/2021	2/4/2021	
		2/11/2021	2/11/2021	
		2/14/2021 - 2/16/2021	2/14/2021 - 2/16/2021	
		2/18/2021 - 2/20/2021	2/18/2021 - 2/20/2021	
		2/22/2021	2/22/2021	
		7/8/2021	7/8/2021	
		8/18/2021	8/18/2021	
		9/23/2021	9/23/2021	
	MY3	1/2/2022	1/2/2022	
		1/16/2022	1/16/2022	
		1/29/2022 - 1/31/2022	1/29/2022 - 1/31/2022	
		2/4/2022	2/4/2022	
		3/12/2022	3/12/2022	
		3/16/2022	3/16/2022	
		3/31/2022	3/31/2022	
		4/5/2022	4/5/2022	
		4/18/2022	4/18/2022	
		7/9/2022	7/9/2022	
		9/9/2022	9/9/2022	
		9/30/2022	9/30/2022	
EF1	MY1	2/6/2020	2/6/2020	
		4/13/2020	4/13/2020	
		5/21/2020	5/21/2020	
		5/27/2020	5/27/2020	
		8/9/2020	8/9/2020	
		8/15/2020	8/15/2020	
		10/11/2020	10/11/2020	
		11/12/2020	11/12/2020	
	MY2	No bankfull events recorded	No bankfull events recorded	
	MY3	1/3/2022	1/3/2022	
		3/12/2022	3/12/2022	
		4/18/2022	4/18/2022	

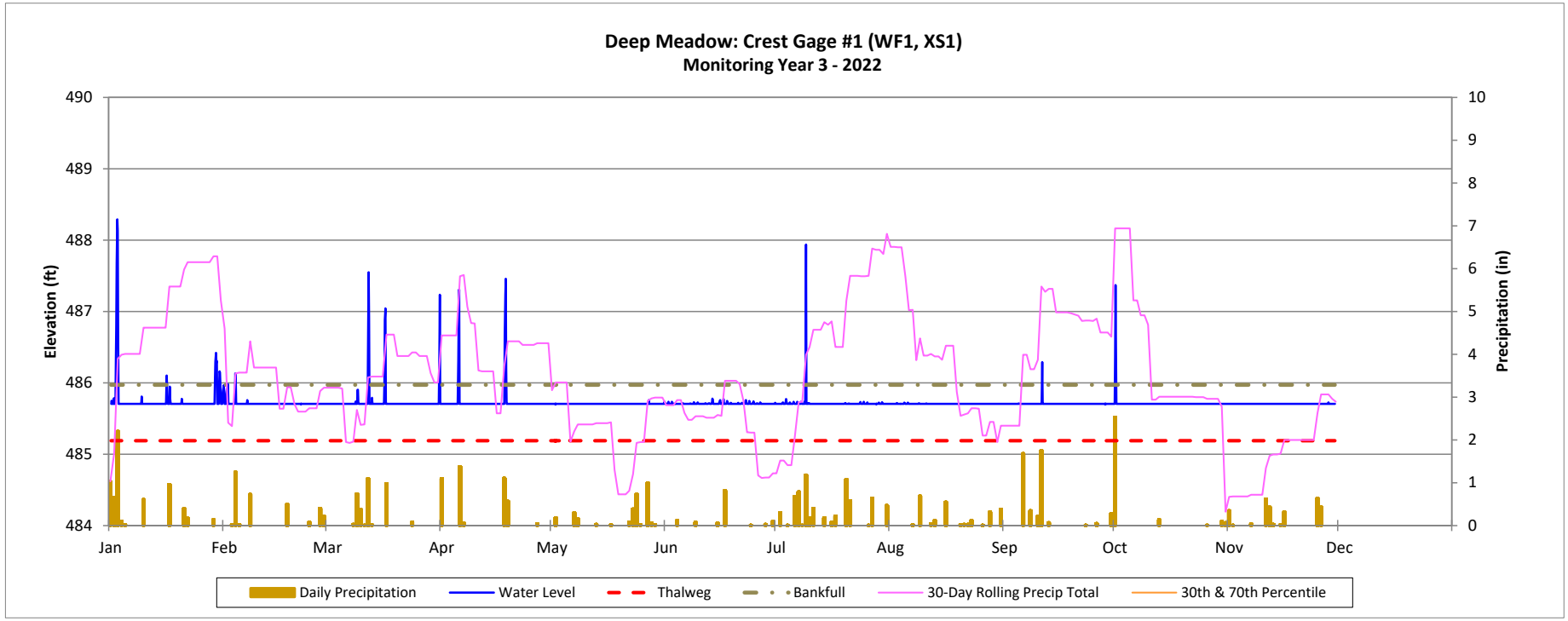
Table 14b. Verification of Bankfull Events

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Reach	MY	Date of Occurrence	Date of Data Collection	Method
WF2	MY1	1/25/2020	1/25/2020	Crest Gage
		2/6/2020	2/6/2020	
		4/13/2020	4/13/2020	
		5/21/2020	5/21/2020	
		5/27/2020	5/27/2020	
		8/9/2020	8/9/2020	
		8/15/2020	8/15/2020	
		10/11/2020	10/11/2020	
		10/30/2020	10/30/2020	
		11/12/2020	11/13/2020	Crest Gage and Photographs
	MY2	2/16/2021	2/16/2021	Crest Gage
	MY3	1/3/2022	1/3/2022	

Recorded Bankfull Events

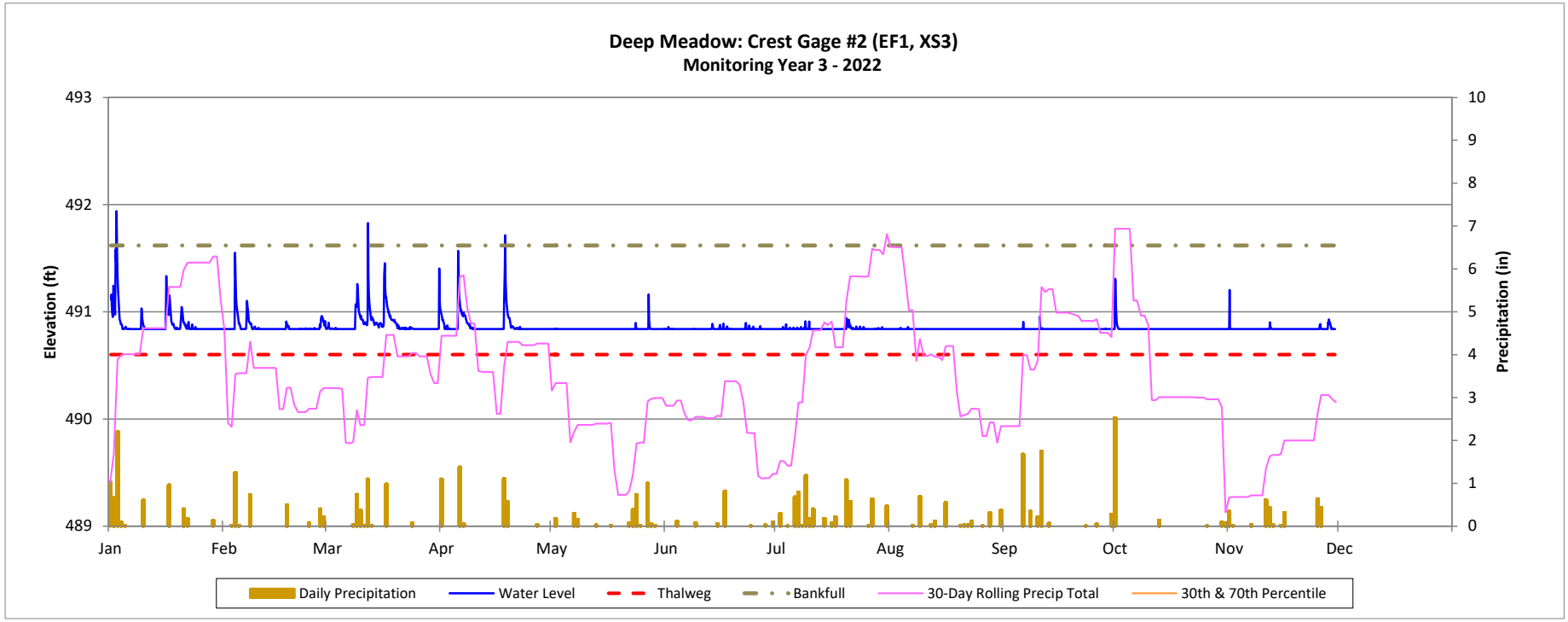
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022



*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

Recorded Bankfull Events

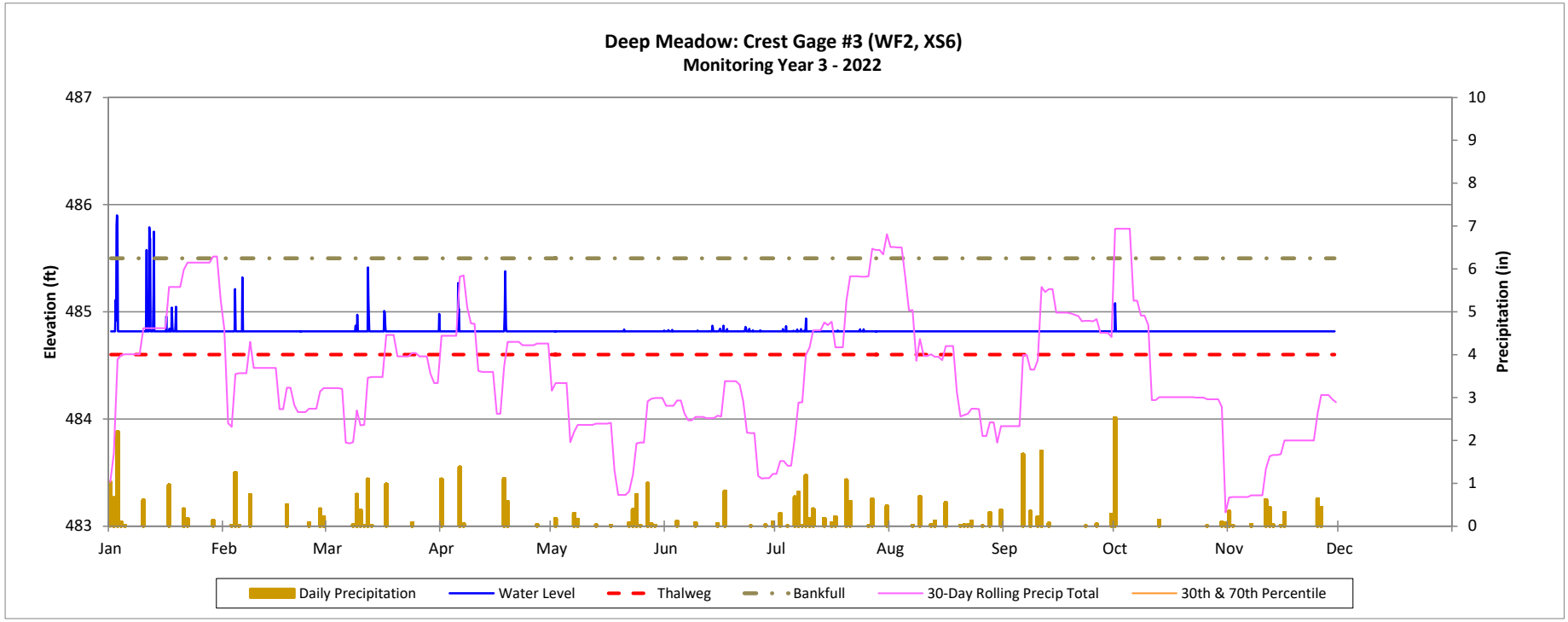
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022



*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

Recorded Bankfull Events

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022



*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

Table 15. Wetland Gage Attainment Summary
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Summary of Groundwater Gage Results for Monitoring Years 1 through 7								
Gage	Max Consecutive Days During Growing Season (Percentage) [1]							
	MY1 - Original Growing Season [2]	MY2 - Original Growing Season [2]	MY3 - Original Growing Season [2]	MY3 - Revised Growing Season [3]	MY4	MY5	MY6	MY7
1	111 days (48.5%)	30 days (13.1%)	70 days (29.0%)	80 days (29.3%)				
2	58 days (25.3%)	13 days (5.7%)	17 days (7.1%)	27 days (9.9%)				
3	25 days (10.9%)	10 days (4.4%)	16 days (6.6%)	18 days (6.6%)				
3a	N/A	N/A	18 days (7.5%)	20 days (7.3%)				
4	63 days (27.5%)	11 days (4.8%)	19 days (7.9%)	21 days (7.7%)				
5	229 days (100%)	42 days (18.3%)	91 days (37.8%)	101 days (37.0%)				
6	51 days (22.3%)	12 days (5.2%)	18 days (7.5%)	20 days (7.3%)				
7	58 days (25.3%)	14 days (6.1%)	16 days (6.6%)	18 days (6.6%)				
8	51 days (22.3%)	11 days (4.8%)	15 days (6.2%)	17 days (6.2%)				
9	27 days (11.8%)	2 days (0.9%)	10 days (4.1%)	12 days (4.4%)				
10	26 days (11.4%)	7 days (3.1%)	14 days (5.8%)	16 days (5.9%)				
11	20 days (8.7%)	11 days (4.8%)	15 days (4.4%)	17 days (6.2%)				
11a	N/A	N/A	17 days (7.1%)	19 days (7.0%)				
Reference	49 days (21.4%)	26 days (11.4%)	49 days (20.3%)	59 days (21.6%)				

1)The wetland hydrology success criteria is free groundwater within 12 inches of the ground surface for 10% of the growing season.

2) The original growing season defined in the Mitigation Plan (Wildlands, 2018) is March 23rd to November 6th. Therefore, the original success criteria is 23 consecutive days of the original growing season.

3) Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st to November 28th. Therefore, the revised success criteria is 28 consecutive days of the revised growing season.

Table 16. Wetland Gage Attainment Criteria Comparison

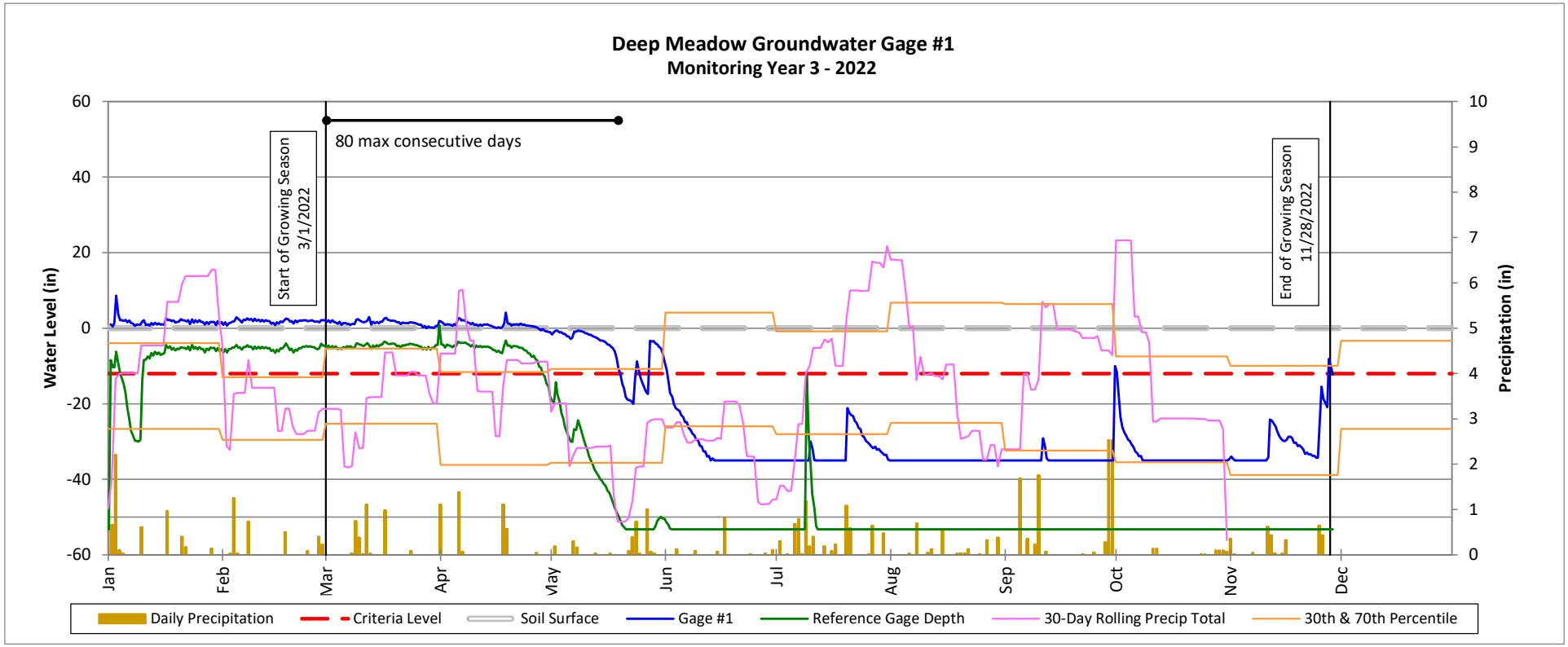
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Groundwater Gage	*Most Consecutive Days Meeting Criteria*	*Percent Consecutive Days in Revised Growing Season*	*Total Days Meeting Criteria*	*Percent Cumulative Days in Revised Growing Season*	*Number of Instances Meeting Criteria*
Reference Well	**59**	**21.6%**	**59**	**21.6%**	**117**
Groundwater Gage #1	**80**	**29.3%**	**88**	**32.2%**	**175**
Groundwater Gage #2	**27**	**9.9%**	**47**	**17.2%**	**92**
Groundwater Gage #3	**18**	**6.6%**	**41**	**15.0%**	**80**
Groundwater Gage #3a	**20**	**7.3%**	**49**	**17.9%**	**96**
Groundwater Gage #4	**21**	**7.7%**	**48**	**17.6%**	**94**
Groundwater Gage #5	**101**	**37.0%**	**168**	**61.5%**	**335**
Groundwater Gage #6	**20**	**7.3%**	**42**	**15.4%**	**82**
Groundwater Gage #7	**18**	**6.6%**	**42**	**15.4%**	**82**
Groundwater Gage #8	**17**	**6.2%**	**31**	**11.4%**	**60**
Groundwater Gage #9	**12**	**4.4%**	**21**	**7.7%**	**41**
Groundwater Gage #10	**16**	**5.9%**	**34**	**12.5%**	**67**
Groundwater Gage #11	**17**	**6.2%**	**31**	**11.4%**	**61**
Groundwater Gage #11a	**19**	**7.0%**	**40**	**14.7%**	**78**

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st to November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E10

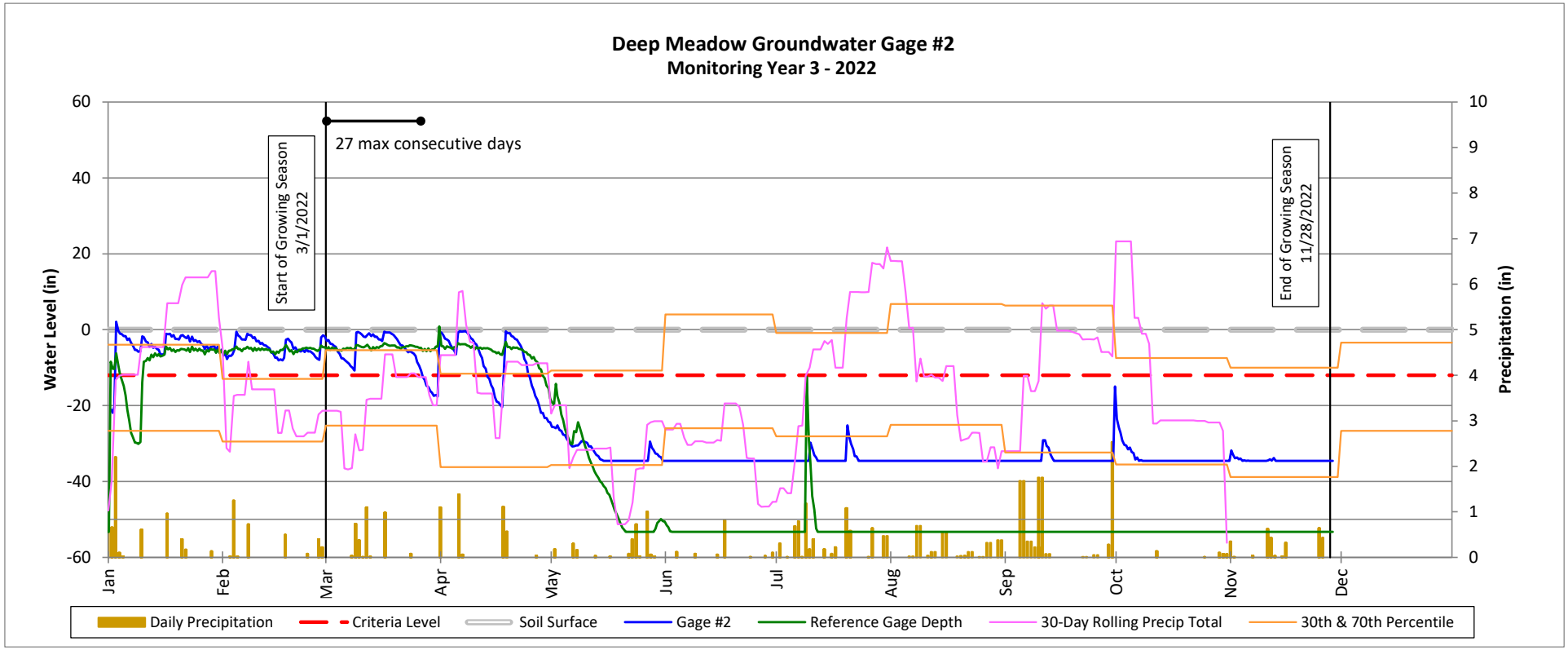


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E9

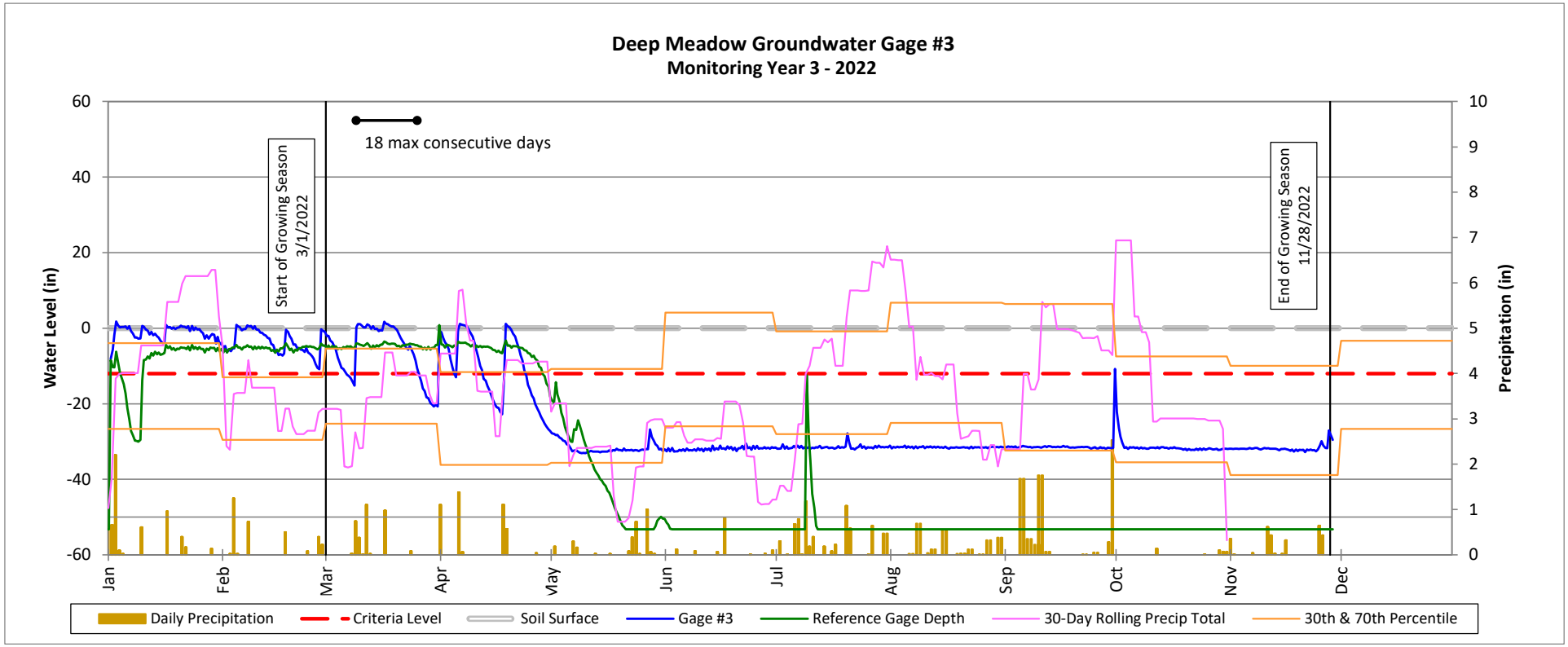


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E8

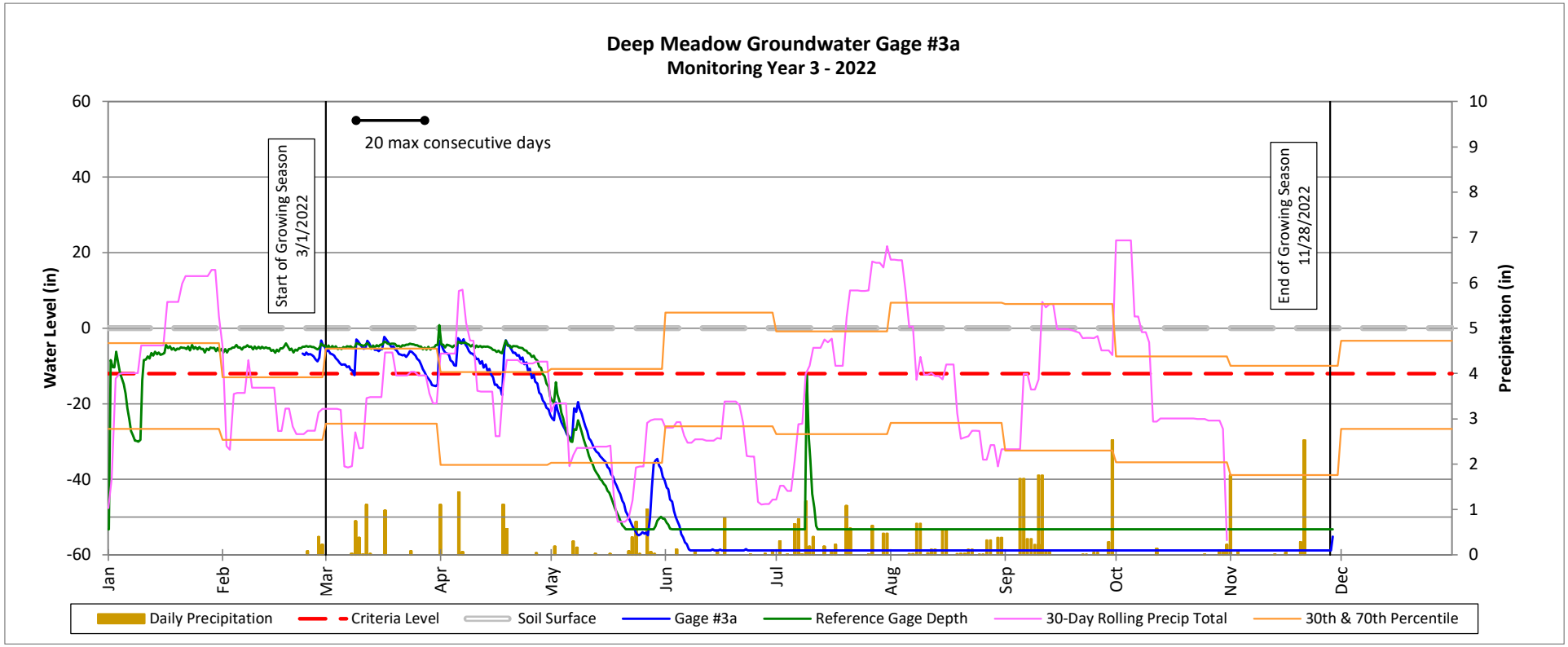


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E8

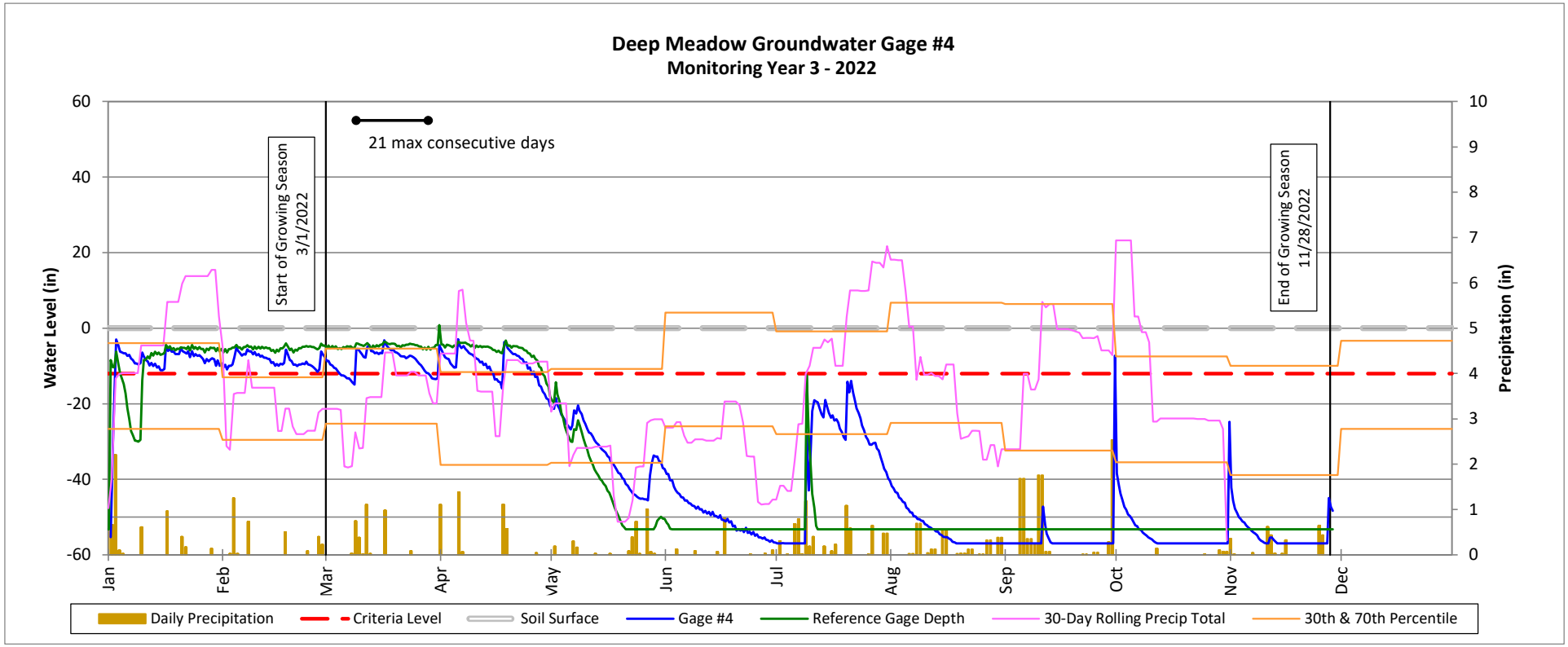


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E7

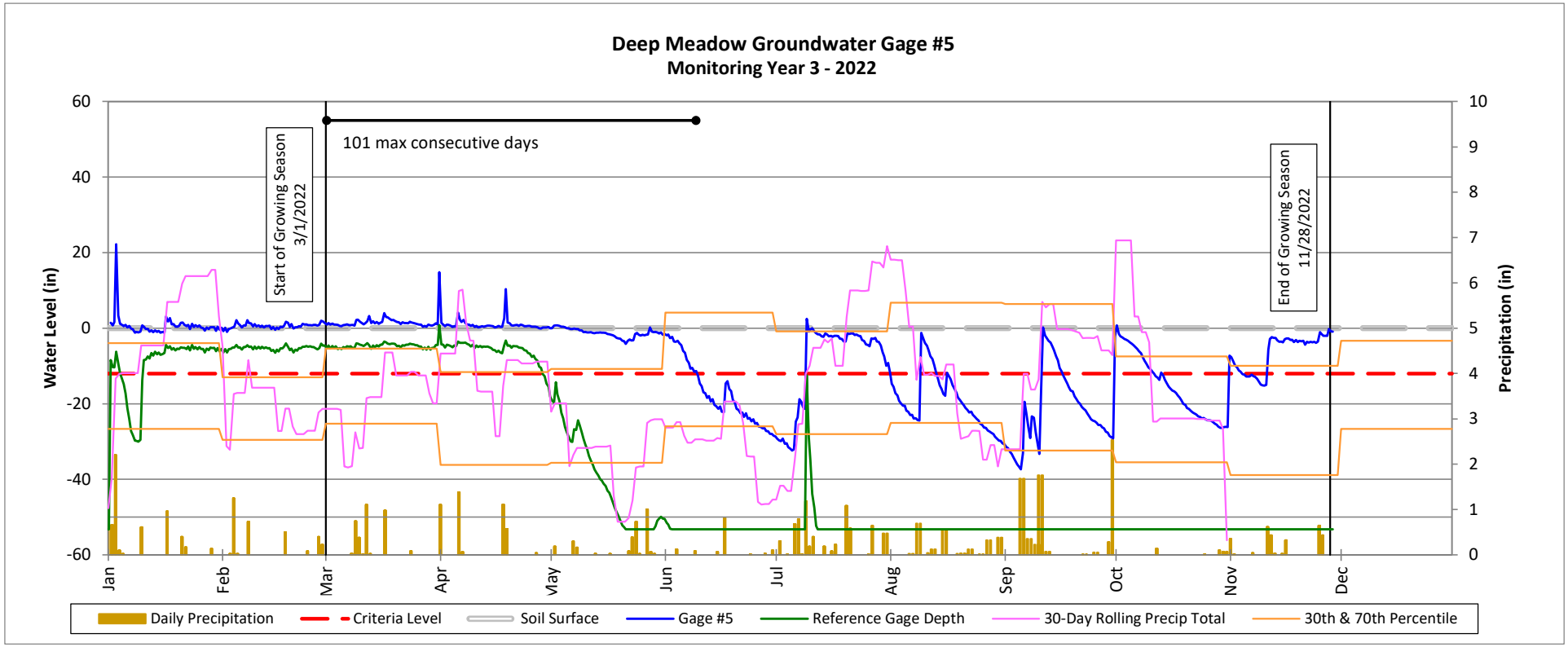


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E1

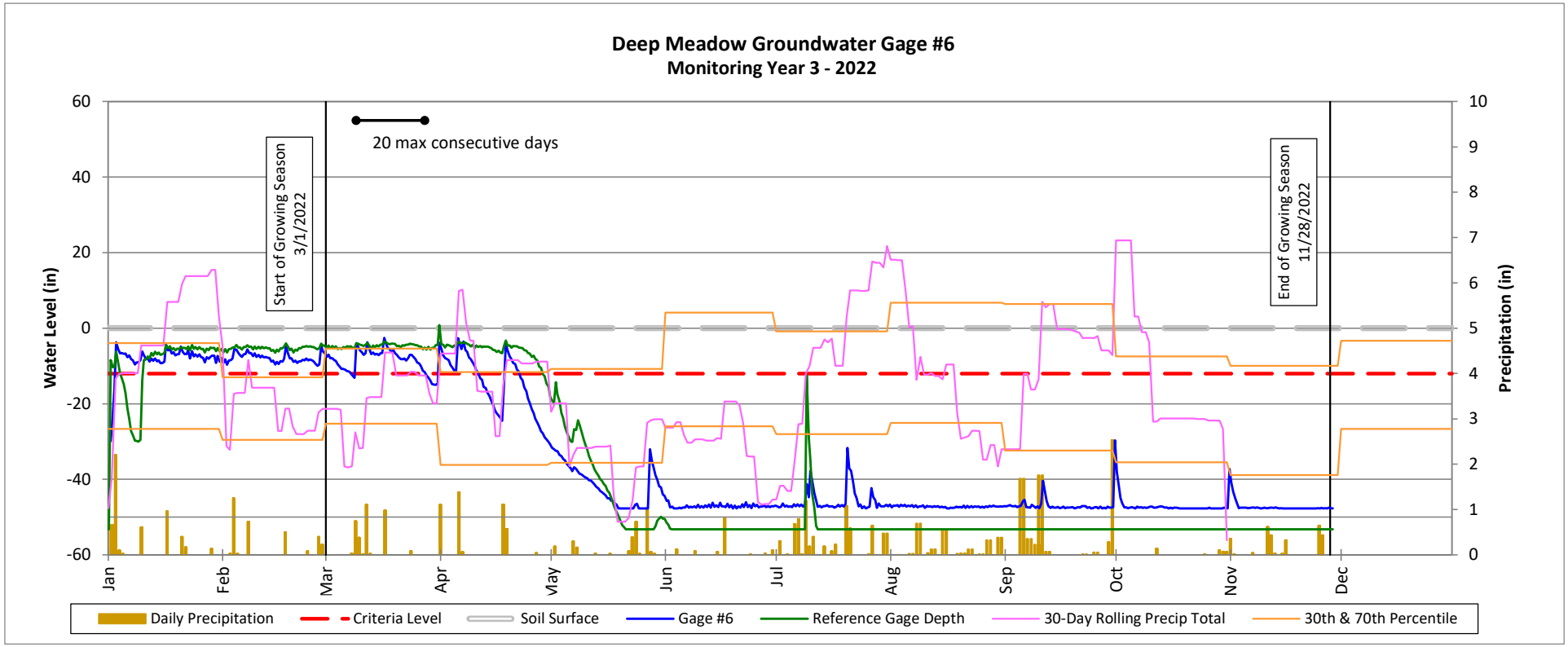


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E2

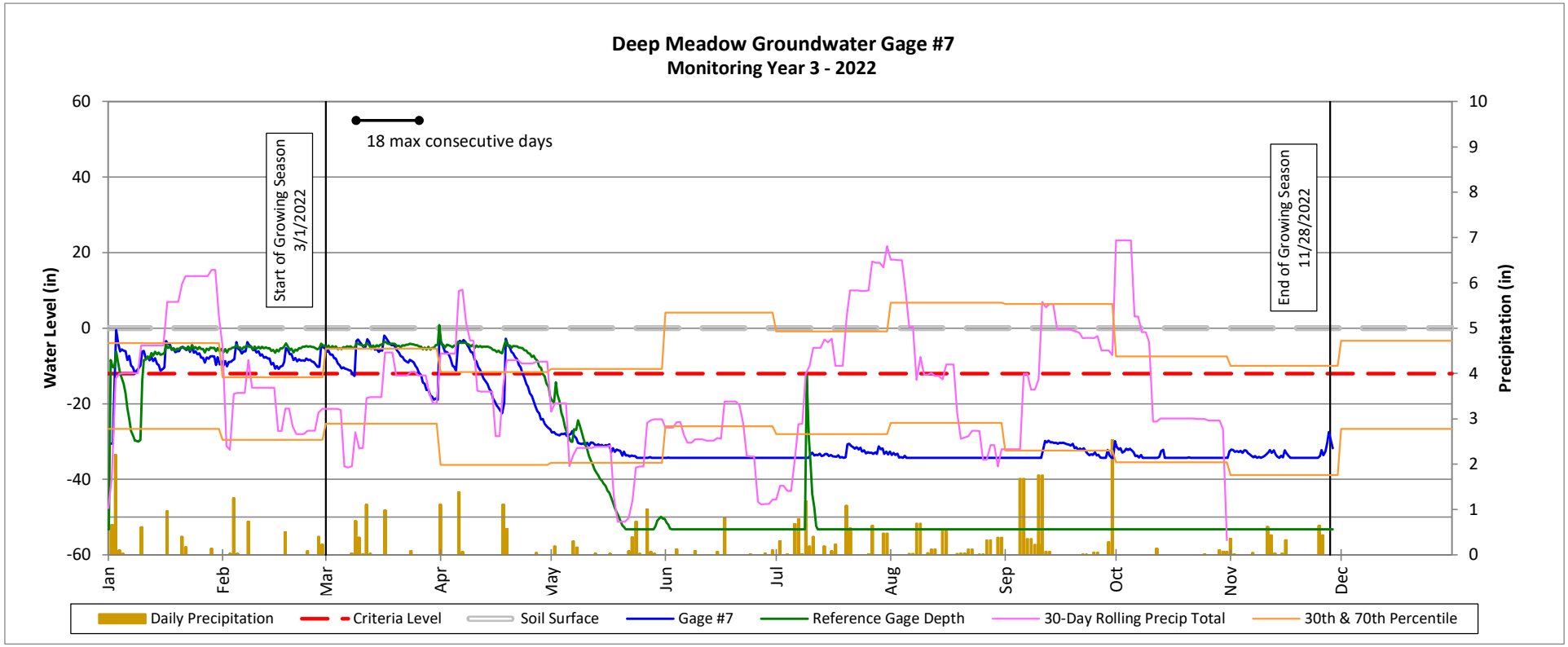


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E2

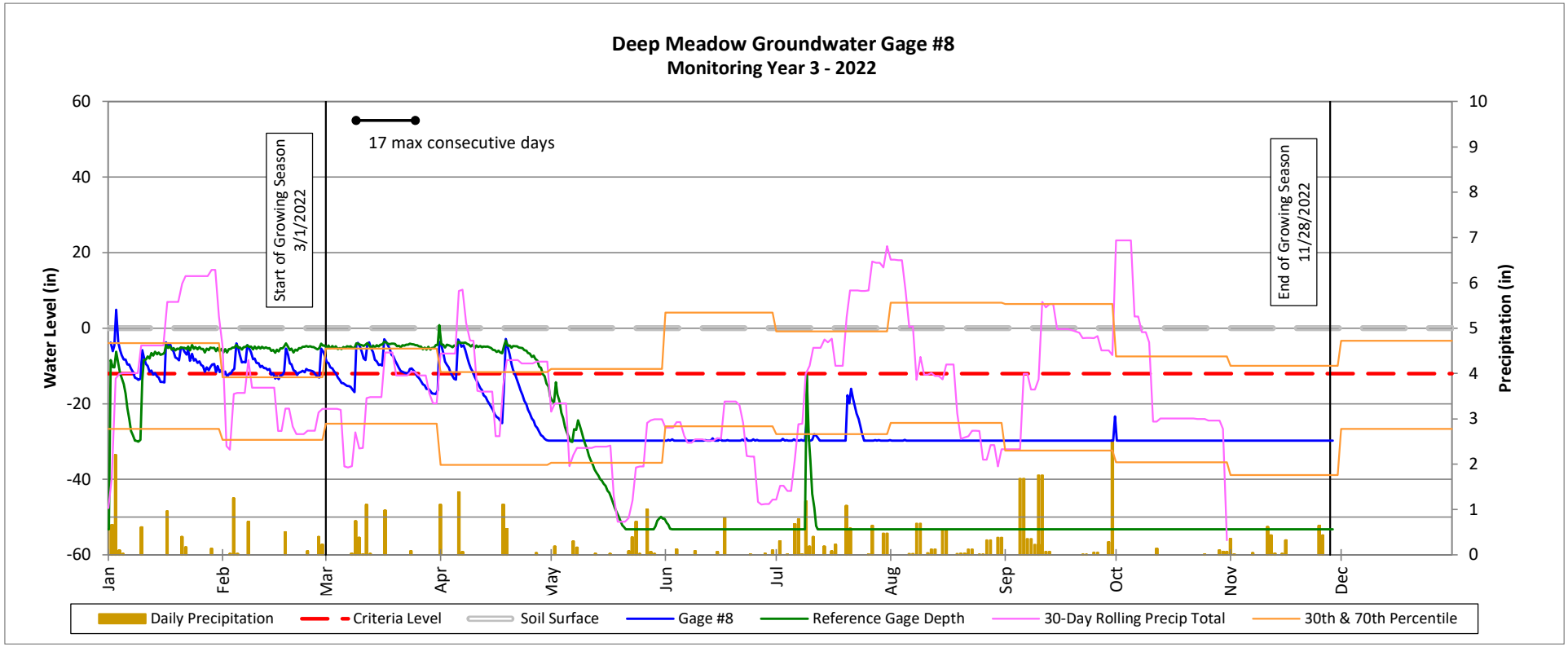


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E3

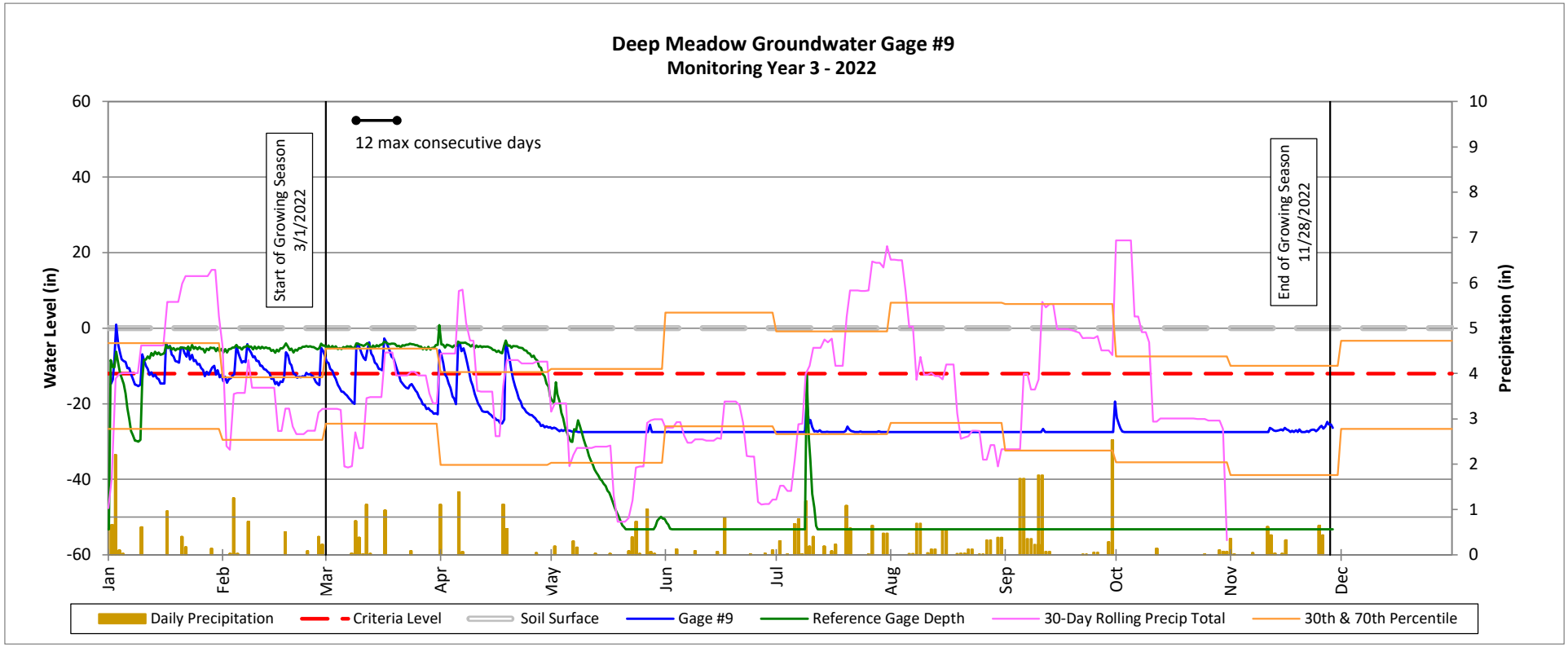


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E4

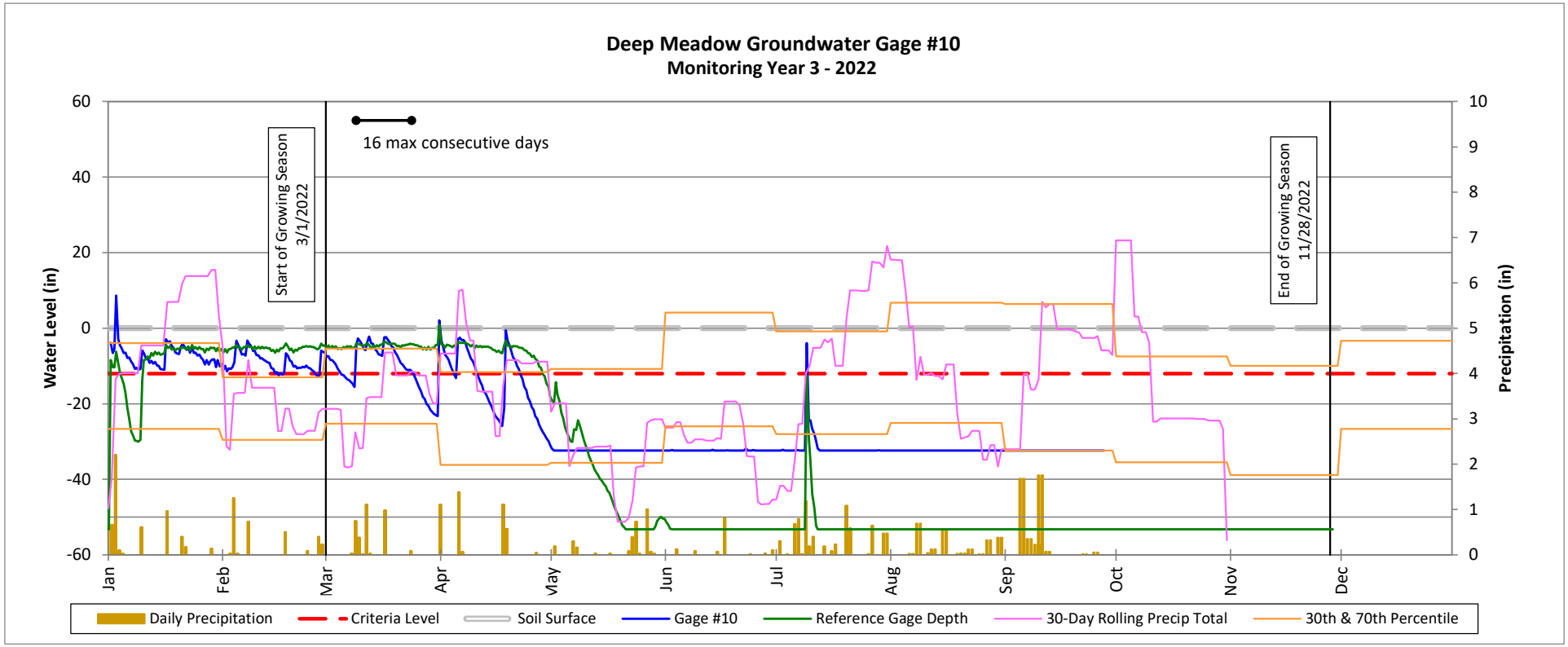


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E5

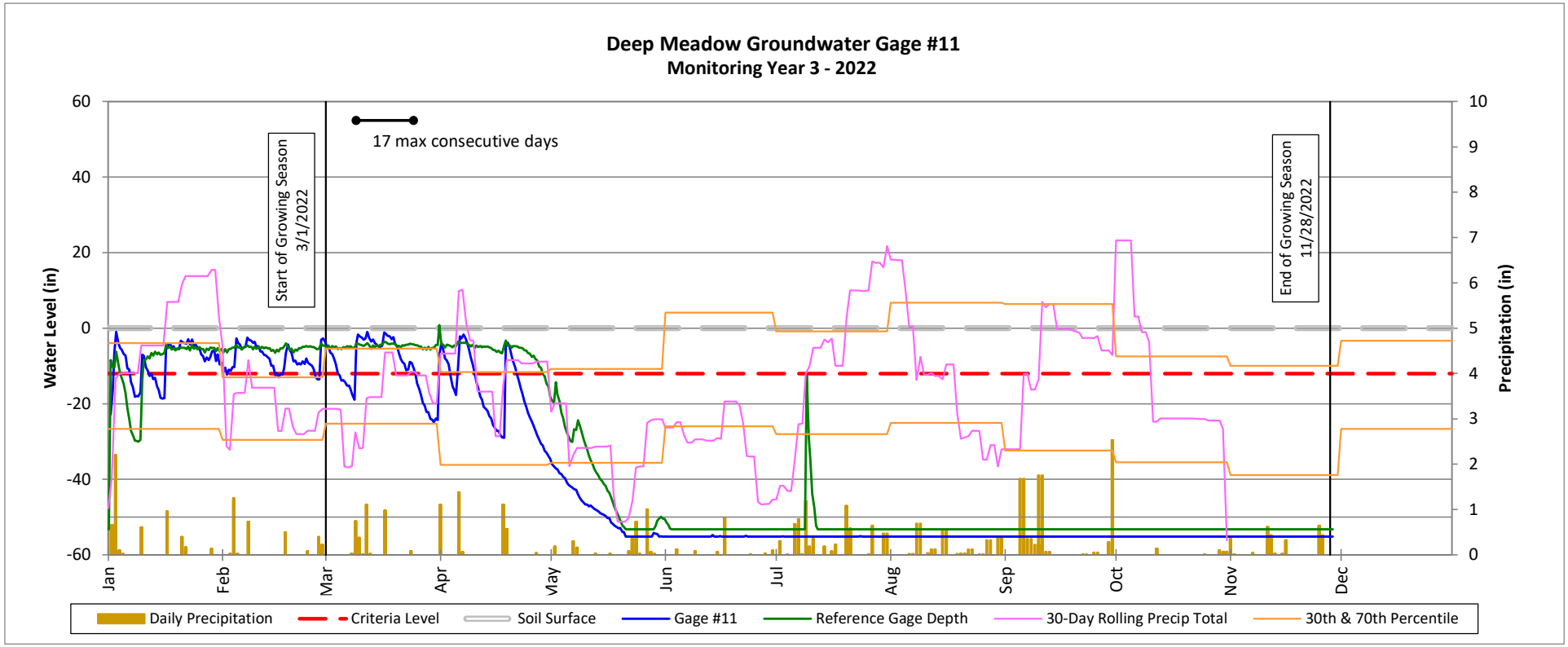


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E6

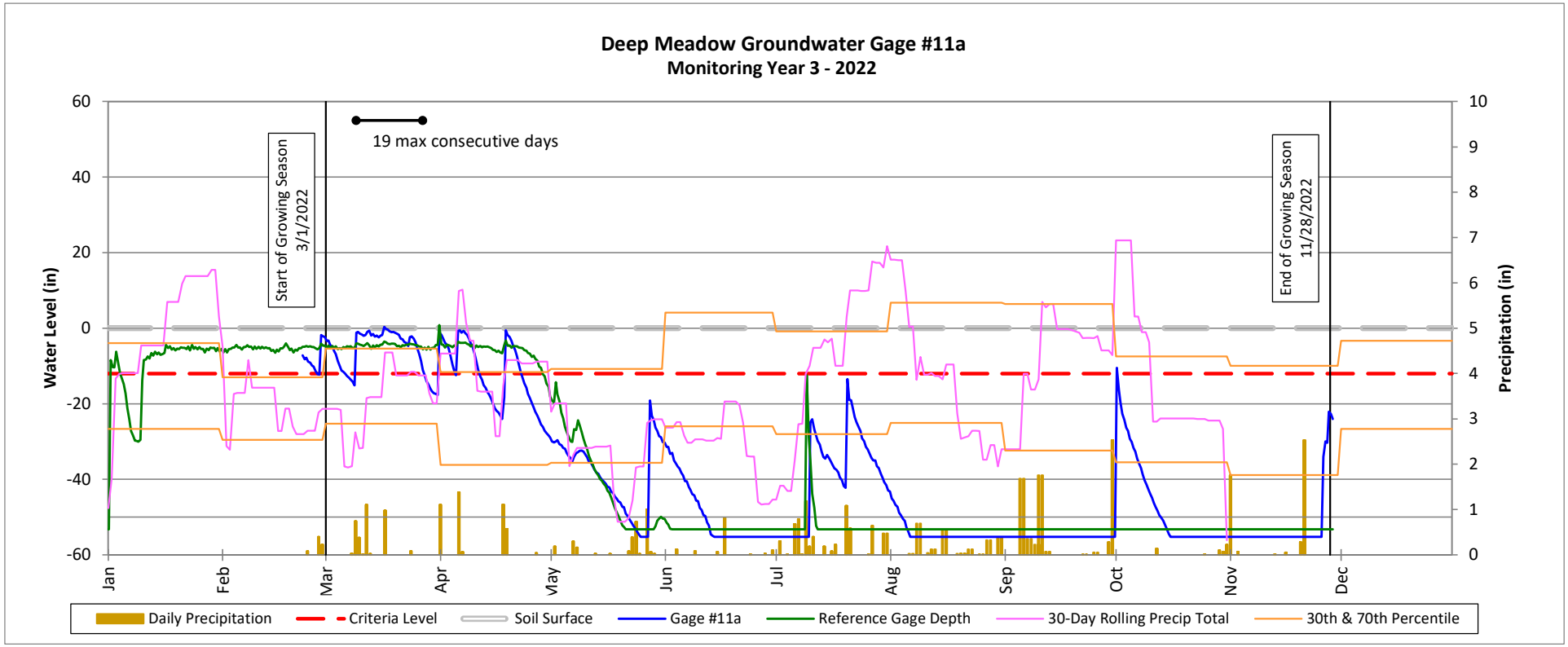


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Wetland W-E6

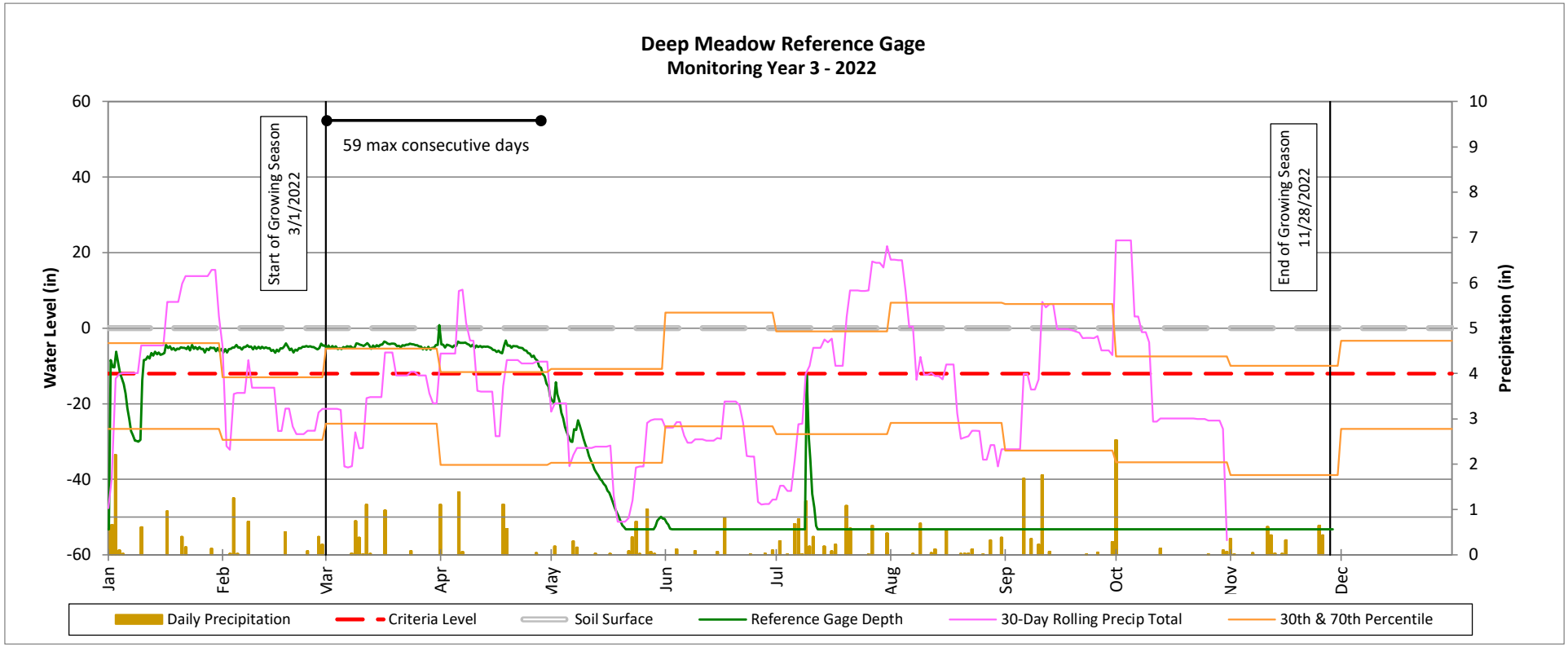


*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Groundwater Gage Plots

Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022
Reference Gage



*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE.

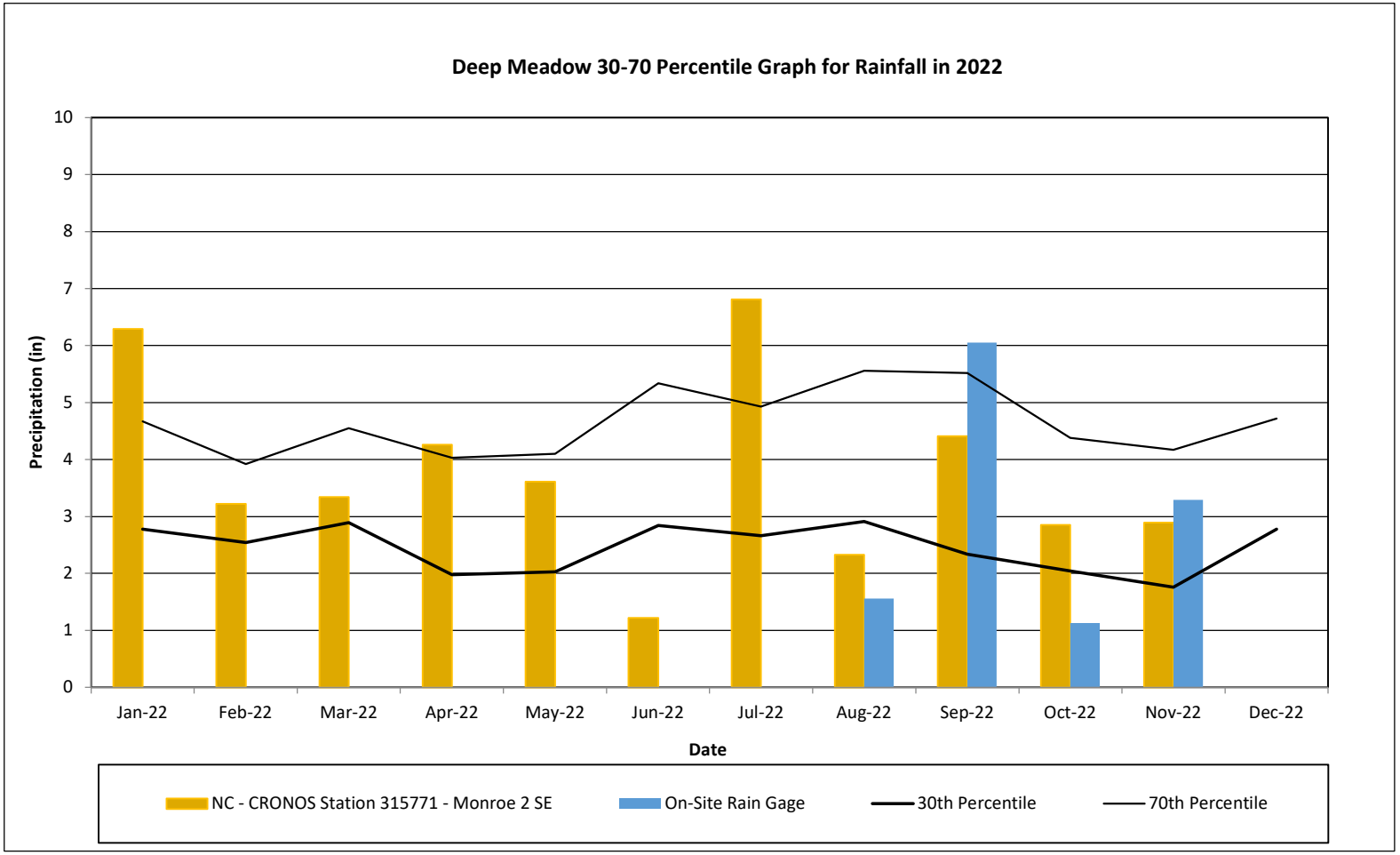
*Due to supporting soil temperature and seasonal vegetation indicators, the growing season was revised to March 1st through November 28th. Therefore, the revised success criteria is 28 consecutive days (10%) of the revised growing season.

Monthly Rainfall Data

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 3 - 2022



*Annual precipitation data was derived from the NC - CRONOS Station 315771 - Monroe 2 SE. (Downloaded 11/30/2022)

*An on-site rain gage was installed in August 2022, and will function as the primary source of precipitation data starting in MY4. (Downloaded 11/29/2022)

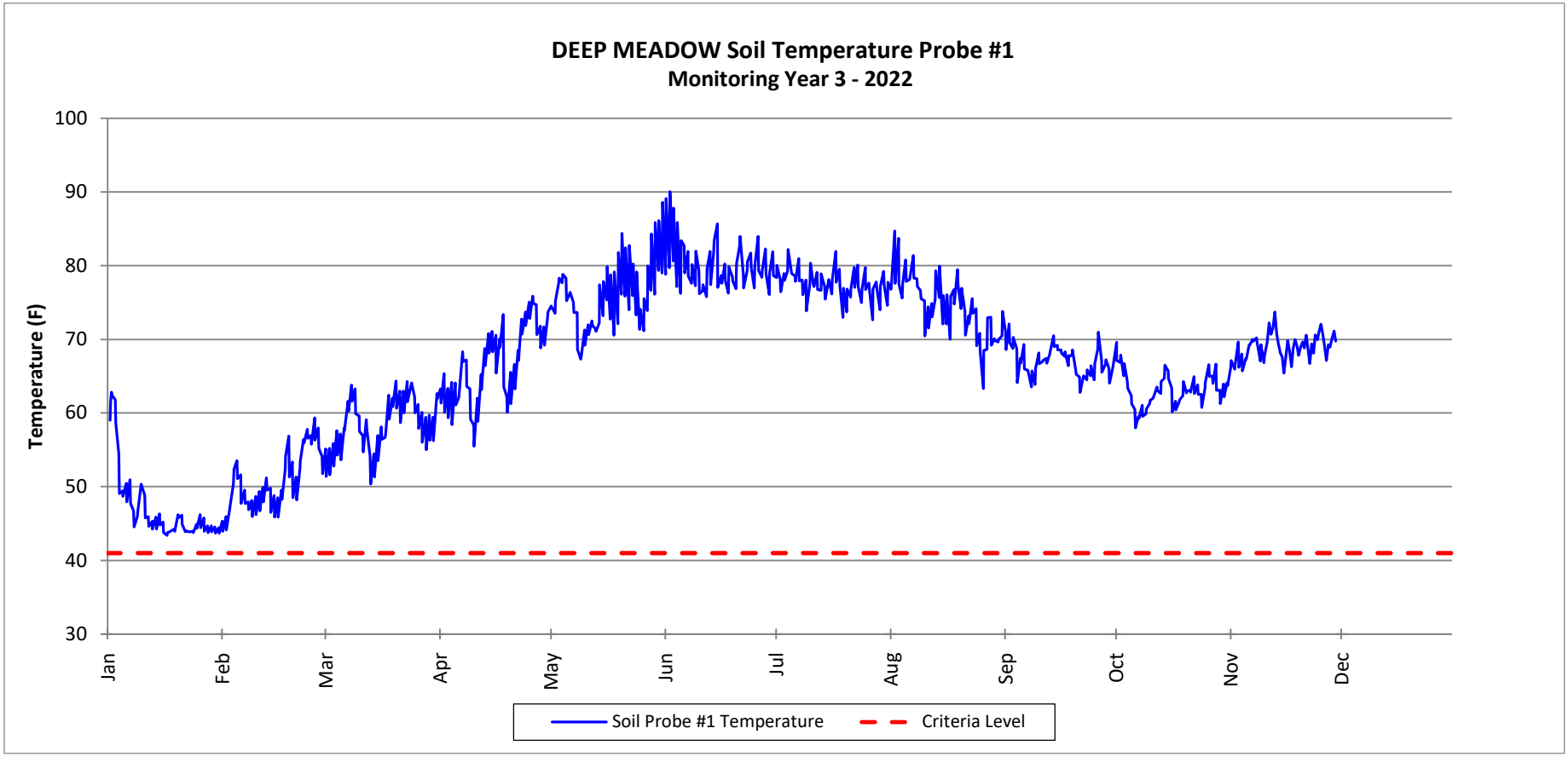
*30th and 70th percentile rainfall data collected from WETS NC - CRONOS Station 315771 - Monroe 2 SE. (Downloaded 11/30/2022)

Soil Temperature Data

Deep Meadow Mitigation Site

DMS Project No. 97131

Monitoring Year 3 - 2022



Vegetation Seasonal Indicators

Monitoring Year 3

	
Start of the Growing Season - Red Maple Bud Burst - (*03/02/2022)*	**End of the Growing Season** - Over 50% Leaf Drop - (11*/29/2022)*

APPENDIX 6. Agency Correspondence

WILDLANDS
ENGINEERING

MEETING NOTES

MEETING:	MY3 IRT Credit Release Site Walk **DEEP MEADOW Mitigation Site** Yadkin 03040105; Union County, NC DEQ Contract No. 6887 DMS Project No. 97131 Wildlands Project No. 005-02169
DATE:	Wednesday, May 11, 2022
LOCATION:	McIntyre Road Wingate, NC

Attendees

Kim (Browning) Isenhour, USACE
Casey Haywood, USACE
Erin Davis, NCDWR
Olivia Munzer, NCWRC
Harry Tsomides, DMS
Paul Wiesner, DMS
Sam Kirk, Wildlands
Kristi Suggs, Wildlands
Aaron Earley, Wildlands
John Hutton, Wildlands

Meeting Notes

The meeting began at 10:30 pm. Attendees discussed the site conditions and issues noted in the MY1 and MY2 reports as summarized in the Opening Remarks section below. From there, the group walked to upstream extent of Meadow Branch, on to GWG4, and then over to wetland W-E2 and stream EF1. The meeting concluded at 1:30 PM.

1) Opening Remarks

a) Attendees had an in-depth discussion about the failing groundwater gage data in MY2.
   i) Kim asked how growing season was established. Kristi said that WETS data was used. Erin asked which WETS data set was used and recommended that the newest 30-year data set be employed. Kristi responded that the data set used for Deep Meadow was from 1971 – 2020 and will consider 30-year data for future projects, but that range was incorrect. It was 1971 – 2000. Kristi further investigated the growing season by using the most recent 30 years of data (1992 – 2022). Using this range of thirty years results in a growing season from 3/17 – 11/17.

ii) John proposed that soil temperature be used to establish a revised growing season that starts March 1. Kim replied that to use soil temperature along with the other 12 indicators (i.e., spring/fall veg indicators) from the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0 to support a revised growing season. Kim said that the revised growing season must be extended on the back end accordingly and to use the revised growing season for all monitoring years. Wildlands agreed and developed a revised growing season after the site walk. See bullet viii) for the revised growing season dates.

iii) Casey asked how many additional gages were installed since baseline. Kristi replied two additional gages had been installed (3a and 11a).

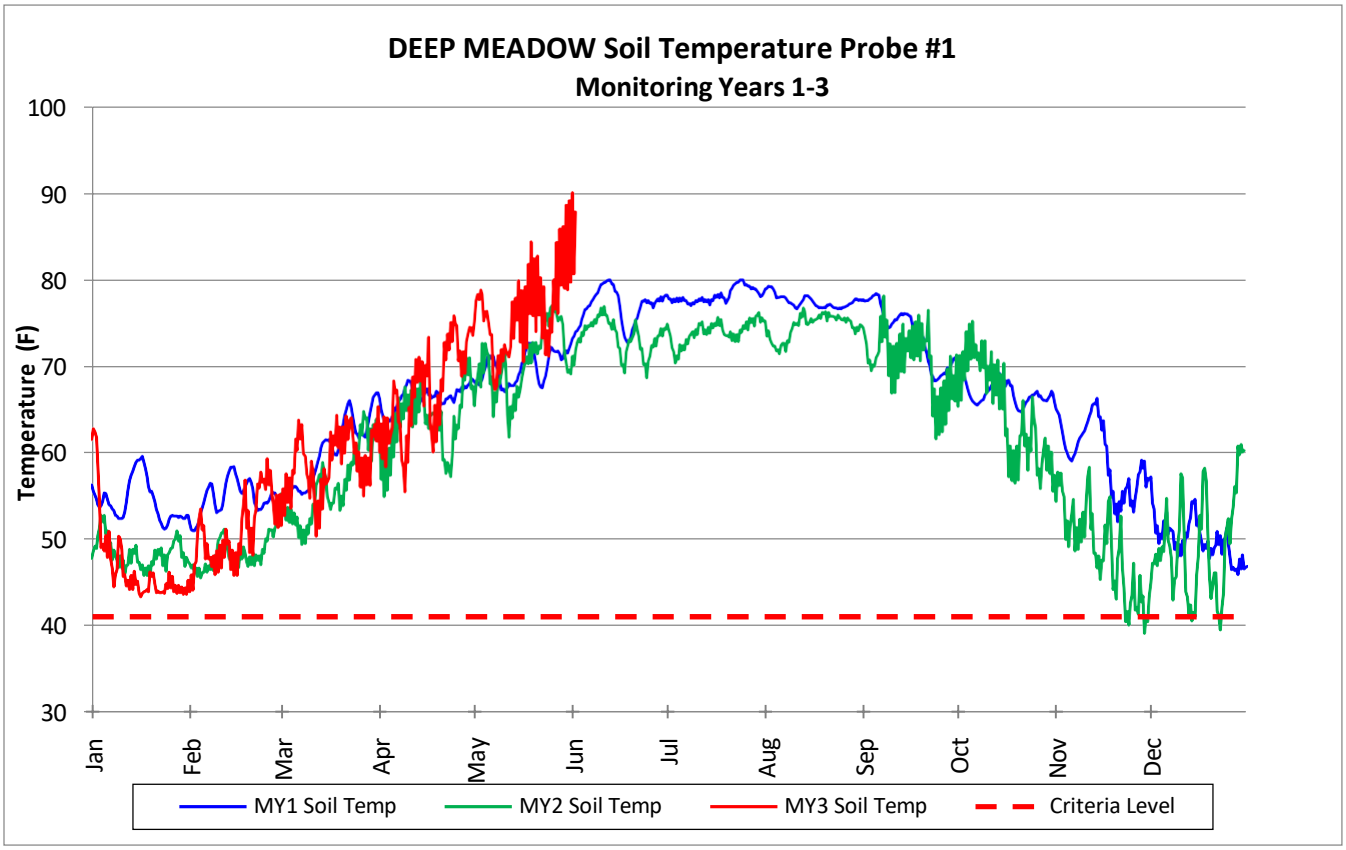
iv) Kim remarked that she expects the reference well to be drier due to mature tree water uptake and that it might not be the best source for on-site gages.

v) Kristi asked how the extended growing season would affect the monitoring report submittal schedule. Paul replied that DMS would work with Wildlands on deliverable schedule. Erin replied that data collected at the end of the growing season could be included on subsequent monitoring report.

vi) Kim suggested to not stop collecting gage data even if it meets criteria early in the growing season. Wildlands agreed.

vii) Kim suggested that additional gages be installed in areas not currently proposed for wetland credit along restoration reaches in case additional wetlands are needed to offset failing gages. Wildlands agreed and plans to further investigate the installation of additional gages during the winter between MY3 and MY4 within the study areas outlined on the attached map.

viii) Kim noted that an addendum is not required to establish a new growing season. She suggested that the new growing season, along with justifications, be included in the meeting minutes. Minutes should be included in MY3 report. MY3 should include original growing season data versus revised growing season data. Erin suggested adding a footnote to the to clarify why growing season was revised. Wildlands agreed with the suggestions and would like to propose a March 1st – November 28th as the growing season for the project. Soil temperature data supports this growing season with a range of 52.0 °F to 80.0 °F from Mar 1st – Nov 28th in MY1, a range of 40.1 °F to 78.1 °F from Mar 1st – Nov 28th in MY2, and a range from 50.4 °F to 89.1 °F from Mar 1st – Nov 28th in MY3. Additional documentation for the growing season revision will be collected in the field during the appropriate time of year. Wildlands will include this data in the subsequent monitoring reports.



	Beginning Date	Ending Date	Success Criteria Max Consecutive Days & Percentage of Growing Season
Current Growing Season	3/17/2022	11/12/2022	24 days, 10%
Revised Growing Season*	3/1/2022	11/28/2022	28 days, 10%

*Current growing season was revised because the ground water wells were failing to meet the success criteria outlined in the WETS Table for the Monroe 2 SE, NC Station, and the soil temperature data and seasonal indicators support an extended growing season.

b) Kristi asked Paul how the missing monument should be re-installed. Paul responded that monuments must be surveyed and set by a PLS.

c) Sam gave a summary on maintenance issues:

i) Additional PVC markers have been installed to help curb scalping by the farmer.

ii) Previous Johnson grass treatments, coupled with shade from taller trees, have almost eradicated the invasive.

iii) Wildlands has and will continue to treat parrot feather in the wetlands.

2) **Items of Discussion During Walk**

a) Casey asked if the in-stream vegetation treated was parrot feather. Sam replied that it was creeping water primrose that was successfully eradicated.

b) Kim noted that FAC species could be added to the failing veg plots in wetlands. Wildlands agreed to evaluate adding FAC species.

c) Kim asked about removal of beaver dams. Sam replied that they have been removed in the past and that it will be an ongoing effort.

d) Kim remarked about the large amount of box elder species and clarified that over 50% of a single species is considered monoculture. She suggested adding transects to help support vegetation success. Kim asked without volunteer box elder species, do veg plots meet criteria? Kristi looked at the data after the site meeting and confirmed that in MY2 no box elder (*Acer negundo*) volunteers were used to meet success criteria for any of the permanent or mobile vegetation plots. However, volunteers of box elder for VP3, VP5, VP9, and VP10 were recorded as greater than 50% of the overall stem density. The total MY2 density of box elder recorded was 77.8%. Wildlands will reassess the vegetative conditions during MY3 to see if natural selection and competition begin to suppress the proliferation of box elder within the site. If the trend of box elder establishment continues, Wildlands will work to thin out the species monoculture.

e) Kim asked how wetland areas were determined. Wildlands confirmed wetland areas were based on soil report data gathered during proposal stage.

f) At GWG4, Kim noted the significant reduction in consecutive growing days between MY1 and MY2. John agreed that the decrease was surprising. Kim and Casey suggested that soil profiles be included with groundwater gage data in MY4 and MY6 reports. Wildlands agreed.

g) At wetland W-E2, Kim suggested that Wildlands look at consecutive versus cumulative gage data. She noted that the Corps is considering including cumulative criteria in future guidance. Using the revised growing season dates, Wildlands compared the number of consecutive versus cumulative days for MY2 in the table below. We will include a discussion of cumulative data in subsequent monitoring reports.

GROWING SEASON: 3/1 – 11/20

- MY2 Results:
  - Consecutive = 5 out of 11 wells
  - Cumulative = 7 out of 11 wells

GAGE MEASUREMENTS MY2

	Most Consecutive Days Meeting Criteria	*Percent Consecutive Days in Growing Season*	*Total Days Meeting Criteria*	*Percent Cumulative Days in Growing Season*	*Number of Instances Meeting Criteria*
Reference Well	**48**	**17.5%**	**49.0**	**17.8%**	**96**
Groundwater Gage #1	**53**	**19.3%**	**54.0**	**19.6%**	**106**
Groundwater Gage #2	**20**	**7.3%**	**31.0**	**11.3%**	**62**
Groundwater Gage #3	**17**	**6.2%**	**26.0**	**9.5%**	**51**
Groundwater Gage #4	**34**	**12.4%**	**34.0**	**12.4%**	**66**
Groundwater Gage #5	**64**	**23.3%**	**106.0**	**38.5%**	**211**
Groundwater Gage #6	**34**	**12.4%**	**34.0**	**12.4%**	**67**
Groundwater Gage #7	**21**	**7.6%**	**35.0**	**12.7%**	**69**
Groundwater Gage #8	**34**	**12.4%**	**34.0**	**12.4%**	**66**
Groundwater Gage #9	**5**	**1.8%**	**9.0**	**3.3%**	**18**
Groundwater Gage #10	**8**	**2.9%**	**21.0**	**7.6%**	**42**
Groundwater Gage #11	**17**	**6.2%**	**26.0**	**9.5%**	**52**

h) At stream EF-1, attendees gathered at monitoring cross section XS4.

i) Kim asked if the restored channel was intermittent or perennial and if the number of dry days changed post-project. Kristi responded that it still scores perennial and the dry periods had not changed compared to pre-project conditions. The continuous flow gage data, which is located on XS3, shows continuous flow in MY1 within the recorded dates of 1/1/20 – 1/12/20. In MY2, the gage shows continuous flow within the recorded dates of 1/1/21 – 11/8/21. In MY3, the gage shows continuous flow within the recorded dates of 1/1/22- 5/2/22.

ii) Kim asked it Wildlands has pre-project photos that showed if the channel was flowing or dry. Aaron checked after the site meeting and found pre-construction photos of EF-1 from 2016 as shown in attached photo log.

iii) Casey asked about the risk of wood structures (log sill and brush toe) rotting due to dry channel. Aaron responded that there is a risk but implementing habitat into the restored channel was a goal of the mitigation plan.

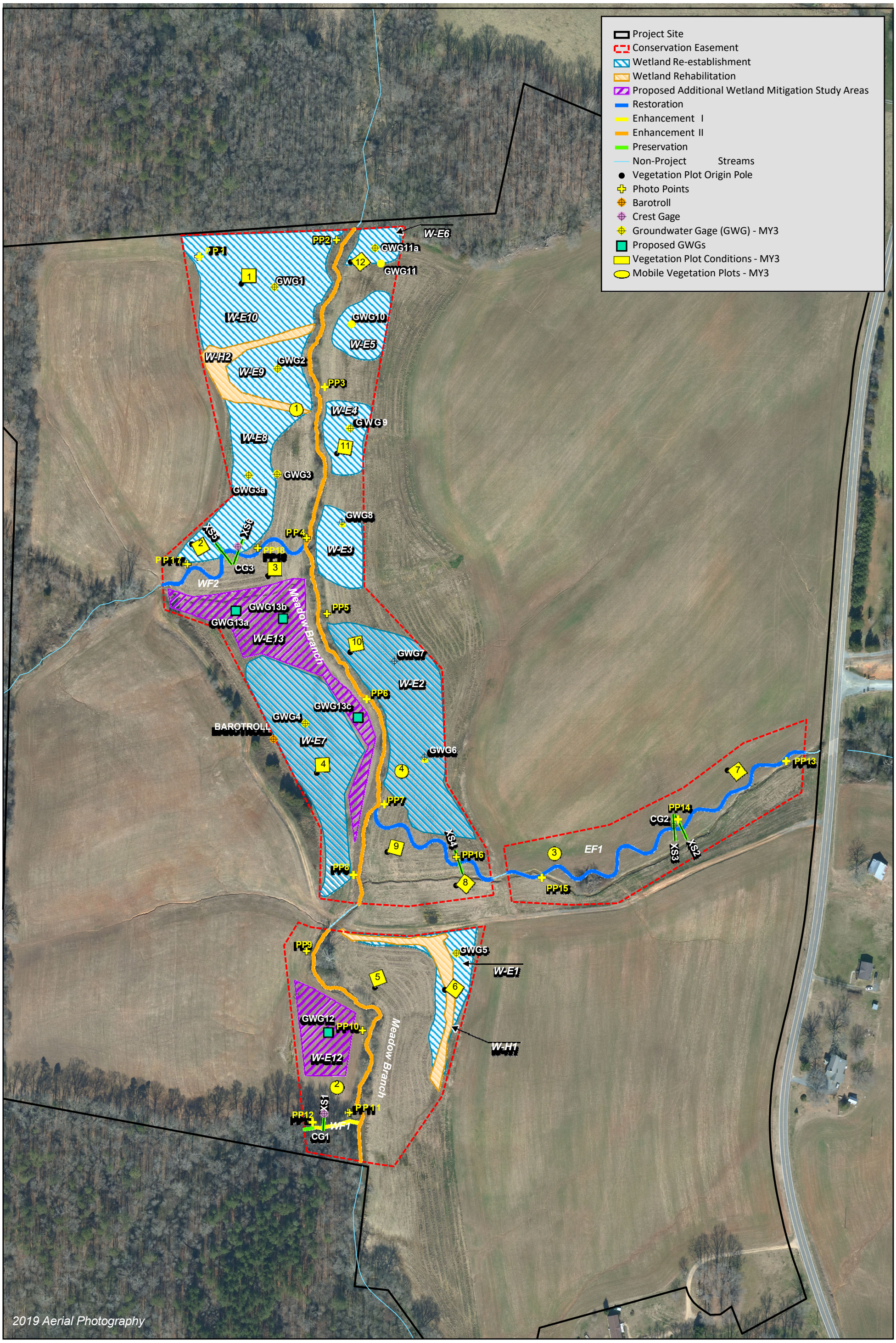
iv) Kim asked why veg plot 7 on EF-1 did not meet criteria since it is not in a wetland like the other failing veg plots. Likely due to a couple of reasons, the location of the plot is drier than conditions required for some of the planted species (FACW & OBL) and competition with herbaceous vegetation.

3) **Closing Remarks**

a) Kim reiterated that a revised growing season must be backed up with data such as on-site soil temp, bud burst, emergence of herbaceous plants, and other indicators listed in the guidance. See our response outlined table in Section 1a bullet #8.

b) Kim said that the IRT agrees with releasing MY2 (2021) stream and wetland credits. She said that if the groundwater gage data is bad again next year, a conversation about credits will be needed.

These meeting minutes were prepared by Aaron Earley and reviewed by John Hutton and Kristi Suggs on June 7, 2022 and represent the authors' interpretation of events. Please report and discrepancies or corrections within 5 business days of receipt of these minutes.



WILDLANDS ENGINEERING

Proposed Wetland Mitigation Study Area
Deep Meadow Mitigation Site
DMS Project No. 97131
Monitoring Year 3 - 2022

Union County, NC

EF1 Historic Photo Log

2016.06.17 (1).JPG

Sara Thompson

From: Isenhour, Kimberly T CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Wednesday, November 2, 2022 3:26 PM
To: Kristi Suggs
Cc: Aaron Earley; Sara Thompson
Subject: RE: Deep Meadow's revised growing season discrepancy

Hey Kristi
I have documentation where Erin and I both approved the extended growing season based on soil temperatures and vegetative indicators. You should stick to the 3/1-11/28 dates for the remainder of monitoring.
Thanks
Kim

Kim Isenhour
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers l 919.946.5107

-----Original Message-----
From: Kristi Suggs <ksuggs@wildlandseng.com>
Sent: Wednesday, November 02, 2022 11:33 AM
To: Isenhour, Kimberly T CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Cc: Aaron Earley <aearley@wildlandseng.com>; Sara Thompson <sthompson@wildlandseng.com>
Subject: [URL Verdict: Neutral][Non-DoD Source] Deep Meadow's revised growing season discrepancy

Hi Kim!

I was looking at the 2016 Stream and Wetland Compensatory Mitigation Update recently and noticed a possible issue with the revised growing season for Deep Meadow (3/1 - 11/28). The guidance states the following when using an alternative growing season to the period identified on the WETS tables, "In general, growing seasons that start earlier than March 1st or end later than November 20th may not be approved, depending on project location". So, I am wanting to confirm that since the IRT has approved the extension of the growing season to November 28th, we are able to use the end date of Nov 28th moving forward. If you need any more information from me, please let me know. Thank you!

Kristi

Kristi Suggs | Senior Environmental Scientist

O: 704.332.7754 x110 M: 704.579.4828

Wildlands Engineering, Inc. <Blockedhttp://www.wildlandseng.com/>