MONITORING YEAR 1 ANNUAL REPORT

Final

January 2024

COOL SPRINGS MITIGATION SITE

Harnett County, NC
Cape Fear River Basin
HUC 03030004

DMS Project No. 100166
NCDEQ Contract No. 0302-02
DMS RFP No. 16-20190302/Issued: December 20, 2019
USACE Action ID No. SAW-2020-01400
DWR Project No. 2020-1279

Data Collection Dates: January 2023 – November 2023

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COOL SPRINGS MITIGATION SITE

Monitoring Year 1 Annual Report

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Section 1: PROJECT OVERVIEW

The Cool Springs Mitigation Site (Site) is located in western Harnett County, approximately 9.5 miles northwest of the City of Lillington and approximately 4.7 miles east of the Town of Broadway. Table 3 presents information related to the project attributes.

1.1 Project Quantities and Credits

The Site is located on a single parcel and a conservation easement was recorded on 21.12 acres. Table 1 below shows stream credits by reach and the total amount of stream credits expected at closeout.

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**
STREAMS							
UT to Cedar Creek Reach 1	1,808	1,799	Warm	EII	2.5	723.200	Fenced Out Livestock, Minor Bank Grading
	64	61	Warm	EII	N/A	0.000	Internal Culvert Crossing
	489	491	Warm	EII	2.5	195.600	Fenced Out Livestock, Minor Bank Grading
UT to Cedar Creek Reach 2	354	359	Warm	R	1.0	354.00	Full Channel Restoration, Fenced Out Livestock
T1	418	425	Warm	EII	2.5	167.200	Fenced Out Livestock, Minor Bank Grading
T2	466	465	Warm	R	1.0	466.000	Full Channel Restoration, Fenced Out Livestock
T3 Reach 1	43	42	Warm	EII	N/A	0.000	Internal Culvert Crossing
	379	379	Warm	EII	2.5	151.600	Fenced Out Livestock, Minor Bank Grading
T3 Reach 2	366	371	Warm	R	1.0	366.000	Full Channel Restoration, Fenced Out Livestock
T3 Reach 3	295	300	Warm	EII	2.5	118.000	Fenced Out Livestock, Minor Bank Grading
T4 Reach 1	101	102	Warm	R	1.0	101.000	Full Channel Restoration, Fenced Out Livestock
T4 Reach 2	62	64	Warm	R	N/A	0.000	Internal Culvert Crossing
	787	790	Warm	R	1.0	787.000	Full Channel Restoration, Fenced Out Livestock
T5	134	134	Warm	R	1.0	134.000	Full Channel Restoration, Fenced Out Livestock
T6	499	502	Warm	R	1.0	499.000	Full Channel Restoration, Fenced Out Livestock
T7	156	155	Warm	EI	1.5	104.000	Bank Protection and Grade Control Structures Installed
T8	697	707	Warm	R	1.0	697.000	Full Channel Restoration, Fenced Out Livestock
					Total:	**4,863.600**	

WETLANDS							
Wetland A	0.066	0.066	Riverine	E	2.0	0.033	Planting, Cattle Exclusion
Wetland B	0.064	0.064	Riverine	E	2.0	0.032	Planting, Cattle Exclusion
Wetland C	0.160	0.160	Riverine	RH	1.5	0.107	Planting, Cattle Exclusion
Wetland D	0.088	0.088	Riverine	E	2.0	0.044	Planting, Cattle Exclusion
Wetland E	0.162	0.162	Riverine	E	2.0	0.081	Planting, Cattle Exclusion
Wetland F	0.265	0.265	Riverine	RH	1.5	0.177	Planting, Cattle Exclusion
Wetland G	0.138	0.138	Riverine	RH	1.5	0.092	Planting, Cattle Exclusion
Wetland H	0.139	0.139	Riverine	E	2.0	0.070	Cattle Exclusion
Wetland I	0.024	0.024	Riverine	E	2.0	0.012	Cattle Exclusion
Wetland J	0.028	0.028	Riverine	E	2.0	0.014	Cattle Exclusion
Wetland 1	0.087	0.087	Riverine	R	1.0	0.087	Planting, Cattle Exclusion
Wetland 2	0.090	0.090	Riverine	R	1.0	0.090	Planting, Cattle Exclusion
Wetland 3	0.227	0.227	Riverine	R	1.0	0.227	Planting, Cattle Exclusion
Wetland 4	0.262	0.262	Riverine	R	1.0	0.262	Planting, Cattle Exclusion
					Total:	**1.328**	

Blue = **Restoration**	Yellow = **Enhancement I**	Orange = **Enhancement II**

Restoration Level	**Stream**	**Riparian Wetland**
	Warm	**Riverine**
Restoration	3,404.000	
Enhancement I	104.000	
Enhancement II	1,355.600	
Re-Establishment		0.666
Rehabilitation		0.376
Enhancement		0.286
Total Stream Credit	**4,863.600**	
Total Wetland Credit		**1.328**

1.2 Project Goals and Objectives

The project is intended to provide numerous ecological benefits. 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 the stability of stream channels.	Construct stream channels that will maintain a stable pattern and profile considering hydrologic and sediment inputs to the system; install bank revetments and grade control; install bank vegetation.	Reduce erosion and sediment inputs; maintain appropriate bed forms and sediment size distribution.	ER stays over 2.2 and BHR below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring and visual inspections.	There are minor deviations from design. Small, isolated areas of scouring on T2 and T8 will be repaired.
Exclude livestock from stream channels.	Install livestock fencing or relocate livestock as needed to exclude livestock from stream channels, riparian areas, proposed wetland areas and/or remove livestock from adjacent fields.	Reduce sediment and nutrients from agriculture/bank erosion. Eliminate livestock waste in streams and trampling of stream substrate.	Fence conservation easement to exclude livestock. Install fenced and gated culvert crossings as needed.	Visually inspect the Site to ensure no cattle encroachment is occurring.	Cattle are excluded from project streams.
Improve water quality.	Stabilize stream banks. Plant riparian buffers with native trees. Construct BMPs to treat pasture runoff. Fence out livestock.	Reduce sediment and nutrient inputs from stream banks; reduce sediment, nutrient, and bacteria inputs from pasture runoff; keep livestock out of streams, further reducing pollutants in project streams.	There is no required performance standard for this metric.	N/A	N/A
Improve wetland hydrology.	Remove livestock to allow soil profiles to stabilize. Raise elevation of streambed and realign stream channels closer to wetlands. Plant native trees and herbaceous plants suitable for saturated conditions.	Increased surface water residence time will provide contact treatment and groundwater recharge potential.	Free groundwater surface within 12 inches of the soil surface for each representative wetland's associated hydroperiod under normal precipitation conditions.	Seven groundwater gauges equipped with pressure transducers are located in representative wetland areas and monitored annually.	During MY1, four out of the seven groundwater gauges attained success criterion for each representative wetland's associated hydroperiod.

Goal	Objective/ Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve stream, wetland, and riparian habitat.	Install habitat features such as constructed steps, cover logs, and brush toes on restored reaches. Add woody materials/ LWD to channel beds. Construct pools of varying depth. Restore and enhance forested riparian wetland habitat.	Support biological communities and processes. Provide aquatic habitats for diverse populations of aquatic and riparian organisms.	There is no required performance standard for this metric.	N/A	N/A
Reconnect channels with floodplains and riparian wetlands.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce shear stress on channel; hydrate adjacent wetland areas; filter pollutants out of overbank flows; provide surface storage of water on floodplain; increase groundwater recharge while reducing outflow of stormwater.	Four bankfull events in separate years within monitoring period. 30 consecutive days of flow for intermittent channels.	Crest gauges and/or pressure transducers recording flow elevations.	Multiple bankfull events have been documented on UT to Cedar Creek and T4. Greater than 30 consecutive days of flow recorded on T2, T3, T5, T6, and T8 during MY1.
Restore/ improve riparian buffers.	Plant native tree species in riparian zone where currently insufficient.	Provide a canopy to shade streams and reduce thermal loadings; stabilize stream banks and floodplain.	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre and average height of 7ft at MY5, and 210 stems per acre and average height of 10ft at MY7.	One hundred square meter vegetation plots are placed on 2% of the planted area of the Site and monitored annually.	All twelve vegetation plots have a planted stem density greater than 320 stems per acre.
Permanently protect the project Site from harmful uses.	Establish conservation easements on the Site.	Ensure that development and agricultural uses that would damage the Site or reduce the benefits of the project are prevented.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.	The entirety of the Site boundaries were visually inspected during MY1. Chicken litter was found dumped in the easement near BMP 2 during August 2023. No pasture fires have been observed since April 2023.

1.3 Project Attributes

The Site was an active cattle and chicken farm with wooded buffers along some of the project streams. Review of aerial photos indicates the landcover in the project watersheds was very consistent between 1950 and 1998. Most of the area was wooded during this period except for the southeastern portion of the UT to Cedar Creek watershed, which was cleared prior to 1950 and appears to have been used for grazing livestock. A small pond was constructed at the headwaters of UT to Cedar Creek at some point in the 1960's. Most of the landcover changes that have occurred on the Site were between 1998 and 2006, including clearing of the pastures and construction of the chicken houses. Table 3 below and Table 8 in Appendix C present additional information on pre-restoration conditions.

Table 3: Project Attributes

PROJECT INFORMATION					
Project Name	Cool Springs Mitigation Site		County	Harnett County	
Project Area (acres)	21.12		Project Coordinates	35°26'50.17"N 78°58'5.78"W	
PROJECT WATERSHED SUMMARY INFORMATION					
Physiographic Province	Piedmont and Coastal Plain		River Basin	Cape Fear	
USGS HUC 8-digit	03030004		USGS HUC 14-digit	03030004010030	
DWR Sub-basin	03-06-07		Land Use Classification	43% agriculture, 25% forested, 15% herbaceous, 4% developed	
Project Drainage Area (ac)	255		Percentage of Impervious Area	<1%	
RESTORATION TRIBUTARY SUMMARY INFORMATION					
Parameters	**UT to Cedar Creek**	**T2**	**T3**	**T4**	
Pre-project length (feet)	2,797	473	1,096	1,091	
Post-project (feet)	2,649	465	1,050	892	
Valley confinement	Moderately Confined to Unconfined	Confined	Moderately Confined to Confined	Unconfined to Moderately Confined	
Drainage area (acres)	255	6	20	33	
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Intermittent/Perennial		
DWR Water Quality Classification	WS-IV				
Dominant Stream Classification (existing)	B4c	A4	A4	F4b	
Dominant Stream Classification (proposed)	C4/B4c	A4/B4a	B4/B4a	B4/B4a	
Dominant Evolutionary class	III/IV	IV	I/IV/III	I/III	
Historic Preservation Act	Yes	Yes			

RESTORATION TRIBUTARY SUMMARY INFORMATION				
Parameters	**T5**	**T6**	**T7**	**T8**
Pre-project length (feet)	142	499	124	722
Post-project (feet)	134	502	155	707
Valley confinement	Moderately Confined	Unconfined	Moderately Confined	
Drainage area (acres)	5	9	76	10
Perennial, Intermittent, Ephemeral	Intermittent	Perennial		
DWR Water Quality Classification	WS-IV			
Dominant Stream Classification (existing)	N/A	A4	B4	A4/B4a
Dominant Stream Classification (proposed)	N/A	A4/B4a	B4/C4b	A4/B4a
Dominant Evolutionary class	I	IV	III	IV

REGULATORY CONSIDERATIONS			
Parameters	**Applicable?**	**Resolved?**	**Supporting Documentation**
Water of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No. 27 and DWQ 401 Water Quality Certification No. 4134.
Water of the United States - Section 401	Yes	Yes	
Endangered Species Act	Yes	Yes	Categorical Exclusion in Mitigation Plan (Wildlands, 2022)
Historic Preservation Act	Yes	Yes	

Section 2: MONITORING YEAR 1 DATA ASSESSMENT

Annual monitoring and Site visits were conducted during MY1 to assess the condition of the project. The vegetation and stream success criteria for the Site follow the approved success criteria presented in the Mitigation Plan (Wildlands, 2022). Performance criteria for vegetation, stream, and hydrologic assessment are located in Section 1.2 Table 2: Goals, Performance Criteria, and Functional Improvements. Methodology for annual monitoring is presented in the MY0 Annual Report (Wildlands, 2023).

2.1 Vegetative Assessment

A total of twelve standard 10-meter by 10-meter vegetation plots were established during baseline monitoring. Two of the twelve vegetation plots will be relocated randomly on an annual basis to monitor vegetation health across the Site.

The MY1 vegetative survey was completed in August 2023. Vegetation monitoring resulted in a stem density range of 324 to 688 planted stems per acre. All twelve vegetation plots exceed the interim requirement of 320 planted stems per acre required at MY3. In response to IRT comments on the Cool Springs Mitigation Plan, Wildlands stated that random vegetation plots will be moved each year to represent different portions of the Site and will include portions of the Wetland Enhancement areas in order to complete sufficient monitoring of all credit areas during the seven-year monitoring period. Random vegetation plot 12 collected within a Wetland Enhancement area has a stem density of 526 stems per acre (see Figure 1b). Herbaceous vegetation is also abundant across the Site and includes native pollinator species, indicating a healthy riparian habitat. The riparian habitat is helping to reduce nutrient runoff from cattle outside the easement and stabilizing the stream banks. Refer to Appendix A for Vegetation Plot Photographs and the Vegetation Condition Assessment Table and Appendix B for Vegetation Plot Data.

There were a significant number of mature hardwood trees that were left untouched from construction along UT to Cedar Creek. Planted trees and volunteer species are growing throughout the Site and starting to fill in an understory that will eventually become a mature hardwood forest.

2.2 Vegetation Areas of Concern and Management

As noted in the Cool Springs MY0 Report, evidence of a fire was observed on April 14, 2023 throughout pastureland directly adjacent to the conservation easement. The fire is the result of a landowner pasture management practice and is unrelated to Wildlands. The prescribed burn encroached into portions of T2, BMP 3, 4, and 5, affecting approximately one acre of the conservation easement in total. Herbaceous cover has sufficiently returned on all burned areas. Vegetation plot 3 was completely burned during the MY0 encroachment but has retained a stem density of 324 stems per acre in MY1, exceeding the criteria of 320 stems per acre at MY3 (see Appendix B, Table 6). Additionally, random vegetation plot 11 data collected within a burned area along T2 (see Figure 1a) reveals a stem density of 405 stems per acre in MY1, exceeding the criteria of 320 stems per acre at MY3. Refer to Appendix A for Easement Encroachment Photographs.

In response to the fire encroachment in MY0, Bermuda grass (*Cynodon dactylon*) has been observed growing prolifically during MY1 along T2 and BMP 3. Foliar spray treatments for smartweed (*Polygonum* sp.) and Bermuda grass were applied in affected areas along T2 and BMP 3 (see Figure 1a). Soil amendments were applied in a localized manner around the base of trees throughout the Site in the spring of 2023. Broadcast seeding was applied in bare areas throughout the Site, and around trees in burned areas where there is heavy Bermuda grass growth. All project streams received foliar spraying for in-stream vegetation, and pockets of *Murdannia keisak* were treated in streams and in wetlands

throughout the Site. Where wetlands were treated for *Mudrannia*, A cover-crop mix of Virginia wildrye (*Elymus virginicus*) and a wetland species mixture consisting of *Panicum rigidulum, Bidens aristosa, Helianthus angustifolius, Carex albolutescens, Juncus effusus, Carex lupulina, Rhexia mariana,* and *Carex vulpinoidea* was applied in an attempt to reduce future *Murdannia* occurrences. Soil amendments and removal of invasive species will continue to be implemented as necessary across the Site, and the need for supplemental planting will be assessed during MY2.

A chicken manure pile spanning approximately 560 square feet was found in the conservation easement near BMP 2 during an August, 2023 Site visit (see Figure 1a and Appendix A). Because the pile doesn't cover more than a couple of planted stems, the pile will not be removed. However, it has been seeded to assist in stabilization. The landowner has been notified, and the easement will continue to be monitored for future manure dumping.

2.3 Stream Assessment

Morphological surveys for MY1 were conducted in July 2023. All eight cross-sections at the Site show little to no change in the bankfull area and width-to-depth ratio, and bank height ratios are less than 1.2. Pebble count data is no longer required per the September 29, 2021 Technical Work Group Meeting and is not included in this report. The IRT reserves the right to request pebble count data/particle distributions if deemed necessary during the monitoring period. Refer to Appendix A for the Visual Stream Morphology Stability Assessment Table and Stream Photographs and Appendix C for Stream Geomorphology Data.

2.4 Stream Areas of Concern

Within the not-for-credit portion of UT to Cedar Creek, located at the lower end of the project stream outside of the easement, localized bank erosion is occurring (see Figure 1b). Boulder toe within this portion of the stream bank dislodged, resulting in bank erosion. Overtime, erosion has spread and worsened, resulting in a partially fallen, mature tree just downstream of the dislodged boulder toe (refer to Appendix A for Stream Area of Concern Photographs). The affected area is approximately 70 linear feet in length. The affected area will continue to be observed, and, if erosion continues to worsen, mechanical repairs may take place in subsequent monitoring years.

Within the bottom half of T2 adjacent to photo point 8, water is piping around a series of structures consisting of a rock sill and two log sills, resulting in scouring of the left bank and dislodging of associated brush toe (refer to Appendix A for Stream Area of Concern Photographs). The affected area is approximately 24 linear feet in length (see Figure 1a). Hand repairs are planned to take place during MY2 and mechanical repairs will then be utilized if necessary.

Water is piping around a log sill on T8 adjacent to photo point 20, resulting in scouring of the left bank totaling approximately one foot (see Figure 1b and refer to Appendix A-Stream Area of Concern Photographs). Hand repairs have been performed during MY1 and will be implemented in subsequent monitoring years as necessary. If hand-repairs are unsuccessful, mechanical repairs will be utilized.

2.5 Hydrology Assessment

UT to Cedar Creek Reach 2 exhibited two bankfull events and T4 Reach 2 exhibited three bankfull events in MY1 as of November 10, 2023, and are on track to meet performance standards of four bankfull events in separate years during the seven-year monitoring period (see Appendix D, table 10). Additional seasons of observation are required to better understand hydrology at the Site and thoroughly evaluate the success of project reaches.

In addition, the presence of baseflow must be documented on intermittent reaches (T2, T3, T5, T6, and T8) for a minimum of 30 consecutive days during a normal precipitation year. Gauges on T2, T3, T5, T6, and T8 all exceed criteria (see Table 12, Summary of Recorded In-Stream Flow Events and refer to Appendix D for Recorded In-Stream Flow Event Plots).

2.6 Wetland Assessment

The performance criterion for groundwater gauge (GW) 3 is a free groundwater surface within 12 inches of the soil surface for 8% of the growing season (20 days). The performance criterion for GWs 2 and 7 is a free groundwater surface within 12 inches of the soil surface for 10% of the growing season (25 days). The performance criterion for GWs 1, 4, 5, and 6 is a free groundwater surface within 12 inches of the soil surface for 12% of the growing season (30 days).

The growing season on Site began on or before March 1 according to bud burst observations and soil temperature probe data. Bud burst of bald cypress (*Taxodium distichum*) was observed at a Wildlands Engineering project approximately two miles east of the Site on February, 23, 2023. Black willow (*Salix nigra*) was seen leafing out on the same neighboring project on February 23, 2023, as well. Additionally, soil temperature data collected on-site shows soil temperatures above 41 degrees consistently after January 30, 2023 (refer to Appendix D). Leaf senescence data and supporting data from AgACIS was utilized to determine the end of the MY1 growing season. Though leaf senescence is primarily controlled by photoperiod, modified by environmental factors, varies with species, and occurs over a period of several weeks, the senescence process begins prior to visible color change. However, because color change is readily observable and requires no laboratory procedures or specialized equipment (Gill et al. 2015, Mariën et al. 2019), Wildlands implemented the approach of assuming leaf senescence is occurring on the Site based on observations of site-scale leaf color change of greater than 50%. On November 10th, 2023, on-site observation indicated approximately 100% of deciduous woody vegetation leaves appeared to have changed color completely, with several hardwood trees beginning to drop leaves. Based on growing season data acquired from AgACIS station Sanford 8 NE, along with leaf senescence data collected in Fall 2023, Wildlands proposes the end of the growing season be November 8th, putting the growing season dates as 3/1 to 11/8 (252 days).

Four of the seven GWs at the Site attained the success criterion for MY1 (see Table 13). GWs 1, 2, and 5 within wetland rehabilitation zones exceeded the hydroperiod criterion. GW 7 within a wetland re-establishment zone exceeded criterion, as well. GWs 3, 4, and 6 have not yet met hydroperiod criterion for wetland re-establishment zones in MY1. After construction of the stream channel, it is anticipated that the groundwater table will take some time to recharge. Additional seasons of water table observation are required to better understand hydrology at the Site and thoroughly evaluate the success of wetland re-establishment areas. Refer to Appendix D for hydrologic data.

2.7 Monitoring Year 1 Summary

All twelve vegetation plots exceed the MY3 interim requirement of 320 planted stems per acre. Most streams within the Site are stable. Two bankfull events were documented on UT to Cedar Creek, and three bankfull events were documented on T4. Greater than 30 consecutive days of stream flow have been recorded on T2, T3, T5, T6, and T8, fulfilling MY1 success requirements. Four out of the seven groundwater wells meet success criteria for MY1. The entirety of the easement boundary was observed during MY1. Damaged conservation easement signs have been replaced as necessary. Fencing and stream crossings are in good condition throughout the Site. A chicken manure pile was found dumped in the easement along a southeastern boundary edge. The landowner has been contacted, and the encroachment has ceased. Overall, the Site is on track to meet final success criteria.

Summary information and data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

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.

Gill, A.L., Gallinat, A.S., Sanders-DeMott, R., Rigden, A.J., Short Gianotti, D.J., Mantooth, J.A., and Templer, P.H. 2015. Changes in autumn senescence in northern hemisphere deciduous trees: a meta-analysis of autumn phenology studies. *Annals of Botany, 132*(2), 1-14.

Harrelson, C.C., Rawlins, C.L., Potyondy, J.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.

Mariën, B., Balzarolo, M., Dox, I., Leys, S., Lorene, M.J., Geron, C., Portillo-Estrada, M., AbdElgawad, H., Asard, H., and Campioli, M. 2019. Detecting the onset of autumn leaf senescence in deciduous forest trees of the temperate zone. *New Phytologist 224*(1), 166-176.

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

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

Rosgen, D.L. 1997. A Geomorphological Approach to Restoration of Incised Rivers. Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision. Center For Computational Hydroscience and Bioengineering, Oxford Campus, University of Mississippi, Pages 12-22.

United States Army Corps of Engineers. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

United States Geological Survey. 1998. North Carolina Geology.

Wildlands Engineering, Inc. 2022. Cool Springs Mitigation Site Mitigation Plan. DMS, Raleigh, NC.

Wildlands Engineering, Inc. 2023. Cool Springs Mitigation Site Monitoring Year 0 (MY0) Annual Report. DMS, Raleigh, NC

Figure 1b

T8

Reach 2

UT to Cedar Creek

T7

T6

Reach 1

T4

Reach 1

Reach 2

BMP 5

T4

Reach 3

T3

T5

T2

BMP 4

T3

Reach 2

Reach 1

UT to Cedar Creek

BMP 3

T1

BMP 2

BMP 1

Figure 1a

Conservation Easement
Internal Crossing

Hydroperiod
Wetland Re-establishment 12%
Wetland Re-establishment 10%
Wetland Re-establishment 8%
Wetland Rehabilitation 12%
Wetland Rehabilitation 10%
Wetland Rehabilitation 8%
Wetland Enhancement
Wetland Not for Credit

Vegetation Plot Condition - MY1
Criterion Met - Fixed
Criterion Met - Random
Stream Restoration
Stream Enhancement I
Stream Enhancement II
Not for Credit
BMP
Non-Project Streams
Fence
Cross-Section

Groundwater Gauge - MY1
Criterion Met
Criterion Not Met
Flow Gauge
Crest Gauge
Soil Temperature Probe
Barotroll
Photo Point
Gate
Reach Break

2019 Aerial Photography

WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 1. Current Condition Plan View Key
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Harnett County, NC

Project Location
Conservation Easement
Internal Crossing

Hydroperiod

Wetland Re-establishment 10%
Wetland Re-establishment 8%
Wetland Rehabilitation 12%
Wetland Rehabilitation 10%
Wetland Rehabilitation 8%
Wetland Enhancement

Vegetation Plot Condition - MY1

Criterion Met - Fixed
Criterion Met - Random
Treated Coastal Bermudagrass - MY1
Pasture Fire Encroachment - MY0
Stream Restoration
Stream Enhancement II
Not for Credit
BMP
Non-Project Streams
As-Built Top of Bank
Structure
Fence
Cross-Section
Chicken Manure Encroachment - MY1
Bank Erosion
Eroding Log Sill
Eroding Rock Sill

Groundwater Gauge - MY1

Criterion Met
Criterion Not Met
Flow Gauge
Soil Temperature Probe
Photo Point
Gate
Reach Break

2019 Aerial Photography

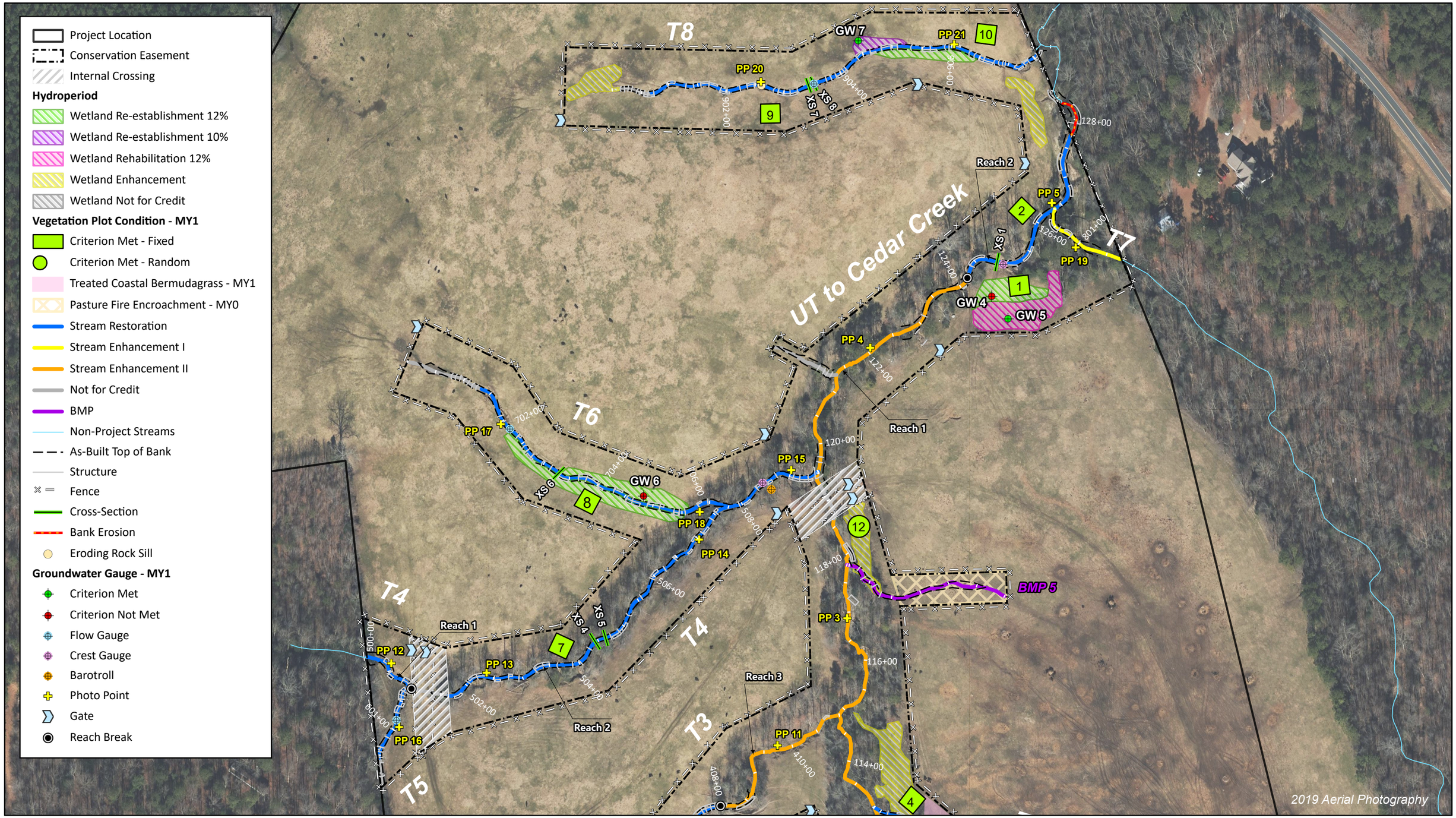
Reach 1
Reach 2
Reach 3
PP 12
PP 13
PP 16
PP 11
PP 3
PP 10
PP 8
PP 7
PP 2
PP 9
PP 6
PP 1
GW 3
GW 2
GW 1
STP
XS 5
XS 4
XS 3
XS 2
T5
T4
T3
T2
T1
BMP 4
BMP 3
BMP 2
BMP 1
UT to Cedar Creek
500+00
502+00
504+00
506+00
408+00
410+00
116+00
114+00
304+00
302+00
112+00
110+00
108+00
106+00
104+00
204+00
102+00
202+00
404+00
402+00
801+00

0 150 300 Feet

WILDLANDS ENGINEERING

Figure 1a. Current Condition Plan View
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Harnett County, NC



WILDLANDS ENGINEERING

0 150 300 Feet

N

Figure 1b. Current Condition Plan View
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Harnett County, NC

APPENDIX A. VISUAL ASSESSMENT DATA

Table 4. Visual Stream Morphology Stability Assessment Table

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

UT to Cedar Creek Reaches 1-2

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	2,649
					Assessed Bank Length	5,298
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	9	9		100%

Visual assessment was completed November 10, 2023.

T1

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	425
					Assessed Bank Length	850
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	3	3		100%

Visual assessment was completed November 10, 2023.

Table 4. Visual Stream Morphology Stability Assessment Table

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

T2

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	465
					Assessed Bank Length	930
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	27	30		90%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	14	15		93%

Visual assessment was completed November 10, 2023.

T3 Reaches 1-3

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	1,050
					Assessed Bank Length	2,100
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	33	33		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	13	13		100%

Visual assessment was completed November 10, 2023.

Table 4. Visual Stream Morphology Stability Assessment Table

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

T4 Reaches 1-2

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	892
					Assessed Bank Length	1,784
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
					Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	33	33		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	26	26		100%

Visual assessment was completed November 10, 2023.

T5

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
					Assessed Stream Length	134
					Assessed Bank Length	268
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
					Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	12	12		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	7	7		100%

Visual assessment was completed November 10, 2023.

Table 4. Visual Stream Morphology Stability Assessment Table

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

T6

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
				Assessed Stream Length		502
				Assessed Bank Length		1,004
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	23	23		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	11	11		100%

Visual assessment was completed November 10, 2023.

T7

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
				Assessed Stream Length		155
				Assessed Bank Length		310
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	3	3		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2		100%

Visual assessment was completed November 10, 2023.

Table 4. Visual Stream Morphology Stability Assessment Table

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

T8

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-Built	Amount of Unstable Footage	% Stable, Performing as Intended
				Assessed Stream Length		707
				Assessed Bank Length		1,414
Bank	**Surface Scour/ Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour.			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse.			0	100%
				Totals:	**0**	**100%**
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	47	47		98%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	16	16		100%

Visual assessment was completed November 10, 2023.

Table 5. Vegetation Condition Assessment Table
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Planted Acreage **13.80**

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10	0.00	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10	0.00	0%
		Total	**0.00**	**0%**
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10	0.00	0%
		Cumulative Total	**0.00**	**0%**

Visual assessment was completed November 10, 2023.

Easement Acreage **21.12**

Vegetation Category	Definitions	Mapping Threshold (ac)	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage. Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Invasive species included in summation above should be identified in report summary.	0.10	1.30	6%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	2 Encroachments Noted* / 1.01 ac	

Visual assessment was completed November 10, 2023.
*Chicken littler has been dumped into approximately 560 square feet of the conservation easement. A landowner-prescribed fire burned approximately 1 acre of the conservation easement during April, 2023.

STREAM PHOTOGRAPHS

Photo Point 1 UT to Cedar Creek R1 – upstream *(11/10/2023)*

Photo Point 1 UT to Cedar Creek R1 – downstream *(11/10/2023)*

Photo Point 2 UT to Cedar Creek R1 – upstream *(11/10/2023)*

Photo Point 2 UT to Cedar Creek R1 – downstream *(11/10/2023)*

Photo Point 3 UT to Cedar Creek R1 – upstream *(11/10/2023)*

Photo Point 3 UT to Cedar Creek R1 – downstream *(11/10/2023)*

Photo Point 4 UT to Cedar Creek R1 – upstream *(11/10/2023)*

Photo Point 4 UT to Cedar Creek R1 – downstream *(11/10/2023)*

Photo Point 5 UT to Cedar Creek R2 – upstream *(11/10/2023)*

Photo Point 5 UT to Cedar Creek R2 – downstream *(11/10/2023)*

Photo Point 6 T1 – upstream *(11/10/2023)*

Photo Point 6 T1 – downstream *(11/10/2023)*

Photo Point 7 T2 – upstream *(11/10/2023)*

Photo Point 7 T2 – downstream *(11/10/2023)*

Photo Point 8 T2 – upstream *(11/10/2023)*

Photo Point 8 T2 – downstream *(11/10/2023)*

Photo Point 9 T3 R1 – upstream *(11/10/2023)*

Photo Point 9 T3 R1 – downstream *(11/10/2023)*

Photo Point 10 T3 R2 – upstream *(11/10/2023)*

Photo Point 10 T3 R2 – downstream *(11/10/2023)*

Photo Point 11 T3 R3 – upstream *(11/10/2023)*

Photo Point 11 T3 R3 – downstream *(11/10/2023)*

Photo Point 12 T4 R1 – upstream *(11/10/2023)*

Photo Point 12 T4 R1 – downstream *(11/10/2023)*

Photo Point 13 T4 R2 – upstream *(11/10/2023)*

Photo Point 13 T4 R2 – downstream *(11/10/2023)*

Photo Point 14 T4 R2 – upstream *(11/10/2023)*

Photo Point 14 T4 R2 – downstream *(11/10/2023)*

Photo Point 15 T4 R2 – upstream *(11/10/2023)*

Photo Point 15 T4 R2 – downstream *(11/10/2023)*

Photo Point 16 T5 – upstream *(11/10/2023)*

Photo Point 16 T5 – downstream *(11/10/2023)*

Photo Point 17 T6 – upstream *(11/10/2023)*

Photo Point 17 T6 – downstream *(11/10/2023)*

Photo Point 18 T6 – upstream *(11/10/2023)*

Photo Point 18 T6 – downstream *(11/10/2023)*

Photo Point 19 T7 – upstream *(11/10/2023)*

Photo Point 19 T7 – downstream *(11/10/2023)*

Photo Point 20 T8 – upstream *(11/10/2023)*

Photo Point 20 T8 – downstream *(11/10/2023)*

Photo Point 21 T8 – upstream *(11/10/2023)*

Photo Point 21 T8 – downstream *(11/10/2023)*

STREAM AREA OF CONCERN PHOTOGRAPHS

	
UT to Cedar Creek STA 127+74-128+44: Before – Partially Fallen Tree on Right Bank Causing Bank Erosion *(4/7/2023)*	**UT to Cedar Creek STA 127+74-128+44: Before – Dislodged Boulder Toe on Right Bank Causing Bank Erosion *(11/10/2023)***
	
T2 STA 303+05-303+20: Before – Piping Log Sill Causing Dislodged Brush Toe and Scouring of the Left Bank *(4/7/2023)*	**T2 STA 303+05-303+20: Before – Piping Rock Sill Causing Dislodged Brush Toe and Scouring of the Left Bank *(4/7/2023)***

	
T2 STA 303+05-303+20: Before – Piping Log Sill Causing Dislodged Brush Toe and Scouring of the Left Bank *(4/7/2023)*	**T2 STA 303+05-303+20: Before – Piping Log Sill Causing Dislodged Brush Toe and Scouring of the Left Bank *(11/29/2023)***
	
T2 STA 303+05-303+20: Before – Piping Rock Sill Causing Dislodged Brush Toe and Scouring of the Left Bank *(11/29/2023)*	**T2 STA 303+05-303+20: Before – Piping Log Sill Causing Dislodged Brush Toe and Scouring of the Left Bank *(11/29/2023)***

	
T8 STA 902+59: Before –Piping Rock Sill Causing Localized Scouring *(4/7/2023)*	**T8 STA 902+59: After –Piping Rock Sill Causing Localized Scouring *(11/29/2023)***

CULVERT CROSSING PHOTOGRAPHS

UT to Cedar Creek - Looking Upstream *(11/10/2023)*

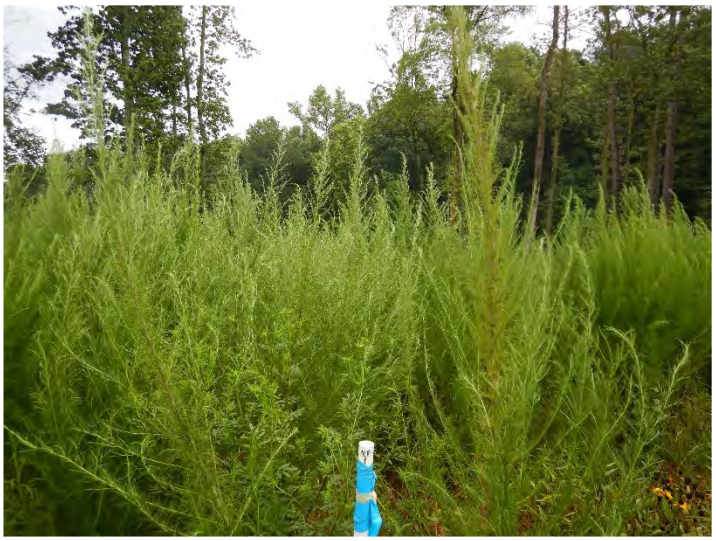
UT to Cedar Creek - Looking Downstream *(11/10/2023)*

T4 R2 - Looking Upstream *(11/10/2023)*

T4 R2 - Looking Downstream *(11/10/2023)*

T3 - Looking Upstream *(11/10/2023)*

VEGETATION PLOT PHOTOGRAPHS



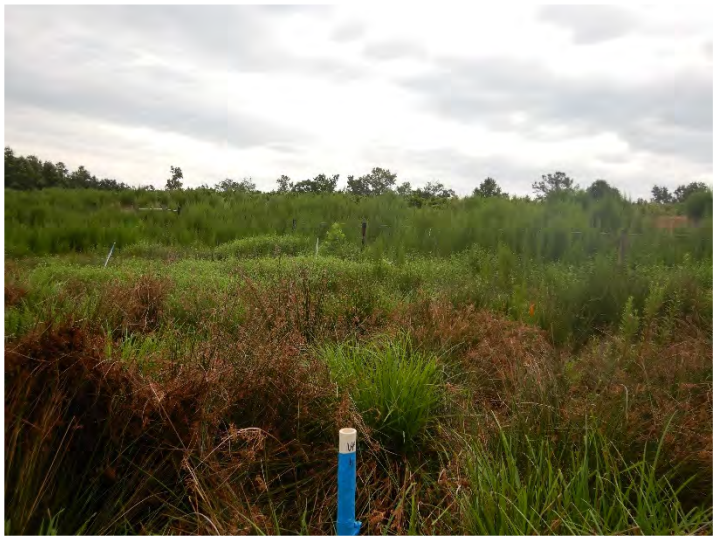
FIXED VEG PLOT 1 *(8/10/2023)*

FIXED VEG PLOT 2 *(8/10/2023)*

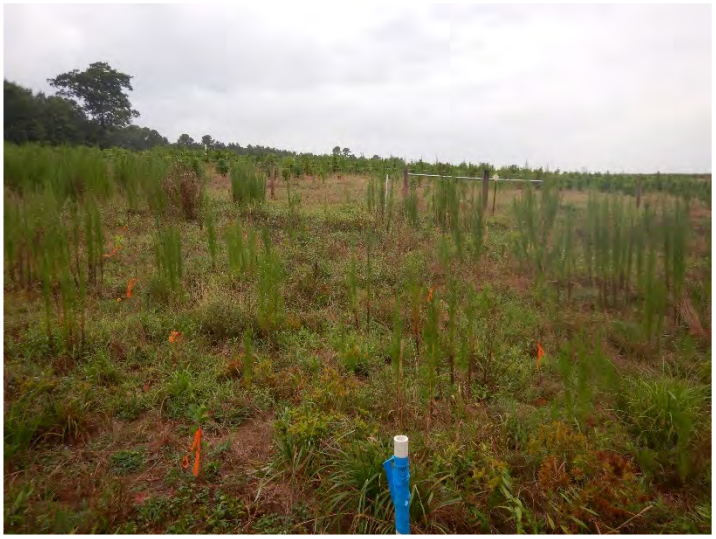
FIXED VEG PLOT 3 *(8/10/2023)*

FIXED VEG PLOT 4 *(8/10/2023)*

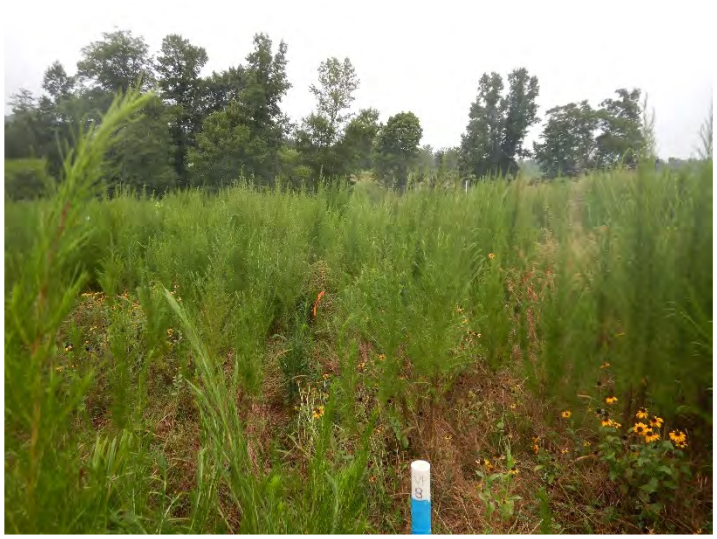
FIXED VEG PLOT 5 *(8/10/2023)*



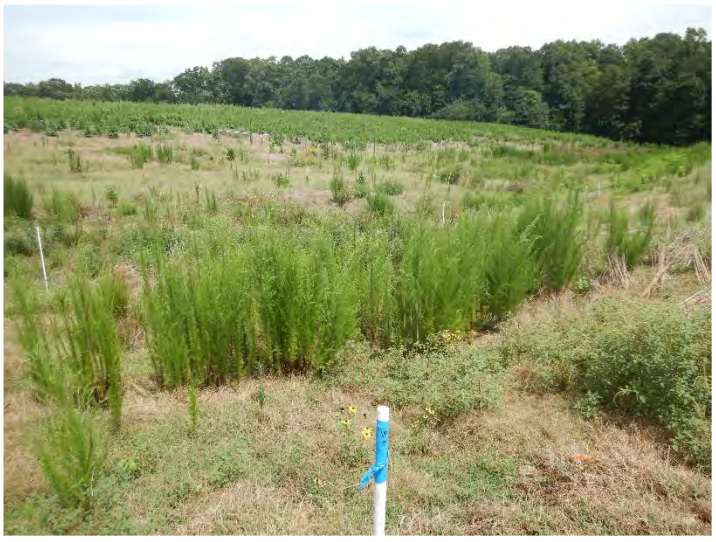
FIXED VEG PLOT 6 *(8/10/2023)*



FIXED VEG PLOT 7 *(8/10/2023)*



FIXED VEG PLOT 8 *(8/10/2023)*



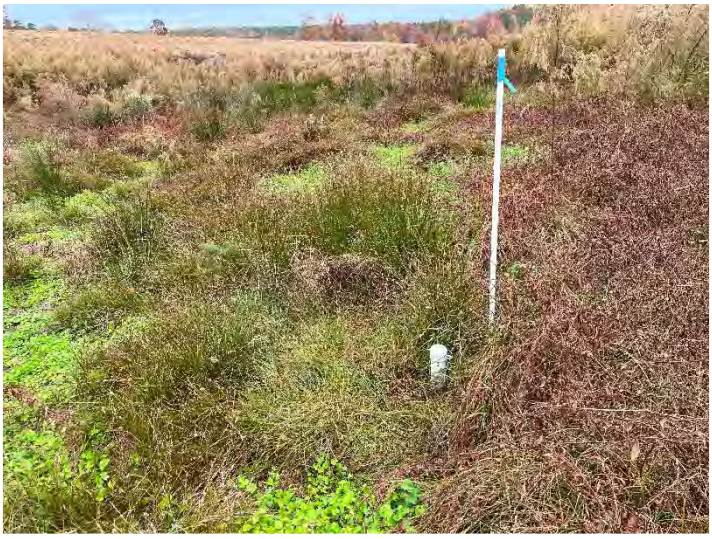
FIXED VEG PLOT 9 *(8/10/2023)*

FIXED VEG PLOT 10 *(8/10/2023)*

RANDOM VEG PLOT 11 *(8/10/2023)*

RANDOM VEG PLOT 12 *(8/10/2023)*

GROUNDWATER WELL PHOTOGRAPHS



GROUNDWATER WELL 1 – (*11/10/2023)*

GROUNDWATER WELL 2 – *(11/10/2023)*

GROUNDWATER WELL 3 – *(11/10/2023)*

GROUNDWATER WELL 4 – *(11/10/2023)*

GROUNDWATER WELL 5 – *(11/10/2023)*

GROUNDWATER WELL 6 – *(11/10/2023)*

GROUNDWATER WELL 7 – *(11/10/2023)*

EASEMENT ENCROACHMENT PHOTOGRAPHS

	
T2 – Four Days After Burned Area First Discovered *(4/18/2023)*	**T2 – Four Days After Burned Area First Discovered *(4/18/2023)***
	
BMP 5 – Four Days After Burn First Discovered *(4/18/2023)*	**BMP 5 – Four Days After Burn First Discovered *(4/18/2023)***
	
T2 VP 3 – Three Weeks After Burned Area First Discovered *(5/4/2023)*	**T2 VP 3 – Three Weeks After Burned Area First Discovered *(5/4/2023)***

Aerial View of T2 Facing West – Three Weeks After Burned Area First Discovered *(5/4/2023)*

Aerial View of T2 Facing West – Three Weeks After Burned Area First Discovered *(5/4/2023)*

Aerial View of BMP 5 and Adjacent Land Three Weeks After Burned Area First Discovered *(5/4/2023)*

Aerial View of BMP 3 and Adjacent Land Three Weeks After Burned Area First Discovered *(5/4/2023)*

T2 – Four Weeks After Burned Area First Discovered *(5/12/2023)*

T2 VP 3 – Four Weeks After Burned Area First Discovered *(5/12/2023)*

	
T2 – Four Weeks After Burned Area Discovered *(5/12/2023)*	**T2 – Four Weeks After Burned Area Discovered *(5/12/2023)***
	
T2 – Seven Months After Burned Area Discovered (11/10/2023)	**T2 – Seven Months After Burned Area Discovered (11/10/2023)**
	
BMP 3 – Seven Months After Burned Area First Discovered *(11/10/2023)*	**BMP 3 – Seven Months After Burned Area First Discovered *(11/10/2023)***

	
BMP 5 – Seven Months After Burned Area First Discovered *(11/10/2023)*	**BMP 5 – Seven Months After Burned Area First Discovered *(11/10/2023)***
	
Chicken Litter Pile Dumped at Fenceline Directly Perpendicular to BMP 2 *(9/1/2023)*	**Chicken Litter Pile Dumped at Fenceline Directly Perpendicular to BMP 2 *(9/1/2023)***

APPENDIX B. VEGETATION PLOT DATA

Table 6. Vegetation Plot Data
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Planted Acreage	13.8
Date of Initial Plant	2023-01-06
Date of Current Survey	2023-08-10
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F	
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	4	4			1	1	4	4	3	3
	Cephalanthus occidentalis*	common buttonbush	Shrub	OBL	1	1							1	1
	Cercis canadensis*	eastern redbud	Tree	UPL							1	1		
	Cornus florida*	flowering dogwood	Tree	FACU							1	1		
	Fraxinus pennsylvanica	green ash	Tree	FACW			1	1			1	1	1	1
	Juniperus virginiana	eastern redcedar	Tree	FACU							3	3	1	1
	Liriodendron tulipifera	tuliptree	Tree	FACU							1	1		
	Nyssa sylvatica	blackgum	Tree	FAC	1	1							1	1
	Platanus occidentalis	American sycamore	Tree	FACW	3	3					3	3	1	1
	Quercus alba	white oak	Tree	FACU			1	1	3	3	1	1		
	Quercus michauxii	swamp chestnut oak	Tree	FACW			2	2	2	2	1	1		
	Quercus rubra	northern red oak	Tree	FACU			1	1	2	2	1	1	1	1
	Rosa palustris*	swamp rose	Shrub	OBL									3	3
	Salix nigra	black willow	Tree	OBL	2	2								
	Sambucus canadensis*	American black elderberry	Tree	FACW	2	2							1	1
	Taxodium distichum	bald cypress	Tree	OBL	2	2							1	1
	Ulmus alata	winged elm	Tree	FACU			1	1						
	Ulmus americana	American elm	Tree	FAC			5	5						
Sum				Performance Standard	15	15	11	11	8	8	17	17	14	14
Mitigation Plan Performance Standard				Current Year Stem Count		15		11		8		17		14
				Stems/Acre		607		445		324		688		567
				Species Count		7		6		4		10		10
				Dominant Species Composition (%)		27		45		38		24		21
				Average Plot Height (ft.)		2		2		2		2		2
				% Invasives		0		0		0		0		0
Post Mitigation Plan Performance Standard				Current Year Stem Count		15		11		8		17		14
				Stems/Acre		607		445		324		688		567
				Species Count		7		6		4		10		10
				Dominant Species Composition (%)		27		45		38		24		21
				Average Plot Height (ft.)		2		2		2		2		2
				% Invasives		0		0		0		0		0

*Species not subject to monitoring height requirement due to species growth habit.

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The ""Species Included in Approved Mitigation Plan"" section contains only those species that were included in the original approved mitigation plan. The ""Post Mitigation Plan Species"" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The ""Mitigation Plan Performance Standard"" section is derived only from stems included in the original mitigation plan, whereas the ""Post Mitigation Plan Performance Standard"" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Table 6. Vegetation Plot Data
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Planted Acreage	13.8
Date of Initial Plant	2023-01-06
Date of Current Survey	2023-08-10
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F		Veg Plot 10 F		Veg Plot 11 R	Veg Plot 12 R
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Total	Total
Species Included in Approved Mitigation Plan	Betula nigra	river birch	Tree	FACW	3	3	3	3			5	5			1	1
	Cephalanthus occidentalis*	common buttonbush	Shrub	OBL	1	1										
	Cercis canadensis*	eastern redbud	Tree	UPL												
	Cornus florida*	flowering dogwood	Tree	FACU									1	1	1	
	Fraxinus pennsylvanica	green ash	Tree	FACW							2	2				2
	Juniperus virginiana	eastern redcedar	Tree	FACU			1	1	1	1	3	3	1	1		
	Liriodendron tulipifera	tuliptree	Tree	FACU												
	Nyssa sylvatica	blackgum	Tree	FAC	1	1			4	4						
	Platanus occidentalis	American sycamore	Tree	FACW	1	1	3	3	2	2			1	1	3	6
	Quercus alba	white oak	Tree	FACU			3	3	1	1	2	2	3	3		
	Quercus michauxii	swamp chestnut oak	Tree	FACW			2	2	3	3	1	1	7	7	2	
	Quercus rubra	northern red oak	Tree	FACU							1	1				
	Rosa palustris*	swamp rose	Shrub	OBL	1	1										
	Salix nigra	black willow	Tree	OBL												4
	Sambucus canadensis*	American black elderberry	Tree	FACW	1	1			1	1						
	Taxodium distichum	bald cypress	Tree	OBL					1	1						
	Ulmus alata	winged elm	Tree	FACU					1	1			3	3	1	
	Ulmus americana	American elm	Tree	FAC			1	1	1	1					2	
Sum				Performance Standard	8	8	13	13	15	15	14	14	16	16	10	13
Mitigation Plan Performance Standard				Current Year Stem Count		8		13		15		14		16	10	13
				Stems/Acre		324		526		607		567		648	405	526
				Species Count		6		6		9		6		6	6	4
				Dominant Species Composition (%)		38		23		27		36		44	30	46
				Average Plot Height (ft.)		2		2		2		2		2	2	2
				% Invasives		0		0		0		0		0	0	0
Post Mitigation Plan Performance Standard				Current Year Stem Count		8		13		15		14		16	10	13
				Stems/Acre		324		526		607		567		648	405	526
				Species Count		6		6		9		6		6	6	4
				Dominant Species Composition (%)		38		23		27		36		44	30	46
				Average Plot Height (ft.)		2		2		2		2		2	2	2
				% Invasives		0		0		0		0		0	0	0

*Species not subject to monitoring height requirement due to species growth habit.

1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
2). The ""Species Included in Approved Mitigation Plan"" section contains only those species that were included in the original approved mitigation plan. The ""Post Mitigation Plan Species"" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded) , species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
3). The ""Mitigation Plan Performance Standard"" section is derived only from stems included in the original mitigation plan, whereas the ""Post Mitigation Plan Performance Standard"" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

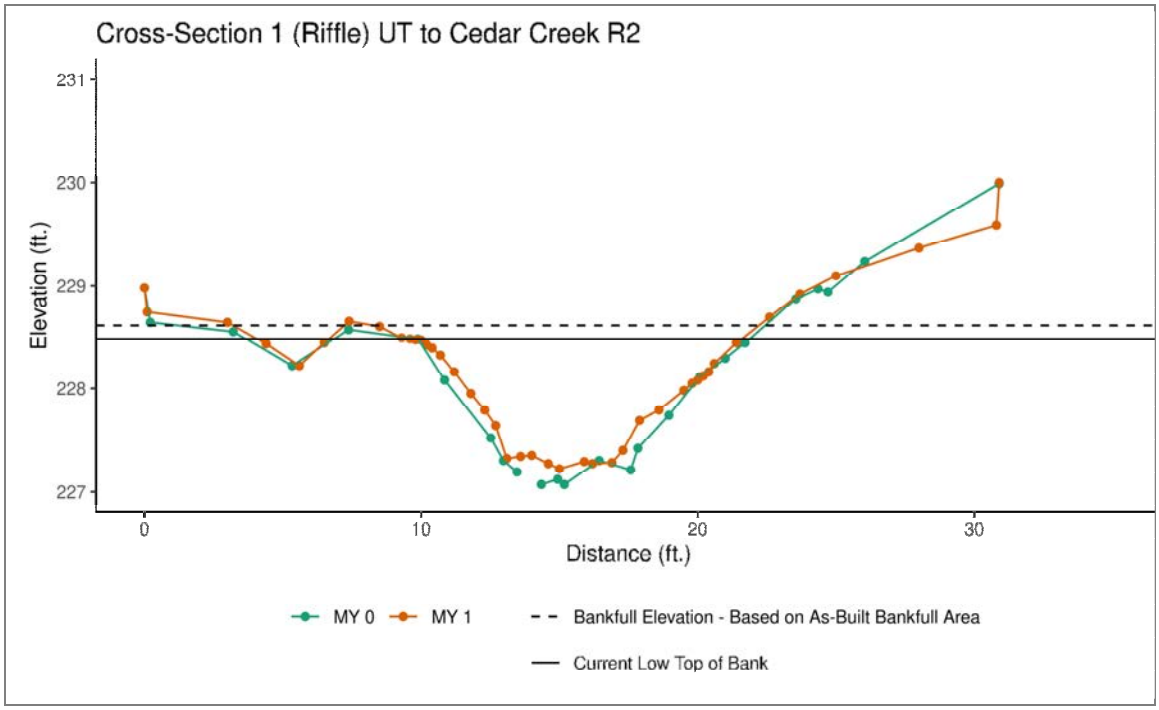
Table 7. Vegetation Performance Standards Summary Table
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	607	2	7	0	445	2	6	0	324	2	4	0
Monitoring Year 0	648	2	7	0	486	2	6	0	607	2	7	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	688	2	10	0	567	2	10	0	324	2	6	0
Monitoring Year 0	688	2	10	0	688	2	11	0	445	2	6	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	526	2	6	0	607	2	9	0	567	2	6	0
Monitoring Year 0	567	2	6	0	648	2	9	0	688	2	7	0
	Veg Plot 10 F				Veg Plot Group 11 R				Veg Plot Group 12 R			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	648	2	6	0	405	2	6	0	526	2	4	0
Monitoring Year 0	688	2	7	0	648	2	7	0	648	2	8	0

*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

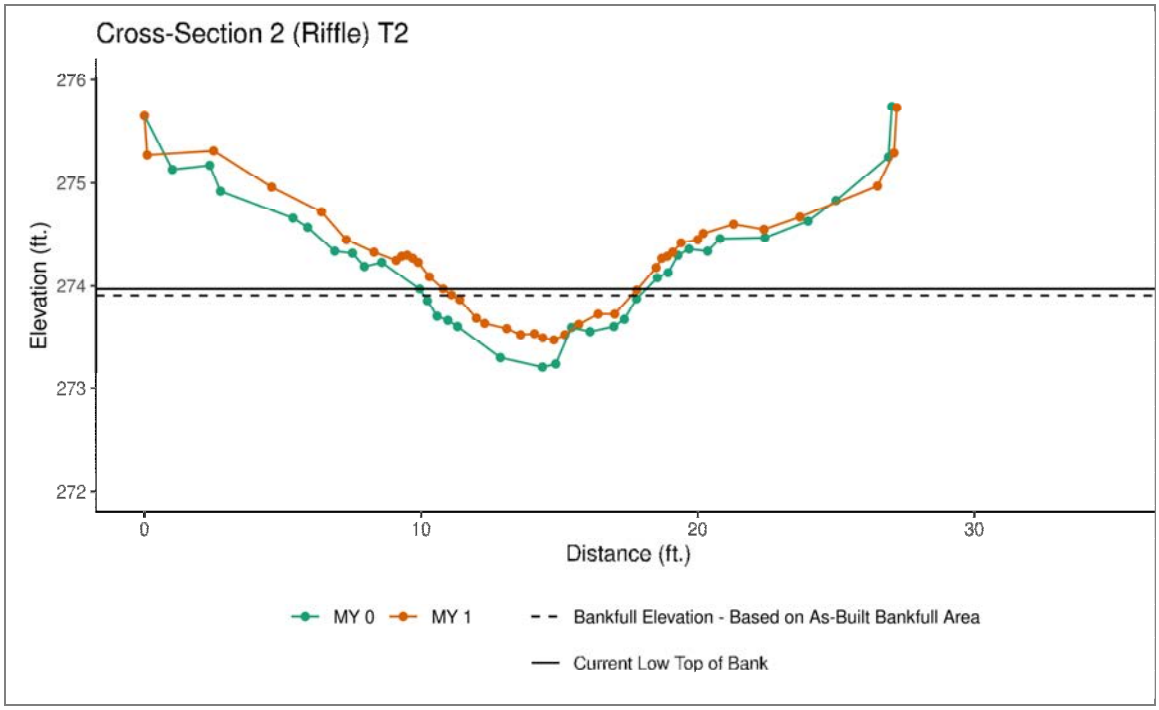
APPENDIX C. STREAM GEOMORPHOLOGY DATA

CROSS-SECTION PLOTS



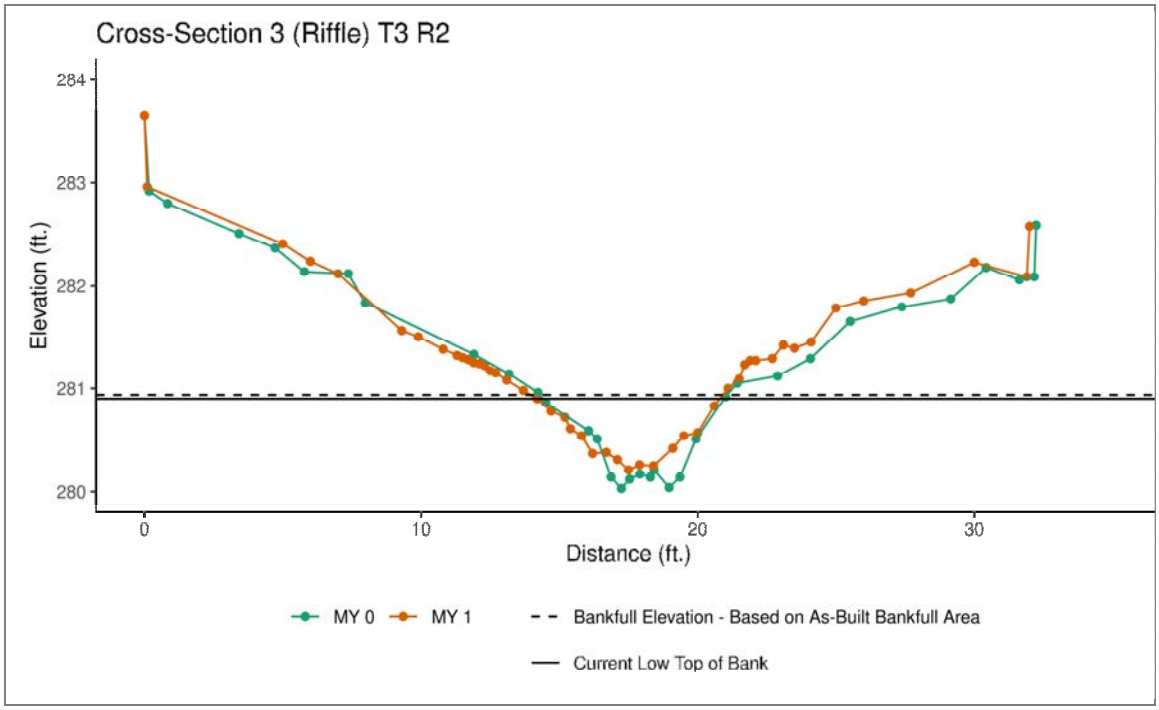
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	228.48	228.61				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.91				
Thalweg Elevation	226.97	227.22				
LTOB Elevation	228.48	228.48				
LTOB Max Depth	1.51	1.26				
LTOB Cross-Sectional Area	10.14	8.59				

Downstream *(7/11/2023)*



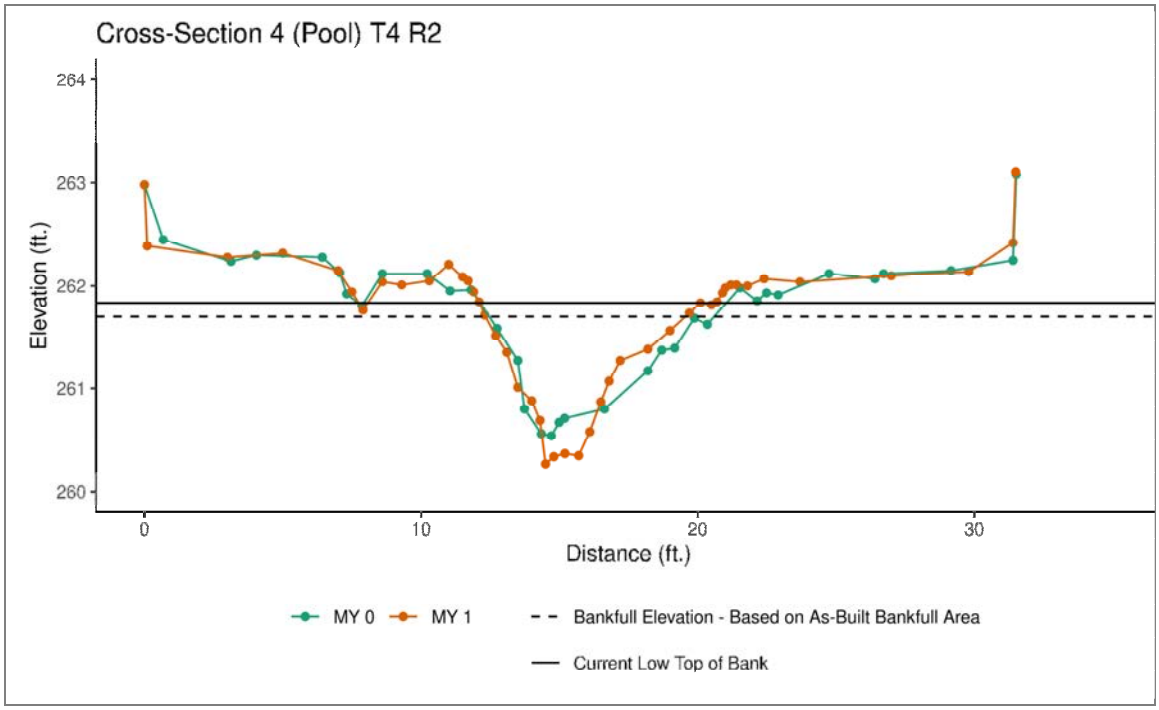
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	273.70	273.90				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.15				
Thalweg Elevation	273.21	273.47				
LTOB Elevation	273.70	273.97				
LTOB Max Depth	0.49	0.50				
LTOB Cross-Sectional Area	1.71	2.16				

Downstream *(7/11/2023)*



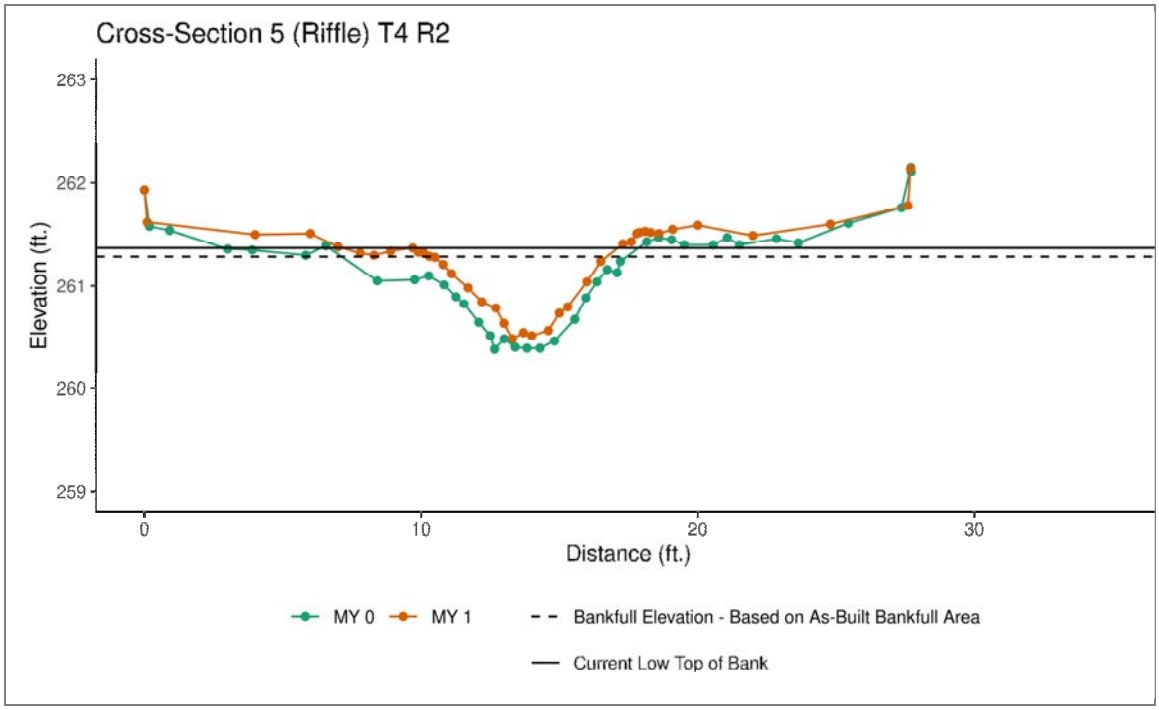
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	280.86	280.94				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.95				
Thalweg Elevation	280.03	280.21				
LTOB Elevation	280.86	280.90				
LTOB Max Depth	0.83	0.69				
LTOB Cross-Sectional Area	2.89	2.65				

Downstream *(7/11/2023)*



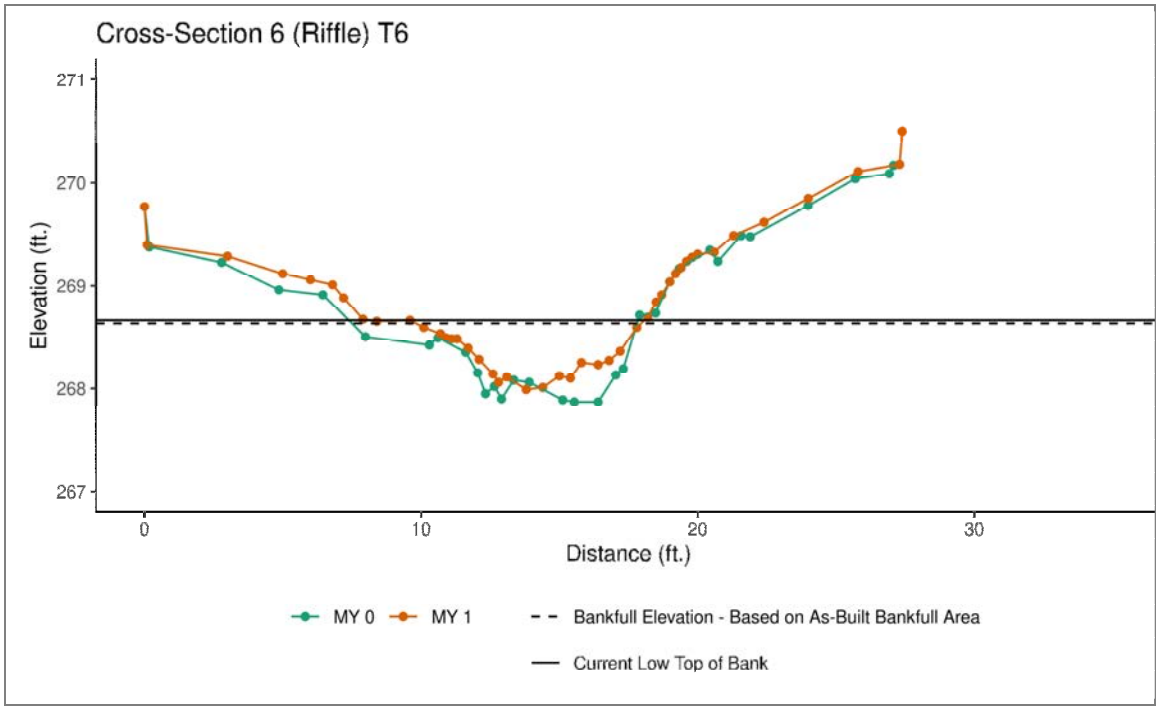
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A				
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A				
Thalweg Elevation	260.54	260.27				
LTOB Elevation	261.68	261.83				
LTOB Max Depth	1.14	1.56				
LTOB Cross-Sectional Area	4.75	5.78				

Downstream *(7/11/2023)*



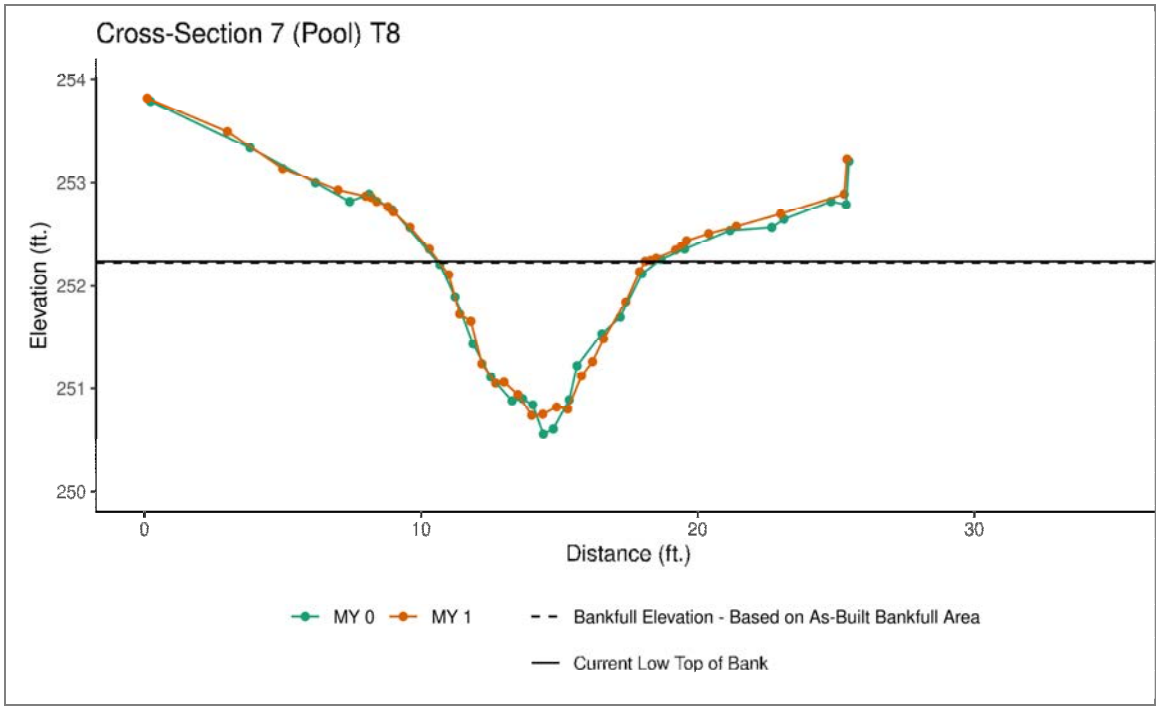
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	261.10	261.29				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.10				
Thalweg Elevation	260.38	260.48				
LTOB Elevation	261.10	261.37				
LTOB Max Depth	0.72	0.89				
LTOB Cross-Sectional Area	2.75	3.33				

Downstream *(7/11/2023)*



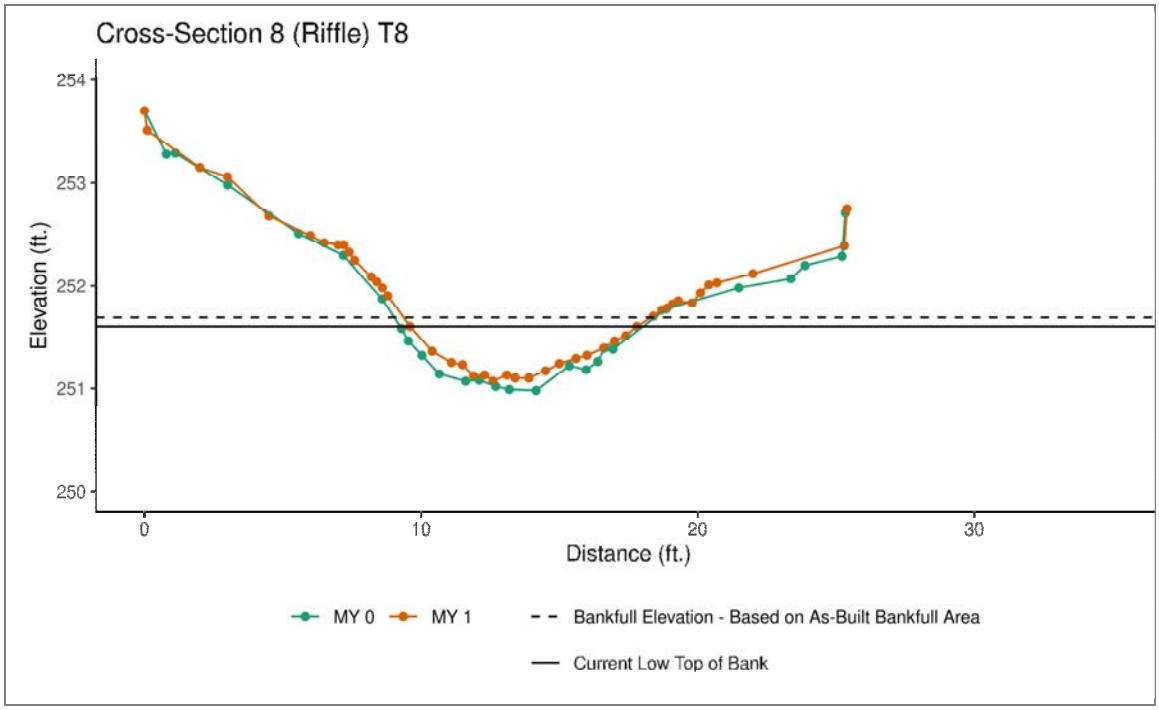
	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	268.49	268.63				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	1.05				
Thalweg Elevation	267.87	267.99				
LTOB Elevation	268.49	268.66				
LTOB Max Depth	0.62	0.67				
LTOB Cross-Sectional Area	2.92	3.18				

Downstream *(7/11/2023)*



	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	N/A	N/A				
Bank Height Ratio - Based on AB-Bankfull Area	N/A	N/A				
Thalweg Elevation	250.56	250.74				
LTOB Elevation	252.21	252.24				
LTOB Max Depth	1.65	1.40				
LTOB Cross-Sectional Area	6.72	6.10				

Downstream *(7/11/2023)*



	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation - Based on AB-Bankfull Area	251.58	251.69				
Bank Height Ratio - Based on AB-Bankfull Area	1.00	0.86				
Thalweg Elevation	250.98	251.07				
LTOB Elevation	251.58	251.60				
LTOB Max Depth	0.60	0.53				
LTOB Cross-Sectional Area	3.38	2.68				

Downstream *(7/11/2023)*

Table 8. Baseline Stream Data Summary
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**UT to Cedar Creek**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	8.2		1	12.5		12.0		1
Floodprone Width (ft)	12.2		1	28.0	63.0	60.0		1
Bankfull Mean Depth (ft)	0.5		1	0.9		0.8		1
Bankfull Max Depth (ft)	0.8		1	1.0	1.3	1.5		1
Bankfull Cross Sectional Area (ft^2)	4.1		1	10.7		10.1		1
Width/Depth Ratio	16.4		1	15.0		14.2		1
Entrenchment Ratio	1.5		1	2.2	5.0	5.0		1
Bank Height Ratio	3.4		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	49			58		52		
Rosgen Classification	B4			C4/B4c		C4/B4c		
Bankfull Discharge (cfs)	17.1		1	43.0		47.5		1
Sinuosity	1.03			1.20		1.20		
Water Surface Slope (ft/ft)	0.0340			0.0110		0.0210		
Other	---			---		---		
Parameter	**T2**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	2.9		1	5.4		6.8		1
Floodprone Width (ft)	4.2		1	8.0	12.0	20.0		1
Bankfull Mean Depth (ft)	0.3		1	0.4		0.2		1
Bankfull Max Depth (ft)	0.5		1	0.5	0.6	0.5		1
Bankfull Cross Sectional Area (ft^2)	0.9		1	2.2		1.7		1
Width/Depth Ratio	9.7		1	14.0		27.4		1
Entrenchment Ratio	1.4		1	2.2	5.0	2.9		1
Bank Height Ratio	12.6		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	42			153		61		
Rosgen Classification	A4			A4/B4a		A4/B4a		
Bankfull Discharge (cfs)	3.1		1	9.4		7.1		1
Sinuosity	1.07			1.10		1.10		
Water Surface Slope (ft/ft)	0.0510			0.0768		0.0813		
Other	---			---		---		
Parameter	**T3 R2**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	2.6	4.6	2	6.3		6.3		1
Floodprone Width (ft)	3.6	5.1	2	9.0	14.0	25.0		1
Bankfull Mean Depth (ft)	0.8	0.4	2	0.5		0.5		1
Bankfull Max Depth (ft)	1.0	0.7	2	0.6	0.7	0.8		1
Bankfull Cross Sectional Area (ft^2)	2.2	1.7	2	2.9		2.9		1
Width/Depth Ratio	3.3	11.5	2	14.0		13.9		1
Entrenchment Ratio	1.4	1.1	2	2.2	5.0	3.9		1
Bank Height Ratio	2.6	4.1	2	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	86	51	2	115		77		
Rosgen Classification	A4			B4/B4a		B4/B4a		
Bankfull Discharge (cfs)	12.5	6.8	2	13.0		14.9		1
Sinuosity	1.04			1.15		1.15		
Water Surface Slope (ft/ft)	0.0540			0.0522		0.0598		
Other	---			---		---		

Table 8. Baseline Stream Data Summary
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

	PRE-EXISTING CONDITIONS			DESIGN		MONITORING BASELINE (MY0)		
Parameter	**T4 R2**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	4.8	7.1	2	7.0		6.3		1
Floodprone Width (ft)	6.0	8.0	2	10.0	15.0	20.0		1
Bankfull Mean Depth (ft)	0.6	0.4	2	0.5		0.4		1
Bankfull Max Depth (ft)	0.8	0.5	2	0.6	0.8	0.7		1
Bankfull Cross Sectional Area (ft^2)	2.7	2.8	2	3.7		2.7		1
Width/Depth Ratio	8.0	17.8	2	13.0		14.3		1
Entrenchment Ratio	1.3	1.1	2	1.4	2.2	3.2		1
Bank Height Ratio	4.8	5.8	2	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	48	36	2	108		59		
Rosgen Classification	F4b			B4/B4a		B4/B4a		
Bankfull Discharge (cfs)	11.3	9.6	2	16.0		1.2		1
Sinuosity	1.23			1.10		1.10		
Water Surface Slope (ft/ft)	0.0310			0.0432		0.0456		
Other	---			---		---		
Parameter	**T6**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	1.3		1	5.8		7.0		1
Floodprone Width (ft)	1.7		1	8.0	13.0	18.0		1
Bankfull Mean Depth (ft)	0.6		1	0.4		0.4		1
Bankfull Max Depth (ft)	0.8		1	0.5	0.6	0.6		1
Bankfull Cross Sectional Area (ft^2)	0.8		1	2.4		2.9		1
Width/Depth Ratio	2.2		1	14.0		17.0		1
Entrenchment Ratio	1.3		1	2.2	5.0	2.6		1
Bank Height Ratio	4.8		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	81			132		70		
Rosgen Classification	A4			A4/B4a		A4/B4a		
Bankfull Discharge (cfs)	4.0		1	10.0		14.1		1
Sinuosity	1.03			1.10		1.10		
Water Surface Slope (ft/ft)	0.0840			0.0650		0.0585		
Other	---			---		---		
Parameter	**T8**							
Riffle Only	**Min**	**Max**	**n**	**Min**	**Max**	**Min**	**Max**	**n**
Bankfull Width (ft)	5.1		1	6.0		8.6		1
Floodprone Width (ft)	91.8		1	8.0	13.0	16.2		1
Bankfull Mean Depth (ft)	0.3		1	0.4		0.4		1
Bankfull Max Depth (ft)	0.3		1	0.5	0.6	0.6		1
Bankfull Cross Sectional Area (ft^2)	1.3		1	2.5		3.4		1
Width/Depth Ratio	17.0		1	14.0		22.1		1
Entrenchment Ratio	18.0		1	1.4	2.2	1.9		1
Bank Height Ratio	7.7		1	1.0		1.0		1
Max particle size (mm) mobilized at bankfull	39			146		85		
Rosgen Classification	A4/B4a			A4/B4a		A4/B4a		
Bankfull Discharge (cfs)	4.3		1	11.0		17.9		1
Sinuosity	1.04			1.10		1.10		
Water Surface Slope (ft/ft)	0.0530			0.0680		0.0719		
Other	---			---		---		

Table 9. Cross-Section Morphology Monitoring Summary

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

	UT to Cedar Creek R2						T2						T3 R2					
	Cross-Section 1 (Riffle)						Cross-Section 2 (Riffle)						Cross-Section 3 (Riffle)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	228.48	228.61					273.70	273.90					280.86	280.94				
Bank Height Ratio - Based on AB Bankfull[1] Area	1.00	0.91					1.00	1.15					1.00	0.95				
Thalweg Elevation	226.97	227.22					273.21	273.47					280.03	280.21				
LTOB[2] Elevation	228.48	228.48					273.70	273.97					280.86	280.90				
LTOB[2] Max Depth (ft)	1.51	1.26					0.49	0.50					0.83	0.69				
LTOB[2] Cross Sectional Area (ft^2)	10.14	8.59					1.71	2.16					2.89	2.65				
	T4 R2												T6					
	Cross-Section 4 (Pool)						Cross-Section 5 (Riffle)						Cross-Section 6 (Riffle)					
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	N/A	N/A					261.10	261.29					268.49	268.63				
Bank Height Ratio - Based on AB Bankfull[1] Area	N/A	N/A					1.00	1.10					1.00	1.05				
Thalweg Elevation	260.54	260.27					260.38	260.48					267.87	267.99				
LTOB[2] Elevation	261.68	261.83					261.10	261.37					268.49	268.66				
LTOB[2] Max Depth (ft)	1.14	1.56					0.72	0.89					0.62	0.67				
LTOB[2] Cross Sectional Area (ft^2)	4.75	5.78					2.75	3.33					2.92	3.18				
	T8																	
	Cross-Section 7 (Pool)						Cross-Section 8 (Riffle)											
	MY0	MY1	MY2	MY3	MY5	MY7	MY0	MY1	MY2	MY3	MY5	MY7						
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	N/A	N/A					251.58	251.69										
Bank Height Ratio - Based on AB Bankfull[1] Area	N/A	N/A					1.00	0.86										
Thalweg Elevation	250.56	250.74					250.98	251.07										
LTOB[2] Elevation	252.21	252.24					251.58	251.60										
LTOB[2] Max Depth (ft)	1.65	1.40					0.60	0.53										
LTOB[2] Cross Sectional Area (ft^2)	6.72	6.10					3.38	2.68										

[1]Bank Height Ratio (BHR) takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation.

[2]LTOB Area and Max depth - These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB max depth.

APPENDIX D. HYDROLOGY DATA

Table 10. Bankfull Events

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Reach	MY1 (2023)	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
UT to Cedar Creek Reach 2	7/5/2023 7/8/2023						
T4 Reach 2	2/5/2023 7/5/2023 7/9/2023						

Table 11. Rainfall Summary

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

	MY1 (2023)	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
Annual Precip Total	35.87*						
WETS 30th Percentile	42.28						
WETS 70th Percentile	50.61						
Normal	*						

*Annual precipitation total was collected up until 10/31/2023. Data will be updated in MY2.

Table 12. Recorded In-Stream Flow Events Summary

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

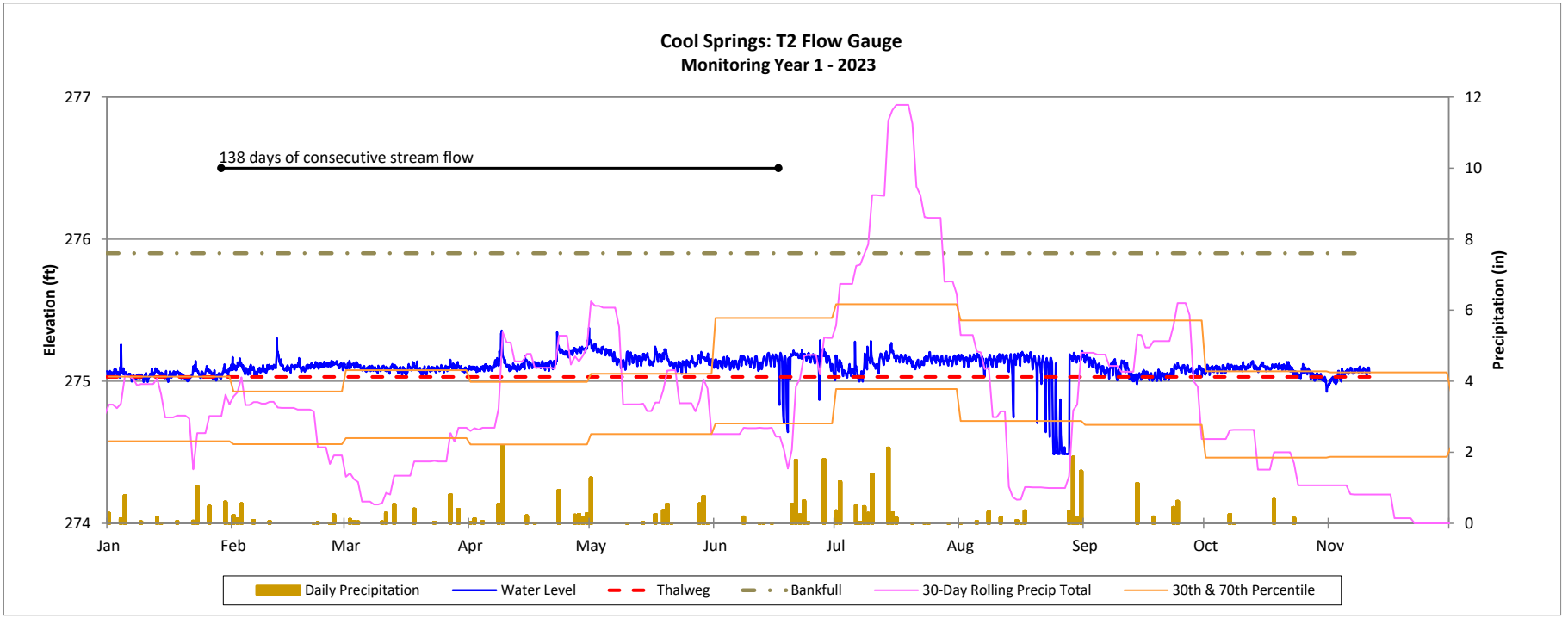
Reach	Max Consecutive Days/Total Days Meeting Success Criteria*						
	MY1 (2023)**	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
T2	138 Days/ 289 Days						
T3 Reach 1	220 Days/ 284 Days						
T5	42 Days/ 71 Days						
T6	66 Days/ 218 Days						
T8	44 Days/ 177 Days						

*Success criteria is 30 consecutive days of flow.

**Data was collected through 11/8/2023. Data will be updated in MY2.

Recorded In-Stream Flow Events Plot

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

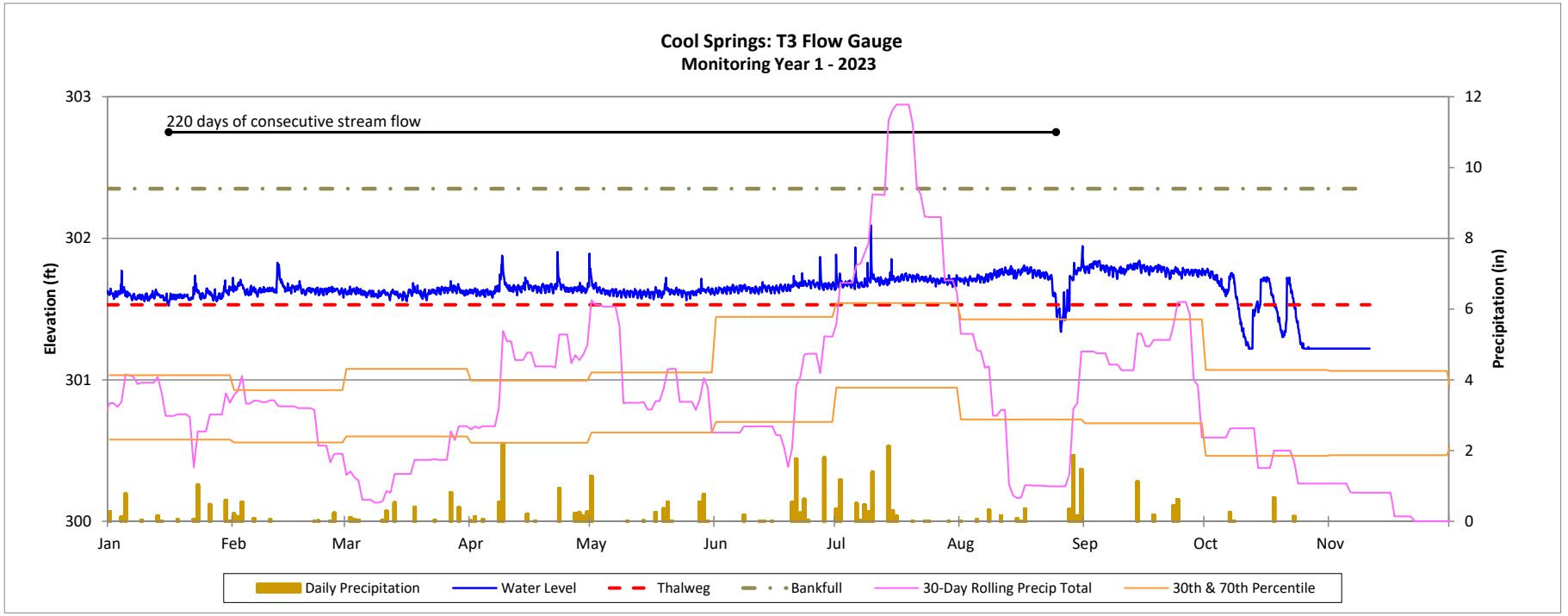


Recorded In-Stream Flow Events Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

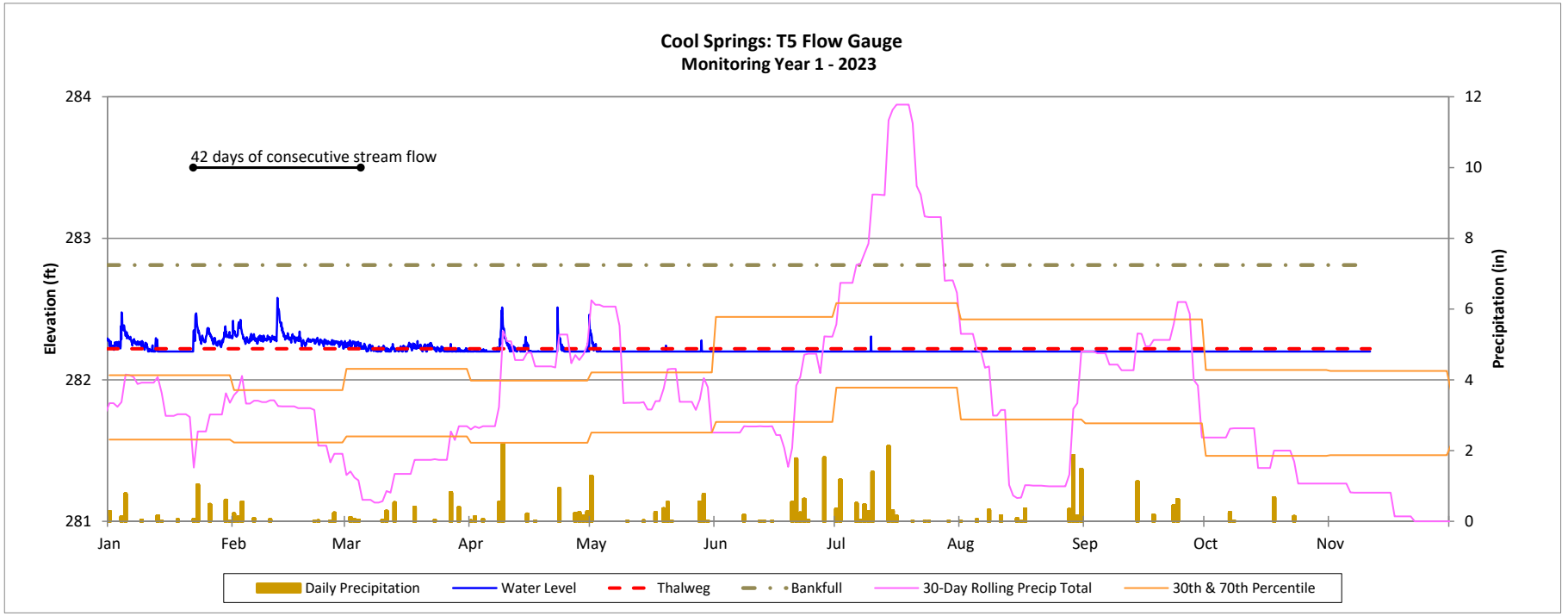


Recorded In-Stream Flow Events Plot

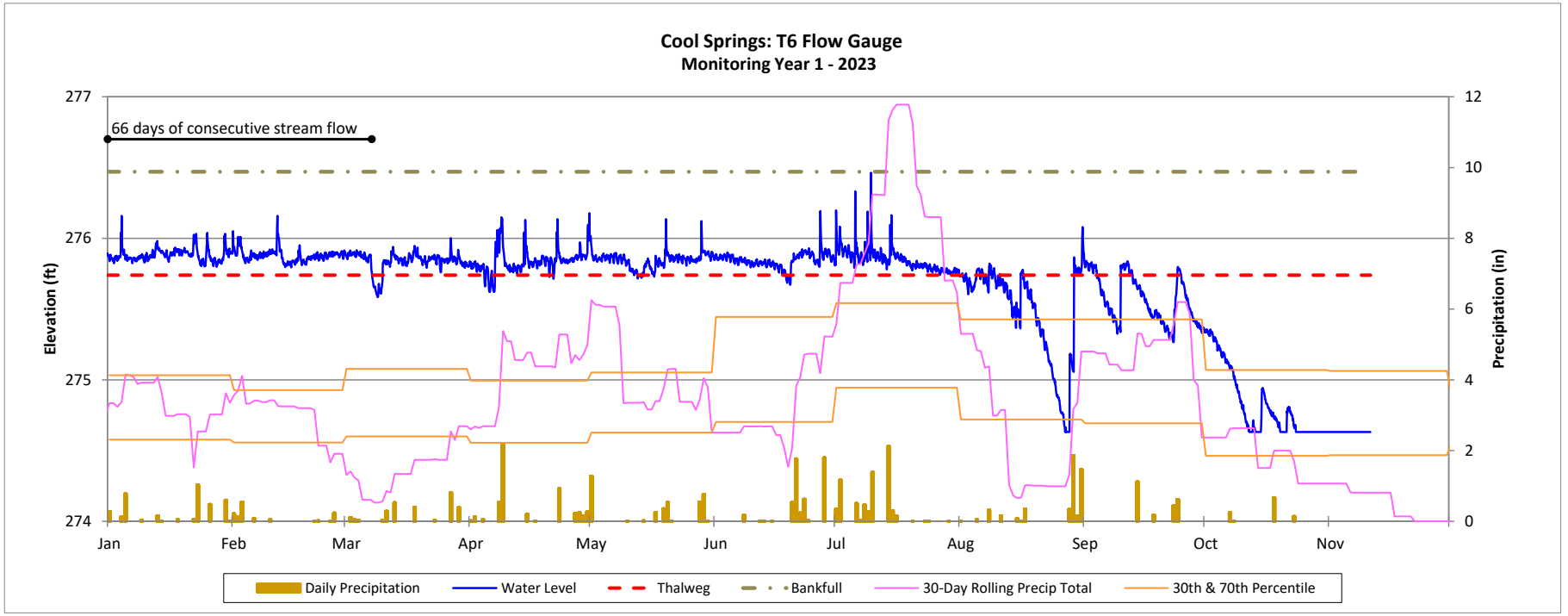
Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023



Recorded In-Stream Flow Events Plot
Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023



Recorded In-Stream Flow Events Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

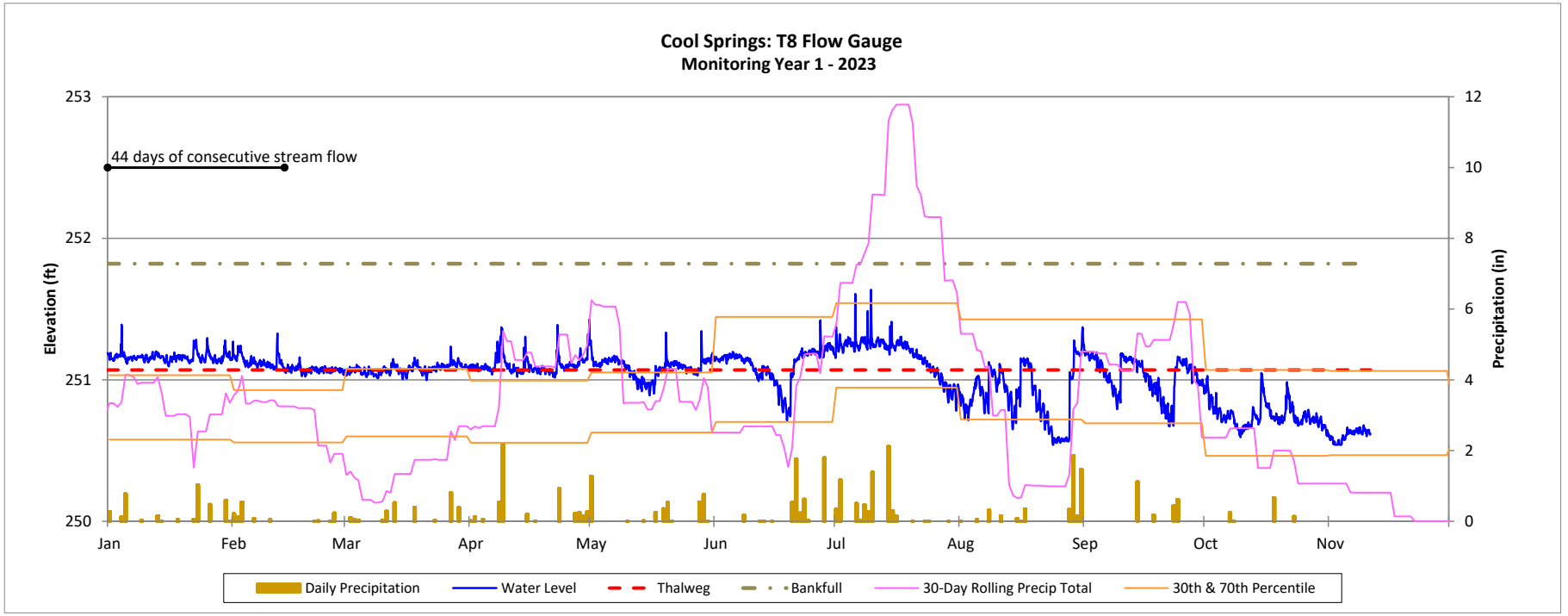


Table 13. Groundwater Gauge Summary

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Gauge	Max. Consecutive Hydroperiod (Percentage)						
	MY1 (2023)	MY2 (2024)	MY3 (2025)	MY4 (2026)	MY5 (2027)	MY6 (2028)	MY7 (2029)
1	178 Days (70.4%)						
2	253 Days (100.0%)						
3	4 Days (1.6%)						
4	16 Days (6.3%)						
5	110 Days (43.5.6%)						
6	3 Days (1.2%)						
7	107 Days (42.3%)						

Performance Standard: **GW 3 has an 8% (20 consecutive day) hydroperiod criterion. GW 2 and 7 have a 10% (25 consecutive day) hydroperiod criterion. GW 1, 4, 5, and 6 have a 12% (30 consecutive day) hydroperiod criterion.**

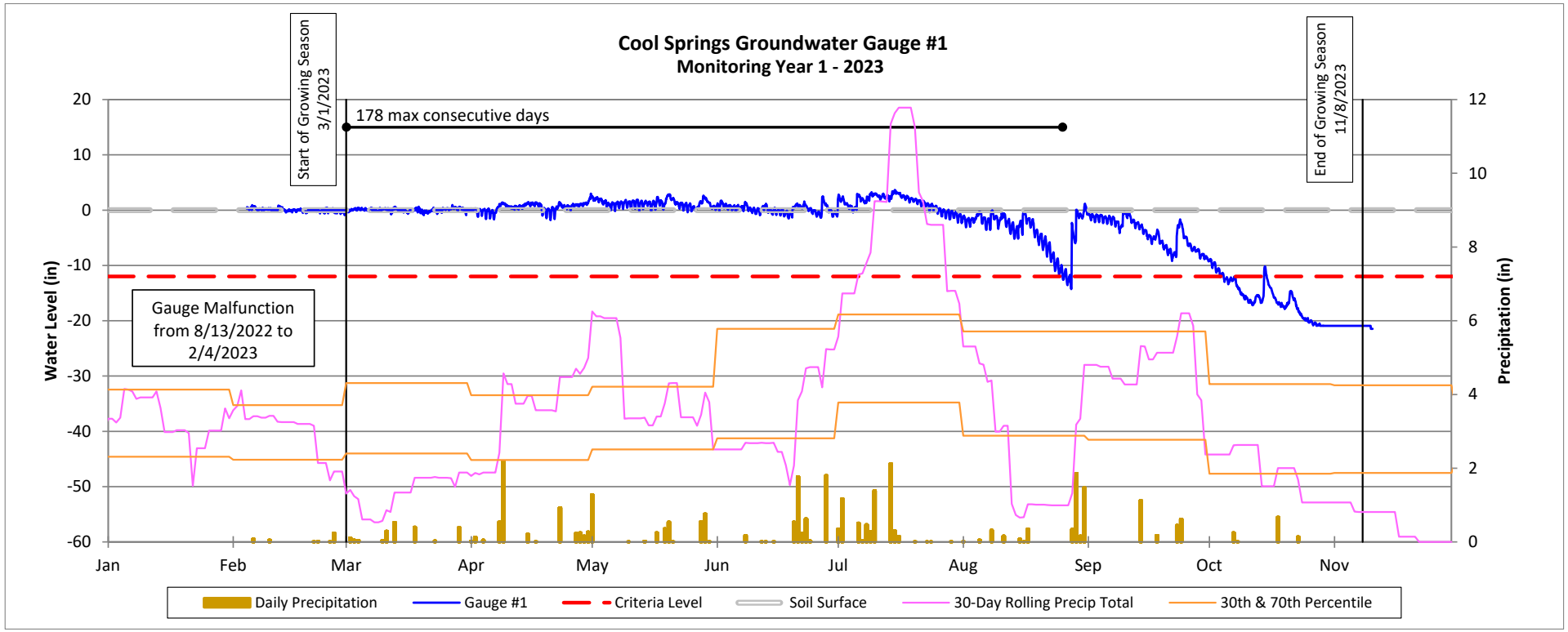
WETS Station (Daily Rainfall): **Lillington 2.0 W** (Approximately 7.5 miles from Site)

WETS Station (30th & 70th Percentile): **Sanford 8 NE** (Approximately 7 miles from Site)

Growing Season: **3/1/2023 to 11/8/2023 (252 Days)**

Groundwater Gauge Plot

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

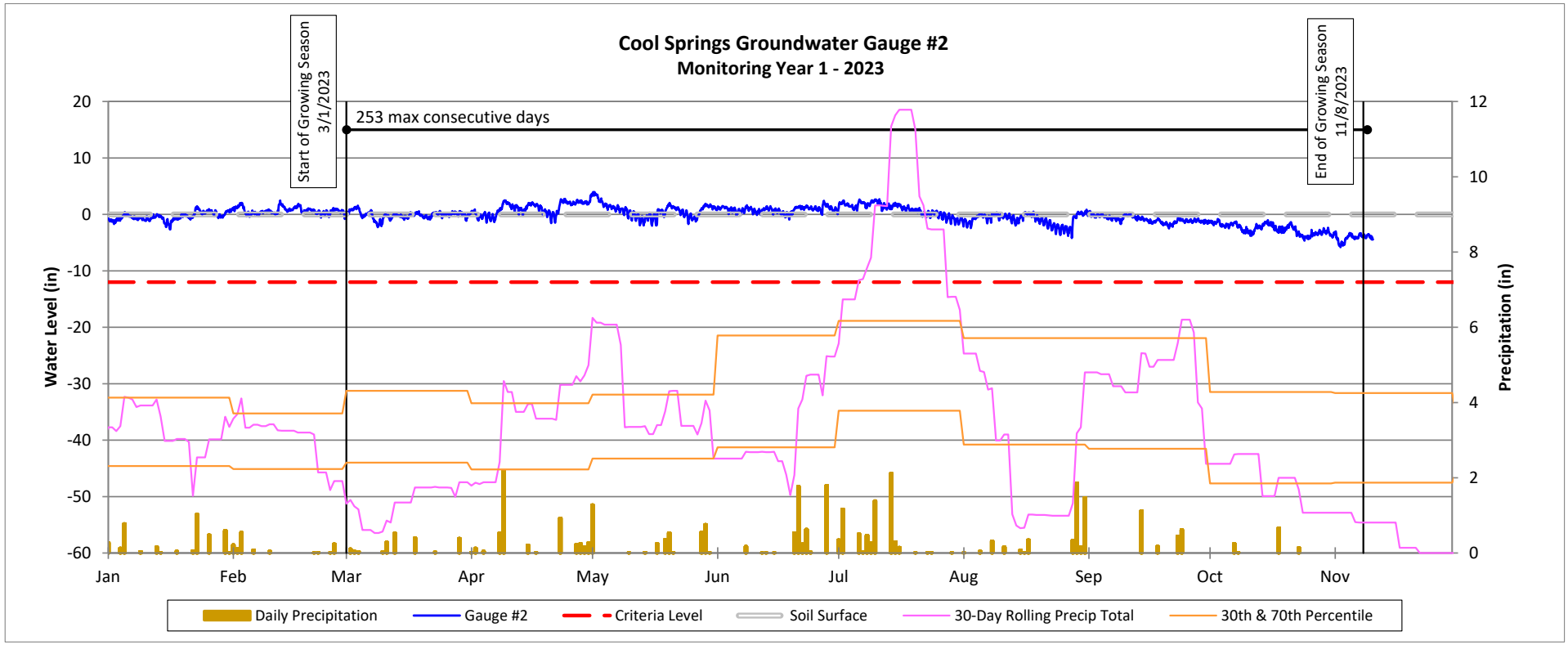


Groundwater Gauge Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

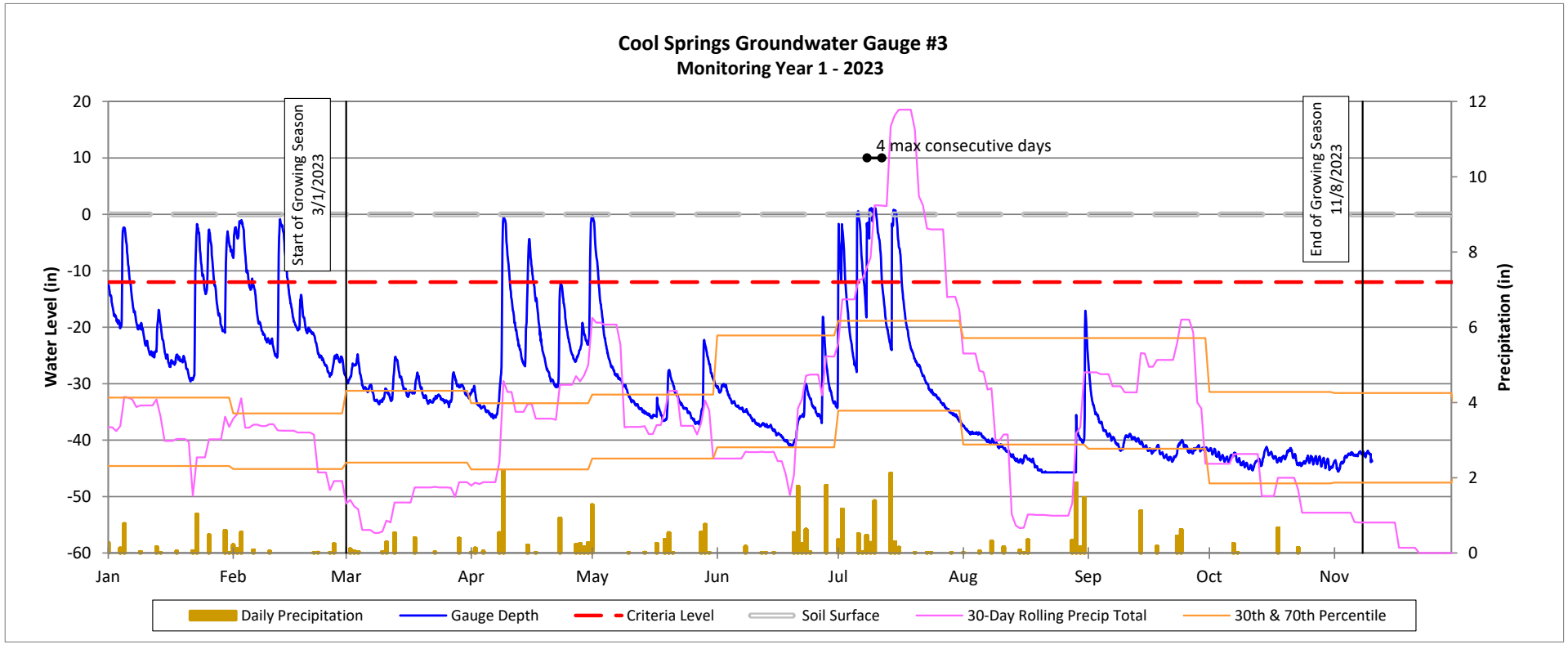


Groundwater Gauge Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

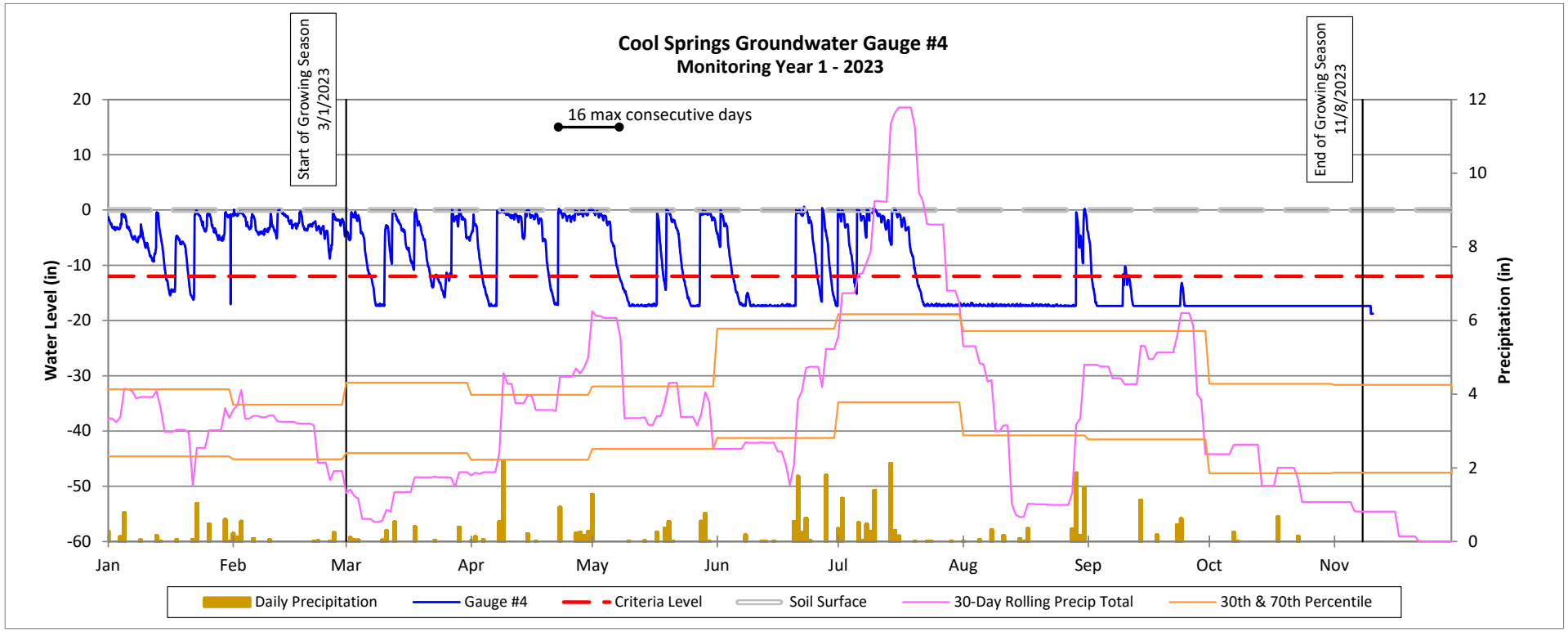


Groundwater Gauge Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

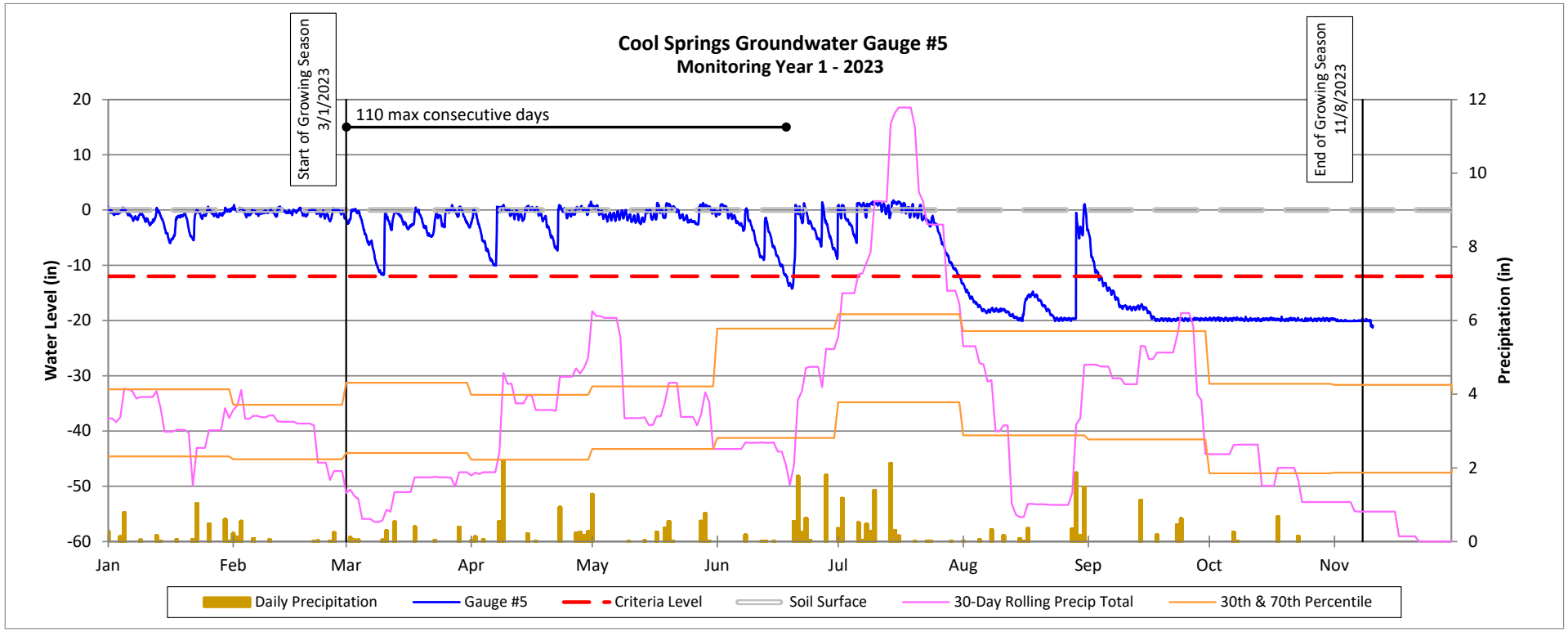


Groundwater Gauge Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

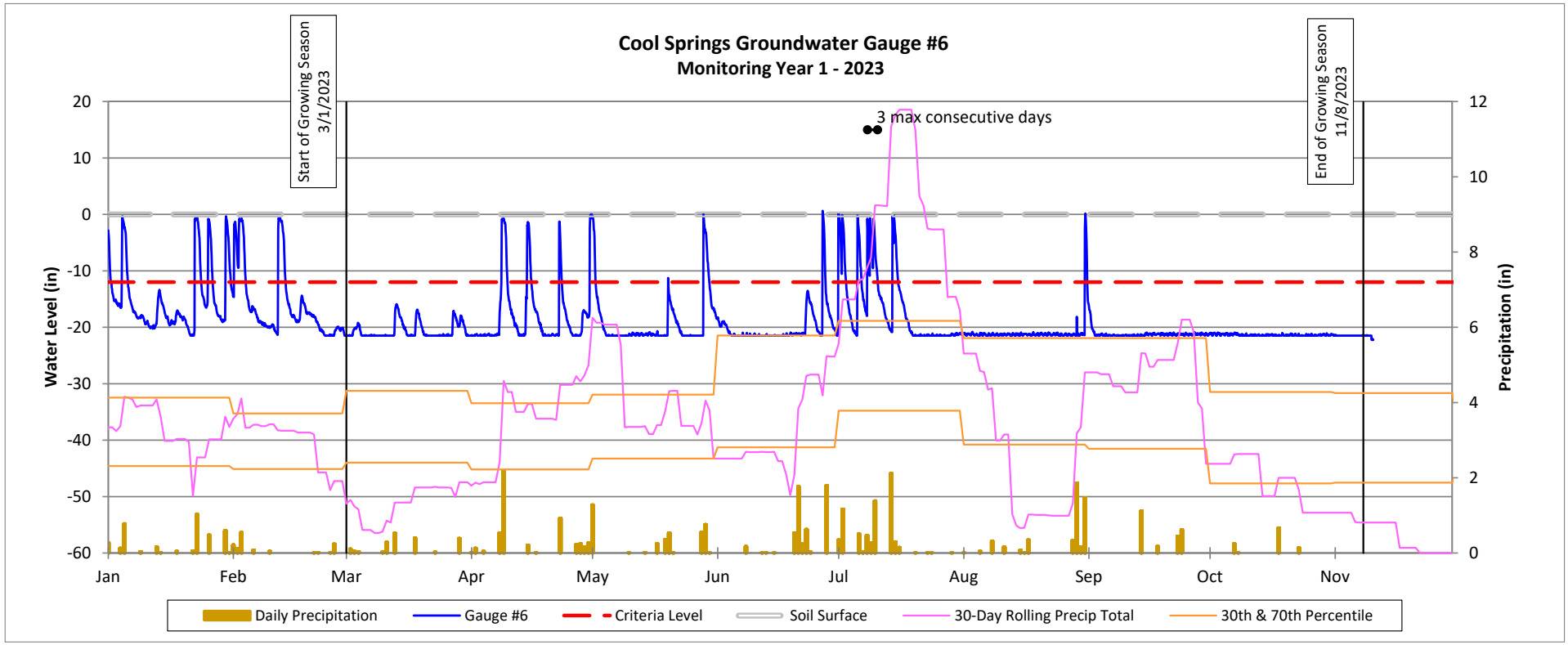


Groundwater Gauge Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

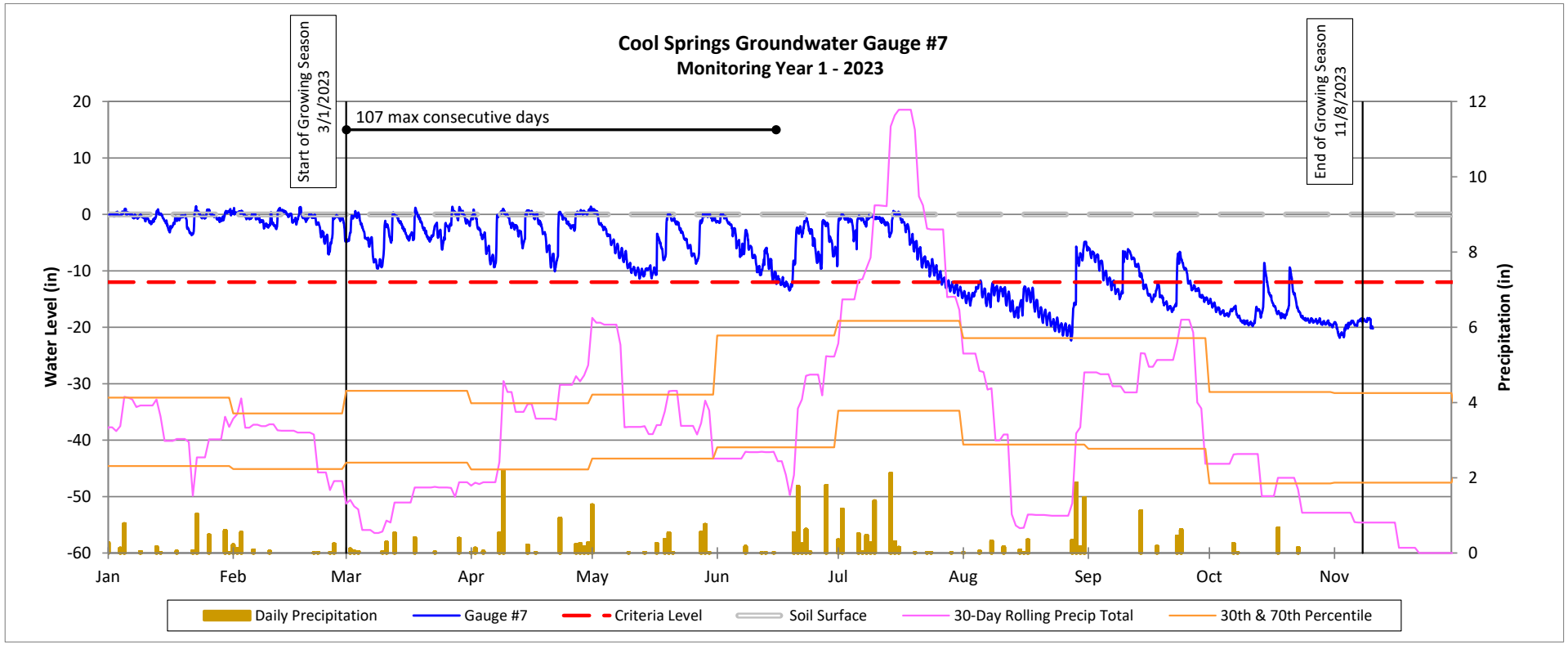


Groundwater Gauge Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023

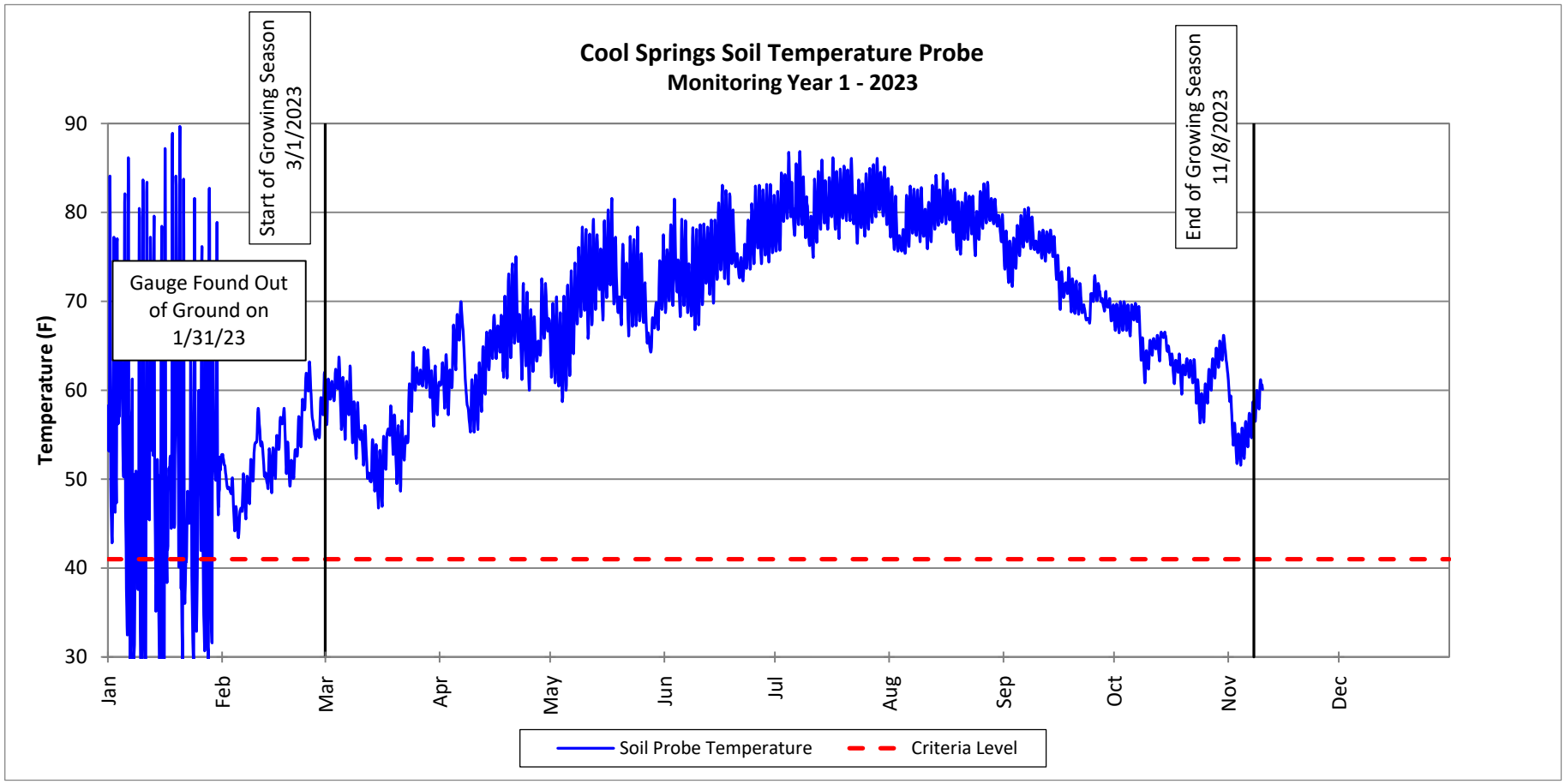


Soil Temperature Probe Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Monitoring Year 1 - 2023



APPENDIX E. PROJECT TIMELINE AND CONTACT INFORMATION

Table 14. Project Activity and Reporting History

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Activity or Deliverable		Data Collection Complete	Task Completion or Deliverable Submission
Project Instituted		NA	July 2020
Mitigation Plan Approved		NA	January 2022
Construction (Grading) Completed		NA	August 2022
Planting Completed		NA	January 2023
As-Built Survey Completed		December 2022	December 2022
Baseline Monitoring Document (Year 0)	Stream Survey	December 2022	May 2023
	Vegetation Survey	January 2023	
	Prescribed Fire Encroachment	April 2023	
Year 1 Monitoring	Soil Ammendments	Spring 2023	December 2023
	Invasive Treatments	Spring and Summer 2023	
	Stream Survey	July 2023	
	Chicken Manure Encroachment	August 2023	
	Vegetation Survey	August 2023	
Year 2 Monitoring	Stream Survey	2024	December 2024
	Vegetation Survey	2024	
Year 3 Monitoring	Stream Survey	2025	December 2025
	Vegetation Survey	2025	
Year 4 Monitoring			December 2026
Year 5 Monitoring	Stream Survey	2027	December 2027
	Vegetation Survey	2027	
Year 6 Monitoring			December 2028
Year 7 Monitoring	Stream Survey	2029	December 2029
	Vegetation Survey	2029	

Table 15. Project Contact Table

Cool Springs Mitigation Site
DMS Project No. 100166
Monitoring Year 1 - 2023

Designer Nicole Millns, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Construction Contractors	**Wildlands Construction** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986

APPENDIX F. ADDITIONAL DOCUMENTATION

December, 2023

Todd Tugwell
Chief – Mitigation Branch
Regulatory Division
Wilmington District, USACE

Subject: Notice of Initial Credit Release/NCDMS Cool Springs Mitigation Site
SAW-2020-01400
Harnett County, North Carolina
DMS Contract Number 0302-02

Dear Mr. Tugwell,

On September 20, 2023, Wildlands Engineering received comments from the North Carolina Interagency Review Team (IRT) regarding the FINAL MY0/As-Built Baseline Report & Record Drawings dated August 30, 2023. The following letter documents IRT feedback and Wildlands' corresponding responses.

Maria Polizzi, DWR:

1) It is difficult to tell from the photograph, but please confirm whether or not there is undercutting occurring on T2 at Photo Point 8.

   There is undercutting occurring on T2 adjacent to Photo Point 8. This portion of T2 is where mechanical repairs are planned to take place on a series of three failing structures. The status of repairs on T2 is documented in the MY1 report.

2) I am not an engineer, so this may be by design, but multiple log sills shown in photographs look high to me. Is there a specification for log size? Did these turn out as expected? Also please confirm that all log sills have footer logs.

   All log sills were installed as designed and have a diameter of at least 12 inches. Footers were used where needed based upon design specifications and site conditions. Large drops visible below log sills are necessary due to the steep slopes of the project channels, with some slopes as high as 8%.

3) Based on the photograph of the culvert at T3, this culvert does not appear to be embedded. DWR would prefer to see embedded culvert designs on future projects.

   The culvert on T3 was embedded during installation, but it is difficult to see in the picture.

4) The riffle at Cross-Section 6 has more rock than DWR would prefer to see. It appears to be just a pile of rocks in the stream rather than a constructed riffle.

This feature was built as a constructed riffle, but was placed in a manner that falls short of typical Wildlands Construction quality. Wildlands will implement hand repairs to achieve a higher quality constructed riffle at cross-section 6.

5) DWR appreciates the justification for red-line changes provided in Section 2.1.

   Noted. Wildlands will continue including justification for red-line changes to record drawings in future As-Built Reports.

6) There are a handful of deviations from the design that were captured in the cross-sections, some of which are outside the performance standard requirement for entrenchment ratio (must stay over 2.2). Below are a few notable examples:
   a. UT to Cedar Creek: The entrenchment ratio of 1.3, with a design range of 2.2 to 5 and pre-existing conditions at 1.5. This section became more entrenched.
   b. T2: Width/Depth ratio is 27.4 with design at 14. Additionally, the entrenchment ratio is 1.5.
   c. T3 R2: The entrenchment ratio is again lower than the pre-existing conditions and significantly lower than the design.
   d. T6: Entrenchment ratio is 1.3.

   MY0 entrenchment ratios displayed in Appendix C, Table 8, were calculated using incorrect floodprone widths. With corrected floodprone widths, all restoration channel dimensions now either closely align, or fall within, design parameters. The correct entrenchment ratios for MY0 all fall within design parameters, and are as follows:
      a. Ut to Cedar Creek: 5.0
      b. T2: 2.9
      c. T3 R2: 3.9
      d. T4 R2: 3.2
      e. T6: 2.6
      f. T8: 1.9

   The mistake in MY0 calculations has been noted and updated for subsequent monitoring reports.

<u>Todd Tugwell, USACE:</u>

1) Table 1.1 – what do the colors mean? I assume mitigation approach. Please label in future reports.

   The coloration of rows in Table 1 indicates the mitigation approach applied to project stream reaches, and aligns with symbology used within Wildlands' Current Condition Plan View map figures. Blue denotes stream restoration, yellow denotes stream enhancement I, and orange denotes stream enhancement II. Wildlands will include a color key in future monitoring reports.

2) We understand that a repair is planned to rebuild a series of three consecutive failing sills on T2 and stabilizing bank erosion on the downstream right bank of UT to Cedar Creek, which is proposed to be conducted under a non-notifying NWP. The MY0 report also noted that a repair

will occur on T8 in MY1 or MY2. Why would this repair not be conducted at the same time as the repair on T2 and UT to Cedar Creek? I also don't believe it is appropriate to state that "all project streams are stable" when in fact several repairs are planned for failing structures.

Wildlands does not believe a mechanical repair is needed for T8. However, if the need for a mechanical repair on T8 becomes apparent, it will occur at the same time as the mechanical repairs on other project streams.

3) Please be sure to include a discussion about the prescribed burn damage to planted stems in MY1 and replant if needed.

A discussion about the prescribed burn damage to planted stems is included in the MY1 report. The burned area will be assessed during MY2 to determine if replanting is necessary.

4) The flow gauge on T2 appears to be lower on the reach than indicated in the approved mit plan. Additionally, the gauges on T6 and T8 also appear to be lower on the reach than the recommended top third. This was also noted as a comment in the draft mit plan review (reference DWR comment 21). Please note that additional monitoring of flow on intermittent reaches may be required if questions about flow arise during annual reviews. Please ensure that flow gauges are placed in accordance with recommendations on future projects.

Noted. Wildlands is prepared to perform additional monitoring of intermittent reaches if questions about flow arise during annual reviews. Wildlands will work to ensure that flow gauges are placed in accordance with recommendations on all future projects.

5) I appreciate the annotation of gate locations on the project maps.

Noted. Wildlands will continue including annotation of gate locations on project maps.

If you have any questions, please contact me by phone (919) 851-9986, or by email (jlorch@wildlandseng.com).

Sincerely,

Jason Lorch, *Monitoring Coordinator*