MONITORING YEAR 3 ANNUAL REPORT

Final

VILE CREEK MITIGATION SITE

Alleghany County, NC
DEQ Contract No. 5999
DMS Project No. 96582

DWR No. 14-0869
USACE Action ID 2014-01585

Data Collection Period: April – October 2019
Submission Date: December 19, 2019

PREPARED FOR:

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

Mitigation Project Name	**Vile Creek Mitigation Site**	**County**	**Alleghany**	**USACE Action ID**	**2014-01585**
DMS ID	**96582**	**Date Project Instituted**	**6/24/2014**	**NCDWR Permit No**	**2014-0869**
River Basin	**New**	**Date Prepared**	**6/18/2019**		
Cataloging Unit	**05050001**				

Credit Release Milestone	Stream Credits						Wetland Credits							
	Scheduled Releases (Stream)	Warm	Cool	Cold	Anticipated Release Year (Stream)	Actual Release Date (Stream)	Scheduled Releases (Forested)	Riparian Riverine	Riparian Non-riverine	Non-riparian	Scheduled Releases (Coastal)	Coastal	Anticipated Release Year (Wetland)	Actual Release Date (Wetland)
Potential Credits (Mitigation Plan)				**5,146.000**					**5.820**					
Potential Credits (As-Built Survey)				**5,053.014**					**5.703**					
1 (Site Establishment)	**N/A**				N/A	N/A	**N/A**				**N/A**		N/A	N/A
2 (Year 0 / As-Built)	**30%**			1,515.904	2017	7/25/2017	**30%**		1.711		**30%**		2017	7/25/2017
3 (Year 1 Monitoring)	**10%**			505.301	2018	4/25/2018	**10%**		0.570		**10%**		2018	4/25/2018
4 (Year 2 Monitoring)	**10%**			505.301	2019	4/26/2019	**10%**		0.570		**15%**		2019	4/26/2019
5 (Year 3 Monitoring)	**10%**				2020		**15%**				**20%**		2020	
6 (Year 4 Monitoring)	**5%**				2021		**5%**				**10%**		2021	
7 (Year 5 Monitoring)	**10%**				2022		**15%**				**15%**		2022	
8 (Year 6 Monitoring)	**5%**				2023		**5%**				**N/A**		2023	
9 (Year 7 Monitoring)	**10%**				2024		**10%**				**N/A**		2024	
Stream Bankfull Standard	**10%**			505.301	2019	4/26/2019	**N/A**				**N/A**			
Total Credits Released to Date				**3,031.808**					**2.851**					

NOTES:

CONTINGENCIES:

Signature of Wilmington District Official Approving Credit Release

27 Sept 2019

Date

1 - For NCDMS, no credits are released during the first milestone
2 - For NCDMS projects, the second credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the NCIRT by posting it to the NCDMS Portal, provided the following criteria have been met:
1) Approval of the final Mitigation Plan
2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan
4) Reciept of necessary DA permit authorization or written DA approval for porjects where DA permit issuance is not required

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

Mitigation Project Name	**Vile Creek Mitigation Site**		**County**	**Alleghany**	**USACE Action ID**	**2014-01585**
DMS ID	**96582**		**Date Project Instituted**	**6/24/2014**	**NCDWR Permit No**	**2014-0869**
River Basin	**New**		**Date Prepared**	**6/18/2019**		
Cataloging Unit	**05050001**					

DEBITS (released credits only)

			Ratios	1.00917	1.72973	2.57596	5	1.12222	3	2	5	1	3	2	5	1	3	2	5
				Stream Restoration	Stream Enhancment I	Stream Enhancement II	Stream Preservation	Riparian Restoration	Riparian Creation	Riparian Enhancement	Riparian Preservation	Nonriparian Restoration	Nonriparian Creation	Nonriparian Enhancement	Nonriparian Preservation	Coastal Marsh Restoration	Coastal Marsh Creation	Coastal Marsh Enhancement	Coastal Marsh Preservation
As-Built Amounts (feet and acres)				**2,970.000**	**1,088.000**	**3,815.000**		**6.400**											
As-Built Amounts (mitigation credits)				**2,943.013**	**629.000**	**1,481.001**		**5.703**											
Percentage Released				**60%**	**60%**	**60%**		**50%**											
Released Amounts (feet / acres)				**1,782.000**	**652.800**	**2,289.000**		**3.200**											
Released Amounts (credits)				**1,765.808**	**377.400**	**888.601**		**2.851**											
NCDWR Permit	USACE Action ID	Project Name																	
2013-0777	2012-01963	NCDOT TIP R-3101 - US 21 Improvements		190.230															
2014-0762	2012-00882	NCDOT R-2915A - US 221 Widening		206.540				0.660											
2014-0762	2012-00882	NCDOT R-2915B - US 221 Widening		494.230	326.400	998.342		0.965											
2014-0762	2012-00882	NCDOT R-2915D - US 221 Widening						0.294											
2014-0762	2012-00882	NCDOT R-2915A - US 221 Widening				154.764													
1997-0616	1997-07161	NCDOT TIP R-0529BA / BB / BD				306.540													
2014-0762	2012-00882	NCDOT R-2915D - US 221 Widening		297.000	108.800	66.356		0.641											
1997-0616	1997-07161	NCDOT TIP R-0529BA / BB / BD		594.000	217.600	762.998													
2014-0762	2012-00882	NCDOT R-2915D - US 221 Widening						0.640											
Remaining Amounts (feet / acres)				**0.000**	**0.000**	**0.000**		**0.000**											
Remaining Amounts (credits)				**0.000**	**0.000**	**0.000**		**0.000**											

PREPARED BY:

WILDLANDS
ENGINEERING

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December 19, 2019

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

RE: **Response to MY3 Draft Report Comments**
Vile Creek Mitigation Project
DMS Project # 96582
Contract Number 5999
New River Basin - #CU# 05050001 - Alleghany County, North Carolina

Dear Mr. Tsomides:

Wildlands Engineering, Inc. (Wildlands) has reviewed the Division of Mitigation Services (DMS) comments from the Draft Monitoring Year 3 report for the Vile Creek Mitigation Project. The following Wildlands responses to DMS's report comments are noted in italics lettering.

Executive Summary – It is stated "*Overall, the Site has partially met the required stream, vegetation, and hydrology success criteria for MY3 and MY5 on track to meet MY7 performance stands/success criteria.*" Why is MY5 being mentioned here?

Wildlands removed MY5 from this sentence.

Section 1.2.5 (Areas of Concern/Adaptive Management Plan):

The section describes and locates stream issues previously identified as well as newer issues and bank instabilities observed by Wildlands but does not relate a plan to address anything. If you are planning to address any stream issues on the site, please indicate what and where (and when).

Wildlands is developing a plan to appropriately address the issues identified in the report. Once completed, Wildlands will submit the plan to DMS for comment before any work is done in 2020.

Gray's lily transplanting is mentioned; please capitalize Gray and provide the scientific name.

Wildlands has added the scientific name to Gray's lily and update the grammatical error.

Thank you for being proactive about bog replanting, treating invasive vegetation on the site, and reseeding the isolated bare areas in the past year.

Wildlands will continue to be proactive on our sites and will continue to closely monitor these areas.

Aggradation is noted at single point stations on UT1b, UT1c, and UT2; can Wildlands give estimates of linear aggradation impacts along these reaches?

Estimates have been included in the report to note the linear footage of aggradation noted along UT2, UT1B, and UT1c.

Section 1.3 (MY3 Summary) – In describing the underperformance of veg plots 5,9, and 14, it is indicated that "*Vegetation plots 5, 9, and 14 may warrant a supplemental planting this winter.*" Please re-state to indicate that areas in and around these plots will be supplemental planted to help establish a native community (or similar) for these sections of the project. In other words, that you are planting more than just the plots.

Wildlands updated the report per DMS's comment above.

Digital Support File review – see email /review comments sent 12/10/2019.

All digital support files have been updated and included with the electronic files per DMS's email.

December 2019 DMS Site Visit Notes – see email/comments sent 12/12/19.

Wildlands reviewed the email and plans to take action to address the stream and easement issues reported by Mr. Tsomides. Wildlands will continue to update DMS and provide a full summary of actions taken in the MY4 report next year.

Enclosed please find two (2) hard copies and one (1) electronic copy on CD of the Final Monitoring Report. Please contact me at 704-332-7754 x101 if you have any questions.

Sincerely,

Andrea S. Eckardt

Andrea S. Eckardt,
Ecological Assessment Team Leader
aeckardt@wildlandseng.com

EXECUTIVE SUMMARY

Wildlands Engineering, Inc. (Wildlands) completed a full-delivery stream and wetland mitigation project at the Vile Creek Mitigation Site (Site) for the North Carolina Division of Mitigation Services (DMS) to restore and enhance a total of 8,056 linear feet (LF) of perennial and intermittent stream and to restore 6.40 acres of riparian wetlands in Alleghany County, NC. The Site is expected to generate 5,053.000 stream mitigation units (SMUs), and 5.703 riparian wetland mitigation units (WMUs) for the New River Basin (Table 1). The Site is located approximately one mile east of the Town of Sparta, NC in the New River Basin eight-digit Hydrologic Unit Code (HUC) 05050001 and the 14-digit HUC 05050001030020 (Figure 1). The Site streams consist of Vile Creek and five unnamed tributaries (UT) to Vile Creek including UT1, UT1b, UT1c, UT2, UT3, and a portion of Little River (Figure 2). Vile Creek flows into Little River near the downstream project boundary. The land adjacent to the streams and wetlands is primarily maintained cattle pasture and forest.

The Site is within a Targeted Local Watershed (TLW) identified in the New River Basin Restoration Priority (RBRP) plan (NCDENR, 2009). The Site is also located within the planning area for the Little River & Brush Creek Local Watershed Plan (LWP). The LWP identified the following stressors to watershed function: Heavily grazed deforested buffer, livestock access to the streams, heavily eroded stream banks, land-disturbing activities on steep slopes, non-point source pollution from the Town of Sparta and surrounding areas, and drained and deforested wetland areas (NCDENR, 2007).

The project goals defined in the mitigation plan (Wildlands, 2016) were established with careful consideration of goals and objectives that were described in the RBRP and to meet DMS mitigation needs while maximizing the ecological and water quality uplift with the watershed. The project goals established in the mitigation plan focused on permanent protection for the Site, re-establishing natural hydrology and vegetation, reducing water quality stressors, and enhancing terrestrial and aquatic habitat.

The Site construction and as-built survey were completed in February 2017. Monitoring Year (MY) 3 assessments and Site visits were completed between April and September 2019 to assess the conditions of the project.

Overall, the Site has partially met the required stream, vegetation, and hydrology success criteria for MY3 and on track to meet MY7 performance stands/success criteria. All restored and enhancement I streams are geomorphically stable and functioning as designed. During MY3, no bankfull events were recorded on Vile Creek Reach 2 but three bankfull events were recorded on UT1 Reach 2. However, bankfull event criteria was already met in MY2. Seven geomorphically significant events were recorded on Vile Creek Reach 2 and UT1 Reach 2. Pebble counts reflect no significant change in restoration and enhancement I stream substrate material. The overall average stem density is 445 stems per acre for woody tree species and 284 stems per acre for shrubs. Therefore, meeting the MY3 requirement of 320 stems per acre for trees and 160 plants per acres for shrubs. Fourteen of seventeen vegetation plots are either meeting or exceeding stem density criteria. Nine of ten gages in the wetland re-establishment and rehabilitation areas are either meeting or exceeding hydrology success criteria.

As requested by the US Fish and Wildlife Service during the IRT site walk in 2017, Wildlands removed the large woody tree species from designated shrubs zoneMY3 and replanted the areas with woody shrub species. Invasive species continue to be present within and around the site. Currently, 13.2 % of the conservation easement contains an invasive species population. Treatments in June of MY3 will be evaluated in MY4.

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APPENDICES

Section 1: PROJECT OVERVIEW

The Site is located approximately one mile east of the Town Sparta in eastern Alleghany County, NC. The project is within the New River Basin eight-digit HUC 05050001 and the 14-digit HUC 05050001030020 (Figure 1). Located in the Blue Ridge Belt of the Blue Ridge Province (USGS, 1998), the project watershed primarily includes managed herbaceous, mixed upland hardwoods, and other forested land. The drainage area for the project streams range from 0.01 square miles to 2.69 square miles.

The project streams consist of Vile Creek and five unnamed tributaries (UT) to Vile Creek including UT1, UT1b, UT1c, UT2, UT3, and a portion of Little River. Stream restoration reaches include Vile Creek (Reaches 1 and 2) and UT1 Reach 2, which together comprise 3,047 linear feet (LF) of perennial stream channel. Stream enhancements reaches include UT1 Reach 1, UT1b, UT1c, UT2, UT3, and a portion of Little River, totaling 5,009 LF. Wetland components include 3.02 acres of wetland rehabilitation and 3.38 acres of wetland re-establishment.

Construction activities were completed by Land Mechanic Designs, Inc. in February 2017. Planting and seeding activities were completed by Bruton Natural Systems, Inc. in February 2017. The land required for construction, management, and stewardship of the mitigation project included portions of five parcels resulting in 25.04 acres of the conservation easement. The project is expected to generate 5,053.000 stream mitigation units (SMUs) and 5.703 riparian wetland mitigation units (WMUs). Annual monitoring will be conducted for seven years with close-out anticipated to commence in 2024 given the success criteria are met.

1.1 Project Goals and Objectives

The Site is intended to provide numerous ecological benefits within the New River Basin. While many of these benefits are limited to the Vile Creek project area, others, such as pollutant removal, reduced sediment loading, and improved aquatic and terrestrial habitat, have farther-reaching effects. Expected improvements to water quality and ecological processes are outlined below as project goals and objectives. These project goals and objectives were established with careful consideration of goals and objectives that were described in the RBRP and to address stressors identified in the LWP.

The following project specific goals established in the mitigation plan (Wildlands, 2016) include:

Goals	Objectives
Reduce pollutant inputs to streams including fecal coliform, nitrogen, and phosphorous.	Exclude cattle from streams and buffers by installing fencing around conservation easements adjacent to cattle pastures. Install wells and drinkers to provide alternative water sources for cattle.
Reduce inputs of sediment into streams from eroding stream banks.	Reconstruct stream channels with stable dimensions. Add bank revetments and in-stream structures to protect restored/enhanced streams.
Return a network of streams to a stable form that is capable of supporting hydrologic, biologic, and water quality functions.	Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions.

Goals	Objectives
Improve aquatic communities in project streams and provide improved habitat for trout migrating from Little River into Vile Creek. *Note: Presence of aquatic organisms and trout will not be tied to project success criteria.*	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.
Raise local groundwater elevations and allow for more frequent overbank flows to provide a source of hydration for floodplain wetlands. Reduce shear stress on channels during larger flow events.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.
Restore wetland hydrology, soils, and plant communities.	Restore riparian wetlands by raising stream beds, plugging existing ditches, removing fill material over relict hydric soils, and planting native wetland species.
Improve and expand Southern Appalachian bog habitat to support bog species such as bog turtles. *Note: Presence of bog turtles will not be tied to project success criteria.*	Widen low lying ditched areas that represent bog conditions.
Create and improve riparian and wetland habitats by planting native vegetation. Provide a canopy to shade streams and reduce thermal loadings. Create a source of woody inputs for streams. Reduce flood flow velocities on floodplain and improve long-term lateral stability of streams. Improve bog habitat by planting herbaceous wetland plants.	Plant native tree and shrub species in riparian zone and wetland areas other than bog areas. Bog areas will be planted with herbaceous species.
Ensure that development and agricultural uses that would damage the site or reduce the benefits of project are prevented.	Establish conservation easements on the site.

1.2 Monitoring Year 3 Data Assessment

Annual monitoring and quarterly Site visits were conducted during MY3 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 Vile Creek Mitigation Plan (Wildlands, 2016).

1.2.1 Stream Assessment

Riffle cross-sections on the restoration and enhancement I reaches should be stable and show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per NCDMS guidance, bank height ratios (BHR) shall not exceed 1.2 and entrenchment ratios (ER) shall be at least 2.2 (C stream type reaches only) for restored channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the appropriate stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include trends in vertical incision or bank erosion. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action would not be taken if channel changes indicate a movement toward stability.

Morphological surveys for the MY3 were conducted in April 2019. All streams within the Site appear stable with some areas exhibiting minor bank scour.

In general, the cross-sections show little change in the bankfull area, maximum depth ratio, and width-to-depth ratio. All cross-sections fell within the parameters defined for channels of the appropriate stream type (Rosgen, 1994 & 1996). During MY3 cross-sections two and seven are exhibiting a bank height ratio greater than 1.2. Cross-section seven degraded during MY1 and has remained stable in subsequent years. Cross section two began to degrade in MY1 and has continued to degrade through MY3. The cross-section is located in between two logs in a rock and roll riffle. It's expected to see some deepening of a scour pool in this location of a rock and roll riffle. The degradation is not expected to affect the structures up and down stream. Wildlands will continue to watch these cross-sections in upcoming monitoring years.

MY3 Pebble counts in UT1 and Vile Creek did not indicate a significant change in bed material compared to previous years. Refer to Appendix 2 for the visual stability assessment table, Current Condition Plan View (CCPV) maps, and reference photographs. Refer to Appendix 4 for the morphological data and plots.

1.2.2 Stream Hydrology Assessment

At the end of the seven-year monitoring period, two or more bankfull events and geomorphically significant (60% of bankfull flow) events must have occurred in separate years within the restoration and enhancement reaches. Additional survey is required following a geomorphically significant event. The additional survey can be completed at any time during the seven-year monitoring period. The survey requirement is two sets of cross-sections two pools and two riffles and one longitudinal profile per design reach. The longitudinal profile must encompass two riffles that are constructed differently.

During MY3, three bankfull events and seven geomorphically significant events were documented on UT1, while no bankfull events and seven geomorphically significant events were documented on Vile Creek Reach 2. With at least three bankfull events occurring in separate years documented on UT1 and at least two bankfull events occurring in separate years documented on Vile Creek, the success criteria for bankfull events has been met on all reaches and partially met for geomorphically significant events.

Although geomprphically significant events were recorded in MY3, the additional required survey was not completed. The additional survey requirement will be completed in MY4. Refer to Appendix 5 for hydrology summary data and plots.

1.2.3 Vegetative Assessment

A total of 25 vegetation monitoring plots were installed during baseline monitoring throughout the project easement to measure the survival of the planted trees, shrubs, and herbaceous vegetation. Seventeen of the plots were established to evaluate woody species composition, density, and survival rates, while 8 of the plots were established to evaluate percent coverage of herbaceous species of bog areas. The size of individual quadrants is 100 square meters (10m x 10m or 5m x 20m) for woody tree and shrub species and 20 square meters (5m x 4m) for herbaceous vegetation bog plots.

Tree and shrub assessments are conducted following the 2006 Carolina Vegetation Survey (CVS) Level 2 Protocol for Recording Vegetation. The final planted stem vegetative success criteria for the Site is the survival of 210 planted stems per acre in the planted riparian and wetland corridor at the end of the required monitoring period (MY7). The interim measure of vegetative success for the Site is the survival of at least 320 planted stems per acre at the end of the third monitoring year (MY3) and at least 260 stems per acre at the end of the fifth monitoring year (MY5). In addition, planted trees must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation plots one and two contain only shrub species; therefore, shrub stem density success criteria of 160 surviving plants per acre at the end of year 3, 130 at the end of year 5, and 105 at the end of year 7 is used for these plots.

There are no height criteria for shrubs. The bog plots are assessed by visually estimating the percent coverage within each plot and must have 80% coverage for success criteria.

The MY3 vegetative survey was completed in September 2019. The MY3 vegetation monitoring resulted in an average planted stem density of 445 stems per acre for woody tree species and 284 stems per acre for shrubs species, both of which exceed the interim requirement of 320 stems per acre for tree species and 160 required for shrub species at MY3 and are on target to meet the requirements for MY5 and MY7. In addition, 14 of the 17 plots individually met the success criteria with a stem density ranging from 364 to 728 stems per acre for tree species and 162 to 405 for shrub species. Vegetation plots five, nine, and fourteen did not meet stem density requirements and may warrant supplemental planting this winter. The bog cells have become well established since project construction. Each with approximately 99% herbaceous coverage, the MY3 monitoring shows all herbaceous bog plots are exceeding success criteria.

Refer to Appendix 2 for vegetation plot photographs and Appendix 3 for vegetation data tables.

1.2.4 Wetland Assessment

A total of ten groundwater hydrology gages (GWG) and two soil temperature gages were established during baseline monitoring within the wetland rehabilitation, wetland re-establishment, and bog areas. A barotroll logger, used to measure barometric pressure and aid in the calculation of groundwater levels, was also installed on-site. Groundwater monitoring gages are downloaded on a quarterly basis and maintained as needed. Under typical precipitation conditions, the final performance success criteria for groundwater hydrology is the documentation of free groundwater within 12 inches of the ground surface for 14 consecutive days (8.5%) of the defined 169-day growing season (April 26 – October 11) for wetlands and 20 consecutive days (12%) of the defined 169-day growing season (April 26 – October 11) for bog areas.

Nine of the Site's ten GWGs met the success criteria for MY3, with the measured hydroperiod ranging from 2% to 100% of the growing season. While the attainment criteria for hydrologic success for most of the wells increased or remained the same in comparison to previous years, GWGs 2, 3, 7, and 8 showed a decrease in the number of consecutive days when groundwater was within 12 inches of the ground surface for MY3. GWG 8 was the only well that did not meet the hydrology requirement for MY3. During MY1 a berm was lowered that was initially backing up 6-10 inches of water. A significant drop in ground water attainment for GWG 8 occurred between MY1 and MY2. In MY3 GWG 8 hydrology continued to decrease. Wildlands will continue monitoring this change to determine if the addition of another well may be needed to document hydrologic conditions for this area.

Rainfall data collected from the NC-AG-1-Sparta 3.5 SSW(NCCRONOS) rain gage, showed average to above average rainfall for a majority of the growing season. The months of March, May, August, and September saw below average rainfall.

Refer to the CCPV Maps in Appendix 2 for the groundwater gage locations and Appendix 5 for groundwater hydrology and average rainfall summary data and plots.

1.2.5 Areas of Concern/Adaptive Management Plan

Following Hurricane Michael and Florence in Fall 2018, areas of scour and erosion were observed along several meander bends. Many of the areas observed at the end of MY2 have re-established with vegetation and appear stable. However, the following areas are now experiencing localized bank instability and include: Vile Creek Reach 1 station 103+05, Vile Creek Reach 2 station 120+60-120+90, Vile Creek Reach 3 station 124+00, UT1 Reach 1 between stations 210+60 – 210+80, and UT2 stations 305+00 and 306+50. Areas of aggradation along enhancement II reaches, UT2 (Stations 308+50 (23') and

211+50 (41')), UT1b (station 251+20 (51')), and UT1c (Station 271+50 (109')), have resulted in sheet flow onto the floodplain rather than maintaining flow within a single thread channel. Two headcuts have formed on UT2 at stations 302+40 and 309+80. The BMP at the top of UT2 has formed a headcut at the intake from a natural crenulation flowing into the BMP. Wildlands plans to address areas of localized bank instability across the site and further evaluate headcut and aggradation areas of concern during winter 2019/2020. All completed repairs will be included in MY4 monitoring report.

The areas surrounding the bogs near Vile Creek Reach 2 were previously planted incorrectly with trees. In June of MY3, the trees were removed from these areas and planted with shrubs. In addition, the transplanted Gray's lily (*Lilium grayi*) near GWG 7 was found and monumented. A second population of Gray's lily found downstream was also monumented.

Invasive species including Japanese barberry (*Berberis thunbergii*), Oriental bittersweet (*Celastrus orbiculatus*), and multiflora rose (*Rosa multiflora*) continue to be present within and around the Site. Previous invasive species treatments have included cutting the plants and applying glyphosate the stumps or stems and have reduced the invasive species population from 17.4% in MY2 to 13.2% in MY3. Although, these species are not impacting survival rates of planted stems at this time, these areas will likely warrant additional treatment to prevent any advancement within the conservation easement and future impacts to the Site. Treatments conducted in June of MY3 will be evaluated in MY4. Wildlands will continue to monitor the areas of concern and take action as necessary.

Less than 1% of the easement contains areas of poor herbaceous cover. The areas are located between GWGs 8 and 9, along the right bank of UT2 near station 305+00, and the left bank of Vile Creek Reach 3 located at the boulder toe between stations 124+00 and 124+50. These areas were reseeded in June of MY3 with a custom erosion control mix of native species. These areas will be reassessed in MY4 to determine the success of the supplemental planting application.

Refer to Appendix 2 for the vegetation condition assessment table and the CCPV map.

1.3 Monitoring Year 3 Summary

The majority of the streams within the Site appear to be stable and functioning as designed. Multiple gemorphically significant events were documented for UT1 and Vile Creek, as well as and multiple bankfull events on UT1; therefore, the Site has partially met the stream hydrological success criteria. The average planted stem density for the Site is 445 stems per acres and shrub density is 284 stems per acre, which is on track to meet the MY7 success criteria with 14 of the 17 individual vegetation plots meeting the MY3 success criteria. The areas in and around vegetation plots 5, 9, and 14 may warrant a supplemental planting this winter to help establish a native community. The bog cells have become well established, with approximately 99% coverage of herbaceous vegetation. Nine of the ten groundwater gages met the success criteria for MY3; however, a decrease was observed in the hydrology for multiple gages. Planned management and maintenance will continue to address any areas of concerns that should advance or arise.

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. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan documents available on DMS's website. All raw data supporting the tables and figures in the appendices are available from DMS upon request.

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 either a Trimble or Topcon handheld GPS with sub-meter accuracy and processed using Pathfinder and ArcGIS. Crest gages were installed in surveyed riffle cross sections and monitored quarterly. Hydrologic monitoring instrument installation and monitoring methods are in accordance with the United States Army Corps of Engineers (USACE, 2016) standards. Planted woody vegetation is being monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006).

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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North Carolina Department of Environment and Natural Resources. 2009. New River Basin Restoration Priorities. Retrieved from http://deq.nc.gov/about/divisions/mitigation-services/dms-planning/watershed-planning-documents/new-river-basin.

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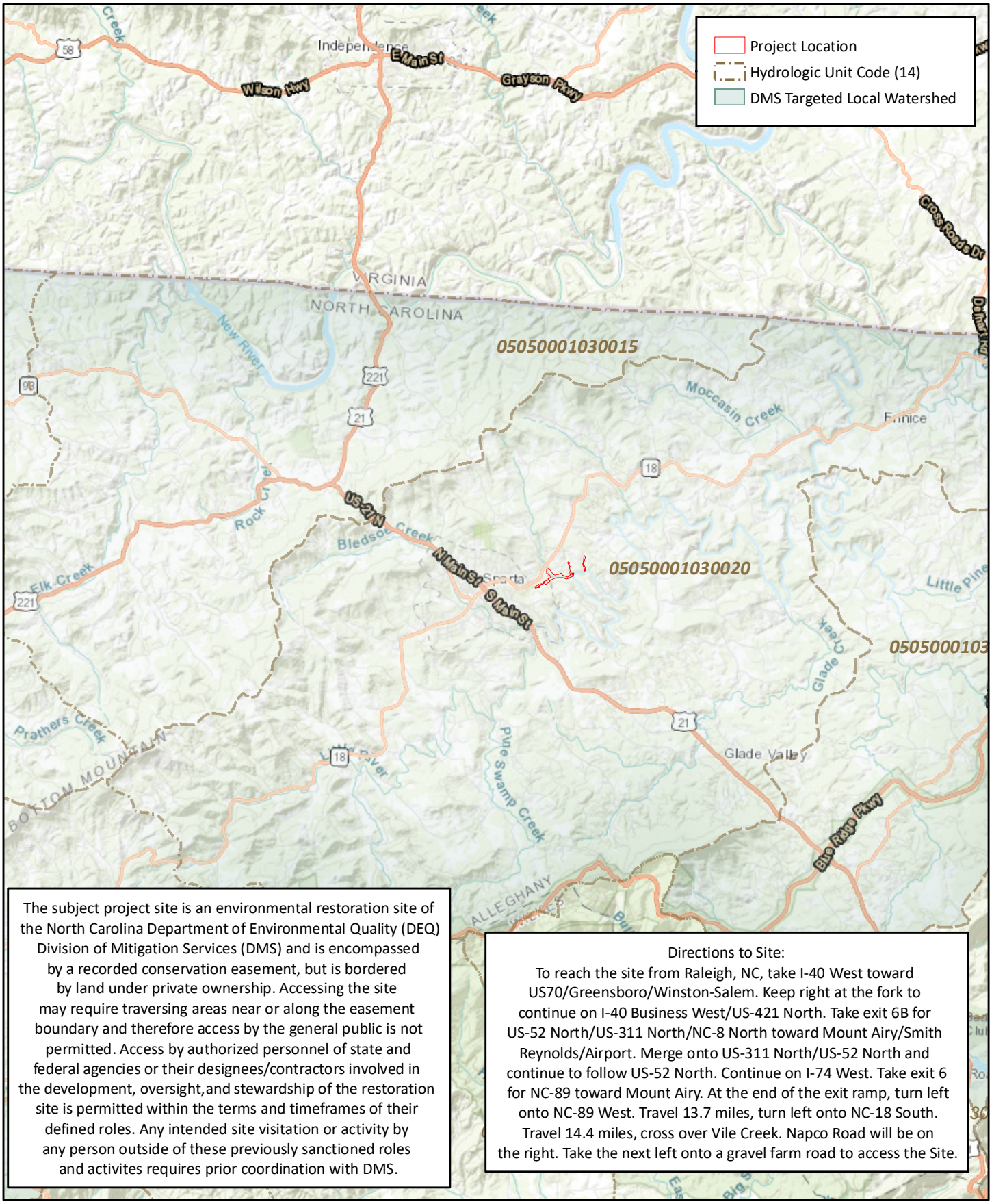
APPENDIX 1. General Figures and Tables



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:
To reach the site from Raleigh, NC, take I-40 West toward US70/Greensboro/Winston-Salem. Keep right at the fork to continue on I-40 Business West/US-421 North. Take exit 6B for US-52 North/US-311 North/NC-8 North toward Mount Airy/Smith Reynolds/Airport. Merge onto US-311 North/US-52 North and continue to follow US-52 North. Continue on I-74 West. Take exit 6 for NC-89 toward Mount Airy. At the end of the exit ramp, turn left onto NC-89 West. Travel 13.7 miles, turn left onto NC-18 South. Travel 14.4 miles, cross over Vile Creek. Napco Road will be on the right. Take the next left onto a gravel farm road to access the Site.

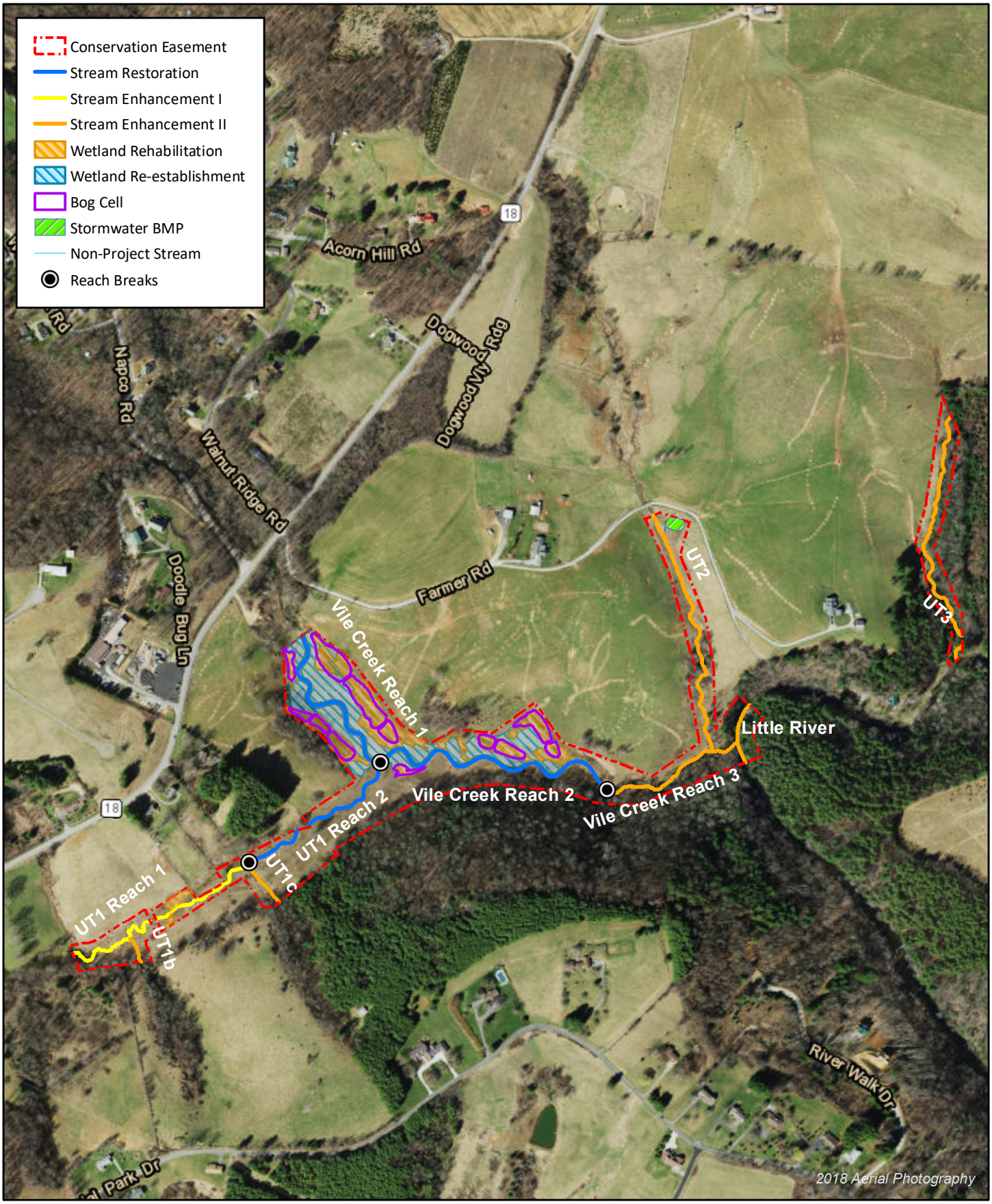
WILDLANDS ENGINEERING

0 1 2 Mile

N

Figure 1 Project Vicinity Map
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC



WILDLANDS ENGINEERING

0 300 600 Feet

N

Figure 2 Project Component Map
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC

Table 1. Project Components and Mitigation Credits
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

MITIGATION CREDITS									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,053.000	N/A	5.703	N/A	N/A	N/A	N/A	N/A	N/A

PROJECT COMPONENTS											
Reach ID	Existing Footage/ Acreage	Design Footage/ Acreage	Approach	Restoration (R) or Restoration Equivalent (RE)	As-Built Stationing/ Location[3]	As Built Footage/ Acreage[3]	Creditable As Built Footage/ Acreage[1,3]	Mitigation Ratio	Buffer Width Credit Reduction[2]	As-Built Credits (SMU/WMU)[2,3]	Notes
STREAMS											
Vile Creek Reach 1	962	920	P1	Restoration (R)	101+81 - 110+63	882	882	1:1	N/A	882.000	Alignment changed from mitigation plan/final design due to bedrock obstruction.
Vile Creek Reach 2	1,247	1,260	P1	Restoration (R)	110+63 -123+74	1,311	1,311	1:1	N/A	1,311.000	Alignment changed from mitigation plan/final design due to bedrock obstruction.
Vile Creek Reach 3	714	714	Bank Grading/ Fencing/Planting	Enhancement II (R)	123+74 - 130+87	713	713	2.5:1	6	279.000	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1 Reach 1	1,143	1,107	Reconstructing channel to correct profile & cross section	Enhancement I (R)	201+60 - 207+16 & 207+42 - 212+74	1,114	1,088	1.5:1	95	630.000	Excludes one 25 foot easement crossing break from 207+13 - 207+38. As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1 Reach 2	989	825	P1	Restoration (R)	212+74 - 215+68 & 216+45 - 221+28	854	777	1:1	27	750.000	Excludes 77 feet of stream outside of conservation easement from 215+68 - 216+45. Alignment changed from design due to bedrock obstruction. As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1B	128	128	Fencing/Planting	Enhancement II (R)	250+36 - 251+64	128	128	2.5:1	3	48.000	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT1C	234	228	Fencing/Planting	Enhancement II (R)	270+53 - 272+81	228	228	2.5:1	2	89.000	As-Built credits were reduced for areas where easement is restricted and the full buffer width is not possible.
UT2	1,226	1,226	Fencing/Planting	Enhancement II (R)	300+36 - 312+62	1,226	1,226	2.5:1	N/A	490.000	
UT3	1,316	1,236	Fencing/Planting	Enhancement II (R)	401+10 - 412+94 & 413+29 - 414+26	1,316	1,236	2.5:1	33	461.000	Creditable length reduced by 45 LF to account for 45 LF of alignment that does not have the full bankfull width within the CE.
Little River	284	284	Fencing/Planting	Enhancement II (R)	502+33 - 505+17	284	284	2.5:1	N/A	114.000	
WETLANDS											
Wetland Rehabilitation	3.02	3.02	Planting / Minor grading	Restoration (R)	N/A	3.02	3.02	1.3:1	N/A	2.323	
Wetland Re-establishment	0	3.50	Grading / Planting	Restoration (R)	N/A	3.38	3.38	1:1	N/A	3.380	The reduction in wetland re-establishment acreage from design to as-built stages was mainly due to Vile Creek Reaches 1 and 2 having wider top widths in the as-built survey than in the design wetland area calculations. Thus, Vile Creek cut more into the wetland area in the as-built plans than it did in the design calculations, resulting in lower as-built wetland acreage.

[1] Creditable As-Built footage excludes conservation easement breaks and a section along UT3 that exists outside of conservation easement.
[2] As-Built credits (SMUs) have been adjusted where the easement is restricted and the full buffer width and/or bankfull width is not fully contained within the conservation easement. The reductions are greater in the as-built compared to the mitigation plan. The as-built credit reductions follows the updated 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation update.
[3]Stream mitigation credits and stationg noted above are based on the as-built stream centerline.

COMPONENT SUMMATION					
Restoration Level	Stream (LF)	Riparian Wetland (acres)	Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
Restoration	3,047.000				
Enhancement I	1,114.000				
Enhancement II	3,895.000				
Wetland Rehabilitation		3.020			
Wetland Re-establishment		3.380			

Table 2. Project Activity and Reporting History

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Activity or Report		Data Collection Complete	Completion or Scheduled Delivery
Mitigation Plan		N/A	June 2016
Final Design - Construction Plans		N/A	June 2016
Construction		N/A	February 2017
Temporary S&E mix applied to entire project area[1]		N/A	February 2017
Permanent seed mix applied to reach/segments[1]		N/A	February 2017
Bare root and live stake plantings for reach/segments		N/A	February 2017
Baseline Monitoring Document (Year 0)	Stream Survey	March 2017	April 2017
	Vegetation Survey	April 2017	
Year 1 Monitoring	Stream Survey	September 2017	December 2017
	Vegetation Survey	September 2017	
Year 2 Monitoring	Stream Survey	April 2018	November 2018
	Vegetation Survey	September 2018	
Year 3 Monitoring	Stream Survey	April 2019	December 2019
	Shrub Planting	June 2019	
	Invasive Treatment	June 2019	
	Vegetation Survey	September 2019	
Year 4 Monitoring	Stream Survey	2020	December 2020
	Vegetation Survey	2020	December 2020
Year 5 Monitoring	Stream Survey	2021	December 2021
	Vegetation Survey	2021	December 2021
Year 6 Monitoring	Stream Survey	2022	December 2022
	Vegetation Survey	2022	December 2022
Year 7 Monitoring	Stream Survey	2023	December 2023
	Vegetation Survey	2023	December 2023

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

Table 3. Project Contact Table

Vile Creek Mitigation Site
DMS Project No.96582
Monitoring Year 3 - 2019

Designer Jeff Keaton, PE	**Wildlands Engineering, Inc.** 1430 South Mint Street, Ste 104 Charlotte, NC 28205 704.332.7754
Construction Contractor	**Land Mechanics Design, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Seeding Contractor	**Land Mechanics Design, Inc.** 126 Circle G Lane Willow Spring, NC 27592
Seed Mix Sources	**Green Resource, LLC**
Nursery Stock Suppliers **Bare Roots** **Live Stakes** **Plugs**	 **Dykes and Son Nursery** **Bruton Natural Systems, Inc.; Foggy Mountain Nursery, LLC** **Wetland Plants Inc.**
Monitoring Performers	**Wildlands Engineering, Inc.**
Monitoring, POC	Kristi Suggs 704.332.7754, ext. 110

Table 4. Project Information and Attributes
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

PROJECT INFORMATION	
Project Name	Vile Creek Mitigation Site
County	Alleghany County
Project Area (acres)	25.04
Project Coordinates (latitude and longitude)	36.510530° N, -80.104092° W

PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Blue Ridge Belt of the Blue Ridge Province
River Basin	New
USGS Hydrologic Unit 8-digit	05050001
USGS Hydrologic Unit 14-digit	05050001030020
DWR Sub-basin	05-07-03
Project Drainiage Area (acres)	22,912
Project Drainage Area Percentage of Impervious Area	2%
CGIA Land Use Classification	Managed Herbaceous (50%), Forested (45%), Mountain Conifers (3%), Impervious (2%)

REACH SUMMARY INFORMATION

Parameters	Vile Creek Reach 1	Vile Creek Reach 2	Vile Creek Reach 3	UT1 Reach 1	UT1 Reach 2	UT1B	UT1C	UT2	Little River	UT3
Length of Reach (linear feet) - Post-Restoration	882	1,311	713	1,114	854	128	228	1,226	284	1,316
Drainage Area (acres)	1,375	1,639	1,720	190	218	8	8	80	22,912	38
NCDWR Stream Identification Score - Pre-Restoration	45.5	45.5	45.5	43	43	28.25	26	27, 42.5	49.5	33.5
NCDWR Water Quality Classification	C									
Morphological Desription (stream type) - Pre-Restoration	C3	C4	C4	E4b	F4b	E4b	E4b	B4	C4	B4a
Evolutionary Trend (Simon's Model) - Pre-Restoration	IV	IV	IV	III	IV	III	III	II	I	III
Underlying Mapped Soils	Alluvial land, wet (Nikwasi); Chandler silt loam; Chandler stony silt loam; Chester loam; Chester stony loam; Clifton loam; Fannin silt loam; Stony Steep Land; Tate loam; Tusquitee loam; Watauga loam									
Drainage Class	Very poorly drained (Alluvial land, wet (Nikwasi); Well Drained (Chester loam, Chester stony loam, Clifton loam, Fannin silt loam, Tate loam, Tusquitee loam, Watauga loam); Somewhat excessively drained (Chandler silt loam, Chandlery stony silt loam); Excessively drained (Stony steep land).									
Soil Hydric Status	A/D (Nikwasi); A (Chandler silt loam, Chandler stony silt loam, Tusquitee loam, Stony steep land); B (Chester silt loam, Chester stony loam, Clifton loam, Fannin silt loam, Tate loam, Watauga loam)									
Valley Slope - Pre-Restoration	0.017	0.016	0.015	0.032	0.033	0.071	0.067	0.048	N/A	0.070
FEMA Classification	AE									
Native Vegetation Community	Montane Alluvial Forest, Southern Appalachian Bog									
Percent Composition Exotic Invasive Vegetation -Post-Restoration	<1%									

REGULATORY CONSIDERATIONS

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	USACE Nationwide Permit No.27 and DWQ 401 Water Quality Certification No. 3885. Action ID# SAW-2014-01585
Waters of the United States - Section 401	Yes	Yes	
Division of Land Quality (Dam Safety)	N/A	N/A	N/A
Endangered Species Act	Yes	Yes	Vile Creek Mitigation Site Categorical Exclusion (CE) Approved 9/15/2014
Historic Preservation Act	Yes	Yes	No historic resources were found to be impacted (letter from SHPO dated 7/25/2014)
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	No impact application was prepared for local review. No post-project activities required.	Vile Creek Final Mitigation Plan (June 2016) and Vile Creek Categorical Exclusion (CE) Approved 9/15/2014
Essential Fisheries Habitat	No	No	Vile Creek Final Mitigation Plan (June 2016) and Vile Creek Categorical Exclusion (CE) Approved 9/15/2014

MEETING SUMMARY

Vile Creek Mitigation Site IRT Meeting

Meeting Date: July 18, 2017

Meeting Attendees
Todd Tugwell/USACE
Andrea Hughes/USACE
Kim Browning/USACE
Mac Haupt/NCDWR
Marella Buncick/USFWS
Sue Cameron/USFWS
Gabrielle Graeter/NCWRC
Paul Wisener/NCDMS
Harry Tsomides/NCDMS
Shawn Wilkerson/Wildlands
Jeff Keaton/Wildlands

On July 18, representatives from Wildlands Engineering met with several members of the Inter-Agency Review Team and NC Division of Mitigation Services on site to observe and discuss the construction and performance of the bog habitat built on site. The key topics of the discussion are described below.

1. Break up flow paths in bog area

   The middle bog area on the left floodplain along Vile Creek Reach 1 has some concentrated flow paths that seem to consistently convey water through the bog. These are a risk for headcutting. The flow will be dispersed by placing three coir logs across the concentrated flow paths. They will be staked in place. The coir logs are only intended to be a temporary measure to prevent erosion until the vegetation becomes fully established. The approximate location for the coir logs is shown on the attached map.

2. Lowering of bog area berm

   The most downstream bog area has approximately 6 to 10 inches of water backed up behind the berm (see attached map). This particular berm was constructed slightly too high. Wildlands has agreed to lower the spillway elevation on this berm by about six inches to reduce the depth of water ponded behind the berm. This will be done with manual labor in order to minimize the impacts on the surrounding wetlands and vegetation.

3. Transplant Gray's Lily

   Because one or two specimens of Gray's Lily identified on site were graded over during construction, Wildlands located a source for the flowers to transplant on the site. During the site visit, a Gray's Lily was found adjacent to a bog area on the left floodplain of Vile Creek Reach 2. U.S. Fish and Wildlife Service representatives asked Wildlands to install the transplants in the same area as the existing plant. On Thursday, July 20 Wildlands planted three Gray's Lily bulbs in this location (see attached map).

4. Remove trees from shrub planting zones and replant with shrubs

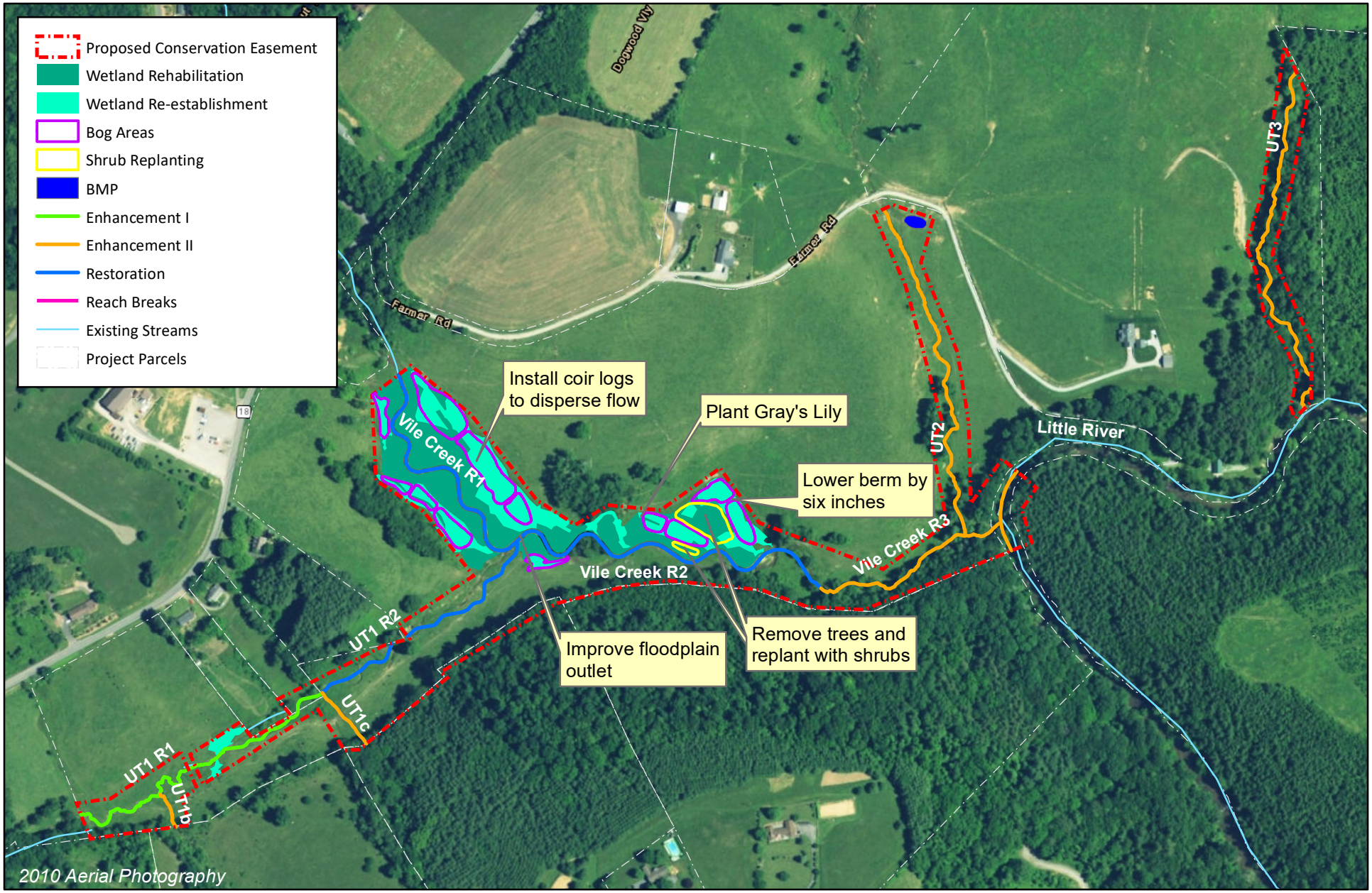
   In a couple of areas along Vile Creek, at least some trees were planted in shrub zones. This is a problem because the shrub zones were planned to minimize shade on the bog areas. Trees will create undesirable shade on the bogs. Wildlands will remove the trees from these areas and replant with shrubs. The primary areas where trees are planted in shrub zones are shown on the attached map. **Action Item: Please review the attached map and coordinate with Jeff Keaton if there are other areas where trees are planted in a shrub zone. Please also review the approved planting plan map submitted with the final mitigation plan (also included) to make sure the any additional areas are within planned shrub zones.**

5. Improve floodplain outlet

   At the upstream end of Vile Creek Reach 2, there is a floodplain outlet that is not functioning properly (see attached map). Most of the water draining out of a nearby bog area is not entering the channel through the constructed outlet but is draining over a brush toe where the brush overlaps with the riffle. After some discussion, it seems like the best solution is to relocate the outlet to the location where the water wants to flow. Wildlands will relocate the outlet.

6. Meander bend erosion

   At the downstream end of Vile Creek Reach 2 there is some erosion beginning on the outside of a meander bend. The group agreed that this area does not need remedial action at this point but Wildlands agreed to continue to watch this area going forward. If remedial action becomes necessary, Wildlands will stabilize the bank and correct the problem.



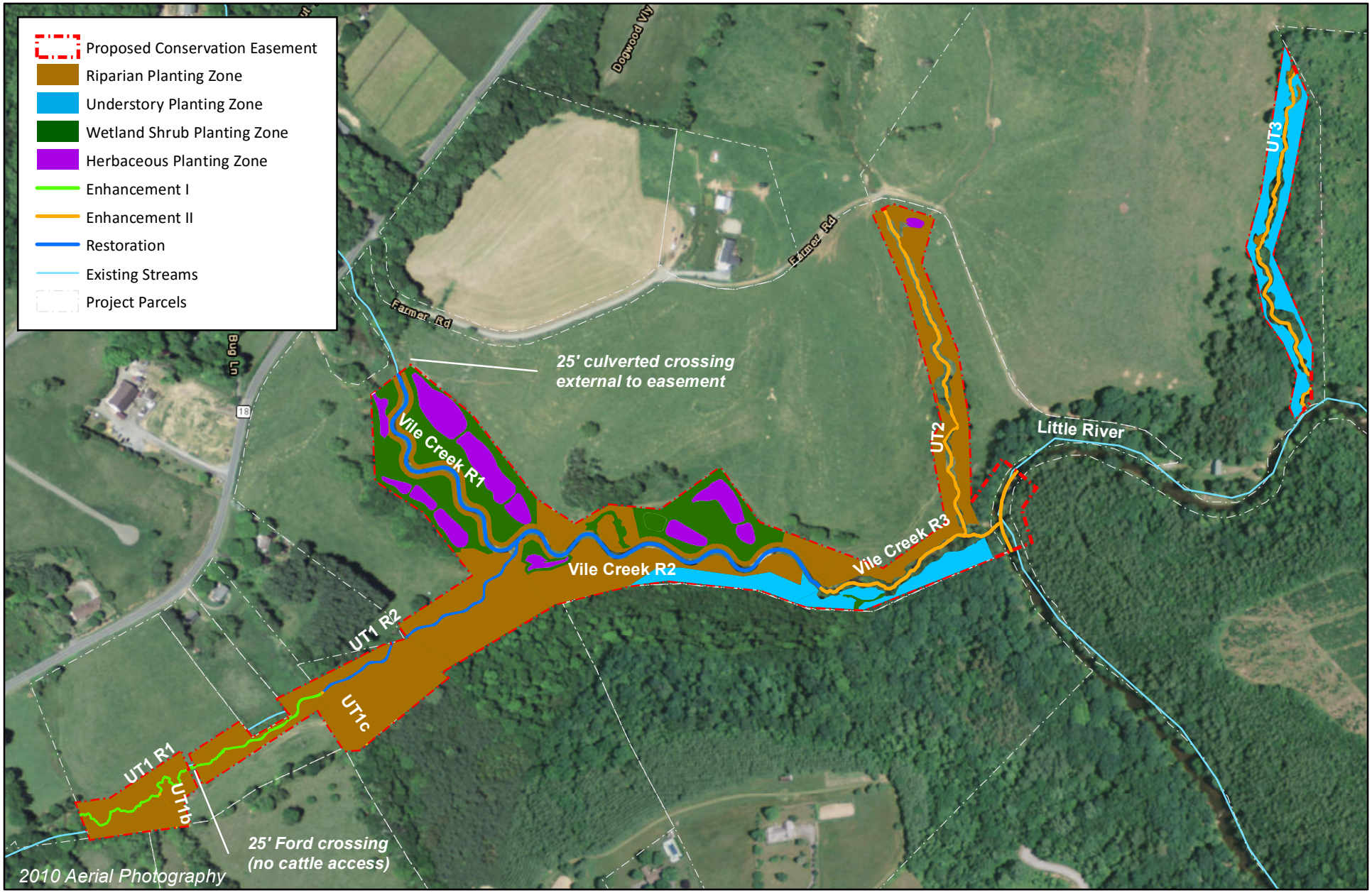
WILDLANDS ENGINEERING

0 225 450 Feet

N

Vile Creek Mitigation Site
New River Basin 05050001

Alleghany County, NC



WILDLANDS ENGINEERING

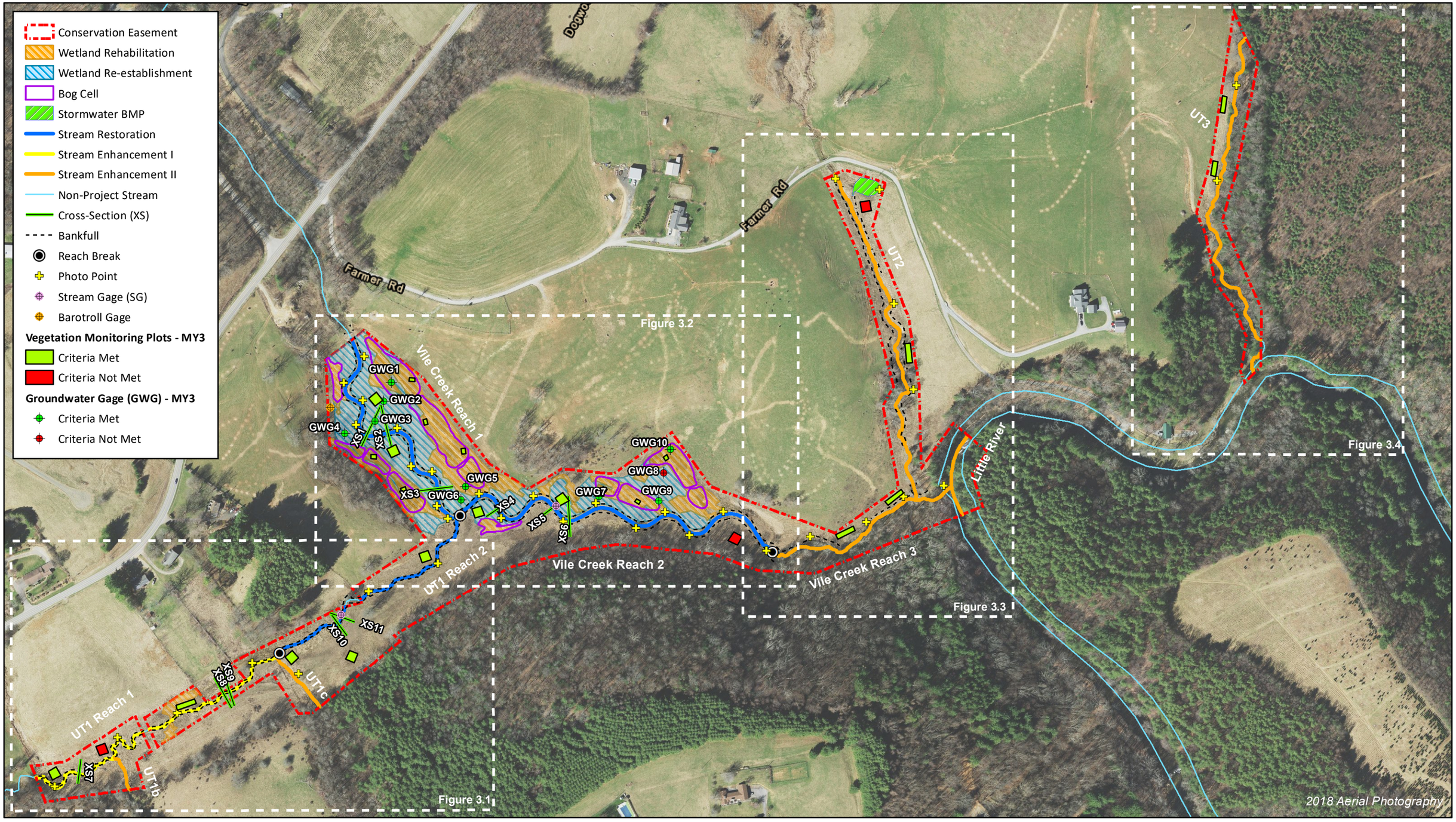
0 225 450 Feet

N

Figure 12 Proposed Planting Overview
Vile Creek Mitigation Site
New River Basin 05050001

Alleghany County, NC

APPENDIX 2. Visual Assessment Data



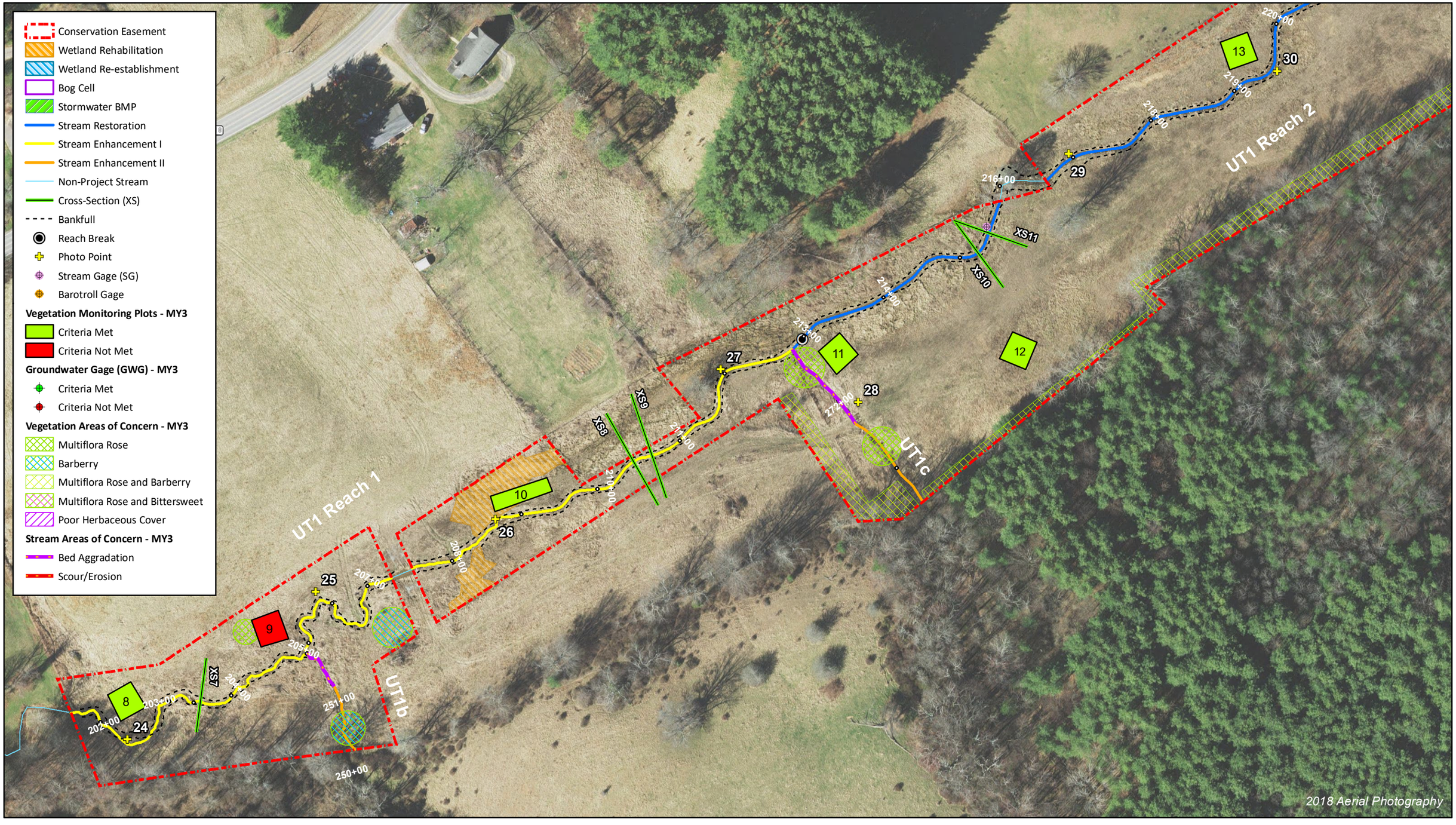
WILDLANDS ENGINEERING

0 300 600 Feet

N

Figure 3.0 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC



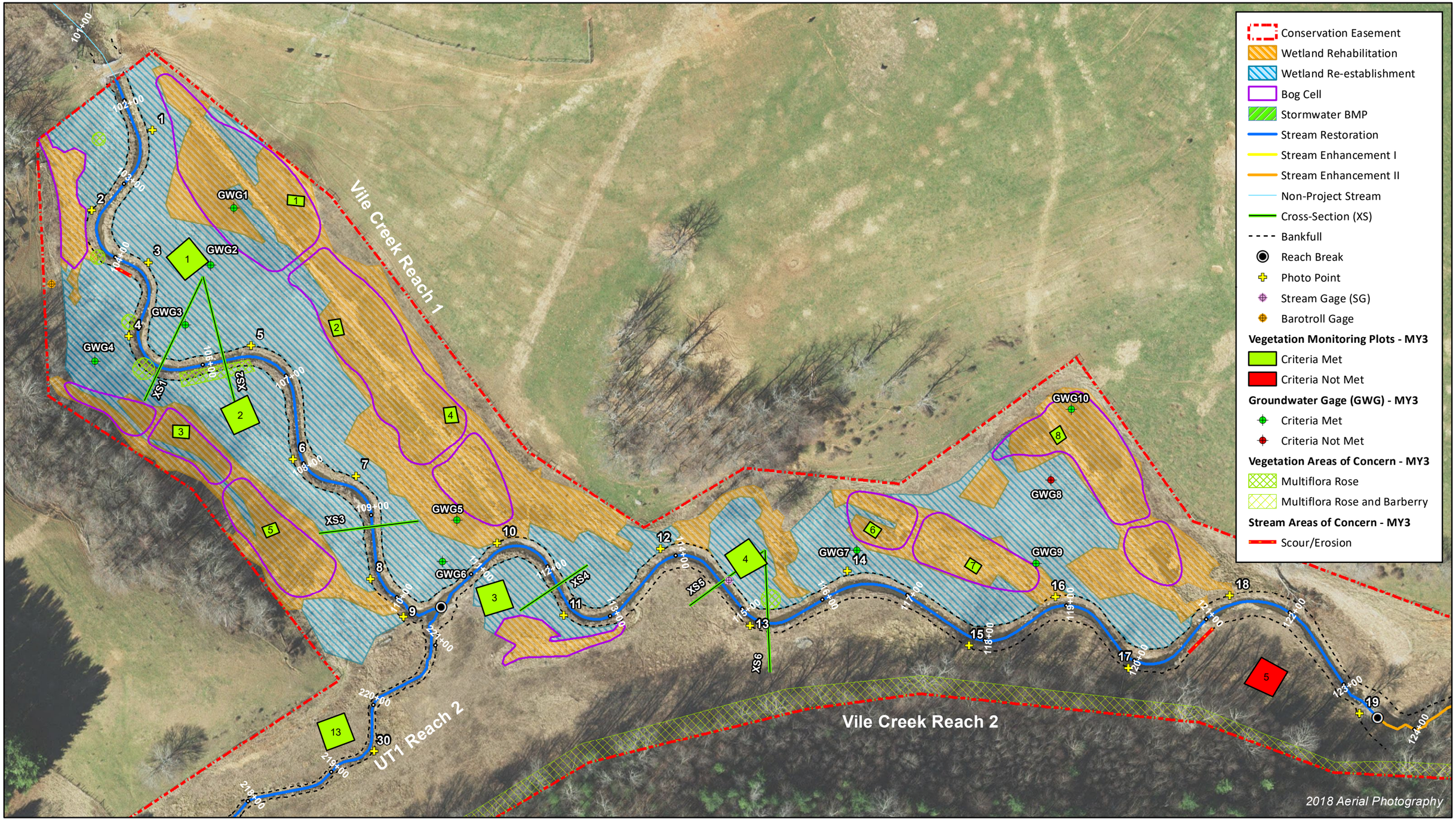
WILDLANDS ENGINEERING

0 100 200 Feet

N

Figure 3.1 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC

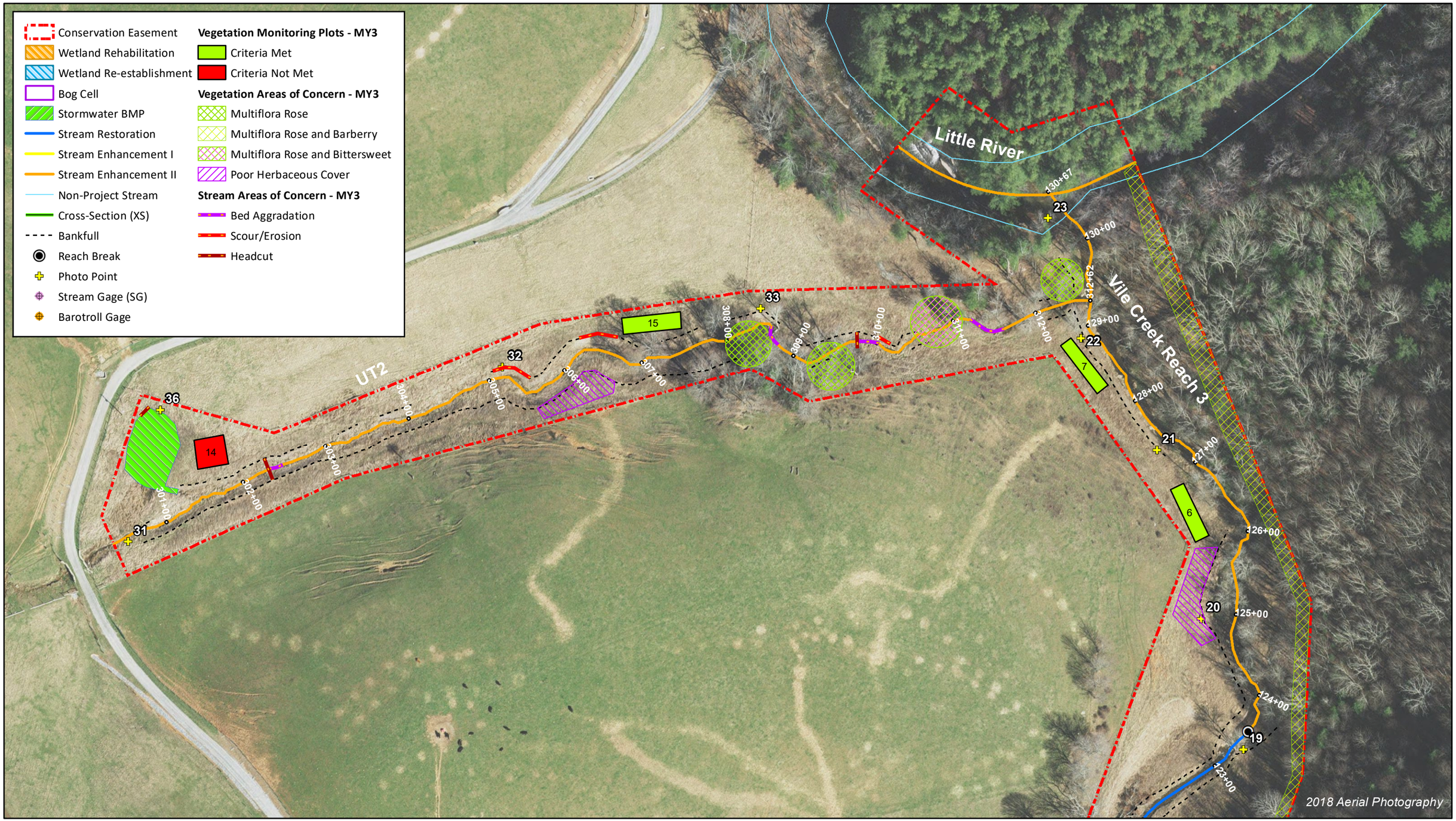


WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.2 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC



WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.3 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC

WILDLANDS ENGINEERING

0 100 200 Feet

Figure 3.4 Integrated Current Condition Plan View
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Alleghany County, NC

Table 5a. Visual Stream Morphology Stability Assessment Table

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

UT1 Reach 1 (1,114 LF)

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	22	22			100%			
	3. Meander Pool Condition	Depth Sufficient	14	14			100%			
		Length Appropriate	14	14			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	14	14			100%			
		Thalweg centering at downstream of meander bend (Glide)	14	14			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]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	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			

[1]Excludes constructed riffles since they are evaluated in section 1.

N/A - Not applicable: No Engineered Structures applies to UT1 Reach 1

Table 5b. Visual Stream Morphology Stability Assessment Table

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

UT1 Reach 2 (854 LF)

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	11	11			100%			
	3. Meander Pool Condition	Depth Sufficient	11	11			100%			
		Length Appropriate	11	11			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	11	11			100%			
		Thalweg centering at downstream of meander bend (Glide)	11	11			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]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	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			

[1]Excludes constructed riffles since they are evaluated in section 1.

N/A - Not applicable: No Engineered Structures applies to UT1 Reach 2

Table 5c. Visual Stream Morphology Stability Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 1 (882 LF)

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. Meander Pool Condition	Depth Sufficient	4	4			100%			
		Length Appropriate	4	4			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	4	4			100%			
		Thalweg centering at downstream of meander bend (Glide)	4	4			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			1	15	99%	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	1	15	99%	0	0	100%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	2	2			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	2	2			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	2	2			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%.	2	2			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	2	2			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5d. Visual Stream Morphology Stability Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 2 (1,311 LF)

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	11	11			100%			
	3. Meander Pool Condition	Depth Sufficient	8	8			100%			
		Length Appropriate	8	8			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	8	8			100%			
		Thalweg centering at downstream of meander bend (Glide)	8	8			100%			
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			1	30	99%	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	1	30	99%	0	0	99%
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	6			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%.	6	6			100%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow.	6	6			100%			

[1]Excludes constructed riffles since they are evaluated in section 1.

Table 5e. Visual Stream Morphology Stability Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 3 (713 LF)

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	1	1			100%			
	3. Meander Pool Condition	Depth Sufficient	1	1			100%			
		Length Appropriate	1	1			100%			
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	1	1			100%			
		Thalweg centering at downstream of meander bend (Glide)	1	1			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]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A			
	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			

[1]Excludes constructed riffles since they are evaluated in section 1.
N/A - Not applicable: No Engineered Structures applies to Vile Creek Reach 3

Table 5f. Visual Stream Morphology Stability Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT2: Stations 300+37 -308+00 (763 LF)

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
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			1	16	98%		
		Degradation			0	0	100%		
	2. Riffle Condition	Texture/Substrate	N/A	N/A			n/a		
	3. Meander Pool Condition	Depth Sufficient	N/A	N/A			n/a		
		Length Appropriate	N/A	N/A			n/a		
	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.			2	58	96%	0	0
	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
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0
				Totals	0	0	100%	0	0
3. Engineered Structures[1]	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	N/A	N/A			N/A		
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	N/A	N/A			N/A		
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	N/A	N/A			N/A		
	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		

[1]Excludes constructed riffles since they are evaluated in section 1.
N/A - Not applicable: No Engineered Structures applies to UT2

Table 6. Vegetation Condition Assessment Table
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Planted Acreage **17**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	2	0.1	0.6%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	3	0.1	0.6%
		Total	**5**	**0.2**	**1.2%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 Ac	0	0.0	0.0%
		Cumulative Total	**5**	**0.2**	**1.2%**

Easement Acreage **25**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	18	3.3	13.2%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0.0%

Stream Photographs

Monitoring Year 3

	
Photo Point 1 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 1** – view downstream Vile Creek R1 *(9/17/2019)*
	
Photo Point 2 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 2** – view downstream Vile Creek R1 *(9/17/2019)*
	
Photo Point 3 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 3** – view downstream Vile Creek R1 (*9/17/2019)*

	
Photo Point 4 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 4** – view downstream Vile Creek R1 *(9/17/2019)*
	
Photo Point 5 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 5** – view downstream Vile Creek R1 *(9/17/2019)*
	
Photo Point 6 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 6** – view downstream Vile Creek R1 *(9/17/2019)*

	
Photo Point 7 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 7** – view downstream Vile Creek R1 *(9/17/2019)*
	
Photo Point 8 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 8** – view downstream Vile Creek R1 *(9/17/2019)*
	
Photo Point 9 – view upstream Vile Creek R1 *(9/17/2019)*	**Photo Point 9** – view downstream Vile Creek R1 *(9/17/2019)*

	
Photo Point 10 – view upstream Vile Creek R2 *(10/14/2019)*	**Photo Point 10** – view downstream Vile Creek R2 *(10/14/2019)*
	
Photo Point 11 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 11** – view downstream Vile Creek R2 *(9/17/2019)*
	
Photo Point 12 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 12** – view downstream Vile Creek R2 *(9/17/2019)*

	
Photo Point 13 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 13** – view downstream Vile Creek R2 *(9/17/2019)*
	
Photo Point 14 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 14** – view downstream Vile Creek R2 *(9/17/2019)*
	
Photo Point 15 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 15** – view downstream Vile Creek R2 *(9/17/2019)*

	
Photo Point 16 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 16** – view downstream Vile Creek R2 *(9/17/2019)*
	
Photo Point 17 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 17** – view downstream Vile Creek R2 *(9/17/2019)*
	
Photo Point 18 – view upstream Vile Creek R2 *(9/17/2019)*	**Photo Point 18** – view downstream Vile Creek R2 *(9/17/2019)*

	
Photo Point 19 – view upstream Vile Creek R3 *(9/17/2019)*	**Photo Point 19** – view downstream Vile Creek R3 *(9/17/2019)*
	
Photo Point 20 – view upstream Vile Creek R3 *(9/17/2019)*	**Photo Point 20** – view downstream Vile Creek R3 *(9/17/2019)*
	
Photo Point 21 – view upstream Vile Creek R3 *(9/17/2019)*	**Photo Point 21** – view downstream Vile Creek R3 *(9/17/2019)*

	
Photo Point 22 – view upstream Vile Creek R3 *(9/17/2019)*	**Photo Point 22** – view downstream Vile Creek R3 *(9/17/2019)*
	
Photo Point 23 – view upstream Little River *(9/17/2019)*	**Photo Point 23** – view downstream Little River *(9/17/2019)*
	
Photo Point 24 – view upstream UT1 R1 *(9/17/2019)*	**Photo Point 24** – view downstream UT1 R1 *(9/17/2019)*

	
Photo Point 25 – view upstream UT1 R1 (*9/17/2019*)	**Photo Point 25** – view downstream UT1 R1 (*9/17/2019*)
	
Photo Point 26 – view upstream UT1 R1 (9/17/2019)	**Photo Point 26** – view downstream UT1 R1 (9/17/2019)
	
Photo Point 27 – view upstream UT1 R1 (9/17/2019)	**Photo Point 27** – view downstream UT1 R1 (9/17/2019)

Photo Point 28 – view upstream UT1 R2 *(9/17/2019)*

Photo Point 28 – view downstream UT1 R2 *(9/17/2019)*

Photo Point 29 – view upstream UT1 R2 *(9/17/2019)*

Photo Point 29 – view downstream UT1 R2 *(9/17/2019)*

Photo Point 30 – view upstream UT1 R2 *(9/17/2019)*

Photo Point 30 – view downstream UT1 R2 *(9/17/2019)*

Photo Point 31 – view upstream UT2 *(9/17/2019)*

Photo Point 31 – view downstream UT2 *(9/17/2019)*

Photo Point 31 – view of UT2 BMP *(9/17/2019)*

Photo Point 32 – view upstream UT2 *(9/17/2019)*

Photo Point 32 – view downstream UT2 *(9/17/2019)*

	
Photo Point 33 – view upstream UT2 *(9/17/2019)*	**Photo Point 33** – view downstream UT2 *(9/17/2019)*
	
Photo Point 34 – view upstream UT3 *(9/16/2019)*	**Photo Point 34** – view downstream UT3 *(9/16/2019)*
	
Photo Point 35 – view upstream UT3 *(9/16/2019)*	**Photo Point 35** – view downstream UT3 *(9/16/2019)*

Photo Point 36 –stormwater wetland *(9/17/2019)*

Vegetation Photographs

Monitoring Year 3

Vegetation Plot 1 - *(9/16/2019)*

Vegetation Plot 2 - *(9/16/2019)*

Vegetation Plot 3 - *(9/16/2019)*

Vegetation Plot 4 - *(9/16/2019)*

Vegetation Plot 5 - *(9/16/2019)*

Vegetation Plot 6 - *(9/16/2019)*

Vegetation Plot 7 - *(9/16/2019)*

Vegetation Plot 8 - *(9/17/2019)*

Vegetation Plot 9 - *(9/17/2019)*

Vegetation Plot 10 - *(9/17/2019)*

Vegetation Plot 11 - *(9/17/2019)*

Vegetation Plot 12 - *(9/17/2019)*

Vegetation Plot 13 - *(9/17/2019)*

Vegetation Plot 14 - *(9/16/2019)*

Vegetation Plot 15 - *(9/16/2019)*

Vegetation Plot 16 – (*9/16/2019*)

Vegetation Plot 17 - *(9/16/2019)*

Bog Vegetation Photographs

Monitoring Year 3

Bog Vegetation Plot 1 - *(9/17/2019)*

Bog Vegetation Plot 2 - *(9/17/2019)*

Bog Vegetation Plot 3 - *(9/17/2019)*

Bog Vegetation Plot 4 - *(9/17/2019)*

Bog Vegetation Plot 5 - *(9/17/2019)*

Bog Vegetation Plot 6 - *(9/17/2019)*

	
Bog Vegetation Plot 7 - *(9/17/2019)*	**Bog Vegetation Plot 8** - *(9/17/2019)*

APPENDIX 3. Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Plot	MY3 Success Criteria Met (Y/N)	Tract Mean
1	Y	82%
2	Y	
3	Y	
4	Y	
5	N	
6	Y	
7	Y	
8	Y	
9	N	
10	Y	
11	Y	
12	Y	
13	Y	
14	N	
15	Y	
16	Y	
17	Y	

Table 8. CVS Vegetation Plot Metadata

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Report Prepared By	Jordan Hessler
Date Prepared	10/7/2019 15:28
Database Name	cvs-eep-entrytool-v2.5.0 Vile MY3.mdb
Database Location	Q:\ActiveProjects\005-02147 Vile Creek\Monitoring\Monitoring Year 3 (2019)\Vegetation Assessment
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project 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	96582
project Name	Vile Creek Restoration Project
Description	Stream and Wetland Mitigation
Required Plots (calculated)	17
Sampled Plots	17

Table 9a. Planted and Total Stem Counts

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

			Current Plot Data (MY3 2019)																				
			Vegetation Plot 1*			Vegetation Plot 2*			Vegetation Plot 3			Vegetation Plot 4			Vegetation Plot 5			Vegetation Plot 6			Vegetation Plot 7		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	Red Maple	Tree							1	1	1												
Alnus serrulata	Tag Alder	Shrub Tree																					
Aronia arbutifolia	Red Chokeberry	Shrub																					
Betula nigra	River Birch, Red Birch	Tree										3	3	3	1	1	1	4	4	4			
Carpinus caroliniana	Ironwood	Shrub Tree										1	1	1				2	2	2	1	1	1
Cephalanthus occidentalis	Buttonbush	Shrub Tree	2	2	2	6	6	6															
Cornus amomum	Silky Dogwood	Shrub Tree	1	1	1	3	3	3	13	13	13												
Diospyros virginiana	American Persimmon	Tree																					
Fraxinus pennsylvanica	Green Ash	Tree										3	3	3	3	3	3	2	2	2	7	7	7
Lindera benzoin	Northern Spicebush	Shrub Tree	1	1	1	1	1	1															
Liriodendron tulipifera	Tulip Poplar	Tree																3	3	3			
Platanus occidentalis	Sycamore	Tree										4	4	4	1	1	1	2	2	2	2	2	2
Quercus pagoda	Cherrybark Oak	Tree										2	2	2				3	3	3	2	2	2
		Stem count	4	4	4	10	10	10	14	14	14	13	13	13	5	5	5	16	16	16	12	12	12
		size (ares)		1			1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	3	3	3	3	3	3	2	2	2	4	4	4	3	3	3	5	5	5	3	3	3
		Stems per ACRE	162	162	162	405	405	405	567	567	567	526	526	526	202	202	202	647	647	647	486	486	486

			Current Plot Data (MY3 2019)																				
			Vegetation Plot 8			Vegetation Plot 9			Vegetation Plot 10			Vegetation Plot 11			Vegetation Plot 12			Vegetation Plot 13			Vegetation Plot 14		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	Red Maple	Tree																					
Alnus serrulata	Tag Alder	Shrub Tree																					
Aronia arbutifolia	Red Chokeberry	Shrub																					
Betula nigra	River Birch, Red Birch	Tree							2	2	2	3	3	3	2	2	2	2	2	2			
Carpinus caroliniana	Ironwood	Shrub Tree				1	1	1				3	3	3									
Cephalanthus occidentalis	Buttonbush	Shrub Tree																					
Cornus amomum	Silky Dogwood	Shrub Tree																					
Diospyros virginiana	American Persimmon	Tree	1	1	1										2	2	2	2	2	2			
Fraxinus pennsylvanica	Green Ash	Tree	6	6	6	1	1	1	6	6	6	1	1	1	3	3	3	1	1	1			
Lindera benzoin	Northern Spicebush	Shrub Tree																					
Liriodendron tulipifera	Tulip Poplar	Tree	2	2	2	1	1	1	2	2	2	3	3	3	1	1	2						
Platanus occidentalis	Sycamore	Tree	2	2	2	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4	1	1	1
Quercus pagoda	Cherrybark Oak	Tree	2	2	2				3	3	3	1	1	1	4	4	4	3	3	3	2	2	2
		Stem count	13	13	13	6	6	6	18	18	18	13	13	13	13	13	14	12	12	12	3	3	3
		size (ares)		1			1		1				1			1			1			1	
		size (ACRES)		0.02			0.02		0.02				0.02			0.02			0.02			0.02	
		Species count	5	5	5	4	4	4	5	5	5	6	6	6	6	6	6	5	5	5	2	2	2
		Stems per ACRE	526	526	526	243	243	243	728	728	728	526	526	526	526	526	567	486	486	486	121	121	121

			Current Plot Data (MY3 2019)									Annual Means											
			Vegetation Plot 15			Vegetation Plot 16			Vegetation Plot 17			MY3 (9/2019)			MY2 (9/2018)			MY1 (9/2017)			MY0 (3/2017)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	Red Maple	Tree										1	1	1	1	1	2	1	1	1			
Aronia arbutifolia	Red Chokeberry	Shrub															3						
Alnus serrulata	Tag Alder	Shrub Tree																			1	1	1
Betula nigra	River Birch	Tree	2	2	2	8	8	8	1	1	1	27	27	27	29	29	29	43	43	43	55	55	55
Carpinus caroliniana	Ironwood	Shrub Tree	3	3	3				1	1	1	13	13	13	16	16	16	21	21	21	21	21	21
Cephalanthus occidentalis	Buttonbush	Shrub Tree										8	8	8	12	12	12	12	12	12	14	14	14
Cornus amomum	Silky Dogwood	Shrub Tree										17	17	17	17	17	19	16	16	16	19	19	19
Diospyros virginiana	American Persimmon	Tree	1	1	1				1	1	1	7	7	7	9	9	9	11	11	11	12	12	12
Fraxinus pennsylvanica	Green Ash	Tree							1	1	1	34	34	34	35	35	35	36	36	36	35	35	35
Lindera benzoin	Northern Spicebush	Shrub Tree										2	2	2	7	7	7	11	11	11	14	14	14
Liriodendron tulipifera	Tulip Poplar	Tree	1	1	1				3	3	3	15	15	16	18	18	18	24	24	24	38	38	38
Platanus occidentalis	Sycamore	Tree	6	6	6				3	3	3	37	37	37	38	38	39	40	40	40	40	40	40
Quercus pagoda	Cherrybark Oak	Tree	1	1	1	1	1	1	2	2	2	26	26	26	29	29	29	35	35	35	39	39	39
		Stem count	14	14	14	9	9	9	12	12	12	187	187	188	211	211	218	250	250	250	288	288	288
		size (ares)		1			1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.42			0.42			0.42			0.42	
		Species count	6	6	6	2	2	2	7	7	7	11	11	11	11	11	12	11	11	11	11	11	11
		Stems per ACRE	567	567	567	364	364	364	486	486	486	445	445	448	502	502	519	595	595	595	686	686	686

* MY3 - MY7 vegetation plots one and two will use shrub density requirements to determine if success critera is met.

Color For Density

Exceeds requirements by 10% or greater
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 9b. Planted Herbaceous Cover (Bog Cells)
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Percent Cover %								
Plot ID	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**MY7**
1	<5	30	65	100				
2	10	75	100	100				
3	<5	75	95	95				
4	<5	90	100	100				
5	<5	80	90	100				
6	<5	85	95	100				
7	<5	100	100	100				
8	50	95	100	100				

APPENDIX 4. Morphological Summary Data and Plots

Table 10a. Baseline Stream Data Summary
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 1, Reach 2

	PRE-RESTORATION CONDITION				REFERENCE REACH DATA								DESIGN				AS-BUILT/BASELINE			
Parameter	**Vile Creek Reach 1**		**Vile Creek Reach 2**		**Meadow Creek**		**West Fork of Chestnut Creek**		**Brush Creek**		**Little Glade Creek**		**Vile Creek Reach 1**		**Vile Creek Reach 2**		**Vile Creek Reach 1**		**Vile Creek Reach 2**	
	Min	**Max**	**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)	19.3		22.4		26.0		18.3	20.3	22.8		34.7		17.0		19.0		17.1	18.8	18.7	19.2
Floodprone Width (ft)	333		119		52.0		---		---		---		37	85	42	95	>200		156	188
Bankfull Mean Depth	1.6		0.9		2.4		1.8	2.2	1.7		2.2		1.2		1.2		1.1	1.2	1.2	1.5
Bankfull Max Depth	2.7		1.6		3.3		2.2	2.8	2.3		2.4		1.4	1.7	1.5	1.9	1.9	2.1	2.0	2.3
Bankfull Cross-sectional Area (ft^2)	30.4	31.7	20.1	48.0	62.2		35.8	40.0	37.9		76.5		19.6		23.7		19.8	21.2	22.5	28.6
Width/Depth Ratio	12.2		25.1		10.9		8.3	11.5	13.4		15.8		14.7		15.2		13.7	17.8	12.9	15.5
Entrenchment Ratio	17.2		5.3		>2.2		>2.2		>2.2		>2.2		2.2	5.0	2.2	5.0	>2.2		>2.2	
Bank Height Ratio	1.4		1.8		---		1.3	1.4	1.1		1.5		1.0		1.0		1.0	1.1	1.0	
D50 (mm)	112.0		56.3		---		---		---		---		---		---		60.4	69.3	58.6	61.5
Riffle Length (ft)	---		---		---		---		---		---		---		---		19.7	74.1	18.3	94.1
Riffle Slope (ft/ft)	0.021	0.050	0.0190	0.063	---		0.0110	0.0280	0.0040		0.0140		0.0148	0.0333	0.016	0.0360	0.0164	0.0420	0.0187	0.0385
Pool Length (ft)	---		---		---		---		---		---		---		---		38.8	149.3	47.1	123.7
Pool Max Depth (ft)	2.9		3.1		---		3.8	4.1	---		---		1.4	2.9	1.5	3.1	3.1	4.4	3.4	5.5
Pool Spacing (ft)	36	69	33	88	---		31	124	---		---		34	119	38	133	55	161	87	172
Pool Volume (ft^3)	---		---		---		---		---		---		---		---		---		---	
Pattern																				
Channel Beltwidth (ft)	38	90	42	93	---		64	71	---		---		51	119	57	133	34	127	48	88
Radius of Curvature (ft)	22	80	55	125	---		26	40	---		---		34	68	38	76	34	50	38	76
Rc:Bankfull Width (ft/ft)	1.1	4.1	2.4	5.6	---		1.3	2.0	---		---		2.0	4.0	2.0	4.0	1.8	2.9	2.0	4.1
Meander Wavelength (ft)	160	190	100	330	---		---		---		---		119	238	133	266	125	214	177	235
Meander Width Ratio	2.0	4.7	1.9	4.2	---		---		---		---		3	7	3	7	2	7	3	5
Substrate, Bed and Transport Parameters																				
Ri%/Ru%/P%/G%/S%																				
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100	8.7/30.2/99.4/180/243/>2048		0.16/6.1/38/95/139/>2048		---		---		---		---		---		---		0.15/0.39/25.7/90.0/163.3/362.0		0.19/0.53/9.6/69.2/120.3/362.0	
Reach Shear Stress (Competency) lb/ft^2	1.20		0.80		---		---		---		---		1.1		1.2		0.86	1.09	0.69	0.74
Max part size (mm) mobilized at bankfull	175		130		---		---		---		---		165		175		42	54	43	53
Stream Power (Capacity) W/m^2																	3.8	5.9	4.1	5.8
Additional Reach Parameters																				
Drainage Area (SM)	2.2		2.6		2.70		1.60		1.67		3.30		2.2		2.6		2.2		2.6	
Watershed Impervious Cover Estimate (%)	3%				---		---		---		---		3%				3%			
Rosgen Classification	C3		C4		C		E4		C4		C4		C		C		C		C	
Bankfull Velocity (fps)	3.3	3.2	6.0	2.5	---		4.6	5.3	4.4		5.5		4.7		5.0		4.4	5.2	5.5	5.2
Design Bankfull Discharge (cfs)	100		120		---		164	210	168		424		100		120		87	133	103	144
Q- Little River LWP Regional 1.25-yr(cfs)	107		124																	
Q- Little River LWP Regional 1.5-yr (cfs)	122		141																	
Q- Rural Mountain Regional Curve (cfs)	180		206																	
Q-Revised Piedmont/Mountain Regional Curve (cfs)	102		117																	
Q- Basin Ration Method 1.1-yr (cfs)	101		121																	
Q- Basin Ration Method 1.25-yr (cfs)	122		146																	
Valley Length (ft)	---		---		---		---		---		---		---		---		729		1042	
Channel Thalweg Length (ft)	962		1,247		---		---		---		---		920		1260		882		1,311	
Sinuosity	1.3		1.3		---		---		---		---		1.20	1.30	1.20	1.30	1.21		1.26	
Water Surface Slope (ft/ft)	0.014		0.011		---		0.010		0.012		0.010		0.0123	0.0133	0.0131	0.0142	0.014		0.012	
Bankfull Slope (ft/ft)	0.017		0.016		---		---		---		---		0.016		0.017		0.015		0.012	

(---): Data was not provided

Table 10b. Baseline Stream Data Summary
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT1 Reach 1, UT1 Reach 2

	PRE-RESTORATION CONDITION				REFERENCE REACH DATA								DESIGN				AS-BUILT/BASELINE			
Parameter	**UT1 Reach 1**		**UT1 Reach 2**		**Little Pine III UT2A**		**Henry Fork UT Upstream**		**UT to Gap Branch**		**Group Camp Tributary**		**UT1 Reach 1**		**UT1 Reach 2**		**UT1 Reach 1**		**UT1 Reach 2**	
	Min	**Max**	**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)	7.9		19.2		12.6		3.2	7.7	6.2		4.2	4.4	8.0		9.0		7.7	8.6	9.0	
Floodprone Width (ft)	203.0		28.0		31.0		6	13	21		9	11	14	18	15	20	63	91	96	
Bankfull Mean Depth	0.9		0.4		1.4		0.5	0.6	0.6		0.8		0.5		0.6		0.5	0.7	0.8	
Bankfull Max Depth	1.7		0.9		2.0		0.7	0.8	1.0		1.0	1.2	0.7	0.8	0.7	0.9	1.1	1.1	1.3	
Bankfull Cross-sectional Area (ft^2)	7.3	10.3	8.4	11.8	18.1		1.9	3.6	3.8		3.4	3.6	4.3		5.2		4.1	5.9	7.8	
Width/Depth Ratio	8.6		43.9		8.7		5.2	16.4	10.1		5.2	5.5	14.9		15.6		12.4	14.7	11.4	
Entrenchment Ratio	25.6		1.5		2.4		1.7	2.0	3.4		1.9	2.5	1.8	2.3	1.7	2.2	>2.2		>2.2	
Bank Height Ratio	1.3		3.8		1.0		1.0	1.3	1.0		1.0		1.0		1.0		1.0	1.0	1.0	
D50 (mm)	32		28.5		---		---		---		---		---		---		22.6	34.3	28.1	
Profile																				
Riffle Length (ft)	---		---		---		---		---		---		---		---		11.0	53.1	13.5	60.7
Riffle Slope (ft/ft)	0.022	0.11	0.0280	0.071	0.0404	0.0517	0.0500	0.0700	0.0110	0.1400	0.0110	0.1220	0.0291	0.0640	0.0282	0.6200	0.0149	0.0410	0.0176	0.0897
Pool Length (ft)	---		---		---		---		---		---		---		---		13.0	36.9	8.6	42.5
Pool Max Depth (ft)	2.3		1.6		2.2	2.5	---		6.1		1.8	2.8	1.1	1.9	1.2	2	0.8	2.6	1.1	2.5
Pool Spacing (ft)	15	39	14	58	78		14	25	18	27	5	58	16	48	162	486	7	59	38	88
Pool Volume (ft^3)	---		---		---		---		---		---		---		---		---		---	
Pattern																				
Channel Beltwidth (ft)	40	55	60	80	---		---		---		16	17	N/A[1]		13	32	N/A[1]		6	66
Radius of Curvature (ft)	12	40	15	65	---		---		---		8	11.8	N/A[1]		20	59	N/A[1]		18	59
Rc:Bankfull Width (ft/ft)	1.5	5.1	0.8	3.4	---		---		---		1.9	2.7	N/A[1]		2.2	6.6	N/A[1]		2.0	6.5
Meander Length (ft)	57	100	115	140	---		---		---		31	34	N/A[1]		64	110	N/A[1]		56	152
Meander Width Ratio	5.1	7.0	3.1	4.2	---		---		---		3.6	3.8	N/A[1]		1.5	3.6	N/A[1]		1	7
Substrate, Bed and Transport Parameters																				
Ri%/Ru%/P%/G%/S%																				
SC%/Sa%/G%/C%/B%/Be%																				
d16/d35/d50/d84/d95/d100	0.4/1.7/25.9/137/203/256		0.17/0.55/26.9/133/205/256		---		---		---		---						0.21/0.79/8.6/51.0/126.9/256.0		0.25/4.47/12.1/70.5/101.2/180.0	
Reach Shear Stress (Competency) lb/ft^2	0.7		0.4		---		---		---		---		0.5		0.6		0.53	0.84	1.39	
Max part size (mm) mobilized at bankfull	115		75		---		---		---		---		95		100		26	41	68	
Stream Power (Capacity) W/m^2																	1.54	3.4	8.2	
Additional Reach Parameters																				
Drainage Area (SM)	0.30		0.34		0.12		0.20		0.04		0.10		0.30		0.34		0.30		0.34	
Watershed Impervious Cover Estimate (%)	1%				---		---		---		---		1%				1%			
Rosgen Classification	E4b		F4b		A/B		B4a		B4a/A4		E5b		B		B		B		B	
Bankfull Velocity (fps)	1.7	2.3	1.7	2.4	0.5		3.8	5.4	5.0		3.4	3.6	3.8		3.9		2.8	3.9	5.3	
Design Bankfull Discharge (cfs)	17		20		9		12		19		12		17		20		8	16	42	
Q- Little River LWP Regional 1.25-yr(cfs)	21		23																	
Q- Little River LWP Regional 1.5-yr (cfs)	24		26																	
Q- Rural Mountain Regional Curve (cfs)	40		44																	
Q-Revised Piedmont/Mountain Regional Curve (cfs)	21		24																	
Q- Basin Ration Method 1.1-yr (cfs)	16		16																	
Q- Basin Ration Method 1.25-yr (cfs)	17		19										---		---					
Valley Length (ft)	---		---		---		---		---		---		---		---		903		755	
Channel Thalweg Length (ft)	1,143		989		---		---		---		---		1,132		863		1,114		854	
Sinuosity	1.26		1.3		---		1.1		---		1.6		1.0 - 1.1		1.0 - 1.1		1.2		1.1	
Water Surface Slope (ft/ft)[2]	0.022		0.028		0.0433		0.0420		0.0680		0.0167		0.0291	0.0320	0.0282	0.0310	0.0264		0.0288	
Bankfull Slope (ft/ft)	0.032		0.033		---		0.0460		---		0.0229		0.0320		0.0310		0.0261		0.0284	

(---): Data was not provided

[1] Design parameters for pattern features are not reported for UT1 Reach 1 because the channel was designed as Enhancement I.

Table 11. Morphology and Hydraulic Summary (Dimensional Parameters - Cross-Section)

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

	Cross-Section 1, Vile Creek Reach 1 (Pool)						Cross-Section 2, Vile Creek Reach 1 (Riffle)						Cross-Section 3, Vile Creek Reach 1 (Riffle)					
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2700.8	2700.7	2700.8	2700.8			2700.0	2700.0	2700.2	2700.2			2695.7	2695.7	2695.8	2695.6		
Low Bank Elevation (ft)	2700.8	2700.7	2700.8	2700.8			2700.0	2700.0	2700.2	2700.2			2695.7	2695.7	2695.8	2695.6		
Bankfull Width (ft)	25.1	24.6	25.6	15.8			17.1	17.6	20.4	18.9			18.8	17.9	19.4	19.9		
Floodprone Width (ft)	---	---	---	---			>200	>200	143.9	145.9			>200	>200	108.6	110.9		
Bankfull Mean Depth (ft)	1.2	1.1	1.0	1.5			1.2	1.3	1.6	1.7			1.1	1.2	1.2	1.1		
Bankfull Max Depth (ft)	3.0	2.8	2.5	2.6			2.1	2.3	3.1	3.3			1.9	2.2	2.6	2.5		
Bankfull Cross-Sectional Area (ft^2)	29.2	25.8	25.6	23.9			21.2	22.7	32.8	32.5			19.8	20.9	23.9	22.2		
Bankfull Width/Depth Ratio	---	---	---	---			13.7	13.7	12.8	10.9			17.8	15.3	15.8	17.9		
Bankfull Entrenchment Ratio[2]	---	---	---	---			>10.6	11.4	7.0	7.7			>10.7	>11.2	5.6	5.6		
Bankfull Bank Height Ratio	---	---	---	---			1.1	1.1	1.3	1.3			1.0	1.0	1.1	1.1		
	Cross-Section 4, Vile Creek Reach 2 (Riffle)						**Cross-Section 5, Vile Creek Reach 2 (Riffle)**						**Cross-Section 6, Vile Creek Reach 2 (Pool)**					
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2691.7	2691.7	2691.7	2691.5			2688.9	2688.9	2689.0	2689.0			2687.9	2687.9	2688.1	2687.9		
Low Bank Elevation (ft)	2691.7	2691.7	2691.7	2691.5			2688.9	2688.9	2689.0	2689.0			2687.9	2687.9	2688.1	2687.9		
Bankfull Width (ft)	18.7	19.4	19.5	17.6			19.2	19.8	19.9	19.5			24.1	24.0	26.1	18.2		
Floodprone Width (ft)	188.0	188.0	88.6	89.2			156.0	156.0	96.9	101.0			---	---	---	---		
Bankfull Mean Depth (ft)	1.2	1.2	1.1	1.3			1.5	1.5	1.6	1.6			1.8	1.6	1.6	2.0		
Bankfull Max Depth (ft)	2.0	2.3	2.2	2.5			2.3	2.5	2.7	2.7			3.6	4.0	3.8	4.0		
Bankfull Cross-Sectional Area (ft^2)	22.5	23.1	21.7	22.0			28.6	29.7	31.3	31.0			44.3	39.6	41.9	36.3		
Bankfull Width/Depth Ratio	15.5	16.3	17.5	14.0			12.9	13.2	12.7	12.2			---	---	---	---		
Bankfull Entrenchment Ratio[2]	10.1	9.7	4.6	5.1			8.1	7.9	4.9	5.2			---	---	---	---		
Bankfull Bank Height Ratio	1.0	1.0	1.0	1.0			1.0	1.0	1.1	1.1			---	---	---	---		
	Cross-Section 7, UT1 Reach 1 (Riffle)						**Cross-Section 8, UT1 Reach 1 (Pool)**						**Cross-Section 9, UT1 Reach 1 (Riffle)**					
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**
Bankfull Elevation (ft)	2743.9	2743.9	2744.1	2744.0			2725.7	2725.7	2726.0	2726.1			2725.3	2725.3	2725.4	2725.3		
Low Bank Elevation (ft)	2743.9	2743.9	2744.1	2744.0			2725.7	2725.7	2726.0	2726.1			2725.3	2725.3	2725.4	2725.3		
Bankfull Width (ft)	8.6	8.1	8.9	8.5			11.3	8.2	6.8	8.2			7.7	6.5	7.2	5.3		
Floodprone Width (ft)	63.0	63.0	83.7	85.5			---	---	---	---			97.0	97.0	81.8	83.2		
Bankfull Mean Depth (ft)	0.7	1.2	1.2	1.1			0.6	0.5	0.7	0.8			0.5	0.7	0.6	0.7		
Bankfull Max Depth (ft)	1.1	2.2	2.3	2.0			1.4	0.8	0.9	1.4			1.1	1.1	1.1	1.0		
Bankfull Cross-Sectional Area (ft^2)	5.9	9.4	10.3	9.3			7.1	4.4	4.5	6.6			4.1	4.2	4.2	3.6		
Bankfull Width/Depth Ratio	12.4	7.0	7.6	7.8			---	---	---	---			14.7	9.9	12.5	7.9		
Bankfull Entrenchment Ratio[2]	7.3	7.8	9.5	10.1			---	---	---	---			12.5	15.0	11.3	15.6		
Bankfull Bank Height Ratio	1.0	1.0	1.4	1.3			---	---	---	---			1.0	1.0	1.0	0.9		
	Cross-Section 10, UT1 Reach 2 (Pool)						**Cross-Section 11, UT1 Reach 2 (Riffle)**											
Dimension and Substrate[1]	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**	**Base**	**MY1**	**MY2**	**MY3**	**MY5**	**MY7**						
Bankfull Elevation (ft)	2713.5	2713.5	2713.3	2713.3			2712.9	2712.9	2712.9	2712.9								
Low Bank Elevation (ft)	2713.5	2713.5	2713.3	2713.3			2712.9	2712.9	2712.9	2712.9								
Bankfull Width (ft)	13.3	12.6	11.8	5.6			9.0	12.6	8.4	8.2								
Floodprone Width (ft)	---	---	---	---			96.0	96.0	85.3	86.8								
Bankfull Mean Depth (ft)	0.9	0.7	0.5	0.9			0.8	0.5	0.8	0.9								
Bankfull Max Depth (ft)	1.9	1.8	1.7	1.8			1.3	1.4	1.5	1.4								
Bankfull Cross-Sectional Area (ft^2)	12.6	9.0	6.3	4.8			7.8	6.5	7.0	7.4								
Bankfull Width/Depth Ratio	---	---	---	---			11.4	24.5	10.2	9.0								
Bankfull Entrenchment Ratio[2]	---	---	---	---			10.7	7.6	10.1	10.6								
Bankfull Bank Height Ratio	---	---	---	---			1.0	1.0	0.9	1.0								

[1] MY2 – MY7 Bank Height Ratio was 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 year's low bank height.

[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Table 12a. Monitoring - Stream Reach Data Summary

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Vile Creek, Reach 1 and Reach 2

Parameter	As-Built/Baseline				MY1				MY2				MY3			
	Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile Reach 2		Vile Reach 1		Vile Reach 2	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	17.1	18.8	18.7	19.2	17.6	17.9	19.4	19.8	19.4	20.4	19.5	19.9	18.9	19.9	17.6	19.5
Floodprone Width (ft)	>200		156	188	>200		156.0	188.0	108.6	143.9	88.6	96.9	110.9	145.9	89.2	101.0
Bankfull Mean Depth	1.1	1.2	1.2	1.5	1.2	1.3	1.2	1.5	1.2	1.6	1.1	1.6	1.1	1.7	1.3	1.6
Bankfull Max Depth	1.9	2.1	2.0	2.3	2.2	2.3	2.3	2.5	2.6	3.1	2.2	2.7	2.5	3.3	2.5	2.7
Bankfull Cross Sectional Area (ft^2)	19.8	21.2	22.5	28.6	20.9	22.7	23.1	29.7	23.9	32.8	21.7	31.3	22.2	32.5	22.0	31.0
Width/Depth Ratio	13.7	17.8	12.9	15.5	13.7	15.3	13.2	16.3	12.8	15.8	12.7	17.5	10.9	17.9	12.2	14.0
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		7.0	5.6	4.6	4.9	5.6	7.7	5.1	5.2
Bank Height Ratio	1.0	1.1	1.0		1.0		1.0		1.1	1.3	1.0	1.1	1.0	1.3	1.0	1.1
D50 (mm)	60.4	69.3	58.6	61.5	82.0	101.2	70.9	78.5	77.8	92.3	78.1	93.6	49.5	53.2	52.7	71.5
Profile																
Riffle Length (ft)	19.7	74.1	18.3	94.1												
Riffle Slope (ft/ft)	0.0164	0.0420	0.0187	0.0385												
Pool Length (ft)	38.8	149.3	47.1	123.7												
Pool Max Depth (ft)	3.1	4.4	3.4	5.5												
Pool Spacing (ft)	55	161	87	172												
Pool Volume (ft^3)	---		---													
Pattern																
Channel Beltwidth (ft)	34	127	48	88												
Radius of Curvature (ft)	34	50	38	76												
Rc:Bankfull Width (ft/ft)	1.8	2.9	2.0	4.1												
Meander Wave Length (ft)	125	214	177	235												
Meander Width Ratio	2	7	3	5												
Additional Reach Parameters																
Rosgen Classification	C		C													
Channel Thalweg Length (ft)	882		1,311													
Sinuosity (ft)	1.21		1.26													
Water Surface Slope (ft/ft)	0.0135		0.0122													
Bankfull Slope (ft/ft)	0.0145		0.0122													
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100																
% of Reach with Eroding Banks					0%		0%		<1%		<1%		<1%		<1%	

[1] MY2 – MY7 Bank Height Ratio was 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 calcu
low bank height.

[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.
Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Table 12b. Monitoring - Stream Reach Data Summary

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

UT1 Reach 1 and Reach 2

Parameter	As-Built/Baseline				MY1				MY2				MY3			
	UT1 Reach 1		UT1 Reach 2		UT1 Reach 1		UT1 Reach 2		UT1 Reach 1		UT1 Reach 2		UT1 Reach 1		UT1 Reach 2	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dimension and Substrate - Riffle																
Bankfull Width (ft)	7.7	8.6	9.0		6.5	8.1	12.6		7.2	8.9	8.4		5.3	8.5	8.2	
Floodprone Width (ft)	63	91	96		63.0	82.4	96.0		81.8	83.7	85.3		83.2	85.5	86.8	
Bankfull Mean Depth	0.5	0.7	0.8		0.7	1.2	0.5		0.6	1.2	0.8		0.7	1.1	0.9	
Bankfull Max Depth	1.1	1.1	1.3		1.1	2.2	1.4		1.1	2.3	1.5		1.0	2.0	1.4	
Bankfull Cross Sectional Area (ft^2)	4.1	5.9	7.8		4.2	9.4	6.5		4.2	10.3	7.0		3.6	9.3	7.4	
Width/Depth Ratio	12.4	14.7	11.4		7.0	9.9	24.5		7.6	12.5	10.2		7.8	7.9	9.0	
Entrenchment Ratio	>2.2		>2.2		>2.2		>2.2		9.5	11.3	10.1		10.1	15.6	10.6	
Bank Height Ratio	1.0	1.0	1.0		1.0		1.0		1.0	1.4	0.9		0.9	1.3	1.0	
D50 (mm)	22.6	34.3	28.1		29.8	48.3	58.6		45	78.1	72.7		25.9	30.2	54.7	
Profile																
Shallow Length (ft)	11.0	53.1	13.5	60.7												
Shallow Slope (ft/ft)	0.0149	0.0410	0.0176	0.0897												
Pool Length (ft)	13.0	36.9	8.6	42.5												
Pool Max Depth (ft)	0.8	2.6	1.1	2.5												
Pool Spacing (ft)	7	59	38	88												
Pool Volume (ft^3)	---		---													
Pattern																
Channel Beltwidth (ft)	N/A[1]		6	66												
Radius of Curvature (ft)	N/A[1]		18	59												
Rc:Bankfull Width (ft/ft)	N/A[1]		2.0	6.5												
Meander Wave Length (ft)	N/A[1]		56	152												
Meander Width Ratio	N/A[1]		1	7												
Additional Reach Parameters																
Rosgen Classification	B		B													
Channel Thalweg Length (ft)	1,114		854													
Sinuosity (ft)	1.2		1.1													
Water Surface Slope (ft/ft)	0.0264		0.0288													
Bankfull Slope (ft/ft)	0.0261		0.0284													
Ri%/Ru%/P%/G%/S%																
SC%/Sa%/G%/C%/B%/Be%																
d16/d35/d50/d84/d95/d100																
% of Reach with Eroding Banks					0%		0%		<1%		<1%		<1%		0%	

N/A: Not Applicable

[1] MY2 – MY7 Bank Height Ratio was 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 calc low bank height.

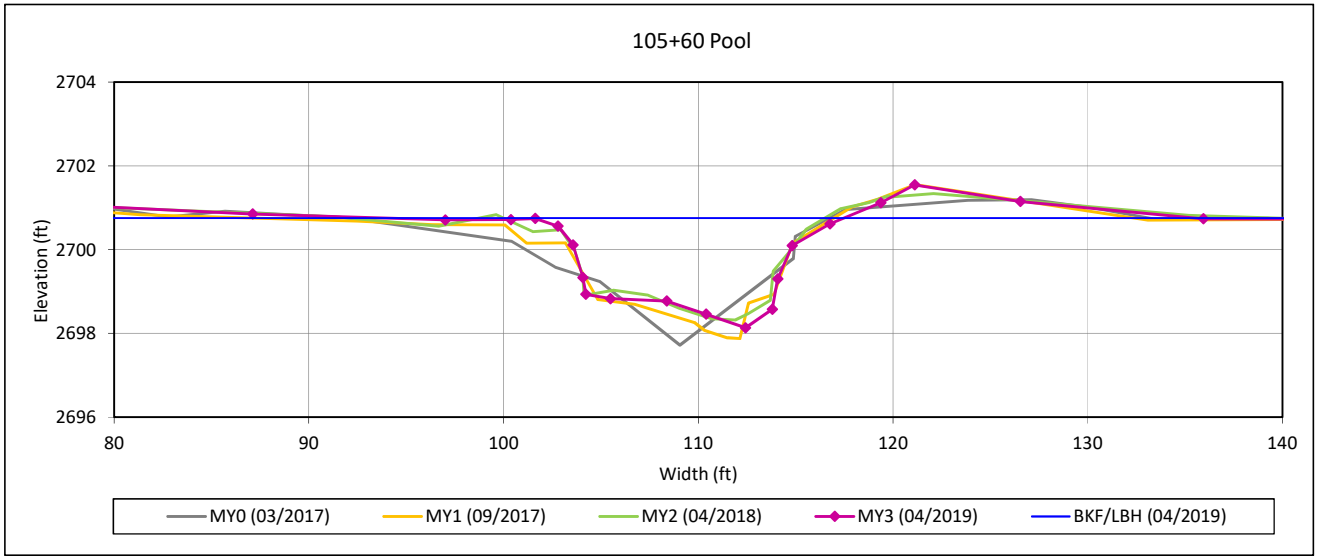
[2] ER in MY3 is based on the width of the cross-section, in lieu of assuming the width across the floodplain as was done in previous monitoring years.

Prior to MY2, bankfull dimensions were calculated using a fixed bankfull elevation.

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 1 - Vile Creek Reach 1



Bankfull Dimensions	
23.9	x-section area (ft.sq.)
15.8	width (ft)
1.5	mean depth (ft)
2.6	max depth (ft)
17.7	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.5	width-depth ratio

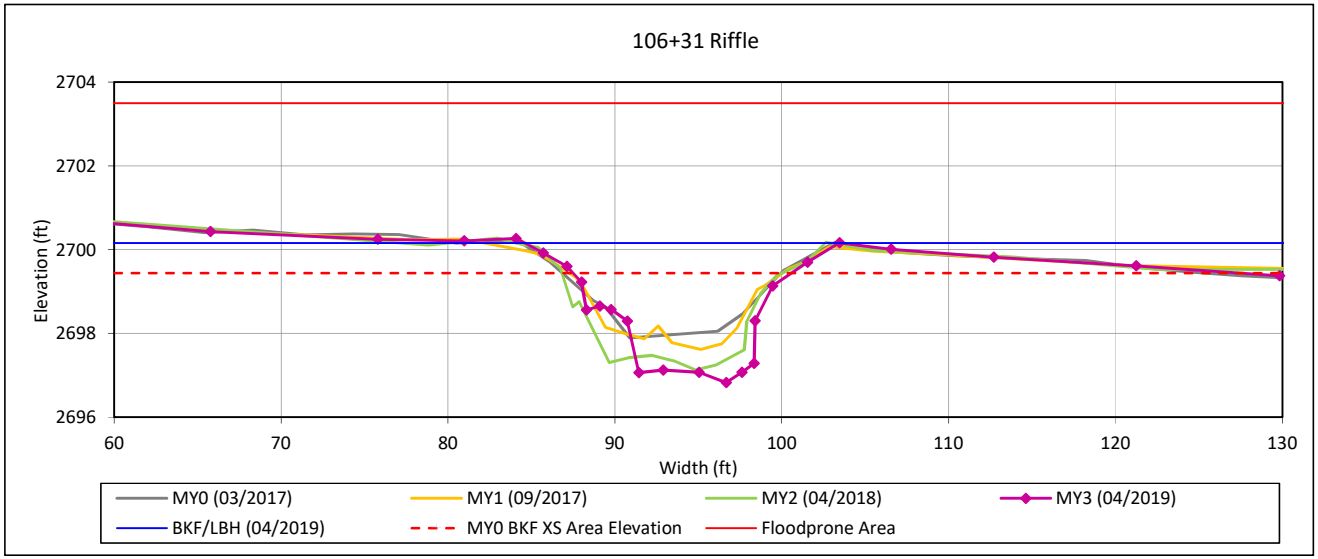
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 2 - Vile Creek Reach 1



Bankfull Dimensions	
32.5	x-section area (ft.sq.)
18.9	width (ft)
1.7	mean depth (ft)
3.3	max depth (ft)
21.7	wetted perimeter (ft)
1.5	hydraulic radius (ft)
10.9	width-depth ratio
145.9	W flood prone area (ft)
7.7	entrenchment ratio
1.3	low bank height ratio

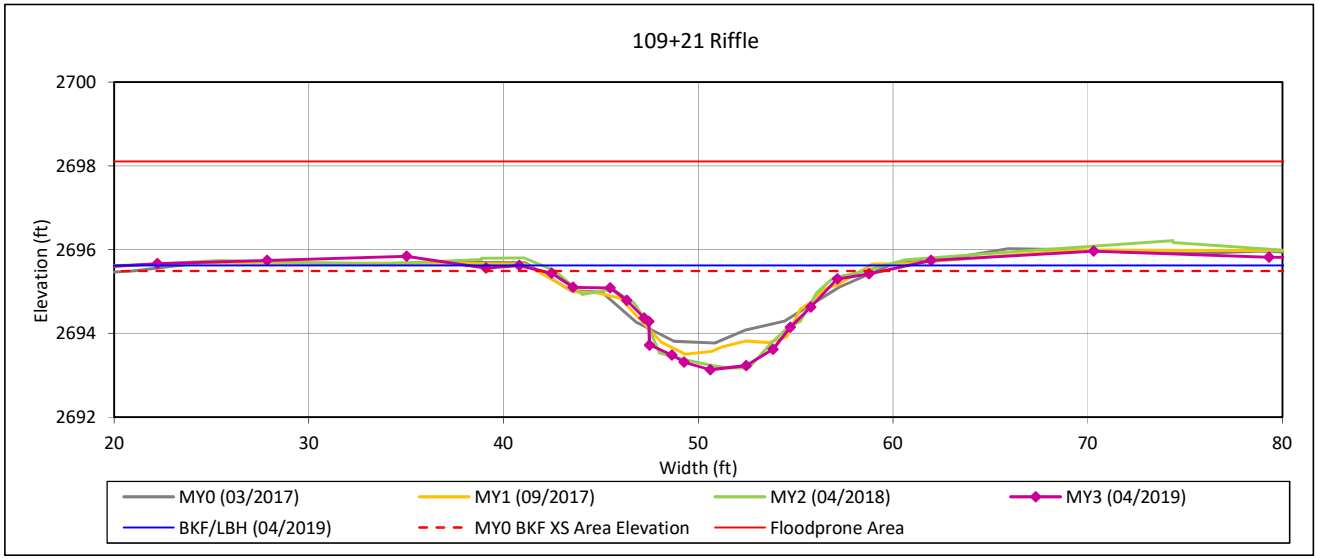
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 3 - Vile Creek Reach 1



Bankfull Dimensions	
22.2	x-section area (ft.sq.)
19.9	width (ft)
1.1	mean depth (ft)
2.5	max depth (ft)
21.2	wetted perimeter (ft)
1.0	hydraulic radius (ft)
17.9	width-depth ratio
110.9	W flood prone area (ft)
5.6	entrenchment ratio
1.1	low bank height ratio

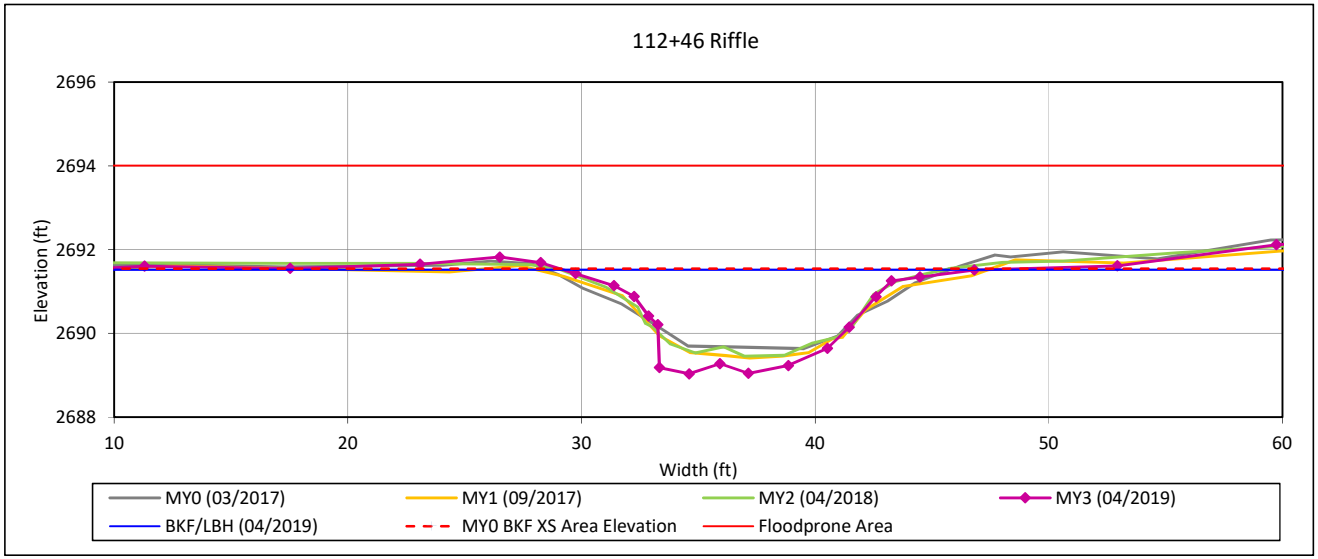
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 4 - Vile Creek Reach 2



Bankfull Dimensions	
22.0	x-section area (ft.sq.)
17.6	width (ft)
1.3	mean depth (ft)
2.5	max depth (ft)
19.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
14.0	width-depth ratio
89.2	W flood prone area (ft)
5.1	entrenchment ratio
1.0	low bank height ratio

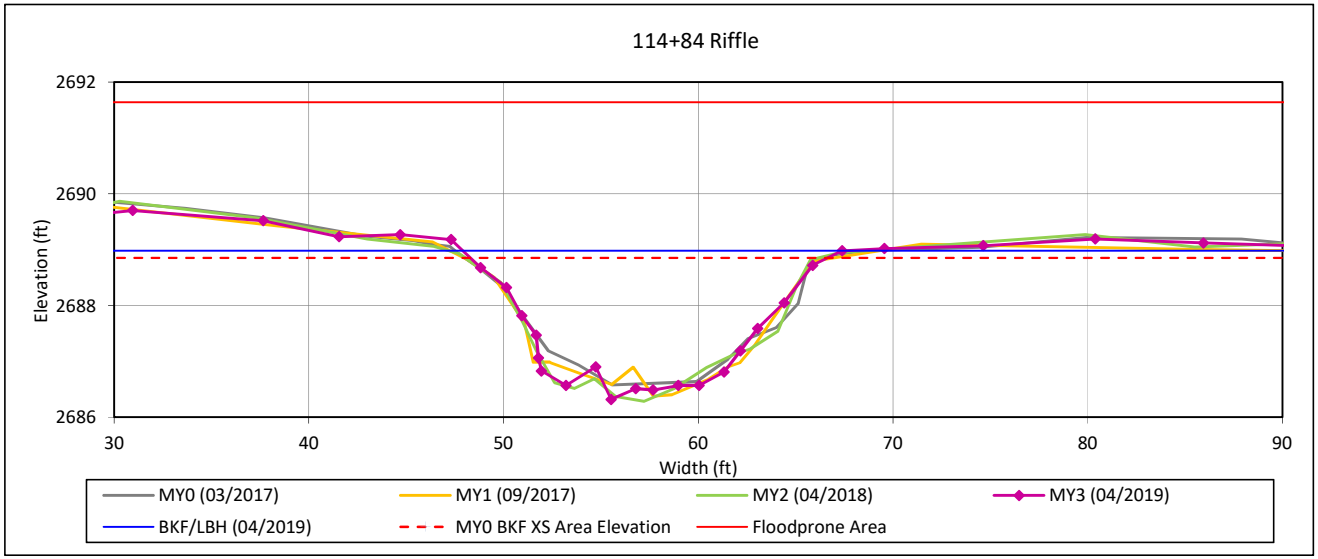
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 5 - Vile Creek Reach 2



Bankfull Dimensions	
31.0	x-section area (ft.sq.)
19.5	width (ft)
1.6	mean depth (ft)
2.7	max depth (ft)
20.9	wetted perimeter (ft)
1.5	hydraulic radius (ft)
12.2	width-depth ratio
101.0	W flood prone area (ft)
5.2	entrenchment ratio
1.1	low bank height ratio

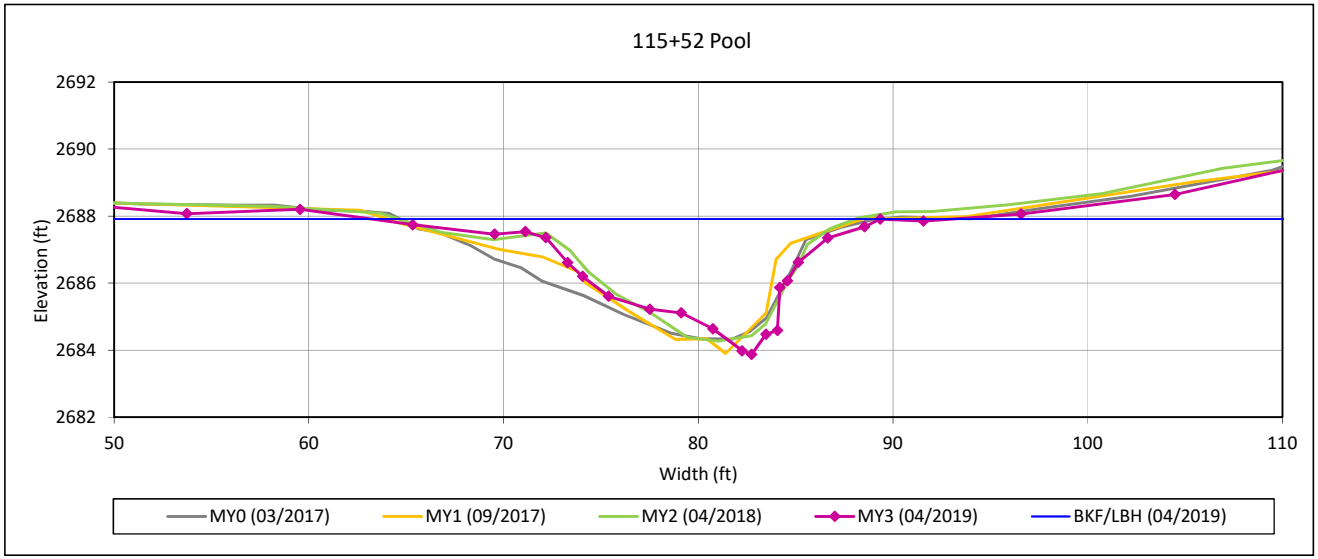
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 6 - Vile Creek Reach 2



Bankfull Dimensions	
36.3	x-section area (ft.sq.)
18.2	width (ft)
2.0	mean depth (ft)
4.0	max depth (ft)
20.9	wetted perimeter (ft)
1.7	hydraulic radius (ft)
9.2	width-depth ratio

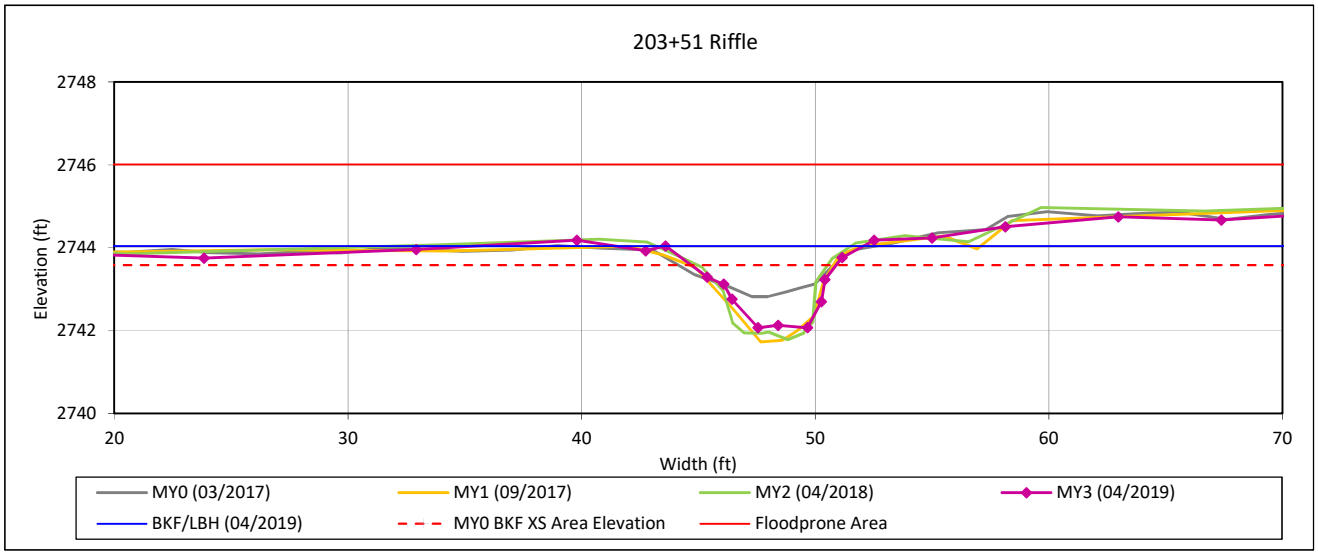
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 7 - UT1 Reach 1



Bankfull Dimensions	
9.3	x-section area (ft.sq.)
8.5	width (ft)
1.1	mean depth (ft)
2.0	max depth (ft)
9.9	wetted perimeter (ft)
0.9	hydraulic radius (ft)
7.8	width-depth ratio
85.5	W flood prone area (ft)
10.1	entrenchment ratio
1.3	low bank height ratio

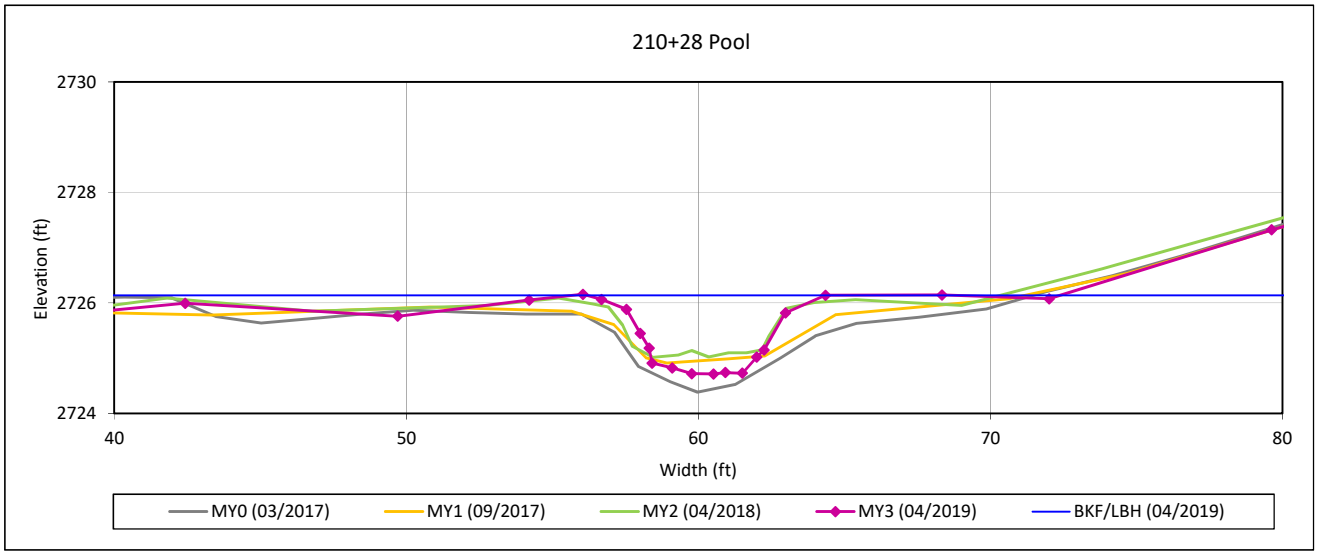
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 8 - UT1 Reach 1



Bankfull Dimensions	
6.6	x-section area (ft.sq.)
8.2	width (ft)
0.8	mean depth (ft)
1.4	max depth (ft)
9.1	wetted perimeter (ft)
0.7	hydraulic radius (ft)
10.2	width-depth ratio

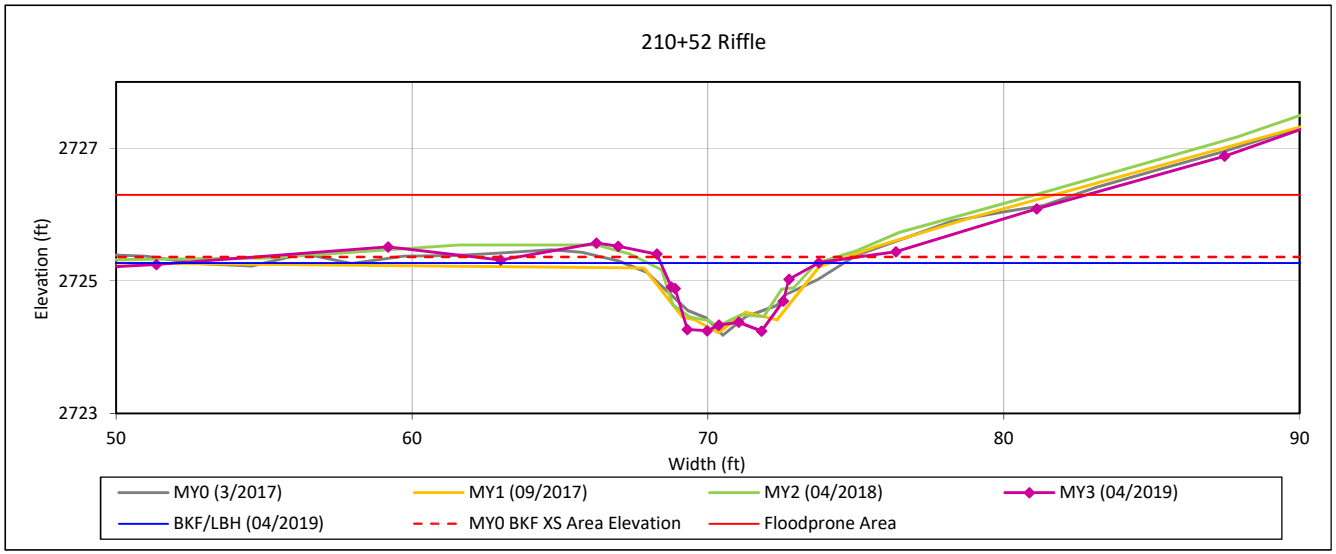
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 9 - UT1 Reach 1



Bankfull Dimensions	
3.6	x-section area (ft.sq.)
5.3	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
6.2	wetted perimeter (ft)
0.6	hydraulic radius (ft)
7.9	width-depth ratio
83.2	W flood prone area (ft)
15.6	entrenchment ratio
0.9	low bank height ratio

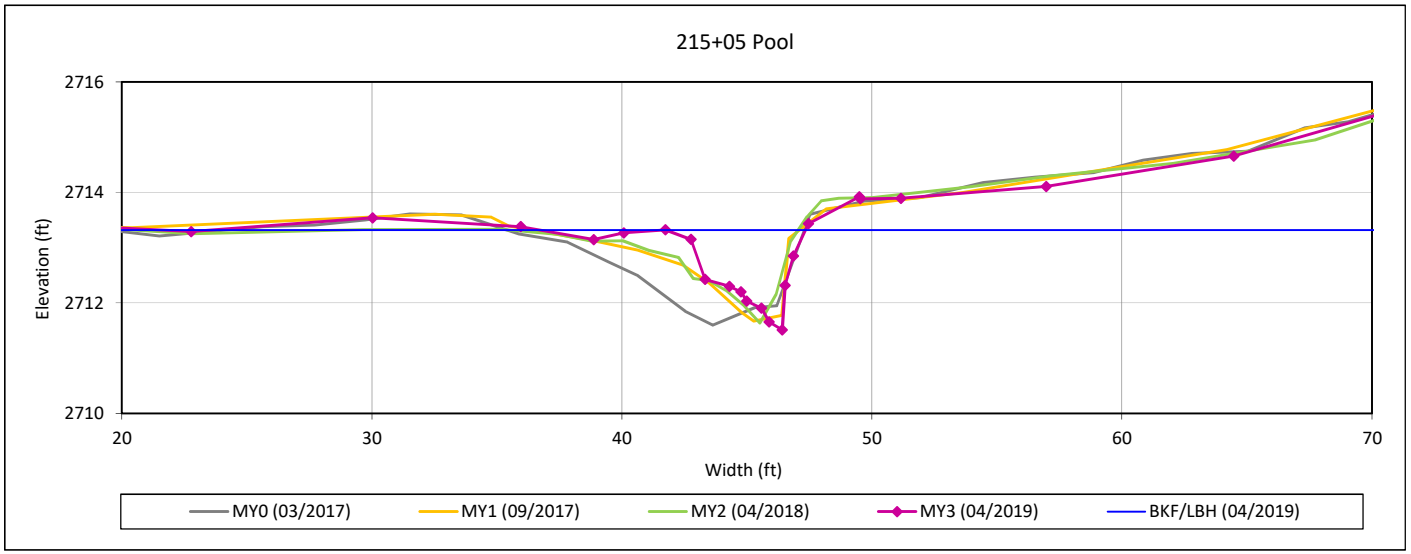
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 10 - UT1 Reach 2



Bankfull Dimensions	
4.8	x-section area (ft.sq.)
5.6	width (ft)
0.9	mean depth (ft)
1.8	max depth (ft)
7.3	wetted perimeter (ft)
0.7	hydraulic radius (ft)
7.1	width-depth ratio

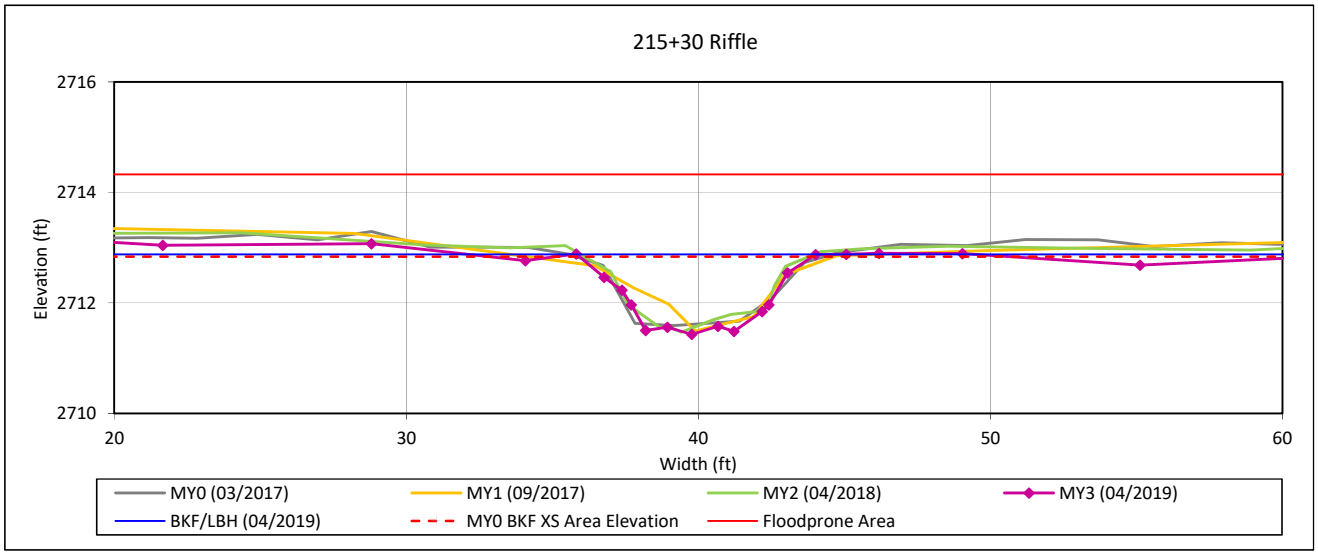
Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

Cross-section Plots

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Cross-section 11 - UT1 Reach 2



Bankfull Dimensions	
7.4	x-section area (ft.sq.)
8.2	width (ft)
0.9	mean depth (ft)
1.4	max depth (ft)
9.0	wetted perimeter (ft)
0.8	hydraulic radius (ft)
9.0	width-depth ratio
86.8	W flood prone area (ft)
10.6	entrenchment ratio
1.0	low bank height ratio

Survey Date: 04/2019
Field Crew: Wildlands Engineering

View Downstream

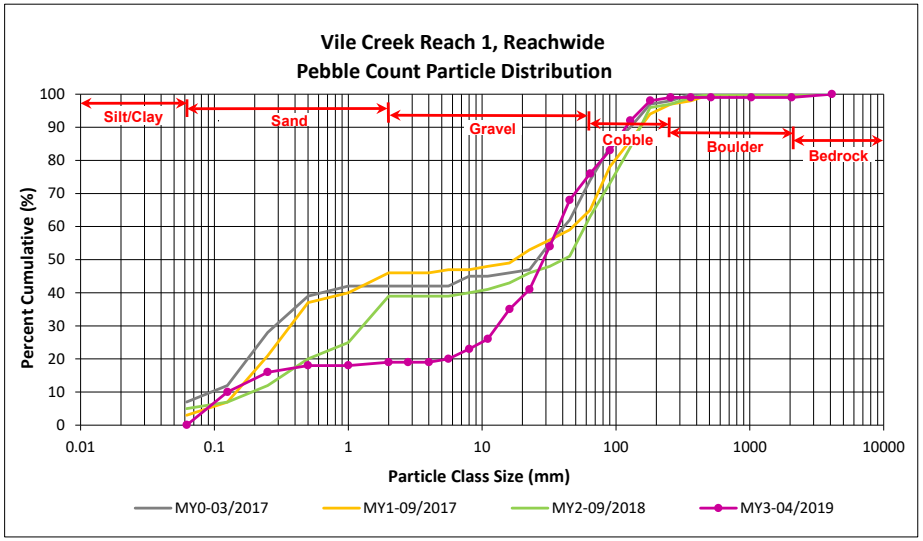
Reachwide and Cross-section Pebble Count Plots

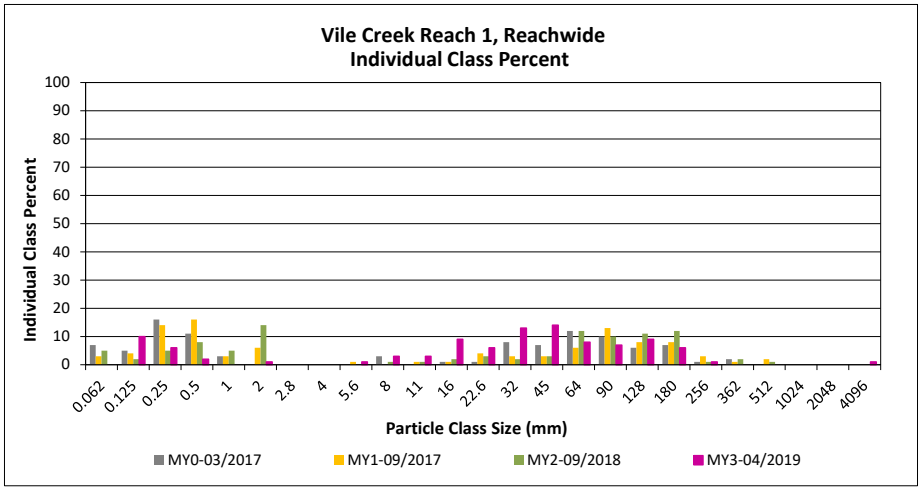
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125	1	9	10	10	10
	Fine	0.125	0.250		6	6	6	16
	Medium	0.25	0.50		2	2	2	18
	Coarse	0.5	1.0					18
	Very Coarse	1.0	2.0	1		1	1	19
GRAVEL	Very Fine	2.0	2.8					19
	Very Fine	2.8	4.0					19
	Fine	4.0	5.6		1	1	1	20
	Fine	5.6	8.0	1	2	3	3	23
	Medium	8.0	11.0		3	3	3	26
	Medium	11.0	16.0	5	4	9	9	35
	Coarse	16.0	22.6	2	4	6	6	41
	Coarse	22.6	32	6	7	13	13	54
	Very Coarse	32	45	10	4	14	14	68
	Very Coarse	45	64	4	4	8	8	76
COBBLE	Small	64	90	6	1	7	7	83
	Small	90	128	8	1	9	9	92
	Large	128	180	4	2	6	6	98
	Large	180	256	1		1	1	99
BOULDER	Small	256	362					99
	Small	362	512					99
	Medium	512	1024					99
	Large/Very Large	1024	2048					99
BEDROCK	Bedrock	2048	>2048	1		1	1	100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.3
D_{35} =	16.0
D_{50} =	28.8
D_{84} =	93.6
D_{95} =	151.8
D_{100} =	>2048





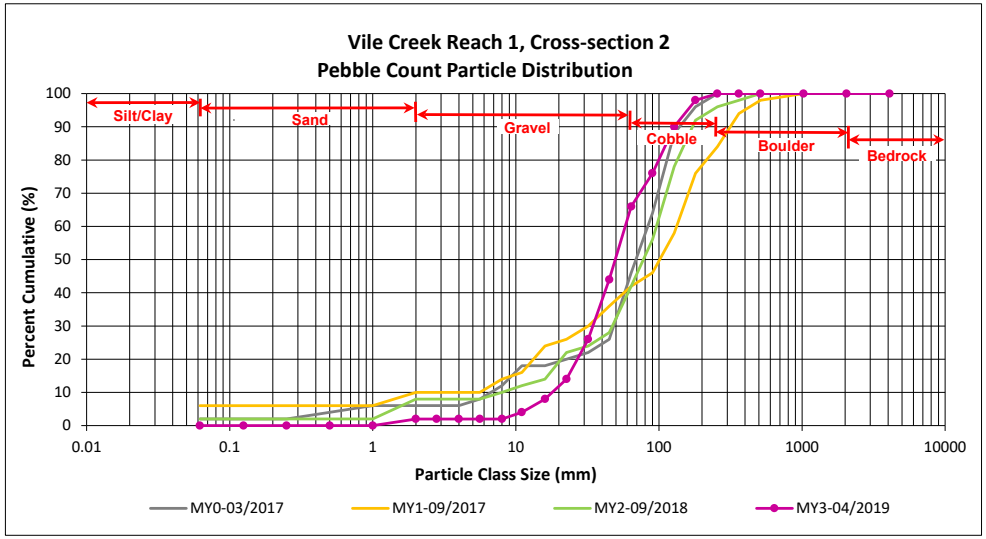
Reachwide and Cross-section Pebble Count Plots

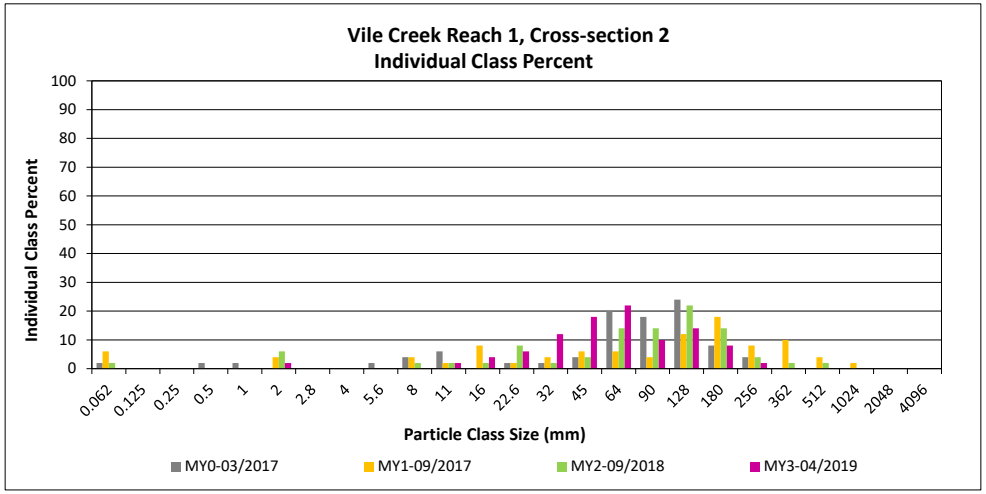
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 1, Cross-section 2

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	2	2	2
GRAVEL	Very Fine	2.0	2.8			2
	Very Fine	2.8	4.0			2
	Fine	4.0	5.6			2
	Fine	5.6	8.0			2
	Medium	8.0	11.0	2	2	4
	Medium	11.0	16.0	4	4	8
	Coarse	16.0	22.6	6	6	14
	Coarse	22.6	32	12	12	26
	Very Coarse	32	45	18	18	44
	Very Coarse	45	64	22	22	66
COBBLE	Small	64	90	10	10	76
	Small	90	128	14	14	90
	Large	128	180	8	8	98
	Large	180	256	2	2	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 2	
Channel materials (mm)	
D_{16} =	23.9
D_{35} =	37.9
D_{50} =	49.5
D_{84} =	110.1
D_{95} =	158.4
D_{100} =	256.0





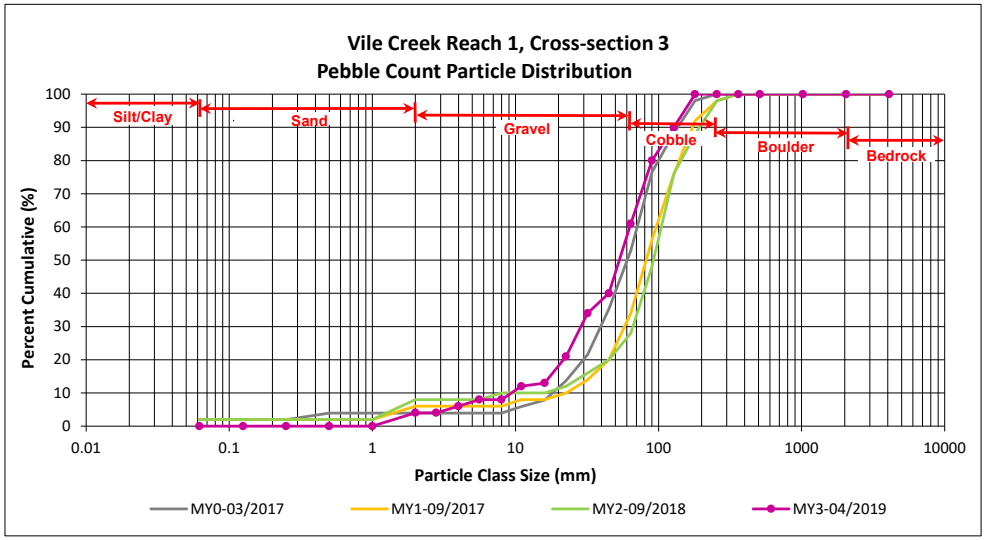
Reachwide and Cross-section Pebble Count Plots

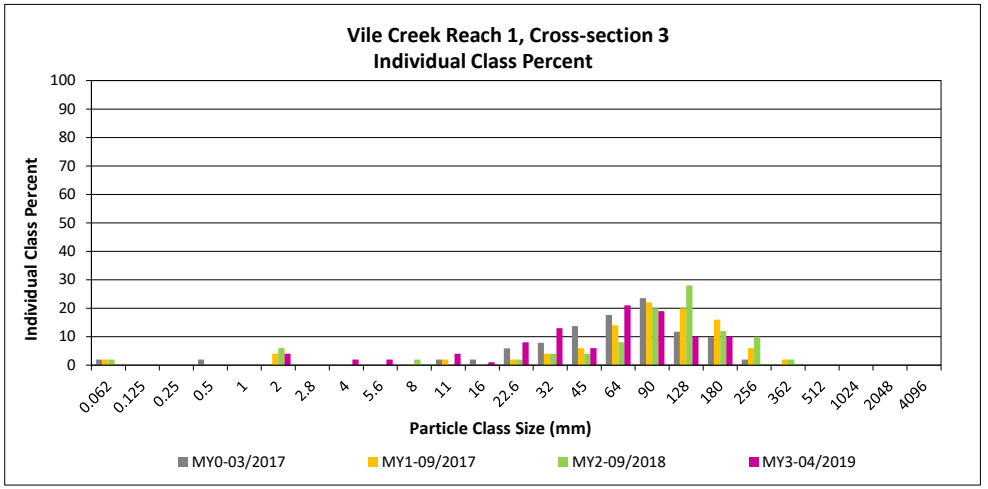
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 1, Cross-section 3

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0	4	4	4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0	2	2	6
	Fine	4.0	5.6	2	2	8
	Fine	5.6	8.0			8
	Medium	8.0	11.0	4	4	12
	Medium	11.0	16.0	1	1	13
	Coarse	16.0	22.6	8	8	21
	Coarse	22.6	32	13	13	34
	Very Coarse	32	45	6	6	40
	Very Coarse	45	64	21	21	61
COBBLE	Small	64	90	19	19	80
	Small	90	128	10	10	90
	Large	128	180	10	10	100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 3	
Channel materials (mm)	
D_{16} =	18.2
D_{35} =	33.9
D_{50} =	53.2
D_{84} =	103.6
D_{95} =	151.8
D_{100} =	180.0





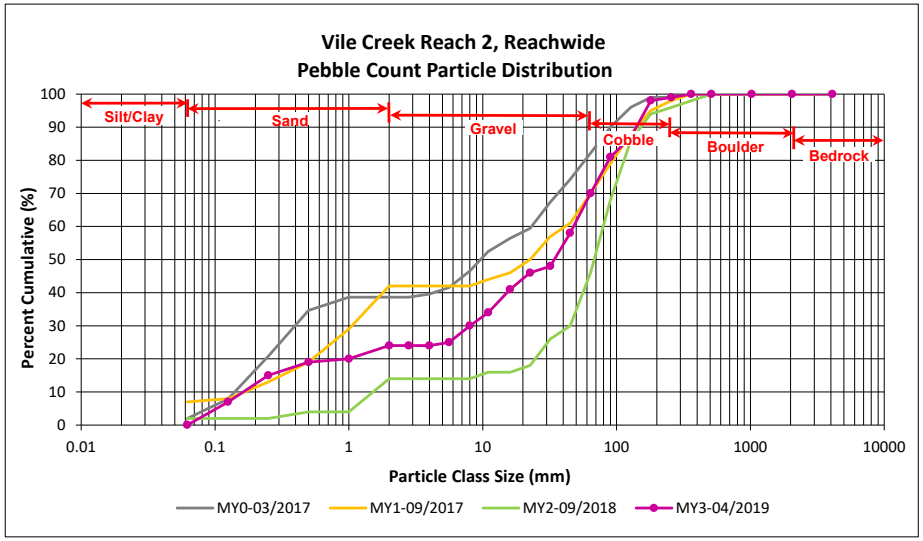
Reachwide and Cross-section Pebble Count Plots

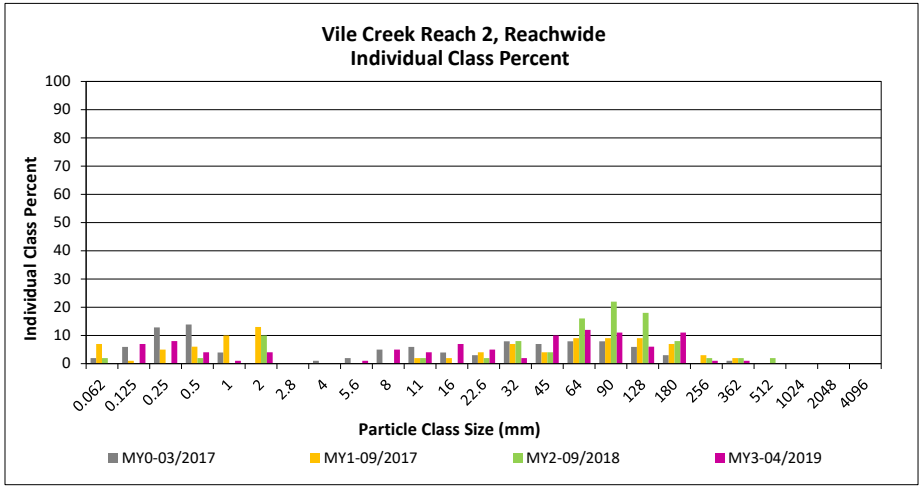
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125	1	6	7	7	7
	Fine	0.125	0.250		8	8	8	15
	Medium	0.25	0.50		4	4	4	19
	Coarse	0.5	1.0		1	1	1	20
	Very Coarse	1.0	2.0	2	2	4	4	24
GRAVEL	Very Fine	2.0	2.8					24
	Very Fine	2.8	4.0					24
	Fine	4.0	5.6		1	1	1	25
	Fine	5.6	8.0	1	4	5	5	30
	Medium	8.0	11.0	3	1	4	4	34
	Medium	11.0	16.0	1	6	7	7	41
	Coarse	16.0	22.6	2	3	5	5	46
	Coarse	22.6	32		2	2	2	48
	Very Coarse	32	45	6	4	10	10	58
	Very Coarse	45	64	8	4	12	12	70
COBBLE	Small	64	90	8	3	11	11	81
	Small	90	128	5	1	6	6	87
	Large	128	180	11		11	11	98
	Large	180	256	1		1	1	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.3
D_{35} =	11.6
D_{50} =	34.3
D_{84} =	107.3
D_{95} =	164.0
D_{100} =	362.0





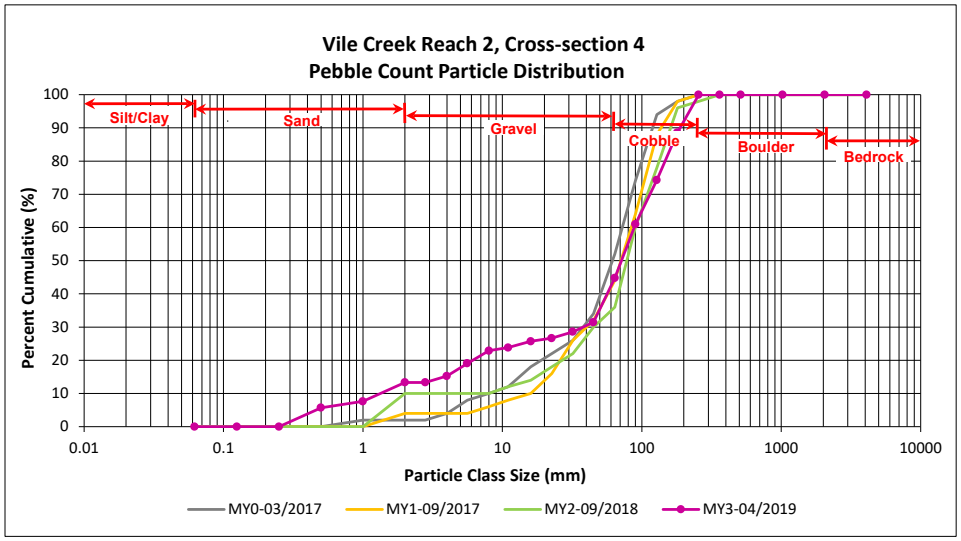
Reachwide and Cross-section Pebble Count Plots

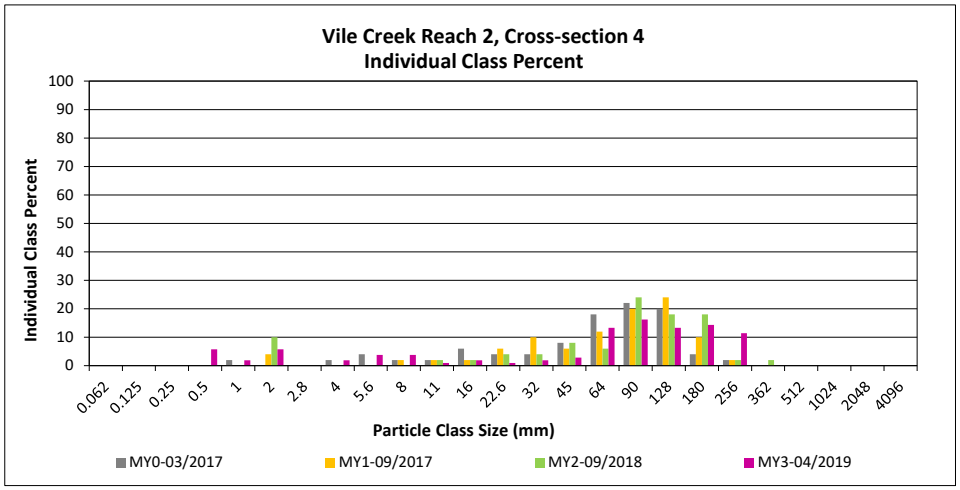
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 2, Cross-section 4

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50	6	6	6
	Coarse	0.5	1.0	2	2	8
	Very Coarse	1.0	2.0	6	6	13
GRAVEL	Very Fine	2.0	2.8			13
	Very Fine	2.8	4.0	2	2	15
	Fine	4.0	5.6	4	4	19
	Fine	5.6	8.0	4	4	23
	Medium	8.0	11.0	1	1	24
	Medium	11.0	16.0	2	2	26
	Coarse	16.0	22.6	1	1	27
	Coarse	22.6	32	2	2	29
	Very Coarse	32	45	3	3	31
	Very Coarse	45	64	14	13	45
COBBLE	Small	64	90	17	16	61
	Small	90	128	14	13	74
	Large	128	180	15	14	89
	Large	180	256	12	11	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**105**	**100**	**100**

Cross-section 4	
Channel materials (mm)	
D_{16} =	4.3
D_{35} =	49.5
D_{50} =	71.5
D_{84} =	161.4
D_{95} =	219.4
D_{100} =	256.0





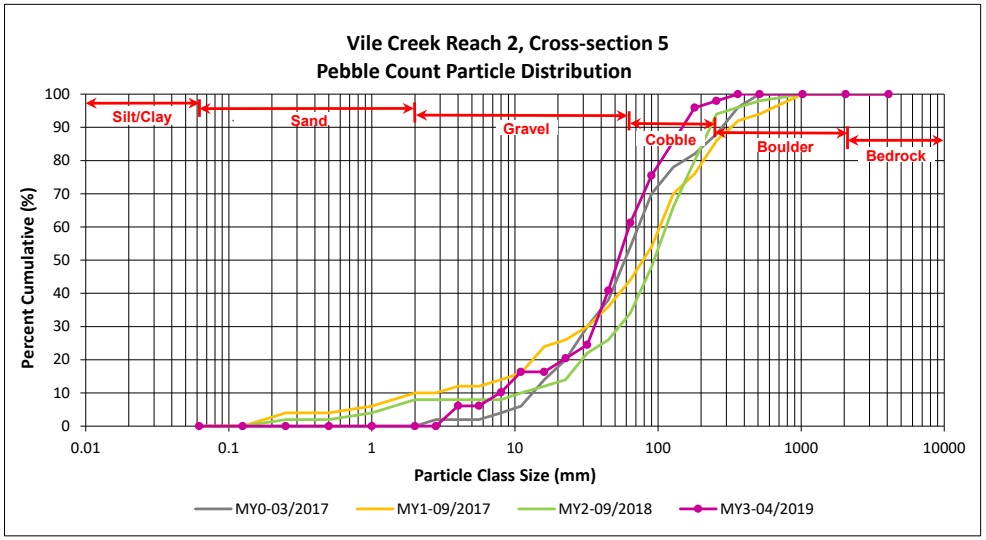
Reachwide and Cross-section Pebble Count Plots

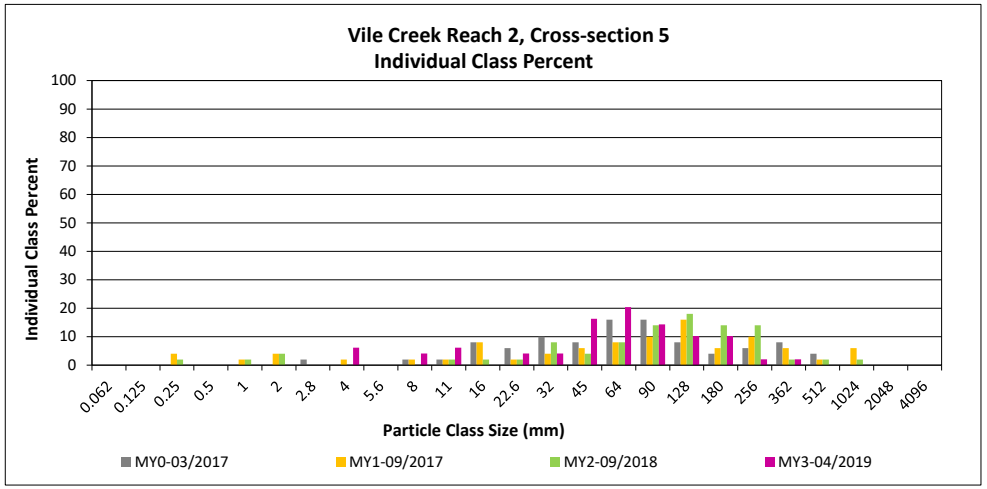
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Vile Creek Reach 2, Cross-section 5

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0			0
	Very Coarse	1.0	2.0			0
GRAVEL	Very Fine	2.0	2.8			0
	Very Fine	2.8	4.0	6	6	6
	Fine	4.0	5.6			6
	Fine	5.6	8.0	4	4	10
	Medium	8.0	11.0	6	6	16
	Medium	11.0	16.0			16
	Coarse	16.0	22.6	4	4	20
	Coarse	22.6	32	4	4	24
	Very Coarse	32	45	16	16	41
	Very Coarse	45	64	22	20	61
COBBLE	Small	64	90	14	14	76
	Small	90	128	10	10	86
	Large	128	180	10	10	96
	Large	180	256	2	2	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 5	
Channel materials (mm)	
D_{16} =	10.8
D_{35} =	39.9
D_{50} =	52.7
D_{84} =	120.6
D_{95} =	174.6
D_{100} =	362.0





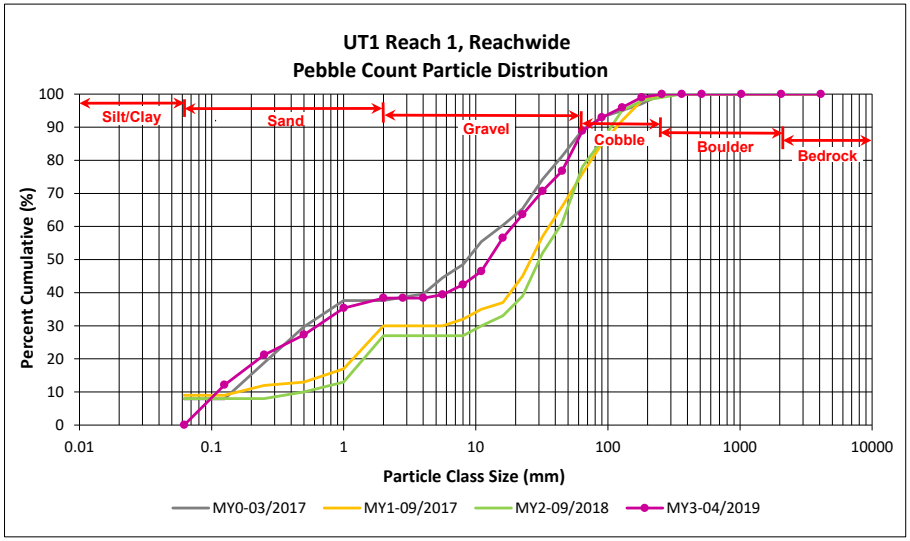
Reachwide and Cross-section Pebble Count Plots

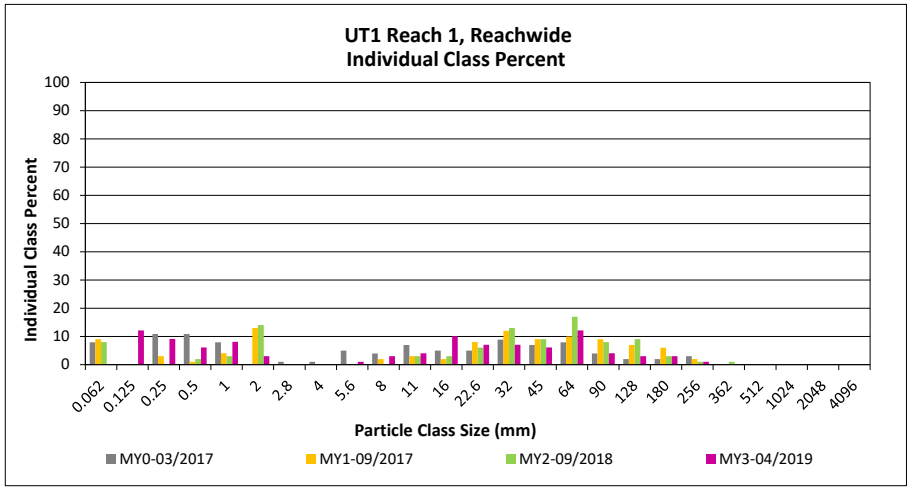
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT1 Reach 1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125		12	12	12	12
	Fine	0.125	0.250	1	8	9	9	21
	Medium	0.25	0.50	1	5	6	6	27
	Coarse	0.5	1.0	1	7	8	8	35
	Very Coarse	1.0	2.0		3	3	3	38
GRAVEL	Very Fine	2.0	2.8					38
	Very Fine	2.8	4.0					38
	Fine	4.0	5.6		1	1	1	39
	Fine	5.6	8.0	2	1	3	3	42
	Medium	8.0	11.0	3	1	4	4	46
	Medium	11.0	16.0	7	3	10	10	57
	Coarse	16.0	22.6	6	1	7	7	64
	Coarse	22.6	32	5	2	7	7	71
	Very Coarse	32	45	6		6	6	77
	Very Coarse	45	64	9	3	12	12	89
COBBLE	Small	64	90	4		4	4	93
	Small	90	128	2	1	3	3	96
	Large	128	180	1	2	3	3	99
	Large	180	256	1		1	1	100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**49**	**50**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	1.0
D_{50} =	12.5
D_{84} =	55.5
D_{95} =	114.5
D_{100} =	256.0





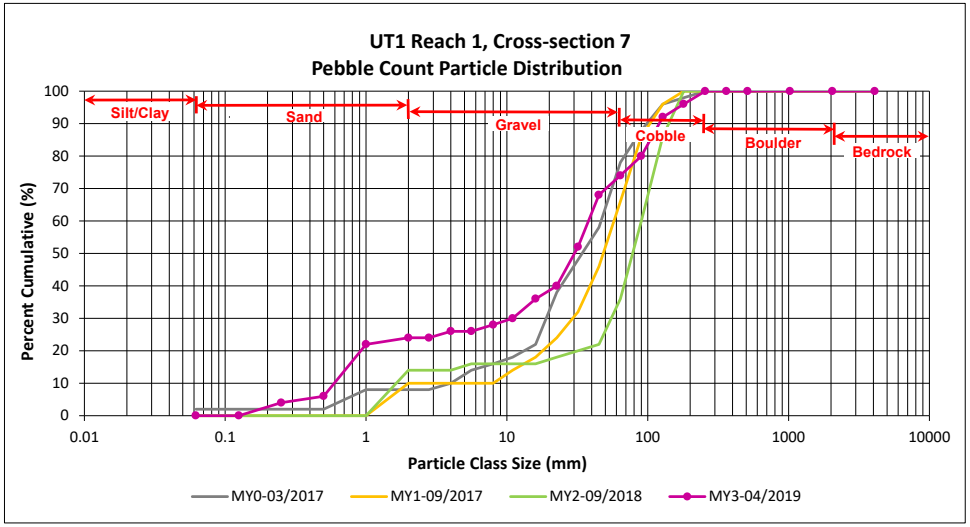
Reachwide and Cross-section Pebble Count Plots

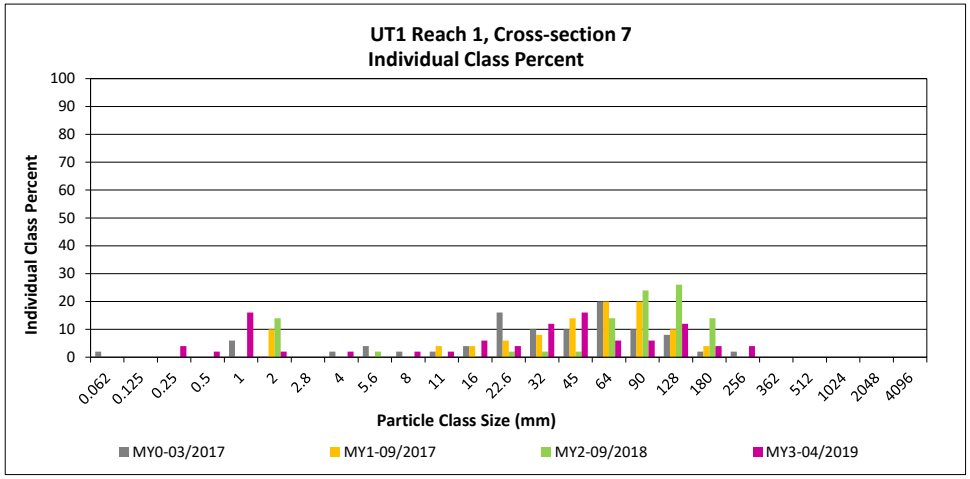
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT1 Reach 1, Cross-section 7

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250	4	4	4
	Medium	0.25	0.50	2	2	6
	Coarse	0.5	1.0	16	16	22
	Very Coarse	1.0	2.0	2	2	24
GRAVEL	Very Fine	2.0	2.8			24
	Very Fine	2.8	4.0	2	2	26
	Fine	4.0	5.6			26
	Fine	5.6	8.0	2	2	28
	Medium	8.0	11.0	2	2	30
	Medium	11.0	16.0	6	6	36
	Coarse	16.0	22.6	4	4	40
	Coarse	22.6	32	12	12	52
	Very Coarse	32	45	16	16	68
	Very Coarse	45	64	6	6	74
COBBLE	Small	64	90	6	6	80
	Small	90	128	12	12	92
	Large	128	180	4	4	96
	Large	180	256	4	4	100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 7	
Channel materials (mm)	
D_{16} =	0.8
D_{35} =	15.0
D_{50} =	30.2
D_{84} =	101.2
D_{95} =	165.3
D_{100} =	256.0





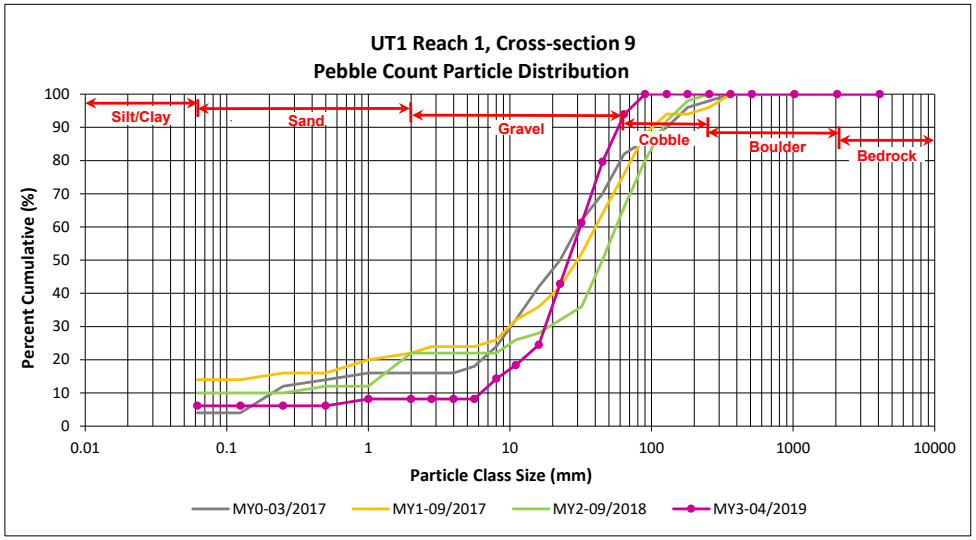
Reachwide and Cross-section Pebble Count Plots

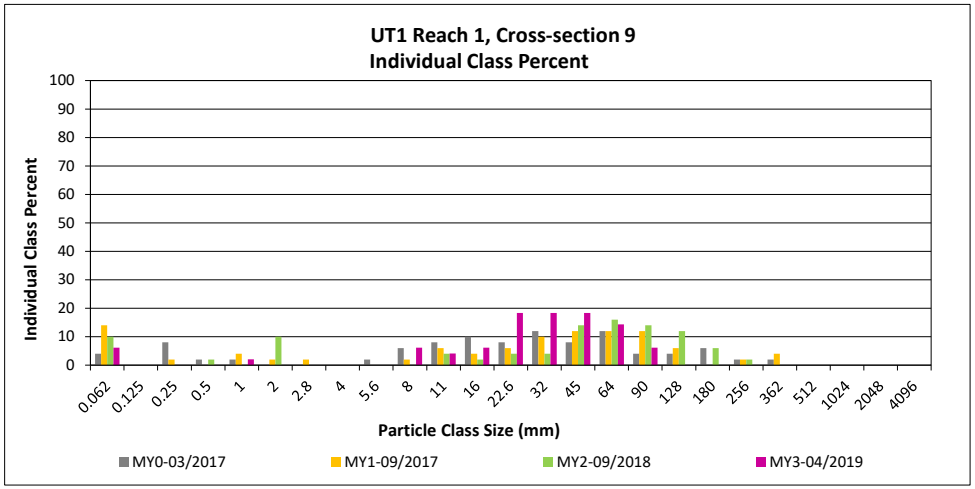
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT1 Reach 1, Cross-section 9

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	6	6	6
SAND	Very fine	0.062	0.125			6
	Fine	0.125	0.250			6
	Medium	0.25	0.50			6
	Coarse	0.5	1.0	2	2	8
	Very Coarse	1.0	2.0			8
GRAVEL	Very Fine	2.0	2.8			8
	Very Fine	2.8	4.0			8
	Fine	4.0	5.6			8
	Fine	5.6	8.0	6	6	14
	Medium	8.0	11.0	4	4	18
	Medium	11.0	16.0	6	6	24
	Coarse	16.0	22.6	19	18	43
	Coarse	22.6	32	19	18	61
	Very Coarse	32	45	18	18	80
	Very Coarse	45	64	14	14	94
COBBLE	Small	64	90	6	6	100
	Small	90	128			100
	Large	128	180			100
	Large	180	256			100
BOULDER	Small	256	362			100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 9	
Channel materials (mm)	
D_{16} =	9.1
D_{35} =	19.5
D_{50} =	25.9
D_{84} =	50.2
D_{95} =	68.1
D_{100} =	90.0





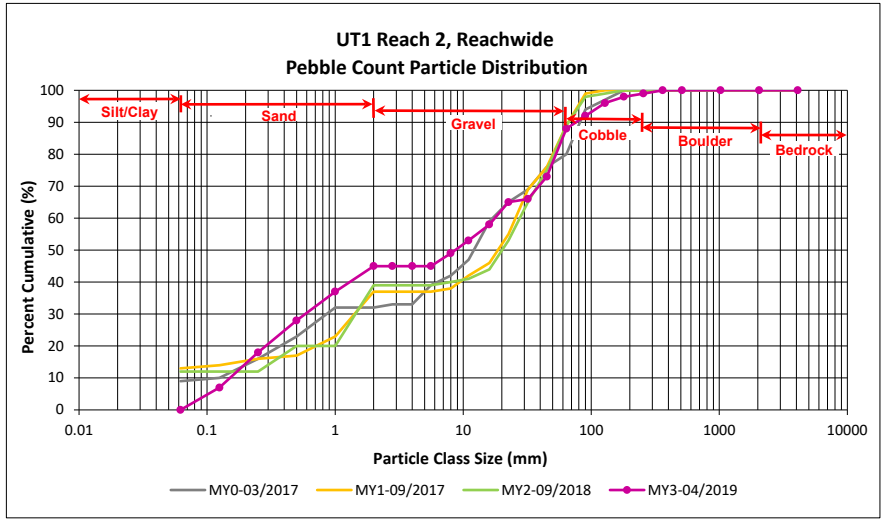
Reachwide and Cross-section Pebble Count Plots

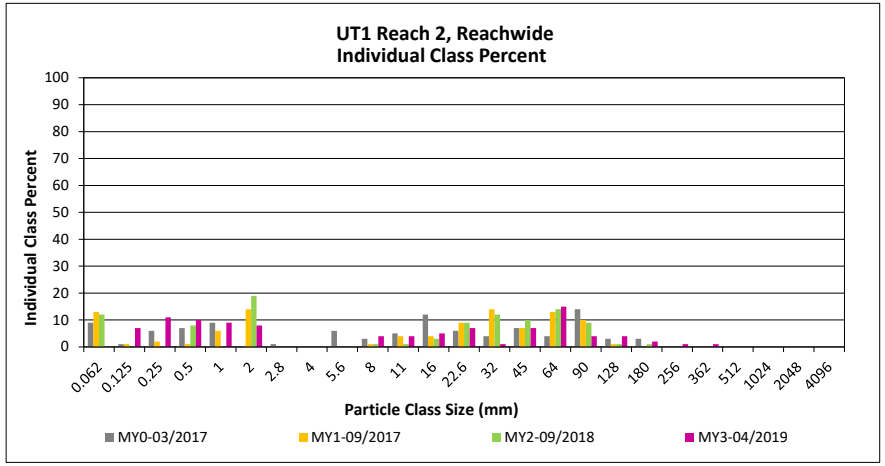
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT1 Reach 2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125		7	7	7	7
	Fine	0.125	0.250		11	11	11	18
	Medium	0.25	0.50		10	10	10	28
	Coarse	0.5	1.0	2	7	9	9	37
	Very Coarse	1.0	2.0	1	7	8	8	45
GRAVEL	Very Fine	2.0	2.8					45
	Very Fine	2.8	4.0					45
	Fine	4.0	5.6					45
	Fine	5.6	8.0	1	3	4	4	49
	Medium	8.0	11.0	3	1	4	4	53
	Medium	11.0	16.0	2	3	5	5	58
	Coarse	16.0	22.6	6	1	7	7	65
	Coarse	22.6	32	1		1	1	66
	Very Coarse	32	45	7		7	7	73
	Very Coarse	45	64	15		15	15	88
COBBLE	Small	64	90	4		4	4	92
	Small	90	128	4		4	4	96
	Large	128	180	2		2	2	98
	Large	180	256	1		1	1	99
BOULDER	Small	256	362	1		1	1	100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.2
D_{35} =	0.9
D_{50} =	8.7
D_{84} =	58.3
D_{95} =	117.2
D_{100} =	362.0





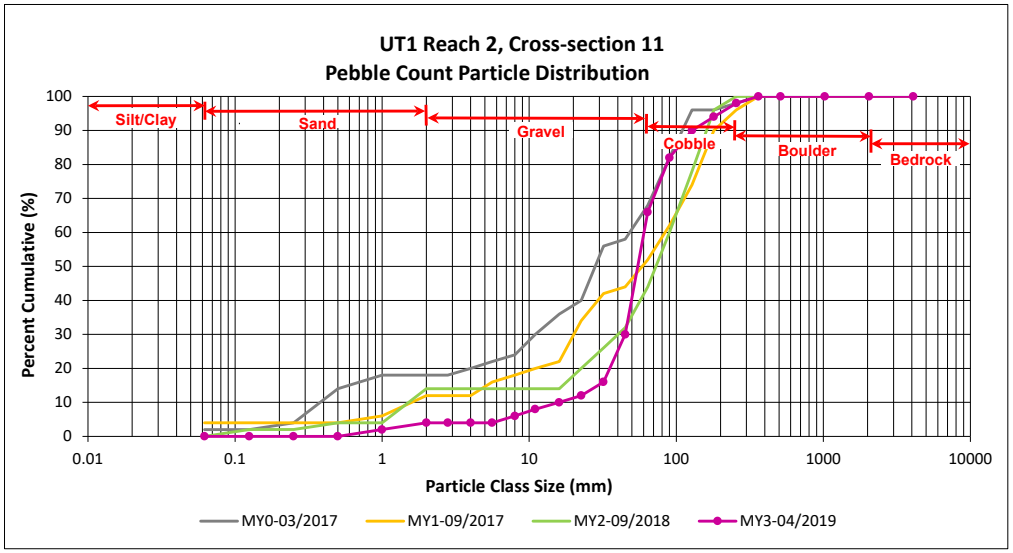
Reachwide and Cross-section Pebble Count Plots

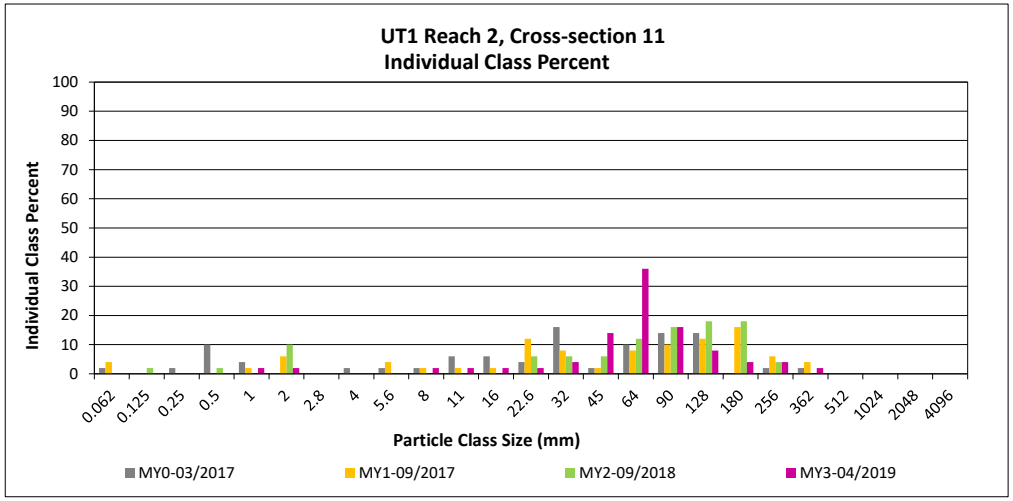
Vile Creek Restoration Site
DMS Project No. 96582
Monitoring Year 3 - 2019

UT1 Reach 2, Cross-section 11

Particle Class		Diameter (mm) min	Diameter (mm) max	Riffle 100-Count	Summary: Class Percentage	Summary: Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062			0
SAND	Very fine	0.062	0.125			0
	Fine	0.125	0.250			0
	Medium	0.25	0.50			0
	Coarse	0.5	1.0	2	2	2
	Very Coarse	1.0	2.0	2	2	4
GRAVEL	Very Fine	2.0	2.8			4
	Very Fine	2.8	4.0			4
	Fine	4.0	5.6			4
	Fine	5.6	8.0	2	2	6
	Medium	8.0	11.0	2	2	8
	Medium	11.0	16.0	2	2	10
	Coarse	16.0	22.6	2	2	12
	Coarse	22.6	32	4	4	16
	Very Coarse	32	45	14	14	30
	Very Coarse	45	64	36	36	66
COBBLE	Small	64	90	16	16	82
	Small	90	128	8	8	90
	Large	128	180	4	4	94
	Large	180	256	4	4	98
BOULDER	Small	256	362	2	2	100
	Small	362	512			100
	Medium	512	1024			100
	Large/Very Large	1024	2048			100
BEDROCK	Bedrock	2048	>2048			100
			Total	**100**	**100**	**100**

Cross-section 11	
Channel materials (mm)	
D_{16} =	32.0
D_{35} =	47.3
D_{50} =	54.7
D_{84} =	98.3
D_{95} =	196.6
D_{100} =	362.0





APPENDIX 5. Hydrology Summary Data and Plots

Table 13a. Verification of Bankfull Events

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3- 2019

Reach	Monitoring Year	Date of Occurrence	Method
Vile Reach 2	MY1	3/31/2017	Stream Gage
		4/24/2017	
		10/8/2017	
	MY2	9/16/2018	
		10/11/2018	
UT1 Reach 2	MY1	5/5/2017	
		10/8/2017	
	MY2	10/11/2018	
	MY3	6/17/2019	
		8/1/2019	
		9/30/2019	

Table 13b. Verification of Geomorphically Significant Events

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3- 2019

Reach	Monitoring Year	Date of Occurrence	Method
Vile Reach 2	MY3	2/23/2019	Stream Gage
		4/14/2019	
		4/19/2019	
		6/17/2019	
		7/5/2019	
		8/1/2019	
		9/30/2019	
UT1 Reach 2	MY3	2/23/2019	
		4/14/2019	
		4/19/2019	
		6/17/2019	
		7/30/2019	
		8/1/2019	
		9/30/2019	

Table 14. Wetland Gage Attainment Summary

Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

Summary of Groundwater Gage Results for Monitoring Years 1 through 7							
Gage	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)						
	Year 1 (2017)	Year 2 (2018)	Year 3 (2019)	Year 4 (2020)	Year 5 (2021)	Year 6 (2022)	Year 7 (2023)
1*	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)				
2	Yes/ 129 Days (77%)	Yes/33 Days (20%)	Yes/15 Days (9%)				
3	Yes/169 Days (100%)	Yes/73 Days (43%)	Yes/14 Days (8.5%)				
4	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)				
5	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)				
6	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)				
7	Yes/ 129 Days (77%)	Yes/33 Days (20%)	Yes/24 Days (14%)				
8	Yes/125 Days (74%)	Yes/14 Days (8%)	No/4 Days (2%)				
9	Yes/40 Days (24%)	Yes/33 Days (20%)	Yes/106 Days (63%)				
10*	Yes/169 Days (100%)	Yes/169 Days (100%)	Yes/169 Days (100%)				

*Gages are located in bog habitat.
Growing season is April 26th -October 11th.
Success criteria for wetlands is 14 consecutive days (8.5%) and 20 consecutive days (12%) for bogs.

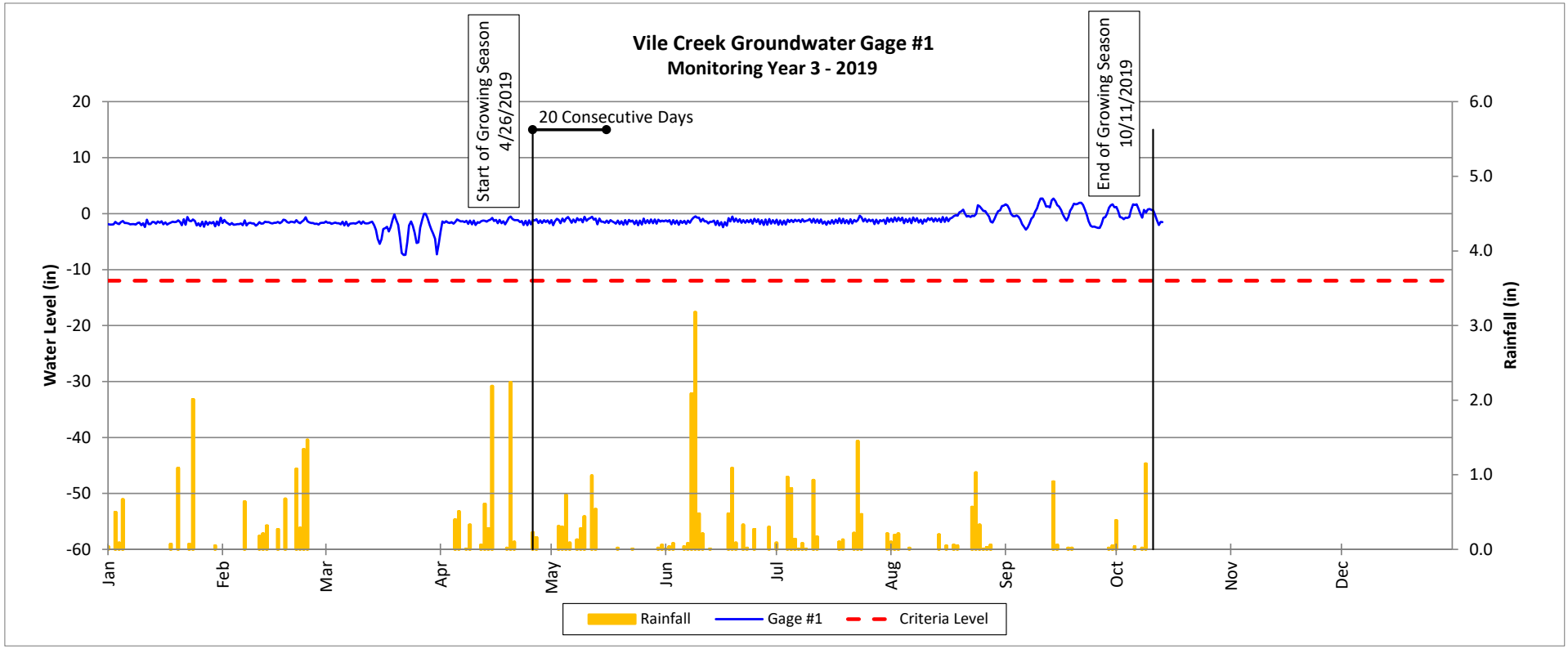
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Bog Rehabilitation



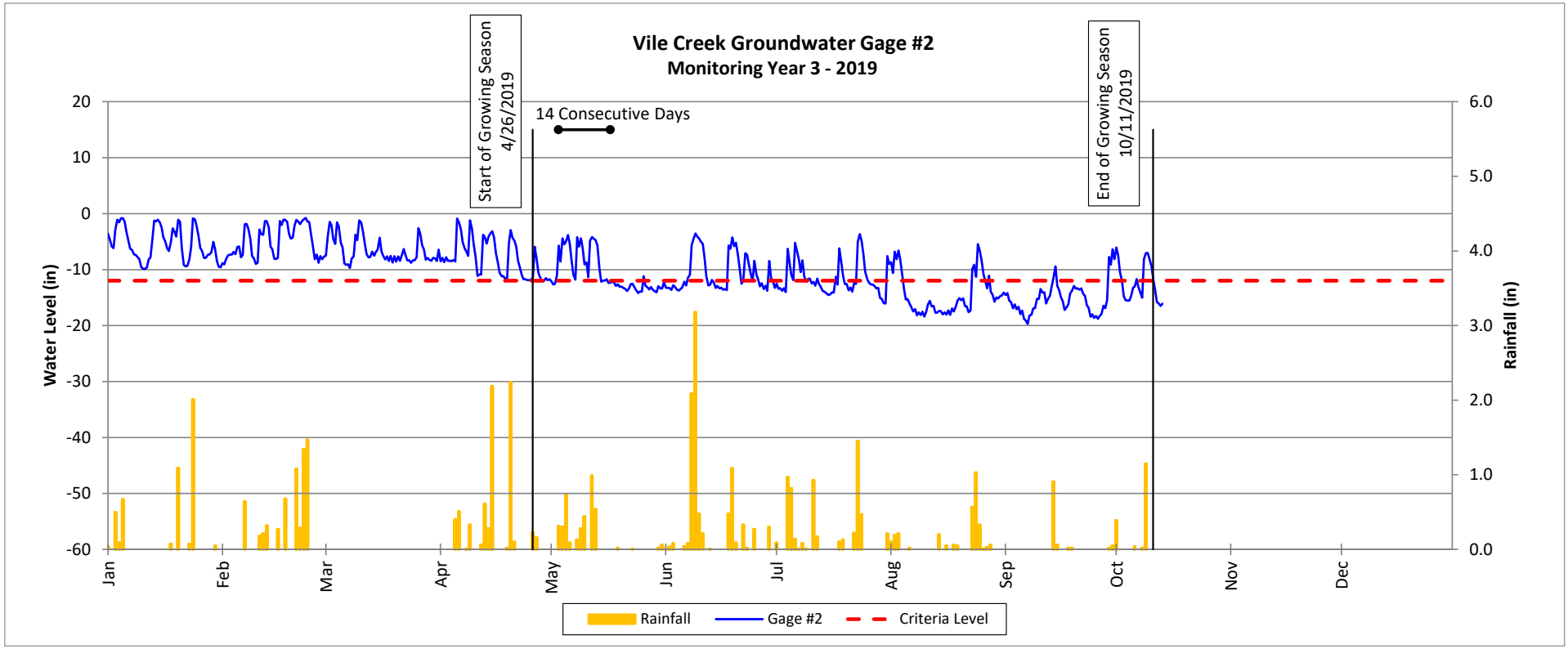
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



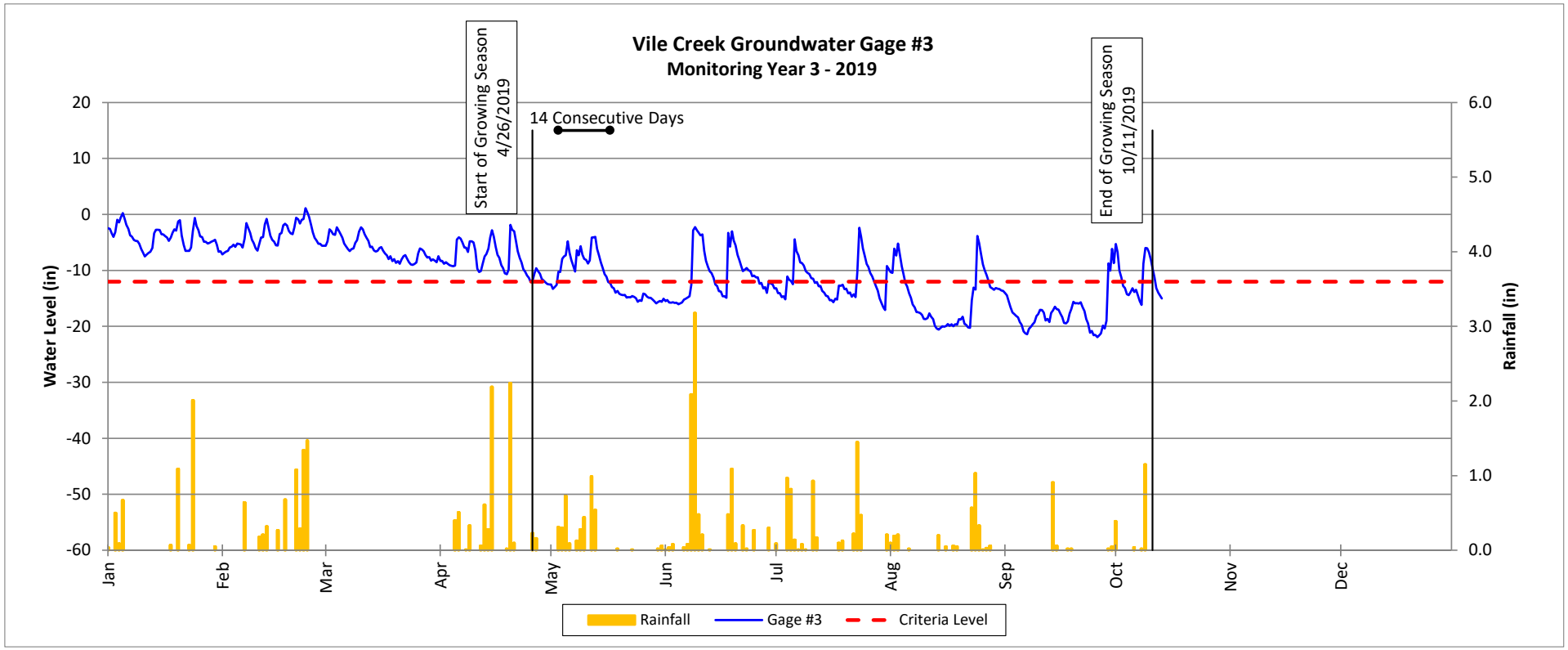
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



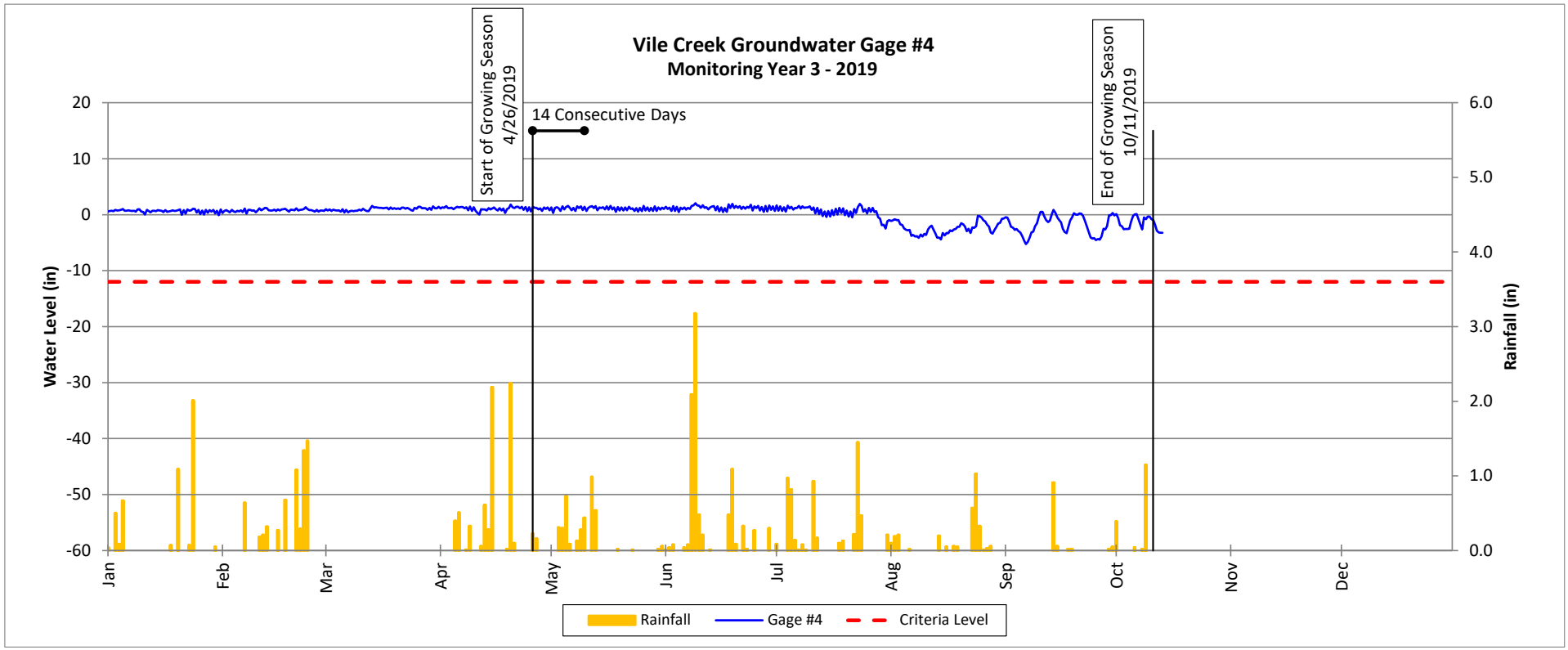
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



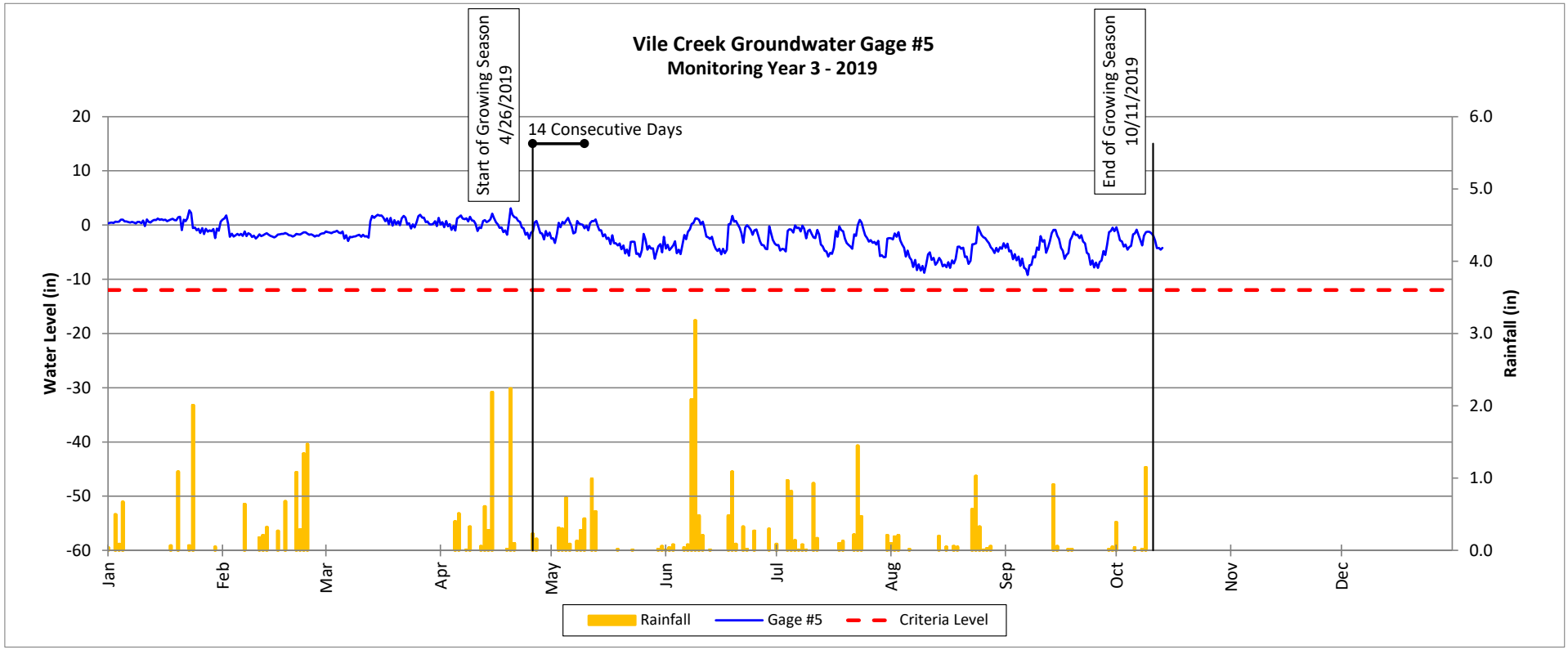
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Rehabilitation



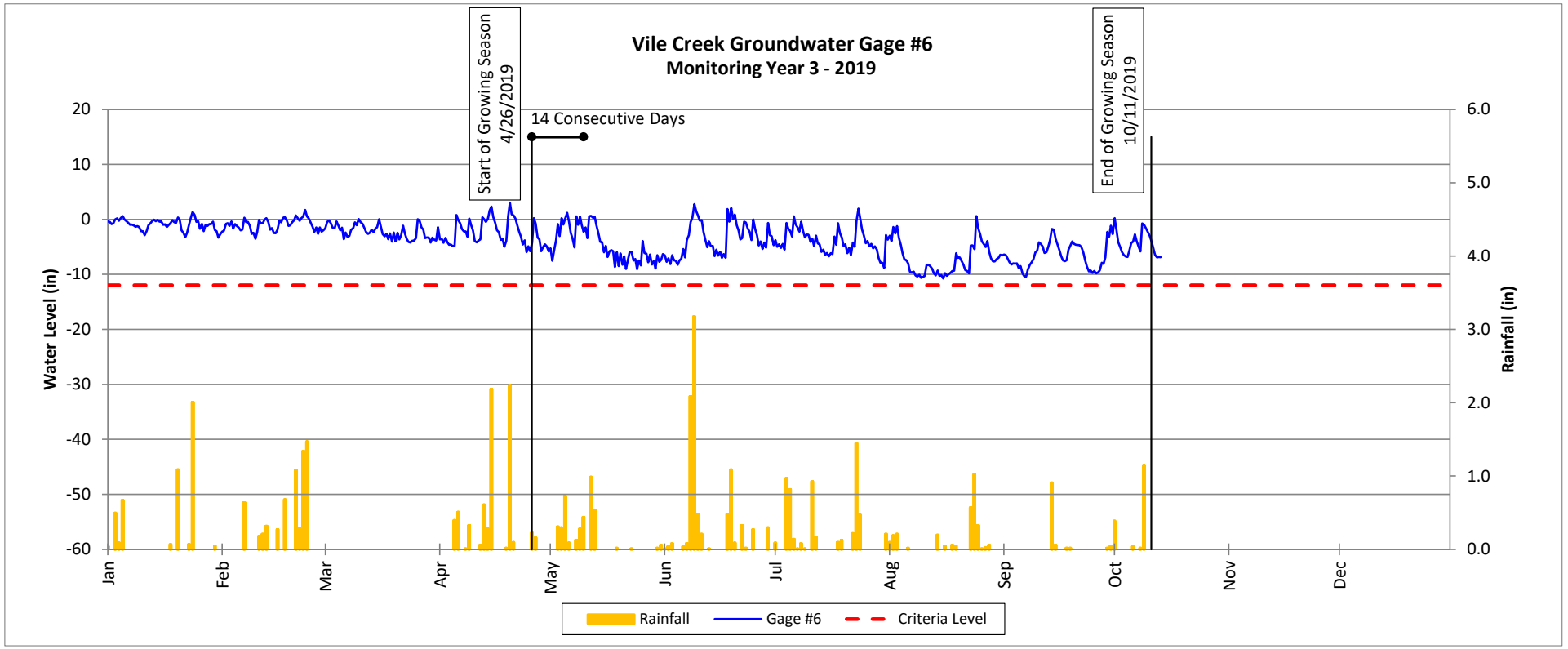
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



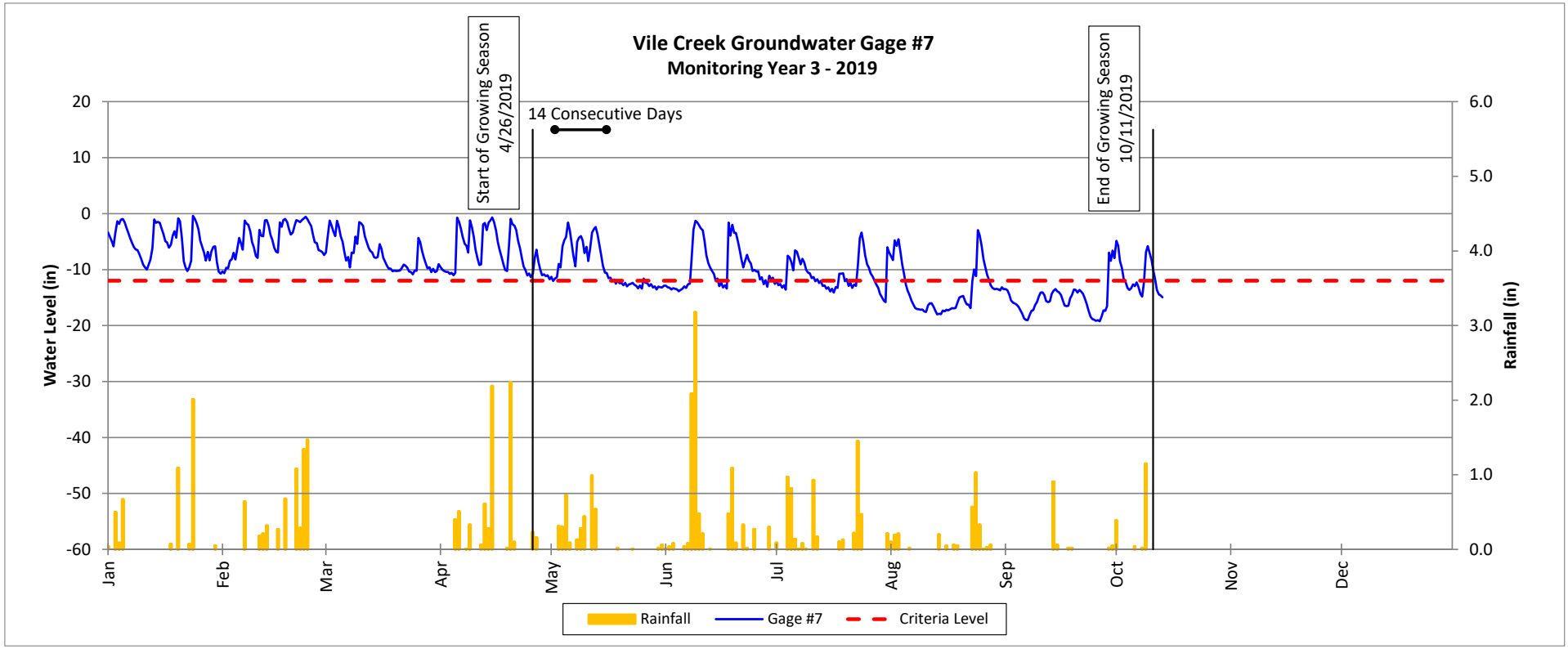
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



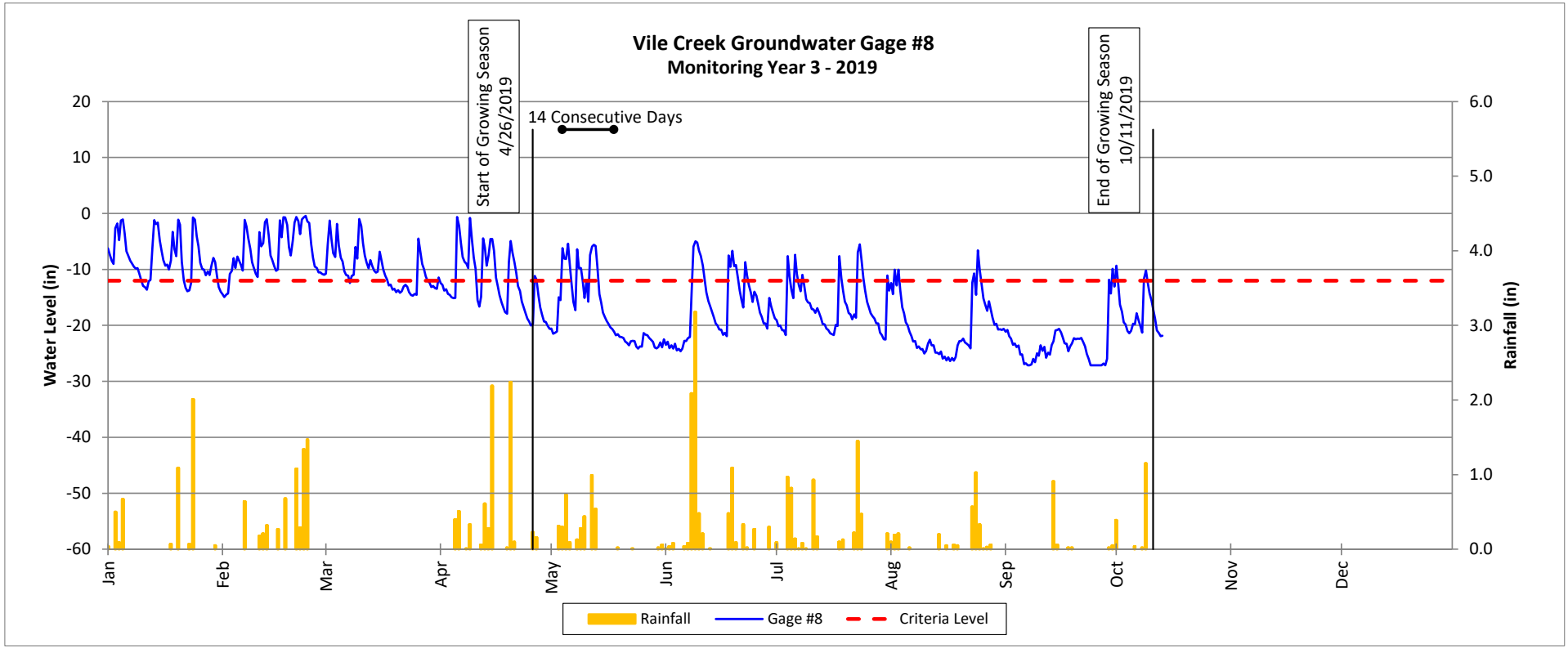
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



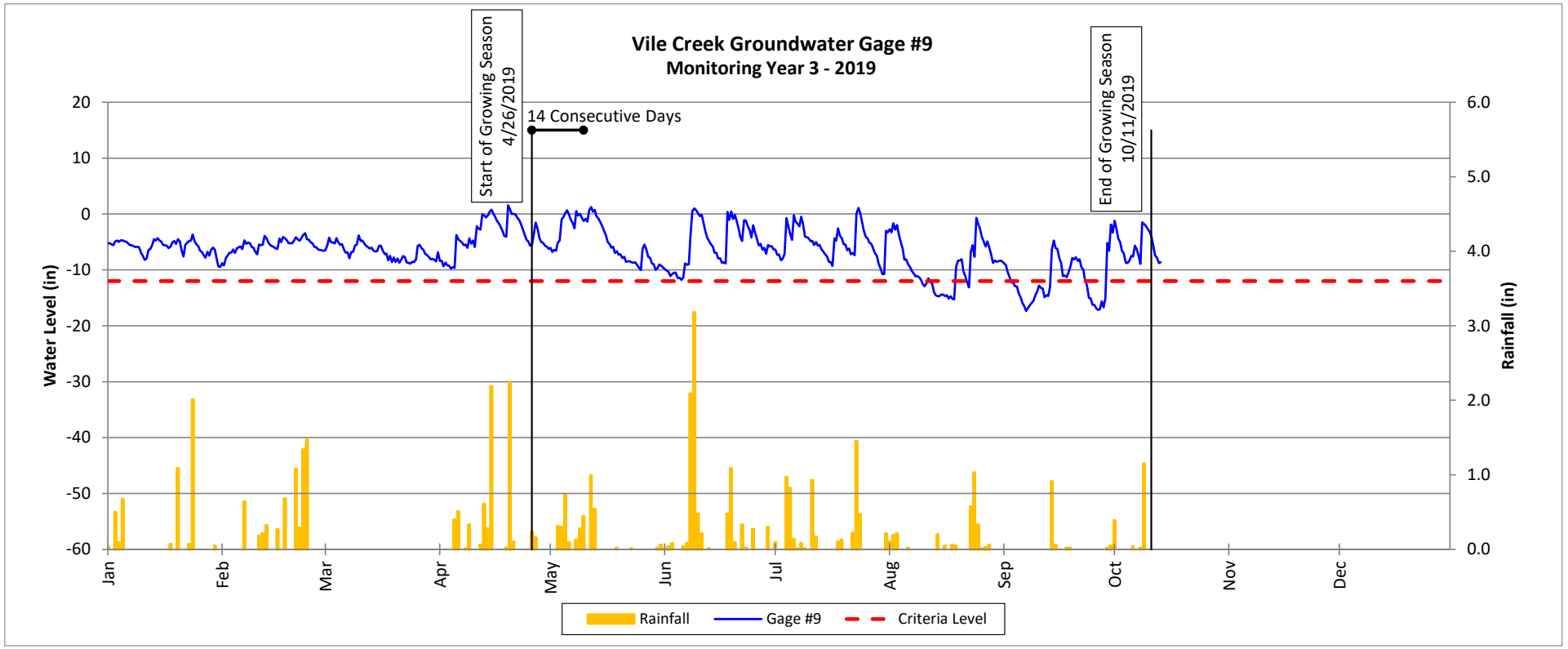
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Re-establishment



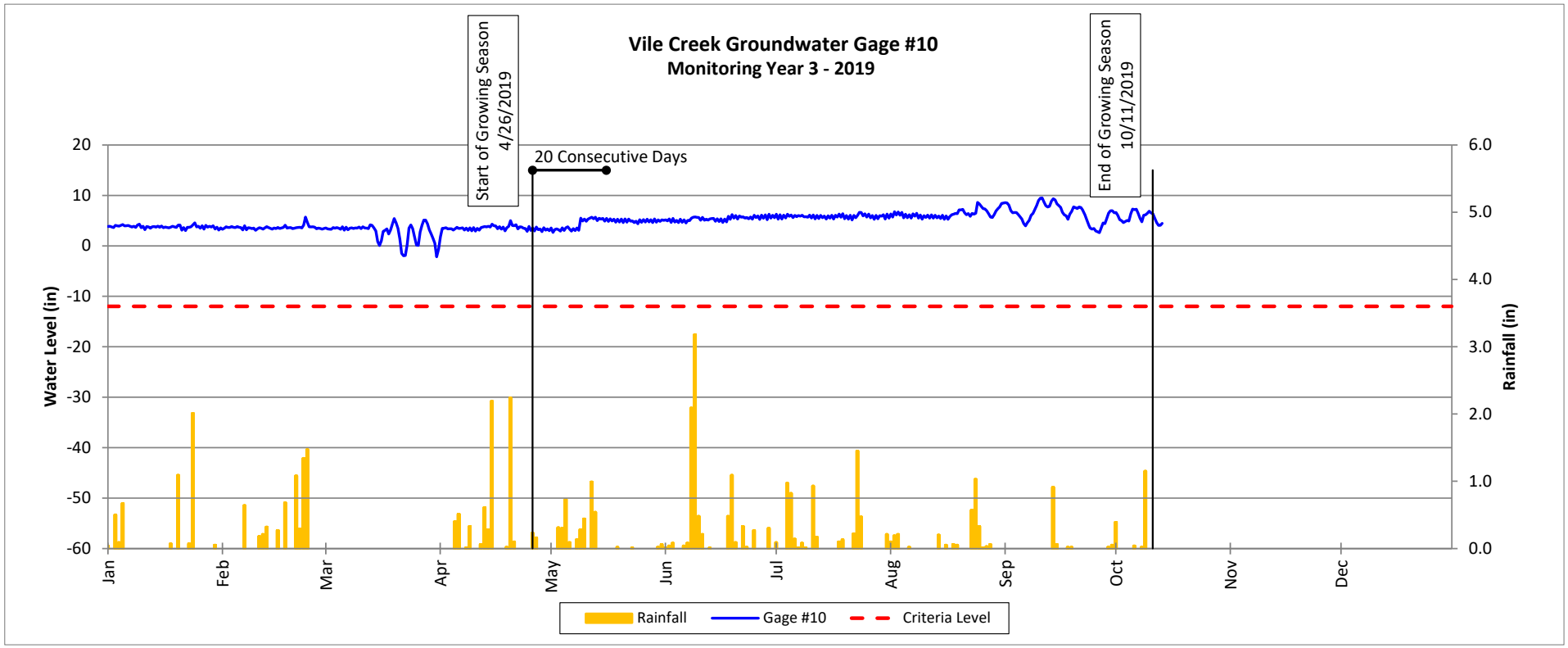
Groundwater Gage Plots

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019

Wetland Bog Rehabilitation

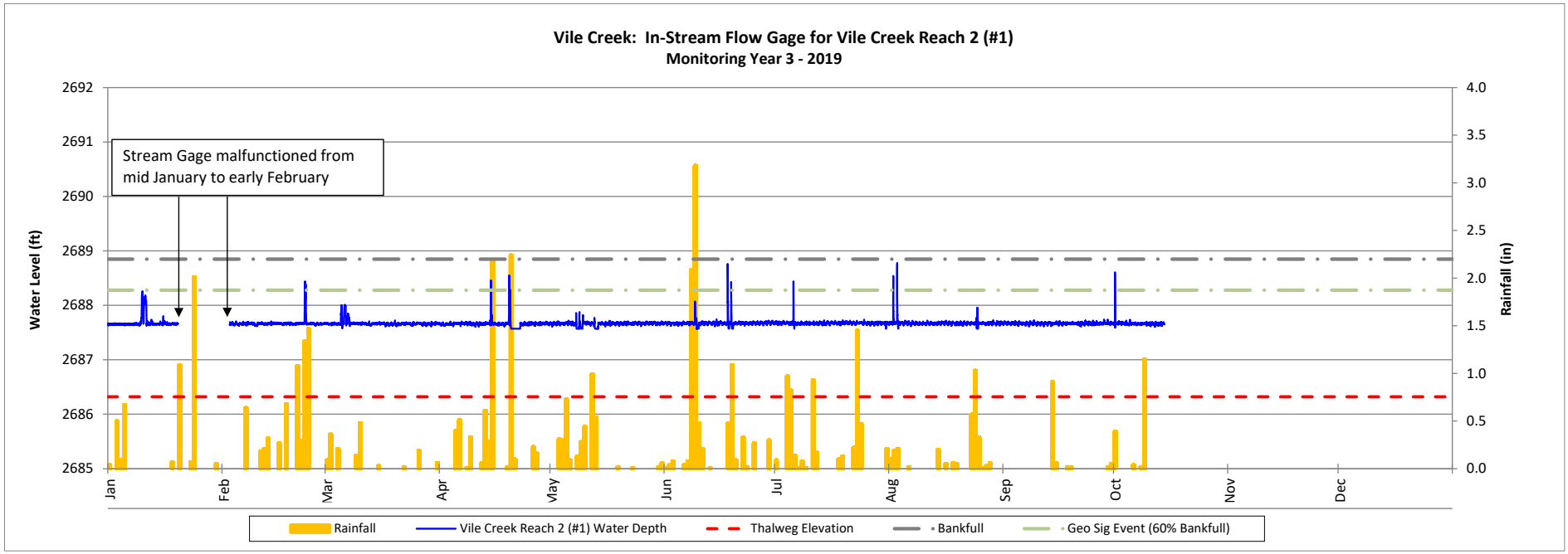


Recorded Geomorphic Significant Flow and Bankfull Events

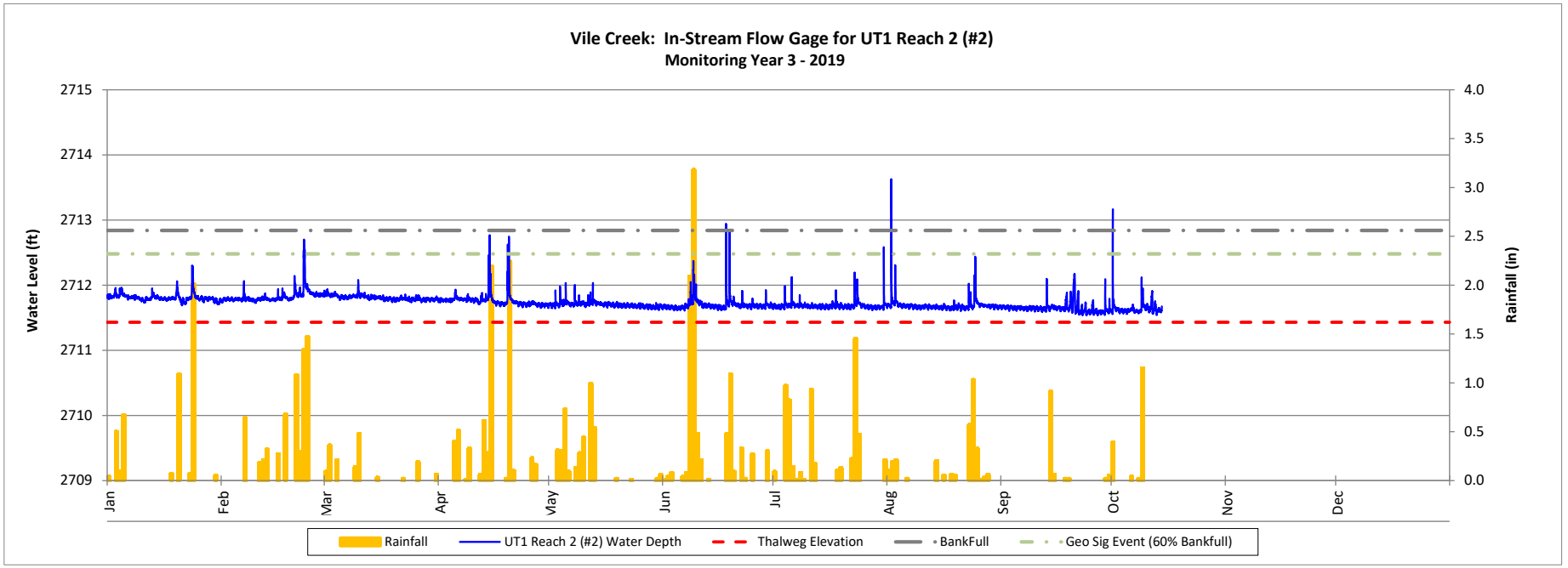
Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019



Recorded Geomorphic Significant Flow and Bankfull Events
Vile Creek Mitigation Site
DMS Project No. 96582
Monitoring Year 3 - 2019

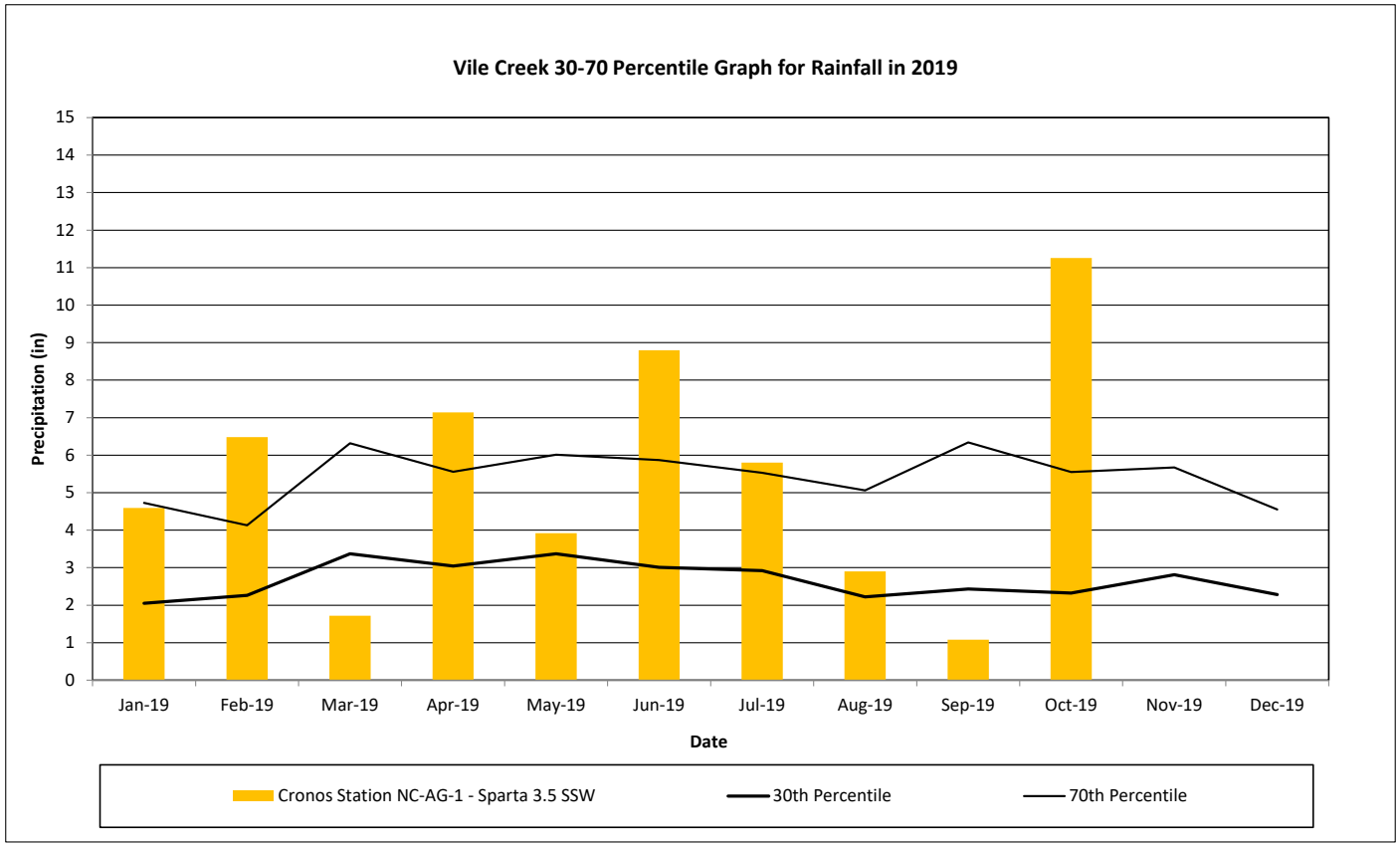


Monthly Rainfall Data

Vile Creek Mitigation Site

DMS Project No. 96582

Monitoring Year 3 - 2019



2019 rainfall collected by Cronos Station NC-AG-1 - Sparta 3.5 SSW

30th and 70th percentile rainfall data collected from Wets Station Sparta 3.5 SSW, NC (Years 1971 - 2019)