

**UT to Clarke Creek Stream and Wetland Restoration Site  
Annual Final Monitoring Report  
FINAL**

DMS # 92500

DENR Contract # 005363

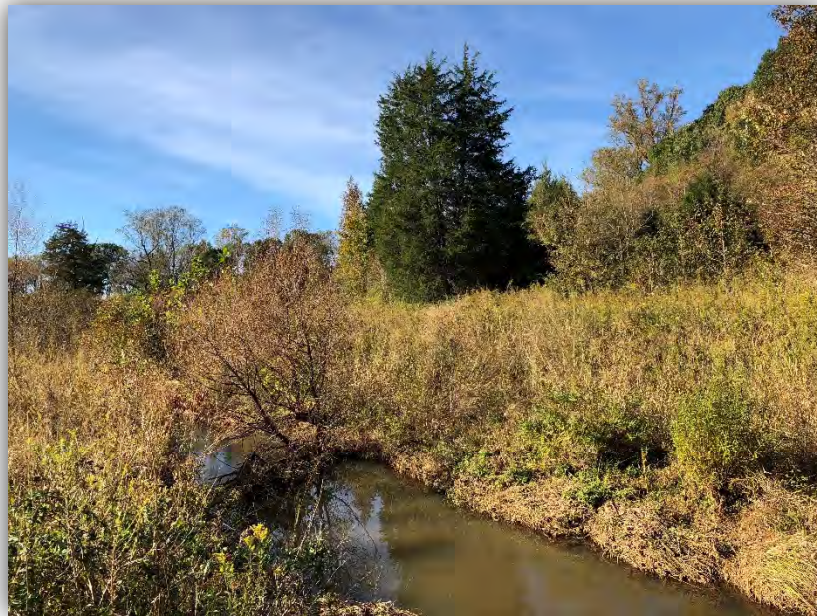
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Monitoring Report Year 5 of 5  
Mecklenburg County, North Carolina



Submitted to:

NC Department of Environmental Quality  
Division of Mitigation Services  
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Data Collection: October 2018  
Report Submission: February 2019

Submitted by:

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February 1, 2019

Paul Wiesner  
Western Regional Supervisor  
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**Re: Comment Response Letter  
UT Clarke Creek Stream and Wetland Restoration  
DRAFT Monitoring Year 5 Report  
Yadkin River Basin – CU# 03040105  
Mecklenburg County  
DMS Project # 92500; DENR Contract No. 005363**

Dear Mr. Wiesner,

Thank you for the comments on the subject document. The following are SEPI Engineering and Constructions (SEPI) response to NC Division of Mitigation Services (NCDMS) comment letter dated and received via email on January 24, 2019. The responses also reflect information contained in the NCDMS January 28, 2019 email.

**Comment:** *General: DMS had concerns regarding the persistence of flow hydrology in UT3, UT4 and UT5 in MY4. DMS installed and monitored flow gauges in these reaches during MY5. A stream gauge location map and the associated stream flow graphs are attached. Please include this attachment as an Appendix and reference it in the report text in the final MY5 report.*

**Response:** The following text was added to the report: "Monitoring gauges were installed by NCDMS on UT3, UT4 and UT5 to document surface flow within the tributaries during MY05. One gauge was installed on UT3; four on UT4 and one on UT5. All gauges showed surface flow for greater than 120 consecutive days between January 2018 and October 2018."

The map and graphs were added in Appendix F: Supplemental Stream Gauge Data.

**Comment:** *Section 1.3.1 – Stream Morphology and Channel Stability: In the revised report, please note that the debris jam within UT1 was removed in December 2018.*

**Response:** The following text was added to the report: "The debris jam was removed in December 2018."

**Comment:** *Section 1.3.1 – Stream Morphology and Channel Stability – 6th paragraph: "On UT to Clarke Creek areas of bare bank which were observed during the 2018 monitoring at Stations 6+00." Please revise the sentence.*

**Response:** The sentence was revised to read "During MY05 (2018), one area of sparse vegetation was observed on UT to Clarke Creek around Station 6+00."

**Comment:** *Section 1.3.2 – Wetlands: "Three more loggers were placed during the 2015 growing season." Please update to: "Three more loggers were placed during the MY02 (2015) growing season."*

**Response:** The sentence was revised to read "Three more loggers were placed during the MY02 (2015) growing season."

**Comment:** *Section 1.3.3 – Vegetation: In the report text, please note that an invasive species treatment will be conducted in 2019.*

**Response:** The following text was added to the report: "An additional invasive species treatment will be conducted in 2019."

**Comment:** *Section 1.3.3 – Vegetation: In the report text, please specify the monitoring years that the supplemental plantings were completed. Example: "Carolina Silvics completed a supplemental planting effort in the 2015 - 2016 dormant season throughout the Site. In February 2016 (MY3), Carolina Silvics replanted 1,300 stems in areas where stem densities were still not meeting the vegetative success criteria."*

**Response:** The paragraphs were revised to read: "...MY03 (February 2016) ..." and "... MY04 (February 2017) ...".

**Comment:** *Table 2: Please update "\*Replant" to "Supplemental Planting" in the table. Please add a footnote or remove the "\*" before the entry.*

**Response:** This edit was made. "Replant" was changed to "Supplemental Planting". The "\*" was removed from the table.

**Comment:** *CCPV Sheets: The "Wetland, Meeting" and "Wetland, Not Meeting" legend and map colors are similar. In the legend and mapping, please update "Wetland, Meeting" to green and "Wetland, Not Meeting" to red.*

**Response:** The "Wetland, Meeting" symbol was changed to green and the "Wetland, Not Meeting" symbol was changed to red.

**Comment:** *CCPV Sheets & Table 13: Based on Table 13, gauge 2 should be shown as an "upland" gauge on the maps. Additionally, gauge 8 should NOT be shown as a "upland" gauge on the maps. Please QA/ QA the Table and CCPV maps and update accordingly.*

**Response:** Table 13 and the CCPV maps were reviewed. The CCPV map was revised, showing gauges 2, 4 and 7 as upland gauges.

**Comment:** *CCPV Sheets: For the vegetation plots, please update the "Meeting" legend and map color to green and the "Not Meeting" legend and map color to red.*

**Response:** The "Meeting" symbol was changed to green and the "Not Meeting" symbol was changed to red.

**Comment:** *CCPV Sheets and Table 6: Areas of invasive should be represented by general polygons (as reported in Table 6) and not points. Please update the CCPV maps accordingly. As noted in Table 6, the mapping threshold for invasive species is 1,000 square feet.*

**Response:** The CCPV was updated to depict invasive species as polygons. All invasive species points were removed.



**Comment:** *CCPV Sheets and Table 6: In the CCPV sheets, "Sparse Vegetation" should be changed. As reported in Table 6, "Bare Areas", "Low Stem Density Areas"; and Areas of Poor Growth Rates of Vigor" should be reported on the CCPV sheets. These areas should be represented by general polygons (as reported in Table 6) and not points or lines. Please update the CCPV maps accordingly. Please note the mapping threshold for these areas as established in Table 6.*

**Response:** "Sparse Vegetation" was changed to "Bare Areas" in the CCPV sheets.

**Comment:** *Photo Station Sheets – Draft hard copy: Some of the photo sheets in the draft hard copy printed upside down. Please correct in the final hard copies.*

**Response:** The final copy was reviewed, and all pages displayed correctly.

**Comment:** *Table 9: Please include the Scientific Name, Common Name, and Species Type for the Annual Means (MY0 – MY5) sheet of the table.*

**Response:** Table 9 was revised to show Scientific Name, Common Name, and Species Type for the Annual Means (MY0 – MY5) sheet of the table.

**Comment:** *Cross-sections: The MY4 line appears to have plotted incorrectly on multiple graphs. Please correct and update any affected data tables.*

*The large change of BHR on XS1A and XS 9 appears visually inconsistent with changes seen in the graph. This may be an artifact of the new calculation method but appears questionable. Please verify the calculations (guidance attached).*

**Response:** Cross-sections: The MY4 line was plotted incorrectly. It was revised and is now accurately shown. All data tables are accurate.

The large change in the BHR on XS1A and XS9 is mainly a result of the new BHR calculation method. The MY05 bankfull cross sectional area was revised to match the MY0 bankfull cross sectional area. This decreased the bankfull elevation, thereby decreasing the bankfull maximum depth, but the low bank elevation remained the same.

Cross Section 1A						
Monitoring Year	0 (baseline)	1 (2014)	2 (2015)	3 (2016)	4 (2017)	5 (2018)
Bankfull area (ft <sup>2</sup> )	1.78	5.96	7.67	7.92	7.5	1.8
Bankfull Elevation (ft)	742.4	742.4	742.4	742.4	742.4	741.8
Thalweg Elevation (ft)	740.92	740.48	740.59	740.74	740.68	740.98
Bankfull d max (ft)	1.48	1.92	1.81	1.66	1.72	0.8
Low Bank Elevation (ft)	742.93	743.04	742.65	742.89	743.14	743.14
Low Bank Height (ft)	2.01	2.56	2.06	2.15	2.46	2.2
BHR	1.4	1.3	1.1	1.3	1.4	2.8

On Cross Section 1A the bankfull elevation was lowered approximately 0.6 feet to adjust the MY05 bankfull cross sectional area to match the MY0 bankfull cross

sectional area. This reduced the bankfull maximum depth by 0.9 feet. The low bank height remained relatively consistent through the monitoring period (2.01 – 2.46 feet). The significant reduction in bankfull maximum depth and stable low bank height resulted in a significantly higher MY05 BHR.

Cross Section 9						
Monitoring Year	0 (baseline)	1 (2014)	2 (2015)	3 (2016)	4 (2017)	5 (2018)
Bankfull area (ft <sup>2</sup> )	2.8	2.48	3.47	4.41	3.1	2.8
Bankfull Elevation (ft)	746.79	746.79	746.79	746.79	746.79	746.3
Thalweg Elevation (ft)	745.94	746.11	746.23	745.55	745.88	745.37
Bankfull d max (ft)	0.85	0.68	0.56	1.24	0.91	0.9
Low Bank Elevation (ft)	747.11	747.01	747.18	746.89	747.57	747.53
Low Bank Height (ft)	1.17	0.9	0.95	1.34	1.69	2.2
BHR	1.4	1.3	1.7	1.1	1.9	2.4

The change in BHR on Cross Section 9 is mainly a result in the change of the thalweg elevation. The bankfull cross sectional area remained roughly the same (2.8 – 4.4 ft<sup>2</sup>) even though the bankfull elevation decreased by approximately 0.5 feet. Between MY04 and MY05, the maximum bankfull depth did not change (0.91 and 0.93 feet respectively). The bankfull cross sectional area and maximum depth showed little change because the thalweg elevation decreased roughly the same amount as the bankfull elevation (0.5 feet). This decrease in thalweg elevation and roughly consistent low bank elevation increased the low bank height subsequently increasing the BHR.

**Comment:** *Table 11a: Please remove the guidance notes at the bottom of the table. Please add a footnote explaining how the BHR was calculated in MY5. In MY5, BHR should have been calculated based on DMS guidance provided to consultants in 2018 (attached). Please confirm the guidance was utilized and update the table accordingly. Please note that BHR is not required for pools. A dash can be utilized for pools (BHR).*

**Response:** The guidance notes were removed from Table 11a.

The following footnote was added to the table “The MY05 BHR was calculated using the 2018 Standard Measurement of the BHR monitoring parameters provided by NCDMS.”.

The BHR for pools was not removed.

**Comment:** *Table 12 – Verification of Bankfull Events: The “Date of Data Collection” date for the last entry in the table should be 10/30/2018. Please update the table.*

**Response:** The date was changed to “2018”.

**Comment:** *Please provide an electronic comment response letter addressing the DMS comments received. This comment response letter should also be included in the FINAL MY5 revised report after the report cover.*

**Response:** An electronic comment response letter is included in the CD discussed below and included in the FINAL MY05 Report.

**Comment:** *Please submit three (3) final hard copies and an electronic copy on CD to my attention at the address below (DMS western field office). Please include all MY 5 project support files on the CD deliverable. The final electronic monitoring report with all attachments should be named: **UTClarke\_92500\_MY5\_2018.pdf.***

**Response:** Three final hard copies of the FINAL MY05 Report are provided and project support files are included in the attached CD.

If you have any questions, please contact me via email at [bleptic@sepiengineering.com](mailto:bleptic@sepiengineering.com) or call at (919) 747-5857.

Sincerely,



Robert Lepsic  
Environmental Project Manager

UT to Clarke Creek Stream and Wetland Restoration  
DMS Project #92500

Monitoring Report Year 5 of 5  
Mecklenburg County, North Carolina

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## INTRODUCTION

The UT to Clarke Creek Stream and Wetland Restoration Project (Site) is located in Mecklenburg County, North Carolina near the Town of Huntersville. The property parcel is owned by Mecklenburg County and is referred to as Clark's Creek Nature Preserve. The project consisted of approximately 4,594 linear feet of existing streams on the Site within the USGS cataloging unit Yadkin 03040105. The Site was assessed in the Upper Rocky River Local Watershed Plan (LWP) that was prepared for DMS by MACTEC in 2004. The LWP identified the major stressors in the watershed: stream bank erosion, lack of adequate forested buffer, stream channelization, agricultural impacts, land use changes, sedimentation, point source in-stream impacts, nutrients, and fecal coliform bacteria.

Restoration goals for this project include:

- Reduce sediment stressors caused by stream bank erosion and shear stress along the reach.
- Improve stream bank stability and sediment transport efficiency.
- Provide for uplift in water quality functions and nutrient filtration.
- Provide for greater overall stream and wetland habitat complexity and quality, and
- Improve and maintain riparian buffer habitat.

The project objectives include:

- Implement a sustainable, reference-based, rehabilitation of the project reaches' dimension to support sediment transport equilibrium.
- Provide a sustainable and functional bankfull floodplain feature and reslope banks at a more stable slope.
- Strategically install stream structures and plantings designed to maintain lateral stability and habitat to the stream channel.
- Install, augment, and maintain appropriate vegetative riparian buffer and riverine wetland community types with sufficient density and vigor to support native vegetation. The buffer should have a minimum width of 50 feet (ft) on each side of project streams and consist of a mix of native species representative of a bottomland hardwood forest, and
- Restore and/or enhance the natural hydrology, vegetation, and soil composition in adjacent wetlands.

This report documents the completion of the restoration construction activities and presents year 5 monitoring data for the post-construction monitoring period. Table 1 (Appendix A)



summarizes site conditions before and after restoration, as well as the conditions predicted in the previously approved Mitigation Plan.

## **1.0 PROJECT SUMMARY**

### **1.1 Project Setting and Background**

The UT to Clarke Creek stream and wetland restoration project is located in Mecklenburg County, North Carolina, in the Yadkin-Pee Dee River Basin (USGS cataloging unit 03040105), DWR Subbasin 30711 (Figure 1). The project lies within Clark's Creek Nature Preserve, a 57.2 acre property owned by Mecklenburg County. The project restored 3,061 linear feet of stream and preserved 1,152 linear feet of stream and restored or preserved 1.457 acres of wetlands (Table 1). Prior to construction, the Site had problems with channelization, bank instability, and a limited riparian buffer zone. Areas of mass wasting, bank slumping, incision, and sediment deposition were evident in all reaches. Backwater effects from beaver dams also caused aggradation and habitat loss. The project aimed to reduce the major stressors identified in the LWP which include stream bank erosion, lack of adequate forested buffer, stream channelization, and sedimentation.

The UT to Clarke Creek Stream and Wetland Restoration Project was instituted by NCEEP (now NCDMS) in September 2008. Construction was completed July 2013 with planting in February 2014. The Site was monitored annually beginning in 2014. There was no significant storm damage or repairs performed during the five year monitoring period. Supplemental planting occurred in February 2016 and February 2017.

### **1.2 Project Goals and Objectives**

The goals and objectives of this project focus on improving water quality and restoring physical habitat. These goals and objectives are stated in the UT to Clarke Creek Mitigation Plan (2011).

#### Goals:

1. Reduce sediment stressors caused by stream bank erosion and shear stress along the reach.
2. Improve stream bank stability and sediment transport efficiency.
3. Provide for uplift in water quality functions and nutrient filtration.
4. Provide for greater overall stream and wetland habitat complexity and quality, and
5. Improve and maintain riparian buffer habitat.

#### Objectives:

1. Implement a sustainable, reference-based, rehabilitation of the project reaches' dimension to support sediment transport equilibrium.

2. Provide a sustainable and functional bankfull floodplain feature and reslope banks at a more stable slope.
3. Strategically install stream structures and plantings designed to maintain lateral stability and habitat to the stream channel.
4. Install, augment, and maintain appropriate vegetative riparian buffer and riverine wetland community types with sufficient density and vigor to support native vegetation. The buffer should have a minimum width of 50 feet on each side of project streams and consist of a mix of native species representative of a bottomland hardwood forest, and
5. Restore and/or enhance the natural hydrology, vegetation, and soil composition in adjacent wetlands.

### **1.3 Success Criteria**

The following success criteria are provided from the NCEEP *Mitigation Plan Document Guidance* and the Army Corps of Engineers (ACOE) (2003).

#### **1.3.1 Stream Morphology and Channel Stability**

Restored or enhanced streams should demonstrate morphological stability to be considered successful. Any deviations will be evaluated to determine whether changes are indicative of instability. Stability will be based on permanent cross sections, longitudinal profile, substrate analysis, sediment transport, and evidence of bankfull events.

There have not been substantial changes to cross sections or profiles on either reach from the monitoring year 1 conditions. There is some evidence of channel narrowing, likely due to erosion and sedimentation from development just outside and upstream of the conservation easement. The stream channels are accessing the floodplain and evidence of bankfull events were observed during year 5 monitoring. This evidence included the presence of wrack lines throughout the Site and crest gauge reading on February 27, 2018. At least one bankfull event has occurred each year during the monitoring period.

Monitoring gauges were installed by NCDMS on UT3, UT4 and UT5 to document surface flow within the tributaries during MY05. One gauge was installed on UT3; four on UT4 and one on UT5. All gauges showed surface flow for greater than 120 consecutive days between January 2018 and October 2018. Eleven areas of minor bank erosion were observed totaling 164 feet. Ten areas on UT to Clarke Creek (154 feet) and one on UT1 (10 feet). Because the banks are so low and well vegetated, the erosion is not considered significant. It should be noted that Hurricane Florence and Hurricane Michael passed over Charlotte in 2018. Florence dropped over 3" of rain on September 16, 2018 and Michael over 2" on October 11, 2018.

There is significant scouring on UT1 floodplain at the confluence with UT to Clarke Creek. A debris jam within UT1 is causing the overbank flow during storm events. Low flows are contained within the channel banks. The debris jam was removed in December 2018.

Substrate analysis does not indicate progressive negative change throughout the system on either UT1 or UT to Clarke Creek. Substrate analysis results are generally consistent with a successful project.

During MY05 (2018), one area of sparse vegetation was observed on UT to Clarke Creek around Station 6+00. This is a depression in the floodplain that is holding water limiting the establishment of vegetation. Another small area near Sta. 11+00 is still present. These were the only areas of sparse vegetation on the floodplain observed along UT to Clarke Creek.

Minor beaver activity was noted on UT to Clarke Creek near the confluence with UT1 in the form of chewed stems and slides along the streambanks. No beaver dams were observed. The US Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) visited the Site in July and October 2018, during which they trapped beaver. APHIS will continue to monitor the Site quarterly for evidence of beaver and will remove beaver and dams as necessary.

Two areas of sparse vegetation were observed along UT1, eastern floodplain from Station 3+50 to 5+50 and around Station 6+50. These are roughly the same areas and extend as identified in the MY04 Report.

### 1.3.2 Wetlands

Wetland hydrology attainment will be monitored in accordance to the ACOE (2003) standards. The target wetland hydrological success criterion is saturation or inundation for at least 12.5 percent of the growing season in the lower landscape (floodplain) positions. To achieve the hydrologic success criterion, groundwater levels must be within 12 inches of the ground surface for 29 consecutive days, which is 12.5 percent of the March 22 to November 11 (232 days) growing season. Eight Ecotone Water Level Loggers were established within the wetland restoration, creation, and preservation areas to monitor groundwater levels during the growing season. Three more loggers were placed during the MY02 (2015) growing season. Wells 3, 5, 6, 8, 9, 10, and 11 were placed within the wetland boundaries to provide hydrologic data for the restored and enhanced wetland areas. Wells 2, 4, and 7 were placed outside the wetland boundaries to confirm the upland boundaries of the same wetlands. Well 1 was placed within the wetland preservation to provide reference conditions for the restored and enhanced wetlands in the project.

Wells 1, 5 and 9 met the hydrology success criteria for monitoring year 5. Well 5 barely met the success criteria with a hydroperiod of 13% of the growing season.

### 1.3.3 Vegetation

Planted vegetation was monitored for five years in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-NCDMS Level 2 Protocol (Lee et al.,

2006). To achieve vegetative success criteria, the average number of planted stems per acre must exceed or meet 320 stems/acre after the third year of monitoring, 288 stems/acre after four years, and 260 stems/acre after the fifth year of project monitoring. The monitoring year 5 stem counts are located in Tables 7 and 9 in Appendix C. Currently, plots 6, 7, and 9 are meeting the year 5 success criteria. Plots 5 and 8 are within 10% of the established success criteria. When volunteers are considered, the project as a whole far exceeds the success criteria. Overall, vegetation along both reaches appears adequate. Black willow and smooth alder along the stream banks are thriving. Additionally, a large number of volunteer species were observed during monitoring year 5. Woody volunteers include sycamore, sweet gum, green ash, and river birch. Dominant herbaceous species include blackberry, goldenrod, and big blue stem.

Invasive species observed on site include autumn olive, Japanese privet, multiflora rose, kudzu, Japanese honeysuckle and lespedeza. Kudzu is beginning to establish in vegetation plot 3. The location of autumn olive and Japanese privet are shown on the current condition plan view. Japanese honeysuckle and lespedeza are located throughout the Site. An invasive species treatment was conducted in June 2018. An additional invasive species treatment will be conducted in 2019.

Carolina Silvics completed a supplemental planting effort in the 2015 - 2016 dormant season throughout the Site. In MY03 (February 2016), Carolina Silvics replanted 1,300 stems in areas where stem densities were still not meeting the vegetative success criteria. These stems were as follows:

- Riparian Areas: 300 *Betula nigra*, 200 *Nyssa sylvatica*, 200 *Quercus coccinea*, 150 *Quercus michauxii*, 150 *Quercus nigra*, and 200 *Quercus rubra*.
- Wetland Areas: 50 *Quercus michauxii* and 50 *Quercus nigra*.

During MY04 (February 2017), a second supplemental planting occurred which included a total of 1,213 stems as follows:

- Riparian Areas: 247 *Platanus occidentalis*, 416 *Nyssa sylvatica*, 195 *Celtis laevigata*, and 195 *Quercus coccinea*.
- Wetland Areas: 36 *Platanus occidentalis*, 64 *Nyssa sylvatica*, 30 *Celtis laevigata*, and 30 *Quercus coccinea*.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting documentation formerly found in these reports can be found in the Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the Restoration Plan) documents

available on DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

#### **1.4 Project History, Contacts, and Attribute Data**

The UT to Clarke Creek Stream and Wetland Restoration Site was designed by JJG, North State Environmental constructed the Site, and was monitored by SEPI Engineering & Construction. Tables 2, 3, and 4 in Appendix A provide detailed information regarding the Project Activity and Reporting History, Project Contacts, and Project Baseline Information and Attributes.

##### **1.4.1 Construction Deviations**

The as-built plan sheets/record drawings depict several engineered instream structures that were not located during baseline monitoring. It was determined the structures were not installed due to constraints that arose during construction, and the record drawings were not updated with that information.

## **2.0 METHODOLOGY**

The following methods were utilized during the year 4 monitoring for data collection and post-processing:

- Geomorphic topographic data collections were performed in the field using a survey grade GPS such that each survey point has three-dimensional coordinates, and is georeferenced (NAD83-State Plane Feet – FIPS3200).
- Longitudinal stationing was developed using the as-built survey thalweg as a baseline.
- The Modified-Wolman pebble count particle size distribution protocol was utilized.
- The CVS Level 2 methodology was utilized for the vegetation plot data collection.

### 3.0 REFERENCES

Jordan, Jones, and Goulding, Inc. Mitigation Plan: UT Clarke Creek Stream and Wetland Restoration, 2011.

Mactec Engineering and Consulting, Inc. November 30, 2004. *Watershed Management Plan and Recommendations, Lower Yadkin/Upper Rocky River Basin, Local Watershed Planning (Phase II), Cabarrus, Iredell, Rowan and Mecklenburg Counties, North Carolina*. Prepared for North Carolina Ecosystem Enhancement Program.

NCDWQ. 2008B. *Yadkin – Pee Dee River Basin Plan*. 553 pages.

NC Ecosystem Enhancement Program. As-built Baseline Monitoring Report Format, Data Requirements, and Content Guidance, 2014.

Radford, Albert. 1968. *Manual of Vascular Flora of the Carolinas*. The University of North Carolina Press, Chapel Hill. 596 p.

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

U. S. Army Corps of Engineers. 1987. *Wetland Delineation Manual* (Technical Report Y-87-1), Washington, DC.

U. S. Army Corps of Engineers. 2003. *Stream Mitigation Guidelines*. USACOE, USEPA, NCWRC, NCDENR-DWQ.



## APPENDIX A

### Background Tables

**Table 1a. Project Components  
UT Clarke Creek/DMS Project #92500**

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Mitigation Ratio	Mitigation Units	BMP Elements	Comment
UT Clarke Creek*	1507 lf	E1	P 2/3	1413 lf	00+00 – 15+87	1.5:1	942.0		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT1	723 lf	E1	P 2/3	741 lf	00+00 – 07+48, 07+65 – 07+78	1.5:1	494.0		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT1	17 lf	E1	P 2/3	17 lf	07+48 – 07+65	3:1	5.7		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation in sewer easement
UT2	308 lf	E2	P 4	308 lf	04+22 – 05+99, 07+16 – 08+47	2.5:1	123.2		Planting of native vegetation, removal of invasive species
UT3	100 lf	E1	P 2/3	84 lf	00+00 – 00+56, 00+72 – 01+03	1.5:1	56.0		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT3	16 lf	E1	P 2/3	16 lf	00+56 – 00+72	3:1	5.3		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation in sewer easement
UT4	373 lf	E1	P 2/3	363 lf	01+92 – 05+65	1.5:1	242		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT5	119 lf	E1	P 2/3	119 lf	03+56 – 04+75	1.5:1	79.3		Creating bankfull bench, regrading bank slopes, installing structures, planting native vegetation
UT6*	1464 lf	P	-	1152 lf	00+00 – 14+64	5:1	230.4		Designated as Preservation
Wetland A**	0.085 ac	R		0.0*		0	0		Restoring aerial extent of riparian wetland adjacent to stream
Wetland B	0.134 ac	P		0.134 ac		5:1	0.027		Designated as Preservation
Wetland C	0.057 ac	E		0.057 ac		2:1	0.029		Includes improving hydrology and vegetation to enhance the riparian wetland adjacent to stream
Wetland D	0.070 ac	R		1.020 ac		1:1	1.02		Restoring aerial extent of riparian wetland adjacent to stream
Wetland E	0.109 ac	E		0.109 ac		2:1	0.055		Includes improving hydrology and vegetation to enhance the riparian wetland adjacent to stream
Wetland E	0.109 ac	C		0.137 ac		3:1	0.046		Includes improving hydrology and vegetation to enhance the riparian wetland adjacent to stream

\*DMS cannot receive mitigation credits for streams with conservation easements on only one side of a project stream. A portion of UT Clarke Creek and a portion of UT6 are ineligible for credits, resulting in a deduction of 94 linear feet from the total length of UT Clarke Creek and a deduction of 312 linear feet from the total length of UT6. NOTE - THIS IS AN ADJUSTMENT FROM MY3, WHERE ALL DEDUCTIONS WERE TAKEN FROM UT6.

\*\*One segment of WL A will be incorporated into the enhancement of UT2. The remainder of WL A will be incorporated into the restoration of WL D

**Table 1b. Component Summations  
UT Clarke Creek/DMS Project #92500**

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration		1.02					
Enhancement		0.166					
Enhancement I	2,753						
Enhancement II	308						
Creation		0.137					
Preservation	1,152	0.134					
HQ Preservation							
		1.457	0				
<b>Totals (Feet/Acres)</b>	<b>4,213</b>	<b>1.457</b>					
<b>MU Totals</b>	<b>2177.9*</b>	<b>1.177</b>					

\* The MU totals reflect the changes to credits noted in Table 1a.

Non-Applicable

**Table 2. Project Activity and Reporting History  
UT Clarke Creek/DMS Project #92500**

**Elapsed Time Since Grading Complete: 5 years 8 months  
Elapsed Time Since Planting Complete: 5 years 0 months  
Number of Reporting Years: 5**

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Institution Date	NA	Sept 2008
404 permit date	NA	Jan 2012
Restoration Plan	Sept 2010	Feb 2012
Final Design – Construction Plans	NA	July 2012
Construction	NA	July 2013
Containerized, bare root and B&B plantings	NA	Feb 2014
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Mar 2014	June 2014
Year 1 Monitoring	Sept 2014	Nov 2014
Year 2 Monitoring	Sept-Oct 2015	Jan 2016
Supplemental Planting	NA	Feb 2016
Year 3 Monitoring	Oct 2016	Dec 2016
Supplemental Planting	NA	Feb 2017
Beaver Trapping and Dam Removal	NA	July 2017
Year 4 Monitoring	Oct 2017	Feb 2017
Invasive Treatment	NA	June 2018
Beaver Trapping and Dam Removal	NA	July 2018
Beaver Trapping	NA	Oct 2018
Year 5 Monitoring	Oct 2018	Nov 2018

**Table 3. Project Contacts Table  
UT to Clarke Creek/DMS Project #92500**

<b>Designer</b>	Jordan, Jones, and Goulding, Inc. 309 E. Morehead Street, Suite 110, Charlotte, NC 28202
Primary project design POC	Matthew M. Clabaugh, PE
<b>Construction Contractor</b>	North State Environmental 2889 Lowery Street, Winston-Salem, NC 27101
Construction contractor POC	Michael Anderson, (336) 245-1253
<b>Survey Contractor</b>	NorthState Environmental 2889 Lowery Street, Winston-Salem, NC 27101
Survey contractor POC	David Keith Alley, PLS
<b>Planting Contractor</b>	Carolina Silvics 908 Indian Trail Road, Edenton, NC 27932
Planting contractor POC	
<b>Seeding Contractor</b>	Canady's Landscaping & Erosion 256 Fairview Acres Road, Lexington, NC 27295
Contractor point of contact	Craig Canady, (336) 236-1182
<b>Seed Mix Sources</b>	
<b>Nursery Stock Suppliers</b>	
<b>Monitoring Performers</b>	SEPI Engineering & Construction 1025 Wade Avenue, Raleigh, NC 27605
Stream Monitoring POC	
Vegetation Monitoring POC	Robert Lepsic, PWS 919.747.5857
Wetland Monitoring POC	

**Table 4. Project Attribute Table  
UT to Clarke Creek/DMS Project #92500**

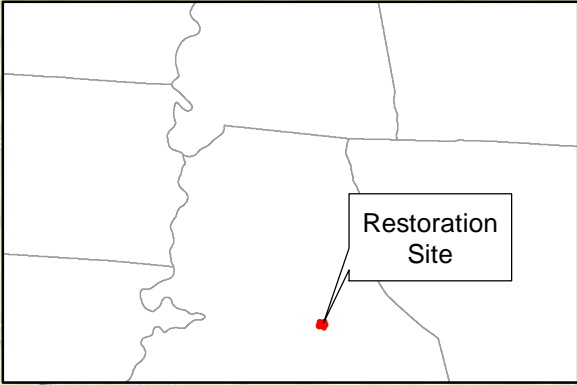
Project County	Mecklenburg		
Physiographic Region	Piedmont		
Ecoregion	Southern Outer Piedmont belt		
Project River Basin	Yadkin-Pee Dee		
USGS HUC for Project (14 digit)	03040105010040		
NCDWQ Sub-basin for Project	03-07-11		
Within extent of EEP Watershed Plan?	Upper Rocky River LWP		
WRC Hab Class (Warm, Cool, Cold)	Warm		
% of project easement fenced or demarcated	100%		
Beaver activity observed during design phase?	Yes		
<b>Restoration Component Attribute Table</b>			
	<b>UT Clarke Creek</b>	<b>UT1</b>	
Drainage area	1.08	0.46	
Stream order	2	1	
Restored length (feet)	1507	758	
Perennial or Intermittent	Perennial	Perennial	
Watershed type (Rural, Urban, Developing etc.)	Rural		
Watershed LULC Distribution (e.g.)			
Residential	94.60%		
Ag-Row Crop	-		
Ag-Livestock	-		
Forested	-		
Etc.	5.40%		
Watershed impervious cover (%)	16.50%		
NCDWQ AU/Index number	13-17-5-2		
NCDWQ classification	C		
303d listed?	No		
Upstream of a 303d listed segment?	Yes		
Reasons for 303d listing or stressor	5, Ecological/Biological Integrity		
Total acreage of easement	57.2		
Total vegetated acreage within the easement	57.2		
Total planted acreage as part of the restoration	57.2		
Rosgen classification of pre-existing	E4	B4c	B4c
Rosgen classification of As-built	N/A		
Valley type	VIII		
Valley slope	-		
Valley side slope range (e.g. 2-3.%)	-		
Valley toe slope range (e.g. 2-3.%)	-		
Cowardin classification	N/A		
Trout waters designation	No		
Species of concern, endangered etc.? (Y/N)	No		
Dominant soil series and characteristics	Mo, MeD, EnD		
Series	Monacan, Mecklenburg, Enon		
Depth	-		
Clay%	-		
K	-		
T	-		



## APPENDIX B

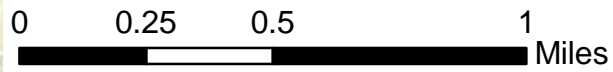
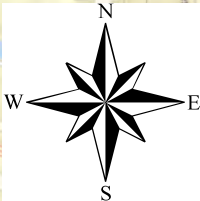
### Visual Assessment Data

Directions to the Site: Take I-40 to I-85 S. Take exit 45B to W WT Harris Blvd and continue for 2.4 miles. Then turn right onto David Cox Rd, right onto W Sugar Creek Rd which turns into Browne Rd. Turn left at the light onto Hucks Rd and continue for a little over one mile. The access to the site is a gravel road on the right.



Restoration Site

Gravel Road Entrance



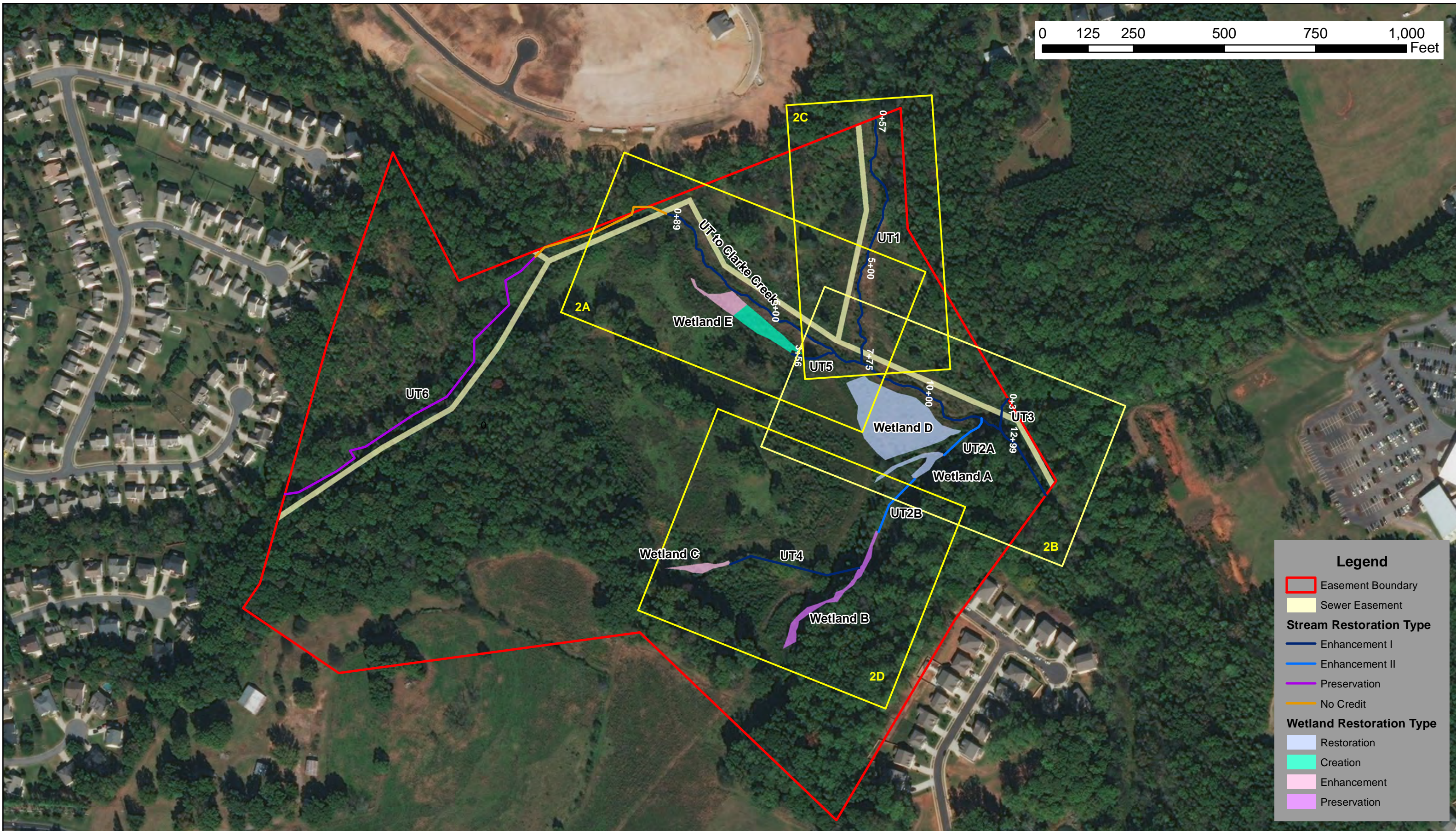
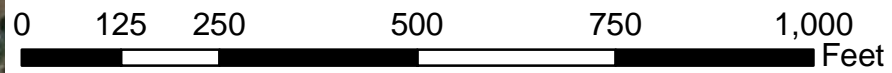
# Restoration Site Vicinity

UT to Clarke Creek  
Monitoring Year 5      Mecklenburg County, NC  
November 2018      Project # 92500      Figure 1

Prepared for:  
NC Department of  
Environmental Quality  
Division of Mitigation Services







**Legend**

- Easement Boundary
- Sewer Easement

**Stream Restoration Type**

- Enhancement I
- Enhancement II
- Preservation
- No Credit

**Wetland Restoration Type**

- Restoration
- Creation
- Enhancement
- Preservation

Prepared for:  
 NC Department of  
 Environmental Quality  
 Division of Mitigation Services

# UT to Clarke Creek Monitoring Year 5 Current Conditions Plan View - Index Map

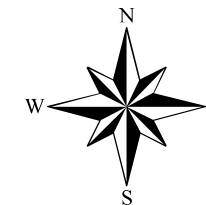
February 2019

Project # 92500

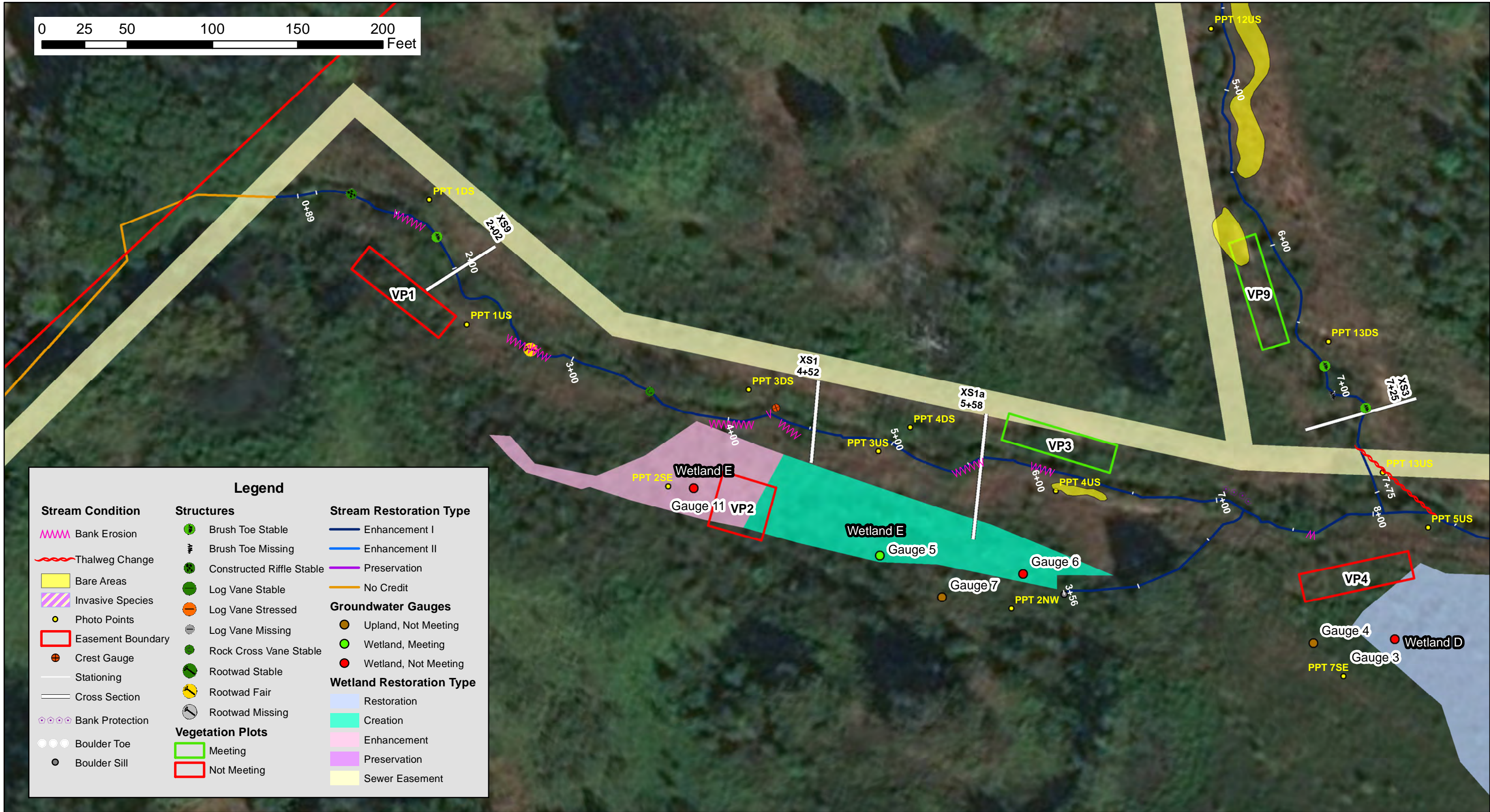
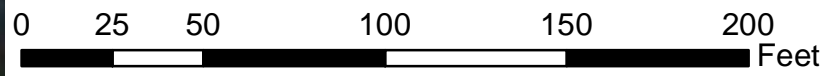
Figure 2

Mecklenburg County, NC

Prepared by:







Legend		
<b>Stream Condition</b>	<b>Structures</b>	<b>Stream Restoration Type</b>
Bank Erosion	Brush Toe Stable	Enhancement I
Thalweg Change	Brush Toe Missing	Enhancement II
Bare Areas	Constructed Riffle Stable	Preservation
Invasive Species	Log Vane Stable	No Credit
Photo Points	Log Vane Stressed	<b>Groundwater Gauges</b>
Easement Boundary	Log Vane Missing	Upland, Not Meeting
Crest Gauge	Rock Cross Vane Stable	Wetland, Meeting
Stationing	Rootwad Stable	Wetland, Not Meeting
Cross Section	Rootwad Fair	<b>Wetland Restoration Type</b>
Bank Protection	Rootwad Missing	Restoration
Boulder Toe	<b>Vegetation Plots</b>	Creation
Boulder Sill	Meeting	Enhancement
	Not Meeting	Preservation
		Sewer Easement

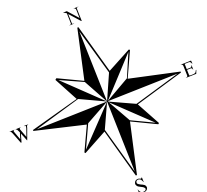
Prepared for:  
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# UT to Clarke Creek Monitoring Year 5

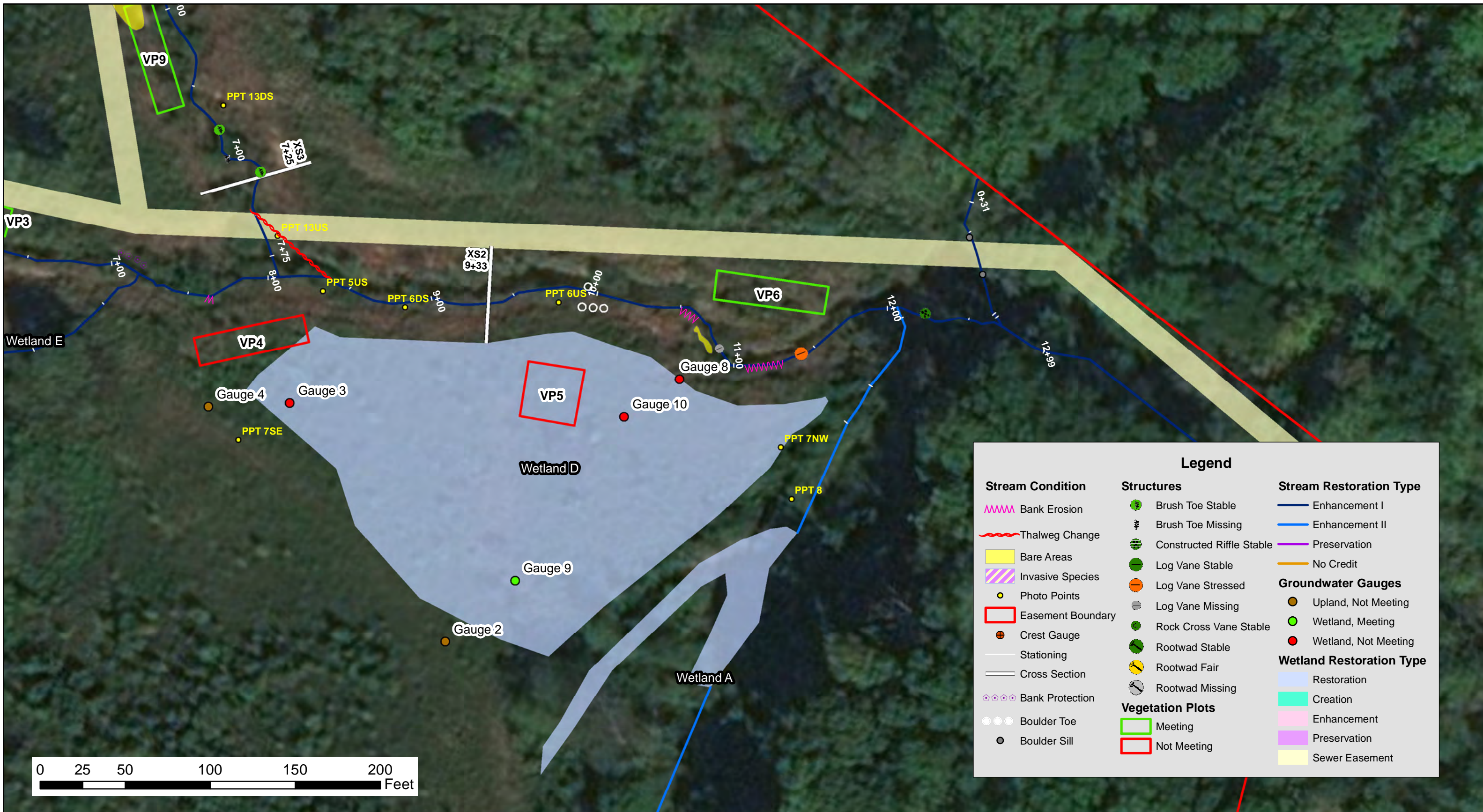
## Current Conditions Plan View - UT Clarke Creek above Confluence

November 2018 Project # 92500 Figure 2A Mecklenburg County, NC

Prepared By







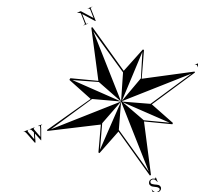
Prepared for:  
 NC Department of  
 Environmental Quality  
 Division of Mitigation Services

# UT to Clarke Creek Monitoring Year 5

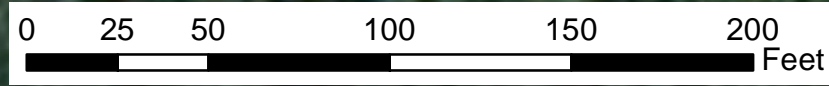
## Current Conditions Plan View - UT Clarke Creek below Confluence

November 2018    Project # 92500    Figure 2B    Mecklenburg County, NC

Prepared By

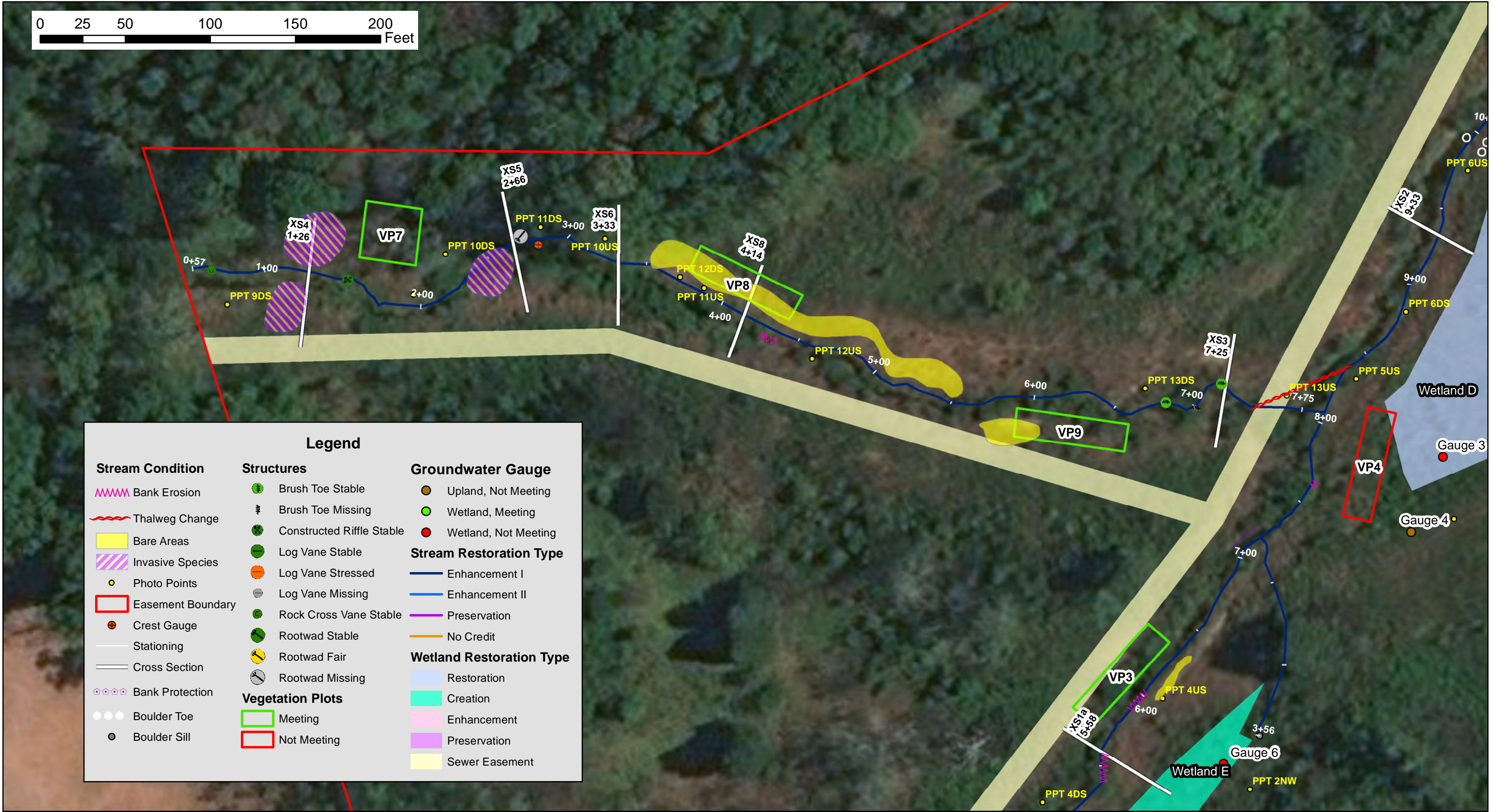






**Legend**

<b>Stream Condition</b>	<b>Structures</b>	<b>Groundwater Gauge</b>
Bank Erosion	Brush Toe Stable	Upland, Not Meeting
Thalweg Change	Brush Toe Missing	Wetland, Meeting
Bare Areas	Constructed Riffle Stable	Wetland, Not Meeting
Invasive Species	Log Vane Stable	<b>Stream Restoration Type</b>
Photo Points	Log Vane Stressed	Enhancement I
Easement Boundary	Log Vane Missing	Enhancement II
Crest Gauge	Rock Cross Vane Stable	Preservation
Stationing	Rootwad Stable	No Credit
Cross Section	Rootwad Fair	<b>Wetland Restoration Type</b>
Bank Protection	Rootwad Missing	Restoration
Boulder Toe	<b>Vegetation Plots</b>	Creation
Boulder Sill	Meeting	Enhancement
	Not Meeting	Preservation
		Sewer Easement



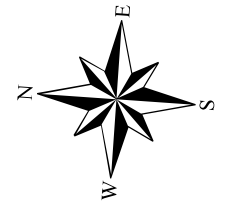
Prepared for:  
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 Division of Mitigation Services

# UT to Clarke Creek Monitoring Year 5

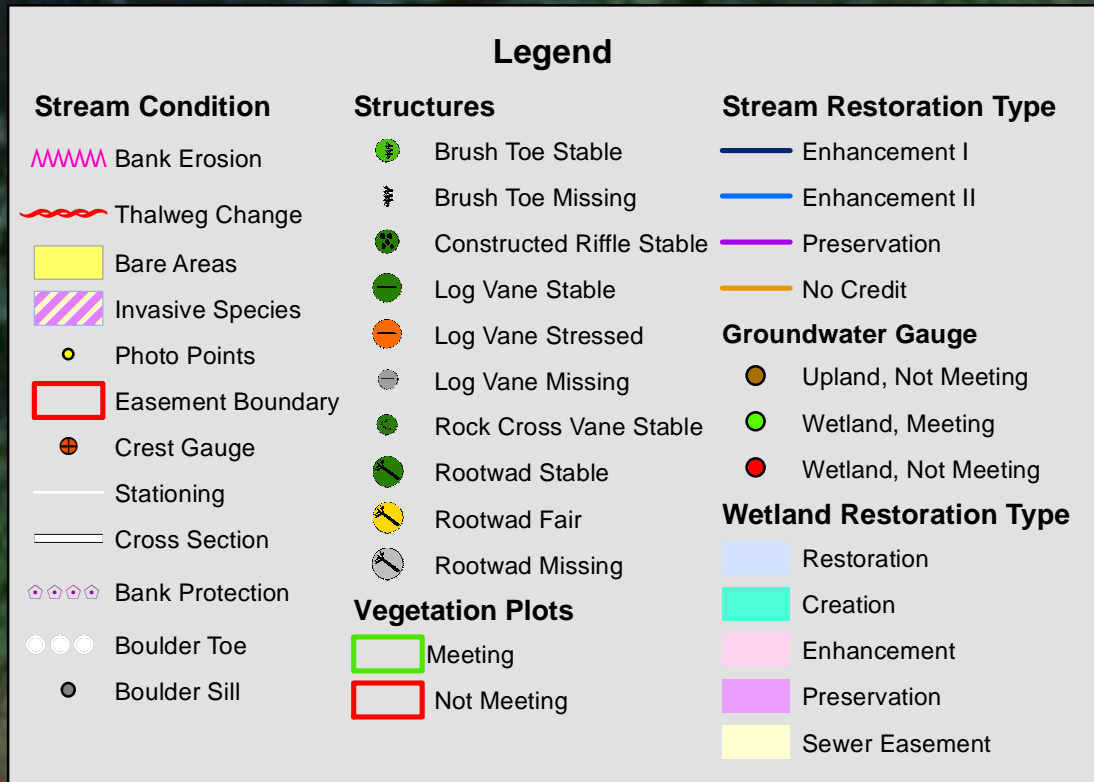
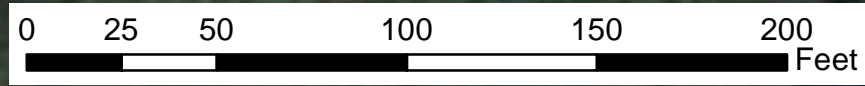
## Current Conditions Plan View - UT 1

November 2018 Project # 92500 Figure 2C Mecklenburg County, NC

Prepared By  
**SEPI**  
 ENGINEERING &  
 CONSTRUCTION







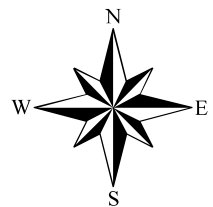
# UT to Clarke Creek Monitoring Year 5

## Current Conditions Plan View - UT 4

November 2018 Project # 92500 Figure 2D Mecklenburg County, NC

Prepared for:  
NC Department of  
Environmental Quality  
Division of Mitigation Services

Prepared By





0 105 210 420 630 840 Feet



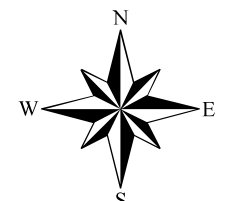
**Legend**

- Easement Boundary
- Sewer Easement
- Stream Restoration Type**
- Enhancement I
- Enhancement II
- Preservation
- No Credit
- Wetland Restoration Type**
- Restoration
- Creation
- Enhancement
- Preservation

# UT to Clarke Creek Monitoring Year 5 Components Map

February 2019 Project # 92500 Figure 3 Mecklenburg County, NC

Prepared for:  
NC Department of  
Environmental Quality  
Division of Mitigation Services







**Legend**

- Easement Boundary
- Stream Restoration Type**
- Enhancement I
- Enhancement II
- Preservation
- No Credit
- Wetland Restoration Type**
- Restoration
- Creation
- Enhancement
- Preservation

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 Division of Mitigation Services

# UT to Clarke Creek Monitoring Year 5

## USGS Topographic Map

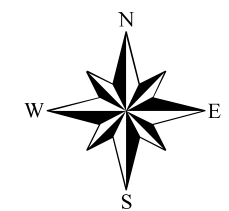
February 2019

Project # 92500

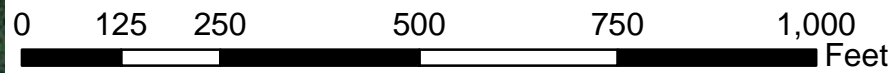
Figure 4

Mecklenburg County, NC









Prepared by:







**Legend**

-  Easement Boundary
- Soils**
-  CeB2 - Cecil sandy clay loam, 2-8%
-  CeD2 - Cecil sandy clay loam, 8-15%
-  EnB - Enon sandy loam, 2-8%
-  EnD - Enon sandy loam, 8-15%
-  MO - Monacan loam, 0-2%
-  MeD - Mecklenburg fine sandy loam, 8-15%
-  PaE - Pacolet sandy loam, 15-25%

Prepared for:  
 NC Department of  
 Environmental Quality  
 Division of Mitigation Services

# UT to Clarke Creek Monitoring Year 5 Soils Map

February 2019

Project # 92500

Figure 5

Mecklenburg County, NC

Prepared by:  
**SEPI**  
 ENGINEERING &  
 CONSTRUCTION

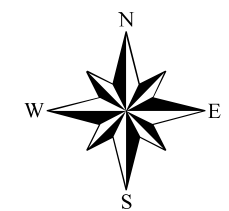




Table 5a  
 Reach ID  
 Assessed Length

**Visual Stream Morphology Stability Assessment**  
 UT to Clarke Creek  
 1507

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	10	10			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	9	10					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		10	10			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	10	10			100%			
		2. Thalweg centering at downstream of meander (Glide)	10	10			100%			
<b>Totals</b>										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			10	153	95%	10	153	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> 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%
<b>Totals</b>										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	5	7			71%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	7	8			88%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

Table 5b  
 Reach ID  
 Assessed Length

**Visual Stream Morphology Stability Assessment**  
 UT1  
 758

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	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	5	5			100%			
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth $\geq$ 1.6)	4	6					
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		6	6			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	6	6			100%			
		2. Thalweg centering at downstream of meander (Glide)	6	6			100%			
<b>Totals</b>										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			1	10	99%	1	10	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> 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%
<b>Totals</b>										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	6	7			86%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	7	8			88%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio $\geq$ 1.6 Rootwads/logs providing some cover at base-flow.	2	2			100%			

**Table 6** **Vegetation Condition Assessment**  
**Planted Acreage** **13**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	4	0.11	0.8%
2. Low Stem Density Areas <sup>1</sup>	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	5	0.10	0.8%
<b>Total</b>				9	0.21	1.6%
3. 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 acres	Pattern and Color	0	0.00	0.0%
<b>Cumulative Total</b>				9	0.21	1.6%

**Easement Acreage** **57.2**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	3	0.05	0.1%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

<sup>1</sup> Area based on vegetation plots not meeting success criteria



Photo Station 1 Downstream-XS9 (MY5 – 10/17/2018)



Photo Station 1 Upstream-XS9 (MY5 – 10/17/2018)





Photo Station 2 Northeast-Wetland E (MY5 10/17/2018)



Photo Station 2 Southeast-Wetland E (MY5 10/17/2018)





Photo Station 3 Downstream-XS1 (MY5 – 10 17/2018)



Photo Station 3 Upstream-XS1 (MY5 – 10/17/2018)





Photo Station 4 Downstream-XS1A (MY5 – 10/17/2018)



Photo Station 4 Upstream-XS1A (MY5 – 10/17/2018)



Photo Station 5 Upstream-Confluence (MY5 – 10/17/2018)





Photo Station 6 Downstream-XS2 (MY5 – 10/17/2018)



Photo Station 6 Upstream-XS2 (MY5 – 10/17/2018)



Photo Station 7 Northwest- Wetland D (MY5 10/17/2018)



Photo Station 7 Southeast-Wetland D (MY5 – 10/17/2018)



Photo Station 8 Downstream-UT2 (MY5 – 10/17/2018)



Photo Station 8 South-Wetland A (MY5 – 10/17/2018)





Photo Station 9 Downstream-XS4 (MY5 – 10/17/2018)



Photo Station 9 Upstream-XS4 (MY5 – 10/17/2018)





Photo Station 10 Downstream-XS6 (MY5 – 10/17/2018)



Photo Station 10 Upstream-XS6 (MY5 – 10/17/2018)





Photo Station 11 Downstream-XS6 (MY5 – 10/17/2018)



Photo Station 11 Upstream-XS6 (MY5 – 10/17/2018)





Photo Station 12 Downstream-XS6 (MY5 – 10/17/2018)



Photo Station 12 Upstream-XS8 (MY5 – 10/17/2018)





Photo Station 13 Downstream-XS3 (MY5 – 10/17/2018)



Photo Station 13 Upstream-XS3 (MY5 – 10/17/2018)





Photo Station 14 North-Wetland B (MY5 – 10/17/2018)



Photo Station 14 South-Wetland B (MY5 – 10/17/2018)





Vegetation Plot 1 – 5m x 20m (M5 – 10/17/2018)



Vegetation Plot 2 – 10m x 10m (M5 – 10/17/2018)





Vegetation Plot 3 – 5m x 20m (MY5 – 10/17/2018)



Vegetation Plot 4 – 5m x 20m (MY5 – 10/17/2018)





Vegetation Plot 5 – 5m x 20m (MY5 – 10/17/2018)



Vegetation Plot 6 – 5m x 20m (MY5 – 10/30/2018)





Vegetation Plot 7 – 10m x 10m (MY5 – 10/30/2018)



Vegetation Plot 8 – 5m x 20m (MY5 – 10/30/2018)





Vegetation Plot 9 – 5m x 20m (MY5 – 10/30/2018)



## APPENDIX C

### Vegetation Plot Data

Table 7. Vegetation Plot Mitigation Success Summary  
 UT to Clarke Creek / DMS Project #92500  
 Year 5 of 5

Plot #	Stems/Acre	Success Criteria Met?
1	121.4	No
2	80.9	No
3	0.0	No
4	161.9	No
5	242.8	No
6	323.7	Yes
7	485.6	Yes
8	242.8	No
9	404.7	Yes



Table 8 - CVS Vegetation Metadata  
 UT to Clark Creek / DMS Project #92500

**Report Prepared By** Robert Lepsic  
**Date Prepared** 11/26/2018 9:37

**database name** UTClarkeCr\_92500\_MY5\_2018\_CVS\_Database.mdb  
**database location** C:\Users\blepsic\Desktop  
**computer name** W138  
**file size** 66662400

**DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----**

**Metadata** Description of database file, the report worksheets, and a summary of project(s) and project data.  
**Proj, planted** Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.  
**Proj, total stems** Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.  
**Plots** List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).  
**Vigor** Frequency distribution of vigor classes for stems for all plots.  
**Vigor by Spp** Frequency distribution of vigor classes listed by species.  
**Damage** List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.  
**Damage by Spp** Damage values tallied by type for each species.  
**Damage by Plot** Damage values tallied by type for each plot.  
**Planted Stems by Plot and Spp** A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.  
**ALL Stems by Plot and spp** A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

**PROJECT SUMMARY-----**

**Project Code** 92500  
**project Name** UT Clarke Creek  
**Description** Stream and Wetland Restoration  
**River Basin** Yadkin-Pee Dee  
**length(ft)**  
**stream-to-edge width (ft)**  
**area (sq m)**  
**Required Plots (calculated)**  
**Sampled Plots** 9

Table 9 - CVS Planted and Total Stem Counts (Stems and Species by Plot with Annual Means)

EEP Project Code 92500. Project Name: UT Clarke Creek

		Current Plot Data (MY5 2018)																												
Scientific Name	Common Name	Species Type	92500-01-0001			92500-01-0002			92500-01-0003			92500-01-0004			92500-01-0005			92500-01-0006			92500-01-0007			92500-01-0008			92500-01-0009			
			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	PnoLS	P-all	T	PnoLS	P-all	T	
Alnus serrulata	hazel alder	Shrub									1							1	1	3			9			6	2	2	2	
Amelanchier arborea	common serviceberry	Tree										1	1	1																
Asimina triloba	pawpaw	Tree																												
Baccharis halimifolia	eastern baccharis	Shrub																												
Betula nigra	river birch	Tree				1	1	1					1					4	4	6	3	3	3	1	1	1	2	2	2	
Carpinus caroliniana	American hornbeam	Tree																												
Carya glabra	pignut hickory	Tree																												
Celtis occidentalis	common hackberry	Tree																												
Chionanthus virginicus	white fringetree	Shrub Tree																												
Cornus amomum	silky dogwood	Shrub								1	1									3								1	1	
Diospyros virginiana	common persimmon	Tree									2																			
Fraxinus pennsylvanica	green ash	Tree									3	2	2	3				1	1	4	1	1	3				1	1	1	
Ilex verticillata	common winterberry	Shrub														1	1	1												
Juglans	walnut	Tree																												
Juglans nigra	black walnut	Tree									2																			
Ligustrum sinense	Chinese privet	Exotic																		2										
Liquidambar styraciflua	sweetgum	Tree			9			9			2									4			10			4				
Liriodendron tulipifera	tuliptree	Tree																		1						3				
Nyssa sylvatica	blackgum	Tree																				3	3	3	2	2	2			
Pinus taeda	loblolly pine	Tree									2														9		11			
Platanus occidentalis	American sycamore	Tree	1	1	3			2			1						1	1	6	2	2	2	1	1	1	2	2	2		
Populus deltoides	eastern cottonwood	Tree												1			2			1					1					
Quercus coccinea	scarlet oak	Tree																				1	1	1	2	2	2	1	1	1
Quercus falcata	southern red oak	Tree										1	1	1	1	1	1					1	1	1						
Quercus michauxii	swamp chestnut oak	Tree	2	2	2	1	1	1								2	2	2									1	1	1	
Quercus nigra	water oak	Tree																	1	1	1									
Quercus phellos	willow oak	Tree																				1	1	1						
Quercus rubra	northern red oak	Tree													1	1	1													
Salix nigra	black willow	Tree			6			6	1	1			5	1	1	6				6							1	1	1	
Sambucus canadensis	Common Elderberry	Shrub																												
		<b>Stem count</b>	3	3	20	2	2	19	0	2	15	4	4	12	6	6	13	8	8	40	12	12	43	6	6	30	10	11	11	
		<b>size (ares)</b>	1			1			1			1			1			1			1			1			1			
		<b>size (ACRES)</b>	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			
		<b>Species count</b>	2	2	4	2	2	5	0	2	9	3	3	6	5	5	6	5	5	12	7	7	11	4	4	8	7	8	8	
		<b>Stems per ACRE</b>	121.4	121.4	809.4	80.94	80.94	768.9	0	80.94	607	161.9	161.9	485.6	242.8	242.8	526.1	323.7	323.7	1619	485.6	485.6	1740	242.8	242.8	1214	404.7	445.2	445.2	

Table 9 - CVS Planted and Total Stem Counts (Stems and Species by Plot with Annual Means)

EEP Project Code 92500. Project Name: UT Clarke Creek

Scientific Name	Common Name	Species Type	Annual Means																	
			MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)			MY0 (2014)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub	3	3	21	3	3	14	1	1	2	1	1	11			3			1
Amelanchier arborea	common serviceberry	Tree	1	1	1	1	1	1	3	3	3	3	3	3	1	1	2	1	1	1
Asimina triloba	pawpaw	Tree														1				
Baccharis halimifolia	eastern baccharis	Shrub														1				
Betula nigra	river birch	Tree	11	11	14	14	14	16	17	17	17	20	20	21	6	6	6	8	8	8
Carpinus caroliniana	American hornbeam	Tree													2	2	2	2	2	2
Carya glabra	pignut hickory	Tree																1	1	1
Celtis occidentalis	common hackberry	Tree						4												
Chionanthus virginicus	white fringetree	Shrub Tree				1	1	1	1	1	1	3	3	3						
Cornus amomum	silky dogwood	Shrub		2	5		2	4	1	5	5	1	5	6		3	3		6	6
Diospyros virginiana	common persimmon	Tree			2			2						2			3			
Fraxinus pennsylvanica	green ash	Tree	5	5	14	7	7	10	8	8	18	15	15	18	11	11	12	15	15	15
Ilex verticillata	common winterberry	Shrub	1	1	1	1	1	1										1	1	1
Juglans	walnut	Tree																		1
Juglans nigra	black walnut	Tree			2									1						
Ligustrum sinense	Chinese privet	Exotic			2															
Liquidambar styraciflua	sweetgum	Tree			38			23			2			10			7			4
Liriodendron tulipifera	tuliptree	Tree			4							3	3	3	5	5	5	12	12	12
Nyssa sylvatica	blackgum	Tree	5	5	5	7	7	8	3	3	3	3	3	3						
Pinus taeda	loblolly pine	Tree			22			16			10			9						
Platanus occidentalis	American sycamore	Tree	7	7	17	8	8	15	8	8	8	15	15	15	4	4	4	7	7	7
Populus deltoides	eastern cottonwood	Tree			5			20			9			21			13			
Quercus coccinea	scarlet oak	Tree	4	4	4	8	8	8												
Quercus falcata	southern red oak	Tree	3	3	3	6	6	6	11	11	11	19	19	19	13	13	13	26	26	26
Quercus michauxii	swamp chestnut oak	Tree	6	6	6	8	8	8	6	6	8	11	11	11						
Quercus nigra	water oak	Tree	1	1	1	1	1	1	1	1	1	3	3	3	4	4	4	8	8	8
Quercus phellos	willow oak	Tree	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1			
Quercus rubra	northern red oak	Tree	1	1	1	2	2	2	2	2	7	3	3	3	1	1	1	1	1	1
Salix nigra	black willow	Tree	2	3	31	2	6	51	1	5	63		4	120		2	73		5	98
Sambucus canadensis	Common Elderberry	Shrub			3									2						
<b>Stem count</b>			51	54	203	70	76	212	64	72	169	102	110	286	48	53	154	82	93	192
<b>size (ares)</b>			9			9			9			9			9			9		
<b>size (ACRES)</b>			0.22			0.22			0.22			0.22			0.22			0.22		
<b>Species count</b>			14	15	23	15	16	21	14	14	17	14	15	21	10	12	18	11	13	16
<b>Stems per ACRE</b>			229.3	242.8	912.8	314.8	341.7	953.3	287.8	323.7	759.9	458.6	494.6	1286	215.8	238.3	692.5	368.7	418.2	863.3



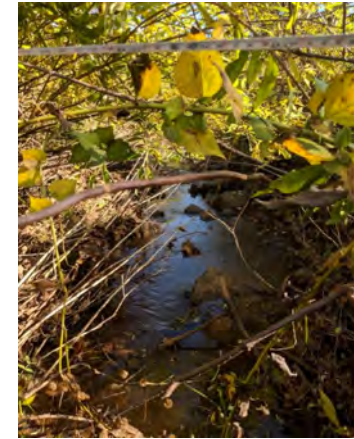
## APPENDIX D

### Stream Survey Data

Station	Elevation
0.00	747.07
0.02	747.28
1.33	746.26
7.41	745.73
13.60	745.04
16.67	745.13
18.78	745.17
21.88	745.40
24.04	744.88
25.14	744.46
26.32	743.93
26.77	743.85
27.65	743.30
28.75	743.45
29.94	743.39
30.86	743.81
31.80	744.79
33.52	745.13
38.26	745.50
45.10	745.89
48.31	746.18
48.37	746.92
48.38	746.76

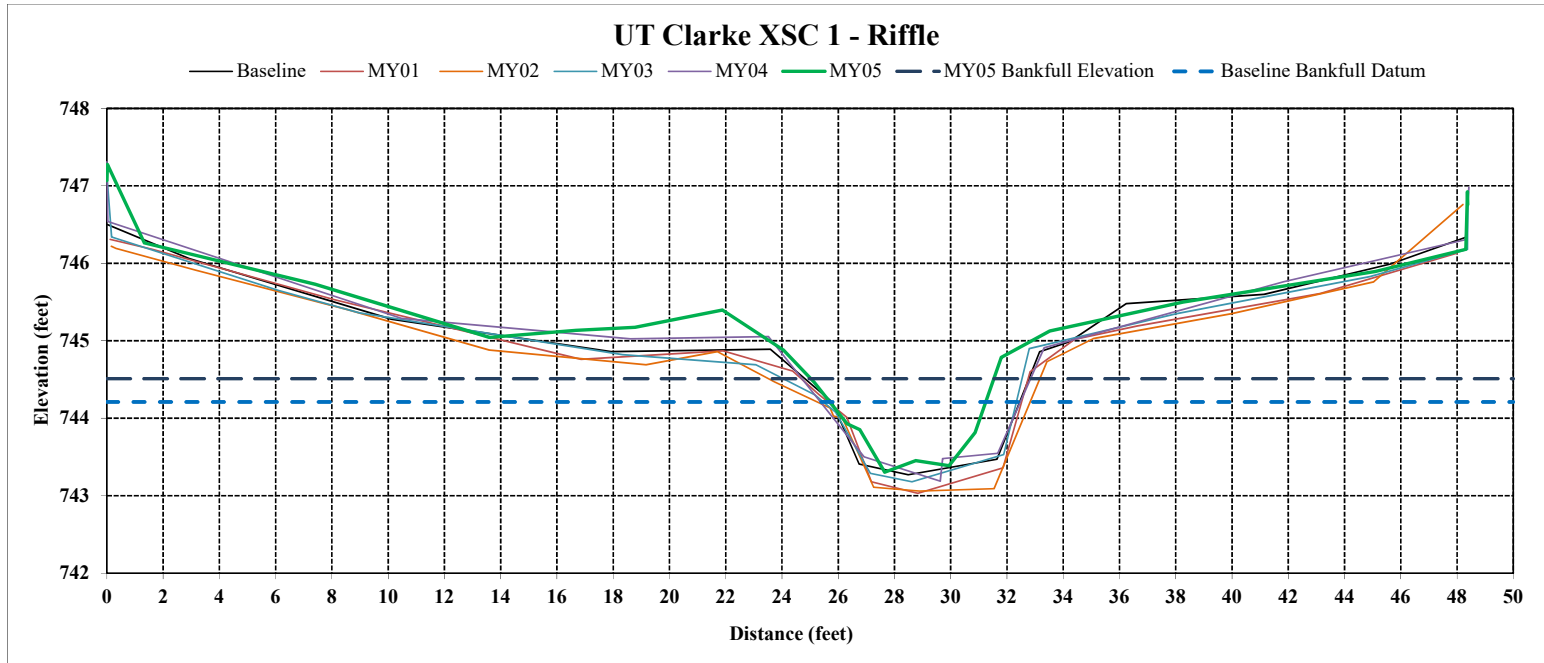
Reach	UT to Clarke Creek
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-1, Riffle, 4+52
Drainage Area (Sq Mi)	1.08
Date	10/30/2018
Observers	D. Moose, B. Wahab

SUMMARY DATA	
MY05 Bankfull Elevation, ft	744.5
Baseline Bankfull Datum, ft	744.2
Bankfull Cross Sectional Area, ft <sup>2</sup>	5.1
Bankfull Width, ft	6.5
Max Depth at Bankfull, ft	1.2
Mean Depth at Bankfull, ft	0.8
Width/Depth Ratio	8.3
Flood Prone Width, ft	34.5
Flood Prone Area Elevation	745.7
Entrenchment Ratio	5.3
Bank Height Ratio	1.5



Stream Type E4

Sta. 4+52 Looking Downstream





Station	Elevation
0.00	746.82
0.05	746.12
1.12	745.82
4.24	744.82
9.68	744.13
16.73	743.59
21.49	743.14
22.00	742.66
23.05	741.89
23.17	741.63
24.63	741.44
25.63	740.98
26.39	741.06
27.34	741.82
27.95	741.78
28.62	741.74
29.16	742.36
30.84	743.06
31.84	743.29
34.70	743.20
36.82	743.28
40.49	744.38
44.45	744.40
52.06	744.67
61.47	745.39
68.19	745.86
72.74	745.58
73.96	745.66
74.01	746.06

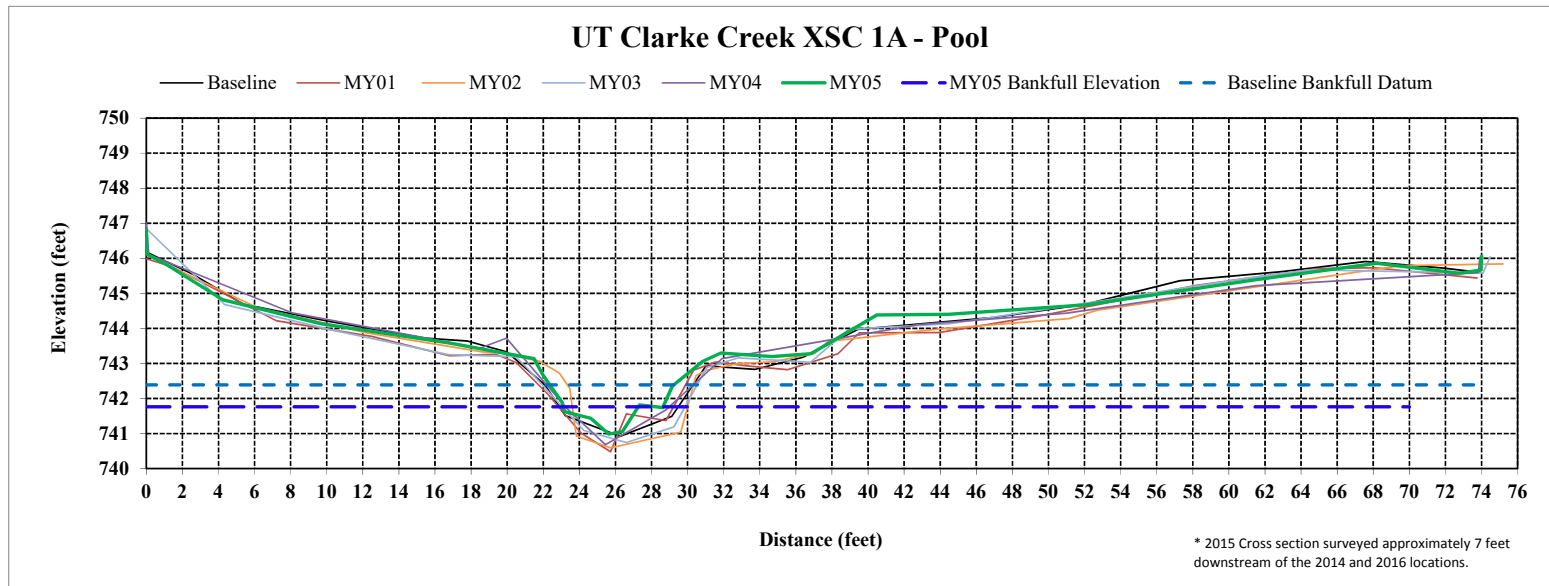
<b>Reach</b>	UT to Clarke Creek
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-1A, Pool, 5+58
<b>Drainage Area (Sq Mi)</b>	1.08
<b>Date</b>	10/18/2017
<b>Observers</b>	D. Moose, B. Wahab

SUMMARY DATA	
<b>MY05 Bankfull Elevation, ft</b>	741.8
<b>Baseline Bankfull Datum, ft</b>	742.4
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	1.8
<b>Bankfull Width, ft</b>	4.2
<b>Max Depth at Bankfull, ft</b>	0.8
<b>Mean Depth at Bankfull, ft</b>	0.4
<b>Width/Depth Ratio</b>	9.8
<b>Flood Prone Width, ft</b>	7.4
<b>Flood Prone Area Elevation</b>	742.6
<b>Entrenchment Ratio</b>	1.8
<b>Bank Height Ratio</b>	2.8



Stream Type N/A

Sta. 5+58 Looking Downstream



Station	Elevation
0.00	744.43
0.01	744.38
0.79	743.36
3.86	742.76
7.19	741.62
10.99	741.02
13.02	740.75
21.52	739.65
26.78	739.83
28.01	739.29
28.64	738.97
28.69	738.64
29.47	737.79
30.64	737.41
32.41	737.21
33.85	737.18
36.10	737.80
37.26	737.88
37.85	738.45
38.05	738.73
38.81	739.90
40.67	740.44
43.08	740.18
49.04	740.49
52.57	741.81
54.90	742.76
56.67	743.10
56.75	743.66
56.86	743.57

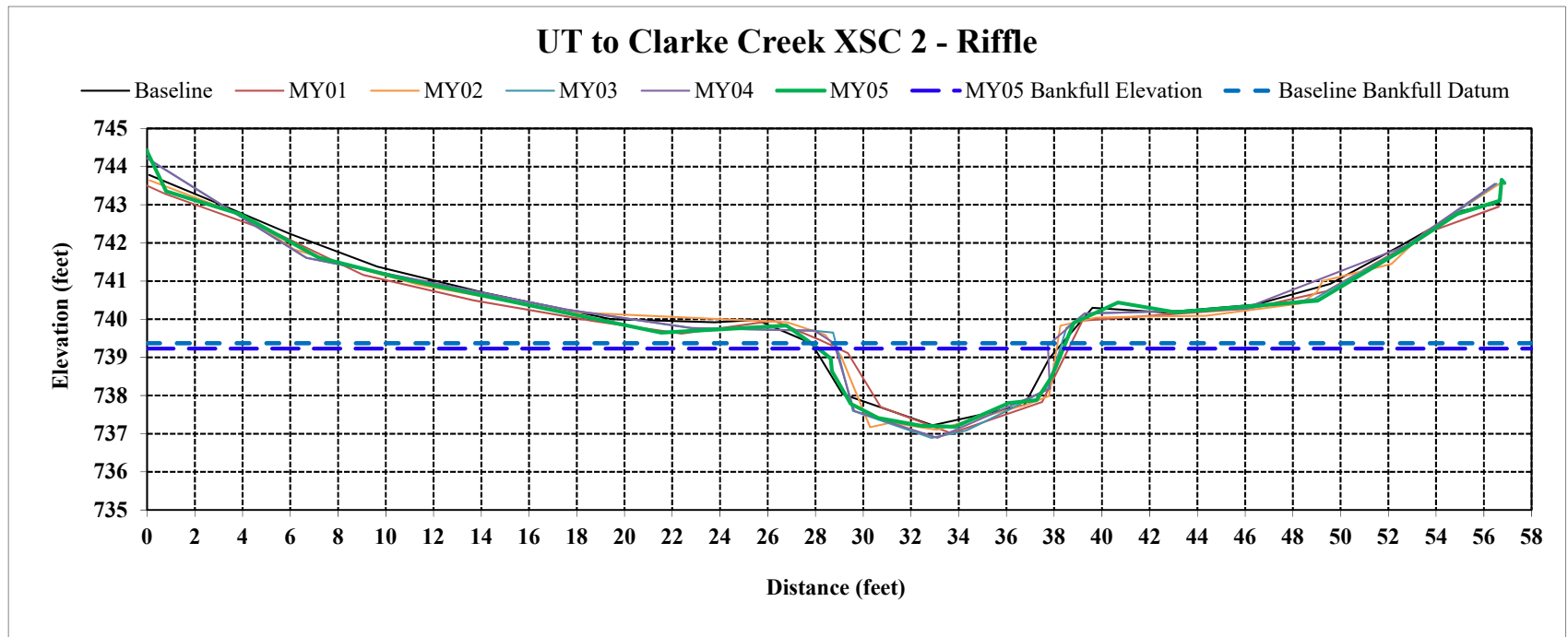
<b>Reach</b>	UT to Clarke Creek
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-2, Riffle, 9+33
<b>Drainage Area (Sq Mi)</b>	1.08
<b>Date</b>	10/30/2018
<b>Observers</b>	D. Moose, B. Wahab

SUMMARY DATA	
<b>MY05 Bankfull Elevation, ft</b>	739.2
<b>Baseline Bankfull Datum, ft</b>	739.4
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	15.5
<b>Bankfull Width, ft</b>	10.3
<b>Max Depth at Bankfull, ft</b>	2.0
<b>Mean Depth at Bankfull, ft</b>	1.5
<b>Width/Depth Ratio</b>	6.8
<b>Flood Prone Width, ft</b>	41.8
<b>Flood Prone Area Elevation</b>	741.2
<b>Entrenchment Ratio</b>	4.1
<b>Bank Height Ratio</b>	1.3



Stream Type E4

Sta. 9+33 Looking Downstream





Station	Elevation
0.00	745.20
0.01	744.67
2.00	743.76
5.53	742.76
11.25	742.11
20.16	741.90
24.42	742.01
25.39	741.74
25.77	741.21
26.06	740.82
26.49	739.82
27.41	739.12
28.38	738.64
29.64	738.45
32.21	738.88
33.57	738.97
34.22	739.53
34.52	740.86
34.81	741.23
36.39	741.43
38.38	741.66
40.80	741.73
52.05	741.83
59.29	742.44
63.60	743.21
66.65	743.88
67.72	744.17
67.73	744.86
67.64	744.60

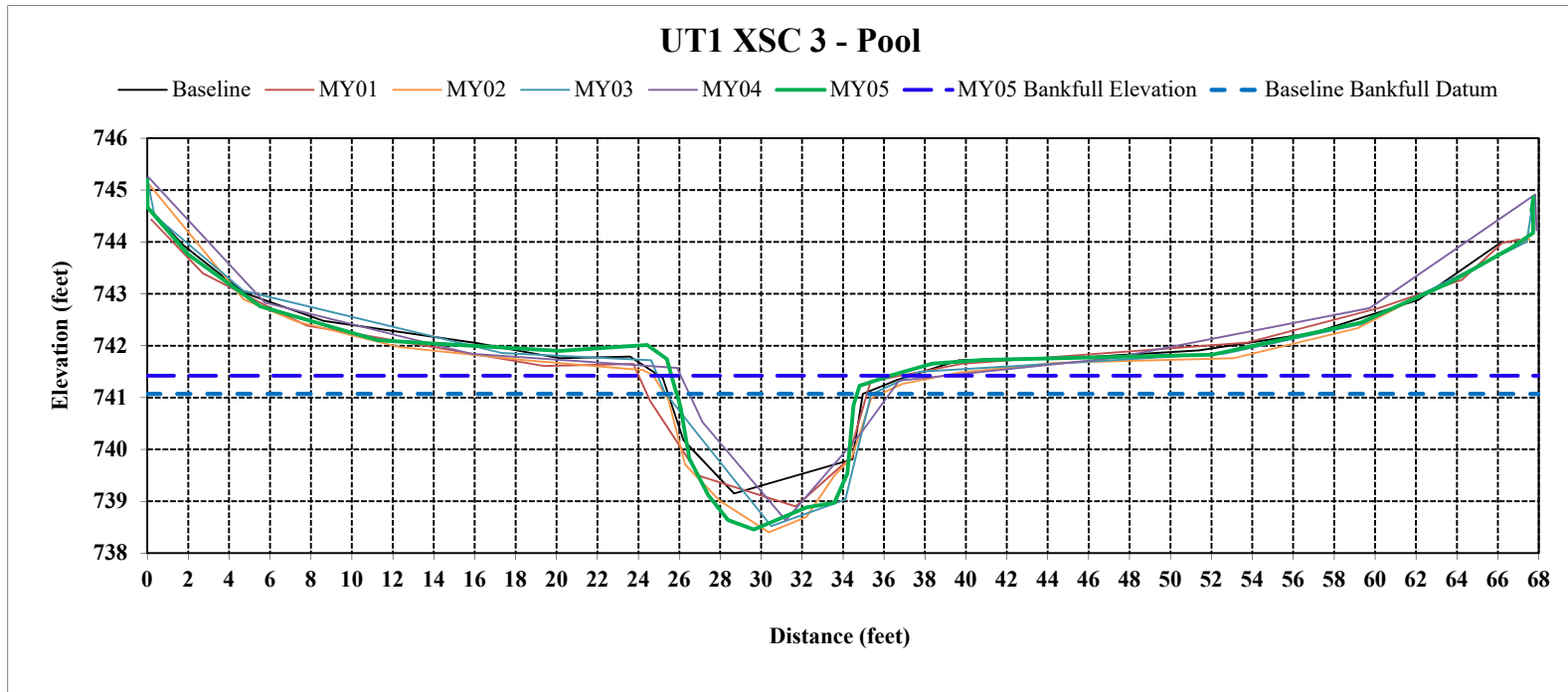
<b>Reach</b>	UT1
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-3, Pool, 7+25
<b>Drainage Area (Sq Mi)</b>	0.46
<b>Date</b>	10/30/2018
<b>Observers</b>	D. Moose, B. Wahab

SUMMARY DATA	
<b>MY05 Bankfull Elevation, ft</b>	741.4
<b>Baseline Bankfull Datum, ft</b>	741.1
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	16.2
<b>Bankfull Width, ft</b>	8.7
<b>Max Depth at Bankfull, ft</b>	3.0
<b>Mean Depth at Bankfull, ft</b>	1.9
<b>Width/Depth Ratio</b>	4.7
<b>Flood Prone Width, ft</b>	67.1
<b>Flood Prone Area Elevation</b>	744.4
<b>Entrenchment Ratio</b>	7.7
<b>Bank Height Ratio</b>	1.1



Stream Type N/A

Sta. 7+25 Looking Downstream



Station	Elevation
0	749.01
0.09299	749.6867
0.07675	748.8605
4.15792	748.7429
10.666	748.1753
17.9602	747.2845
17.9602	747.2845
27.0205	746.8521
28.6962	746.804
29.9981	746.4103
30.3893	745.7688
30.406	745.8494
31.2374	745.5544
32.1535	745.0345
32.8669	745.0485
33.7381	745.3381
34.1271	745.7043
34.4262	745.8722
34.8302	746.235
35.2641	746.2767
36.6435	746.6564
41.9633	746.7199
44.5888	746.122
49.0731	746.7607
56.4257	746.9508
61.1642	747.6772
64.5403	748.9684
68.8442	749.3553
73.2854	749.3206
76.4865	749.0983
76.5378	749.6318
76.536	749.5

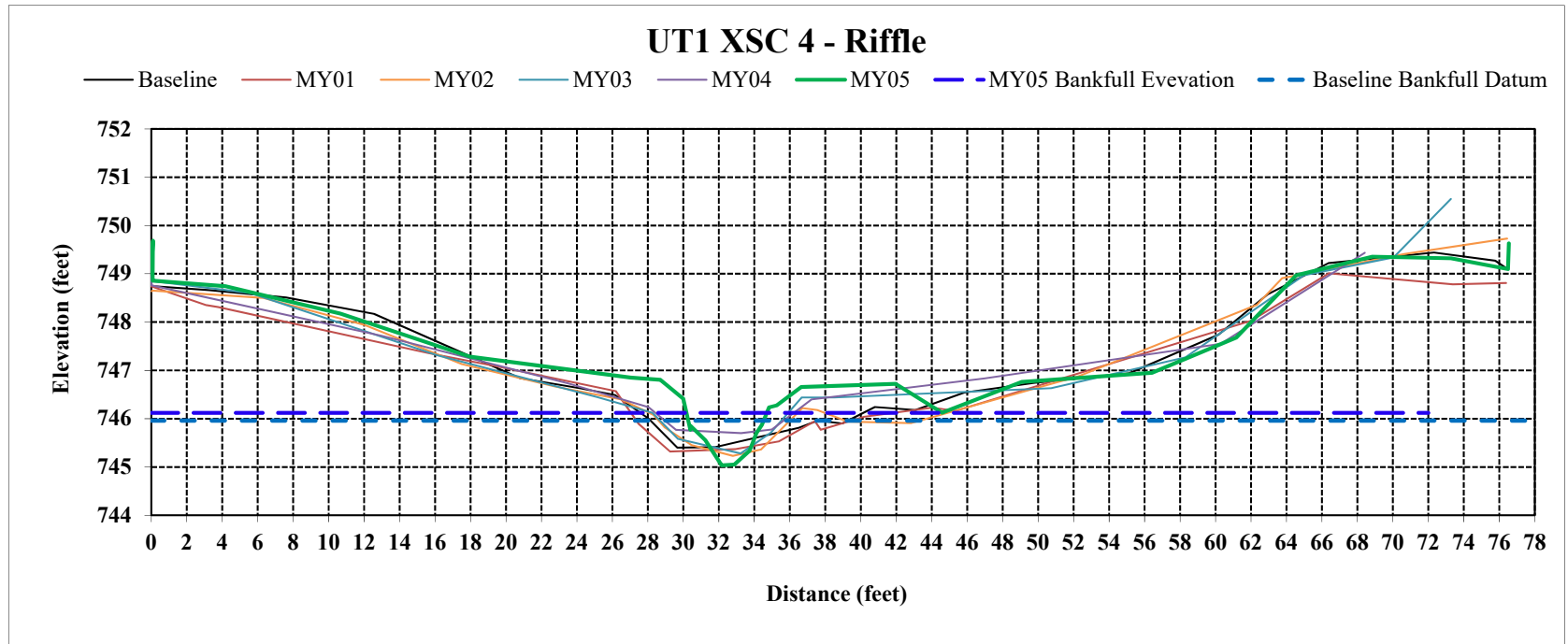
Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-4, Riffle, 1+26
Drainage Area (Sq Mi)	0.46
Date	10/30/2018
Observers	D. Moose, B. Wahab

SUMMARY DATA	
MY05 Bankfull Elevation, ft	746.1
Baseline Bankfull Datum, ft	745.8
Bankfull Cross Sectional Area, ft <sup>2</sup>	3.1
Bankfull Width, ft	4.5
Max Depth at Bankfull, ft	1.1
Mean Depth at Bankfull, ft	0.7
Width/Depth Ratio	6.6
Flood Prone Width, ft	38.5
Flood Prone Area Elevation	747.2
Entrenchment Ratio	8.6
Bank Height Ratio	1.4



Stream Type B4c

Sta. 1+26 Looking Downstream





Station	Elevation
0.00	750.35
0.11	750.97
3.59	749.51
11.26	747.21
20.54	745.68
25.75	745.25
27.27	744.57
30.85	743.43
30.33	744.87
32.93	744.62
35.27	745.58
42.01	745.98
54.57	746.54
65.87	747.07
71.91	747.61
72.12	747.94

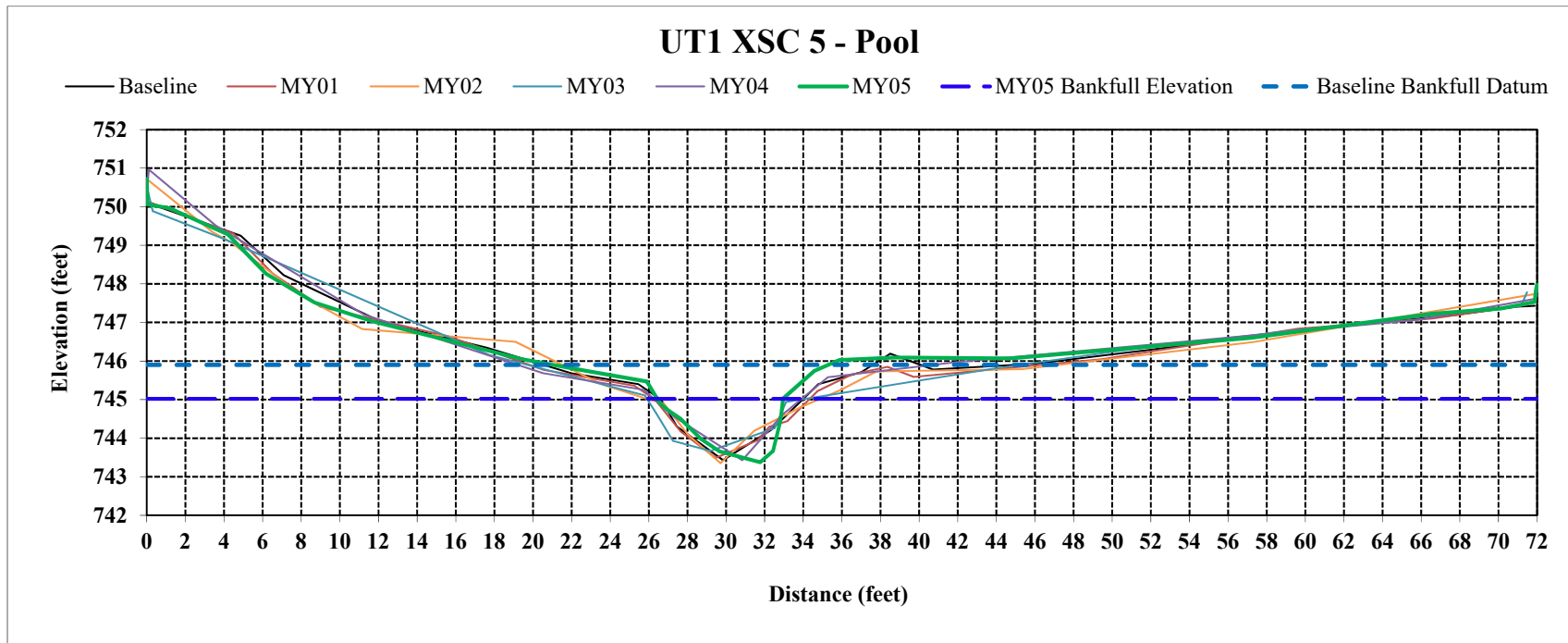
Reach	UT1
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-5, Pool, 2+66
Drainage Area (Sq Mi)	0.46
Date	10/30/2018
Observers	D. Moose, B. Wahab

SUMMARY DATA	
MY05 Bankfull Elevation, ft	745.02
Baseline Bankfull Datum, ft	745.90
Bankfull Cross Sectional Area, ft <sup>2</sup>	6.90
Bankfull Width, ft	6.5
Max Depth at Bankfull, ft	1.60
Mean Depth at Bankfull, ft	1.10
Width/Depth Ratio	6.20
Flood Prone Width, ft	43.6
Flood Prone Area Elevation	746.6
Entrenchment Ratio	6.70
Bank Height Ratio	1.30



Stream Type B4c

Sta. 2+66 Looking Downstream



Station	Elevation
0.00	750.71
0.11	750.99
0.16	750.48
1.25	750.21
3.70	749.49
7.33	747.65
20.23	746.11
23.75	746.21
28.73	745.80
30.92	745.39
32.92	744.91
33.42	744.39
33.77	744.24
34.05	743.91
36.28	743.73
36.73	743.91
37.21	744.39
37.34	744.49
38.00	745.02
39.91	745.49
48.57	745.81
54.95	746.54
64.96	746.93
69.46	747.29
70.61	747.42
70.56	747.92

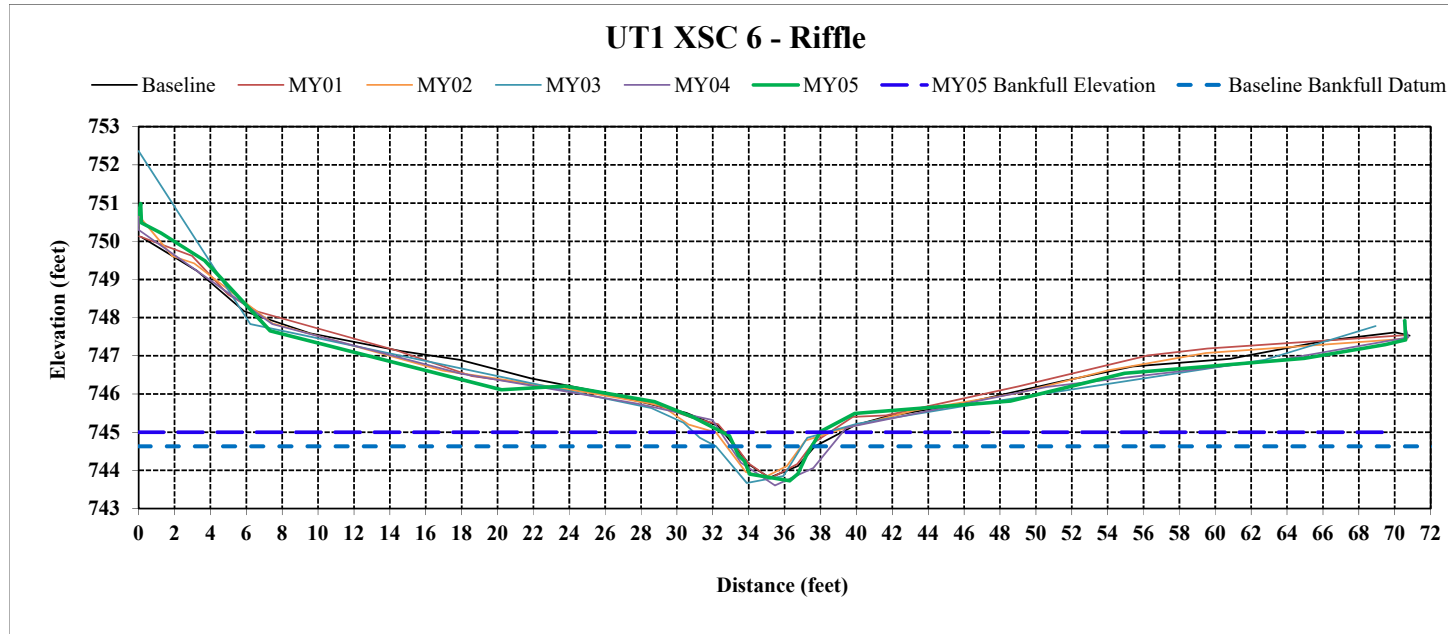
<b>Reach</b>	UT1
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-6, Riffle, 3+33
<b>Drainage Area (Sq Mi)</b>	0.46
<b>Date</b>	10/30/2018
<b>Observers</b>	D. Moose, B. Wahab

SUMMARY DATA	
<b>MY05 Bankfull Elevation, ft</b>	745.00
<b>Baseline Bankfull Datum, ft</b>	744.63
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	4.60
<b>Bankfull Width, ft</b>	5.6
<b>Max Depth at Bankfull, ft</b>	1.30
<b>Mean Depth at Bankfull, ft</b>	0.80
<b>Width/Depth Ratio</b>	6.70
<b>Flood Prone Width, ft</b>	34.4
<b>Flood Prone Area Elevation</b>	746.3
<b>Entrenchment Ratio</b>	6.20
<b>Bank Height Ratio</b>	1.40



Stream Type B4c

Sta. 3+33 Looking Downstream





Station	Elevation
0.0548	751.3262
0.1938	750.3809
1.2186	750.0507
3.6235	748.9537
6.3307	747.8305
17.921	746.2428
23.619	745.741
25.875	745.1517
28.048	744.6199
28.41	744.4043
28.724	744.1346
30.241	743.5895
31.26	743.5429
32.061	743.9694
33.00	744.25
34.158	744.4681
35.674	744.4433
36.293	744.7406
37.041	745.3669
39.222	745.2076
42.194	745.4759
51.959	746.032
56.632	746.2575
57.583	746.49
57.686	747.244

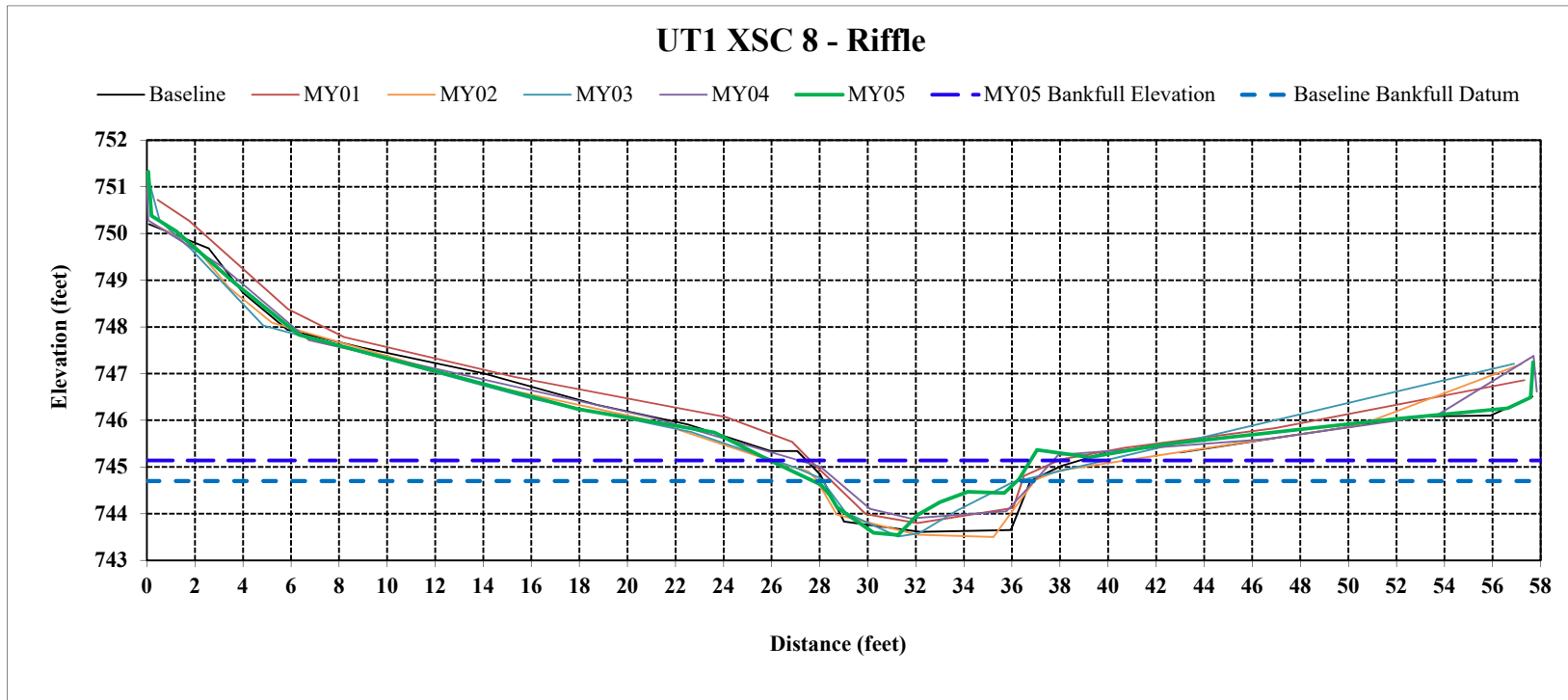
<b>Reach</b>	UT1
<b>River Basin</b>	Yadkin/Pee Dee
<b>Cross Section ID</b>	XSC-8, Riffle, 4+14
<b>Drainage Area (Sq Mi)</b>	0.46
<b>Date</b>	10/30/2018
<b>Observers</b>	D. Moose, B. Wahab

SUMMARY DATA	
<b>MY05 Bankfull Elevation, ft</b>	745.14
<b>Baseline Bankfull Datum, ft</b>	744.70
<b>Bankfull Cross Sectional Area, ft<sup>2</sup></b>	9.10
<b>Bankfull Width, ft</b>	10.8
<b>Max Depth at Bankfull, ft</b>	1.60
<b>Mean Depth at Bankfull, ft</b>	0.80
<b>Width/Depth Ratio</b>	13.00
<b>Flood Prone Width, ft</b>	43.3
<b>Flood Prone Area Elevation</b>	746.74
<b>Entrenchment Ratio</b>	4.00
<b>Bank Height Ratio</b>	1.20



Stream Type B4c

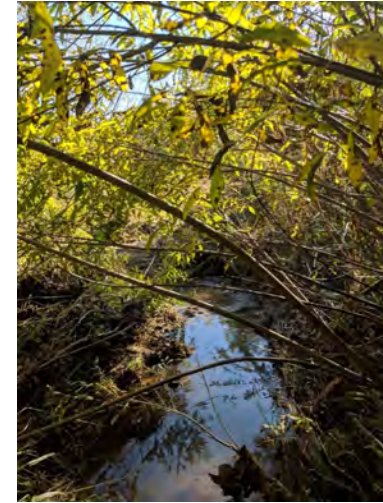
Sta. 4+14 Looking Downstream



Station	Elevation
0.00	749.08
0.09	748.61
7.91	747.87
16.06	747.37
20.88	747.63
24.12	747.01
24.44	746.06
25.71	745.37
27.03	745.70
28.04	745.71
29.40	746.03
29.73	746.17
30.22	746.59
31.46	747.17
32.07	747.35
33.33	747.53
37.39	747.69
42.75	748.10
47.66	748.41
47.75	748.97

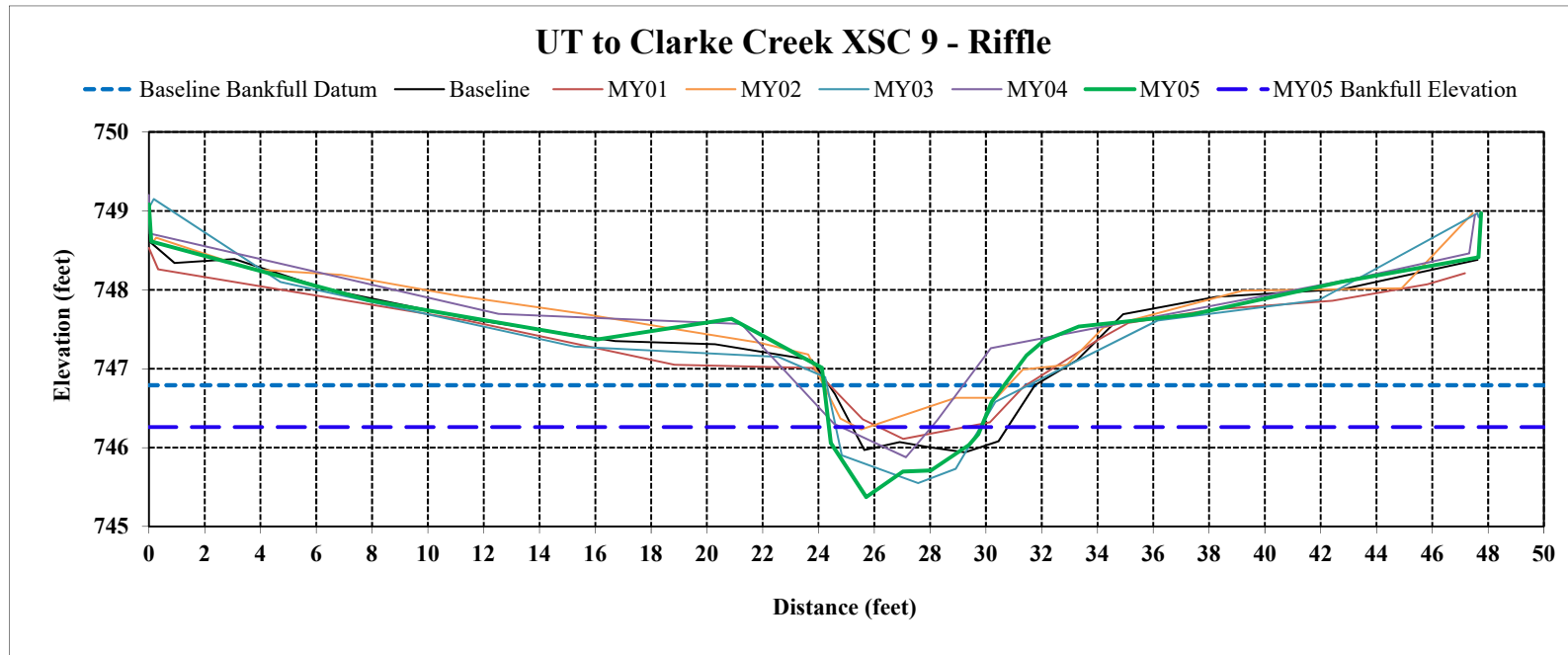
Reach	UT to Clarke Creek
River Basin	Yadkin/Pee Dee
Cross Section ID	XSC-9, Riffle, 2+02
Drainage Area (Sq Mi)	1.08
Date	10/30/2018
Observers	D. Moose, B. Wahab

SUMMARY DATA	
MY05 Bankfull Elevation, ft	746.26
Baseline Bankfull Datum, ft	746.79
Bankfull Cross Sectional Area, ft <sup>2</sup>	2.80
Bankfull Width, ft	5.5
Max Depth at Bankfull, ft	0.90
Mean Depth at Bankfull, ft	0.50
Width/Depth Ratio	10.60
Flood Prone Width, ft	8
Flood Prone Area Elevation	747.16
Entrenchment Ratio	1.45
Bank Height Ratio	2.40



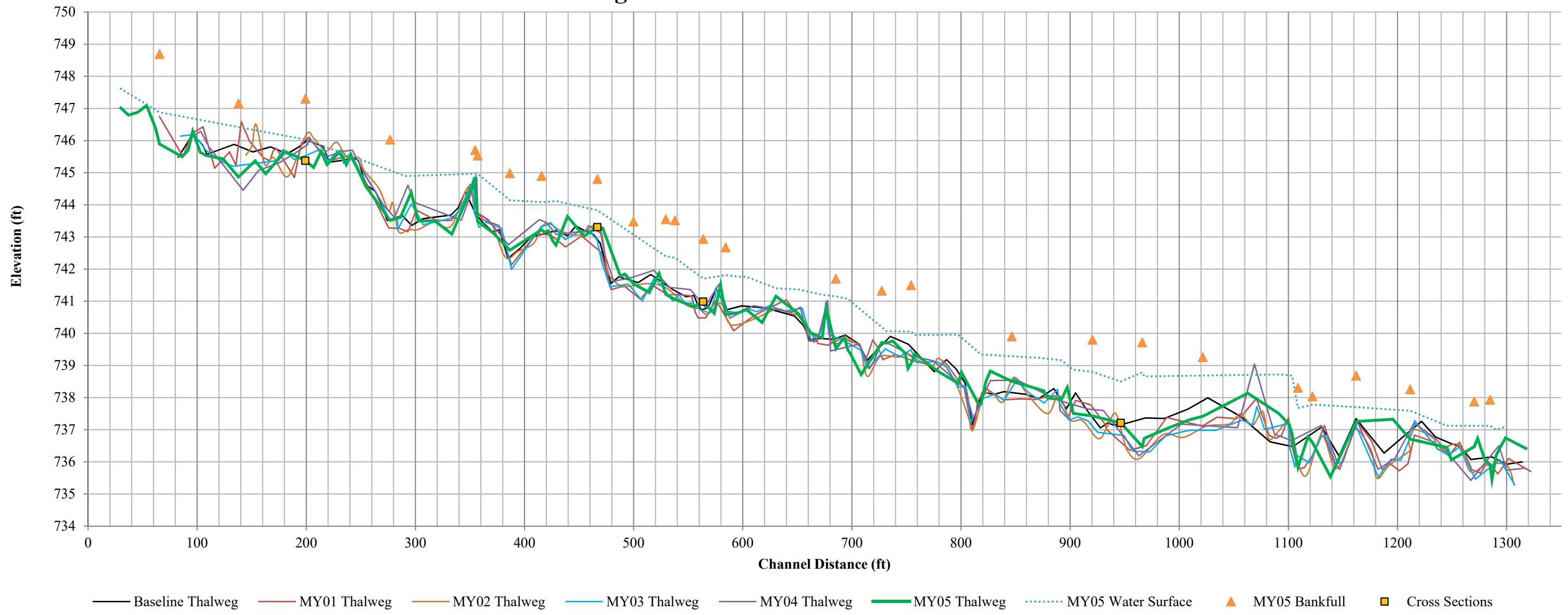
Stream Type | E4

Sta. 2+02 Looking Downstream

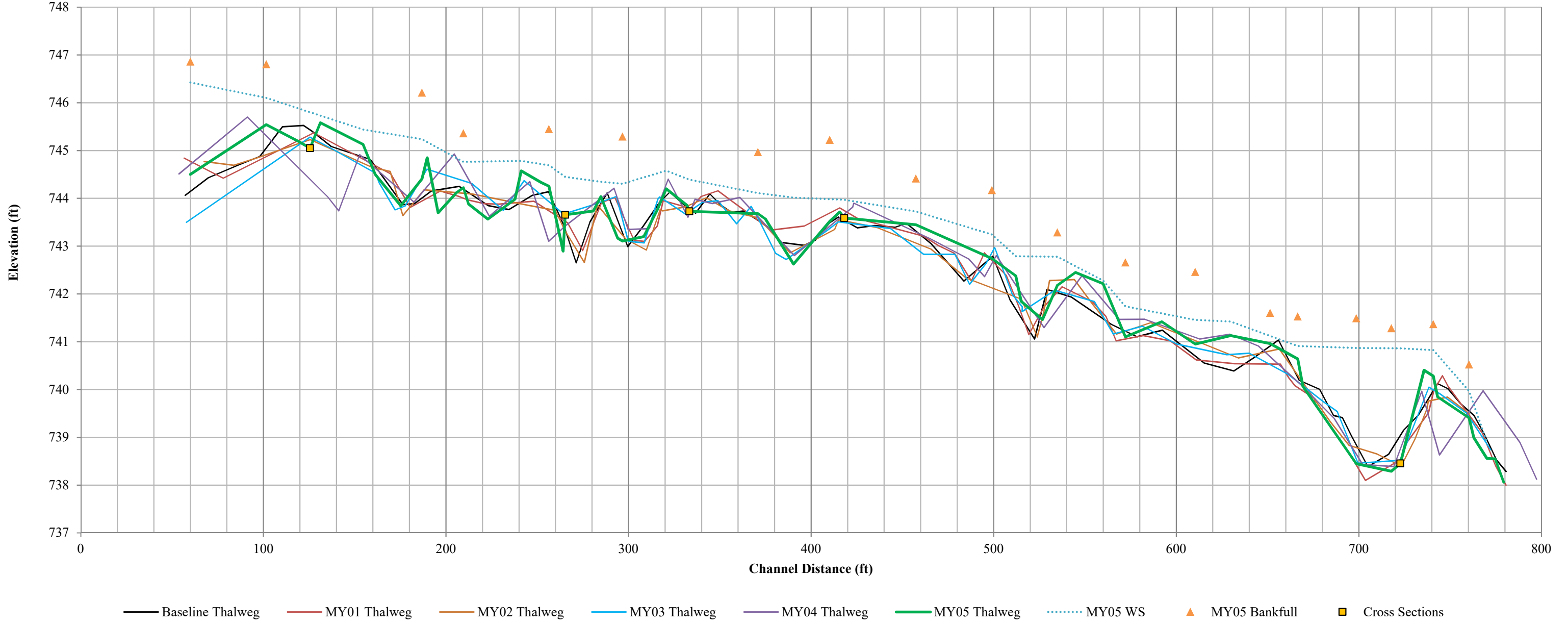




### Longitudinal Profile - UT to Clarke Creek



# Longitudinal Profile - UT 1





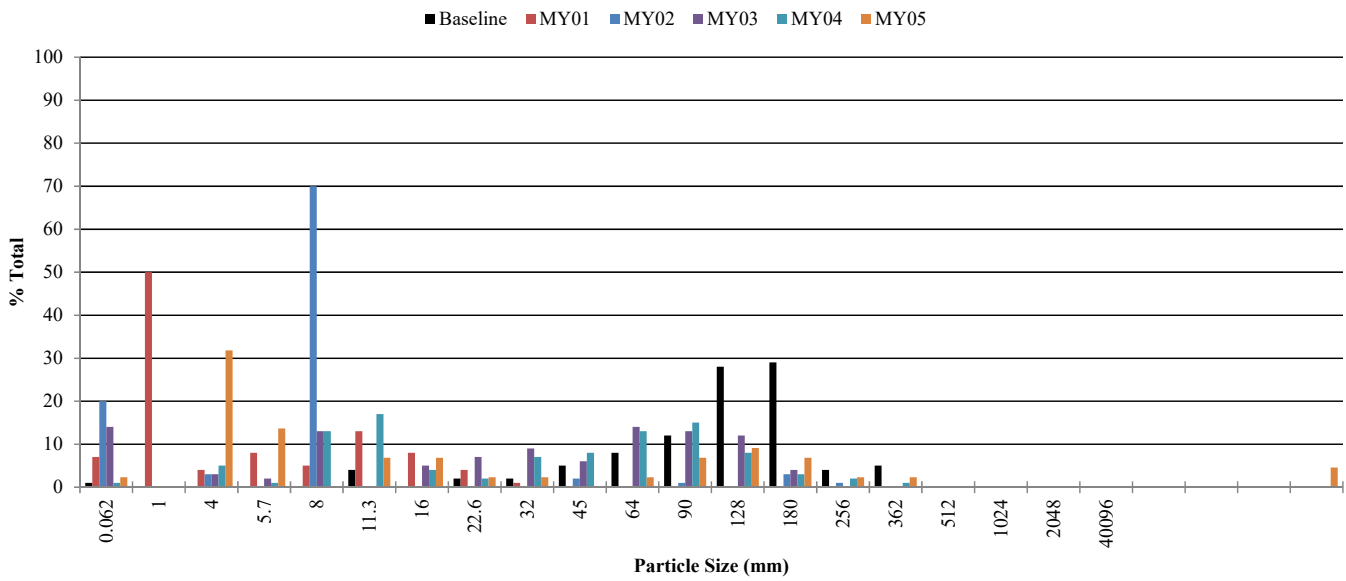
UT to Clarke Creek - US of XS9 - Riffle Pebble Count

Location: STA 2+02

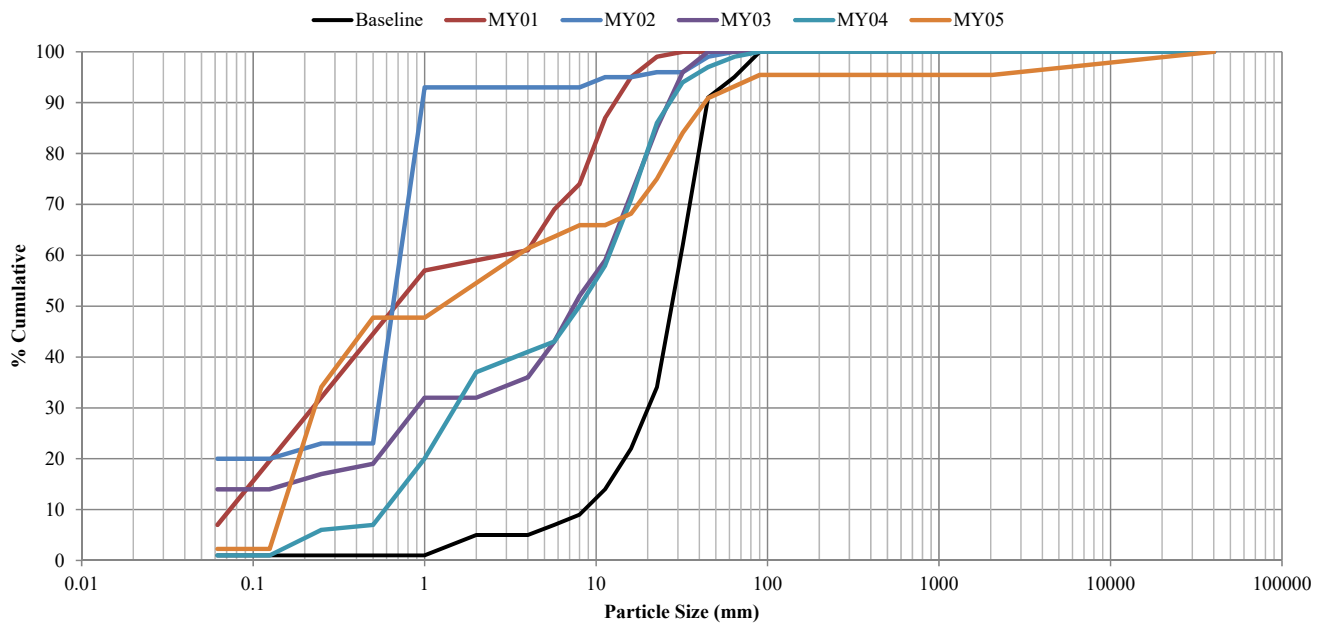
Inches	Particle	Millimeters		Count	% Total	% Cum.	
	Silt/Clay	<0.062	S A N D	1	2	2	
	Very Fine	0.062-0.125				0	2
	Fine	0.125-0.25			14	32	34
	Medium	0.25-0.50			6	14	48
	Coarse	0.50-1.0				0	48
0.04-0.08	Very Coarse	1.0-2			3	7	55
0.08-0.16	Very Fine	2-4	G R A V E L	3	7	61	
0.16-0.22	Fine	4-5.7			1	2	64
0.22-0.31	Fine	5.7-8			1	2	66
0.31-0.44	Medium	8-11.3				0	66
0.44-0.63	Medium	11.3-16			1	2	68
0.63-0.89	Coarse	16-22.6			3	7	75
0.89-1.26	Coarse	22.6-32			4	9	84
1.26-1.77	Very Coarse	32-45			3	7	91
1.77-2.5	Very Coarse	45-64			1	2	93
2.5-3.5	Small	64-90	C O B B L E	1	2	95	
3.5-5.0	Small	90-128				0	95
5.0-7.1	Medium	128-180			0	0	95
7.1-10.1	Large	180-256			0	0	95
10.1-14.3	Small	256-362	B O U L D E R	0	0	95	
14.3-20	Small	362-512			0	0	95
20-40	Medium	512-1024			0	0	95
40-80	Large	1024-2048			0	0	95
	Bedrock	Bedrock	Bedrock	2	5	100	
<b>Total Counted</b>				44			

Summary Data	
D50	1.3
D84	32
D95	84

**Individual Class Percent  
Pebble Count - US of XSC9 - Riffle**



**Cumulative Percent  
Pebble Count - US of XSC9 - Riffle**





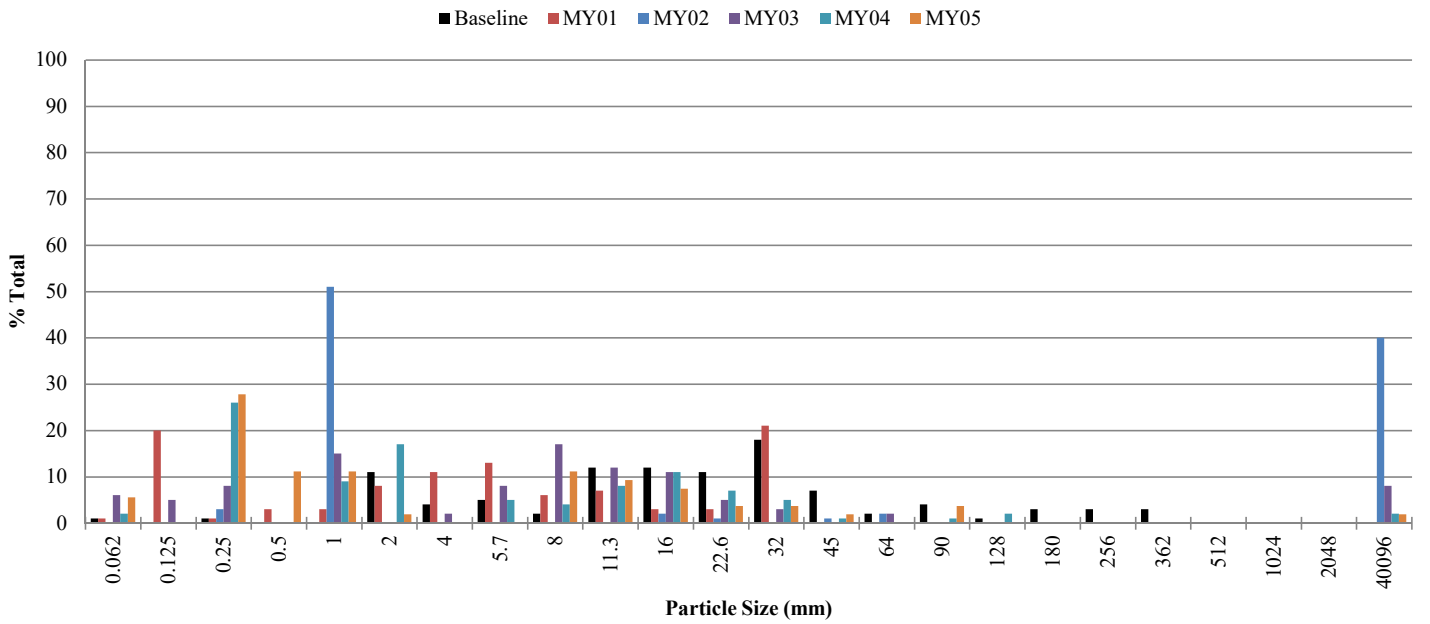
UT to Clarke Creek - XS1A - Riffle Pebble Count

Location: STA 5+58

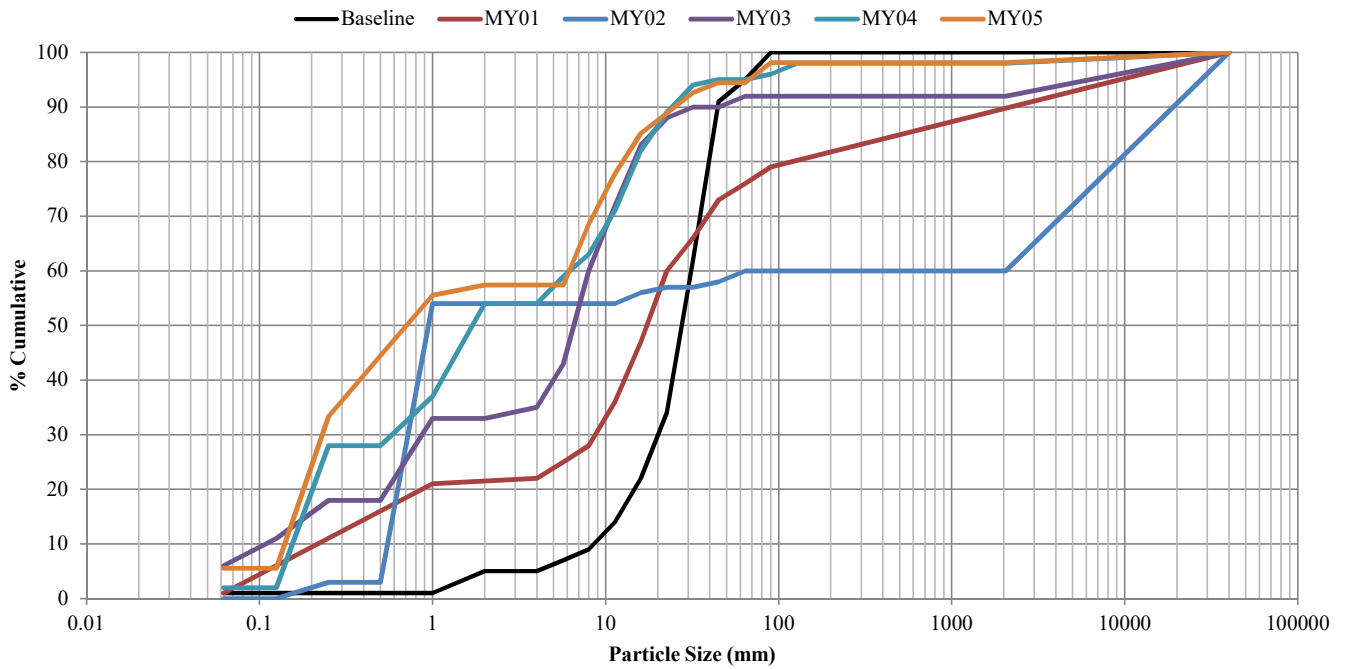
Inches	Particle	Millimeters		Count	% Total	% Cum.	
	Silt/Clay	<0.062	S A N D	3	6	6	
	Very Fine	0.062-0.125				0	6
	Fine	0.125-0.25			15	28	33
	Medium	0.25-0.50			6	11	44
	Coarse	0.50-1.0			6	11	56
0.04-0.08	Very Coarse	1.0-2			1	2	57
0.08-0.16	Very Fine	2-4	G R A V E L		0	57	
0.16-0.22	Fine	4-5.7				0	57
0.22-0.31	Fine	5.7-8			6	11	69
0.31-0.44	Medium	8-11.3			5	9	78
0.44-0.63	Medium	11.3-16			4	7	85
0.63-0.89	Coarse	16-22.6			2	4	89
0.89-1.26	Coarse	22.6-32			2	4	93
1.26-1.77	Very Coarse	32-45			1	2	94
1.77-2.5	Very Coarse	45-64				0	94
2.5-3.5	Small	64-90	C O B B L E	2	4	98	
3.5-5.0	Small	90-128				0	98
5.0-7.1	Medium	128-180				0	98
7.1-10.1	Large	180-256				0	98
10.1-14.3	Small	256-362	B O U L D E R		0	98	
14.3-20	Small	362-512				0	98
20-40	Medium	512-1024				0	98
40-80	Large	1024-2048				0	98
	Bedrock	Bedrock	Bedrock	1	2	100	
<b>Total Counted</b>				54			

Summary Data	
D50	0.7
D84	15
D95	67

### Individual Class Percent Pebble Count - XSC1A - Riffle



### Cumulative Percent Pebble Count - XSC1A - Riffle





UT to Clarke Creek - Reach: UT1 - XS4 - Riffle Pebble Count

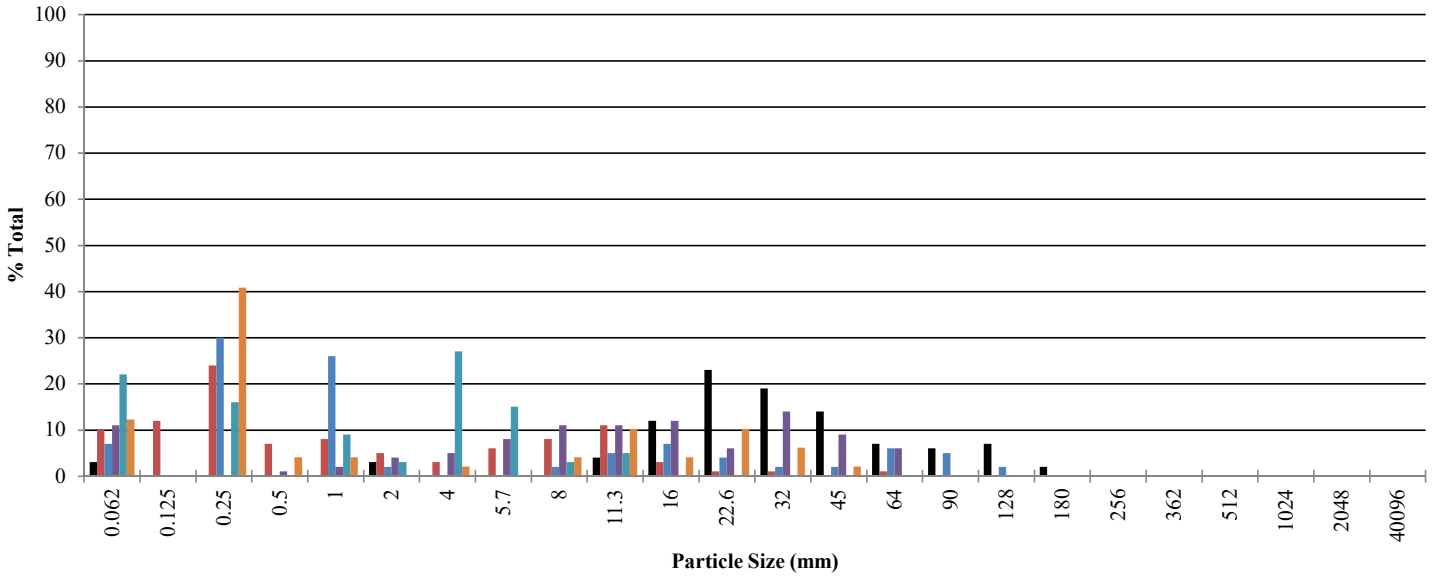
Location: STA 1+29

Inches	Particle	Millimeters		Count	% Total	% Cum.	
	Silt/Clay	<0.062	S A N D	6	12	12	
	Very Fine	0.062-0.125				0	12
	Fine	0.125-0.25			20	41	53
	Medium	0.25-0.50			2	4	57
	Coarse	0.50-1.0			2	4	61
0.04-0.08	Very Coarse	1.0-2				0	61
0.08-0.16	Very Fine	2-4	G R A V E L	1	2	63	
0.16-0.22	Fine	4-5.7				0	63
0.22-0.31	Fine	5.7-8			2	4	67
0.31-0.44	Medium	8-11.3			5	10	78
0.44-0.63	Medium	11.3-16			2	4	82
0.63-0.89	Coarse	16-22.6			5	10	92
0.89-1.26	Coarse	22.6-32			3	6	98
1.26-1.77	Very Coarse	32-45			1	2	100
1.77-2.5	Very Coarse	45-64			0	0	100
2.5-3.5	Small	64-90	C O B B L E	0	0	100	
3.5-5.0	Small	90-128			0	0	100
5.0-7.1	Medium	128-180			0	0	100
7.1-10.1	Large	180-256			0	0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100	
14.3-20	Small	362-512			0	0	100
20-40	Medium	512-1024			0	0	100
40-80	Large	1024-2048			0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100	
<b>Total Counted</b>				49			

Summary Data	
D50	0.2
D84	17
D95	27

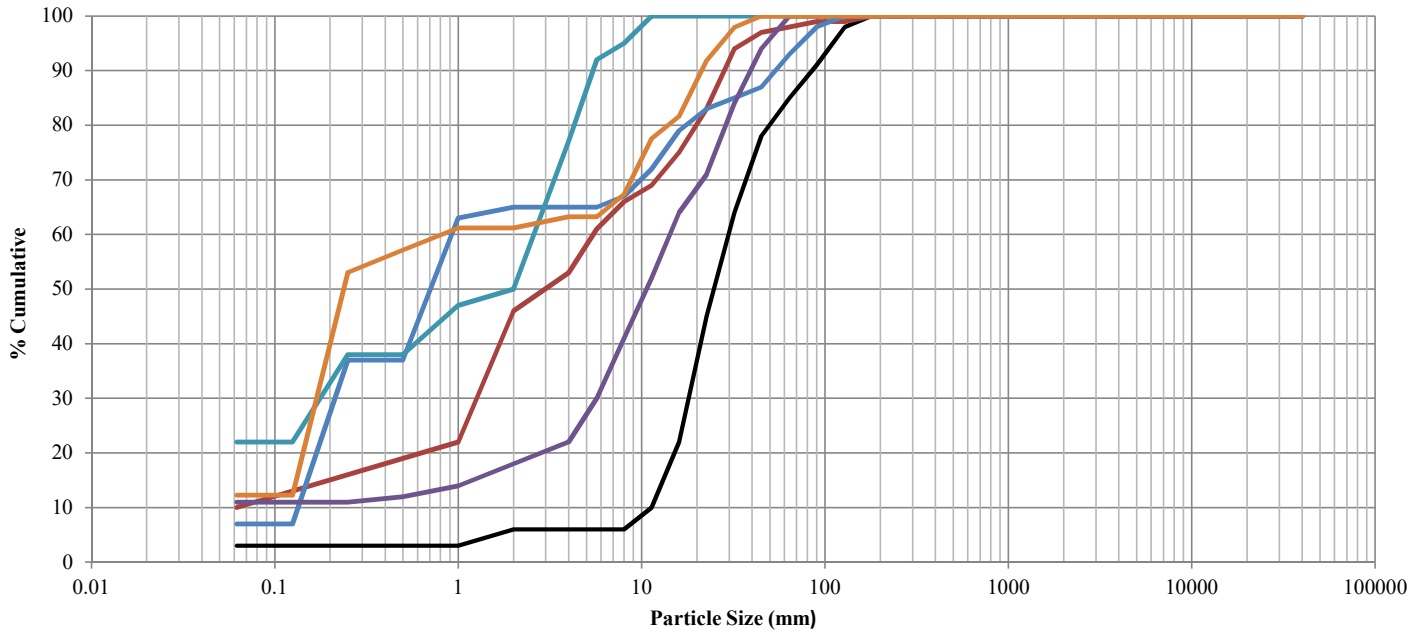
**Individual Class Percent  
Pebble Count - XSC4 - Riffle**

■ Baseline ■ MY01 ■ MY02 ■ MY03 ■ MY04 ■ MY05



**Cumulative Percent  
Pebble Count - XSC4 - Riffle**

— Baseline — MY01 — MY02 — MY03 — MY04 — MY05



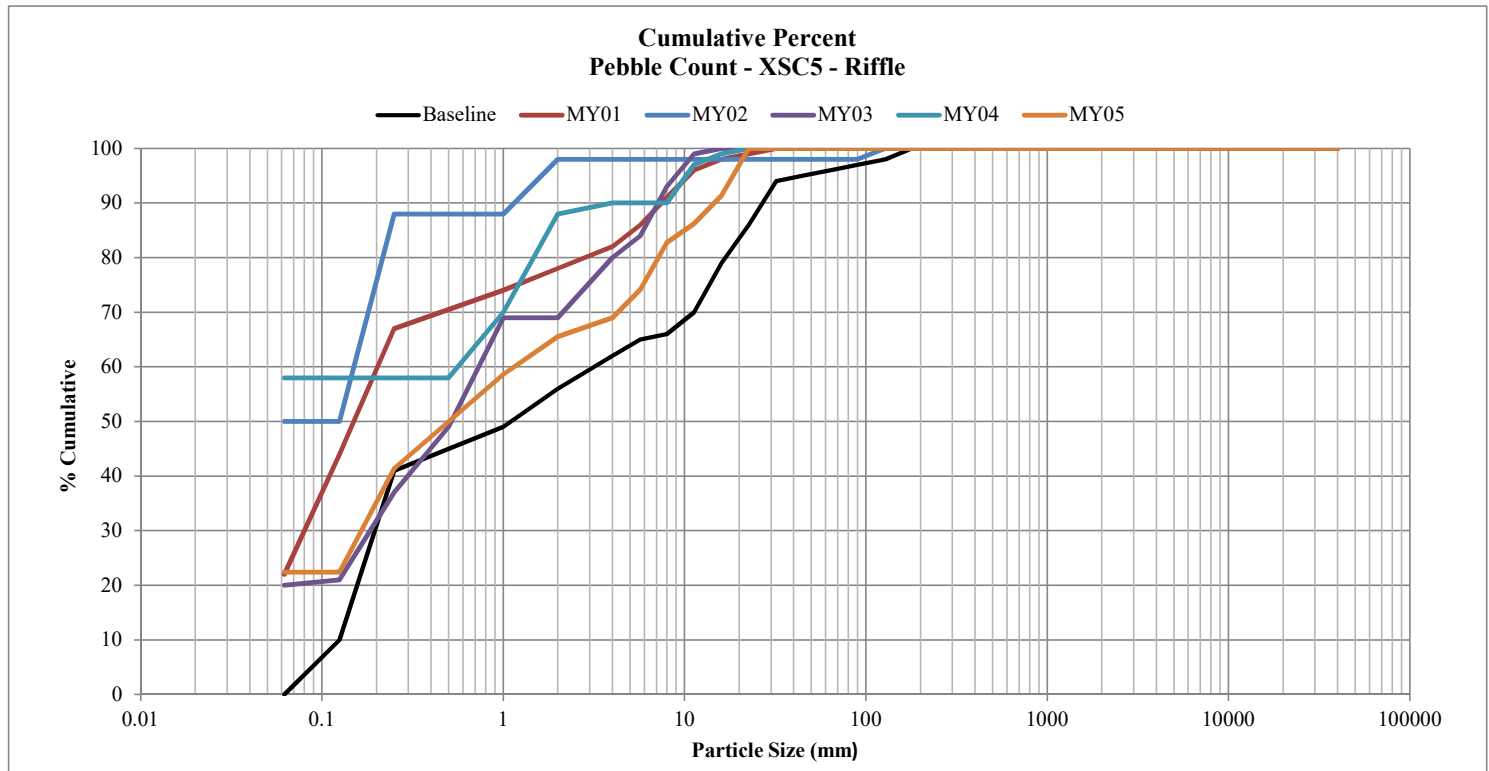
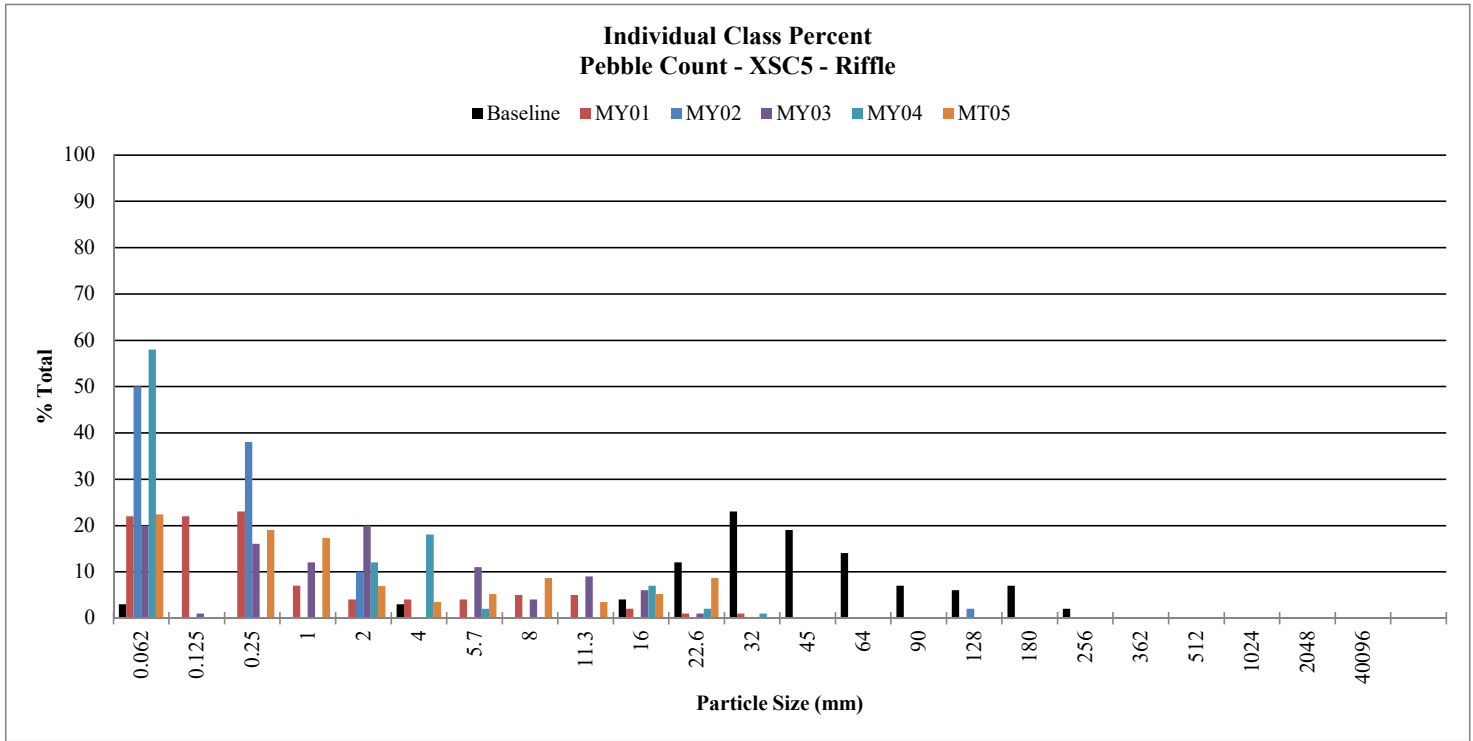


UT to Clarke Creek - Reach: UT1 - XS5 - Riffle Pebble Count

Location: STA 2+69

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	13	22	22
	Very Fine	0.062-0.125		0	22	
	Fine	0.125-0.25		11	41	
	Medium	0.25-0.50		10	59	
	Coarse	0.50-1.0		4	66	
0.04-0.08	Very Coarse	1.0-2		2	69	
0.08-0.16	Very Fine	2-4	G R A V E L	3	74	
0.16-0.22	Fine	4-5.7		5	83	
0.22-0.31	Fine	5.7-8		2	86	
0.31-0.44	Medium	8-11.3		3	91	
0.44-0.63	Medium	11.3-16		5	100	
0.63-0.89	Coarse	16-22.6		0	100	
0.89-1.26	Coarse	22.6-32		0	100	
1.26-1.77	Very Coarse	32-45		0	100	
1.77-2.5	Very Coarse	45-64		0	100	
2.5-3.5	Small	64-90	C O B B L E	0	100	
3.5-5.0	Small	90-128		0	100	
5.0-7.1	Medium	128-180		0	100	
7.1-10.1	Large	180-256		0	100	
10.1-14.3	Small	256-362	B O U L D E R	0	100	
14.3-20	Small	362-512		0	100	
20-40	Medium	512-1024		0	100	
40-80	Large	1024-2048		0	100	
	Bedrock	Bedrock	Bedrock		0	100
<b>Total Counted</b>				58		

Summary Data	
D50	0.4
D84	6.7
D95	13



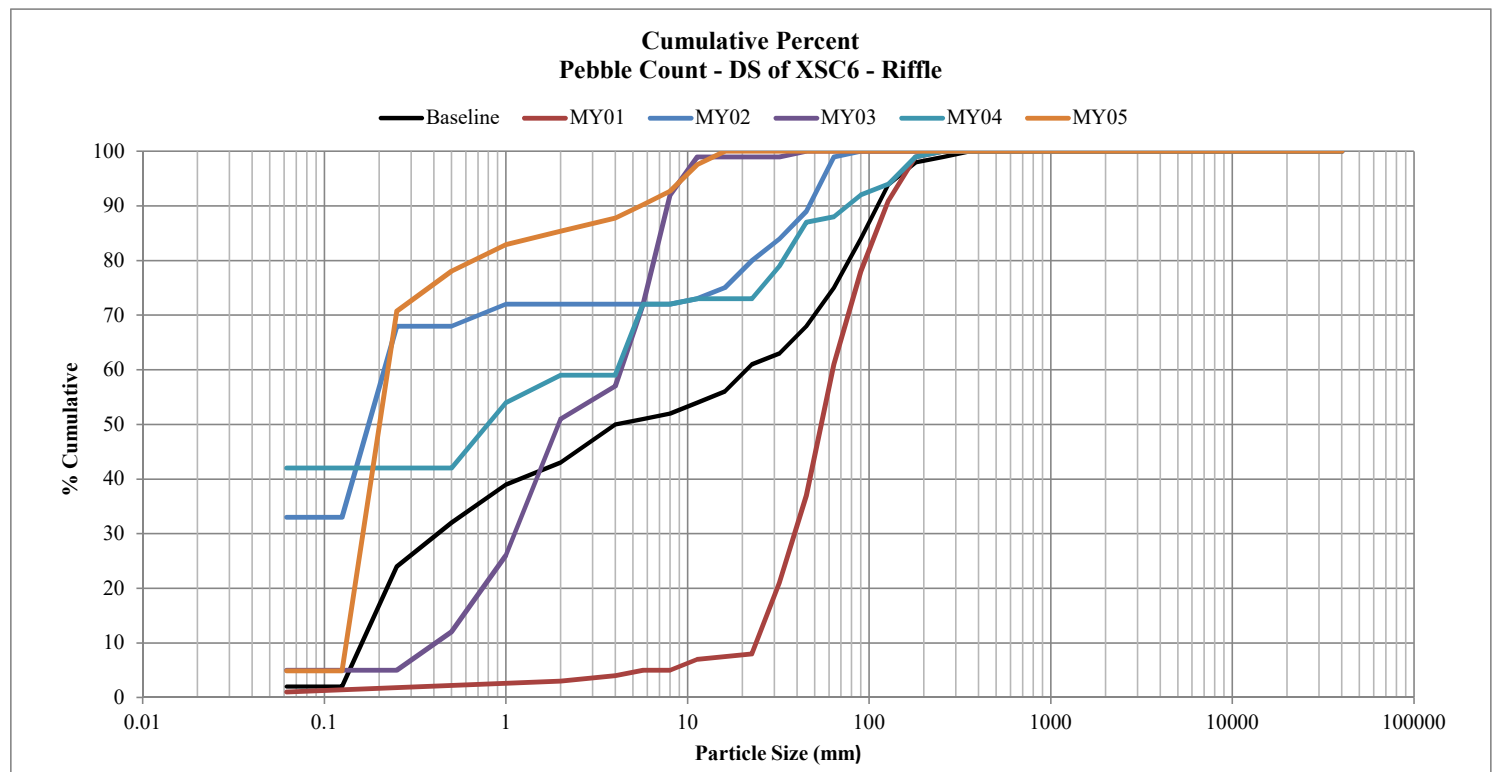
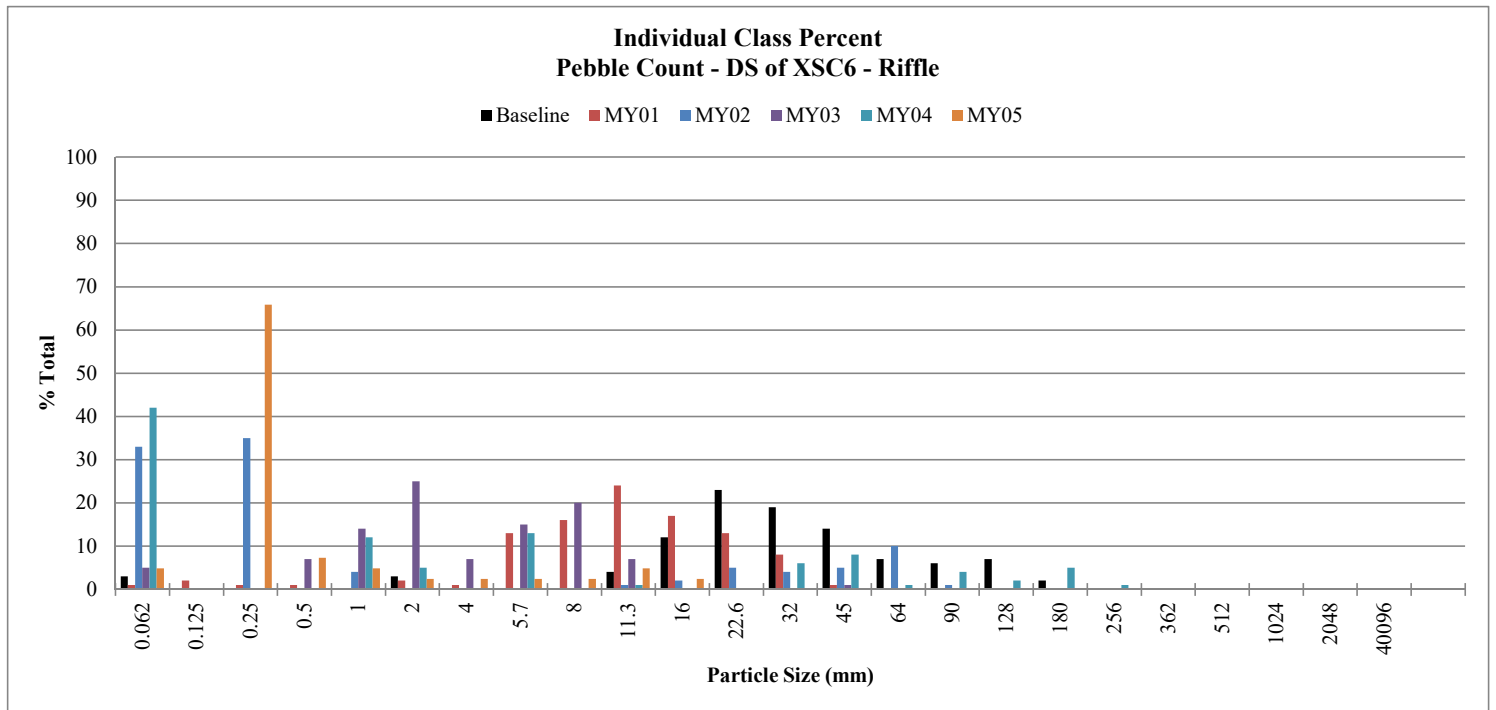


UT to Clarke Creek - Reach: UT1 - DS of XS6 - Riffle Pebble Count

Location: STA 3+34

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	2	5	5
	Very Fine	0.062-0.125		0	5	
	Fine	0.125-0.25		27	66	71
	Medium	0.25-0.50		3	7	78
	Coarse	0.50-1.0		2	5	83
0.04-0.08	Very Coarse	1.0-2		1	2	85
0.08-0.16	Very Fine	2-4	G R A V E L	1	2	88
0.16-0.22	Fine	4-5.7		1	2	90
0.22-0.31	Fine	5.7-8		1	2	93
0.31-0.44	Medium	8-11.3		2	5	98
0.44-0.63	Medium	11.3-16		1	2	100
0.63-0.89	Coarse	16-22.6			0	100
0.89-1.26	Coarse	22.6-32			0	100
1.26-1.77	Very Coarse	32-45			0	100
1.77-2.5	Very Coarse	45-64			0	100
2.5-3.5	Small	64-90	C O B B L E		0	100
3.5-5.0	Small	90-128			0	100
5.0-7.1	Medium	128-180			0	100
7.1-10.1	Large	180-256			0	100
10.1-14.3	Small	256-362	B O U L D E R	0	0	100
14.3-20	Small	362-512		0	0	100
20-40	Medium	512-1024		0	0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				41		

Summary Data	
D50	0.2
D84	1.4
D95	9.3





UT to Clarke Creek - DS of Confluence with 2B - Riffle Pebble Count

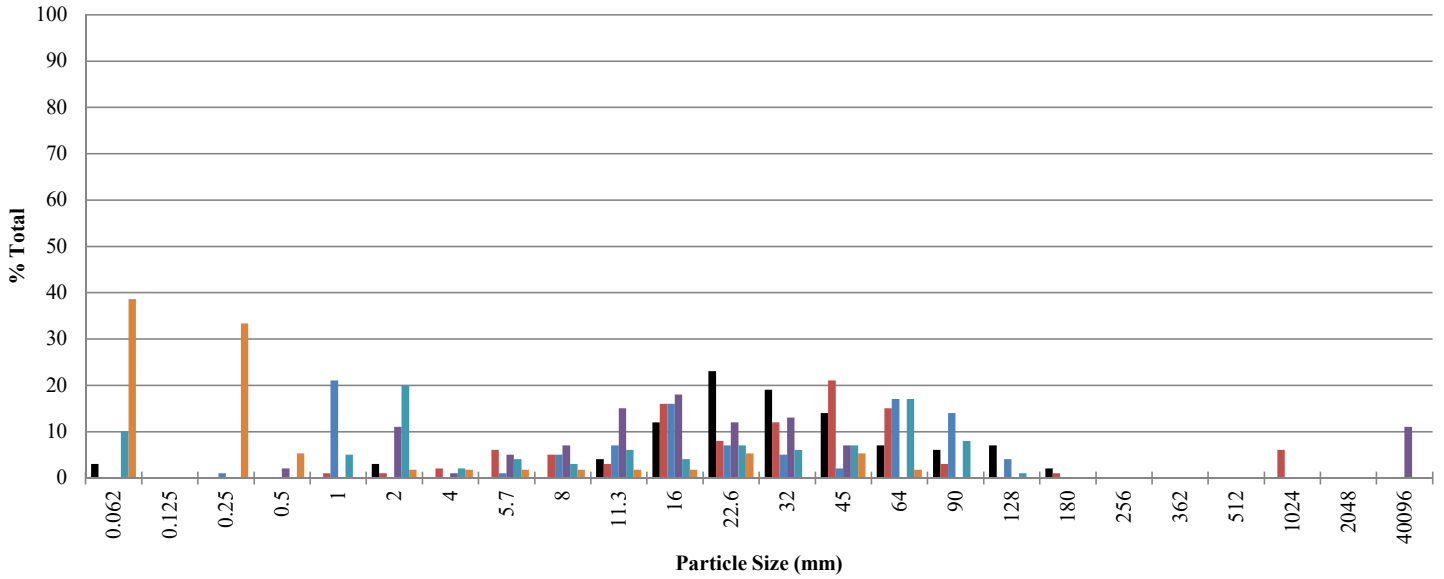
Location: STA 12+00

Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D	22	39	39
	Very Fine	0.062-0.125		0	0	39
	Fine	0.125-0.25		19	33	72
	Medium	0.25-0.50		3	5	77
	Coarse	0.50-1.0		0	0	77
0.04-0.08	Very Coarse	1.0-2		1	2	79
0.08-0.16	Very Fine	2-4	G R A V E L	1	2	81
0.16-0.22	Fine	4-5.7		1	2	82
0.22-0.31	Fine	5.7-8		1	2	84
0.31-0.44	Medium	8-11.3		1	2	86
0.44-0.63	Medium	11.3-16		1	2	88
0.63-0.89	Coarse	16-22.6		3	5	93
0.89-1.26	Coarse	22.6-32		0	0	93
1.26-1.77	Very Coarse	32-45		3	5	98
1.77-2.5	Very Coarse	45-64		1	2	100
2.5-3.5	Small	64-90	C O B B L E		0	100
3.5-5.0	Small	90-128			0	100
5.0-7.1	Medium	128-180			0	100
7.1-10.1	Large	180-256			0	100
10.1-14.3	Small	256-362	B O U L D E R		0	100
14.3-20	Small	362-512			0	100
20-40	Medium	512-1024			0	100
40-80	Large	1024-2048			0	100
	Bedrock	Bedrock	Bedrock		0	100
<b>Total Counted</b>				57		

Summary Data	
D50	silt
D84	7.7
D95	36

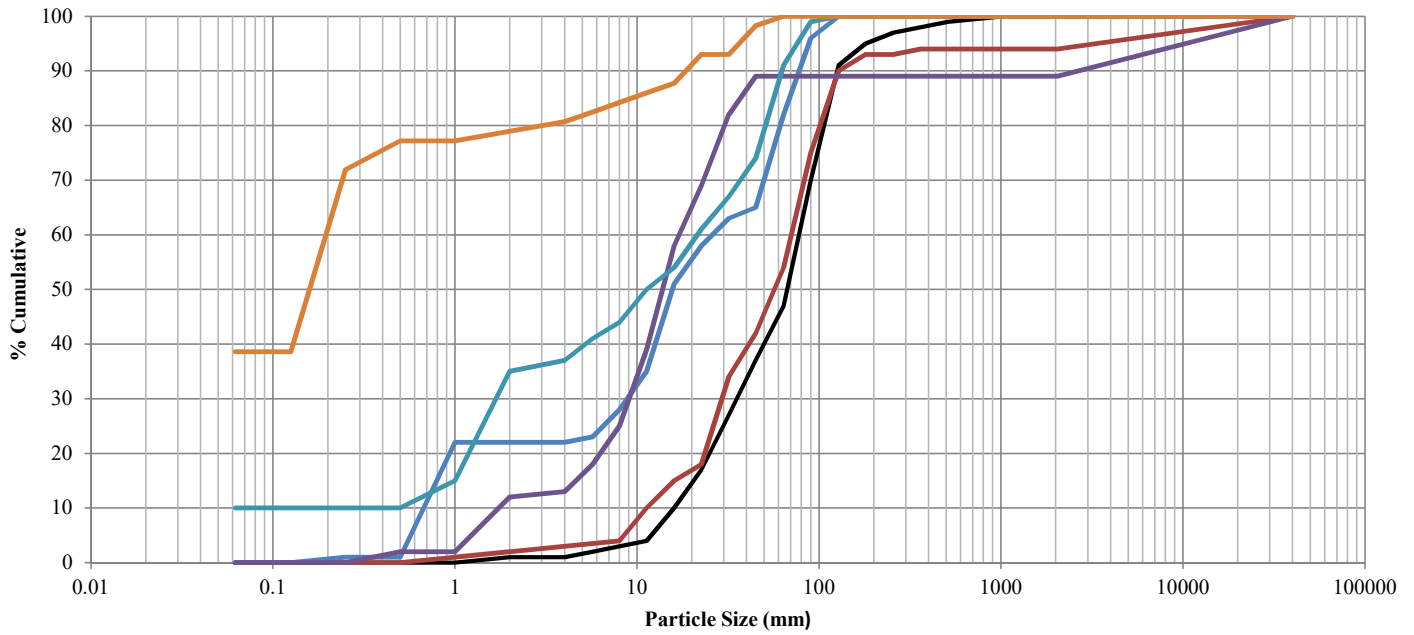
**Individual Class Percent  
Pebble Count - DS of Confluence with 2B - Riffle**

■ Baseline ■ MY01 ■ MY02 ■ MY03 ■ MY04 ■ MY05



**Cumulative Percent  
Pebble Count - DS of Confluence with 2B - Riffle**

— Baseline — MY01 — MY02 — MY03 — MY04 — MY05



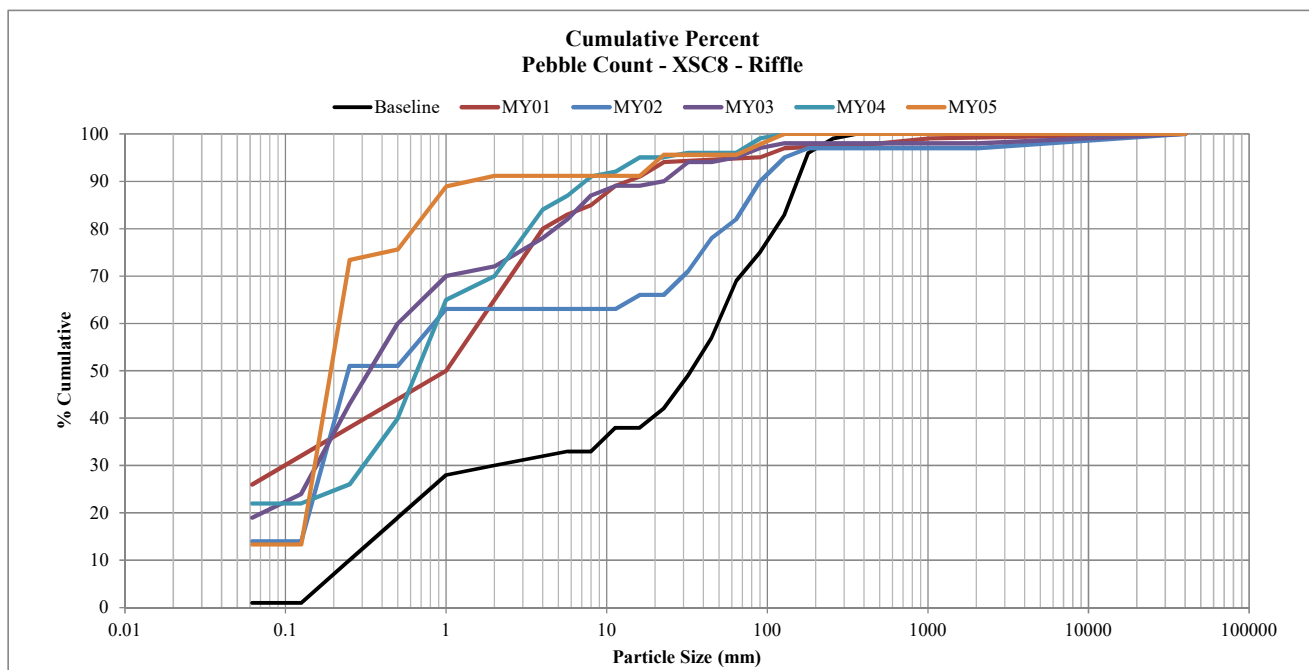
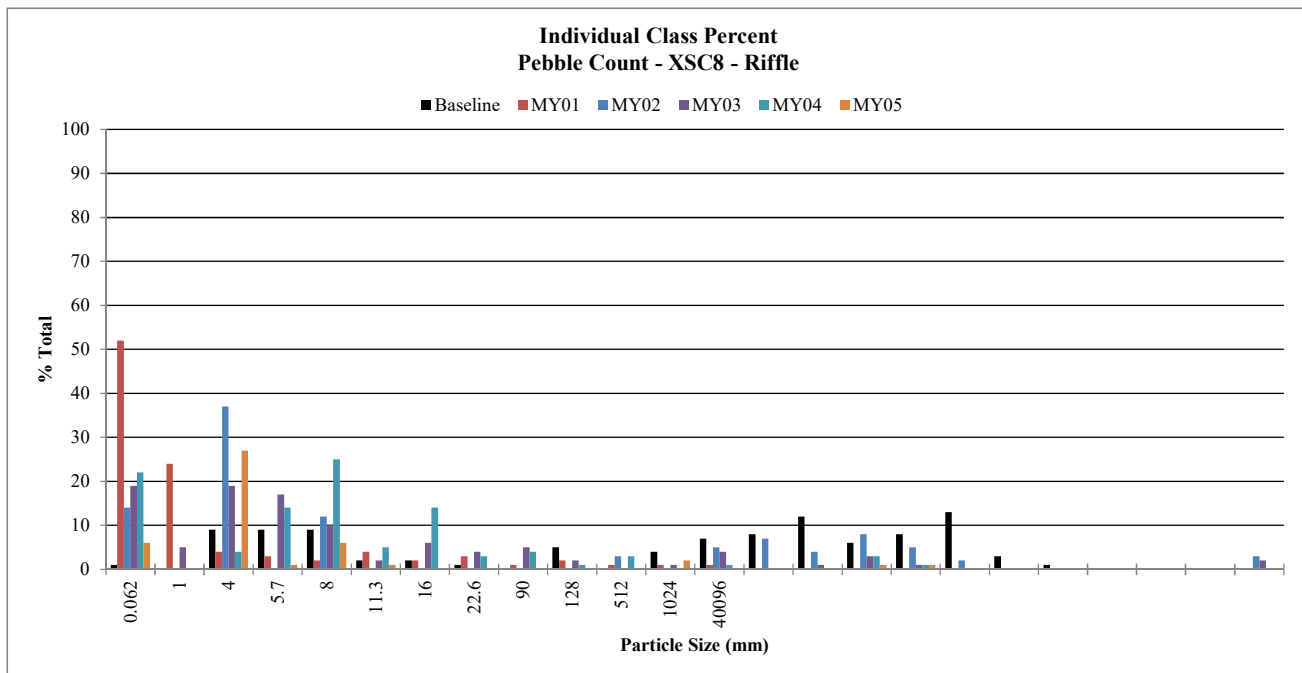
UT to Clarke Creek - Reach: UT1 - XS8 - Riffle Pebble Count

Location: STA 4+14

Inches	Particle	Millimeters		Count	% Total	% Cum.	
	Silt/Clay	<0.062	S A N D	6	13	13	
	Very Fine	0.062-0.125				0	13
	Fine	0.125-0.25			27	60	73
	Medium	0.25-0.50			1	2	76
	Coarse	0.50-1.0			6	13	89
0.04-0.08	Very Coarse	1.0-2		1	2	91	
0.08-0.16	Very Fine	2-4	G R A V E L		0	91	
0.16-0.22	Fine	4-5.7				0	91
0.22-0.31	Fine	5.7-8				0	91
0.31-0.44	Medium	8-11.3				0	91
0.44-0.63	Medium	11.3-16				0	91
0.63-0.89	Coarse	16-22.6			2	4	96
0.89-1.26	Coarse	22.6-32				0	96
1.26-1.77	Very Coarse	32-45				0	96
1.77-2.5	Very Coarse	45-64				0	96
2.5-3.5	Small	64-90	C O B B L E	1	2	98	
3.5-5.0	Small	90-128			1	2	100
5.0-7.1	Medium	128-180				0	100
7.1-10.1	Large	180-256				0	100
10.1-14.3	Small	256-362	B O U L D E R		0	100	
14.3-20	Small	362-512				0	100
20-40	Medium	512-1024				0	100
40-80	Large	1024-2048				0	100
	Bedrock	Bedrock	Bedrock		0	100	
<b>Total Counted</b>				<b>45</b>			

Summary Data	
D50	0.2
D84	0.8
D95	21





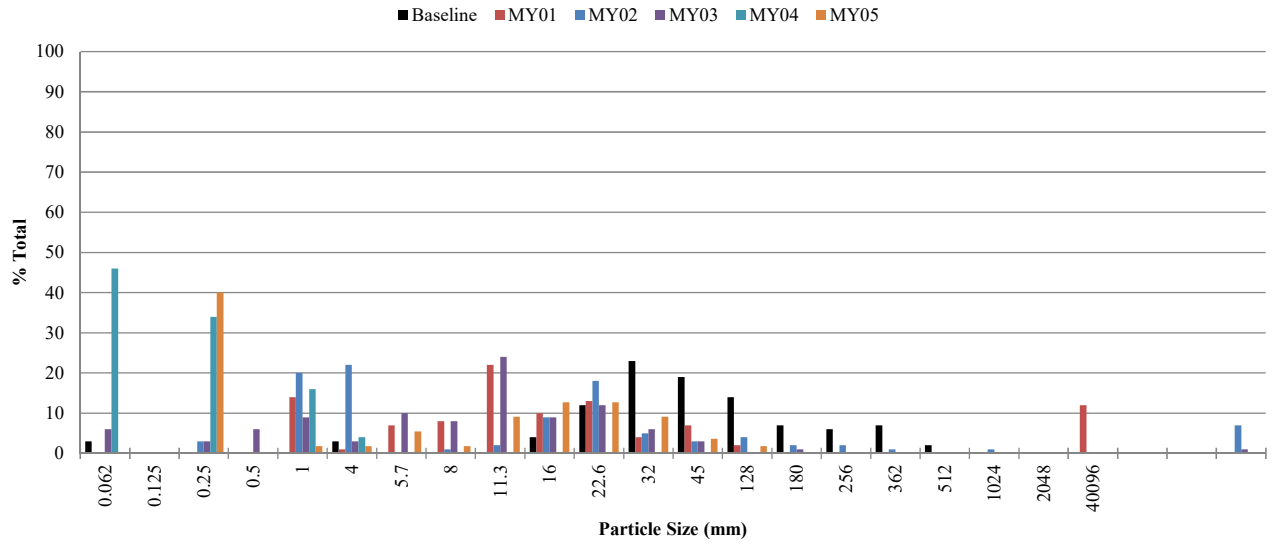
UT to Clarke Creek - US of Confluence with UT1 - Riffle Pebble Count

Location: STA 7+50

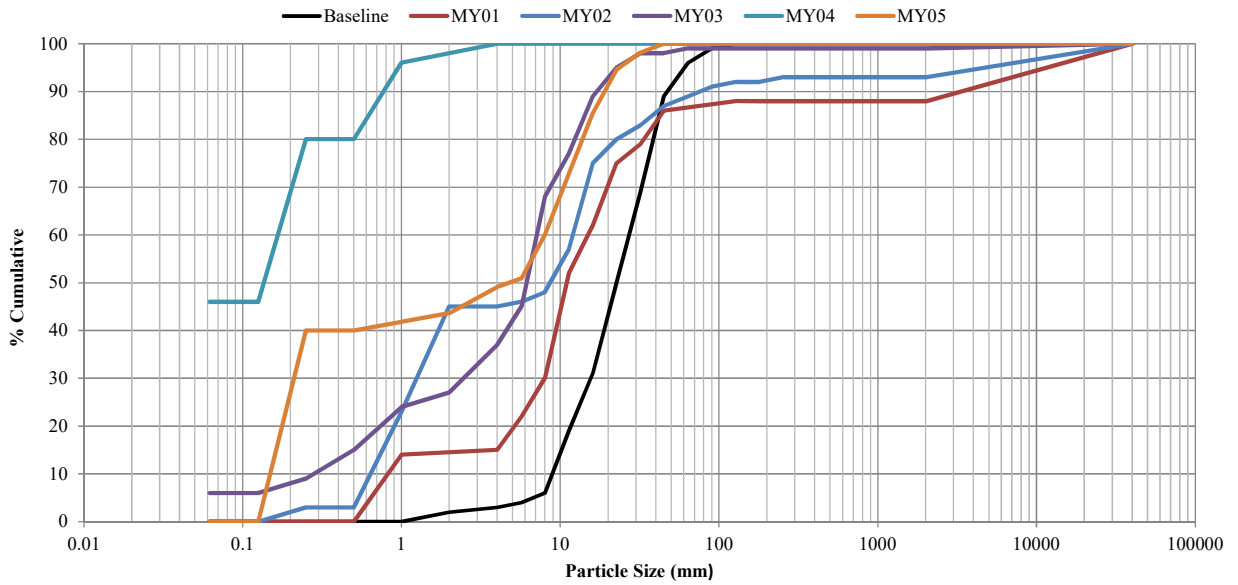
Inches	Particle	Millimeters		Count	% Total	% Cum.
	Silt/Clay	<0.062	S A N D		0	0
	Very Fine	0.062-0.125			0	0
	Fine	0.125-0.25		22	40	40
	Medium	0.25-0.50			0	40
	Coarse	0.50-1.0		1	2	42
0.04-0.08	Very Coarse	1.0-2		1	2	44
0.08-0.16	Very Fine	2-4	G R A V E L	3	5	49
0.16-0.22	Fine	4-5.7		1	2	51
0.22-0.31	Fine	5.7-8		5	9	60
0.31-0.44	Medium	8-11.3		7	13	73
0.44-0.63	Medium	11.3-16		7	13	85
0.63-0.89	Coarse	16-22.6		5	9	95
0.89-1.26	Coarse	22.6-32		2	4	98
1.26-1.77	Very Coarse	32-45		1	2	100
1.77-2.5	Very Coarse	45-64			0	100
2.5-3.5	Small	64-90	C O B B L E		0	100
3.5-5.0	Small	90-128			0	100
5.0-7.1	Medium	128-180			0	100
7.1-10.1	Large	180-256			0	100
10.1-14.3	Small	256-362	B O U L D E R		0	100
14.3-20	Small	362-512			0	100
20-40	Medium	512-1024			0	100
40-80	Large	1024-2048		0	0	100
	Bedrock	Bedrock	Bedrock	0	0	100
<b>Total Counted</b>				55		

Summary Data	
D50	4.9
D84	15
D95	23

**Individual Class Percent  
Pebble Count - US of Confluence with UT1 - Riffle**



**Cumulative Percent  
Pebble Count - US of Confluence with UT1 - Riffle**





**Table 10a. Baseline Stream Data Summary**  
 UT to Clarke Creek/EEP #92500 - UT Clarke Creek (1507 feet)

Parameter	Gauge <sup>2</sup>	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Med	Max	Min	Mean	Med	Max	SD <sup>5</sup>	n
<b>Dimension and Substrate - Riffle Only</b>																									
Bankfull Width (ft)		7	30	3	11.38			12.62			8.26			10.93			10.57		12.2	6.72	7.95	7.17	9.97	-	3
Floodprone Width (ft)					36.14			49.08			11.69			19.17			54.63		63.43	18.7	25.23	22.4	34.6	-	3
Bankfull Mean Depth (ft)		1	2.5	1.17	1.77			1.83			1.02			1.98			1.22		1.46	0.39	0.9	0.76	1.55	-	3
<sup>1</sup> Bankfull Max Depth (ft)											1.57			2.05			1.89		2.21	0.85	1.313	0.94	2.15	-	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )		5	40	8.47	20.88			22.29			8.42			17.17			12.89		17.86	2.8	7.803	5.11	15.5	-	3
Width/Depth Ratio					6.22			7.13			6.96			8.1			8.36		8.66	6.41	11.2	8.84	18.36	-	3
Entrenchment Ratio					2.86			4.31			1.41			1.86			5.17		5.2	2.61	3.137	3.33	3.47	-	3
<sup>1</sup> Bank Height Ratio					1.43			1.48			1.86			2.22			1		1	0.82	0.897	0.87	1	-	3
<b>Profile</b>																									
Riffle Length (ft)																				8.89	19.21	13.85	54.02	13.73	10
Riffle Slope (ft/ft)																				0.008	0.026	0.021	0.073	0.019	10
Pool Length (ft)																				14.37	42.2	34.77	84.52	26.2	10
Pool Max depth (ft)																				0.698	2.027	2.141	3.445	0.793	10
Pool Spacing (ft)																				34.82	82.81	83.19	151.6	36.88	9
<b>Pattern</b>																									
Channel Beltwidth (ft)																				14	14.8	14.5	15.9	-	3
Radius of Curvature (ft)																				10.4	16.17	16.9	21.2	-	3
Rc:Bankfull width (ft/ft)																				1.5	2	2	2.5	-	3
Meander Wavelength (ft)																				67.3	80.1	70	103	-	3
Meander Width Ratio																				1.9	4.6	2.0	9.8	-	3
<b>Transport parameters</b>																									
Reach Shear Stress (competency) lb/ft <sup>2</sup>								0.74												0.74					
Max part size (mm) mobilized at bankfull								1												0.41					
Stream Power (transport capacity) W/m <sup>2</sup>								-												-					
<b>Additional Reach Parameters</b>																									
Rosgen Classification								E4						B4c						E4					E4
Bankfull Velocity (fps)		-	-	-				5.03												4.4-4.9					-
Bankfull Discharge (cfs)		25	300	26.78				110.8						28						54.6-63.4					
Valley length (ft)								1612						200											1612
Channel Thalweg length (ft)								1507						-						-					1507
Sinuosity (ft)								1.07						-						-					1.07
Water Surface Slope (Channel) (ft/ft)								0.0075						-						0.0083					0.0089
BF slope (ft/ft)								0.0083						-						-					0.0092
<sup>3</sup> Bankfull Floodplain Area (acres)								-						-						-					-
<sup>4</sup> % of Reach with Eroding Banks								-						-						-					-
Channel Stability or Habitat Metric								-						-						-					-
Biological or Other								-						-						-					-

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

**Table 10b. Baseline Stream Data Summary**  
UT to Clarke Creek/EEP #92500 - UT 1 (758 feet)

Parameter	Gauge <sup>2</sup>	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline								
		LL	UL	Eq.	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Mean	Med	Max	SD <sup>5</sup>	n	Min	Med	Max	Min	Mean	Med	Max	SD <sup>5</sup>	n			
<b>Dimension and Substrate - Riffle Only</b>																												
Bankfull Width (ft)		6	11	2.07	9.08			11.26			7.09			11.96			10.6		10.77	7.18	8.44	8.60	9.40	0.93	4			
Floodprone Width (ft)					19.5			20.02			13.18			39.46			49.4		93.72	11.30	25.48	16.40	57.80	21.83	4			
Bankfull Mean Depth (ft)		6	11	0.89	1.51			1.7			0.78			1.33			1.1		1.28	0.37	0.87	0.84	1.43	0.46	4			
<sup>1</sup> Bankfull Max Depth (ft)					1.83			2.45			1.11			1.82			1.6		2.14	0.56	1.10	0.96	1.92	0.59	4			
Bankfull Cross Sectional Area (ft <sup>2</sup> )		6	12	4.73	15.46			17.01			8.69			13.75			11.84		13.54	3.14	7.57	6.84	13.45	4.67	4			
Width/Depth Ratio					5.34			7.46			5.81			15.33			8.28		9.79	6.57	12.23	9.83	22.69	7.23	4			
Entrenchment Ratio					1.73			2.2			1.85			3.8			4.59		8.84	1.57	2.88	1.90	6.15	2.20	4			
<sup>1</sup> Bank Height Ratio					1.34			1.56			1.53			1.6			1		1	0.73	0.93	1.00	1.00	0.14	4			
<b>Profile</b>																												
Riffle Length (ft)																							4.82	9.83	8.81	18.46	5.27	5
Riffle Slope (ft/ft)																							0.008	0.023	0.025	0.036	0.011	5
Pool Length (ft)																							22.7	29.14	27.48	39.29	7.208	5
Pool Max depth (ft)																							0.944	1.956	1.857	3.012	0.777	5
Pool Spacing (ft)																							73.48	108.4	116.9	126.4	24.56	4
<b>Pattern</b>																												
Channel Beltwidth (ft)																							13.7	15.7	13.8	19.8	-	3
Radius of Curvature (ft)																							21.9	32.6	34.7	41.1	-	3
Rc:Bankfull width (ft/ft)																							2.5	3.9	3.6	5.6	-	3
Meander Wavelength (ft)																							41.5	64.1	46	105	-	3
Meander Width Ratio																							1.46	1.78	1.59	2.3	-	3
<b>Transport parameters</b>																												
Reach Shear Stress (competency) lb/ft <sup>2</sup>								0.88											0.59									
Max part size (mm) mobilized at bankfull								0.75											4.27									
Stream Power (transport capacity) W/m <sup>2</sup>								-											-									
<b>Additional Reach Parameters</b>																												
Rosgen Classification								B4c					B4c					B4c										
Bankfull Velocity (fps)		-	-	-				4.11											3.6-4.0									
Bankfull Discharge (cfs)		10	200	14.48				64											42.2-53.4									
Valley length (ft)								657					150													657		
Channel Thalweg length (ft)								723					-						-							758		
Sinuosity (ft)								1.1					-						-							1.15		
Water Surface Slope (Channel) (ft/ft)								0.009					-						0.0077							0.0089		
BF slope (ft/ft)								0.009					-						0.009							0.0083		
<sup>3</sup> Bankfull Floodplain Area (acres)								-					-						-							-		
<sup>4</sup> % of Reach with Eroding Banks								-					-						-							-		
Channel Stability or Habitat Metric								-					-						-							-		
Biological or Other								-					-						-							-		

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing survey data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

**Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)**

UT to Clarke Creek/DMS #92500 Segment/Reach: UT to Clarke Creek (1507', XS1, 1A, 2, 9) and UT1 (758', XS 3, 4, 5, 6, 8)

	Cross Section 1 (Riffle)							Cross Section 1A (Pool)							Cross Section 2 (Riffle)							Cross Section 9 (Riffle)													
Based on fixed baseline bankfull elevation <sup>†</sup>	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+
Record elevation (datum) used	744.2	744.2	744.2	744.2	744.2	744.5		742.4	742.4	742.4	742.4	742.4	741.8		739.37	739.4	739.4	739.4	739.4	739.2		746.7	746.7	746.7	746.7	746.7	746.3								
Bankfull Width (ft)	6.7	6.9	7.08	6.89	7.1	6.5		9.02	8	7	8.71	8.1	4.2		9.97	10.7	9.85	9.77	9.1	10.3		7.17	6.35	7.7	6.1	5.9	5.5								
Floodprone Width (ft)	22.4	29.5	30.98	21	23.5	34.5		25.6	41.79	38	29	31.1	7.4		34.6	45	45.14	47.25	46.4	41.8		18.7	21.5	12.13	38	24.3	8								
Bankfull Mean Depth (ft)	0.76	0.67	0.87	0.63	0.7	0.8		0.2	0.75	1.1	0.91	0.9	0.4		1.55	1.28	1.9	2.06	1.9	1.5		0.39	0.39	0.45	0.72	0.5	0.5								
Bankfull Max Depth (ft)	0.94	1.17	1.15	1.03	1	1.2		1.47	1.91	1.8	1.65	1.7	0.8		2.15	2.36	2.27	2.48	2.5	2		0.85	0.68	0.56	1.24	0.9	0.9								
Bankfull Cross Sectional Area (ft <sup>2</sup> )	5.11	4.59	6.15	4.35	4.8	5.1		1.78	5.96	7.67	7.92	7.5	1.8		15.5	13.66	18.7	20.16	16.8	15.5		2.8	2.48	3.47	4.41	3.1	2.8								
Bankfull Width/Depth Ratio	8.84	10.37	8.15	10.9	10.4	8.3		45.71	10.74	6.39	9.58	8.8	9.8		6.41	8.38	5.19	4.73	4.9	6.8		18.36	16.26	17.09	8.44	11.3	10.6								
Bankfull Entrenchment Ratio	3.33	4.28	4.38	3.05	3.3	5.3		2.84	5.22	5.43	3.33	3.84	1.8		3.47	4.21	4.58	4.84	5.1	4.1		2.61	3.39	1.58	6.23	4.1	1.45								
Bankfull Bank Height Ratio	1	0.84	0.93	1.09	1	1.5		1	1.22	0.94	1.47	1.4	2.8		0.82	0.89	1.1	1.09	1.1	1.3		0.87	0.97	1.36	1.29	1.5	2.4								
Cross Sectional Area between end pins (ft <sup>2</sup> )	65.6	60.5	60.6	61.32	65.33	80.6		145.9	142.8	132.2	113.9	147.1	164.6		187.2	179	178.9	174.7	214.1	209.8		52.1	52.4	46.4	71.17	73.1	72.9								
d50 (mm)	-	-	-	-	-	-		17	18	0.9	6.75	6.75	0.7		-	-	-	-	-	-		28	0.6	0.7	7.5	7.5	1.3								
	Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)							Cross Section 6 (Riffle)							Cross Section 8 (Riffle)						
Based on fixed baseline bankfull elevation <sup>†</sup>	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+	Base	MY1	MY2	MY3	MY4	MY5*	MY+
Record elevation (datum) used	741.1	741.1	741.1	741.1	741.1	741.4		745.8	745.8	745.8	745.8	745.8	746.1		745.9	745.9	745.9	745.9	745.9	745		744.6	744.6	744.6	744.6	744.6	745		744.7	744.7	744.7	744.7	744.7	745.1	
Bankfull Width (ft)	9.78	10.42	10.81	10.11	9.8	8.7		8.4	9.93	8.4	8.41	6.7	4.5		8.18	7.88	7.12	7.31	21.5	6.5		7.18	5.29	5.42	6	5.6	5.6		8.75	8	9.12	5.69	8.2	10.8	
Floodprone Width (ft)	57.8	60.8	63	62	58.5	67.1		13.3	22.81	28.5	26	8.5	38.5		40	40	44	34	45.33	43.6		11.3	11.3	12	16	16.4	34.4		19.5	16.15	28.94	24	19.4	43.3	
Bankfull Mean Depth (ft)	1.66	1.4	1.62	1.93	1.3	1.9		0.37	0.4	0.54	0.5	0.2	0.7		0.84	0.76	0.68	0.85	0.8	1.1		0.64	0.47	0.55	0.71	0.6	0.8		1.04	0.8	0.92	1	0.6	0.8	
Bankfull Max Depth (ft)	1.92	2.17	2.67	2.55	2.4	3		0.56	0.64	0.73	0.68	0.3	1.1		1.57	1.51	1.65	1.33	2.5	1.6		0.82	0.84	0.81	0.96	1	1.3		1.09	0.9	1.2	1.19	0.8	1.6	
Bankfull Cross Sectional Area (ft <sup>2</sup> )	16.24	14.57	17.54	19.48	12.6	16.2		3.14	3.95	4.55	4.24	1.3	3.1		6.9	5.98	4.86	6.2	17.4	6.9		4.59	2.48	2.96	4.23	3.5	4.6		9.09	6.4	8.37	5.68	4.8	9.1	
Bankfull Width/Depth Ratio	5.89	7.45	6.66	5.25	7.6	4.7		22.69	24.96	15.51	16.67	33.7	6.6		9.7	10.38	10.43	8.61	26.6	6.2		11.23	11.28	9.92	8.51	9.1	6.7		8.42	10	9.94	5.7	13.9	13	
Bankfull Entrenchment Ratio	5.91	5.83	5.83	6.13	6	7.7		1.58	2.3	3.39	3.09	1.3	8.6		4.89	5.08	6.18	4.65	2.1	6.7		1.57	2.14	2.21	2.67	2.9	6.2		2.22	2.02	2.02	4.22	2.4	4	
Bankfull Bank Height Ratio	1	1.11	0.97	1.17	1.1	1.1		0.73	0.98	1.16	1.99	2.1	1.4		1	1	0.88	1.59	0.5	1.3		1	1.09	1.19	1.61	1.5	1.4		1	1.12	1.02	1.24	1.2	1.2	
Cross Sectional Area between end pins (ft <sup>2</sup> )	170.9	174	157.5	140.4	180.4	216.6		100.5	115.9	98	112.4	103.9	131.1		258.1	258.8	285.7	291.4	274.7	198.3		247.5	230.5	271.5	388.2	311	209.4		231.5	229.9	226.7	248.5	291.1	180.9	
d50 (mm)	-	-	-	-	-	-		24	2.5	0.7	10.5	10.5	0.2		0.5	0.15	0.062	0.55	0.55	0.4		4	55	0.2	1.9	1.9	0.2		24	0.125	0.25	0.2	0.2	0.2	

<sup>†</sup> The MY05 BHR was calculated using the 2018 Standard Measurement of the BHR monitoring parameters provided by NCDMS



**Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary**  
 UT to Clarke Creek/DMS #92500 - UT to Clarke Creek (1507 lf)

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5*					
	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n
<b>Dimension and Substrate - Riffle only</b>																																				
Bankfull Width (ft)	6.72	7.953	7.17	9.97	-	3	6.35	7.98	6.9	10.7	-	3	7.08	8.21	7.7	9.85	1.45	3	6.1	7.587	6.89	9.77	1.93	3	5.9	7.4	7.1	9.1	1.6	3	5.5	7.4	6.5	10.3	2.5	3
Floodprone Width (ft)	18.7	25.23	22.4	34.6	-	3	21.5	32	29.5	45	-	3	12.13	29.42	30.98	45.14	16.56	3	21	35.42	38	47.25	13.31	3	23.5	31.4	24.3	46.4	13	3	8	28.1	34.5	41.8	17.8	3
Bankfull Mean Depth (ft)	0.39	0.9	0.76	1.55	-	3	0.39	0.78	0.67	1.28	-	3	0.45	1.07	0.87	1.9	0.75	3	0.63	1.137	0.72	2.06	0.80	3	0.5	1	0.7	1.9	0.76	3	0.5	0.9	0.8	1.5	0.5	3
<sup>1</sup> Bankfull Max Depth (ft)	0.85	1.313	0.94	2.15	-	3	0.68	1.40	1.17	2.36	-	3	0.56	1.33	1.15	2.27	0.87	3	1.03	1.583	1.24	2.48	0.78	3	0.9	1.5	1	2.5	0.9	3	0.9	1.4	1.2	2	0.6	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	2.8	7.803	5.11	15.5	-	3	2.48	6.91	4.59	13.66	-	3	3.47	9.44	6.15	18.7	8.13	3	4.35	9.64	4.41	20.16	9.11	3	3.1	8.2	4.8	16.8	7.47	3	2.8	7.8	5.1	15.5	6.8	3
Width/Depth Ratio	6.41	11.2	8.84	18.36	-	3	8.38	11.67	10.37	16.26	-	3	5.19	10.14	8.15	17.09	6.2	3	4.73	8.023	8.44	10.9	3.11	3	4.9	8.9	10.4	11.3	3.46	3	6.8	8.6	8.3	10.6	1.9	3
Entrenchment Ratio	2.61	3.137	3.33	3.47	-	3	3.39	3.96	4.21	4.28	-	3	1.58	3.51	4.38	4.58	1.68	3	3.05	4.707	4.84	6.23	1.59	3	3.3	4.2	4.1	5.1	0.9	3	1.455	3.6	4.1	5.3	2.0	3
<sup>1</sup> Bank Height Ratio	0.82	0.897	0.87	1	-	3	0.84	0.90	0.89	0.97	-	3	0.93	1.13	1.1	1.36	0.22	3	1.09	1.157	1.09	1.29	0.12	3	1	1.2	1.1	1.5	0.26	3	1.3	1.7	1.5	2.4	0.6	3
<b>Profile</b>																																				
Riffle Length (ft)	4.82	9.826	8.81	18.46	5.272	5	26.31	57.23	65.37	82.74	24.05	5	14.48	23.41	21.86	37.21	8.65	5	13.39	27.55	23.27	50.39	14.07	5	7.4	15.1	22.9	30.6	11.8	5	65.53	87.29	73.85	147.9	34.64	5
Riffle Slope (ft/ft)	0.008	0.023	0.025	0.036	0.011	5	0.003	0.020	0.010	0.049	0.020	5	0.012	0.040	0.035	0.066	0.020	5	0.003	0.037	0.038	0.087	0.0311	5	0.011	0.072	0.076	0.140	0.060	5	0.002	0.007	0.005	0.015	0.005	5
Pool Length (ft)	22.7	29.14	27.48	39.29	7.208	5	15.31	38.0	41.1	55.2	14.79	5	22.87	31.86	34.57	37.04	6.06	5	20.94	33.61	36.44	54.1	11.99	7	9.4	76.5	94.8	180.1	90.9	7	35.62	72.93	77.79	97.4	25.19	5
Pool Max depth (ft)	0.944	1.956	1.857	3.012	0.777	5	2.58	3.1	2.98	3.78	0.49	5	1.72	2.62	2.38	3.81	0.9	5	1.6	2.344	2.25	3.05	0.47	7	0.98	1.55	1.36	2.14	0.44	7	1.554	2.01	1.952	2.608	0.439	5
Pool Spacing (ft)	73.48	108.4	116.9	126.4	24.56	4	94.9	165.4	174.2	218.3	56.67	4	37.47	76.75	83.33	102.9	30.28	4	61.44	107.8	93.69	164.1	36.98	7	40.5	130.1	127.1	303.2	133.5	7	144.7	246	212.9	413.5	119.8	4
<b>Pattern</b>																																				
Channel Beltwidth (ft)	14	14.8	14.5	15.9	-	3																														
Radius of Curvature (ft)	10.4	16.17	16.9	21.2	-	3																														
Rc:Bankfull width (ft/ft)	1.5	2	2	2.5	-	3																														
Meander Wavelength (ft)	67.3	80.1	70	103	-	3																														
Meander Width Ratio	1.9	4.6	2.0	9.8	-	3																														
<b>Additional Reach Parameters</b>																																				
<sup>5</sup> Rosgen Classification	E4						E4						E4						E4						E4											
<sup>5</sup> Channel Thalweg length (ft)	1507						1507						1507						1507						1507											
<sup>5</sup> Sinuosity (ft)	1.07						1.07						1.07						1.07						1.07											
Water Surface Slope (Channel) (ft/ft)	0.0089						0.0091						0.0092						0.009						0.0089						0.0094					
BF slope (ft/ft)	0.0092						0.009						0.0092						0.0093						0.0088						0.0099					
<sup>3</sup> Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks	-						-						-						-						-											
Channel Stability or Habitat Metric	-						-						-						-						-											
Biological or Other	-						-						-						-						-											

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.  
 1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.  
 2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table  
 3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave  
 4 = Of value/needed only if the n exceeds 3  
 5 = Reflects baseline monitoring values

**Exhibit Table 11c. Monitoring Data - Stream Reach Data Summary**  
UT to Clarke Creek/DMS #92500 - UT1 (758 lf)

Parameter	Baseline						MY-1						MY-2						MY-3						MY-4						MY-5*					
	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n	Min	Mean	Med	Max	SD <sup>4</sup>	n
<b>Dimension and Substrate - Riffle only</b>																																				
Bankfull Width (ft)	7.18	8.443	8.595	9.4	0.932	4	8	8.965	8.965	9.93	-	2	8.4	8.76	8.76	9.12	-	2	5.69	6.7	6	8.41	1.49	3	5.6	6.8	6.7	8.2	1.31	3	4.5	7.0	5.6	10.8	3.4	3
Floodprone Width (ft)	11.3	25.48	16.4	57.8	21.83	4	16.15	19.48	19.48	22.81	-	2	28.94	50.97	50.97	73	-	2	16	22	24	26	5.29	3	8.5	14.8	16.4	19.4	5.63	3	34.4	38.7	38.5	43.3	4.5	3
Bankfull Mean Depth (ft)	0.37	0.87	0.84	1.43	0.464	4	0.4	0.6	0.6	0.8	-	2	0.54	0.73	0.73	0.92	-	2	0.5	0.737	0.71	1	0.25	3	0.2	0.5	0.6	0.6	0.23	3	0.7	0.8	0.8	0.8	0.1	3
<sup>1</sup> Bankfull Max Depth (ft)	0.56	1.098	0.955	1.92	0.589	4	0.64	0.77	0.77	0.9	-	2	0.73	0.965	0.965	1.2	-	2	0.68	0.943	0.96	1.19	0.26	3	0.3	0.7	0.8	1	0.36	3	1.1	1.3	1.3	1.6	0.3	3
Bankfull Cross Sectional Area (ft <sup>2</sup> )	3.14	7.568	6.84	13.45	4.669	4	3.95	5.175	5.175	6.4	-	2	4.55	6.46	6.46	8.37	-	2	4.23	4.717	4.24	5.68	0.83	3	1.3	3.2	3.5	4.8	1.77	3	3.1	5.6	4.6	9.1	3.1	3
Width/Depth Ratio	6.57	12.23	9.825	22.69	7.233	4	10	17.48	17.48	24.96	-	2	9.94	12.73	12.73	15.51	-	2	5.7	10.29	8.51	16.67	5.70	3	9.1	18.9	13.9	33.7	13.04	3	6.6	8.8	6.7	13.0	3.7	3
Entrenchment Ratio	1.57	2.88	1.9	6.15	2.201	4	2.02	2.16	2.16	2.3	-	2	2.02	5.355	5.355	8.69	-	2	2.67	3.327	3.09	4.22	0.80	3	1.3	2.2	2.4	2.9	0.82	3	4.0	6.3	6.2	8.6	2.3	3
<sup>1</sup> Bank Height Ratio	0.73	0.933	1	1	0.135	4	0.98	1.05	1.05	1.12	-	2	1.02	1.09	1.09	1.16	-	2	1.24	1.613	1.61	1.99	0.38	3	1.2	1.6	1.5	2.1	0.46	3	1.2	1.3	1.4	1.4	0.1	3
<b>Profile</b>																																				
Riffle Length (ft)	4.82	9.826	8.81	18.46	5.272	5	16.49	44.86	42	78.79	22.87	5	12.43	33.85	33.74	47.95	14.26	5	18.56	34.4	35.79	46.62	12.67	5	5.6	29.4	46.5	63.6	24.8	5	15.2	61.69	53.02	106.6	34.84	5
Riffle Slope (ft/ft)	0.008	0.023	0.025	0.036	0.011	5	0.004	0.01	0.013	0.02	0.01	5	0.0075	0.016	0.016	0.022	0.005	5	0.012	0.017	0.015	0.024	0.005	5	0.01	0.05	0.08	0.12	0.05	5	0.006	0.01	0.009	0.013	0.003	5
Pool Length (ft)	22.7	29.14	27.48	39.29	7.208	5	14.39	32.24	20.83	59	20.07	5	15.37	48.01	48.01	80.66	46.17	2	22.65	36.02	28.29	57.56	15.77	5	17.5	32.9	7.5	47.9	17.7	5	19.84	47.36	39.36	80.02	26.09	5
Pool Max depth (ft)	0.944	1.956	1.857	3.012	0.777	5	1.01	2.01	2.03	3.57	1.02	5	1.1522	2.047	2.068	2.934	0.648	5	1.29	1.948	1.97	2.54	0.446	5	0.87	1.6	1.6	2.5	0.67	5	1.797	2.229	1.976	2.991	0.525	5
Pool Spacing (ft)	73.48	108.4	116.9	126.4	24.56	4	31.28	107.2	106.5	184.4	62.5	4	43.39	80.66	89.2	99.37	22.12	5	77.75	137.6	132.9	207	53.12	4	32.5	165.9	298	430.3	171	4	41.15	123.7	131.3	191.1	61.97	4
<b>Pattern</b>																																				
Channel Beltwidth (ft)	13.7	15.7	13.8	19.8	-	3																														
Radius of Curvature (ft)	21.9	32.6	34.7	41.1	-	3																														
Rc:Bankfull width (ft/ft)	2.5	3.9	3.6	5.6	-	3																														
Meander Wavelength (ft)	41.5	64.1	46	105	-	3																														
Meander Width Ratio	1.46	1.78	1.59	2.3	-	3																														
<b>Additional Reach Parameters</b>																																				
<sup>5</sup> Rosgen Classification							B4c						B4c					B4c						B4c						B4c						
<sup>5</sup> Channel Thalweg length (ft)							758						758					758						758						758						
<sup>5</sup> Sinuosity (ft)							1.15						1.15					1.15						1.3						1.3						
Water Surface Slope (Channel) (ft/ft)							0.0089						0.0095					0.0081						0.0086						0.008						
BF slope (ft/ft)							0.0083						0.0082					0.008						0.0093						0.0092						
<sup>3</sup> Ri% / Ru% / P% / G% / S%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<sup>3</sup> SC% / Sa% / G% / C% / B% / Be%																																				
<sup>3</sup> d16 / d35 / d50 / d84 / d95 /																																				
<sup>2</sup> % of Reach with Eroding Banks							-						-					-																		
Channel Stability or Habitat Metric							-						-					-																		
Biological or Other							-						-					-																		

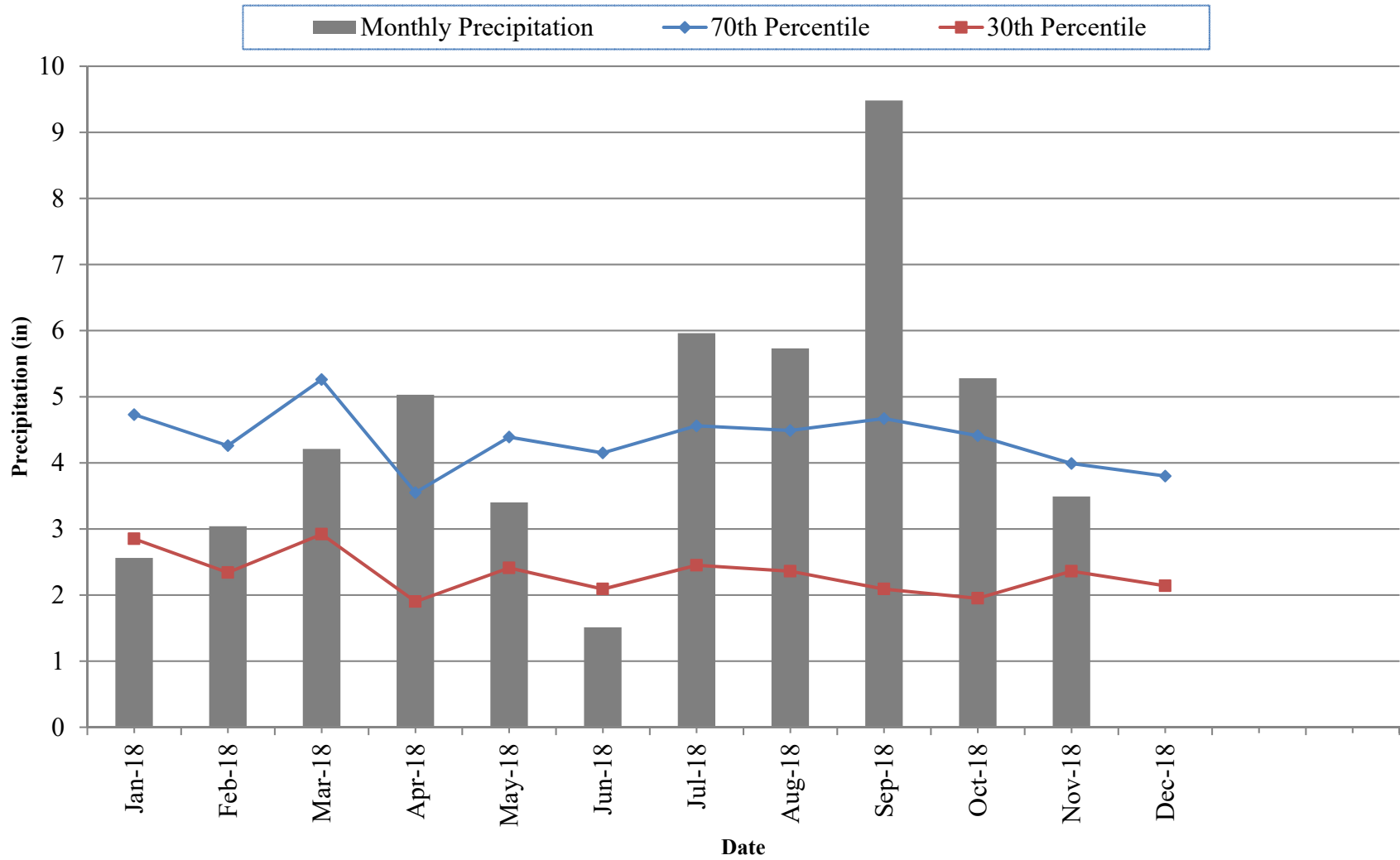
Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.  
 1 = The distributions for these parameters can include information from both the cross-section surveys and the longitudinal profile.  
 2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table  
 3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave  
 4 = Of value/needed only if the n exceeds 3  
 5 = Reflects baseline monitoring values

APPENDIX E  
Hydrologic Data



**Figure 4 - Monthly Rainfall Data**  
**UT Clarke Creek / DMS Project #92500**



**Table 12. Verification of Bankfull Events  
UT to Clarke Creek - DMS Project #92500**

Date of Data Collection	Date of Occurrence	Method	Photo
2/19/2014	2/19/2014	Visual observation of wrack lines	See photo from Baseline Monitoring Report
9/18/2014	Between 2/19/2014 and 9/18/2014	Crest Gauge Reading*: 20" above bankfull (UT1) and 15.5" above bankfull (UT Clarke Creek); Visual observation of wrack lines	See photo from MY01 Annual Monitoring Report
9/18/2014	Between 2/19/2014 and 9/18/2014	Crest Gauge Reading*: 20" above bankfull (UT1) and 15.5" above bankfull (UT Clarke Creek); Visual observation of wrack lines	See photo from MY02 Annual Monitoring Report
4/15/2015	Between 9/18/2014 and 4/15/2015	Crest Gauge Reading: 7" above bankfull (UT1) and 8.5" above bankfull (UT Clarke Creek); Visual observation of bankfull event and wracklines	See photo from MY02 Annual Monitoring Report
10/22/2015	Between 4/15/2015 and 10/22/2015	Crest Gauge Reading*: 20" above bankfull (UT1) and 19" above bankfull (UT Clarke Creek); Visual observation of wrack lines	See photo from MY02 Annual Monitoring Report
5/18/2016	Between 10/22/2015 and 5/18/2016	Crest Gauge Reading* 12.5" above bankfull (UT1) and 24" above bankfull (UT Clarke Creek); visual observation of wrack lines	See photo from MY03 Annual Monitoring Report
10/21/2016	Between 5/18/2016 and 10/21/2016	Crest Gauge Reading* 13" above bankfull (UT1) and 11" above bankfull (UT Clarke Creek)	See photo from MY03 Annual Monitoring Report
3/9/2017	Between 10/21/16 and 3/9/17	Crest Gauge Reading*: 20" above bankfull (UT Clarke Creek) and 26.5" above bankfull (UT1); visual observation of wrack lines	See photo from MY04 Annual Site Assessment
10/19/2017	Between 3/9/17 and 10/19/17	Crest Gauge Reading*: 45" above bankfull (UT Clarke Creek) and 37.5" above bankfull (UT1); visual observation of wrack lines	See photo from MY04 Annual Monitoring Report
3/27/2018	Between 10/19/17 and 3/27/2018	Crest gauge readings and visual observations.	See photos from MY05 Site Assessment
10/30/2018	Between 3/27/18 and 10/30/18	visual observation of wrack lines	See photos



Photo 1: 10/30/18 - Wracklines on UT to Clarke Creek at crest gauge.



Photo 2: 10/30/18 - Wracklines on UT1 at crest gauge.

Table 13. Wetland Gauge Attainment Data					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2014)	Year 2 (2015)	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)
1	Yes/236 days (99%)	Yes/177 days (74%)	Yes/213 days (92%)	Yes/211 days (91%)	Yes/211 days (91%)
2 <sup>upland</sup>	No/23 days (10%)	No/25 days (10%)	No/4 days (2%)	No/7 days (3%)	No/9 days (4%)
3	Yes/45 days (19%)	No/24 days (10%)	No/4 days (2%)	No/22 days (9%)	No/21 days (9%)
4 <sup>upland</sup>	No/12 days (5%)	No/11 days (5%)	No/1 day (0%)	No/5 days (2%)	No/12 days (5%)
5	Yes/47 days (20%)	No Data <sup>b</sup>	No/6 days (3%)	No/25 days (11%)	Yes/30 days (13%)
6	Yes/45 days (19%)	No Data <sup>b</sup>	No/6 days (3%)	No/10 days (4%)	No/10 days (4%)
7 <sup>upland</sup>	Yes/64 days (27%)	Yes/63 days (26%)	No/9 days (4%)	No/6 days (3%)	No/9 days (4%)
8	No/0 days (0%)	No Data <sup>b</sup>	No/6 days (3%)	No/2 days (1%) <sup>c</sup>	No/8 days (3%)
9	No Data <sup>a</sup>	No/7 days (10% of days with data)	No/19 days (8%)	Yes/56 days (24%)	Yes/78 days (34%)
10	No Data <sup>a</sup>	No/6 days (8% of days with data)	No/9 days (4%)	No/20 days (9%)	No/14 days (6%)
11	No Data <sup>a</sup>	No/1 day (1% of days with data)	No/15 days (6%)	No/3 days (1%) <sup>d</sup>	No/14 days (6%)

<sup>a</sup>Well installed after start of 2015 growing season; therefore, gauge data not available for entire growing season

<sup>b</sup>Well malfunction - no data during growing season

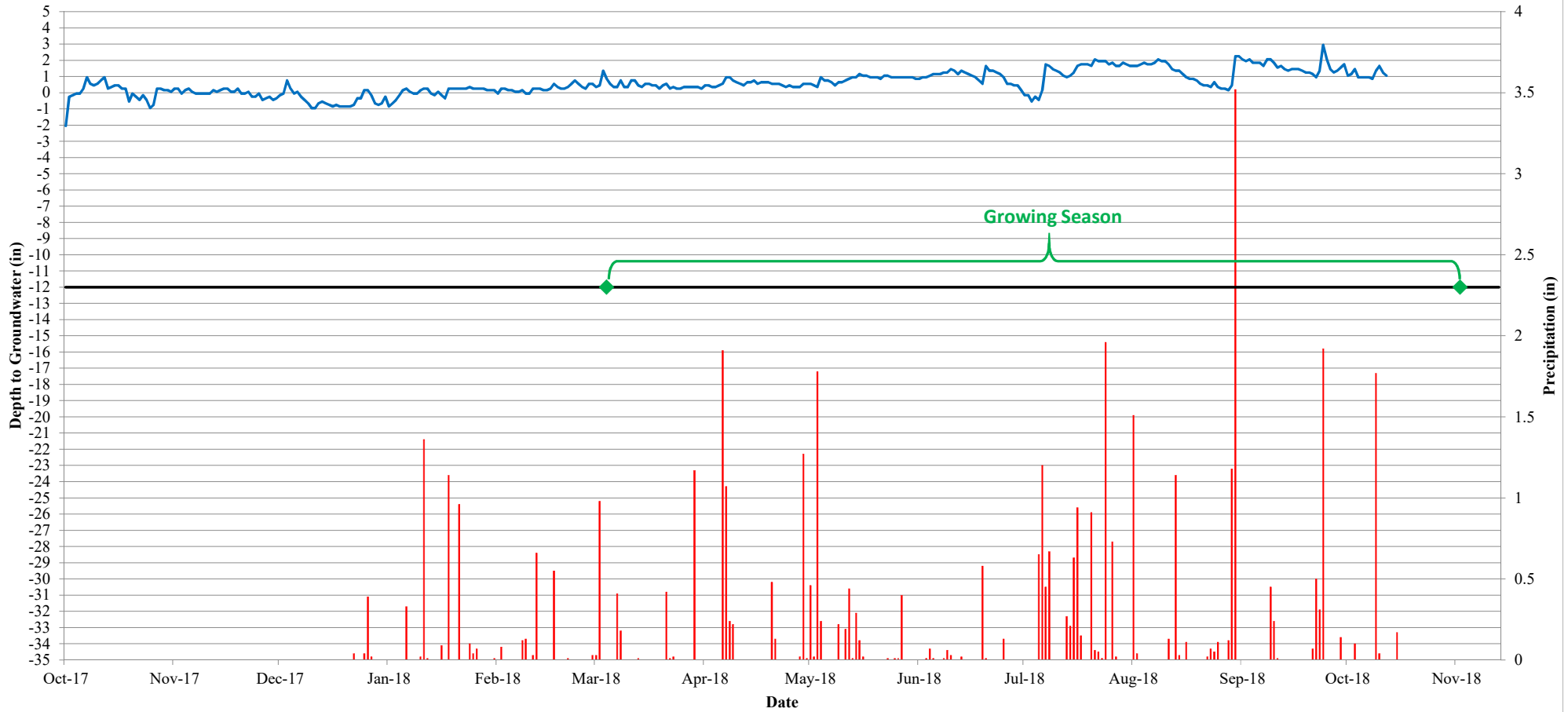
<sup>c</sup>Well malfunction - only 32 readings over 210 days data collected during growing season

<sup>d</sup>Well malfunction - only 50 readings over 210 days data collected during growing season



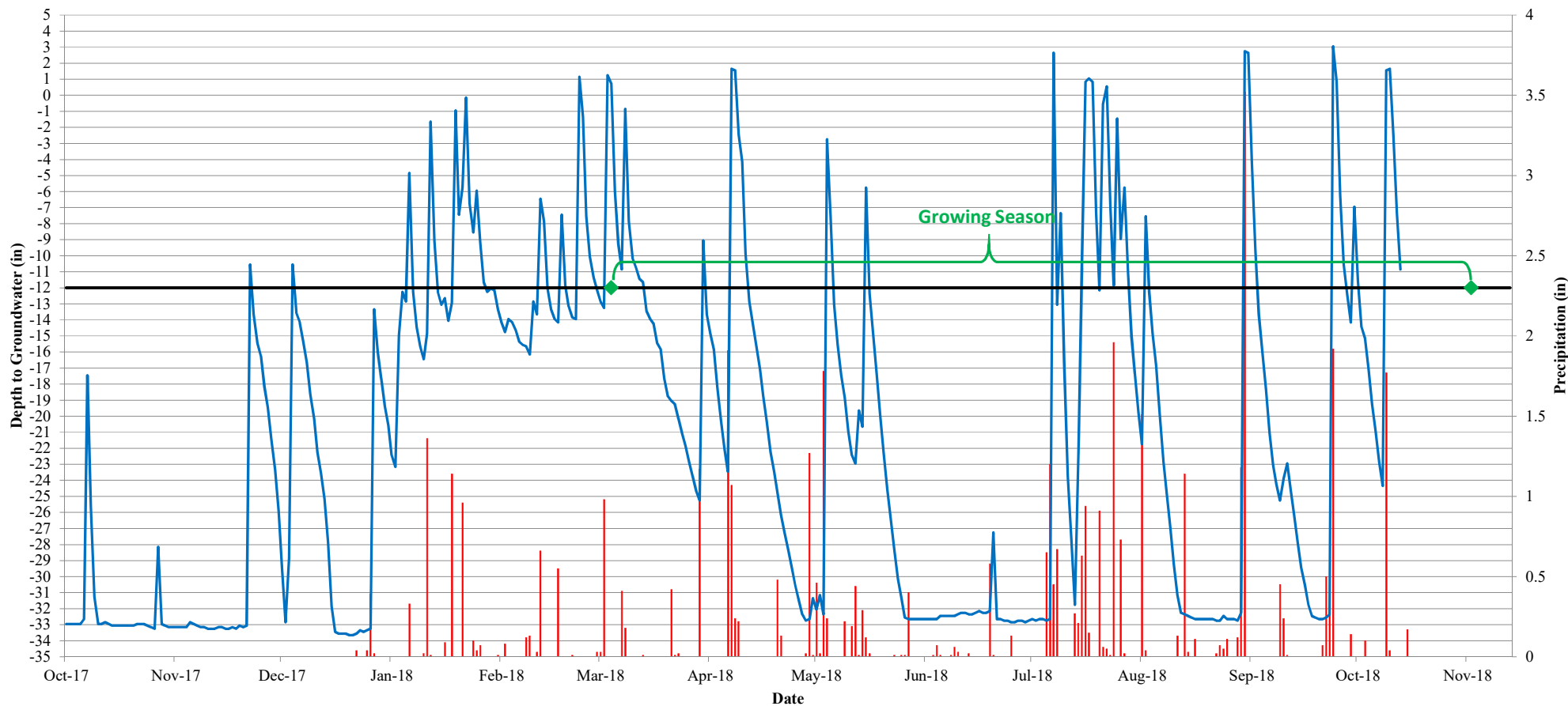
**Figure 5**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 1 - 2018**  
**WM000013D4BB8F**

■ Precipitation (in)    — Depth to Groundwater (in)    — Required Depth

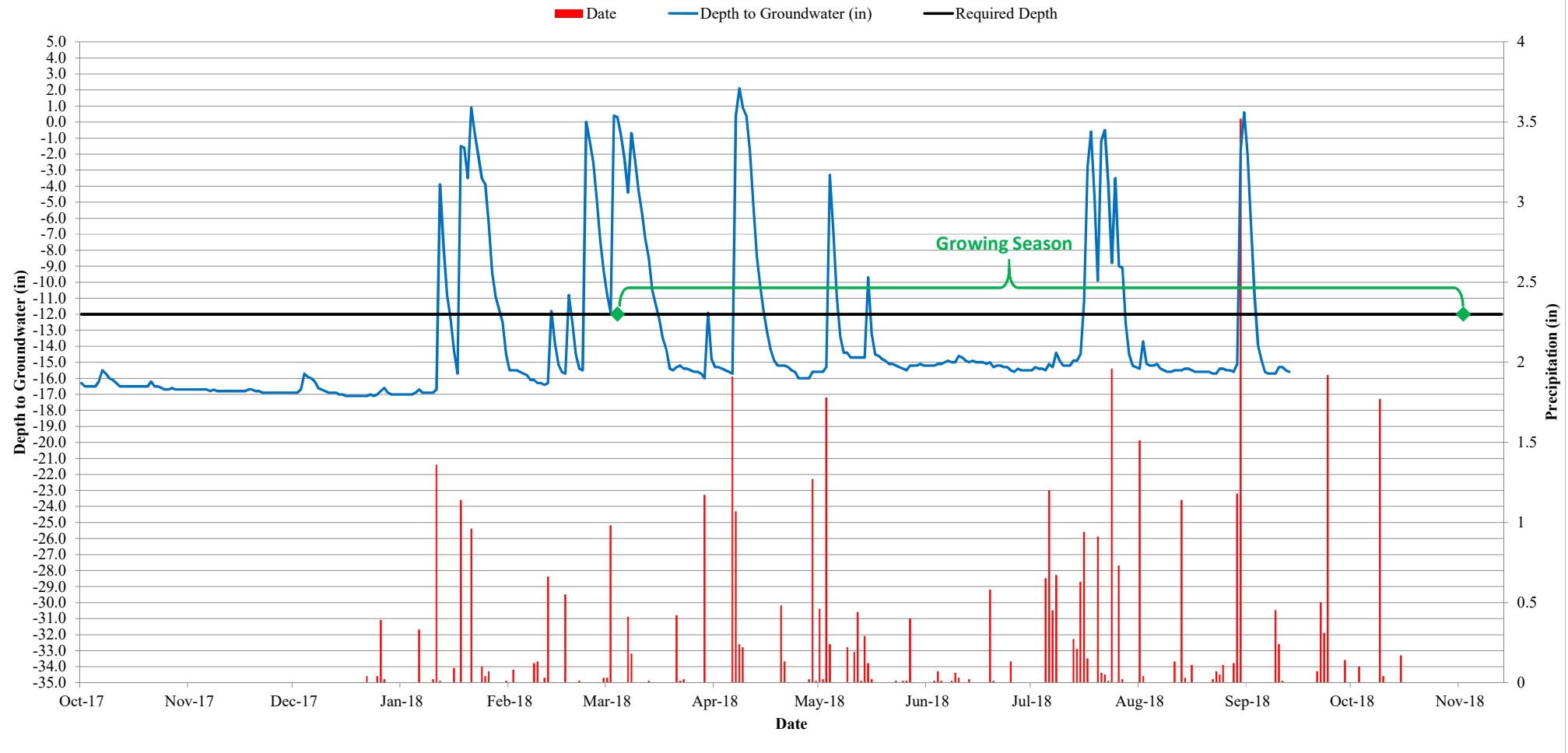


**Figure 6**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 2 - 2018**  
**WM00001130F789**

■ Precipitation (in)    — Depth to Groundwater (in)    — Required Depth



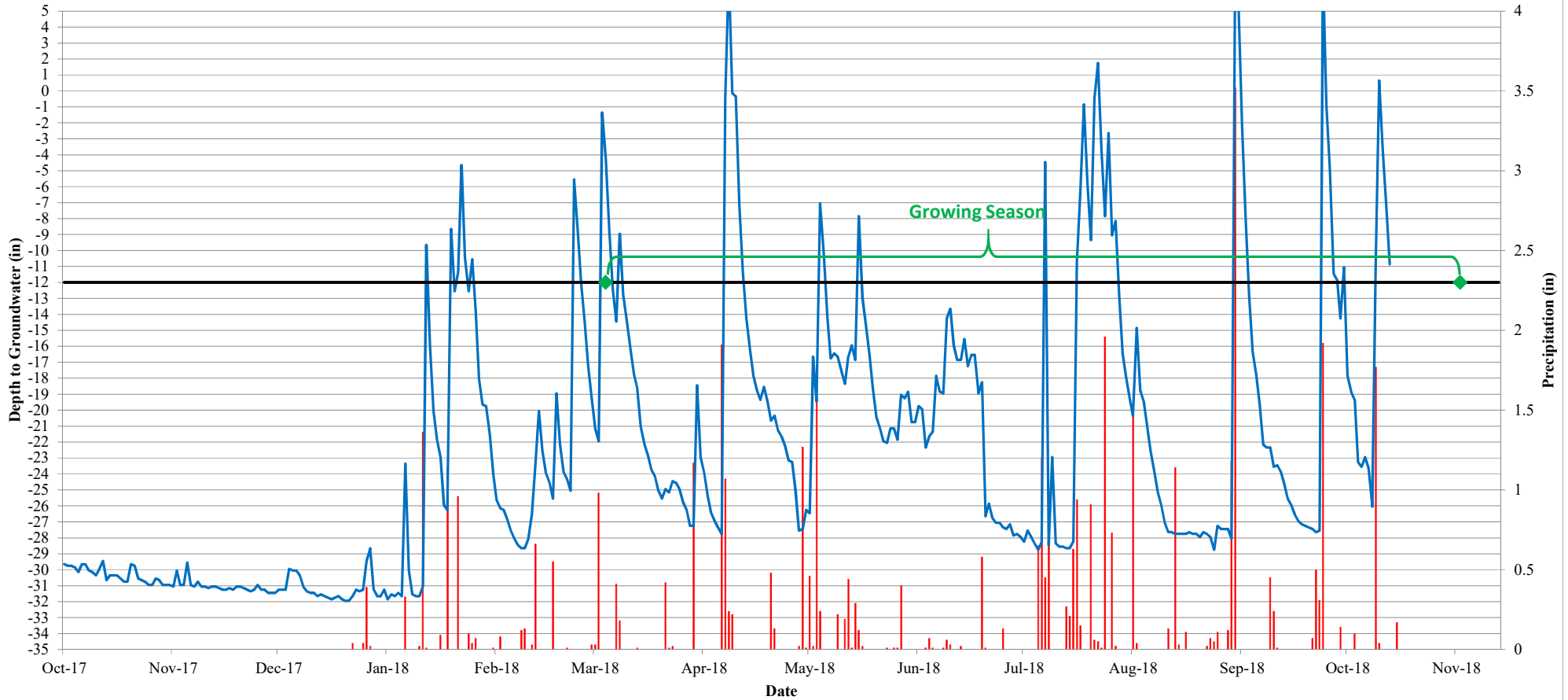
**Figure 7**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 3 - 2018**  
**WM0000B651C42**



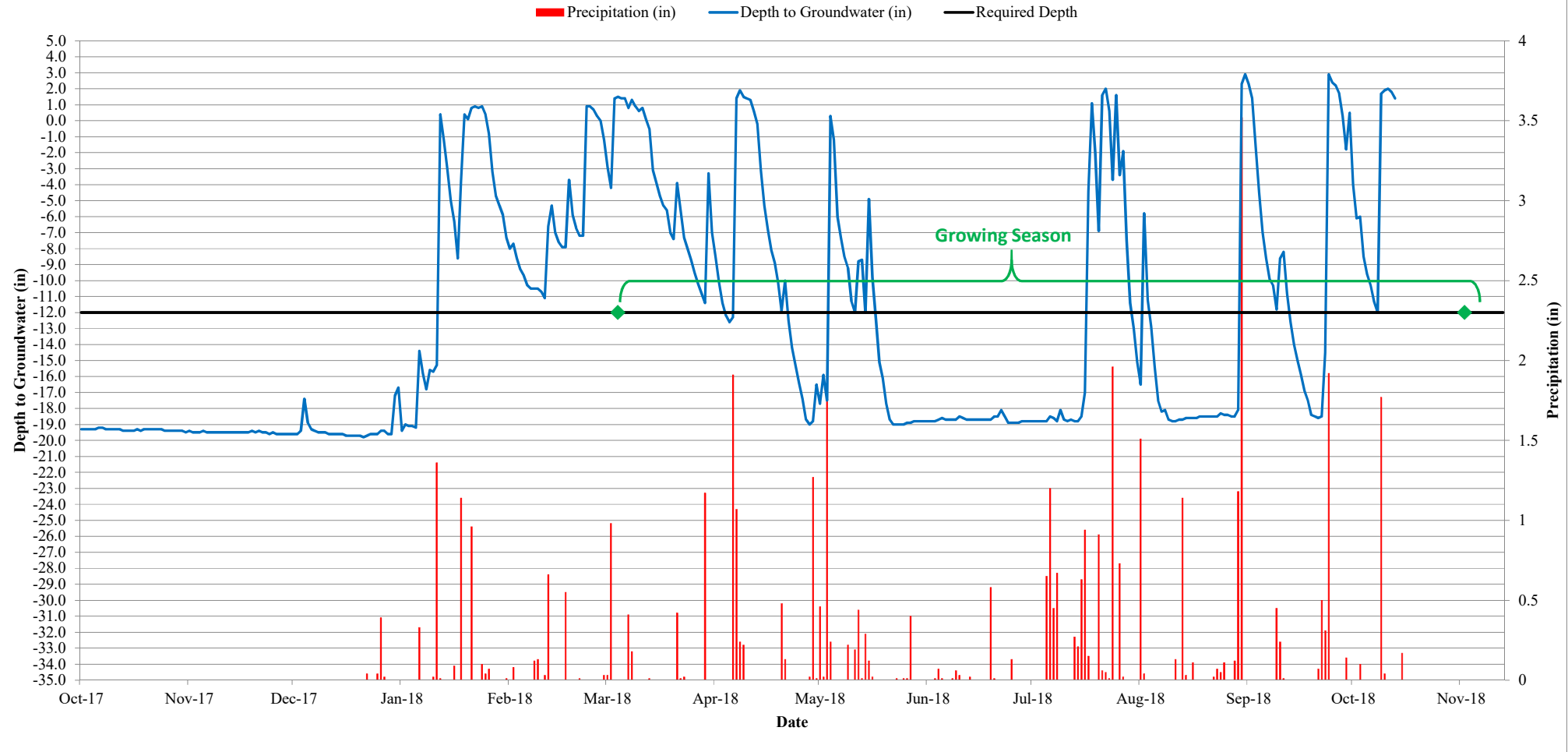


**Figure 8**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 4 - 2018**  
**WM000011312519**

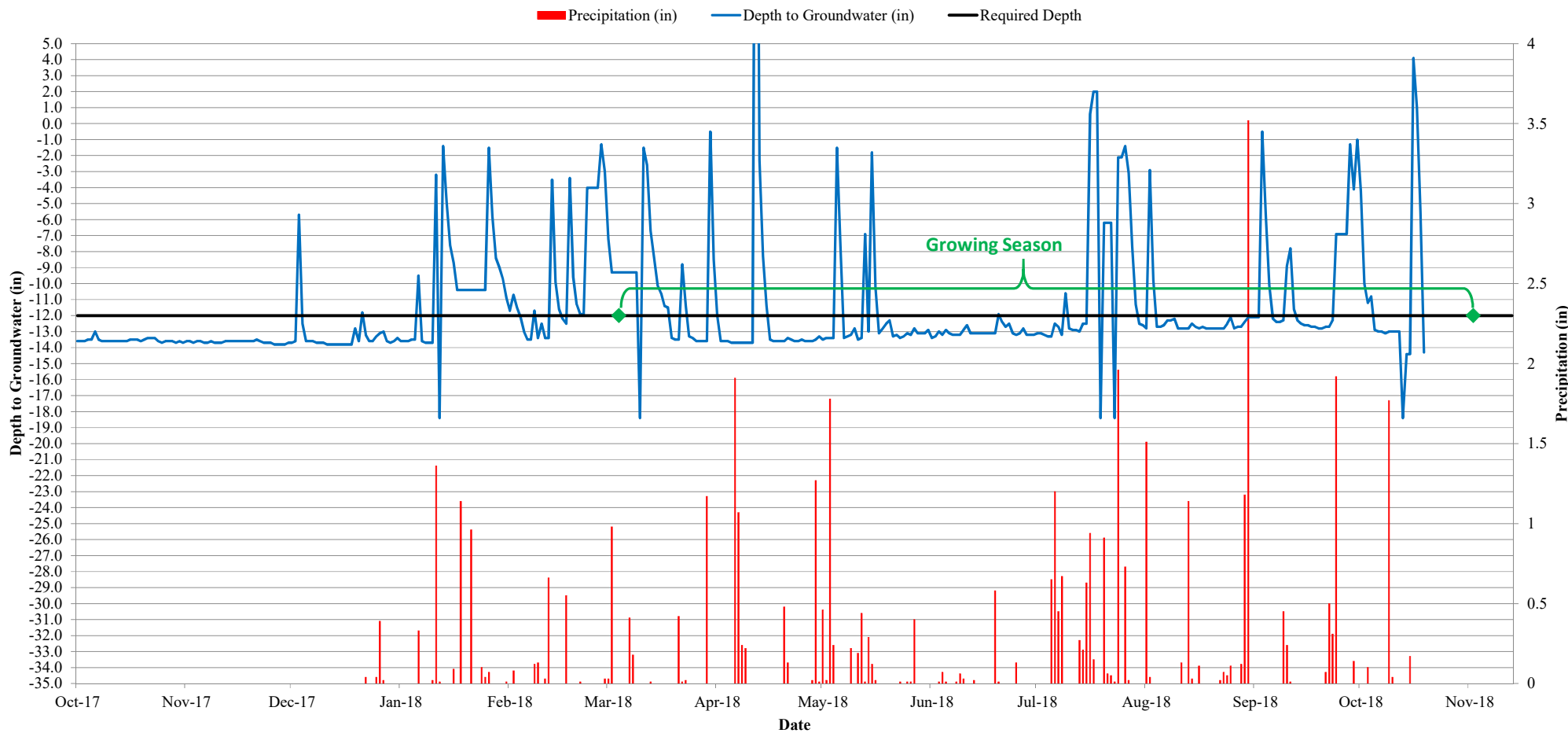
■ Precipitation (in)    — Depth to Groundwater (in)    — Required Depth



**Figure 9**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 5 - 2018**  
**WM0000136AEA8E**

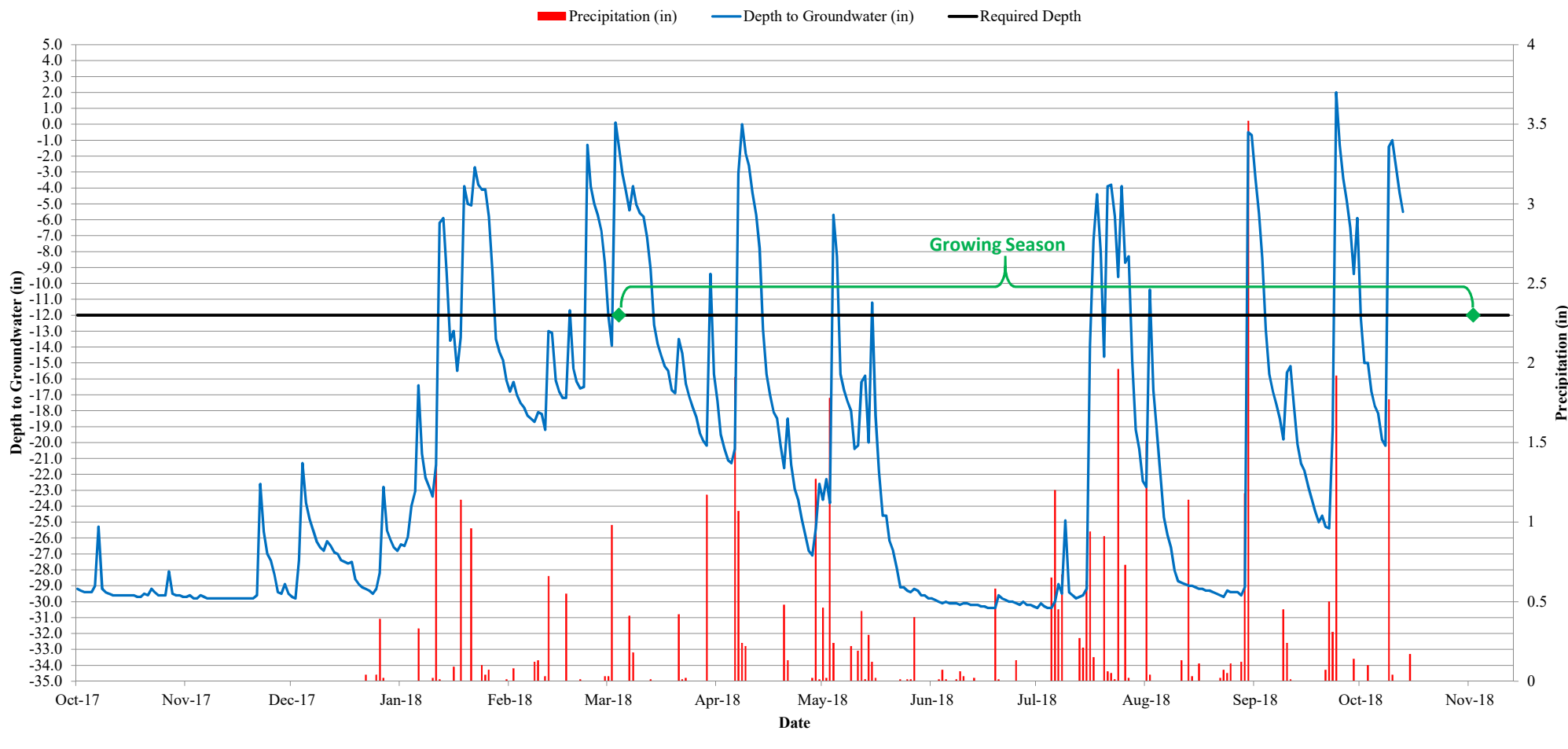


**Figure 10**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 6 - 2018**  
**WM000013D4BB73**

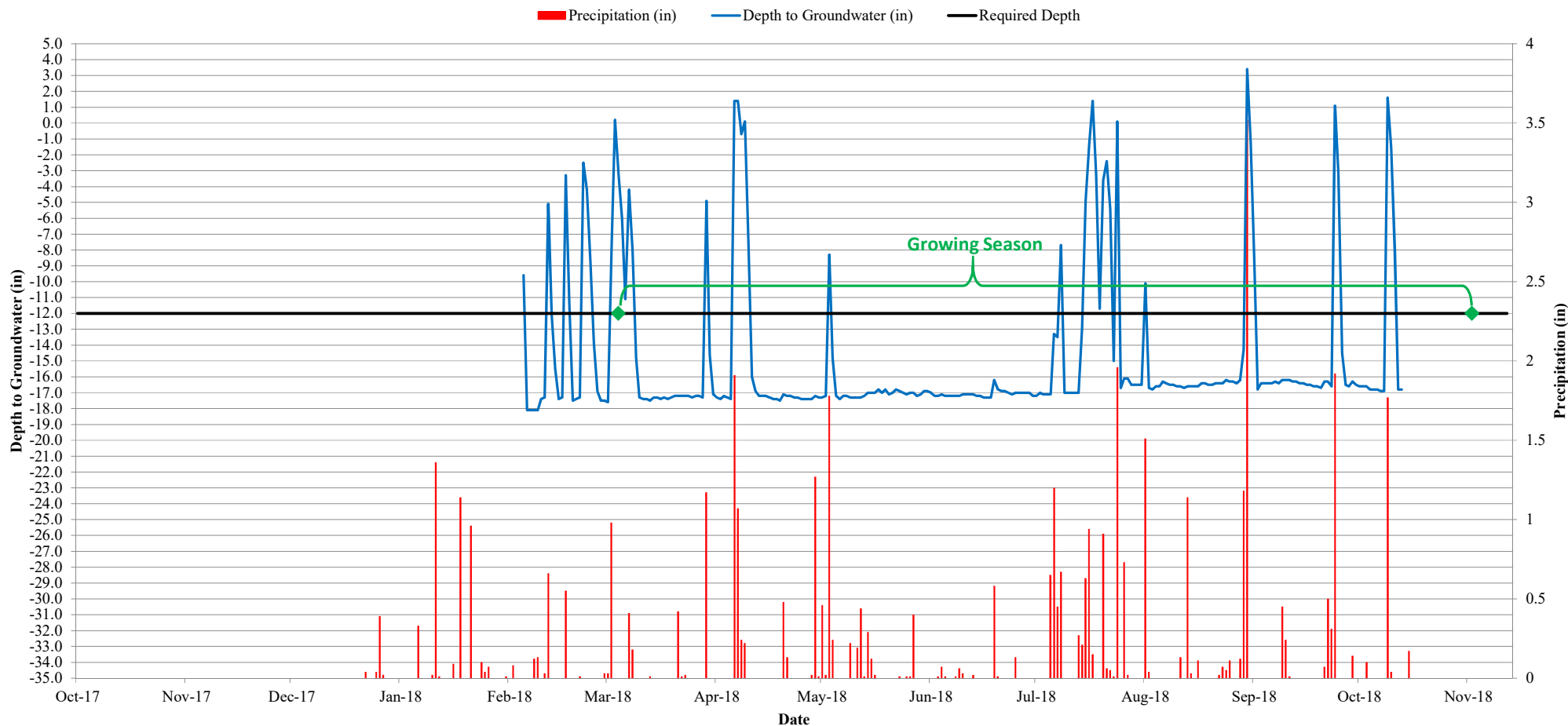




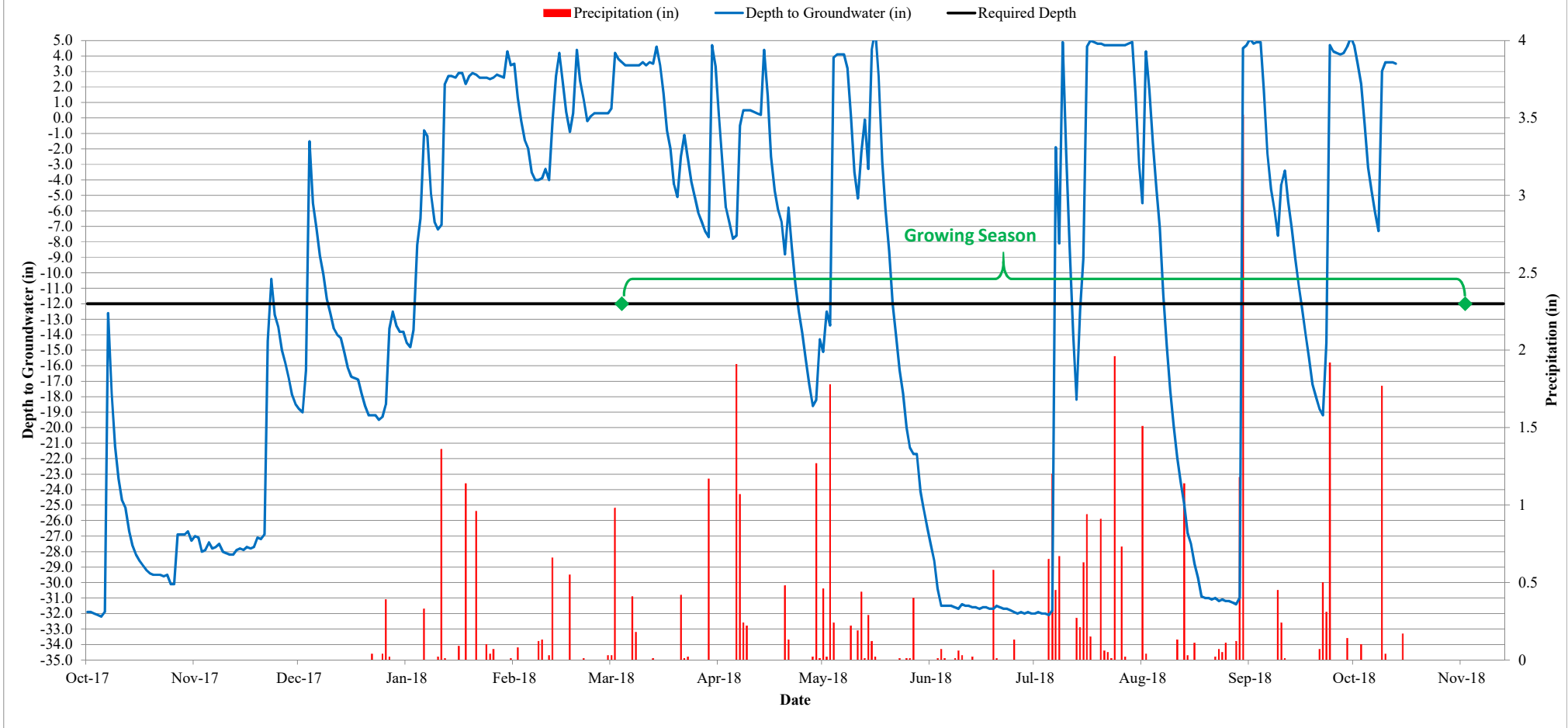
**Figure 11**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 7 - 2018**  
**WM00001315052C**



**Figure 12**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 8 - 2018**  
**WM0000128B8383E**

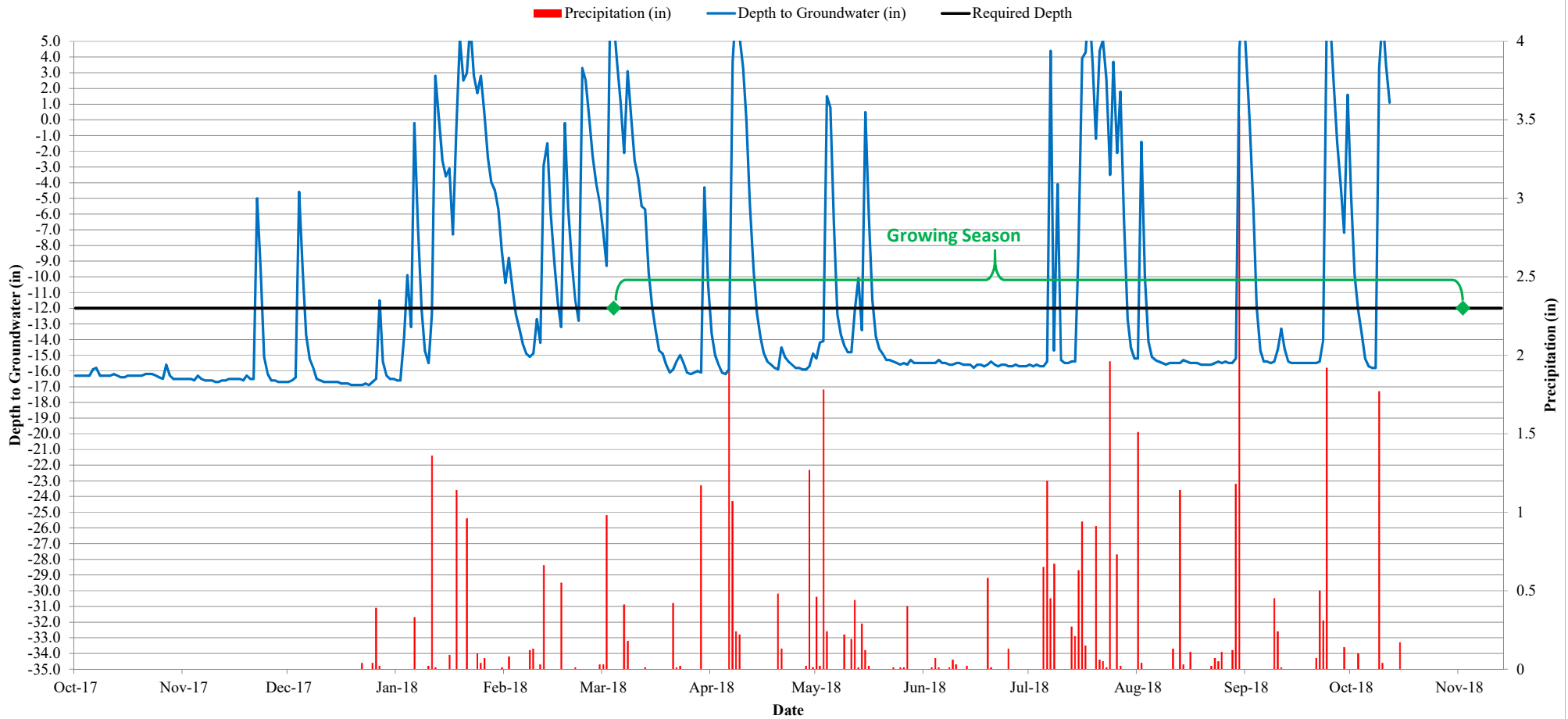


**Figure 13**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 9 - 2018**  
**WM00009DE4B47**

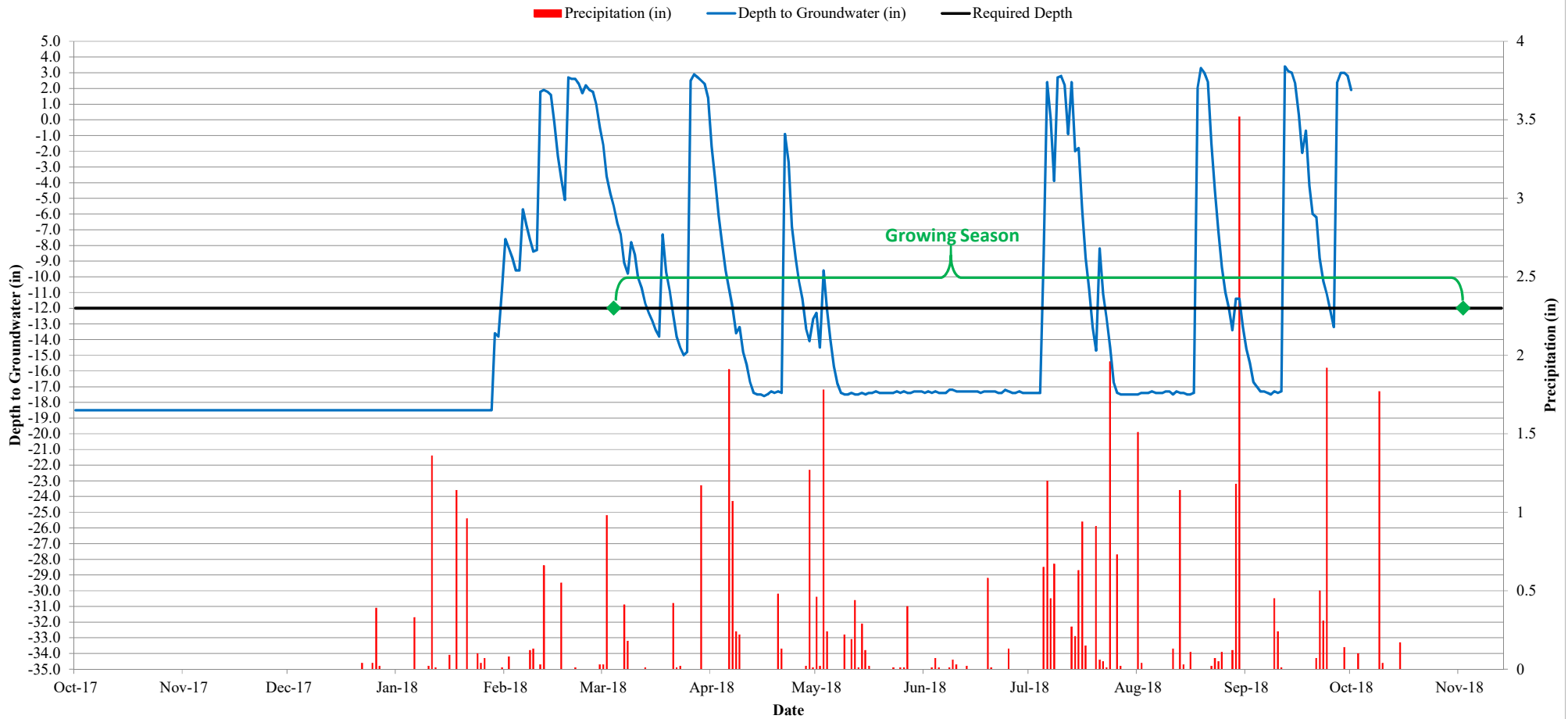




**Figure 14**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 10 - 2018**  
**WM0000EBD27A5**



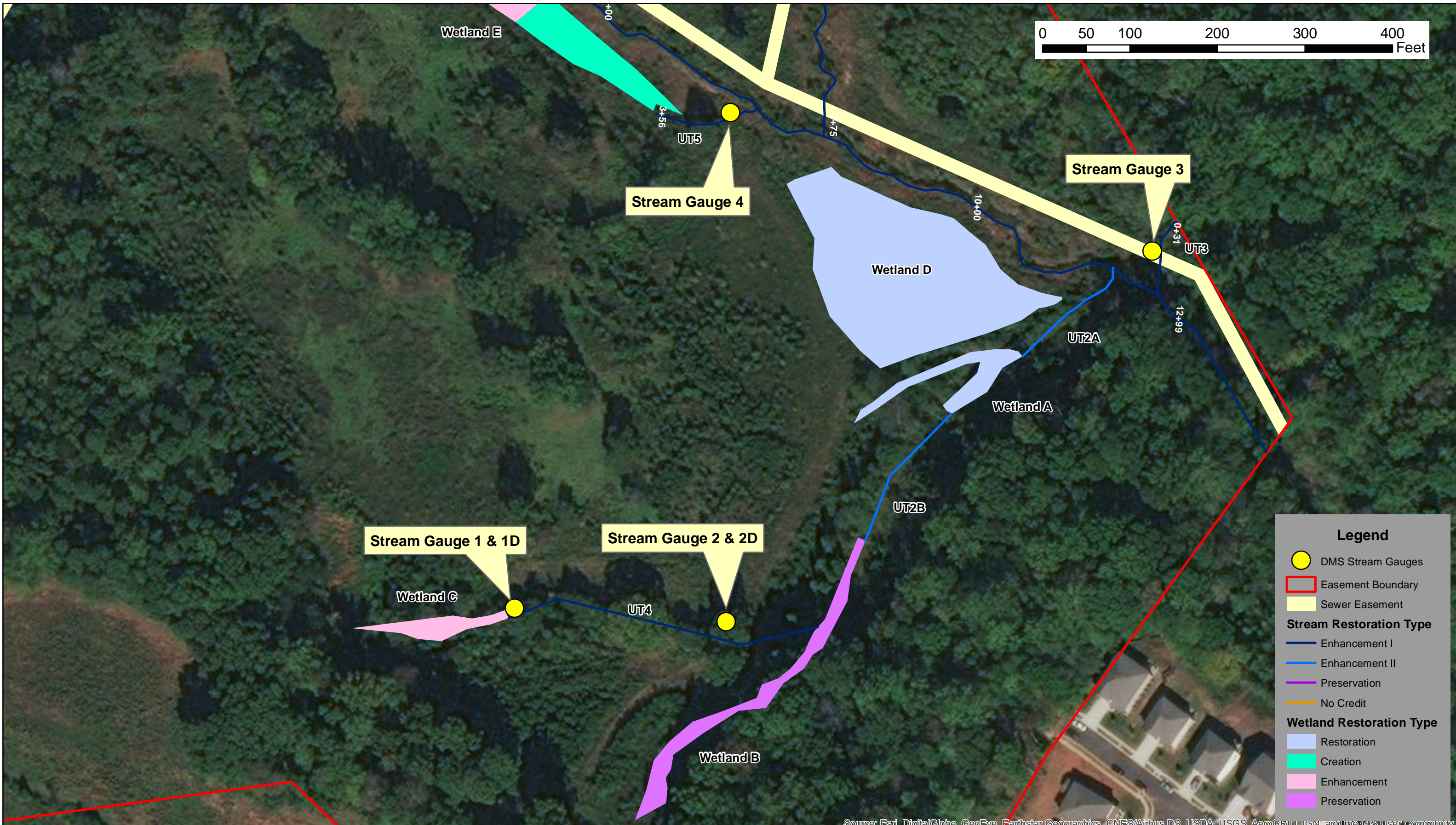
**Figure 15**  
**UT to Clarke Creek Hydrology Monitoring**  
**Groundwater Gauge 11 - 2018**  
**WM0000136B1C42**



## APPENDIX F

### Supplemental Stream Gauge Data



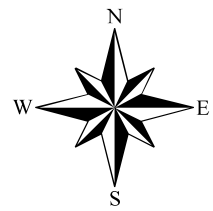


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

# UT to Clarke Creek DMS Stream Gauge Location Map

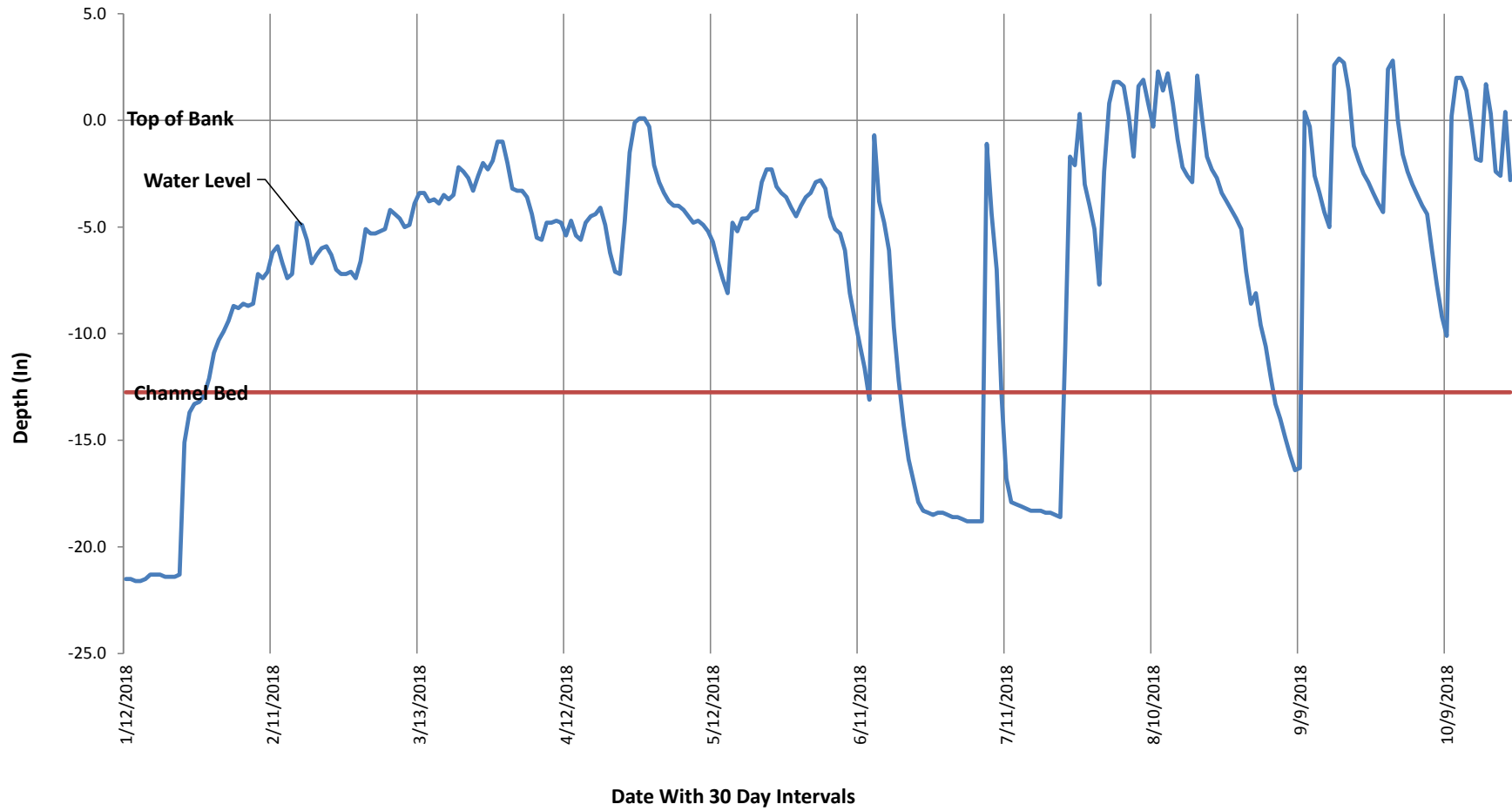
Monitoring Year 5 - 2018 Project # 92500 Mecklenburg County, NC

Prepared by:  
NC Department of  
Environmental Quality  
Division of Mitigation Services

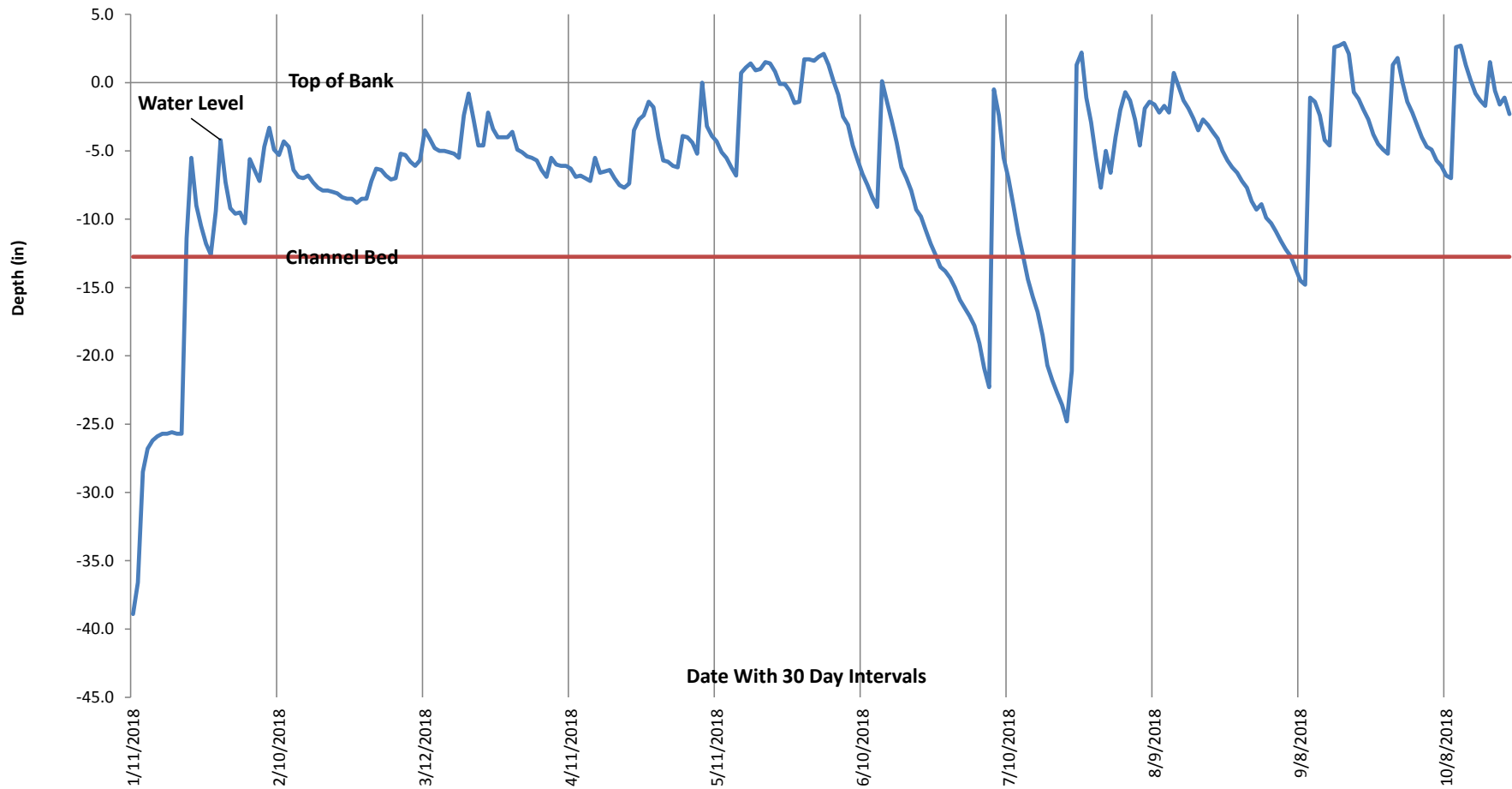




### Hydrology Monitoring UT-4 Upstream (MY5) Gauge MW-1

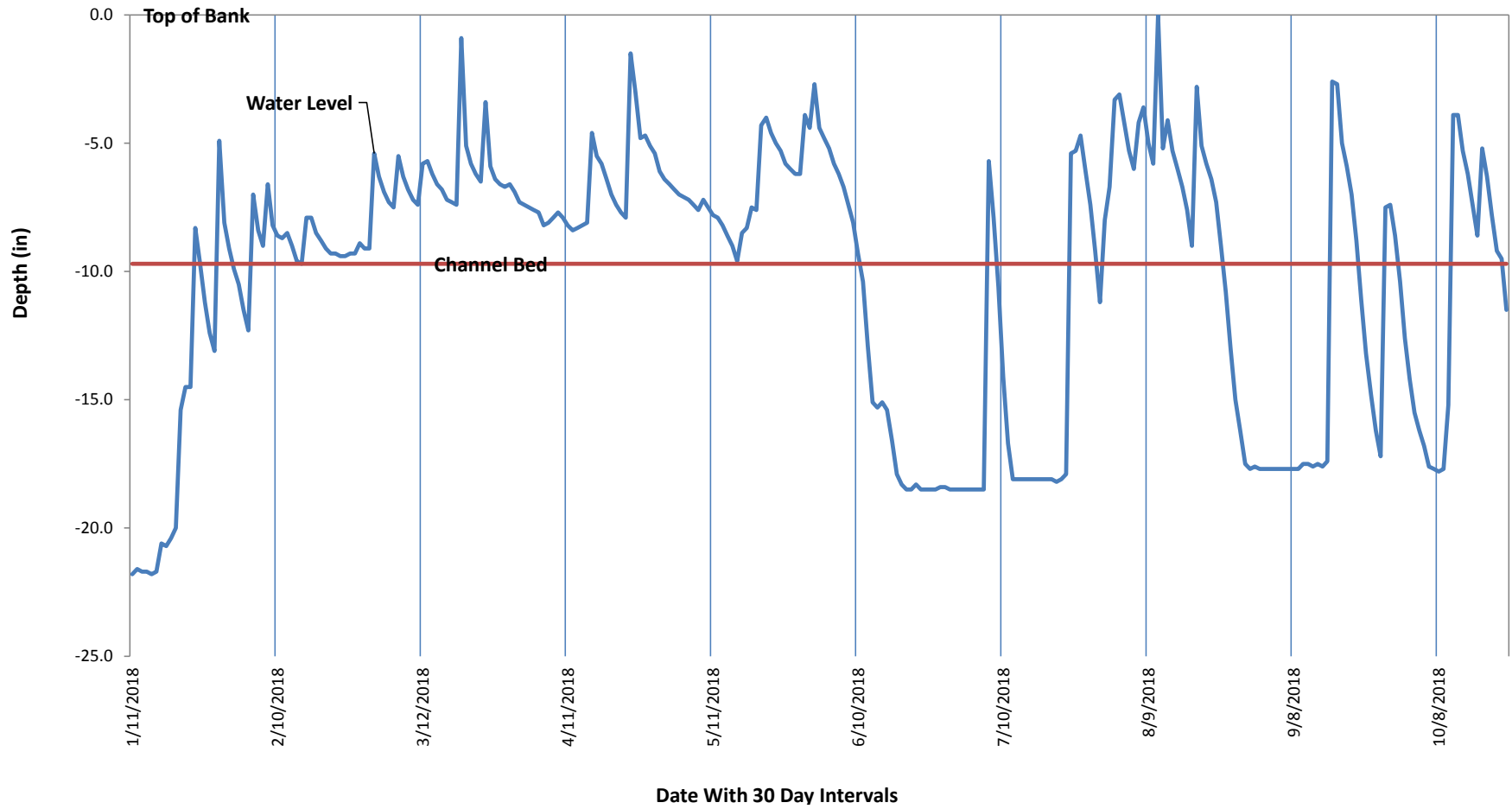


### Hydrology Monitoring UT-4 Upstream (MY5) Gauge MW-1D

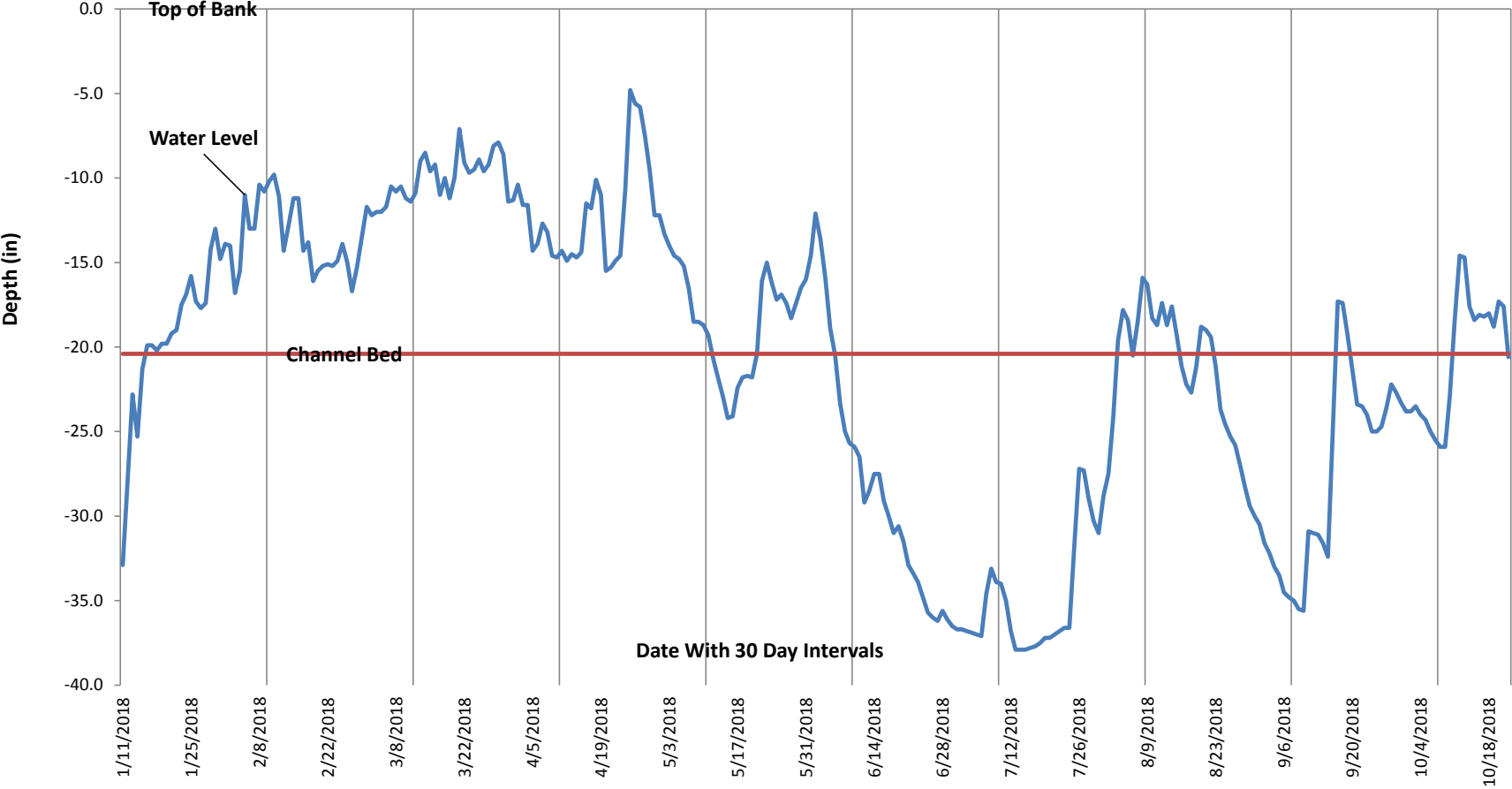




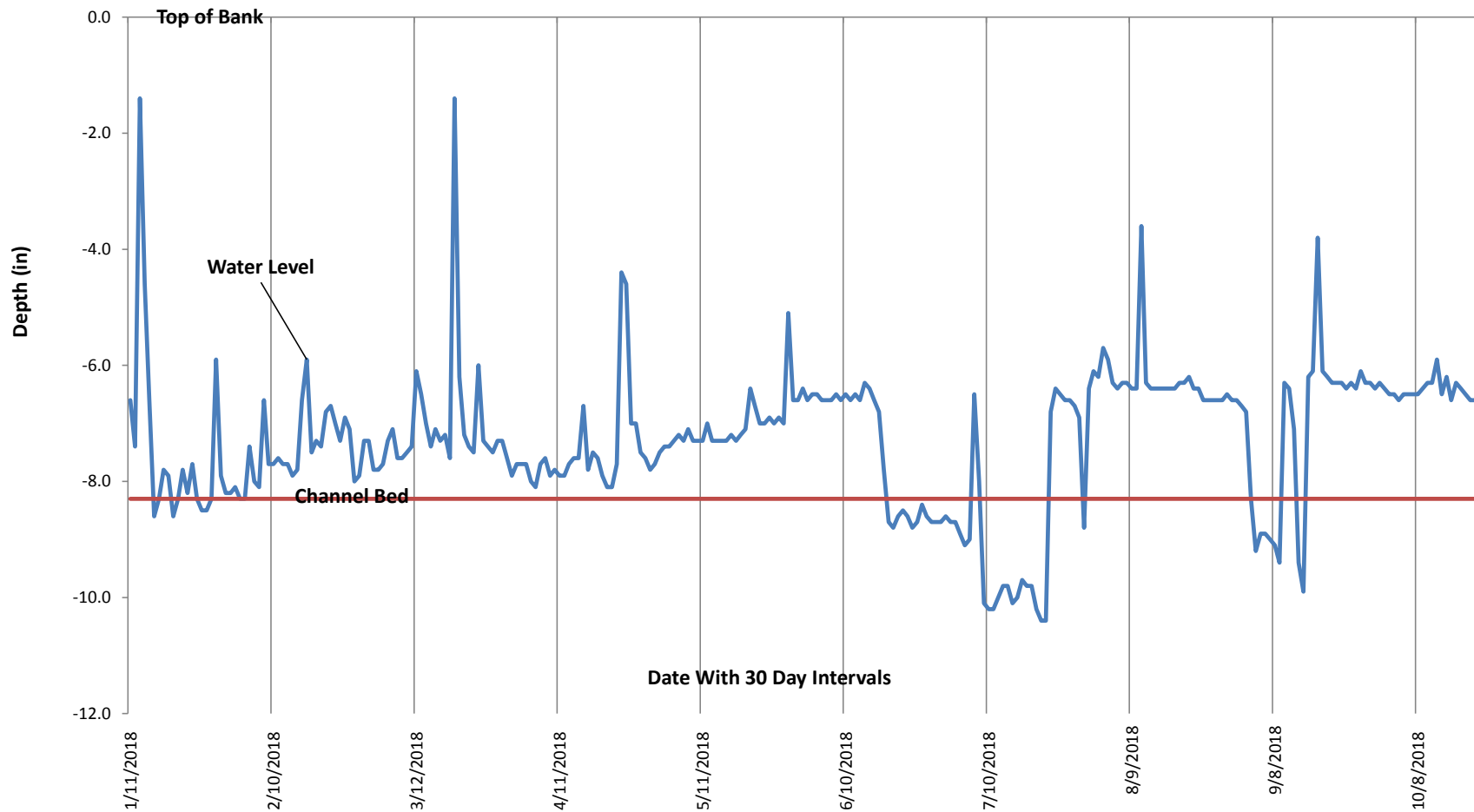
### Hydrology Monitoring UT-4 Downstream (MY5) Gauge MW-2



### Hydrology Monitoring UT-4 Downstream (MY5) Gauge MW-2D



### Hydrology Monitoring UT-3 (MY5) Gauge MW-3





### Hydrology Monitoring UT-5 (MY5) Gauge MW-4

