Russell Gap Stream Mitigation Project
Year 3 (2022) Monitoring Report FINAL

DMS Project ID No. 100003, DEQ Contract No. 6980

USACE Action ID No. SAW-2017-00826, DWR# 20150416

Alexander County, North Carolina, Catawba River Basin: 03050101-120010

MY3 Data Collection Period: January – October 2022



Submitted to/Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services (DMS)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Michael Baker
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Submission Date: February 2023

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February 15, 2023

Matt Reid, PM
NCDEQ, Division of Mitigation Services
Asheville Regional Office
2090 U.S. 70 Highway
Swannanoa, NC 28778-8211

Subject:
Response to DMS Comments (January 19, 2023) for DRAFT Monitoring Year 3 Report.
Russell Gap Mitigation Project, Alexander County
Catawba River Basin: 06010106
DMS Project #100003 DEQ Contract #6980

Dear Mr. Reid,

Please find below our responses to the NC Division of Mitigation Services (DMS) review comments dated January 19, 2023, in reference to the Russel Gap Mitigation Project's DRAFT Monitoring Year 3 Report. We have revised the Draft document in response to review comments as outlined below.

- In an effort to identify and resolve property issues, please verify the conservation easement has been inspected, marking is up to date, fencing is intact, and no encroachments have been identified.
  RESPONSE: The conservation easement has been inspected, marking is up to date, fencing is intact, and no encroachments were observed during MY3.

- 1.4 Monitoring Results: Section indicates that the right floodplain of R26 was replanted during MY3. Please include a brief discussion with approximate number, area and type of plants installed (bare root, gallon, etc.). Were the species used from the approved planting list from the mitigation plan? Please add this supplemental planting to Table 2 and to the CCPV.
  RESPONSE: The discussion has been included as requested. The encroachment area noted during MY2 was approximately 577 square feet. This area was replanted along the easement boundary for clear visibility with approximately seven 3-gallon pots of Willow Oak (*Quercus phellos)* and Sycamore (*Platanus occidentalis)*, both of which are included on the approved planting list.

- Please include a statement regarding average tree height for MY3 monitoring. Is the site on track to meet the MY5 6' success criteria?
  RESPONSE: A statement has been added to section 1.4 as requested.

- At the 2022 Credit Release Meeting, the IRT expressed concern with the amount of juncus at the site and potential problems with tree growth. The IRT requested a random vegetation

plot on this reach due to vegetation success concerns. Please add a short discussion regarding the two random plots added and the status of the juncus on the site.
RESPONSE: Dense populations of *Juncus* occur mainly along the right floodplain of R1. A vegetation transect was included on the right bank of R1 and is shown as MY3 RVP4 on Figure 3A. This transect was considered one of nine annual Random Vegetation Plots and did not meet the success criteria of 320 stems per acre by the end of Year 3 at 161 stems per acre; however, permanent vegetation plots 2 and 4 both exceeded criteria at 566 and 526 stems per acre respectively. Permanent vegetation plots 1, 3, and Random vegetation plot 2 on the left floodplain of R1 are also located in areas with *Juncus* and exceeded success criteria. Existing stems in these areas were just beginning to exceed the height of the *Juncus* during MY3, thus we will continue to watch the area and will add containerized material if necessary.

- Only 4 of 12 groundwater gauges met success criteria in MY3 and lower rainfall was discussed in the report as a possible reason. DMS recommends adding additional gauges in areas with failing gauges prior to the start of the growing season. If wetland gauges are not trending towards success in MY4, credit releases and invoice payment will need to be adjusted to reflect the site conditions. Please be prepared to discuss this issue at the 2023 Credit Release Meeting.
  RESPONSE: We acknowledge that 8 of 12 wells did not meet success criteria in MY3; however, only one well (RGAW1) has ever failed to meet success criteria in one previous monitoring year. We request to postpone any addition of monitoring wells pending well data analysis from the MY4 growing season.

- Figure 2: There are two dark green lines in the wetland restoration area along R9/R4 floodplain that are not include in the legend. Recommend reducing the width of these lines so it can clearly be seen that these areas are cut out of the wetland restoration areas or turn off the layer
  RESPONSE: The line thickness and color has been revised as requested.

- CCPV: Please update color codes for vegetation plots, wetland gauges, and flow gauges for meeting/not meeting criteria.
  RESPONSE: Vegetation plots, wetland gauges, and flow gauges have been color coded for meeting/not meeting criteria as requested. All permanent vegetation plots met criteria in MY3 and are all colored green; therefore, color coding is not represented for these plots in the CCPV legend.

- CCPV: Random Vegetation Plots are labeled with different colors on various sheets. Please update for consistency.
  RESPONSE: Random Vegetation Plot labels and colors have been updated for consistency as requested.

- Table 5 R1: Table shows 2 areas of aggradation for a total of 40'. These areas are not shown on the CCPV. Section 1.4 indicates all reaches are performing at 100%. Please review and revise as necessary.
  RESPONSE: A discussion of these areas has been added to Section 1.4 and these areas are depicted on CCPV A.

- Table 11: Recommend color coding cells for meeting/not meeting success criteria.
  RESPONSE: Cells have been color coded to indicate those wells not meeting success criteria.

- Flow Gauge Graphs: Graph notes for RGFL2 and RGFL5 are misleading. Note indicates that flow criteria is met; however, both gauges failed to meet the 30 day success criteria. Please revise for clarity. Also, four of the five graph notes are in red, and one is in black. Recommend using red for gauges not meeting and black for gauges that are meeting.
  RESPONSE: Language was changed on graph notes for clarification. Font colors have been changed to black when criteria is met and red when it is not.

Electronic Deliverable Comments:

- Please include a USB with updated digital files based on comments above with final submittal.
  RESPONSE: A USB and updated digital files are included with the final submittal as requested.

As requested, Michael Baker has provided an electronic response letter addressing the DMS comments received and two (2) hardcopies of the FINAL report, and the updated e-submission digital files will be sent via secure ftp link. A full final electronic copy with electronic support files have been included on a USB drive. Please do not hesitate to contact me (Jason.york@mbakerintl.com 828-412-6101) should you have any questions regarding our response submittal.

Sincerely,

Jason York
Environmental Scientist

Jason York

Enclosure: Final MY3 Report Russell Gap Mitigation Project

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1.0 PROJECT SUMMARY

1.1 Project Description

Michael Baker Engineering, Inc. (Michael Baker) restored approximately 4,209 linear feet of existing stream, enhanced 8,857 linear feet of stream along Unnamed Tributaries (UTs) to Davis Creek, the East Prong Lower Little River, and UTs to the East Prong Lower Little River. Michael Baker also restored and/or enhance approximately 7.3 acres of riparian wetland in the Catawba River Watershed. The project is located in the Catawba River Basin, within the Hydrologic Unit Code (HUC) 03050101-120010, which is identified as a Targeted Local Watershed (TLW) in the NC Division of Mitigation Services'(DMS) 2009 *Upper Catawba River Basin Restoration Priorities* (RBRP) report.

The Russell Gap Stream Mitigation project is located on an active cattle farm in Alexander County, North Carolina, 10 miles northwest of the Town of Taylorsville as shown on the Project Vicinity Map (Figure 1). Historic agriculture uses on the project site include cattle production, row crops, and apple orchards. These activities had negatively impacted both water quality and streambank stability along the project streams and their tributaries (Table 4). The project is being conducted as part of the NCDMS Full Delivery In-Lieu Fee Program and is anticipated to generate at close-out a total of 9,166.949 stream mitigation credits (contracted for 9,400) and up to 7.053 riparian wetland mitigation units (contracted for 4.0) (Table 1) and is protected by a 35.97-acre permanent conservation easement.

1.2 Goals and Objectives

The goals of this project are identified below:

- Establishment of geomorphically stable conditions along all project reaches,
- Improvement of water quality by reducing nutrient and sediment inputs,
- Restoration of natural stream and floodplain interactions,
- Restoration and enhancement of riparian wetland functions,
- Restoration and protection of riparian buffer functions and corridor habitat,
- Improvement of in-stream aquatic habitat, and
- Establishment of a permanent conservation easement on the entire project.

To accomplish these goals, the following objectives were identified:

- To restore appropriate bankfull dimensions, remove spoil berms, and/or raise channel beds, by utilizing either a Priority I Restoration approach or an Enhancement Level I approach.
- To construct streams of appropriate dimensions, pattern, and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced streams and utilize bioengineering to provide long-term stability.
- Construct a correct channel morphology to all streams increasing the number and depths of pools, with structures including geo-lifts with brush toe, log vanes/weirs, root wads, and/or J-hooks.
- Raise ground water levels in delineated hydric soils areas through the implementation of Priority I restoration and the filling of ditches. Wetland vegetation will also be planted.
- Establish riparian buffers at a 50-foot minimum width along all stream reaches, planted with native tree and shrub species.
- Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.

1.3 Project Success Criteria

The success criteria and performance standards for the project will follow the North Carolina Interagency Review Team (NCIRT) guidance document *Wilmington District Stream and Wetland Compensatory Mitigation Update* dated October 24, 2016 and as described in Section 7 of the approved Mitigation Plan. All specific monitoring activities will follow those outlined in detail in Section 8 of the approved Mitigation Plan and will be conducted for a period of seven years unless otherwise noted. Annual monitoring reports will follow the DMS document *Annual Monitoring Report Format, Data Requirements, and Content Guidance* from April 2015. The performance standards for the riparian buffer assets will be held in accordance with 15A NCAC 02B.0295(n)(2)(B) and 15A NCAC 02B.0295(n)(4), and annual monitoring reports will be submitted at the end of each of the seven monitoring years.

1.4 Monitoring Results and Project Performance

The Year 3 monitoring survey data of the twenty-six permanent cross-sections indicates that these stream sections are geomorphically stable and are within the lateral/vertical stability and in-stream structure performance categories. Live staking successfully stabilized Stream Problem Area 1 (SPA1) on R1 that was reported during MY2. This area is stable and functioning and has been removed as a Stream Problem Area in MY3. This location will continue to be monitored in MY4. SPA2 on R4a was also live staked and is currently stable. Two approximately 20-foot-long mid-channel bars were found on R1, although no lateral bank scour was observed. These bars will be removed with hand tools during MY4. R1 is 98% stable and performing as intended. All other reaches were stable and performing as designed and are rated at 100 percent for all the parameters evaluated (Table 5 in Appendix B).

During Year 3 monitoring, the planted acreage performance categories were functioning well overall. The average density of total planted stems based on data collected from the 20 permanent and 9 random monitoring plots for the Year 3 monitoring conducted in November 2022 was 556 stems per acre (Table 7 in Appendix C). Thus, the Year 3 vegetation data demonstrate that the Site has met the minimum success interim criteria of 320 trees per acre by the end of Year 3 and based on observation appears to be on track to meet the MY5 6-foot height success criteria. No vegetation problem areas (VPAs) were identified as exceeding the reportable mapping threshold of 0.1 acres. Planted trees in the R1 floodplain have begun over top the *Juncus*. Containerized plants may be added to this area if competition from *Juncus* inhibits growth of planted stems or causes widespread mortality. Scattered stems of privet (*Ligustrum spp.)* and multiflora rose *(Rosa multiflora)* located throughout the site were treated with herbicide in April 2022 and follow up treatment is anticipated to occur in future monitoring years.

A culverted crossing on Reach 1 was damaged during a high flow event in November 2020. The culvert was replaced with a railcar bridge in May 2021. During MY3 the bridge remains stable. The encroachment area reported on the right floodplain of R26 during MY2 was clearly marked and replanted during MY3 with approximately seven 3-gallon pots of *Quercus phellos* (Willow Oak) and *Platanus occidentalis* (Sycamore), both of which are included on the approved planting list. No further encroachments have occurred.

During Year 3 monitoring, one post-construction bankfull event on R9 was observed (see Table 10 in Appendix E and the Overbank Photographs in Appendix B). Bankfull events are documented using manual cork crest gauge readings and post-flood event site inspection photographs. Rain data and groundwater well inundation is also considered to determine the approximate date of bankfull events. Crest gauges located on R1, R4, and R6 did not record an overbank event during MY3.

Figure 6 in Appendix E demonstrates that rainfall since November 2021 has been lower than the historic averages all months during MY3 monitoring and growing season. A total of 37.2 inches of rainfall was observed for the project which is less than the annual historic average of 52.36 inches. All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database CRONOS station TAYL, located in Taylorsville, NC.

During Year 3 monitoring, four of twelve automated groundwater monitoring wells met or exceeded the minimum hydroperiod performance criteria approved in the Mitigation Plan of 12% of the 227-day growing season (27 or more consecutive days). Three of five automated flow gauges met or exceeded the minimum 30-day performance criteria during MY3. One of the two flow gauges needed only four more days to meet success. It was noticed that the dry month of December 2021 and dry months of April – June 2022 shortened the window for success. Historically both flow and groundwater need this time period with near average precipitation in order to meet consecutive day criteria. (See Appendix E, Table 12).

Summary information/data related to the Site 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 information formerly found in these reports can be found in the Baseline Monitoring Report and in the Mitigation Plan available on the DMS website. Any raw data supporting the tables and figures in the Appendices is available from DMS upon request.

This report documents the successful completion of the Year 3 monitoring activities for the post-construction monitoring period.

1.5 Technical and Methodological Descriptions

Stream survey data was collected to a minimum of Class C Vertical and Class A Horizontal Accuracy using a Leica TS06 Total Station and was georeferenced to the NAD83 State Plane Coordinate System, FIPS3200 in US Survey Feet, which was derived from the MY-1 Survey. The survey data from the permanent project cross-sections were collected and classified using the Rosgen Stream Classification System to confirm design stream type (Rosgen 1994 and 1996).

The twenty permanent and nine annual random vegetation-monitoring quadrants (plots) were installed across the site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.1 (Lee 2007) and the data collected from each was input into the CVS-DMS Data Entry Tool v. 2.3.1 (CVS 2012).

Nine automated groundwater monitoring wells were installed in the floodplain along Reach R1 following USACE protocols (USACE 2005). Three additional groundwater monitoring wells were installed in the floodplain along R9. Flow gauges were installed on R11, R13, R14, R19 and R20 and an additional camera was installed on R11 to capture pictures of flow. Collective data will document that these intermittent streams continue to exhibit base flow for at least thirty consecutive days throughout each monitoring year. The gauges themselves are all Van Essen DI800 BARO Diver data loggers. Four manual cork crest gauges were installed on R1, R4, R6, and R9.

All observed project rainfall was collected from the North Carolina Climate Office Weather Climate Database CRONOS station TAYL, located in Taylorsville, NC approximately nine miles south of the project at 35.9139, -81.19087.

The specific locations of monitoring features, such as vegetation plots, permanent cross-sections, reference photograph stations, and crest gauges, are shown on the CCPV map found in Appendix B.

1.6 References

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (DMS). CVS-DMS Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC. 2012.

Lee, M., Peet R., Roberts, S., Wentworth, T. 2007. CVS-DMS Protocol for Recording Vegetation, Version 4.1.

North Carolina Division of Mitigation Services. 2010. Neuse River Basin Restoration Priorities. NC Department of Environmental Quality. Raleigh, NC.

North Carolina Division of Mitigation Services. 2016. Neuse River Basin Restoration Priorities: Neuse-01 Catalog Unit *Update*. NC Department of Environmental Quality. Raleigh, NC.

North Carolina Division of Mitigation Services. 2017. *Annual Monitoring Report Format, Data Requirements, and Content Guidance June 2017.* NC Department of Environmental Quality. Raleigh, NC.

North Carolina Interagency Review Team (NCIRT). 2016. Guidance document "*Wilmington District Stream and Wetland Compensatory Mitigation Update".* October 24, 2016

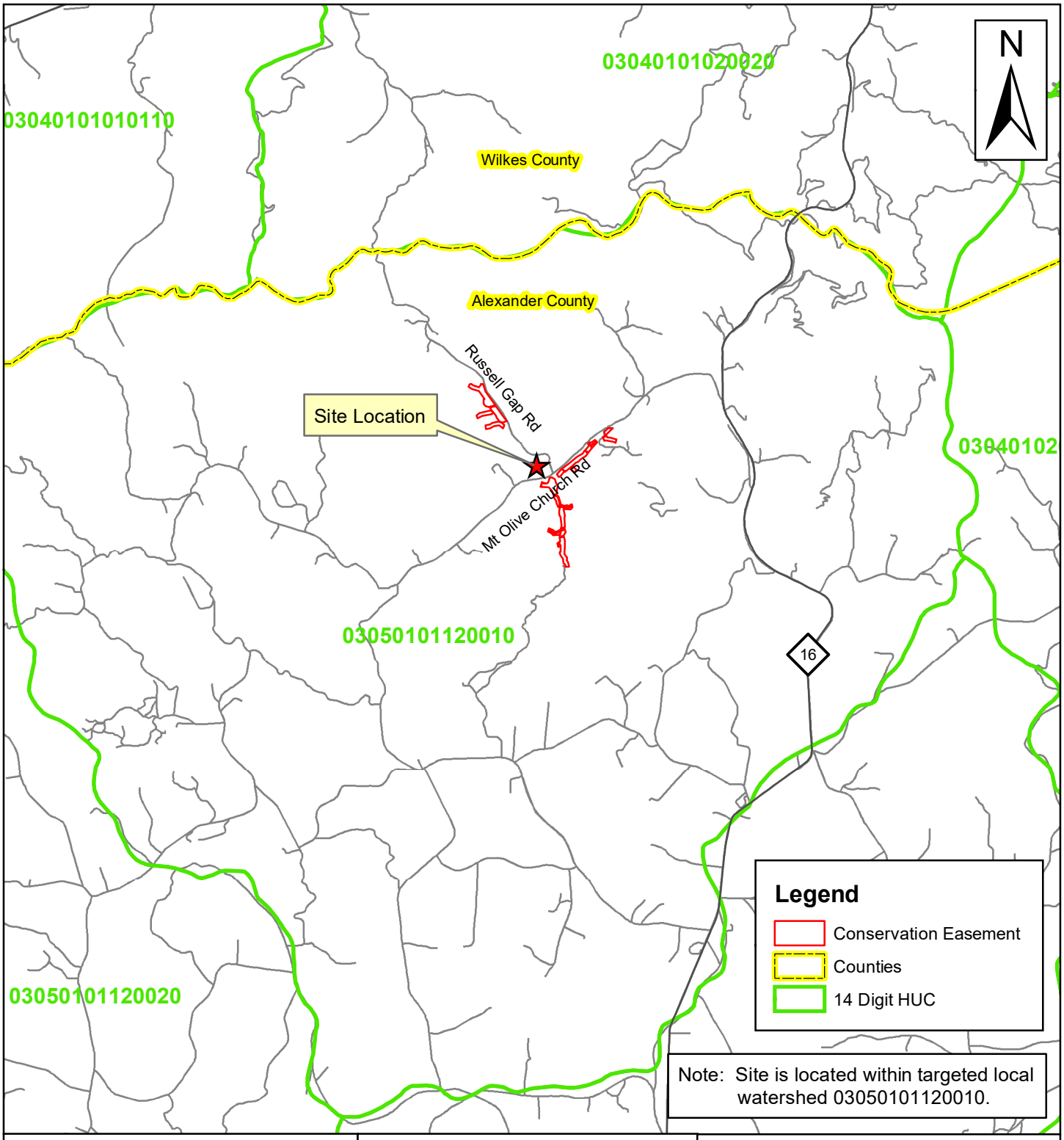
Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena 22:169-199.

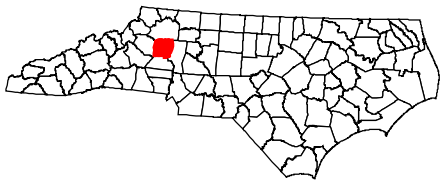
Rosgen, D.L. 1996. Applied River Morphology. Wildlands Hydrology. Pagosa Springs, CO.

United States Army Corps of Engineers (USACE). 2005. "Technical Standard for Water-Table Monitoring of Potential Wetland Sites," WRAP Technical Notes Collection (ERDC TN-WRAP-05-2), U.S. Army Engineer Research and Development Center. Vicksburg, MS.

APPENDIX A

Background Tables and Figures





Alexander County

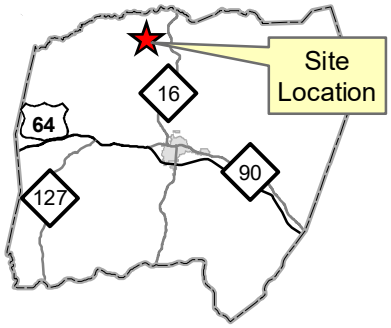


Figure 1
Project Vicinity Map
Russell Gap Project

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0 0.5 1 2 Miles

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)	Asset Category		Overall Credits
		Riverine	Non-Riverine					
Restoration	4,063	6.773				Stream		9166.949
Enhancement		0.559				RP Wetland		7.053
Enhancement I	5,760					NR Wetland		
Enhancement II	2,684					Buffer		
Creation								
Preservation								
High Quality Pres								

N

R10a/b
R1
Davis Creek
R11
R12
R13
R14
Russell Gap Rd
R4a
R27
R26
R4
R15
R2
R3
R4
R3
R9
R8
Mt Olive Church Rd
East Prong Little Lower River
R22
R25
R7b
R20
R21
R19
R18
R7a
R17
R6
R5

Russell Gap Stream Centerline

Stream Approach
- Restoration
- Enhancement I
- Enhancement II
- No Credit
- Conservation Easement

Russell Gap Wetland Boundaries

Wetland Type
- Restoration
- Enhancement

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0 500 1,000 Feet

Figure 2
Project Asset Map
Russell Gap Project

rev: 5Dec2016

Table 1. Project Components and Mitigation Credits
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	As-Built CL Restored Footage, or SF [1]	As-Built CL w/o Xing Footage, or SF [2]	Mitigation Plan Designed Footage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits [3]
Reach R1		2,142	10+00 - 29+45.90	1,946	1,910.90	1,841.60	R	PI	1.0	1,841.60
Reach R2		288	10+00 - 11+65.62	166	165.62	174.21	R	P2	1.0	174.21
Reach R3		388	32+28.36 - 36+34.66	406	406.30	388.74	R	P2	1.0	388.74
Reach R4a		299	10+00 - 13+00.00	300	300.00	300.00	EII	-	2.5	120.00
Reach R4		2,245	10+00 - 32+28.36	2,228	2,038.36	2,063.32	EI	-	1.5	1,375.55
Reach R5		256	10+00 - 12+10.00 w/o pipe	193	193.00	193.00	EII	-	2.5	77.20
Reach R5 Pipe Removal		17	10+32 - 10+49 pipe	17	17.00	17.00	R	P1	1.0	17.00
Reach R6		631	12+10.00 - 19+57.36	747	747.36	741.05	R	P1	1.0	741.05
Reach R7a		155	19+57.36- 20+61.17	104	103.81	110.12	EII	-	2.5	44.05
Reach R7b		1,170	20+61.17 - 33+51.48	1,290	1,216.31	1,202.37	EI	-	1.5	801.58
Reach R8		463	33+75.40 - 38+28.55	453	453.15	455.79	EII	-	2.5	182.32
Reach R9		439	38+65.34 - 43+10.91	446	445.57	445.52	R	P1	1.0	445.52
Reach R10a		371	10+08.40 - 13+74.94	367	366.54	376.11	EII		2.0	188.06
Reach R10b		0	13+74.94 - 14+79.77	105	104.83	112.65	R	P1	1.0	112.65
Reach R11		481	10+00 - 17+31.85	732	711.85	725.83	EI	-	1.5	483.89
Reach R12		86	10+00 - 11+01.78	102	101.78	120.02	R	P1	1.0	120.02
Reach R13		124	10+00 - 11+45.00	145	145.00	145.00	EI	-	1.5	96.67
Reach R14		528	11+45.00 - 17+14.80	570	569.80	572.27	R	P1/2	1.0	572.27
Reach R15		226	10+00 - 13+02.77	303	283.77	281.80	EII	-	2.5	112.72
Reach R17		130	10+00 - 11+06.64	107	106.64	104.44	EII	-	2.5	41.78
Reach R18		185	10+00 - 12+03.31	203	176.31	179.01	EII	-	2.5	71.60
Reach R19		481	9+86.00 - 13+75.96	390	352.96	359.49	EI	-	1.5	239.66
Reach R20		206	10+00 - 12+52.61	253	252.61	252.68	R	P1	1.0	252.68
Reach R21		67	10+00 - 10+91.76	92	91.76	89.11	EII	-	2.5	35.64
Reach R22		161	10+00 - 11+19.46	119	119.46	136.87	EII	-	2.5	54.75
Reach R22a		68	10+60 - 11+28.42	68	68.42	68.42	EII	-	2.5	27.37
Reach R25		422	10+00 - 14+30.52 (w/o pipe)	403	402.52	399.05	EI	-	1.5	266.03
Reach R25 Pipe Removal		28	12+62 - 12+90 pipe	28	28.00	28.00	R	P1	1.0	28.00
Reach R26		548	10+00 - 14+72.96	473	472.96	472.13	EII	-	2.5	188.85
Reach R27		165	10+00 - 11+63.76	164	163.76	163.76	EII	-	2.5	65.50
Wetland Group 1	RR	0		5.285		5.285	Restoration		1.0	5.285
Wetland Group 2	RR	0		1.488		1.488	Restoration		1.0	1.488
Wetland Group 3	RR	0.261		0.261		0.261	Enhancement		2.0	0.131
Wetland Group 4	RR	0.156		0.156		0.156	Enhancement		2.0	0.078
Wetland Group 5	RR	0.034		0.034		0.034	Enhancement		2.0	0.017
Wetland Group 6	RR	0.108		0.108		0.108	Enhancement		2.0	0.054

1 All stream stationing and restored footage numbers reported here, discussed in the report text, and shown in the as-built plan sheets use survey values.

2 The stream footage reported here uses the as-built stream *centerline* survey values and have all easement breaks removed from their totals. Buffer group values reported here are the creditable areas as allowed for each group as described in detail in the mitigation plan.

3 Credits reported here are taken directly from the approved mitigation plan Table 11.1

Table 1.1
As-Built Centerline Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)
		Riverine	Non-Riverine		
Restoration	4,063	6.773			
Enhancement		0.559			
Enhancement I	5,760				
Enhancement II	2,684				
Creation					
Preservation					
High Quality Pres					

Table 1.2
Overall Assets Summary

Asset Category	Overall Credits
Stream	**9,166.949**
RP Wetland	**7.053**
NR Wetland	
Buffer	

Table 2. Project Activity and Reporting History
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Elapsed Time Since grading complete:	**34 months**
Elapsed Time Since planting complete:	**33 months**
Number of Reporting Years[1]:	**3**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
404 permit date	N/A	Dec-18
Mitigation Plan	N/A	Sep-18
Final Design – Construction Plans	N/A	Sep-18
Construction Grading Completed	N/A	Feb-20
As-Built Survey	May-20	May-20
Livestake and Bareroot Planting Completed	N/A	Mar-20
As-Built Baseline Monitoring Report (MY0)	Mar-20	Sep-20
Year 1 Monitoring	Nov-20	Dec-20
Year 2 Monitoring	Oct-21	Dec-21
Vegetation Monitoring	Oct-21	Dec-21
Stream Survey	Oct-21	Dec-21
Bridge Replacement	May-21	May-21
Maintenance, Repairs, Live Staking	May and Oct-21	Dec-21
Invasive Treatment	June and Oct-21	Dec-21
Year 3 Monitoring	Oct and Nov-22	Dec-22
Vegetation Monitoring	Aug, Oct, Nov 2022	Dec-22
Stream Survey	Sep-22	Sep-22
Invasive Treatment and Supplemental Planting	Apr-22	Apr-22
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

[1] = The number of monitoring reports excluding the as-built/baseline report

Table 3. Project Contacts
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Designer	8000 Regency Parkway, Suite 600
Michael Baker Engineering, Inc.	Cary, NC 27518 Contact: Katie McKeithan, Tel. 919-481-5703
Construction Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Survey Contractor	P.O. Box 148
Turner Land Surveying (As-Built Only)	Swannanoa, NC 28778 Contact: David Turner, Tel. 919-827-0745
Kee Mapping and Surveying (Existing Conditions and Monitoring Survey)	88 Central Avenue Asheville, NC 28801 Contact: Brad Kee, Tel. 828-575-9021
Planting Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Seeding Contractor	5616 Coble Church Rd
KBS Earthworks, Inc.	Julian, NC 27283 Contact: Kory Strader, Tel. 336-362-0289
Seed Mix Sources	
Green Resources	Telephone: 336-855-6363
Nursery Stock Suppliers	
Mellow Marsh Farm **ArborGen**	Telephone: 919-742-1200 Telephone: 843-528-3204
Monitoring Performers	
Michael Baker Engineering, Inc. Monitoring Point of Contact	797 Haywood Rd. Suite 201. Asheville, NC 28806 Jason York, Tel. 828-380-0118

Table 4. Project Attributes
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Project Name		Russell Gap Stream Mitigation Project			
County		Alexander County			
Project Area (acres)		35.97			
Project Coordinates (latitude and longitude)		36.0091 N, -81.2139 W			
Planted Acreage (Acres of Woody Stems Planted)		29.67			
Project Watershed Summary Information					
Physiographic Province		Peidmont			
River Basin		Catawba			
USGS Hydrologic Unit 8-digit	3050101	USGS Hydrologic Unit 14-digit	03050101-120010		
DWR Sub-basin		03-08-32			
Project Drainage Area (Acres and Square Miles)		2,227 acres / 3.48 square miles (at downstream end of R3)			
Project Drainage Area Percentage of Impervious Area		0.13% impervious area			
CGIA Land Use Classification		82.6% forested, 14.5% agriculture, 1.5% rural residential, 1.4% roadway			
Existing Reach Summary Information					
Parameters		**Reach R1**	**Reach R2**	**Reach R3**	**Reach R4**
Length of reach (linear feet)		2,142	288	388	2,245
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)		960	1,056	2227	806
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification		C	C	C	C
Stream Classification (existing)		E4 (incised)	E4 (incised)	E4	E4
Stream Classification (proposed)		C4	C4	C4	B4c
Evolutionary trend (Simon)		IV - Degradation and Widening	III - Degradation	III - Degradation	IV - Degradation and Widening
FEMA classification		Zone X	Zone X	Zone X	Zone X
Existing Reach Summary Information					
Parameters		**Reach R4a**	**Reach R5**	**Reach R6**	**Reach R7a**
Length of reach (linear feet)		299	256	631	155
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)		716	150	154	210
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification		C	C	C	C
Stream Classification (existing)		E4	C4b	G4	E4b
Stream Classification (proposed)		B4c	C4b	B4	E4b
Evolutionary trend (Simon)		I - Stable System	I - Stable System	IV - Degradation and Widening	I - Stable System
FEMA classification		Zone X	Zone X	Zone X	Zone X
Existing Reach Summary Information					
Parameters		**Reach R7b**	**Reach R8**	**Reach R9**	**Reach R10(A/B)**
Length of reach (linear feet)		1,170	463	439	371
Valley confinement (Confined, moderately confined, unconfined)		Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (Acres)		288	333	358	17
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification		C	C	C	C
Stream Classification (existing)		E4b	C4	E4b	E4b
Stream Classification (proposed)		E4b	C4	B4	E4b-C4
Evolutionary trend (Simon)		III - Degradation	I - Stable System	IV - Degradation and Widening	II - Disturbance
FEMA classification		Zone X	Zone X	Zone X	Zone X

Existing Reach Summary Information				
Parameters	**Reach R11**	**Reach R12**	**Reach R13**	**Reach R14**
Length of reach (linear feet)	481	86	124	528
Valley confinement (Confined, moderately confined, unconfined)	Confined	Unconfined	Moderately Confined	Confined (Upper) Unconfined (Lower)
Drainage area (Acres)	17	115	21	22
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Intermittent	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	B4a	Eb	C4	A4
Stream Classification (proposed)	B4a	C4b	C4	E4
Evolutionary trend (Simon)	III - Degradation	IV - Degradation and Widening	II - Disurbance	IV - Degradation and Widening
FEMA classification	Zone X	Zone X	Zone X	Zone X

Existing Reach Summary Information				
Parameters	**Reach R15**	**Reach R17**	**Reach R18**	**Reach R19**
Length of reach (linear feet)	226	130	185	481
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Moderately Confined
Drainage area (Acres)	19	26	24	22
Perennial, Intermittent, Ephemeral	Intermittent	Intermittent	Intermittent	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	E4b	E4b	E4b	B4a
Stream Classification (proposed)	E4b	E4b	E4b	B4a
Evolutionary trend (Simon)	I - Stable System	I - Stable System	I - Stable System	IV - Degradation and Widening
FEMA classification	Zone X	Zone X	Zone X	Zone X

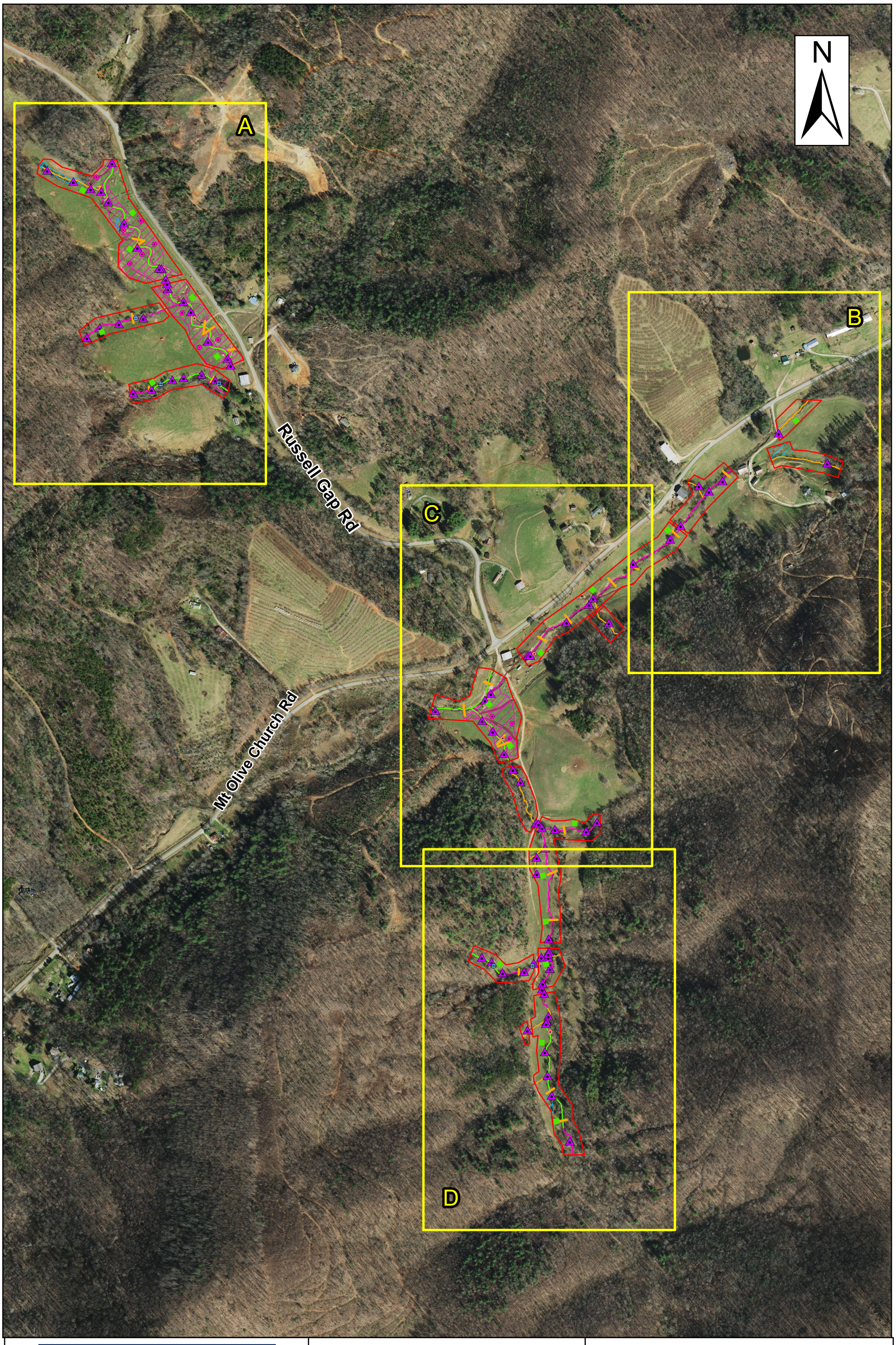
Existing Reach Summary Information				
Parameters	**Reach R20**	**Reach R21**	**Reach R22**	**Reach R22a**
Length of reach (linear feet)	206	67	161	68
Valley confinement (Confined, moderately confined, unconfined)	Confined	Unconfined	Moderately Confined	Moderately Confined
Drainage area (Acres and Square Miles)	9	33	3	3
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C	C	C	C
Stream Classification (existing)	A4a+	B4	B4	B4
Stream Classification (proposed)	A4a+	B4	B4	B4
Evolutionary trend (Simon)	III - Degrading	I - Stable System	II - Channelized	II - Channelized
FEMA classification	Zone X	Zone X	Zone X	Zone X

Existing Reach Summary Information			
Parameters	**Reach R25**	**Reach R26**	**Reach R27**
Length of reach (linear feet)	422	548	165
Valley confinement (Confined, moderately confined, unconfined)	Moderately Confined	Unconfined	Moderately Confined
Drainage area (Acres and Square Miles)	33	32	19
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C	C	C
Stream Classification (existing)	B4a	E4b	E4b
Stream Classification (proposed)	B4a	E4b	E4b
Evolutionary trend (Simon)	III - Degrading	I - Stable System	I - Stable System
FEMA classification	Zone X	Zone X	Zone X

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	PCN
Water of the United States - Section 401	Yes	Yes	PCN
Endangered Species Act	Yes	Yes	Categorical Exclusion
Historic Preservation Act	Yes	Yes	Categorical Exclusion
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

APPENDIX B

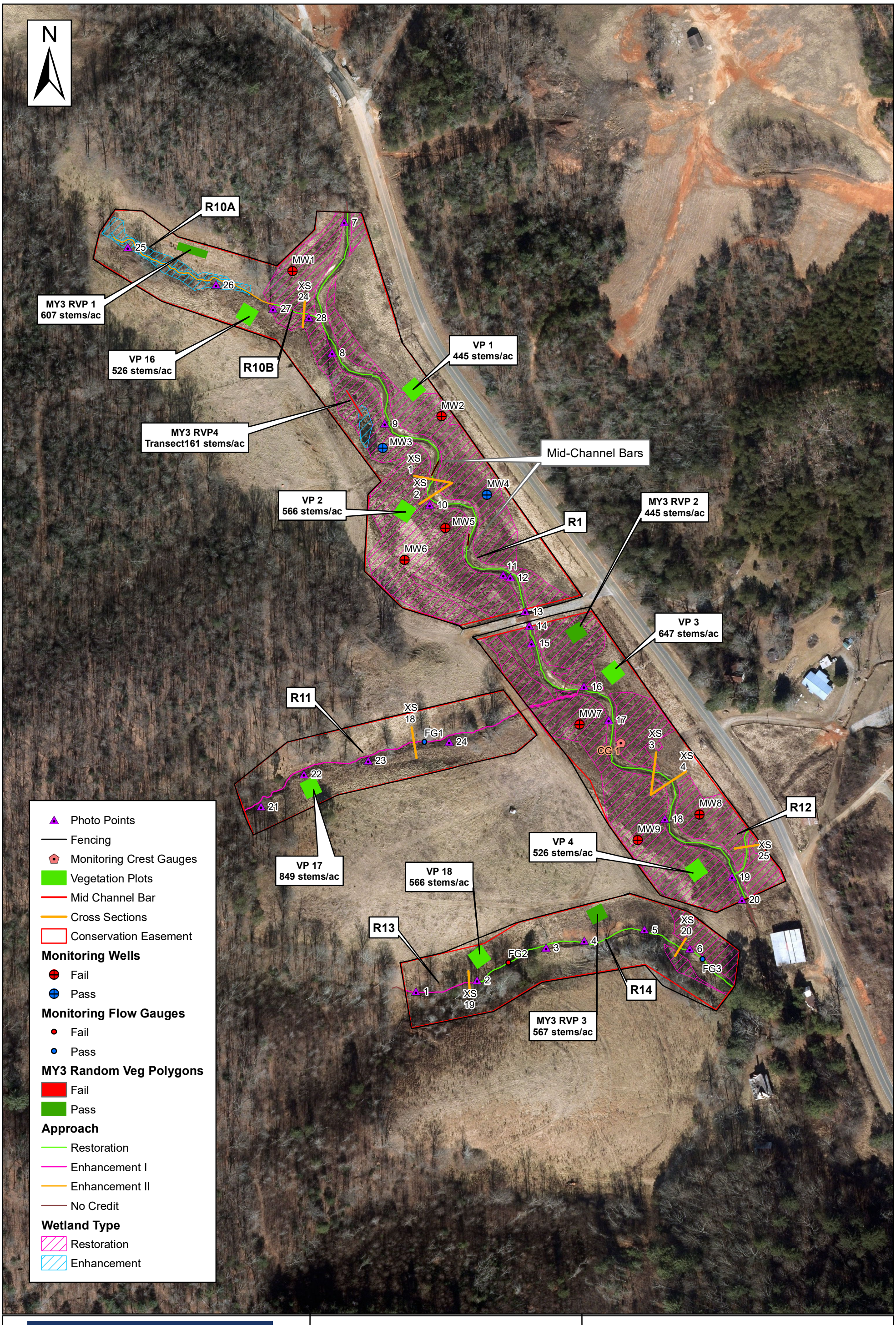
Visual Assessment Data



Michael Baker INTERNATIONAL

0 500 1,000 Feet

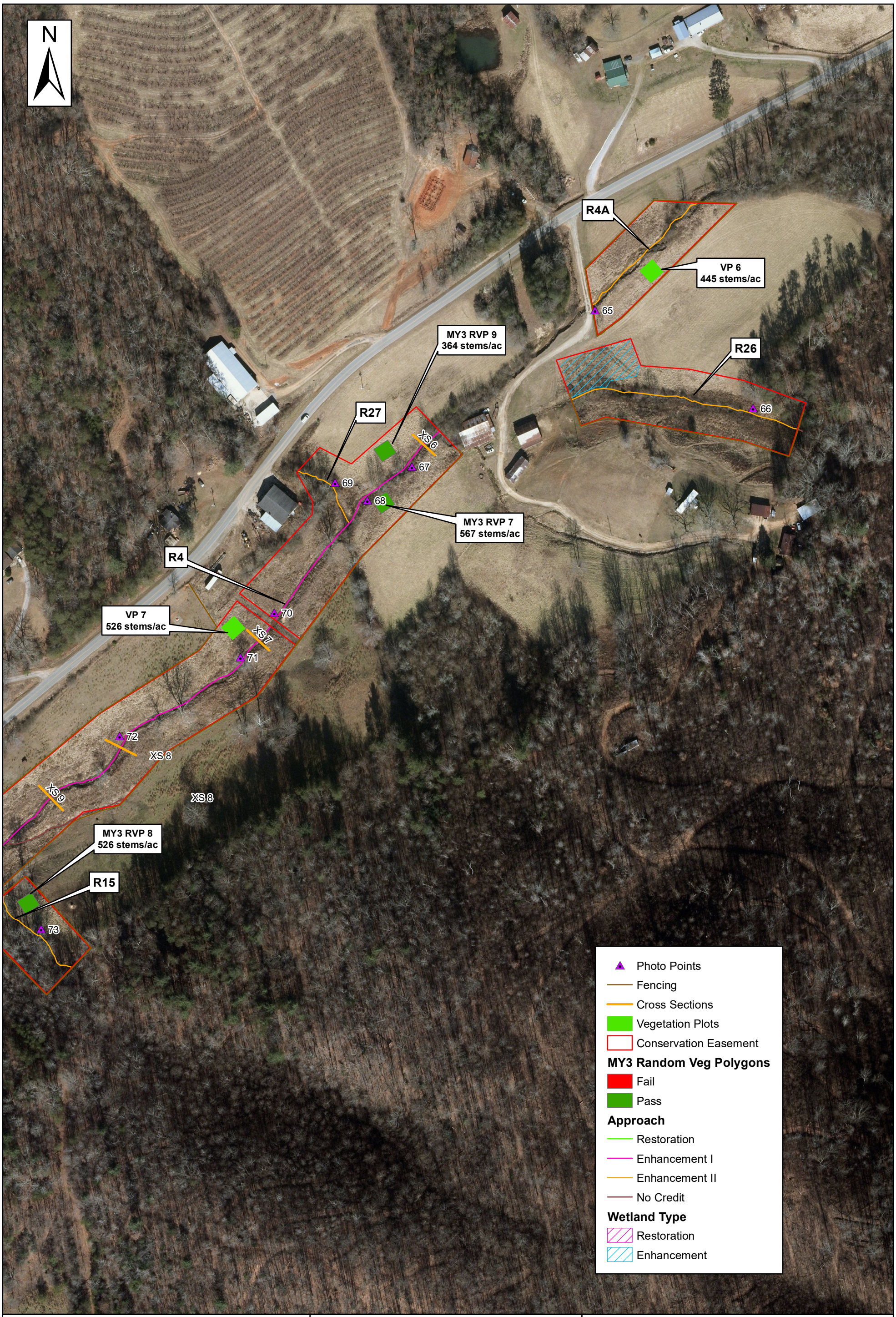
Figure 3 Overview
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

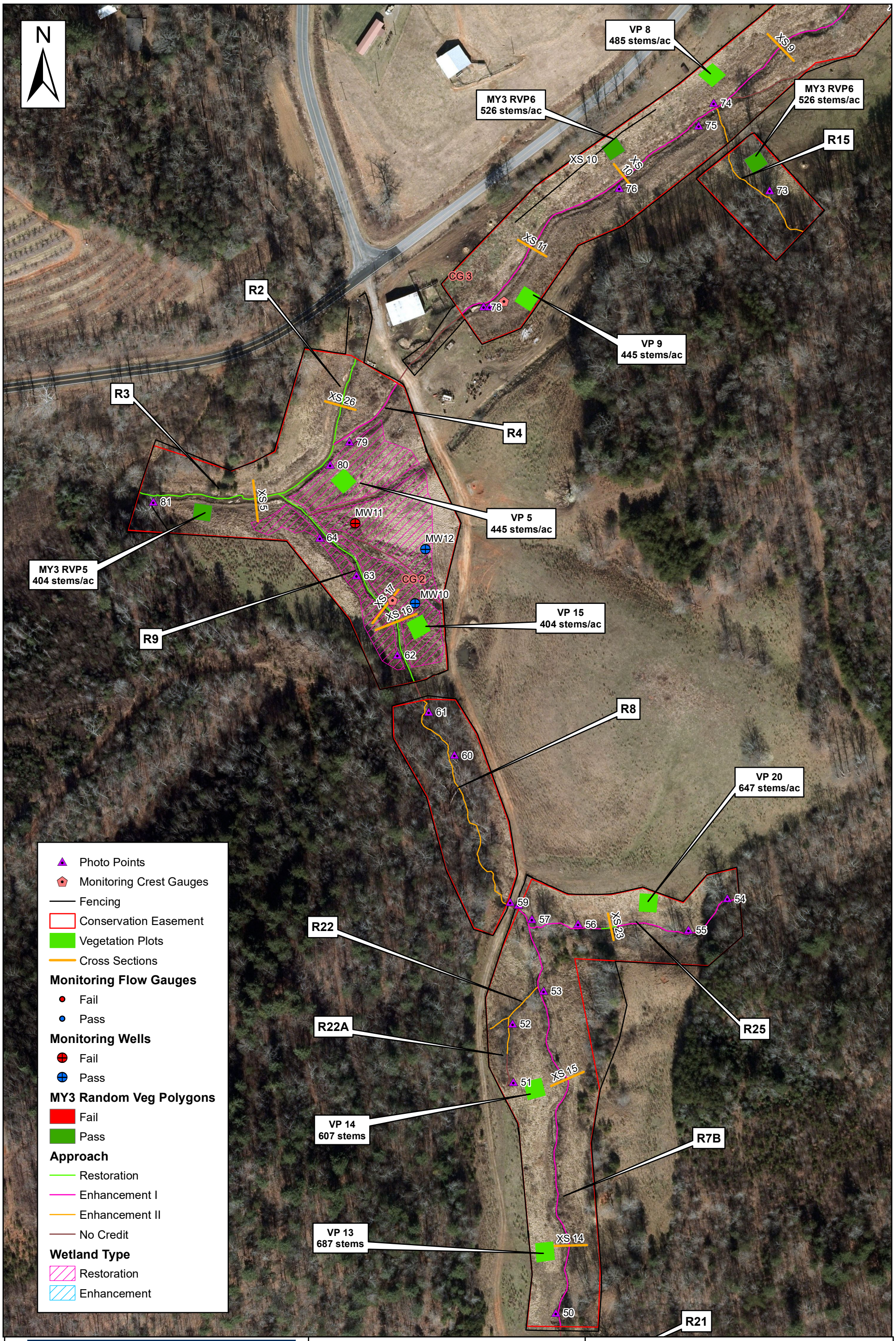
Figure 3A
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

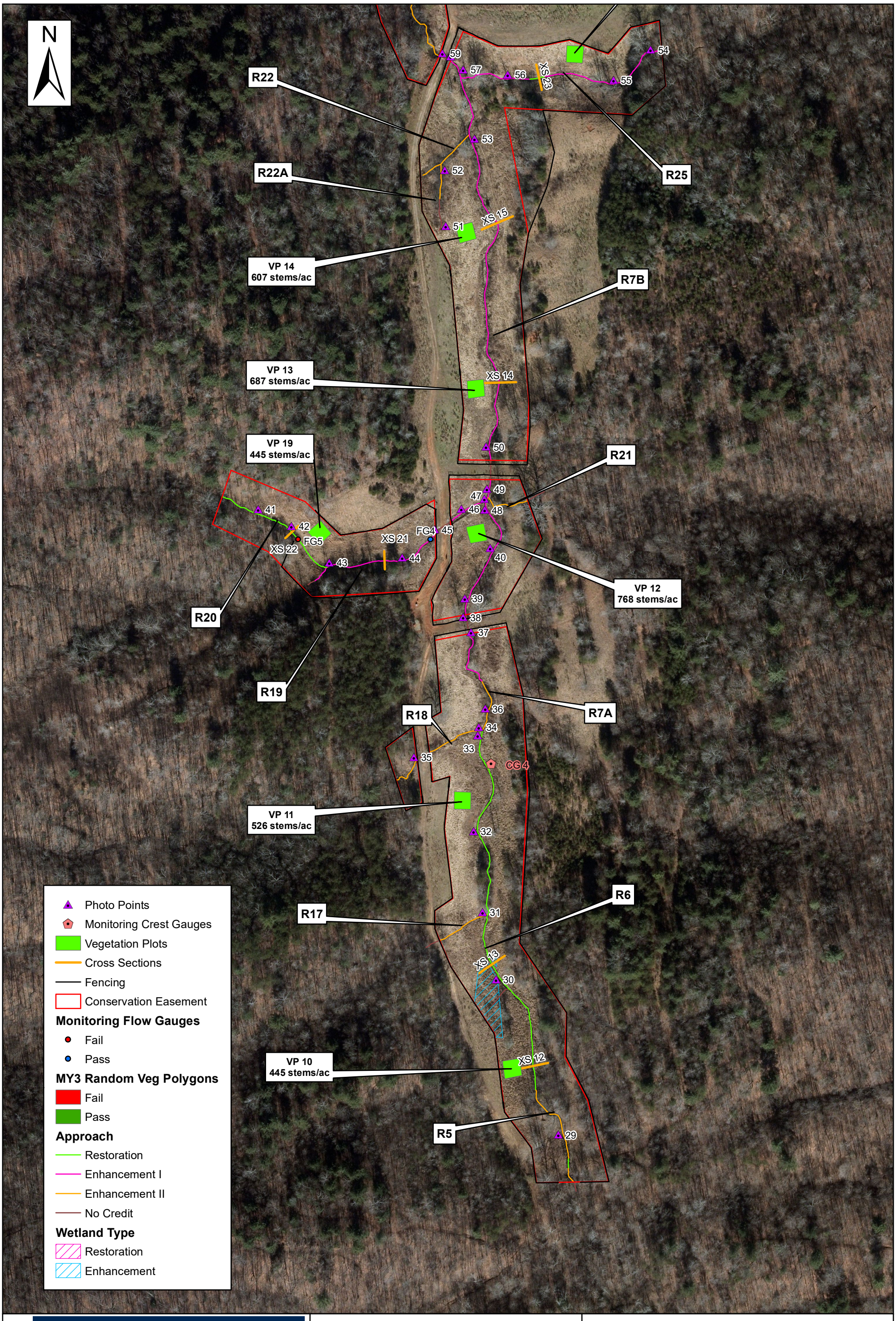
Figure 3B
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

Figure 3C
Current Conditions Plan View
Russell Gap Project



Michael Baker INTERNATIONAL

0 150 300 Feet

Figure 3D
Current Conditions Plan View
Russell Gap Project

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R1							
Assessed Length (LF):	**1,911**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			2	40	98%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	21	21	**0.00**	**0.00**	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	19	19			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	19	19			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	21	21			100%
		2. Thalweg centering at downstream of meander bend (Glide)	19	19			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion		0	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected		0	0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse		0	0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	27	27			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	27	27			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	27	27			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	27	27			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	24	24			100%

Reach ID: Reach R2							
Assessed Length (LF):	**166**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1	**0.00**	**0.00**	100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	1	1			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	1	1			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	1	1			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	1	1	0	0	100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1	0	0	100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1	0	0	100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	1	1			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R3							
Assessed Length (LF):	**406**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	1	1			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Reach ID: Reach R4a							
Assessed Length (LF):	**300**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R4							
Assessed Length (LF):	**2,063**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	17	17			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	15	15			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	15	15			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	17	17			100%
		2. Thalweg centering at downstream of meander bend (Glide)	15	15			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	20	20			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	20	20			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	20	20			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	20	20			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	15	15			100%

Reach ID: Reach R5							
Assessed Length (LF):	**193**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	8	8			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	1	1			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	1	1			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	1	1			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	8	8			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R6							
Assessed Length (LF):	**747**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	9	9			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	8	8			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	8	8			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	9	9			100%
		2. Thalweg centering at downstream of meander bend (Glide)	8	8			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	8	8			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	8	8			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	8	8			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	8	8			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	8	8			100%

Reach ID: Reach R7a							
Assessed Length (LF):	**104**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R7b							
Assessed Length (LF):	**1,216**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	9	9			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	7	7			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	7	7			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	9	9			100%
		2. Thalweg centering at downstream of meander bend (Glide)	7	7			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs					100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill					100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms					100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%					100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow					100%

Reach ID: Reach R8							
Assessed Length (LF):	**453**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R9							
Assessed Length (LF):	**446**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	7	7			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	6	6			100%
		2. Length - Sufficent (>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)	7	7			100%
		2. Thalweg centering at downstream of meander bend (Glide)	6	6			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	6	6			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	6	6			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	6	6			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	6	6			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	6	6			100%

Reach ID: Reach R10a							
Assessed Length (LF):	**367**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	7	7			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	1	1			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	1	1			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	1	1			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R10b							
Assessed Length (LF):	**105**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	2	2			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	2	2			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	2	2			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Reach ID: Reach R11							
Assessed Length (LF):	**712**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	2	2			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	38	38			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	38	38			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	38	38			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	38	38			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R12							
Assessed Length (LF):	**120**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	1	1			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	1	1			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	2	2			100%
		2. Thalweg centering at downstream of meander bend (Glide)	1	1			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	3	3			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	3	3			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	3	3			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	3	3			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	1	1			100%

Reach ID: Reach R13							
Assessed Length (LF):	**145**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	9	9			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	9	9			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	9	9			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	9	9			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R14							
Assessed Length (LF):	**570**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	2	2			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	26	26			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	26	26			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	26	26			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	26	26			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Reach ID: Reach R15							
Assessed Length (LF):	**284**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	8	8			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	8	8			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	8	8			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	0	0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R17							
Assessed Length (LF):	**107**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Reach ID: Reach R18							
Assessed Length (LF):	**176**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	2	2			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	2	2			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	2	2			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	2	2			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R19							
Assessed Length (LF):	**353**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	1	1			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	1	1			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	26	26			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	26	26			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	26	26			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	26	26			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Reach ID: Reach R20							
Assessed Length (LF):	**253**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	36	36			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	36	36			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	36	36			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	36	36			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R21							
Assessed Length (LF):	**92**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Reach ID: Reach R22, R22a							
Assessed Length (LF):	**187**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate		0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)		0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)		0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)		0			100%
		2. Thalweg centering at downstream of meander bend (Glide)		0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs		0			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill		0			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms		0			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%		0			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow		0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R25							
Assessed Length (LF):	**402**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	6	6			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	6	6			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	13	13			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	13	13			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	13	13			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	13	13			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Reach ID: Reach R26							
Assessed Length (LF):	**473**						
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	4	4			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	4	4			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	4	4			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	4	4			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 5. Visual Stream Morphology Stability Assessment
All reaches assessed October 2022

Reach ID: Reach R27							
Assessed Length (LF):							
Major Channel Category	**Channel Sub-Category**	**Metric**	**Number Stable, Performing as Intended**	**Total Number per As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	**1.Vertical Stability**	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture Substrate - Riffle maintains coarser substrate	0	0			100%
	3. Meander Pool Condition	1. Depth - Sufficent (Max Pool Depth/Mean Bkf Depth ≥ 1.5)	0	0			100%
		2. Length - Sufficent (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	0	0			100%
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	0	0			100%
		2. Thalweg centering at downstream of meander bend (Glide)	0	0			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover due to active scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting is expected			0	0	100%
	3. Mass Wasting	Banks slumping, caving or collapse			0	0	100%
				Totals	0	0	100%
3. Engineering Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs	7	7			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	7	7			100%
	2a. Piping	Structures lacking any substantial flow underneath or around sills or arms	7	7			100%
	3. Bank Position	Bank erosion within the structures extent of influence **does not** exceed 15%	7	7			100%
	4. Habitat	Pool forming structures maintaining - Max Pool Depth/Mean Bankfull Depth ratio ≥ 1.5. Rootwads/logs providing some cover at low flow	0	0			100%

Table 6. Vegetation Conditions Assessment - Assessed November 2022
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Planted Acreage: 9.8						
Vegetation Category	**Defintions**	**Mapping Threshold (acres)**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas *	Very limited cover both woody and herbaceous material.	0.10 acres	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.10 acres	N/A	0	0.00	0.0%
			Total			
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems or a size class that are obviously small given the monitoring year.	0.10 acres	N/A	0	0.00	0.0%
			Cumulative Total			
Easement Acreage: 15.8						
Vegetation Category	**Defintions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Points**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	0.10 acres	N/A	0	0.00	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	0	Polygon	0	0.00	0.0%

Russell Gap: MY3 Stream Station Photo-Points



PP-1: Reach 13, view upstream Station 10+20. (November 8, 2022)



PP-2: Reach 14, view upstream toward Reach 13 at Station 11+45. (November 8, 2022)



PP-3: Reach 14, view upstream Station 13+00. (November 8, 2022)



PP-4: Reach 14, view upstream Station 13+75. (November 8, 2022)



PP-5: Reach 14, view upstream Station 15+00. (November 8, 2022)



PP-6: Reach 14, end of reach Station 16+00. (November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-7: Reach 1, view upstream, at Station 10+20.
(November 8, 2022)



PP-8: Reach 1, view upstream Reach 1 at Station 13+00.
(November 8, 2022)



PP-9: Reach 1, view upstream at Station 15+00.
(November 8, 2022)



PP-10: Reach 1, view upstream at Station 17+25.
(November 8, 2022)



PP-11: Reach 1, view upstream at Station 20+00.
(November 8, 2022)



PP-12: Reach 1, view downstream at Station 20+00.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-13: Reach 1, view upstream at Station 20+75. (November 8, 2022)



PP-14: Reach 1, view downstream at Station 20+75. (November 8, 2022)



PP-15: Reach 1, view upstream at Station 21+50. (November 8, 2022)



PP-16: Reach 1, confluence of Reach 1 and Reach 11 at Station 22+75. (November 8, 2022)



PP-17: Reach 1, view upstream at Station 24+20. (November 8, 2022)



PP-18: Reach 1, view of upstream at Station 27+00. (November 8, 2022

Russell Gap: MY3 Stream Station Photo-Points



PP-19: Reach 1, view upstream Reach 12 at Station 29+10.
(November 8, 2022)



PP-20: Reach 1, view upstream at Station 29+20.
(November 8, 2022)



PP-21: Reach 11, view upstream at Station 10+20.
(November 8, 2022)



PP-22: Reach 11, view upstream at Station 11+50.
(November 8, 2022)



PP-23: Reach 11, view upstream at Station 12+75.
(November 8, 2022)



PP-24: Reach 11, view upstream at Station 14+50.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-25: Reach 10A, view upstream at Station 10+50.
(November 8, 2022)



PP-26: Reach 10A, view upstream at Station 12+50.
(November 8, 2022)



PP-27: Reach 10A, view upstream at Station 13+75.
(November 8, 2022)



PP-28: Reach 10B, view upstream at Station 14+50.
(November 8, 2022)



PP-29: Reach 5, view upstream at Station 11+00.
(November 8, 2022)



PP-30: Reach 6, view upstream at Station 14+50.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-31: Reach 17, view upstream at Station 11+00.
(November 8, 2022)



PP-32: Reach 6, view upstream at Station 17+50.
(November 8, 2022)



PP-33: Reach 6, view upstream at Station 19+50.
(November 8, 2022)



PP-34: Reach 18, view upstream at Station 12+00.
(November 8, 2022)



PP-35: Reach 18, view upstream at Station 10+60.
(November 8, 2022)



PP-36: Reach 7A, view upstream at Station 20+00.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-37: Reach 7B, view upstream at Station 21+75.
(November 8, 2022)



PP-38: Reach7B, view downstream at Station 22+00.
(November 8, 2022)



PP-39: Reach 7B, view upstream at Station 22+25.
(November 8, 2022)



PP-40: Reach 7B, view upstream at Station 23+50.
(November 8, 2022)



PP-41: Reach 20, view upstream at Station 10+80.
(November 8, 2022)



PP-42: Reach 20, view upstream at Station 11+50.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-43: Reach 19, view upstream at Station 10+15.
(November 8, 2022)



PP-44: Reach 19, view upstream at Station 11+85.
(November 8, 2022)



PP-45: Reach 19, view upstream at Station 12+80.
(November 8, 2022)



PP-46: Reach 19, view upstream at Station 13+20.
(November 8, 2022)



PP-47: Reach 19, view upstream at Station013+80.
(November 8, 2022)



PP-48: Reach 7B, view upstream at Station 24+10.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-49: Reach 7B, view downstream at Station 24+60.
(November 8, 2022)



PP-50: Reach 7B, view upstream at Station 25+25.
(November 8, 2022)



PP-51: Reach 22A, view upstream at Station 10+00.
(November 8, 2022)



PP-52: Reach 22A, view of upstream at Station 11+15.
(November 8, 2022)



PP-53: Reach 7B, view upstream at Station 32+00.
(November 8, 2022)



PP-54: Reach 25, view upstream at Station 10+10.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-55: Reach 25, view upstream at Station 11+20.
(November 8, 2022)



PP-56: Reach 25, view upstream at Station 13+40.
(November 8, 2022)



PP-57: Reach 7B, view downstream at Station 33+00.
(November 8, 2022)



PP-58: Reach 7B, view upstream at Station 33+20.
(November 8, 2022)



PP-59: Reach 8, view downstream at Station 34+00.
(November 8, 2022)



PP-60: Reach 8, view upstream at Station 37+00.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-61: Reach 8, view upstream at Station 38+00.
(November 8, 2022)



PP-62: Reach 9, view upstream at Station 39+20.
(November 8, 2022)



PP-63: Reach 9, view upstream at Station 41+00.
(November 8, 2022)



PP-64: Reach 9, view upstream at Station 42+00.
(November 8, 2022)



PP-65: Reach 4A, view upstream at Station 13+00.
(November 8, 2022)



PP-66: Reach 26, view upstream at Station 11+00.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-67: Reach 4, view upstream at Station 11+10.
(November 8, 2022)



PP-68: Reach 4, view upstream at Station 12+00.
(November 8, 2022)



PP-69: Reach 27, view upstream at Station 11+60.
(November 8, 2022)



PP-70: Reach 4, view upstream at Station 15+00.
(November 8, 2022)



PP-71: Reach 4, view upstream at Station 16+10.
(November 8, 2022)



PP-72: Reach 4, view upstream at Station 19+00.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-73: Reach 15, view upstream at Station 11+00.
(November 8, 2022)



PP-74: Reach 15, view upstream at Station 13+00.
(November 8, 2022)



PP-75: Reach 4, view upstream at Station 23+20.
(November 8, 2022)



PP-76: Reach 4, view upstream at Station 25+00.
(November 8, 2022)



PP-77: Reach 4, view upstream at Station 28+30.
(November 8, 2022)



PP-78: Reach 4, view upstream at Station 28+00.
(November 8, 2022)

Russell Gap: MY3 Stream Station Photo-Points



PP-79: Reach 4, view upstream at Station 32+00.
(November 8, 2022)



PP-80: Reach 3, view upstream at Station 33+00.
(November 8, 2022)



PP-81: Reach 3, view upstream at Station 36+40.

(November 8, 2022)

MY3 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003



Photo 1. Vegetation Plot 1 – (October 13, 2022).



Photo 2. Vegetation Plot 2 – (October 13, 2022).



Photo 3. Vegetation Plot 3 – (October 13, 2022).



Photo 4. Vegetation Plot 4 – (October 13, 2022).



Photo 5. Vegetation Plot 5- (October 13, 2022).



Photo 6. Vegetation Plot 6- (October 13, 2022).

MY3 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003



Photo 7. Vegetation Plot 7 – (November 8, 2022).



Photo 8. Vegetation Plot 8 – (November 8, 2022).



Photo 9. Vegetation Plot 9 – (October 14, 2022).



Photo 10. Vegetation Plot 10 – (October 14, 2022).



Photo 11. Vegetation Plot 11 – (October 14, 2022).



Photo 12. Vegetation Plot 12 – (October 14, 2022).

MY3 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003



Photo 13. Vegetation Plot 13 – (October 14, 2022).



Photo 14. Vegetation Plot 14 – (October 14, 2022).



Photo 15. Vegetation Plot 15 – (October 14, 2022).



Photo 16. Vegetation Plot 16 – (October 14, 2022).



Photo 17. Vegetation Plot 17 – (October 14, 2022).



Photo 18. Vegetation Plot 18 – (October 14, 2022).

MY3 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003



Photo 19. Vegetation Plot 19 – (October 14, 2022).



Photo 20. Vegetation Plot 20 – (October 14, 2022).



Photo 21. Random Vegetation Plot 1- (August 17, 2022).



Photo 22. Random Vegetation Plot 2 – (August 17, 2022).



Photo 23. Random Vegetation Plot 3 – (August 17, 2022)



Photo 24. Random Vegetation Plot 4 – Transect (August 17, 2022).

MY3 Vegetation Monitoring Plot Photos
Russell Gap – DMS Project #100003



Photo 25. Random Vegetation Plot 5 – (August 17, 2022).



Photo 26. Random Vegetation Plot 6 – (August 17, 2022).



Photo 27. Random Vegetation Plot 7 – (November 8, 2022).



Photo 28. Random Vegetation Plot 8 – (November 8, 2022).



Photo 29. Random Vegetation Plot 9 – (November 8, 2022).

Russell Gap MY3 Monitoring Gauges and Overbank Photographs



Monitoring Well 1. (October 13, 2022)



Monitoring Well 2. (October 13, 2022)



Monitoring Well 3. (October 13, 2022)



Monitoring Well 4. (October 13, 2022)



Monitoring Well 5. (October 13, 2022)



Monitoring Well 6. (October 13, 2022)

Russell Gap MY3 Monitoring Gauges and Overbank Photographs



Monitoring Well 7. (October 19, 2021)



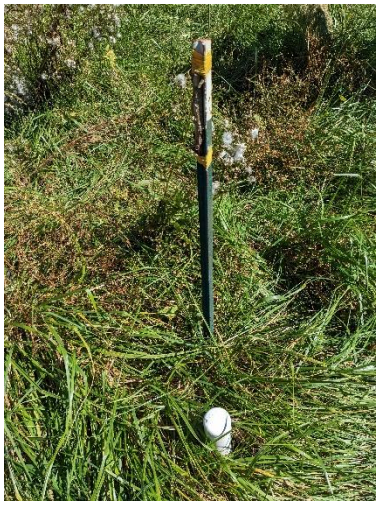
Monitoring Well 8. (October 13, 2022)



Monitoring Well 9. (October 13, 2022)



Monitoring Well 10. (October 14, 2022)



Monitoring Well 11. (October 14, 2022)



Monitoring Well 12. (October 14, 2022)

Russell Gap MY3 Monitoring Gauges and Overbank Photographs



Flow Gauge 1. Reach 11. (August 17, 2022)



Flow Gauge 2. Reach 14. (August 17, 2022)



Flow Gauge 3. Reach 13. (August 17, 2022)



Flow Gauge 4. Reach 19. (August 17, 2022)



Flow Gauge 5. Reach 20. (October 13, 2022)



Crest Gauge 1 Reach 1. (October 13, 2022)

Russell Gap MY3 Monitoring Gauges and Overbank Photographs



Crest Gauge 2 R9.

BKF reading 8.25 inches (October 14, 2022)



Crest Gauge 2 R9. (October 14, 2022)



Crest Gauge 3 R4. (October 14, 2022)



Crest Gauge 4 R6. (October 14, 2022)

APPENDIX C

Vegetation Plot Data

Table 7: Planted Stem Counts by Plot and Species
DMS Project Code 100003. Project Name: Russell Gap Mitigation Project

Current Plot Data (MY3 2022)

Scientific Name	Common Name	Species Type	157329-01-0001			157329-01-0002			157329-01-0003			157329-01-0004			157329-01-0005			157329-01-0006			157329-01-0007			157329-01-0008			157329-01-0009		
			P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree																	8	8			6		5	5		1	1
Acer rubrum		Tree																											
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree		1	1		1	1			1	1	5	6					1	1				3		3			
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree										1		1															
Betula lenta		Tree										1		1															
Betula nigra	River Birch, Red Birch	Tree	3		3	3	1	4	8		8	1		1	1		1	4		4									
Carpinus caroliniana		Shrub Tree																											
Cercis canadensis		Shrub Tree				1		1													2		2	5		5			
Cornus amomum	Silky Dogwood	Shrub Tree																									4	1	5
Cornus florida	Flowering Dogwood	Shrub Tree																											
Corylus americana	American Hazelnut, American Filbert	Shrub																											
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree																											
Diospyros virginiana	American Persimmon, Possumwood	Tree		1	1	1	1	2		2	2										2		2				1		1
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree		1	1				1		1			1													2	1	3
Ilex opaca																													
Hamamelis virginiana		Shrub Tree																											
Juglans nigra	Black Walnut	Tree													1		1										1		1
Liriodendron tulipifera		Tree				4		4	1		1	4		4	3		3				3		3				1		1
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree																											
Pinus strobus																													
Platanus occidentalis	Sycamore, Plane-tree	Tree	3	2	5	2	6	8			1	5	1	6	1	5	6	6		6	5	2	7						1
Prunus nigra																									1	1			
Quercus																													
Quercus alba	White Oak	Tree																							1	1			
Quercus falcata	Spanish Oak, Southern Red Oak	Tree							2		2																		
Quercus lyrata	Overcup Oak	Tree									1					1	1												
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree																									2		2
Quercus pagoda																													
Quercus phellos	Willow Oak	Tree	5		5	3		3	4	1	5		1	1	5		5	1		1	1		1	4		4			
Rhus copallinum		Shrub Tree																											
Salix nigra	Black Willow	Tree											2	2														1	1
Unknown																													
		Stem count	11	5	16	14	9	23	16	3	22	13	9	23	11	6	17	11	9	20	13	2	21	12	7	19	11	4	16
		size (ares)		1			1			1			1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	3	4	6	6	4	7	5	2	9	6	4	9	5	2	6	3	2	5	5	1	6	3	3	6	6	4	9
		Stems per ACRE	445.1542	202.3428	647.497	566.5599	364.2171	930.777	647.497	121.4057	890.3084	526.0913	364.2171	930.777	445.1542	242.8114	687.9656	445.1542	364.2171	809.3713	526.0913	80.93713	849.8398	485.6228	283.2799	768.9027	445.1542	161.8743	647.497

Current Plot Data (MY3 2022)

Scientific Name	Common Name	Species Type	157329-01-0010			157329-01-0011			157329-01-0012			157329-01-0013			157329-01-0014			157329-01-0015			157329-01-0016			157329-01-0017			157329-01-0018		
			P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree											1	1															
Acer rubrum		Tree							1		1																		
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree		2	2	2	3	5		1	1					1	1	1		1									
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree																											
Betula lenta		Tree				1		1																					
Betula nigra	River Birch, Red Birch	Tree							2		2							5		5	4		4						
Carpinus caroliniana		Shrub Tree							1		1	1		1															
Cercis canadensis		Shrub Tree				3		3	1		1	4		4															
Cornus amomum	Silky Dogwood	Shrub Tree	2		2																			5		5	8		8
Cornus florida	Flowering Dogwood	Shrub Tree																											
Corylus americana	American Hazelnut, American Filbert	Shrub																											
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree																											
Diospyros virginiana	American Persimmon, Possumwood	Tree				2		2					1	1	1		1	1		1									
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2		2	1		1	5		5	1		1	6		6							7		7	5		5
Ilex opaca																													
Hamamelis virginiana		Shrub Tree										2		2															
Juglans nigra	Black Walnut	Tree										2		2	2		2				1		1				1		1
Liriodendron tulipifera		Tree	2		2	1		1	1	2	3	2		2	3		3	1		1	1		1						
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree																											
Pinus strobus																													
Platanus occidentalis	Sycamore, Plane-tree	Tree	4		4				3	6	9		1	1	1	1	2				3		3						
Prunus nigra																													
Quercus																													
Quercus alba	White Oak	Tree	1		1							2		2										4		4			
Quercus falcata	Spanish Oak, Southern Red Oak	Tree				3		3	4		4	1		1	1		1							5		5			
Quercus lyrata	Overcup Oak	Tree																											
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree																											
Quercus pagoda																													
Quercus phellos	Willow Oak	Tree							1		1	2		2	1		1	2		2	4		4						
Rhus copallinum		Shrub Tree																											
Salix nigra	Black Willow	Tree		1	1																								
Unknown																													
		Stem count	11	3	14	13	3	16	19	9	28	17	3	20	15	2	17	10	0	10	13	0	13	21	0	21	14	0	14
		size (ares)		1			1			1			1			1			1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02	
		Species count	5	2	7	7	1	7	9	3	10	9	3	12	7	2	8	5	0	5	5	0	5	4	0	4	3	0	3
		Stems per ACRE	445.1542	121.4057	566.5599	526.0913	121.4057	647.497	768.9027	364.2171	1133.12	687.9656	121.4057	809.3713	607.0285	80.93713	687.9656	404.6856	0	404.6856	526.0913	0	526.0913	849.8398	0	849.8398	566.5599	0	566.5599

Table 7: CVS Density Per Plot
DMS Project Code 100003. Project Name: Russell Gap Mitigation Project

			Current Plot Data (MY3 2022)																									
			157329-01-0019			157329-01-0020			157329-01-RV1_MY3			157329-01-RV2_MY3			157329-01-RV3_MY3			157329-01-RV4_MY3			157329-01-RV5_MY3			157329-01-RV6_MY3			157329-01-RV7_MY3		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree					4	4																6		6	4		4
Acer rubrum		Tree	2		2				2		2																		
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree																3		3									
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree																											
Betula lenta		Tree																											
Betula nigra	River Birch, Red Birch	Tree				1		1				6		6	1		1	1		1	1		1				1		1
Carpinus caroliniana		Shrub Tree	1		1																								
Cercis canadensis		Shrub Tree	1		1																								
Cornus amomum	Silky Dogwood	Shrub Tree				2		2							4		4												
Cornus florida	Flowering Dogwood	Shrub Tree																											
Corylus americana	American Hazelnut, American Filbert	Shrub																											
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree																											
Diospyros virginiana	American Persimmon, Possumwood	Tree																			2		2	1		1	1		1
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2		2	4	1	5				3		3	1		1												
Ilex opaca									3		3																		
Hamamelis virginiana		Shrub Tree																						1		1			
Juglans nigra	Black Walnut	Tree	1		1	5		5	2		2				2		2										1		1
Liriodendron tulipifera		Tree	3		3	2		2	5		5										1		1	1		1	1		1
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree				1		1																					
Pinus strobus									1		1																		
Platanus occidentalis	Sycamore, Plane-tree	Tree	3	5	8																6		6	2		2	1		1
Prunus nigra									2		2				1		1												
Quercus							1	1																					
Quercus alba	White Oak	Tree																											
Quercus falcata	Spanish Oak, Southern Red Oak	Tree				1		1																					
Quercus lyrata	Overcup Oak	Tree																						2		2			
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree				1		1																					
Quercus pagoda															4		4												
Quercus phellos	Willow Oak	Tree										1		1	1		1										5		5
Rhus copallinum		Shrub Tree																											
Salix nigra	Black Willow	Tree										1		1															
Unknown																													
		Stem count	11	5	16	16	2	18	13	0	15	5	0	11	13	0	14	0	0	4	9	0	10	7	0	13	9	0	14
		size (ares)	1			1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	1	6	7	2	8	5	0	5	3	0	3	6	0	6	0	0	0	3	0	3	5	0	5	5	0	5
		Stems per ACRE	445.1542	202.3428	647.497	647.497	80.93713	728.4342	607.0285	0	607.0285	445.1542	0	445.1542	566.5599	0	566.5599	161.8743	0	161.8743	404.6856	0	404.6856	526.0913	0	526.0913	566.5599	0	566.5599

			Current Plot Data (MY3 2022)						Annual Means													
			157329-01-RV8_MY3			157329-01-RV9_MY3			MY3 (2022)			MY2 (2021)			MY1 (2020)			MY0 (2020)		
Scientific Name	Common Name	Species Type	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T	P	V	T
Acer negundo		Tree	3		3					38	38	4	4	14	15	15	20			
Acer rubrum		Tree							3	2	5	8	8	17	6	6	6			
Alnus serrulata	Tag Alder, Smooth Alder, Hazel Alder	Shrub Tree							7	19	26	11	11	46	4	4	14			
Asimina triloba	Common Pawpaw, Indian-banana	Shrub Tree							1		1	1	1	1	1	1	1			
Betula lenta		Tree							2		2	3	3	3	4	4	4			
Betula nigra	River Birch, Red Birch	Tree				2		2	32	11	43	60	60	60	50	50	50			
Carpinus caroliniana		Shrub Tree							3		3	4	4	4	11	11	11			
Cercis canadensis		Shrub Tree				1		1	17		17	32	32	32	26	26	26			
Cornus amomum	Silky Dogwood	Shrub Tree	3		3				21	8	29	31	31	32	38	38	38			
Cornus florida	Flowering Dogwood	Shrub Tree										2	2	2	2	2	2			
Corylus americana	American Hazelnut, American Filbert	Shrub										1	1	1	1	1	1			
Crataegus	Hawthorn, Haw, Thornapple	Shrub Tree													1	1	1			
Diospyros virginiana	American Persimmon, Possumwood	Tree	2		2				8	11	19	15	15	16	12	12	12			
Fraxinus pennsylvanica	Green Ash, Red Ash	Tree	2		2				36	10	46	47	47	49	49	49	49			
Ilex opaca										5	5									
Hamamelis virginiana		Shrub Tree							2	1	3	2	2	2						
Juglans nigra	Black Walnut	Tree	2		2				14	7	21	18	18	18	21	21	21			
Liriodendron tulipifera		Tree	1		1	4		4	32	11	43	54	54	59	62	62	62			
Nyssa sylvatica	Sour Gum, Black Gum, Pepperidge	Tree				1		1	1		1	1	1	1	7	7	7			
Pinus strobus										1	1									
Platanus occidentalis	Sycamore, Plane-tree	Tree				1		1	36	41	77	55	55	114	44	44	54			
Prunus nigra										3	3									
Quercus										1	1									
Quercus alba	White Oak	Tree							7	1	8	14	14	14	9	9	9			
Quercus falcata	Spanish Oak, Southern Red Oak	Tree							17		17	23	23	23	25	25	25			
Quercus lyrata	Overcup Oak	Tree								4	4	1	1	1						
Quercus michauxii	Basket Oak, Swamp Chestnut Oak	Tree							3		3	3	3	3	5	5	5			
Quercus pagoda																				
Quercus phellos	Willow Oak	Tree							33	9	42	45	45	45	52	52	52			
Rhus copallinum		Shrub Tree										4	4	4						
Salix nigra	Black Willow	Tree								5	5	1	1	2						
Unknown																		388	388	388
		Stem count			13			9	275	188	463	440	440	563	445	445	470	388	388	388
		size (ares)	1			1			20			20			29			20		
		size (ACRES)	0.02			0.02			0.49			0.49			0.49			0.72		
		Species count	6	0	6	5	0	5	19	19	26	25	25	25	22	22	22	1	1	1
		Stems per ACRE	526.0913	0	526.0913	364.2171	0	364.2171	556.4428	380.4045	936.8473	890.3084	890.3084	1139.19	900.4	900.4	951.0	541.4415	541.4415	541.4415

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

APPENDIX D

Stream Geomorphology Data

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 1

Year 3 Survey Collected: September 2022

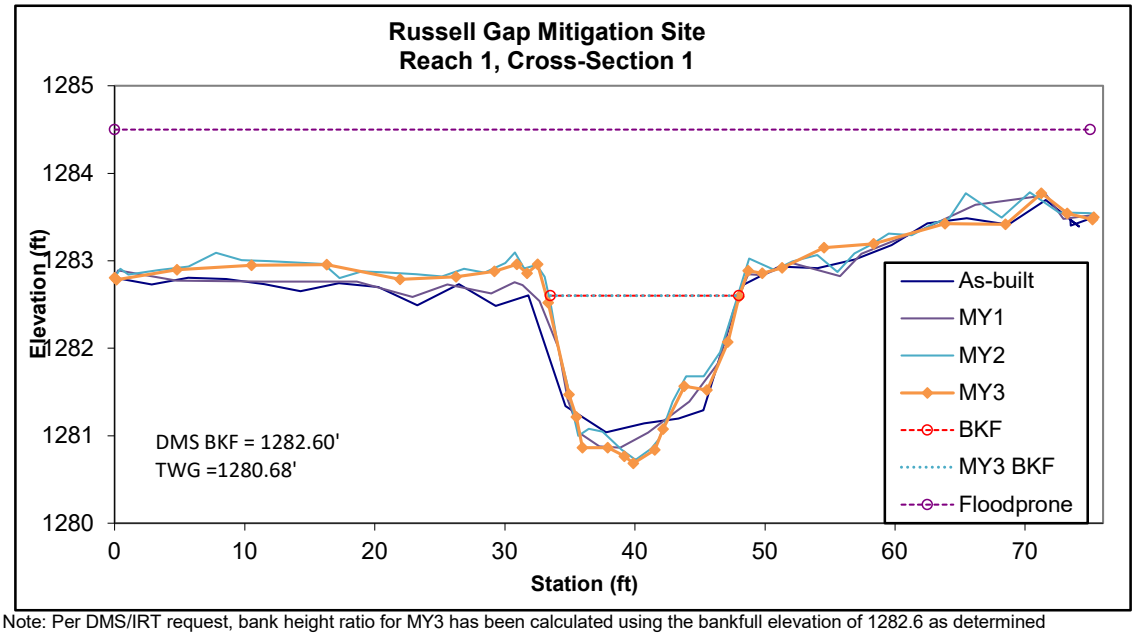


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	18.9	14.8	1.3	1.90	11.7	1.1	5.1	1282.60	1282.88



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1282.6 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 2

Year 3 Survey Collected: September 2022



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	19.8	15.8	1.3	2.0	12.6	--	--	1282.20	1282.40

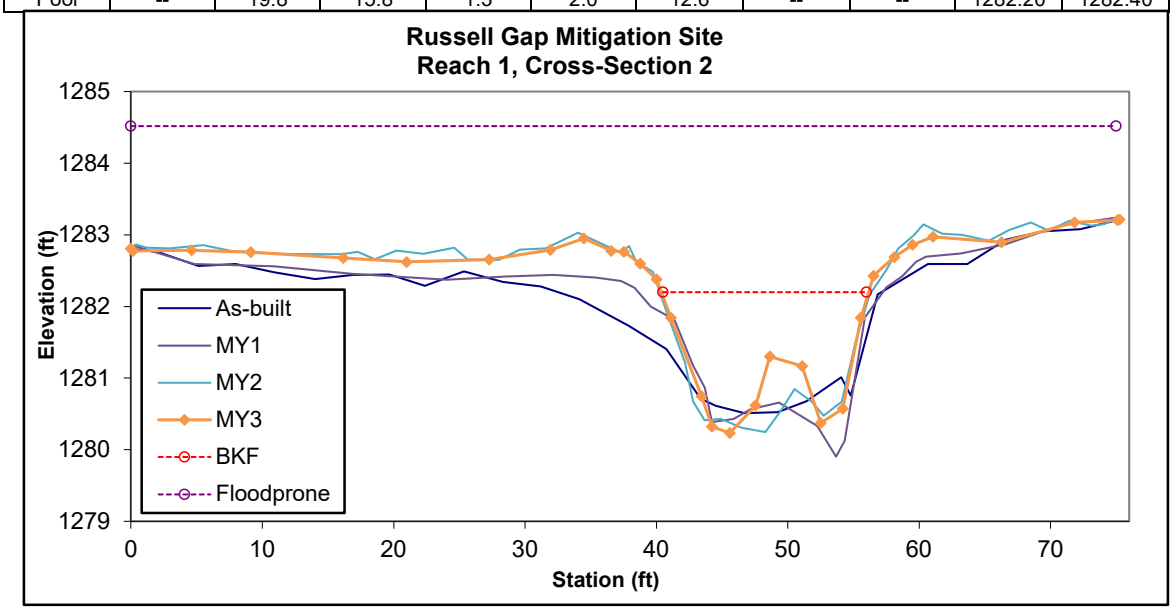


Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 3

Year Survey Collected: September 2022

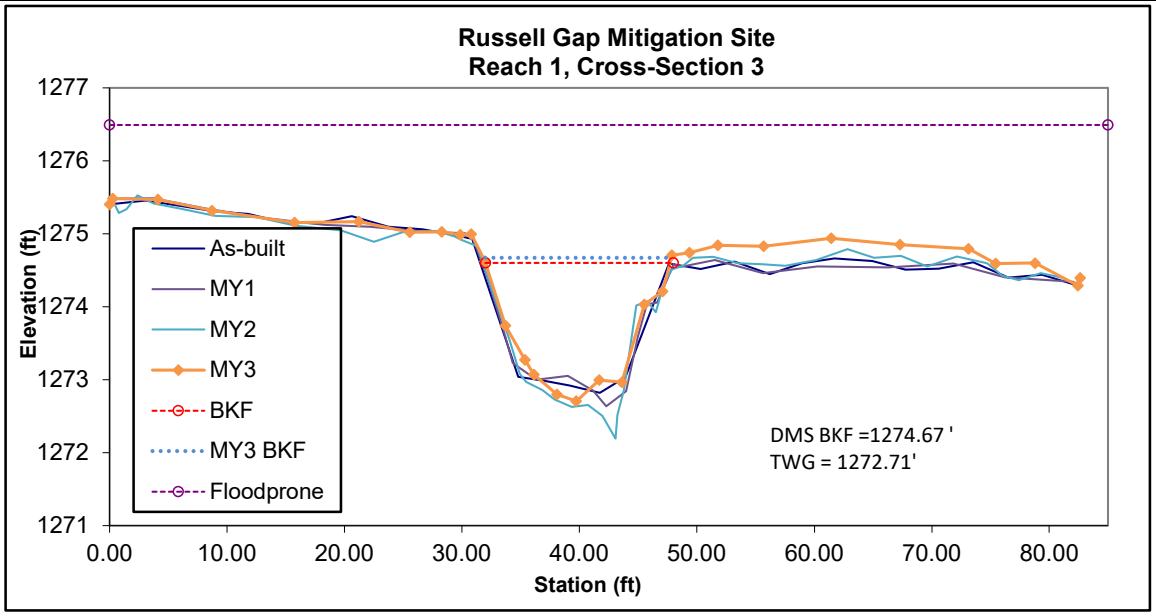


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	19.5	15.7	1.2	1.9	12.7	1.0	5.2	1274.60	1274.71



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1274.62 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 4

Year 3 Survey Collected: September 2022



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	---	25.1	15.1	1.7	2.7	9.1	---	---	1274.00	1274.19

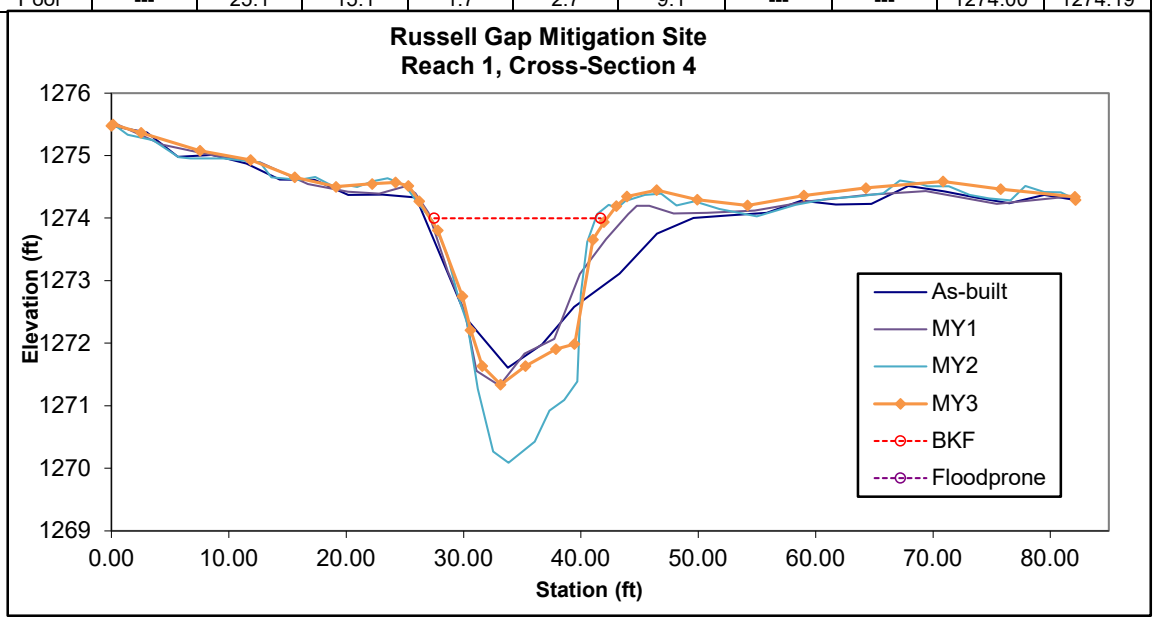


Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 5

Year 3 Survey Collected: September 2022

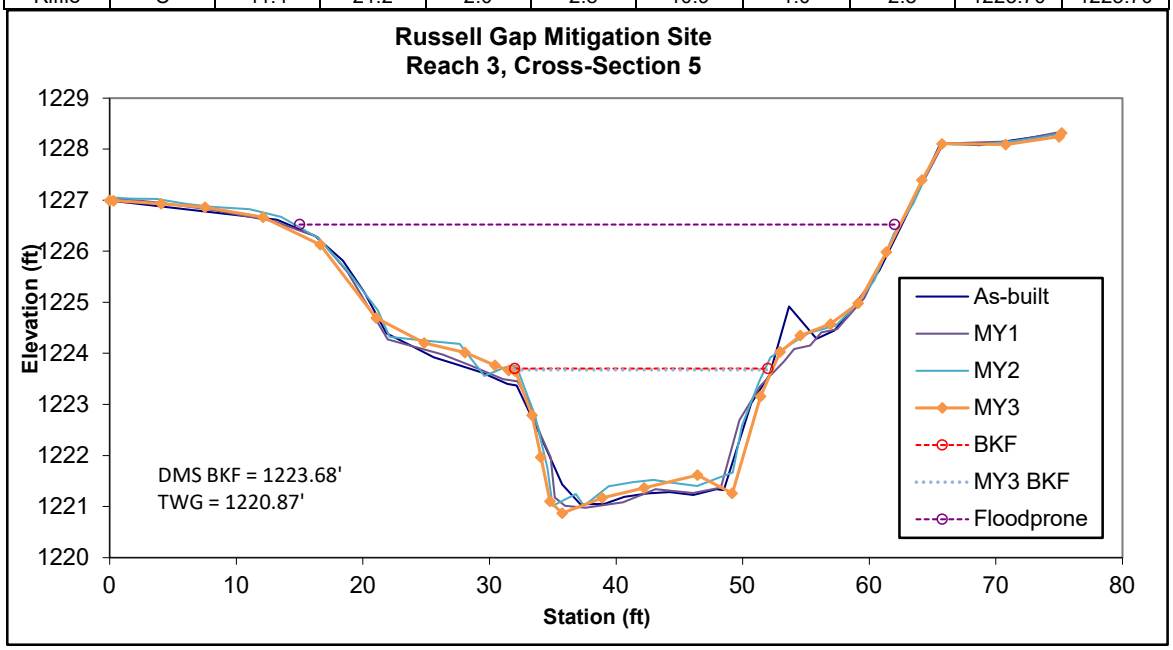


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	41.4	21.2	2.0	2.8	10.9	1.0	2.8	1223.70	1223.70



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1223.68 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 6

Year 3 Survey Collected: September 2022

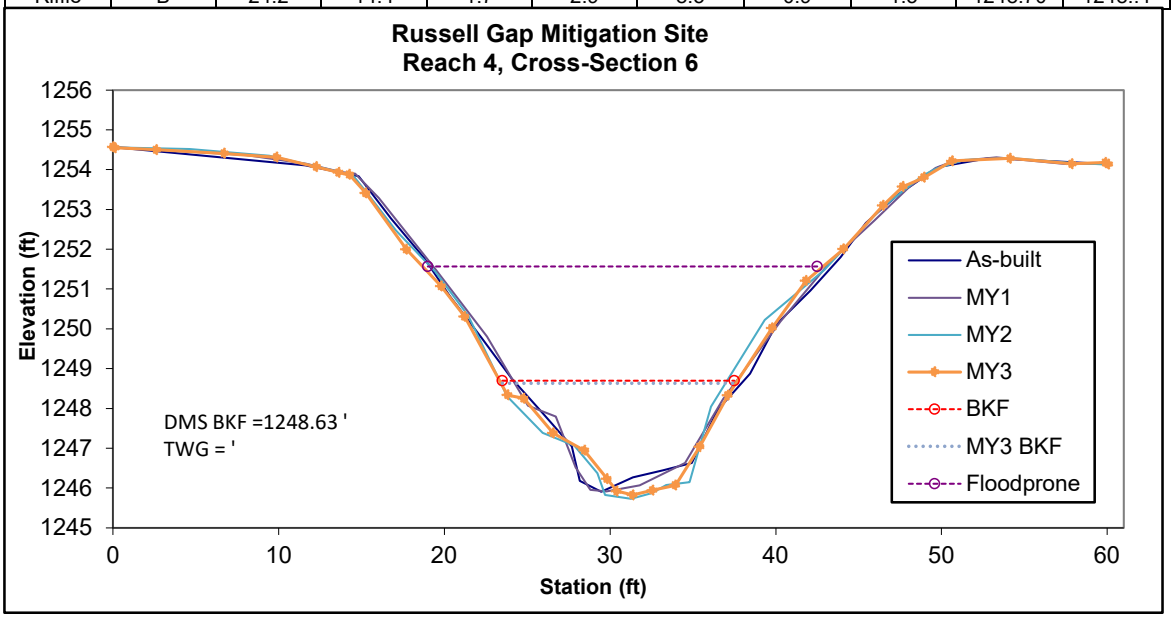


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	24.2	14.4	1.7	2.9	8.5	0.9	1.5	1248.70	1248..4



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1248.63 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 7

Year 3 Survey Collected: September 2022

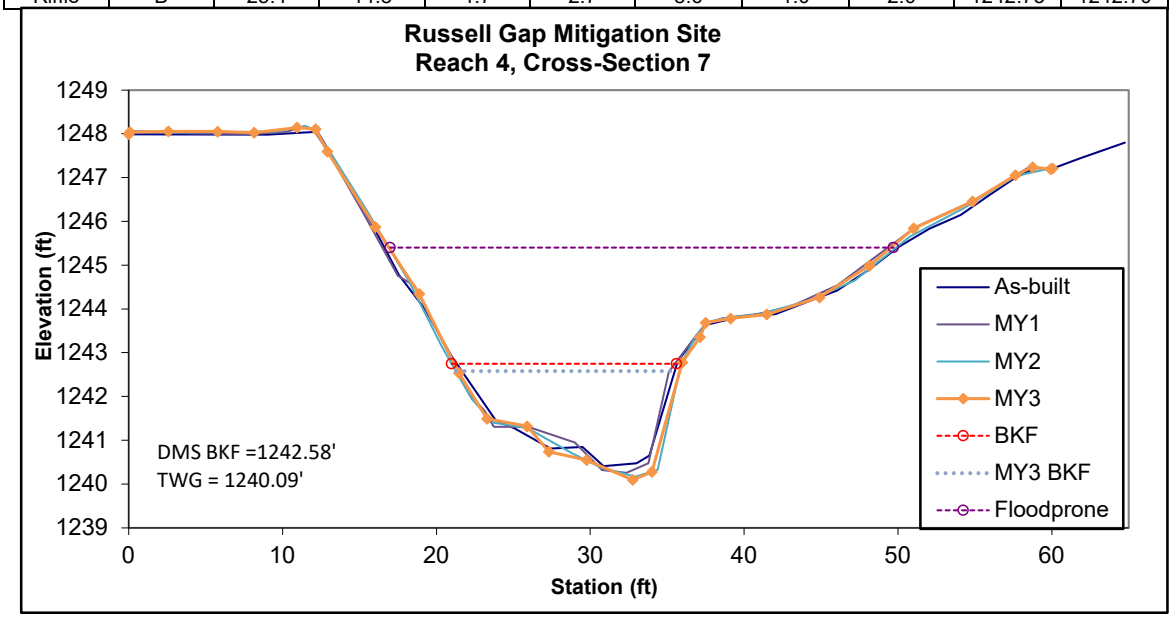


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	25.4	14.8	1.7	2.7	8.6	1.0	2.0	1242.75	1242.70



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1242.58 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 8

Year 3 Survey Collected: September 2022

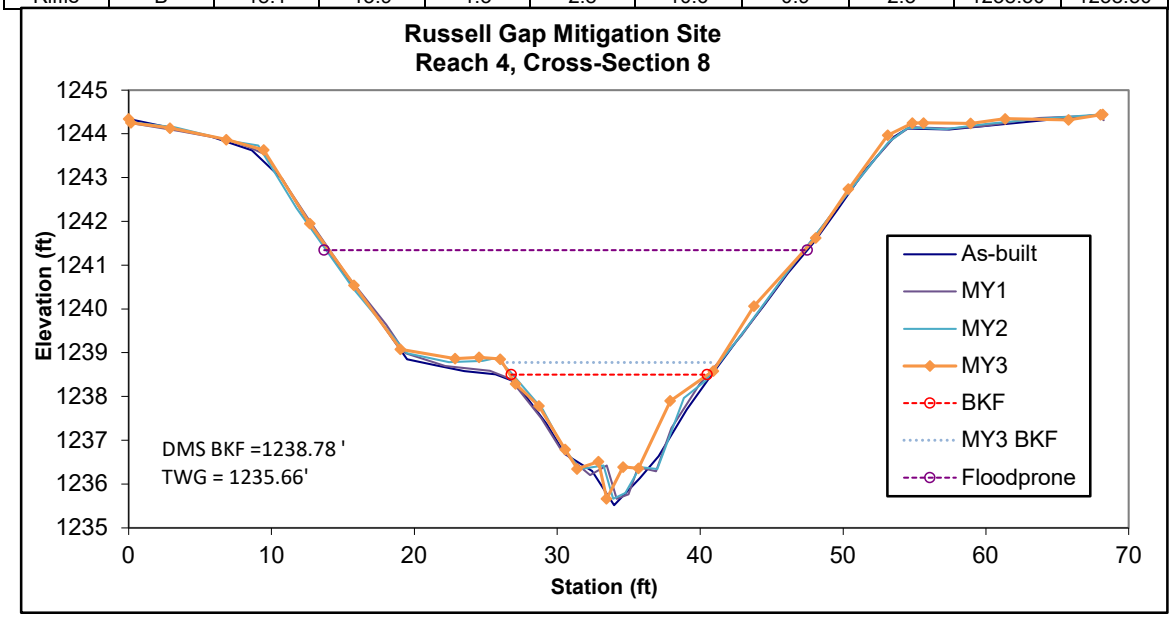


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	18.1	13.9	1.3	2.8	10.6	0.9	2.3	1238.50	1238.50



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1238.78 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 9

Year 3 Survey Collected: September 2022

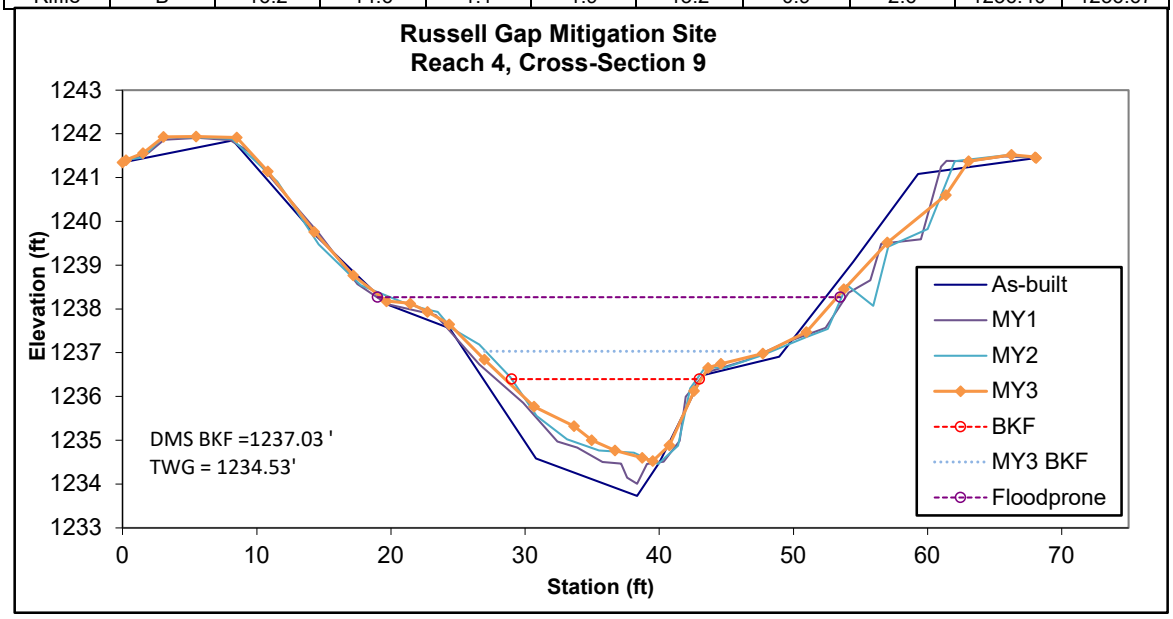


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	16.2	14.6	1.1	1.9	13.2	0.9	2.6	1236.40	1236.67



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1237.03 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 10

Year 3 Survey Collected: September 2022

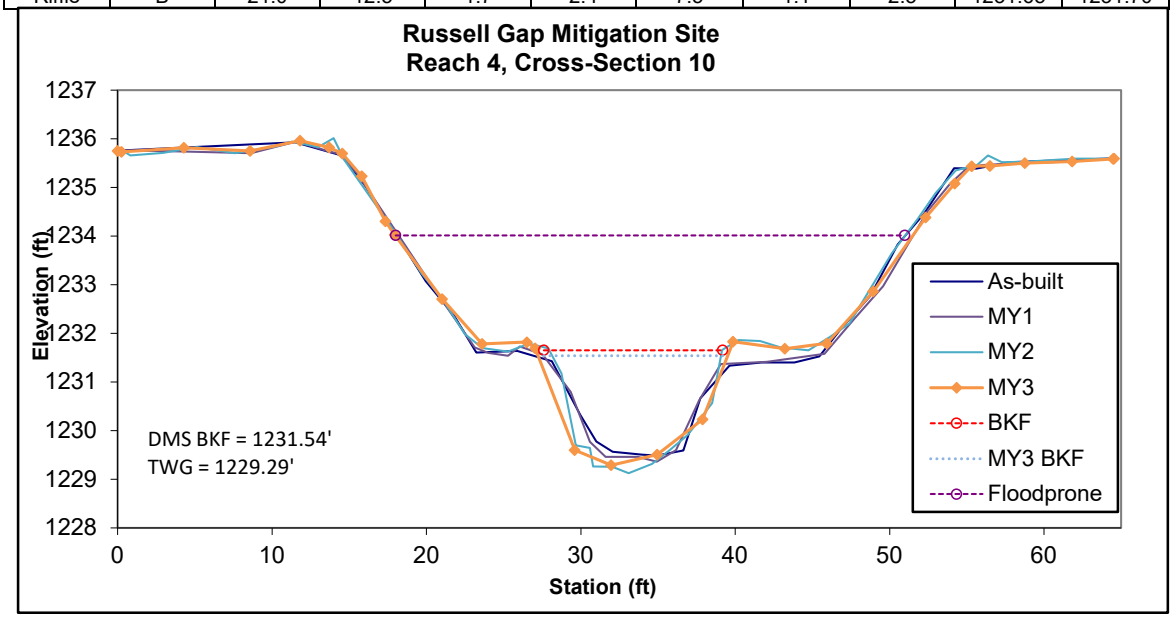


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	21.0	12.5	1.7	2.4	7.5	1.1	2.5	1231.65	1231.70



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1231.54 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 11

Year 3 Survey Collected: September 2022

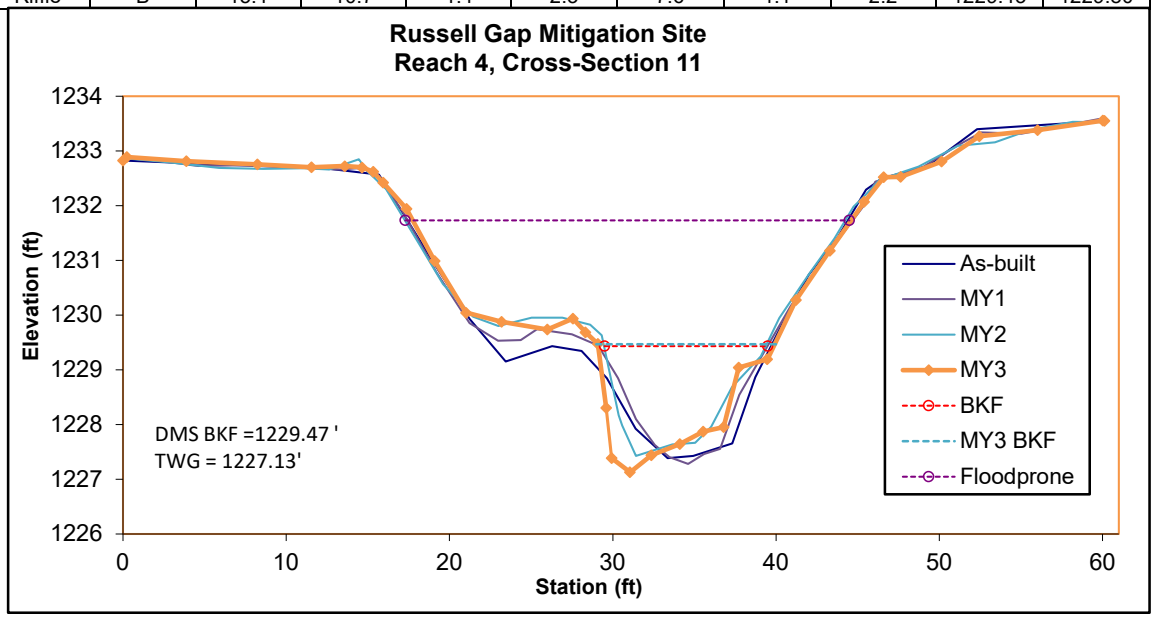


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	15.1	10.7	1.4	2.3	7.6	1.1	2.2	1229.43	1229.80



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1229.47 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

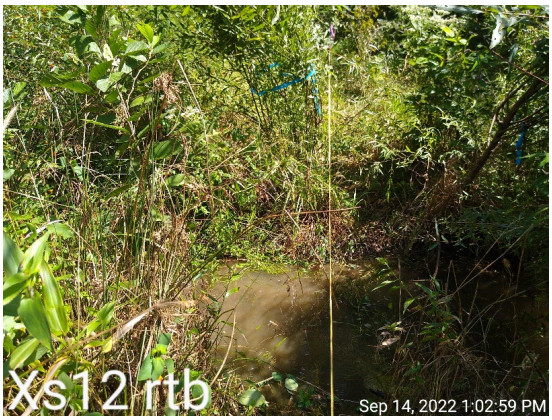
Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 12

Year 3 Survey Collected: September 2022



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	11.7	15.7	0.7	2.0	20.9	---	---	1300.30	1300.30

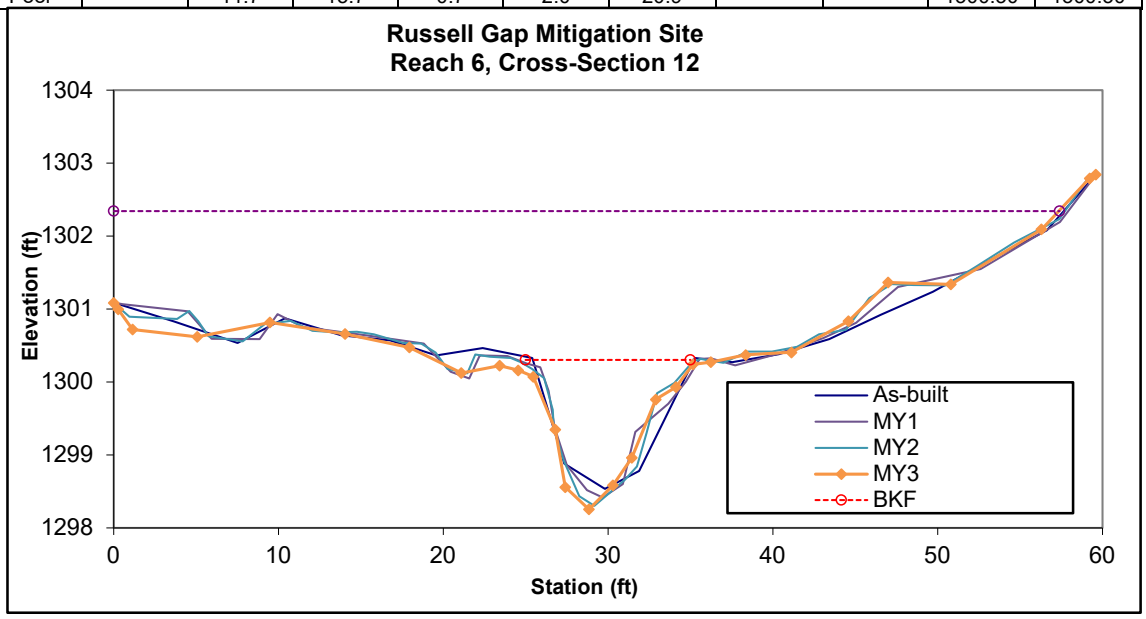


Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 13

Year 3 Survey Collected: September 2022

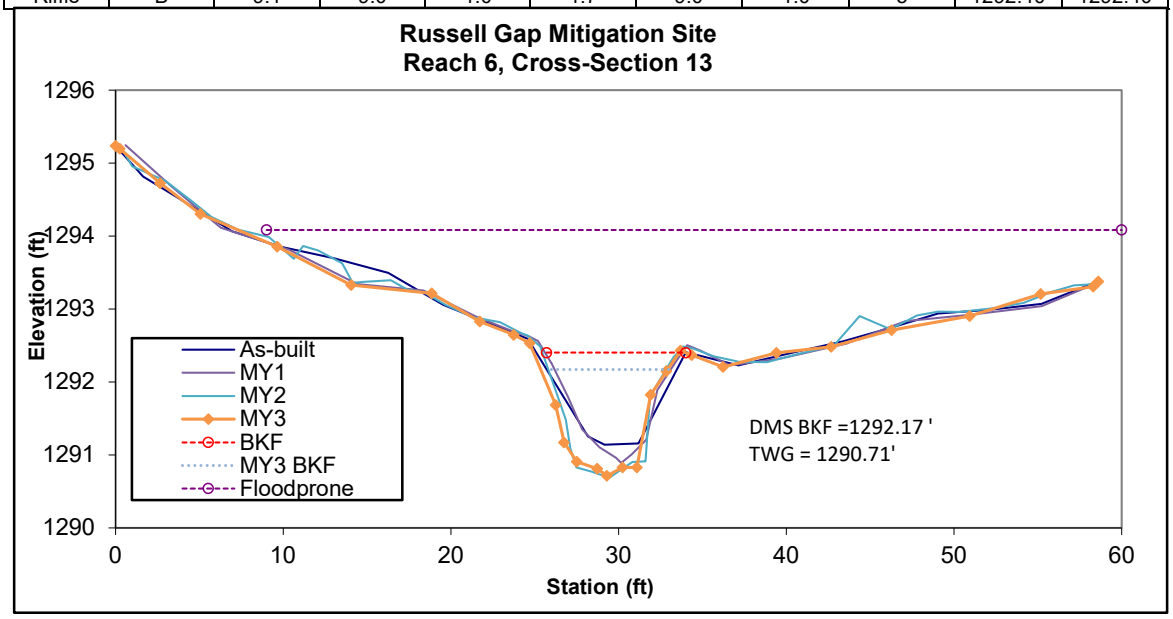


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	9.1	9.0	1.0	1.7	9.0	1.0	5	1292.40	1292.40



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1292.17 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

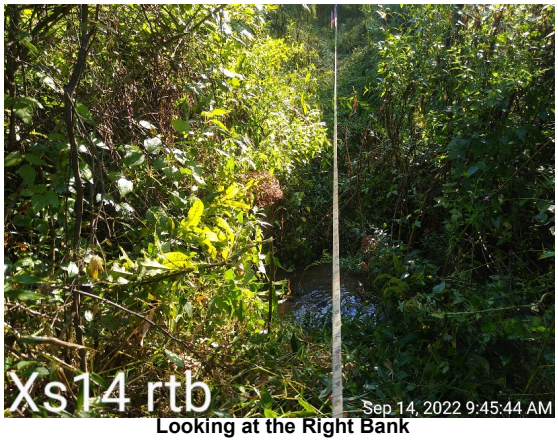
Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 14

Year 3 Survey Collected: September 2022

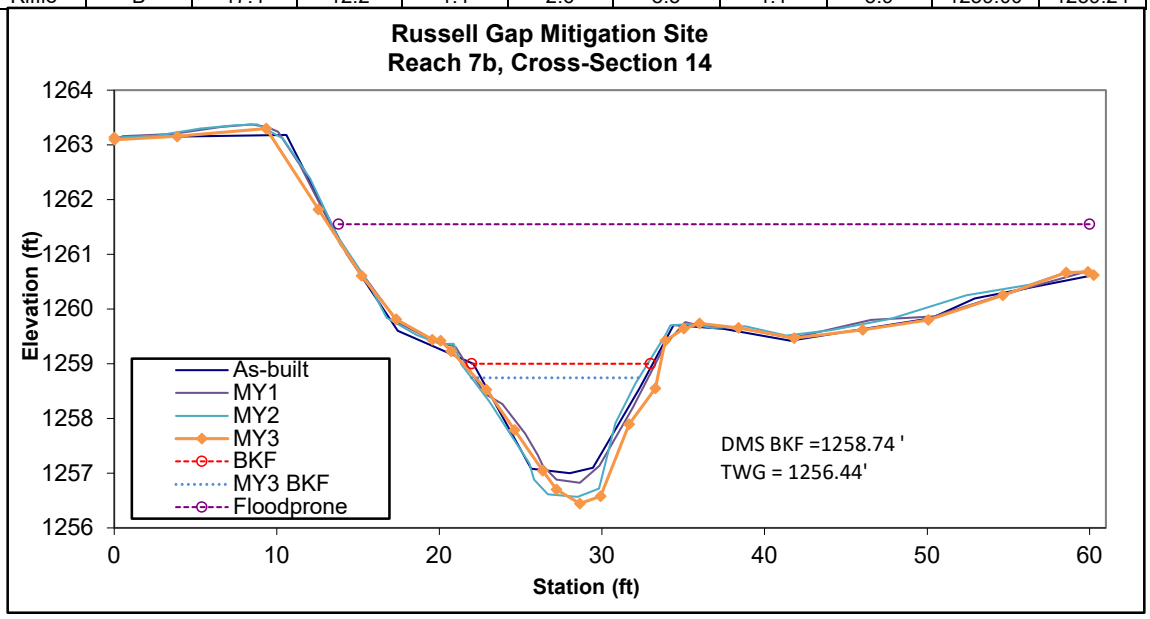


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	17.4	12.2	1.4	2.6	8.5	1.1	3.9	1259.00	1259.24



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1258.82 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 15

Year 3 Survey Collected: September 2022



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	13.1	14.9	0.9	2.1	16.8	--	--	1252.08	1251.80

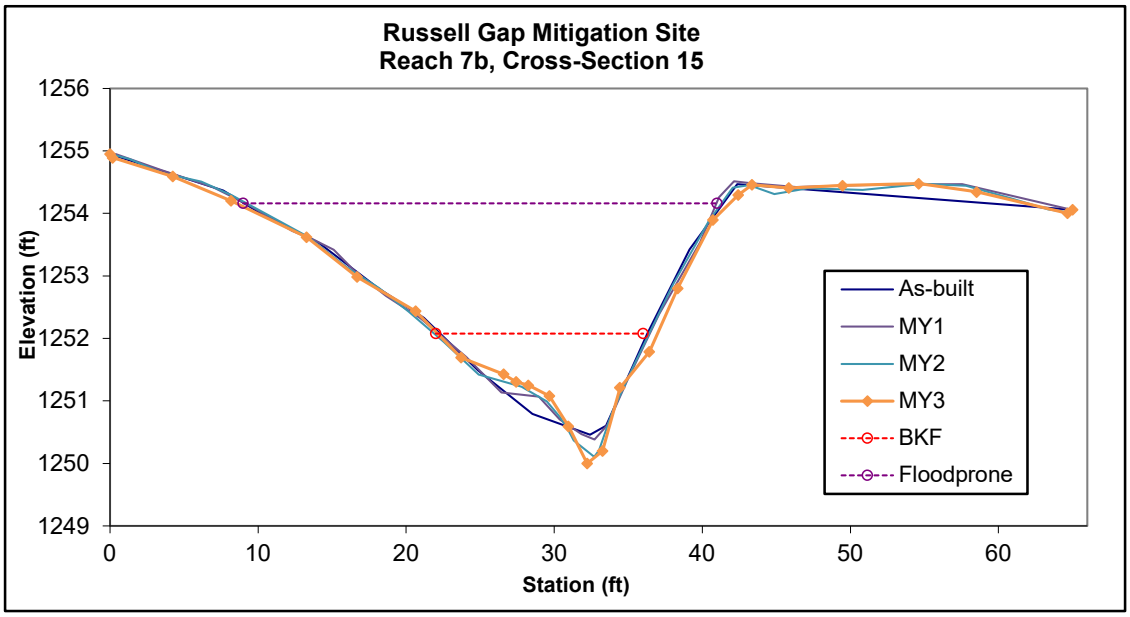


Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 16

Year 3 Survey Collected: September 2022



Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Pool	--	12.3	11.3	1.1	1.7	10.3	--	--	1231.10	1231.30

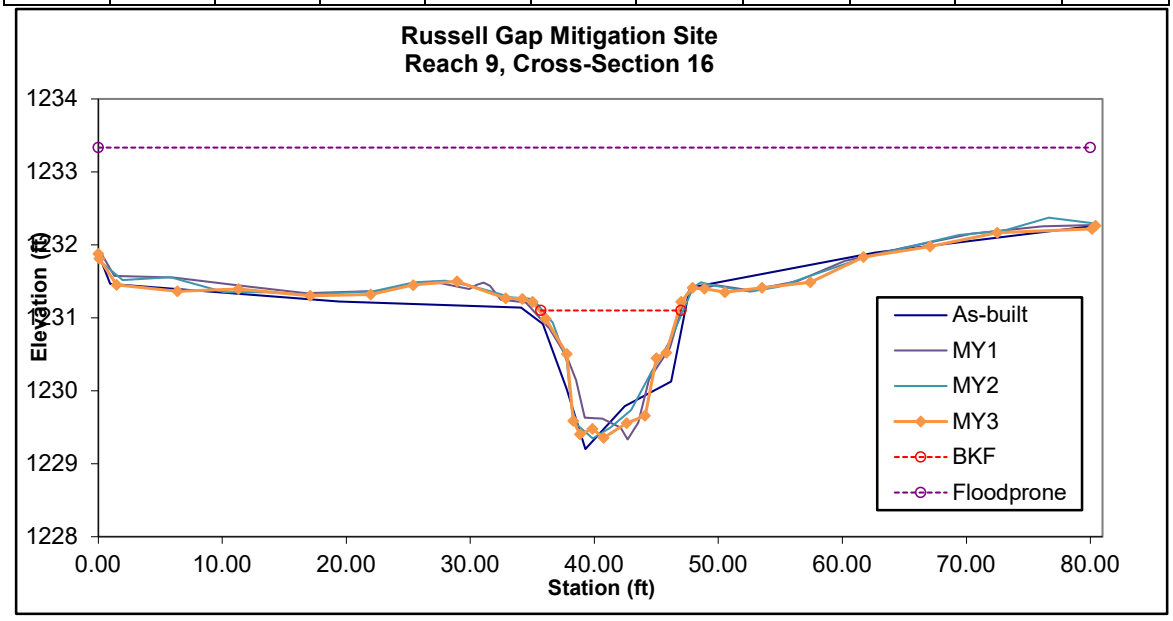


Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 17

Year 3 Survey Collected: September 2022

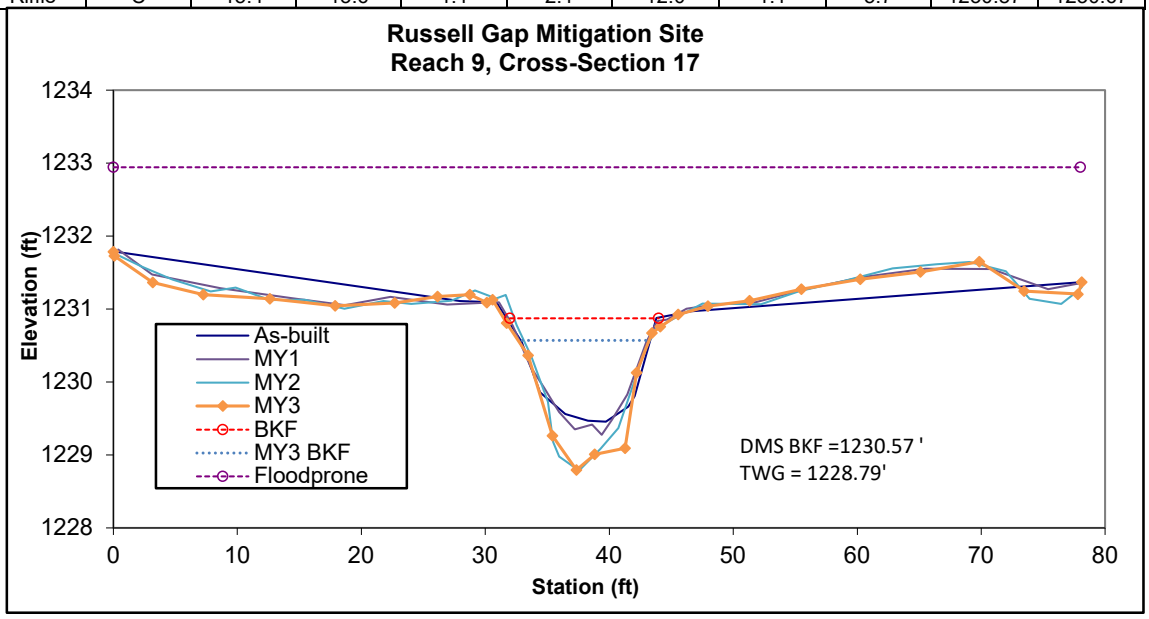


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	15.4	13.6	1.1	2.1	12.0	1.1	5.7	1230.87	1230.67



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1230.57 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 18

Year 3 Survey Collected: September 2022

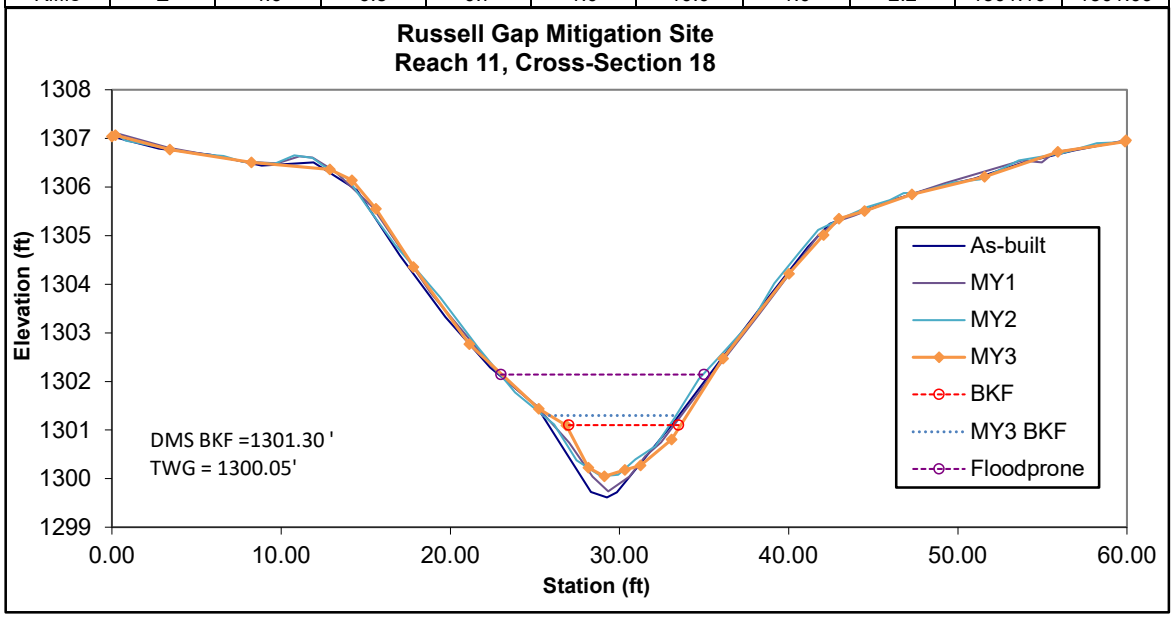


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	E	4.6	6.8	0.7	1.0	10.0	1.0	2.2	1301.10	1301.09



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1301.30 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 19

Year 3 Survey Collected: September 2022

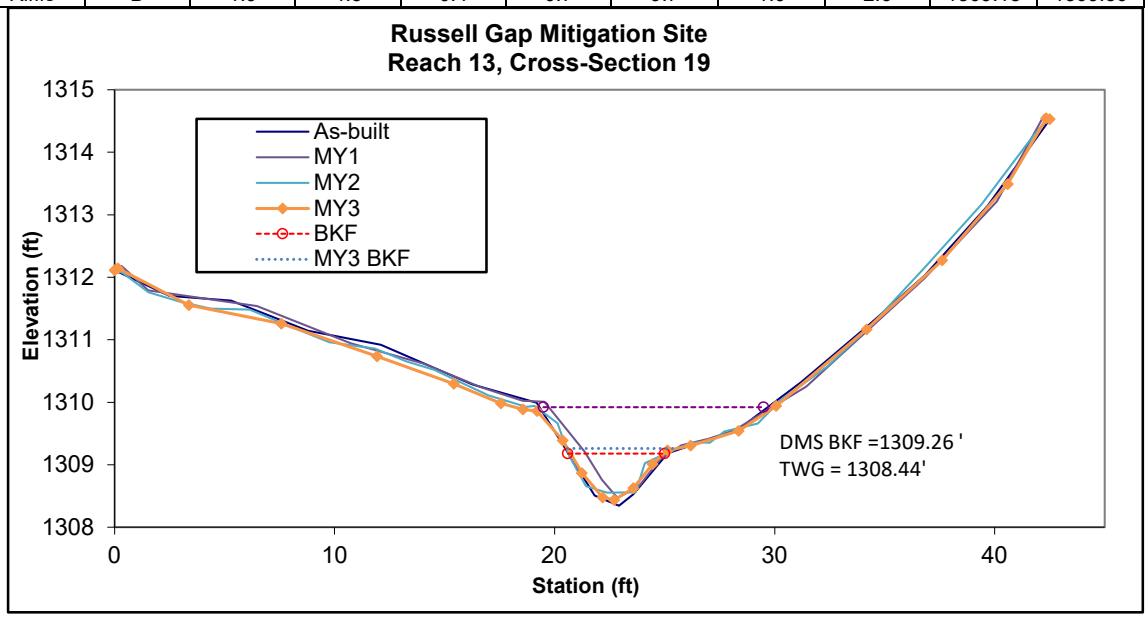


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	1.9	4.3	0.4	0.7	9.7	1.0	2.6	1309.18	1309.30

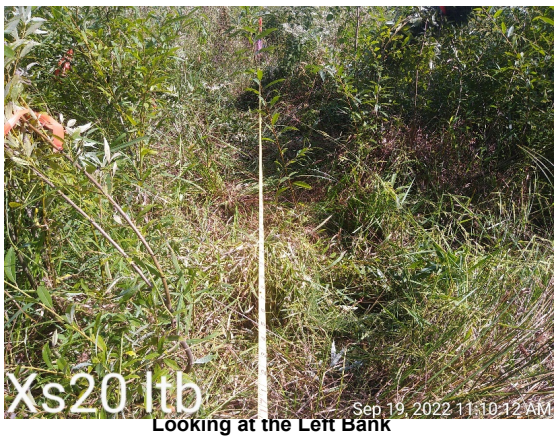


Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1309.26 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 20

Year 3 Survey Collected: September 2022

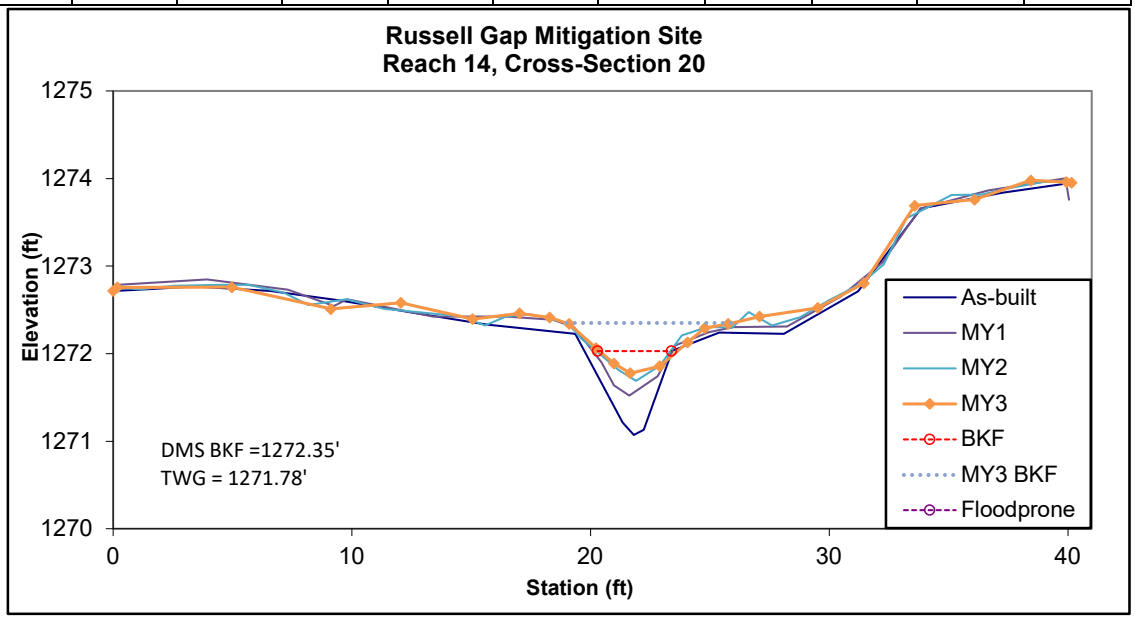


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	0.5	3.3	0.2	0.3	21.1	1.0	9.8	1272.03	1272.34



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1272.35 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 21

Year 3 Survey Collected: September 2022

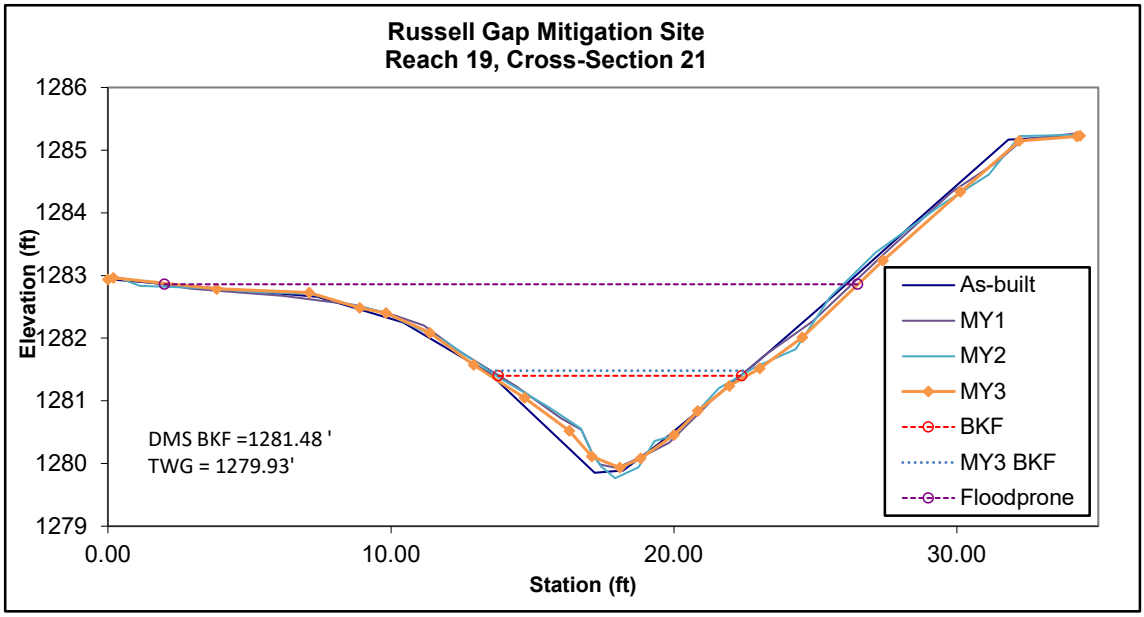


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	E	6.9	9.1	0.8	1.5	12.0	1.0	2.9	1281.40	1281.50



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1281.48 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 22

Year 3 Survey Collected: September 2022

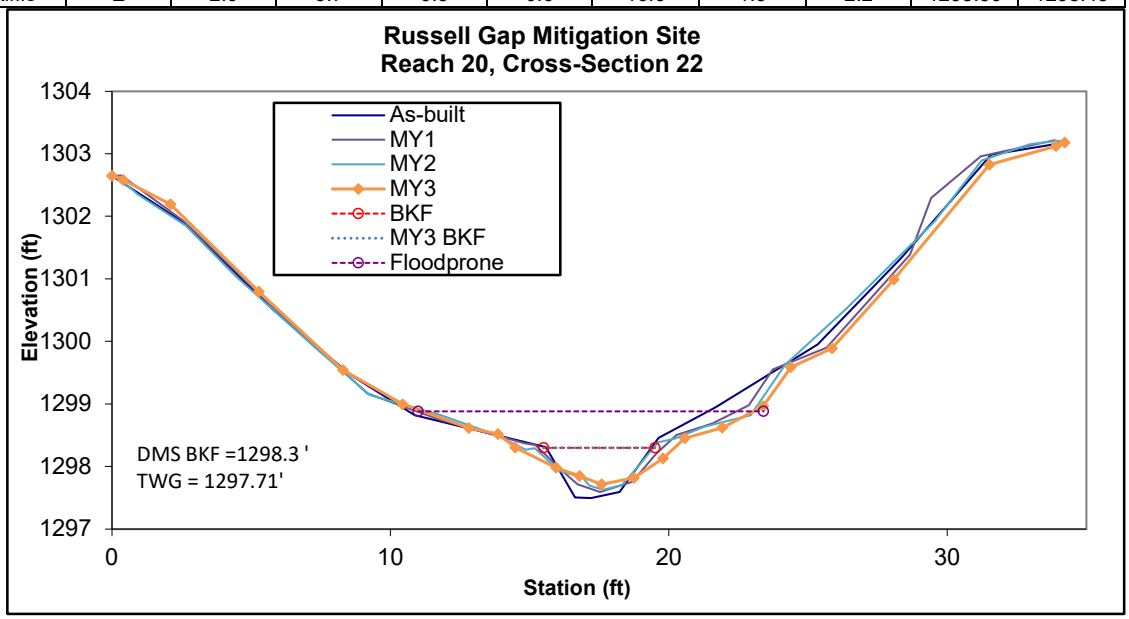


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	E	2.0	5.7	0.3	0.6	16.6	1.3	2.2	1298.30	1298.45



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation 1298.30 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 23

Year 3 Survey Collected: September 2022

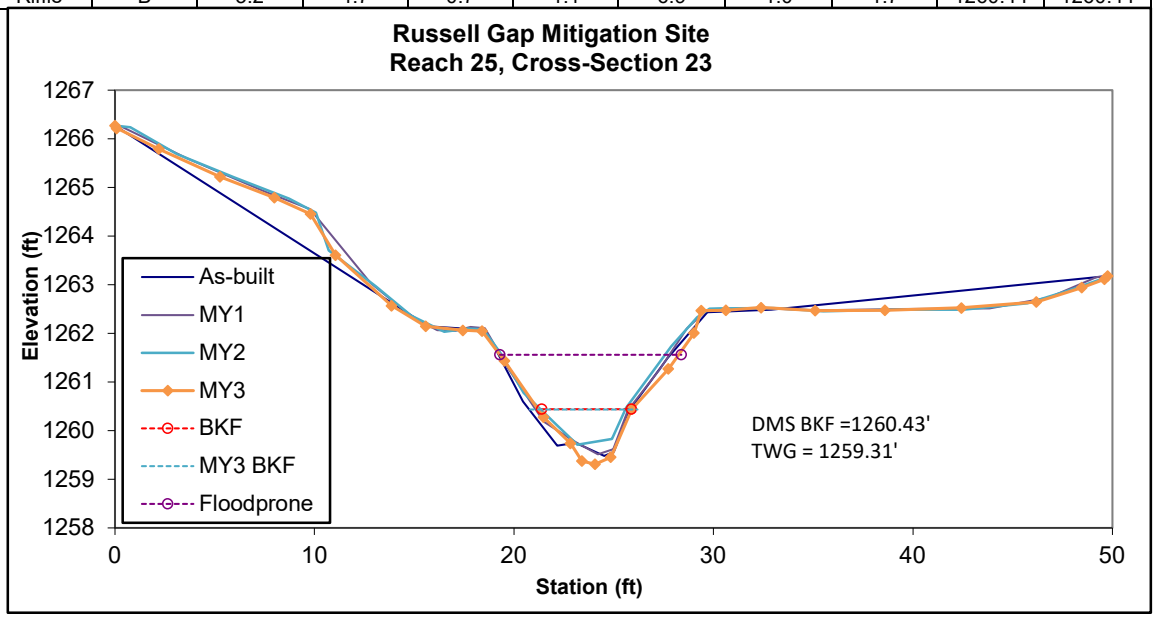


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	B	3.2	4.7	0.7	1.1	6.9	1.0	1.7	1260.44	1260.44



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1260.68 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 24

Year 3 Survey Collected: September 2022

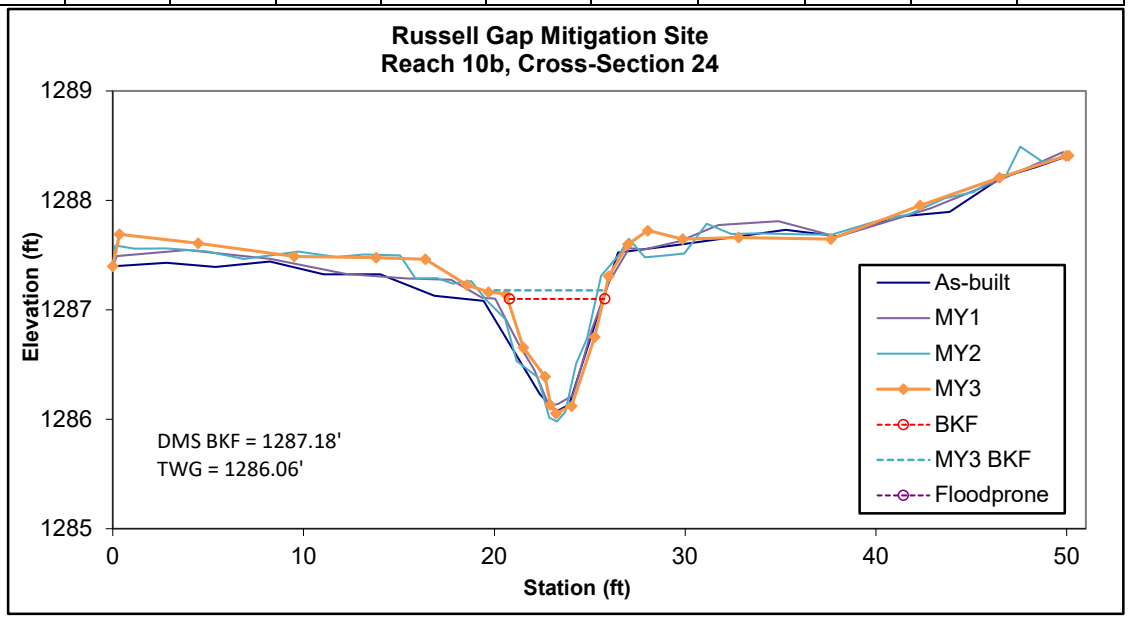


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	3.1	5.0	0.6	1.0	8.2	1.0	9	1287.10	1287.14



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1287.18 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 25

Year 3 Survey Collected: September 2022

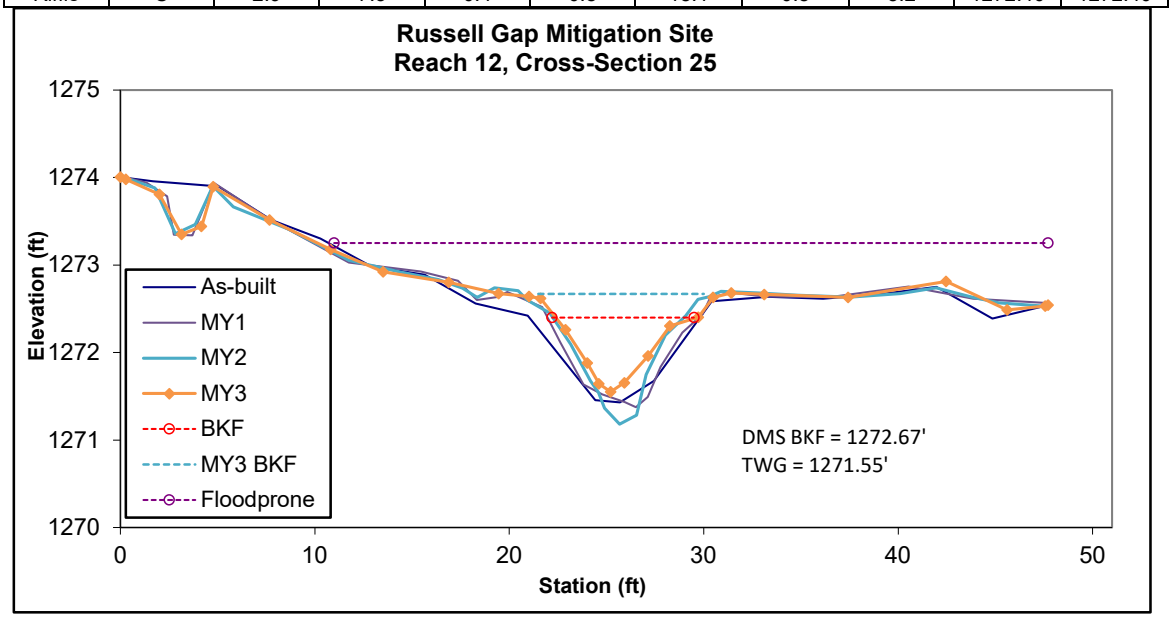


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	2.9	7.3	0.4	0.8	18.1	0.8	5.2	1272.40	1272.40



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1272.67 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Figure 4. Cross-Sections with Annual Overlay

Permanent Cross-Section 26

Year 3 Survey Collected: September 2022

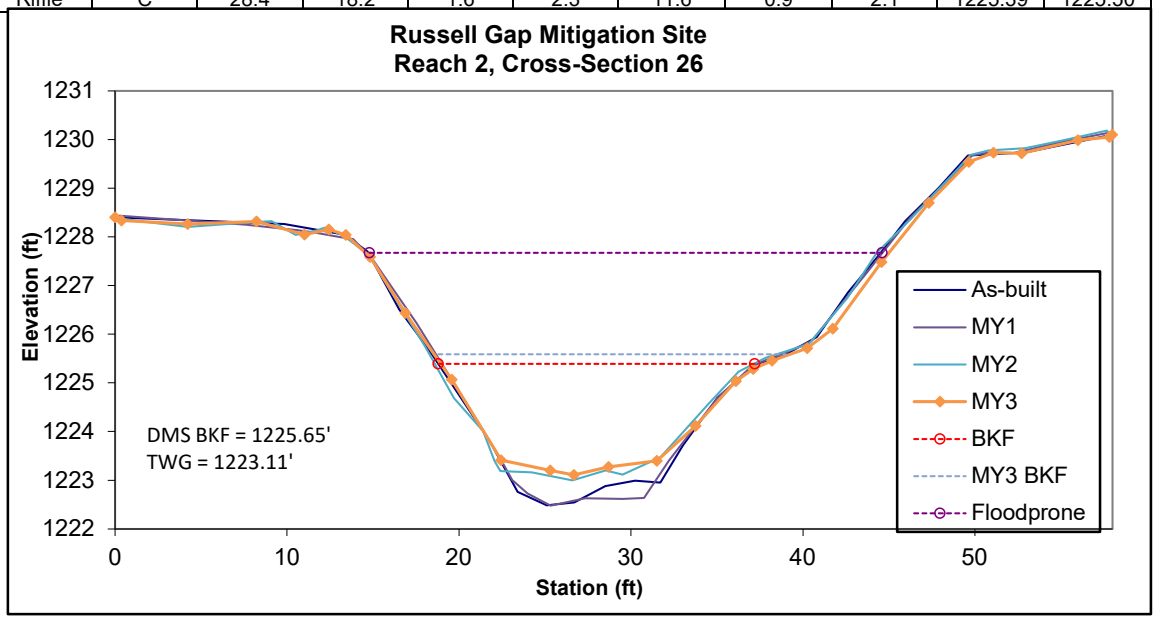


Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	LTOB Elev
Riffle	C	28.4	18.2	1.6	2.3	11.6	0.9	2.1	1225.39	1225.50



Note: Per DMS/IRT request, bank height ratio for MY3 has been calculated using the bankfull elevation of 1225.65 as determined from the as-built bankfull area. All other values were calculated using the as-built bankfull elevation.

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach R1 - (Restoration XS 1-4)																
Parameter	**Pre-Existing Condition**				**Reference Reach(es) Data**				**Design**				**As-built**			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	15.52	16.59	-----	17.65	-----	-----	-----	-----	-----	16.90	-----	-----	16.10	16.15	16.15	16.20
Floodprone Width (ft)	71.92	74.43	-----	76.94	-----	-----	-----	-----	75.00	137.50	-----	200.00	75.30	78.85	78.85	82.40
BF Mean Depth (ft)	1.05	1.25	-----	1.44	-----	-----	-----	-----	-----	1.3	-----	-----	1.20	1.25	1.25	1.30
BF Max Depth (ft)	2.64	2.97	-----	3.30	-----	-----	-----	-----	-----	1.60	-----	-----	1.60	1.70	1.70	1.80
BF Cross-sectional Area (ft^2)	22.35	23.43	-----	24.5	-----	-----	-----	-----	-----	22.0	-----	-----	18.80	19.70	19.70	20.60
Width/Depth Ratio	10.78	13.80	-----	16.81	-----	-----	-----	-----	-----	-----	-----	-----	12.50	13.20	13.20	13.90
Entrenchment Ratio	4.36	4.50	-----	4.64	-----	-----	-----	-----	4.40	8.10	-----	11.80	4.70	4.90	4.90	5.10
Bank Height Ratio	1.20	1.33	-----	1.46	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	33.00	73.50	-----	114.00	-----	-----	-----	-----	60.00	97.50	-----	135.00	53.11	73.15	72.84	89.22
Radius of Curvature (ft)	21.00	39.50	-----	58.00	-----	-----	-----	-----	34.00	41.50	-----	49.00	19.00	41.88	39.50	78.00
Rc/Bankfull width (ft/ft)	17.65	10.70	-----	3.74	2.00	2.50	-----	3.00	2.00	2.45	-----	2.90	1.18	2.59	2.45	4.81
Meander Wavelength (ft)	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	142.35	192.15	163.81	303.38
Meander Width Ratio	1.87	4.61	-----	7.35	3.50	5.75	-----	8.00	3.60	5.80	-----	8.00	3.30	4.53	4.51	5.51
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	33.61	50.90	49.22	64.82
Riffle Slope (ft/ft)	0.0120	0.04	-----	0.0600	-----	-----	-----	-----	0.0110	0.0118	-----	0.0125	0.0029	0.0111	0.0098	0.0168
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	16.67	26.35	29.91	43.15
Pool to Pool Spacing (ft)	23.00	123.50	-----	224.00	60.00	89.50	-----	119.00	-----	-----	-----	-----	84.80	101.00	98.09	111.38
Pool Max Depth (ft)	1.60	2.30	-----	3.00	-----	-----	-----	-----	-----	3.50	-----	-----	1.16	1.77	1.85	2.54
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	1.50	-----	-----	-----	-----	-----	-----	-----	1.50	-----	-----	----	1.50	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	C4/E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	3.67	3.85	-----	4.03	3.50	4.25	-----	5.00	-----	4.10	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	90.0	-----	-----	-----	-----	-----	-----	-----	90.00	-----	-----	----	----	----	----
Valley Length	-----	1,756	-----	-----	-----	-----	-----	-----	-----	1,535	-----	-----	----	1,593	----	----
Channel Length (ft)	-----	2,142	-----	-----	-----	-----	-----	-----	-----	1,842	-----	-----	----	1,911	----	----
Sinuosity	-----	1.22	-----	-----	1.20	1.30	-----	1.40	-----	1.20	-----	-----	----	1.20	----	----

Table 8. Baseline Stream Data Summary
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach R2 - (Restoration XS-26)

Parameter	Pre-Existing Condition				Reference Reach(es) Data				Design				As-built			
					Composite											
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	15.00	-----	-----	-----	-----	-----	-----	-----	18.00	-----	-----	----	18.50	----	----
Floodprone Width (ft)	22.00	26.00	-----	30.00	-----	-----	-----	-----	-----	42.00	-----	-----	----	38.00	----	----
BF Mean Depth (ft)	-----	1.60	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	----	1.80	----	----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	2.90	----	----
BF Cross-sectional Area (ft²)	-----	25.00	-----	-----	-----	-----	-----	-----	-----	25.0	-----	-----	----	33.60	----	----
Width/Depth Ratio	-----	9.40	-----	-----	10.00	12.50	-----	15.00	-----	13.00	-----	-----	----	10.20	----	----
Entrenchment Ratio	1.50	1.75	-----	2.00	-----	-----	-----	-----	-----	2.30	-----	-----	----	2.10	----	----
Bank Height Ratio	-----	2.30	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	24.78	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	2.00	2.50	-----	3.00	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	3.50	5.75	-----	8.00	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	32.58	48.51	48.51	64.43
Riffle Slope (ft/ft)	-----	0.0179	-----	-----	-----	-----	-----	-----	-----	0.0179	-----	-----	0.0058	0.0113	0.0113	0.0167
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	13.55	18.57	20.90	28.24
Pool to Pool Spacing (ft)	20.00	47.50	-----	75.00	-----	-----	-----	-----	65.00	95.00	-----	125.00	32.00	53.25	53.26	74.51
Pool Max Depth (ft)	-----	2.50	-----	-----	-----	-----	-----	-----	-----	3.50	-----	-----	0.43	0.95	1.05	1.66
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	1.65	-----	-----	-----	-----	-----	-----	-----	1.65	-----	-----	----	1.65	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	4.00	-----	-----	3.50	-----	-----	5.00	-----	4.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	100.0	-----	-----	-----	-----	-----	-----	-----	100.00	-----	-----	----	----	----	----
Valley Length	-----	288	-----	-----	-----	-----	-----	-----	-----	174	-----	-----	----	166	----	----
Channel Length (ft)	-----	288	-----	-----	-----	-----	-----	-----	-----	174	-----	-----	----	166	----	----
Sinuosity	-----	1.00	-----	-----	1.20	1.30	-----	1.40	-----	1.00	-----	-----	----	1.00	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach R3 - (Restoration XS-5)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	21.00	-----	-----	-----	-----	-----	-----	-----	23.70	-----	-----	----	23.80	----	----
Floodprone Width (ft)	-----	71.00	-----	-----	-----	-----	-----	-----	-----	71.00	-----	-----	----	46.50	----	----
BF Mean Depth (ft)	-----	2.23	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	----	1.70	----	----
BF Max Depth (ft)	-----	3.40	-----	-----	-----	-----	-----	-----	-----	2.50	-----	-----	----	2.70	----	----
BF Cross-sectional Area (ft²)	-----	46.87	-----	-----	-----	-----	-----	-----	-----	47.0	-----	-----	----	40.90	----	----
Width/Depth Ratio	-----	9.42	-----	-----	10.00	12.50	-----	15.00	-----	11.90	-----	-----	----	13.80	----	----
Entrenchment Ratio	-----	3.38	-----	-----	-----	-----	-----	-----	-----	3.00	-----	-----	----	2.00	----	----
Bank Height Ratio	-----	1.20	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	22.67	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	2.00	2.50	-----	3.00	-----	N/A	-----	-----	----	N/A	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	N/A	----	----
Meander Width Ratio	-----	N/A	-----	-----	3.50	5.75	-----	8.00	-----	N/A	-----	-----	----	N/A	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	29.93	47.57	51.32	72.70
Riffle Slope (ft/ft)	-----	0.0075	-----	-----	-----	-----	-----	-----	-----	0.0075	-----	-----	0.0044	0.0158	0.0138	0.0233
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.28	26.01	29.94	55.59
Pool to Pool Spacing (ft)	18.00	26.00	-----	34.00	-----	-----	-----	-----	85.00	100.00	-----	115.00	47.04	86.95	85.53	124.01
Pool Max Depth (ft)	3.60	3.70	-----	3.80	-----	-----	-----	-----	-----	4.00	-----	-----	0.57	1.27	1.24	1.90
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	3.48	-----	-----	-----	-----	-----	-----	-----	3.48	-----	-----	----	3.48	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	E4 (Incised)	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	5.00	-----	-----	3.50	4.25	-----	5.00	-----	5.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	235.0	-----	-----	-----	-----	-----	-----	-----	235.00	-----	-----	----	----	----	----
Valley Length	-----	350	-----	-----	-----	-----	-----	-----	-----	350	-----	-----	----	366	----	----
Channel Length (ft)	-----	388	-----	-----	-----	-----	-----	-----	-----	389	-----	-----	----	406	----	----
Sinuosity	-----	1.11	-----	-----	1.20	1.30	-----	1.40	-----	1.11	-----	-----	----	1.11	----	----

Table 8. Baseline Stream Data Summary
Russell Gap Stream Mitigation Project: DMS Project No ID. 100003
Reach R4 - (Enhancement I XS 6-11)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	16.00	-----	-----	-----	-----	-----	-----	-----	16.90	-----	-----	13.30	15.84	14.30	22.60
Floodprone Width (ft)	-----	22.82	-----	-----	-----	-----	-----	-----	-----	37.00	-----	-----	24.00	29.58	31.70	34.30
BF Mean Depth (ft)	-----	1.54	-----	-----	-----	-----	-----	-----	-----	1.3	-----	-----	0.90	1.38	1.50	1.70
BF Max Depth (ft)	-----	2.72	-----	-----	-----	-----	-----	-----	-----	1.60	-----	-----	2.00	2.46	2.30	3.00
BF Cross-sectional Area (ft^2)	-----	24.5	-----	-----	-----	-----	-----	-----	-----	22.0	-----	-----	15.50	20.64	22.10	23.10
Width/Depth Ratio	-----	10.36	-----	-----	12.00	15.00	-----	18.00	-----	13.00	-----	-----	8.40	13.04	10.30	26.10
Entrenchment Ratio	-----	1.62	-----	-----	-----	-----	-----	-----	-----	2.20	-----	-----	1.40	1.90	1.90	2.30
Bank Height Ratio	-----	2.32	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Meander Width Ratio	-----	N/A	-----	-----	-----	----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Profile	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	33.46	58.40	68.03	102.60
Riffle Slope (ft/ft)	0.0150	0.0250	-----	0.0350	-----	-----	-----	-----	0.0110	0.0140	-----	0.0170	0.0102	0.0178	0.0195	0.0289
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.23	14.40	20.08	37.92
Pool to Pool Spacing (ft)	55.00	167.50	-----	280.00	-----	-----	-----	-----	85.00	100.00	-----	115.00	33.46	103.56	113.76	194.05
Pool Max Depth (ft)	1.10	-----	-----	2.40	-----	-----	-----	-----	-----	3.00	-----	-----	1.09	1.66	1.71	2.32
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	1.26	-----	-----	-----	-----	-----	-----	-----	1.26	-----	-----	----	----	1.26	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	E4 (Incised)	-----	-----	-----	B4c	-----	-----	-----	B4c	-----	-----	----	----	B4c	----
BF Velocity (fps)	-----	4.01	-----	-----	4.00	5.00	-----	6.00	-----	4.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	87.0	-----	-----	-----	-----	-----	-----	-----	87.00	-----	-----	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	2,245	-----	-----	-----	-----	-----	-----	-----	2,063	-----	-----	----	2,038	----	----
Sinuosity	-----	1.06	-----	-----	1.10	1.20	-----	1.30	-----	1.06	-----	-----	----	1.06	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach R6,R7b - (Restoration, Enhancement I XS 12-15)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	8.44	-----	-----	-----	-----	-----	-----	-----	10.20	-----	-----	11.00	12.40	12.40	13.80
Floodprone Width (ft)	-----	17.64	-----	-----	-----	-----	-----	-----	-----	22.00	-----	-----	45.00	45.45	45.00	45.90
BF Mean Depth (ft)	-----	0.94	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	0.80	1.05	1.05	1.30
BF Max Depth (ft)	-----	1.27	-----	-----	-----	-----	-----	-----	-----	1.10	-----	-----	1.30	1.65	1.65	2.00
BF Cross-sectional Area (ft^2)	-----	7.9	-----	-----	-----	-----	-----	-----	-----	8.0	-----	-----	7.20	10.80	10.80	14.40
Width/Depth Ratio	-----	8.98	-----	-----	12.00	15.00	-----	18.00	-----	12.80	-----	-----	8.40	9.65	9.65	10.90
Entrenchment Ratio	-----	2.09	-----	-----	-----	-----	-----	-----	-----	2.20	-----	-----	4.20	4.65	4.65	5.10
Bank Height Ratio	-----	3.10	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	13.95	40.15	33.06	58.59
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	20.00	46.82	43.00	86.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.82	3.78	3.47	6.23
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	58.19	108.11	113.28	170.29
Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.27	3.24	2.67	4.25
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	34.21	91.23	89.80	145.39
Riffle Slope (ft/ft)	0.0260	0.0430	-----	0.0600	-----	-----	-----	-----	0.0310	0.0375	-----	0.0440	0.0202	0.0384	0.0435	0.0667
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	17.11	20.53	21.39	25.66
Pool to Pool Spacing (ft)	53.00	159.00	-----	265.00	-----	-----	-----	-----	25.00	37.50	-----	50.00	31.36	90.16	138.27	245.18
Pool Max Depth (ft)	1.50	2.05	-----	2.60	-----	-----	-----	-----	-----	1.80	-----	-----	2.28	2.58	2.66	3.04
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.29	-----	-----	-----	-----	-----	-----	-----	0.29	-----	-----	----	0.2900	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	E4	-----	-----	-----	B4	-----	-----	-----	B4	-----	-----	----	B4	----	----
BF Velocity (fps)	-----	4.41	-----	-----	4.00	-----	-----	6.00	-----	4.40	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	35.0	-----	-----	-----	-----	-----	-----	-----	35.00	-----	-----	----	----	----	----
Valley Length	-----	1,783	-----	-----	-----	-----	-----	-----	-----	1,816	-----	-----	----	1,793	----	----
Channel Length (ft)	-----	1,801	-----	-----	-----	-----	-----	-----	-----	1,943	-----	-----	----	1,919	----	----
Sinuosity	-----	1.01	-----	-----	1.10	1.15	-----	1.20	-----	1.07	-----	-----	----	1.07	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach 9 - (Restoration XS 16-17)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	10.40	-----	-----	-----	-----	-----	-----	-----	12.70	-----	-----	----	12.10	----	----
Floodprone Width (ft)	-----	45.00	-----	-----	-----	-----	-----	-----	-----	60.00	-----	-----	----	18.70	----	----
BF Mean Depth (ft)	-----	1.15	-----	-----	-----	-----	-----	-----	-----	0.9	-----	-----	----	1.00	----	----
BF Max Depth (ft)	-----	2.25	-----	-----	-----	-----	-----	-----	-----	1.20	-----	-----	----	1.40	----	----
BF Cross-sectional Area (ft^2)	-----	12.0	-----	-----	-----	-----	-----	-----	-----	12.0	-----	-----	----	11.90	----	----
Width/Depth Ratio	-----	9.04	-----	-----	12.00	15.00	-----	18.00	-----	13.50	-----	-----	----	12.20	----	----
Entrenchment Ratio	-----	4.33	-----	-----	-----	-----	-----	-----	-----	4.70	-----	-----	----	1.60	----	----
Bank Height Ratio	-----	1.19	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	20.86	24.81	22.89	30.60
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	41.00	73.83	56.00	176.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	3.39	6.10	4.63	2.53
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	105.77	121.47	117.31	146.34
Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.72	2.05	1.89	2.53
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	31.00	41.69	42.23	53.45
Riffle Slope (ft/ft)	0.0410	0.0480	-----	0.0550	-----	-----	-----	-----	0.2600	0.1505	-----	0.0410	0.0065	0.0218	0.0199	0.0332
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10.49	19.56	20.03	29.57
Pool to Pool Spacing (ft)	29.00	47.50	-----	66.00	-----	-----	-----	-----	15.00	38.50	-----	62.00	45.71	62.03	62.51	79.31
Pool Max Depth (ft)	2.30	2.70	-----	3.10	-----	-----	-----	-----	-----	2.50	-----	-----	0.52	1.62	1.55	2.58
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.56	-----	-----	-----	-----	-----	-----	-----	0.56	-----	-----	----	0.5600	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	E4b	-----	-----	-----	-----	-----	-----	-----	B4	-----	-----	----	B4	----	----
BF Velocity (fps)	-----	4.00	-----	-----	4.00	5.00	-----	6.00	-----	4.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	48.0	-----	-----	-----	B4	-----	-----	-----	48.00	-----	-----	----	----	----	----
Valley Length	-----	422	-----	-----	-----	-----	-----	-----	-----	429	-----	-----	----	429	----	----
Channel Length (ft)	-----	439	-----	-----	-----	-----	-----	-----	-----	446	-----	-----	----	446	----	----
Sinuosity	-----	1.04	-----	-----	1.10	1.15	-----	1.20	-----	1.04	-----	-----	----	1.04	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach 10b - (Restoration XS-24)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	4.90	-----	-----	----	6.20	----	----
Floodprone Width (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	115.00	-----	-----	----	32.00	----	----
BF Mean Depth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	----	0.50	----	----
BF Max Depth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	----	1.00	----	----
BF Cross-sectional Area (ft²)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	----	3.50	----	----
Width/Depth Ratio	-----	N/A	-----	-----	10.00	12.50	-----	15.00	-----	12.30	-----	-----	----	11.00	----	----
Entrenchment Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	23.50	-----	-----	----	8.70	----	----
Bank Height Ratio	-----	N/A	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	10.37	13.70	11.86	18.87
Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	34.00	66.67	82.00	84.00
Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	2.00	2.50	-----	3.00	-----	N/A	-----	-----	5.48	10.75	1.91	13.55
Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	29.79	49.56	59.44	59.44
Meander Width Ratio	-----	N/A	-----	-----	3.50	5.75	-----	8.00	-----	N/A	-----	-----	1.67	2.21	1.91	3.04
Profile																
Riffle Length (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	107.07	----	----
Riffle Slope (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	0.0142	-----	-----	----	0.0196	----	----
Pool Length (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pool to Pool Spacing (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	38.00	-----	-----	----	----	----	----
Pool Max Depth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	1.00	-----	-----	----	----	----	----
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / Bo%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.26	-----	-----	-----	-----	-----	-----	-----	0.26	-----	-----	----	0.2600	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	-----	-----	-----	3.50	4.25	-----	5.00	-----	3.50	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	-----	-----	-----	-----	-----	-----	-----	-----	7.00	-----	-----	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	0	-----	-----	-----	-----	-----	-----	-----	113	-----	-----	----	105	----	----
Sinuosity	-----	-----	-----	-----	1.20	1.30	-----	1.40	-----	-----	-----	-----	----	----	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach 12 - (Restoration XS-25)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	7.97	-----	-----	-----	-----	-----	-----	-----	8.80	-----	-----	----	9.10	----	----
Floodprone Width (ft)	-----	41.00	-----	-----	-----	-----	-----	-----	-----	20.00	-----	-----	----	38.20	----	----
BF Mean Depth (ft)	-----	0.91	-----	-----	-----	-----	-----	-----	-----	0.7	-----	-----	----	0.60	----	----
BF Max Depth (ft)	-----	1.84	-----	-----	-----	-----	-----	-----	-----	0.80	-----	-----	----	1.00	----	----
BF Cross-sectional Area (ft²)	-----	7.3	-----	-----	-----	-----	-----	-----	-----	6.0	-----	-----	----	5.20	----	----
Width/Depth Ratio	-----	8.75	-----	-----	12.00	13.50	-----	15.00	-----	12.60	-----	-----	----	16.20	----	----
Entrenchment Ratio	-----	5.14	-----	-----	-----	-----	-----	-----	-----	2.30	-----	-----	----	4.20	----	----
Bank Height Ratio	-----	1.63	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	14.22	18.28	18.28	22.33
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	40.00	40.00	40.00	40.00
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	4.40	4.40	4.40	4.40
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	61.50	68.17	68.17	74.84
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	1.56	2.01	2.01	2.45
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	16.04	25.93	25.93	35.81
Riffle Slope (ft/ft)	0.0350	0.0365	-----	0.0380	-----	-----	-----	-----	0.0150	0.0160	-----	0.0170	0.0123	0.1365	0.1123	0.2123
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	5.88	7.24	7.24	8.59
Pool to Pool Spacing (ft)	24.00	32.00	-----	40.00	-----	-----	-----	-----	35.00	40.00	-----	45.00	10.16	49.98	49.98	89.80
Pool Max Depth (ft)	1.80	2.00	-----	2.20	-----	-----	-----	-----	-----	1.50	-----	-----	0.61	0.78	0.82	1.03
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.18	-----	-----	-----	-----	-----	-----	-----	0.18	-----	-----	----	0.1800	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
*Rosgen Classification	-----	E4	-----	-----	-----	C4	-----	-----	-----	C4	-----	-----	----	C4	----	----
BF Velocity (fps)	-----	4.13	-----	-----	3.50	-----	-----	5.00	-----	5.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	30.0	-----	-----	-----	-----	-----	-----	-----	30.00	-----	-----	----	----	----	----
Valley Length	-----	83	-----	-----	-----	-----	-----	-----	-----	115	-----	-----	----	98	----	----
Channel Length (ft)	-----	86	-----	-----	-----	-----	-----	-----	-----	120	-----	-----	----	102	----	----
Sinuosity	-----	1.03	-----	-----	-----	-----	-----	-----	-----	1.04	-----	-----	----	1.04	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach 14 - (Restoration XS 19-20)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design Values Upper				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	3.85	-----	-----	-----	-----	-----	-----	-----	5.10	-----	-----	3.70	4.10	4.10	4.50
Floodprone Width (ft)	-----	5.82	-----	-----	-----	-----	-----	-----	-----	10.00	-----	-----	11.10	21.55	21.55	32.00
BF Mean Depth (ft)	-----	0.51	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	0.50	0.50	0.50	0.50
BF Max Depth (ft)	-----	0.70	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	0.80	0.90	0.90	1.00
BF Cross-sectional Area (ft^2)	-----	2.0	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	2.00	2.10	2.10	2.20
Width/Depth Ratio	-----	7.55	-----	-----	12.00	15.00	-----	18.00	-----	12.80	-----	-----	6.80	7.95	7.95	9.10
Entrenchment Ratio	-----	1.51	-----	-----	-----	-----	-----	-----	-----	2.00	-----	-----	2.50	5.60	5.60	8.70
Bank Height Ratio	-----	9.60	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	1.00	1.00	1.00	1.00
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	24.51	40.15	33.06	58.59
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	21.00	72.88	56.00	178.00
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	5.68	17.78	13.66	39.56
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	62.14	95.04	83.77	56.00
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	6.62	9.79	8.06	13.02
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	4.19	15.81	25.68	47.17
Riffle Slope (ft/ft)	0.1000	0.1400	-----	0.1800	-----	-----	-----	-----	0.0850	0.1075	-----	0.1300	0.0108	0.0398	0.0518	0.0928
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.17	2.00	1.87	2.57
Pool to Pool Spacing (ft)	24.00	37.00	-----	50.00	-----	-----	-----	-----	5.00	12.50	-----	20.00	5.84	14.71	14.13	22.41
Pool Max Depth (ft)	0.50	0.65	-----	0.80	-----	-----	-----	-----	-----	0.70	-----	-----	0.69	1.10	1.15	1.60
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.02	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	----	0.0180	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
*Rosgen Classification	-----	A4	-----	-----	-----	B4a	-----	-----	-----	B4a	-----	-----	----	B4a	----	----
BF Velocity (fps)	-----	4.10	-----	-----	4.00	-----	-----	6.00	-----	4.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	8.0	-----	-----	-----	-----	-----	-----	-----	8.00	-----	-----	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	528	-----	-----	-----	-----	-----	-----	-----	572	-----	-----	----	570	----	----
Sinuosity	-----	N/A	-----	-----	1.10	-----	-----	1.20	-----	N/A	-----	-----	----	N/A	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach 19 - (Enhancement I XS-21)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	4.31	-----	-----	-----	-----	-----	-----	-----	5.40	-----	-----	----	8.80	----	----
Floodprone Width (ft)	-----	8.84	-----	-----	-----	-----	-----	-----	-----	10.00	-----	-----	----	26.30	----	----
BF Mean Depth (ft)	-----	0.45	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	----	0.90	----	----
BF Max Depth (ft)	-----	0.91	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	----	1.50	----	----
BF Cross-sectional Area (ft^2)	-----	1.9	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	----	7.60	----	----
Width/Depth Ratio	-----	9.58	-----	-----	12.00	15.00	-----	18.00	-----	13.50	-----	-----	----	10.20	----	----
Entrenchment Ratio	-----	2.05	-----	-----	-----	-----	-----	-----	-----	1.90	-----	-----	----	3.00	----	----
Bank Height Ratio	-----	1.10	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.14	19.69	40.27	78.40
Riffle Slope (ft/ft)	0.0800	0.0950	-----	0.1100	-----	-----	-----	-----	0.0800	0.0950	-----	0.1100	0.0260	0.0561	0.0515	0.0771
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.27	2.01	2.06	2.85
Pool to Pool Spacing (ft)	7.00	31.50	-----	56.00	-----	-----	-----	-----	4.00	12.00	-----	20.00	6.35	9.34	9.34	12.33
Pool Max Depth (ft)	-----	0.95	-----	-----	-----	-----	-----	-----	-----	1.00	-----	-----	0.89	1.24	1.28	1.66
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.03	-----	-----	-----	-----	-----	-----	-----	0.03	-----	-----	----	0.0300	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
*Rosgen Classification	-----	B4a	-----	-----	-----	B4	-----	-----	-----	B4a	-----	-----	----	B4a	----	----
BF Velocity (fps)	-----	4.12	-----	-----	4.00	-----	-----	6.00	-----	4.00	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	8.0	-----	-----	-----	-----	-----	-----	-----	8.00	-----	-----	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	481	-----	-----	-----	-----	-----	-----	-----	359	-----	-----	----	352	----	----
Sinuosity	-----	1.08	-----	-----	1.10	-----	-----	1.20	-----	1.08	-----	-----	----	1.08	----	----

Table 8. Baseline Stream Data Summary

Russell Gap Stream Mitigation Project: DMS Project No ID. 100003

Reach 25 - (Enhancement I XS-23)

Parameter	Pre-Existing Condition				Reference Reach(es) Data Composite				Design				As-built			
Dimension and Substrate - Riffle	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max	Min	Mean	Med	Max
BF Width (ft)	-----	5.00	-----	-----	-----	-----	-----	-----	-----	5.40	-----	-----	----	5.10	----	----
Floodprone Width (ft)	-----	12.00	-----	-----	-----	-----	-----	-----	-----	12.00	-----	-----	----	11.10	----	----
BF Mean Depth (ft)	-----	0.40	-----	-----	-----	-----	-----	-----	-----	0.4	-----	-----	----	0.50	----	----
BF Max Depth (ft)	-----	0.50	-----	-----	-----	-----	-----	-----	-----	0.50	-----	-----	----	0.80	----	----
BF Cross-sectional Area (ft²)	-----	1.9	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	----	2.20	----	----
Width/Depth Ratio	-----	12.50	-----	-----	12.00	15.00	-----	18.00	-----	13.50	-----	-----	----	9.10	----	----
Entrenchment Ratio	-----	2.40	-----	-----	-----	-----	-----	-----	-----	2.20	-----	-----	----	2.50	----	----
Bank Height Ratio	-----	2.00	-----	-----	1.00	1.05	-----	1.10	-----	1.00	-----	-----	----	1.00	----	----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Pattern																
*Channel Beltwidth (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Radius of Curvature (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Rc/Bankfull width (ft/ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Meander Wavelength (ft)	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
*Meander Width Ratio	-----	N/A	-----	-----	-----	-----	-----	-----	-----	N/A	-----	-----	----	----	----	----
Profile																
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6.68	17.65	18.60	30.52
Riffle Slope (ft/ft)	0.0800	0.0950	-----	0.1100	1.1000	1.4500	-----	1.8000	0.0950	0.1025	-----	0.1100	0.0165	0.0591	0.0564	0.0962
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.23	5.21	5.41	8.59
Pool to Pool Spacing (ft)	7.00	31.50	-----	56.00	-----	-----	-----	-----	7.00	13.50	-----	20.00	7.63	16.24	23.05	38.47
Pool Max Depth (ft)	-----	1.20	-----	-----	-----	-----	-----	-----	-----	1.20	-----	-----	1.16	1.75	1.68	2.19
Substrate and Transport Parameters	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
SC% / Sa% / G% / C% / B%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Additional Reach Parameters																
Drainage Area (SM)	-----	0.30	-----	-----	-----	-----	-----	-----	-----	0.30	-----	-----	----	0.3000	----	----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
*Rosgen Classification	-----	B4a	-----	-----	-----	B4	-----	-----	-----	B4a	-----	-----	----	B4a	----	----
BF Velocity (fps)	-----	4.64	-----	-----	4.00	-----	-----	6.00	-----	4.50	-----	-----	----	----	----	----
BF Discharge (cfs)	-----	9.0	-----	-----	-----	-----	-----	-----	-----	9.00	-----	-----	----	----	----	----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----	----	----	----
Channel Length (ft)	-----	422	-----	-----	-----	-----	-----	-----	-----	427	-----	-----	----	431	----	----
Sinuosity	-----	1.09	-----	-----	1.10	-----	-----	1.20	-----	1.08	-----	-----	----	1.08	----	----

Table 9. Cross-Section Morphology Data Summary
Russell Gap Restoration Project: DMS Project No ID. 100003

Stream Reach	Reach 1																										
	Cross-section X-1 (Riffle)							Cross-section X-2 (Pool)							Cross-section X-3 (Riffle)							Cross-section X-4 (Pool)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation																											
BF Width (ft)	16.2	15.8	14.5	14.8				24.6	18.6	16.1	15.8				16.1	16.3	17.4	19.5				22.9	16.6	14.1	15.1			
BF Mean Depth (ft)	1.2	1.2	1.9	1.3				1.0	1.3	1.4	1.3				1.3	1.3	1.3	1.2				1.2	1.5	2.4	1.7			
Width/Depth Ratio	13.9	13.6	12.0	11.7				24.1	14.7	11.5	12.6				12.5	12.9	13.7	12.7				18.9	11.3	5.8	9.1			
BF Cross-sectional Area (ft²)	18.8	18.4	17.6	18.9				25.1	23.6	22.6	19.8				20.6	20.6	22.2	19.5				27.7	24.4	34.1	25.1			
BF Max Depth (ft)	1.6	1.7	2.0	1.9				1.7	2.3	2.0	2.0				1.8	2.0	2.4	1.9				2.4	2.7	3.9	2.7			
Width of Floodprone Area (ft)	75.3	75.3	75.3	75.3				75.3	75.3	75.3	75.3				82.4	82.4	82.4	82.4				82.2	82.2	82.2	82.2			
Entrenchment Ratio	4.7	4.8	5.2	5.1				3.1	4.0	4.7	4.8				5.1	5.0	4.7	5.2				3.6	5.0	5.8	5.4			
Bank Height Ratio	1.0	1.1	1.1	1.1				0.9	1.0	1.1	1.1				1.0	1.0	1.0	1.0				1.1	1.1	0.7	1.1			
Wetted Perimeter (ft)	16.7	16.4	15.4	15.7				25.3	20.0	17.2	17.3				16.8	17.2	18.7	16.4				23.5	17.7	17.2	16.6			
Hydraulic Radius (ft)	1.1	1.1	1.1	1.2				1.0	1.2	1.3	1.1				1.2	1.2	1.2	1.2				1.2	1.4	2.0	1.5			
d50 (mm)																											

Stream Reach	Reach 3							Reach 4																			
	Cross-section X-5 (Riffle)							Cross-section X-6 (Riffle)							Cross-section X-7 (Riffle)							Cross-section X-8 (Riffle)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation																											
BF Width (ft)	23.8	23.7	19.6	21.2				13.9	13.5	13.7	14.4				14.3	14.4	14.9	14.8				15.1	14.6	13.8	13.9			
BF Mean Depth (ft)	1.7	2.7	1.9	2.0				1.7	1.7	1.8	1.7				1.6	1.6	1.7	1.7				1.5	1.5	1.5	1.3			
Width/Depth Ratio	13.8	13.8	10.1	10.9				8.4	7.8	7.4	8.5				9.0	9.1	8.8	8.6				10.3	9.9	9.4	10.6			
BF Cross-sectional Area (ft²)	40.9	40.6	38.1	41.4				23.1	23.3	25.3	24.2				22.9	22.8	25.4	25.4				22.1	21.4	20.5	18.1			
BF Max Depth (ft)	2.7	2.7	2.7	2.8				2.8	2.8	3.0	2.9				2.3	2.5	2.6	2.7				3.0	2.8	2.8	2.8			
Width of Floodprone Area (ft)	46.5	47.5	59.3	59.3				24.0	23.4	21.8	21.8				31.7	30.3	30.3	30.3				34.3	33.2	31.5	31.5			
Entrenchment Ratio	2.0	2.5	3.0	2.8				1.7	1.6	1.6	1.5				2.2	2.1	2.0	2.0				2.3	2.2	2.3	2.3			
Bank Height Ratio	1.0	0.9	1.1	1.0				1.0	0.8	1.0	0.9				1.0	1.3	1.0	1.0				1.0	1.0	1.0	0.9			
Wetted Perimeter (ft)	25.1	25.3	21.6	23.2				15.5	15.1	15.8	15.8				15.7	16.1	0.9	16.5				16.4	16.3	1.0	15.6			
Hydraulic Radius (ft)	1.6	1.6	1.8	1.8				1.5	1.5	1.6	1.5				1.5	1.4	1.5	1.5				1.4	1.3	1.3	1.2			
d50 (mm)																											

Stream Reach	Reach 4																					Reach 6						
	Cross-section X-9 (Riffle)							Cross-section X-10 (Riffle)							Cross-section X-11 (Riffle)							Cross-section X-12 (Pool)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation																											
BF Width (ft)	16.2	15.2	13.8	14.6				22.6	21.3	12.2	12.5				13.3	10.3	9.9	10.7				13.8	9.2	11.0	15.7			
BF Mean Depth (ft)	1.7	1.3	1.3	1.1				0.9	0.9	1.7	1.7				1.2	1.3	1.3	1.4				0.8	0.9	0.8	0.7			
Width/Depth Ratio	9.7	11.4	10.7	13.2				26.1	23.4	7.3	7.5				11.4	7.9	7.6	7.6				16.3	10.8	15.6	20.9			
BF Cross-sectional Area (ft²)	27.2	20.5	17.9	16.2				19.6	19.4	20.2	21.0				15.5	13.6	12.9	15.1				11.6	7.9	11.0	11.7			
BF Max Depth (ft)	2.7	2.4	1.9	1.9				2.2	2.3	2.5	2.5				2.0	2.1	2.0	2.3				1.8	1.9	2.0	2.0			
Width of Floodprone Area (ft)	38.0	38.0	38.0	38.0				32.0	31.5	31.5	31.5				25.9	23.3	23.3	23.3				56.8	56.8	56.8	56.8			
Entrenchment Ratio	2.3	2.5	2.8	2.6				1.4	1.5	2.6	2.5				1.9	2.3	2.4	2.2				5.7	6.1	4.3	3.6			
Bank Height Ratio	1.0	0.9	0.9	0.9				1.0	1.0	1.0	1.1				1.0	1.1	1.1	1.1				1.0	1.0	0.9	1.0			
Wetted Perimeter (ft)	17.4	16.6	14.9	15.3				23.7	22.5	14.2	13.9				14.3	11.4	11.2	12.8				10.8	9.9	14.2	16.6			
Hydraulic Radius (ft	1.6	1.2	1.2	1.1				0.8	0.9	1.4	1.5				1.1	1.2	1.2	1.2				1.1	0.8	0.8	0.7			
d50 (mm)																											

Table 9. Cross-Section Morphology Data Summary
Russell Gap Restoration Project: DMS Project No ID. 100003

Table 9. Cross-Section Morphology Data Summary
Russell Gap Restoration Project: DMS Project No ID. 100003

Stream Reach	Reach 6							Reach 7b													Reach 9						
	Cross-section X-13 (Riffle)							Cross-section X-14 (Riffle)							Cross-section X-15 (Pool)							Cross-section X-16 (Pool)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	13.8	8.2	7.5	9.0				11.0	11.7	11.5	12.2				14.0	14.3	14.6	14.9				12.9	9.0	11.4	11.3			
BF Mean Depth (ft)	0.8	0.9	1.2	1.0				1.3	1.3	1.4	1.4				1.0	0.9	0.9	0.9				1.0	0.8	1.0	1.1			
Width/Depth Ratio	10.9	9.4	6.4	9.0				8.4	9.3	8.0	8.5				14.4	15.5	15.8	16.8				12.4	11.4	11.2	11.3			
BF Cross-sectional Area (ft²)	7.2	7.1	8.8	9.1				14.4	14.6	16.4	17.4				13.6	13.2	13.4	13.1				13.5	7.1	11.5	12.3			
BF Max Depth (ft)	1.3	1.5	1.7	1.7				2.0	2.2	2.4	2.6				1.6	1.7	2.0	2.1				1.9	1.8	1.8	1.7			
Width of Floodprone Area (ft)	45.0	45.0	45.0	45.0				45.9	45.9	45.9	45.9				27.3	27.3	27.3	27.3				80.4	80.4	80.4	80.4			
Entrenchment Ratio	5.1	5.5	6.0	5.0				4.2	3.9	4.0	3.9				1.9	1.9	1.9	1.8				6.2	8.9	7.1	7.1			
Bank Height Ratio	1.0	1.0	1.1	1.0				1.0	1.1	1.1	1.1				2.4	2.4	0.9	0.9				1.0	1.0	1.1	1.1			
Wetted Perimeter (ft)	9.4	8.9	8.8	10.1				12.0	12.6	12.9	13.4				14.5	14.8	15.3	15.7				13.8	9.8	12.2	12.4			
Hydraulic Radius (ft	0.8	0.8	1.0	0.9				1.2	1.2	1.3	1.3				0.9	0.9	0.9	0.8				1.0	0.7	0.9	1.0			
d50 (mm)																												

Stream Reach	Reach 9							Reach 11																			
	Cross-section X-17 (Riffle)							Cross-section X-18 (Riffle)							Cross-section X-19 (Riffle)							Cross-section X-20 (Riffle)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	12.1	12.2	12.9	13.6				8.9	7.1	6.8	6.8				4.5	3.8	4.4	4.3				3.7	3.3	3.1	3.3			
BF Mean Depth (ft)	1.0	1.0	1.1	1.1				1.1	0.7	0.7	0.7				0.5	0.4	0.4	0.4				0.5	0.3	0.2	0.2			
Width/Depth Ratio	12.2	11.9	11.7	12.0				8.4	9.8	10.2	10.0				9.1	9.7	10.9	9.7				6.8	11.0	16.3	21.1			
BF Cross-sectional Area (ft²)	11.9	12.4	14.3	15.4				9.5	5.2	4.5	4.6				2.2	1.5	1.8	1.9				2.0	1.0	0.6	0.5			
BF Max Depth (ft)	1.4	1.6	2.1	2.1				1.9	1.4	1.1	1.0				0.8	0.7	0.6	0.7				1.0	0.5	0.3	0.3			
Width of Floodprone Area (ft)	18.7	78.1	78.1	78.1				18.6	14.7	14.7	14.7				11.1	11.1	11.1	11.1				32.0	32.0	32.0	32.0			
Entrenchment Ratio	1.6	6.4	6.0	5.7				2.1	2.1	2.2	2.2				2.5	2.9	2.5	2.6				8.7	9.6	10.3	9.8			
Bank Height Ratio	1.0	1.0	1.1	1.1				2.9	1.2	1.0	1.0				1.0	1.1	1.0	1.0				1.0	1.0	1.0	1.0			
Wetted Perimeter (ft)	12.6	12.7	13.8	14.6				9.8	7.7	7.2	7.2				4.8	4.1	4.8	4.5				4.2	3.5	3.2	3.3			
Hydraulic Radius (ft)	0.9	1.0	1.0	1.1				1.0	0.7	0.6	0.6				0.5	0.4	0.4	0.4				0.5	0.3	0.2	0.2			
d50 (mm)																												

Stream Reach	Reach 19							Reach 20							Reach 25							Reach 10b						
	Cross-section X-21 (Riffle)							Cross-section X-22 (Riffle)							Cross-section X-23 (Riffle)							Cross-section X-24 (Riffle)						
Dimension and substrate	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+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	8.8	8.5	8.6	9.1				3.8	4.5	4.7	5.7				5.1	4.7	4.2	4.7				6.2	5.5	5.7	5.0			
BF Mean Depth (ft)	0.9	0.8	0.8	0.8				0.5	0.4	0.4	0.3				0.6	0.6	0.5	0.7				0.6	0.5	0.6	0.6			
Width/Depth Ratio	10.2	11.1	11.4	12.0				7.0	10.2	12.8	16.6				8.1	8.2	8.9	6.9				11.0	10.1	10.0	8.2			
BF Cross-sectional Area (ft²)	7.6	6.6	6.5	6.9				2.0	1.9	1.7	2.0				3.2	2.7	2.0	3.2				3.5	3.0	3.2	3.1			
BF Max Depth (ft)	1.5	1.5	1.6	1.5				0.8	0.7	0.7	0.6				1.0	0.9	0.7	1.1				1.0	1.0	1.1	1.0			
Width of Floodprone Area (ft)	26.3	26.3	26.3	26.3				12.4	12.4	12.4	12.4				8.1	8.1	8.1	8.1				45.5	45.5	45.5	45.5			
Entrenchment Ratio	3.0	3.1	3.0	2.9				3.3	2.8	2.9	2.2				1.6	1.7	1.9	1.7				7.3	8.2	8.0	9.0			
Bank Height Ratio	1.0	1.1	1.0	1.0				1.0	1.0	0.9	1.3				1.0	0.9	1.0	1.0				1.0	1.0	1.0	1.0			
Wetted Perimeter (ft)	9.4	9.1	9.4	9.6				4.3	4.7	5.0	5.8				5.7	5.2	4.6	5.4				6.6	5.9	6.2	5.6			
Hydraulic Radius (ft	0.8	0.7	0.7	0.7				0.5	0.4	0.3	0.3				0.6	0.5	0.4	0.6				0.5	0.5	0.5	0.6			
d50 (mm)																												

Stream Reach	Reach 12							Reach 2						
	Cross-section X-25 (Riffle)							Cross-section X-26 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation														
BF Width (ft)	9.1	7.8	6.7	7.3				18.5	13.4	14.3	18.2			
BF Mean Depth (ft)	0.6	0.6	0.6	0.4				1.8	2.2	1.4	1.6			
Width/Depth Ratio	16.2	12.8	11.0	18.1				10.2	6.1	10.4	11.6			
BF Cross-sectional Area (ft²)	5.2	4.7	4.1	2.9				33.6	29.4	19.6	28.4			
BF Max Depth (ft)	1.0	1.0	1.2	0.8				2.9	2.9	2.4	2.3			
Width of Floodprone Area (ft)	38.2	38.2	38.2	38.2				38.0	38.1	38.1	38.1			
Entrenchment Ratio	4.2	4.9	5.7	5.2				2.1	2.8	2.7	2.1			
Bank Height Ratio	1.0	0.9	1.1	0.8				1.0	0.9	1.0	0.9			
Wetted Perimeter (ft)	9.4	8.1	7.3	7.5				19.4	14.3	15.3	19.0			
Hydraulic Radius (ft	0.5	0.6	0.6	0.4				1.7	2.1	1.3	1.5			
d50 (mm)														

APPENDIX E

Hydrologic Data

Table 10. Verification of Bankfull Events
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Date of Data Collection	R1 Manual Cork Crest Gauge #1	R9 Manual Cork Crest Gauge #2	R4 Manual Cork Crest Gauge #3	R6 Manual Cork Crest Gauge #4	Date of Bankfull Event Occurrence	Method of Data Collection
Year 1 Monitoring (2020)						
6/1/2020	NA	NA	1.25 ft.	NA	5/28/2020	Manual cork measurement
11/5/2020	1.5 ft.	NA	2.5 ft	NA	10/30/2020	Manual cork measurement
Year 2 Monitoring (2021)						
6/14/2021			7.5 inches and 20.5 inches		3/25/2021 and 5/3/2021	Manual cork measurement
10/19/2021	1.1 ft.				10/7/2021	Manual cork measurement
Year 3 Monitoring (2022)						
10/13/2022		8.25 inches			10/1/2022	Manual cork measurement

Note: Manual cork crest gauge readings were corroborated with associated spikes in the automated Continuous Stage Recorder (see graph in Appendix E) and/or with photographs (Appendix B).

Figure 5. Wetland Monitoring Well Graphs

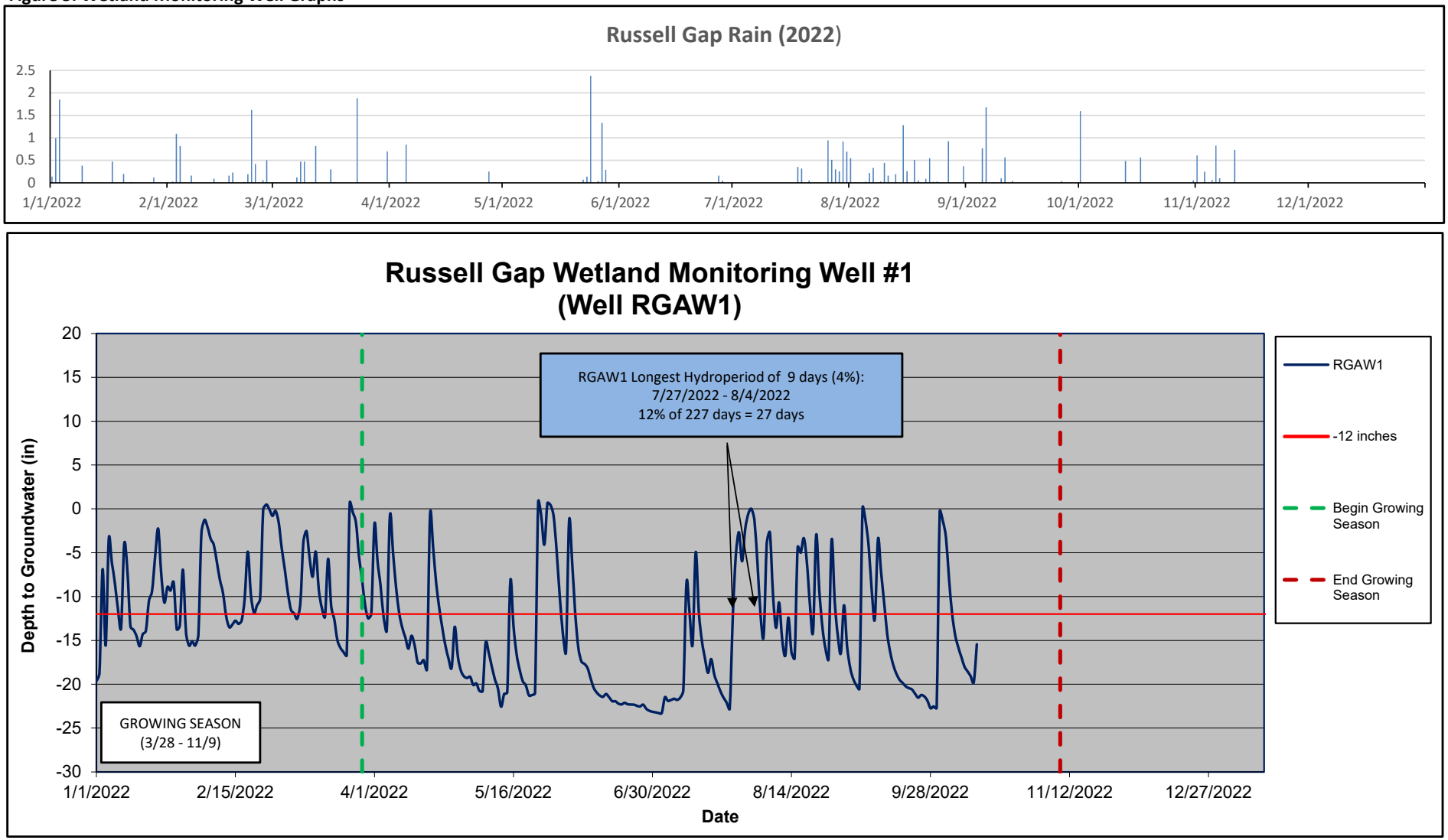
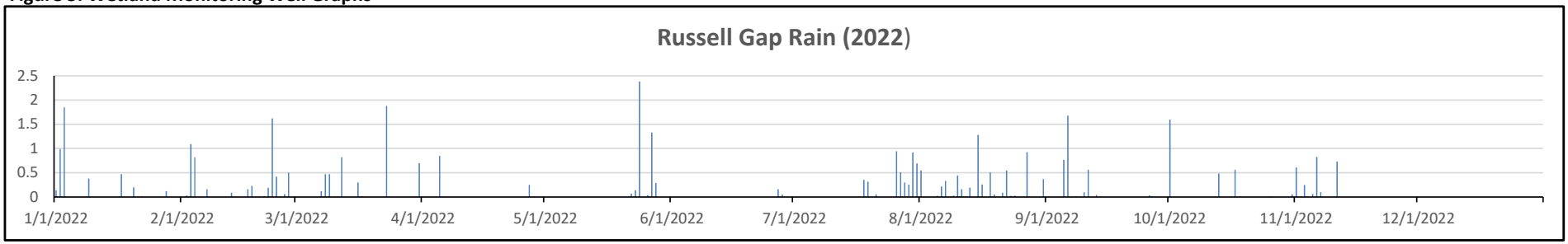


Figure 5. Wetland Monitoring Well Graphs



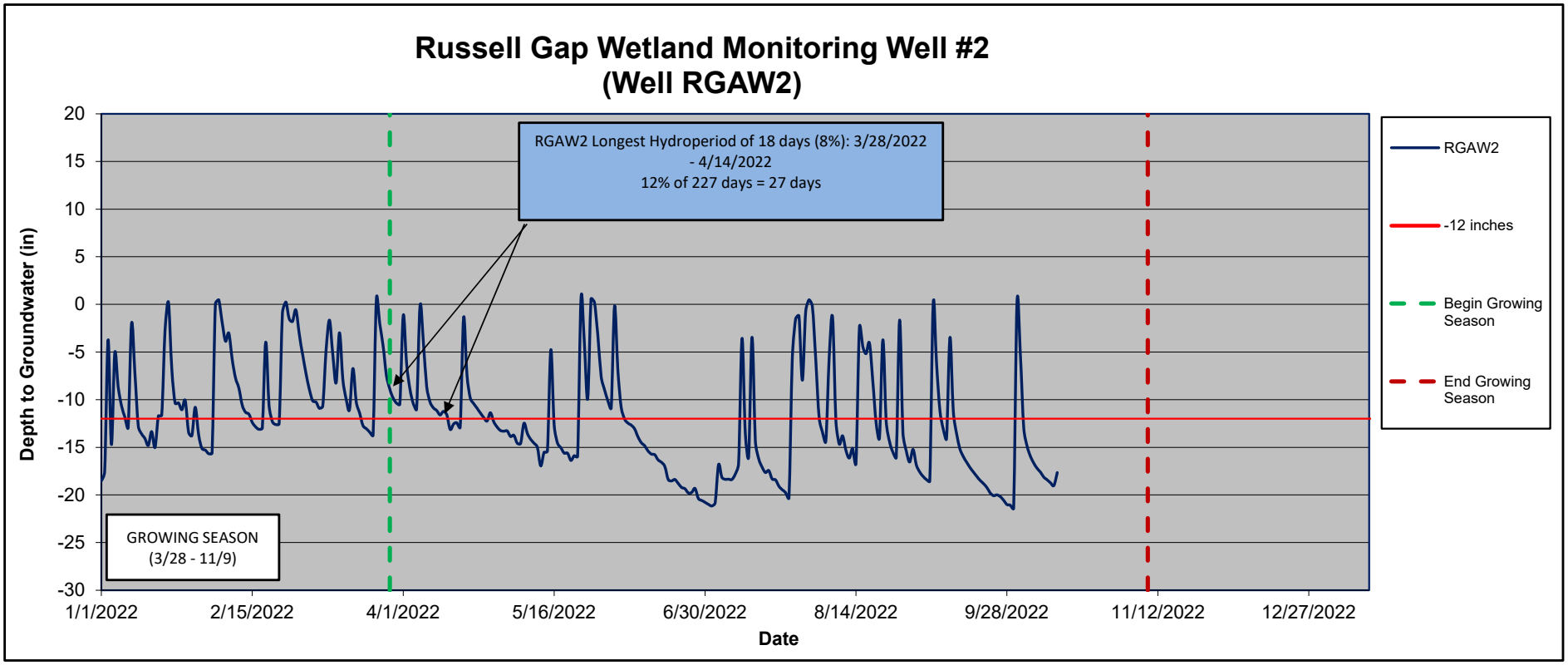
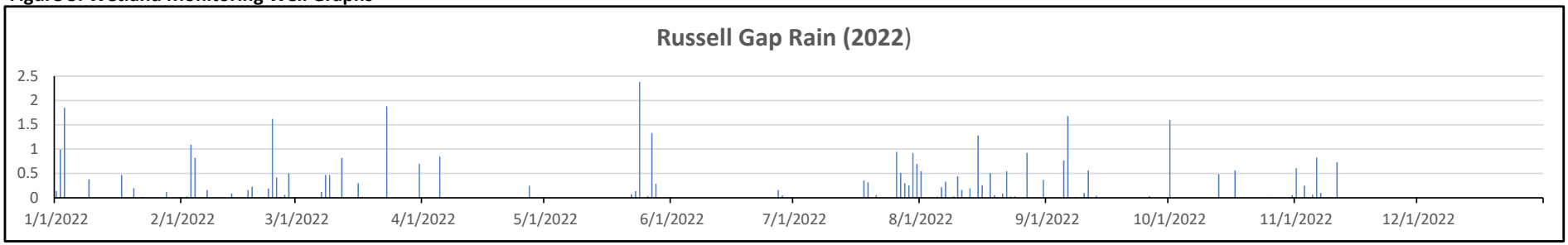


Figure 5. Wetland Monitoring Well Graphs



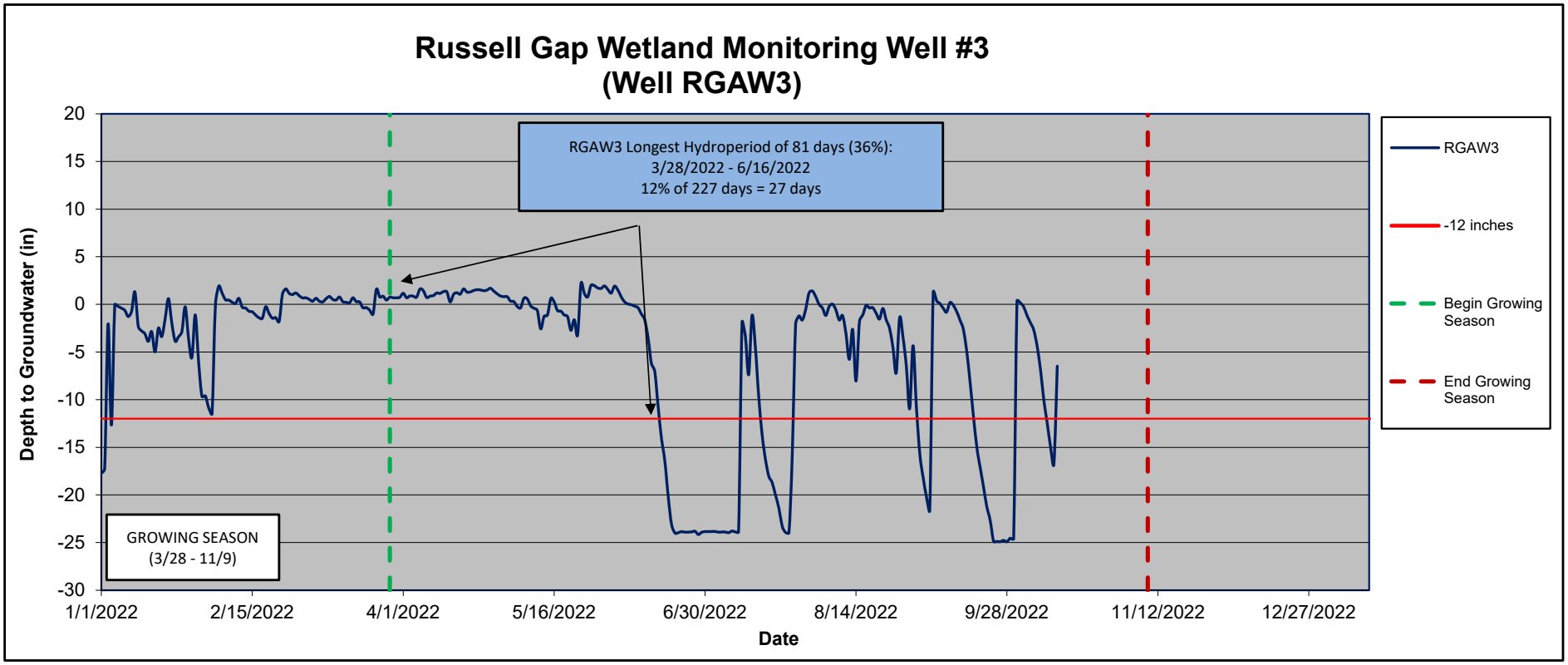
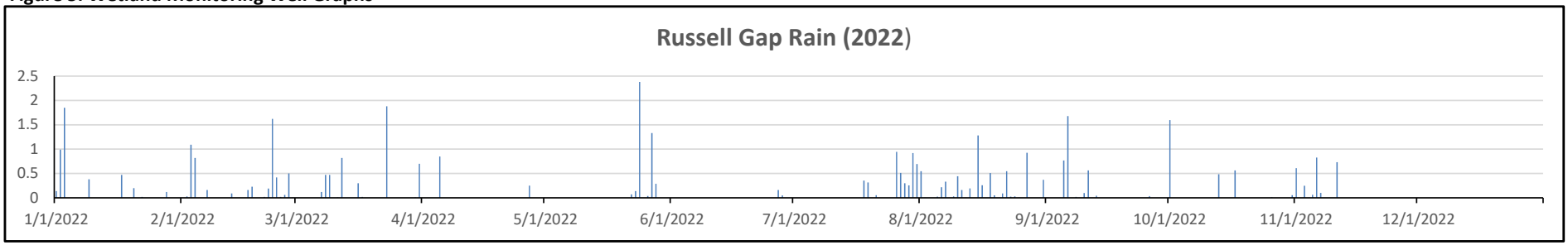


Figure 5. Wetland Monitoring Well Graphs



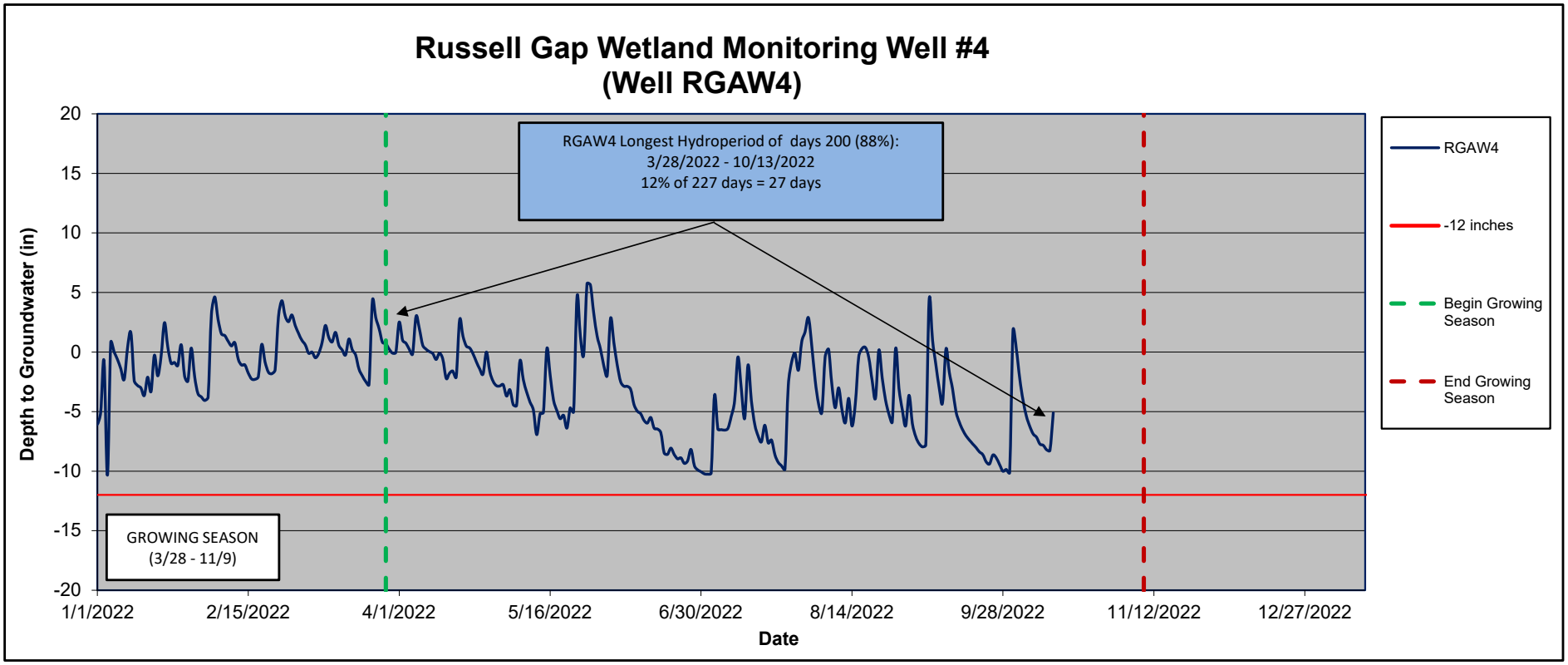


Figure 5. Wetland Monitoring Well Graphs

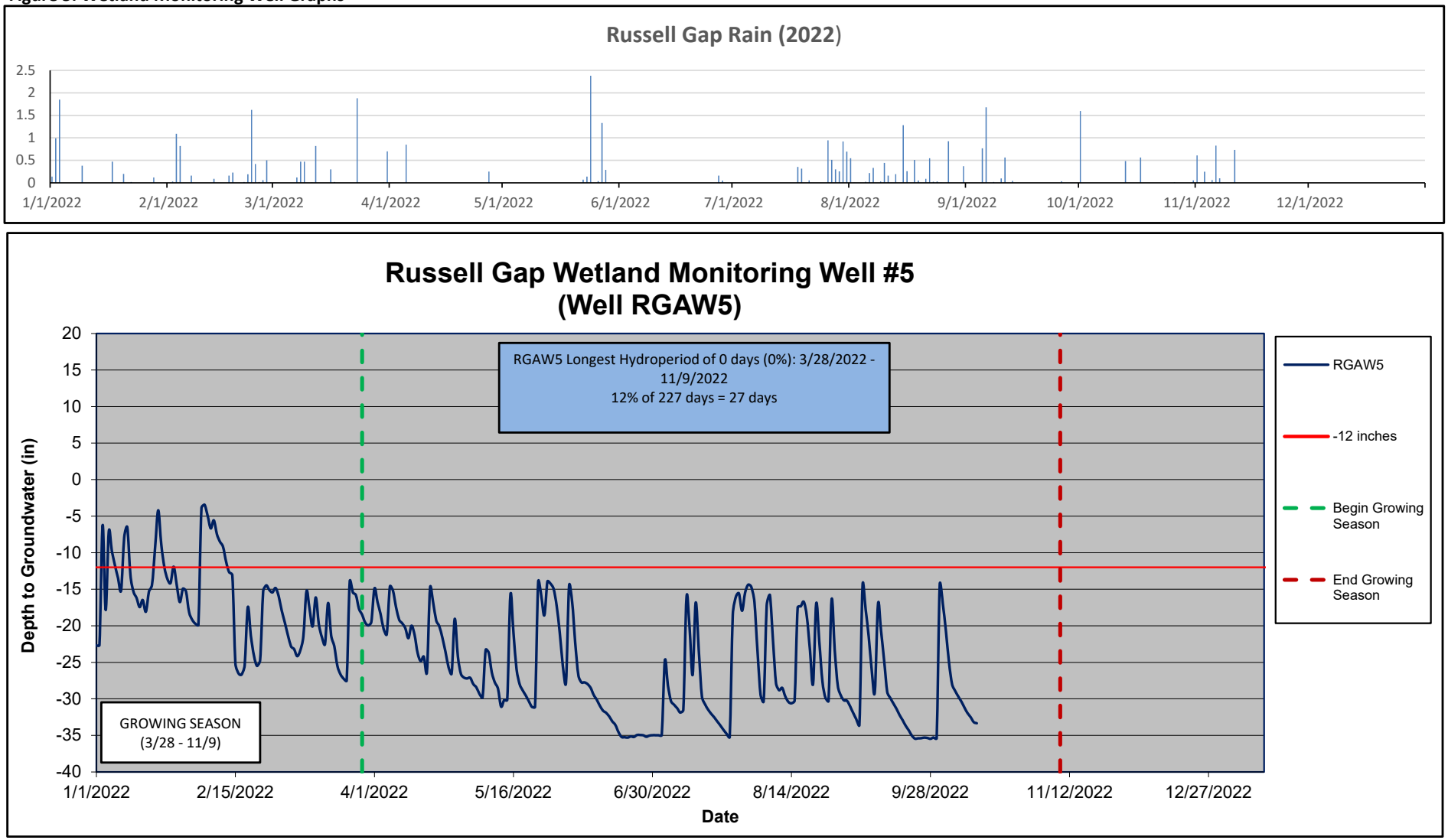
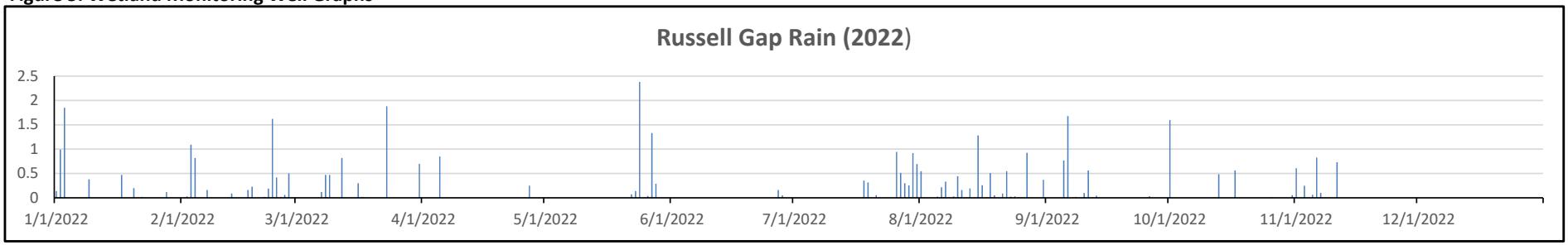


Figure 5. Wetland Monitoring Well Graphs



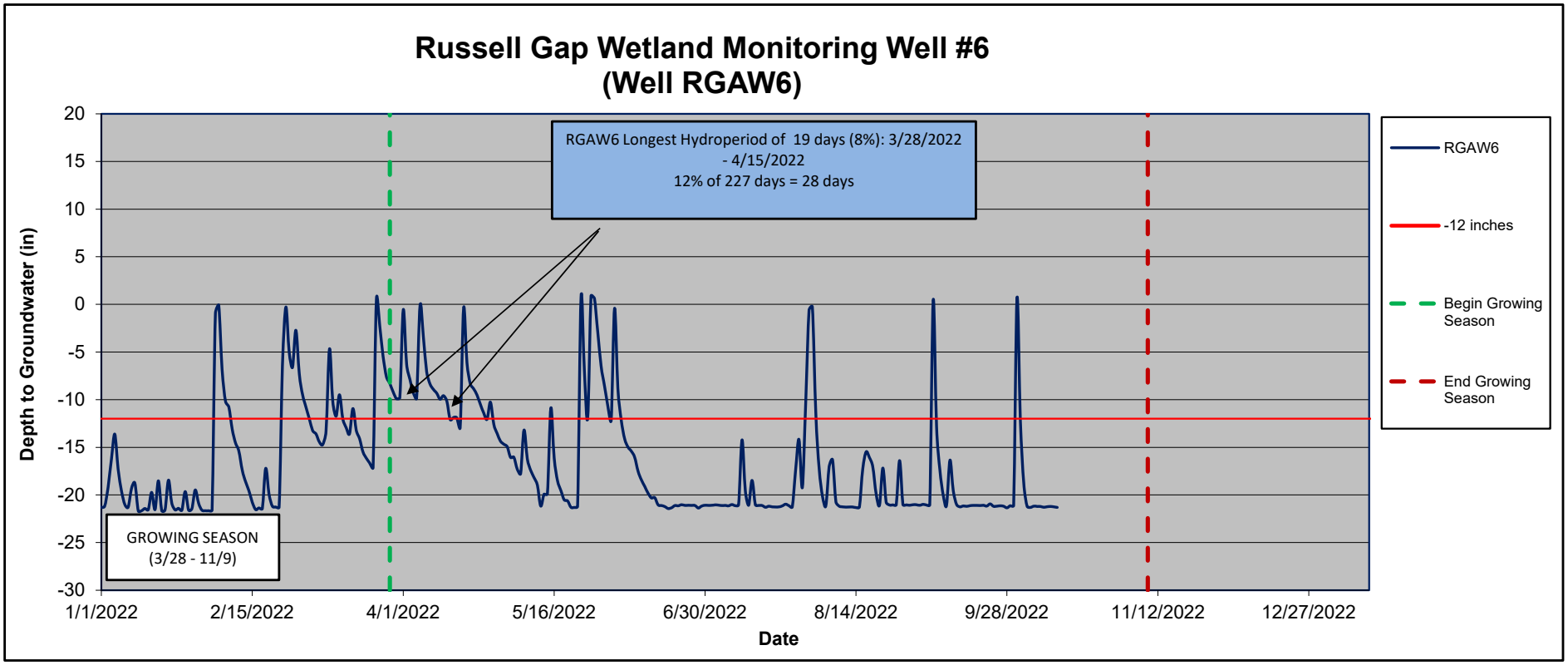
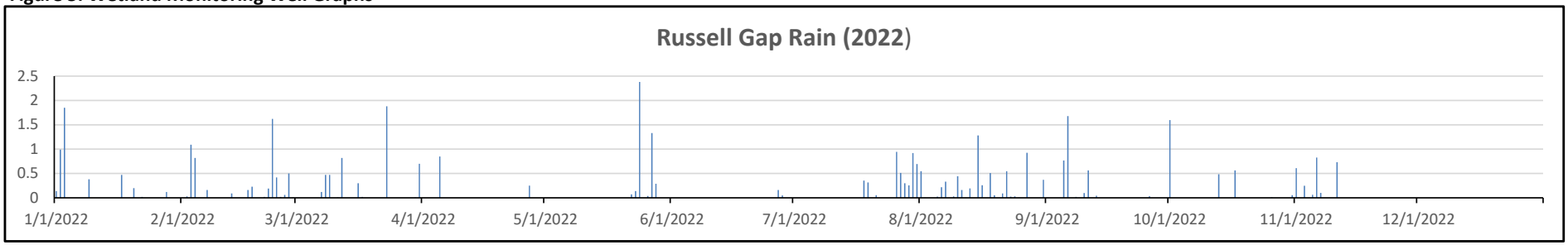


Figure 5. Wetland Monitoring Well Graphs



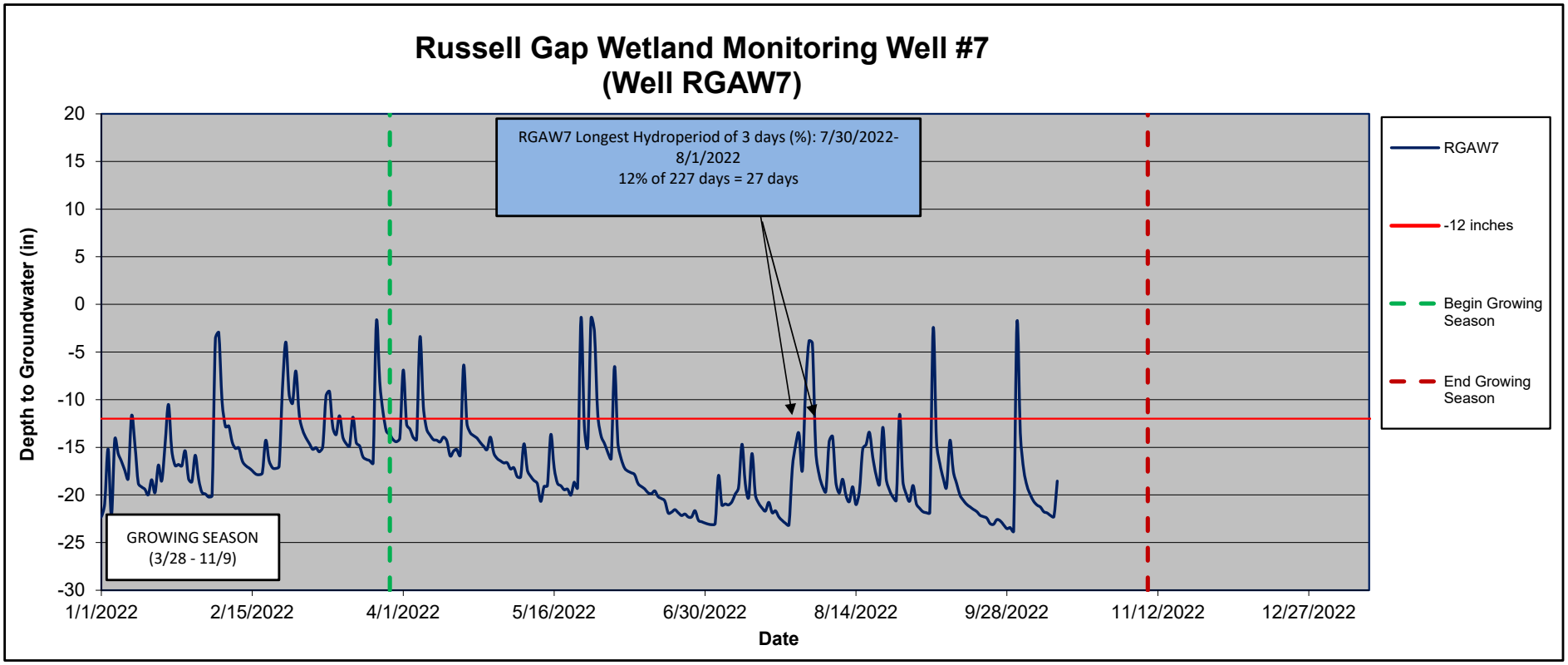
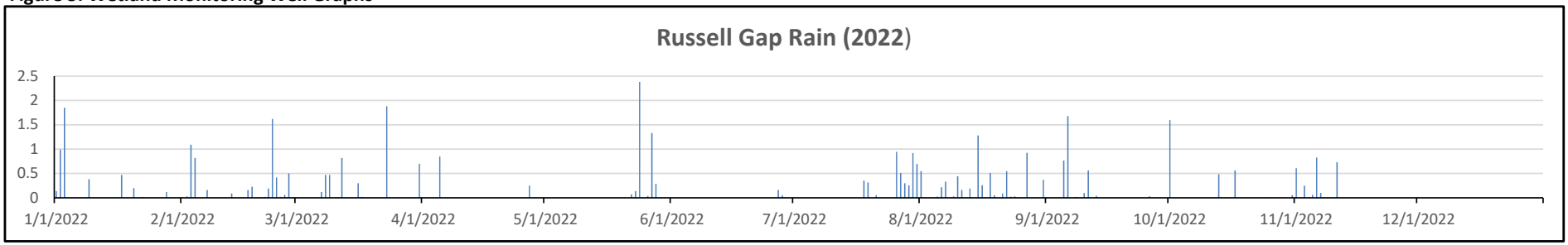
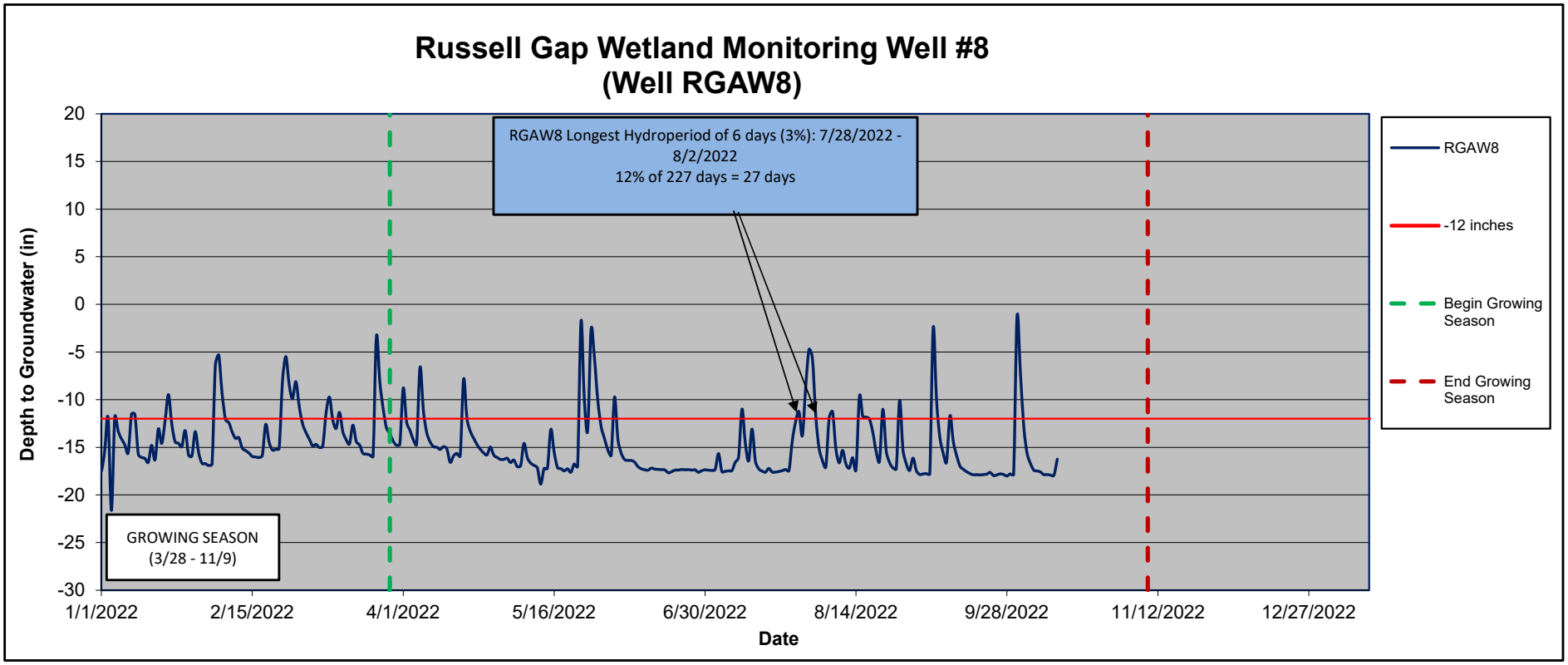


Figure 5. Wetland Monitoring Well Graphs





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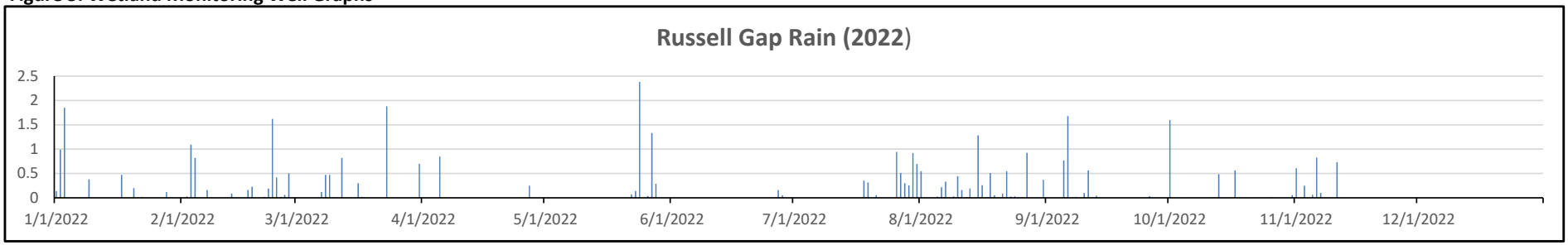


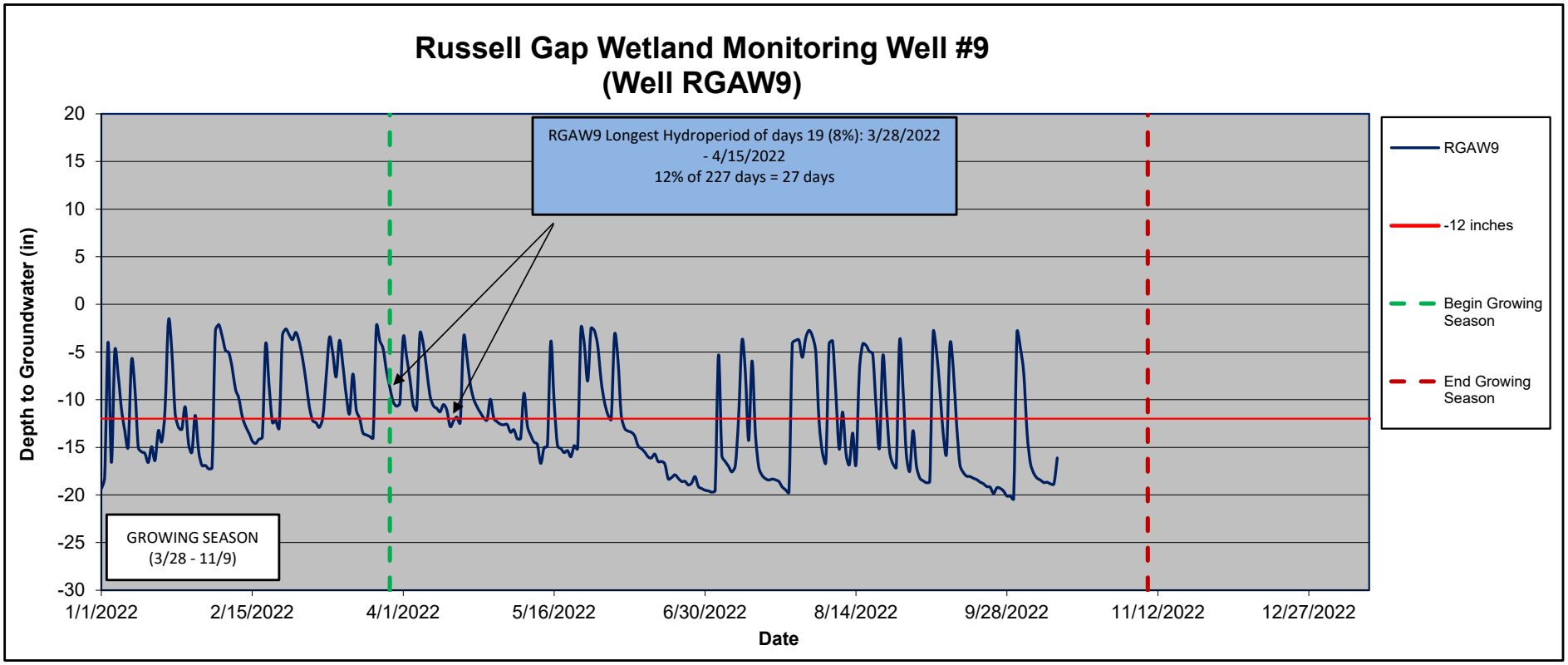
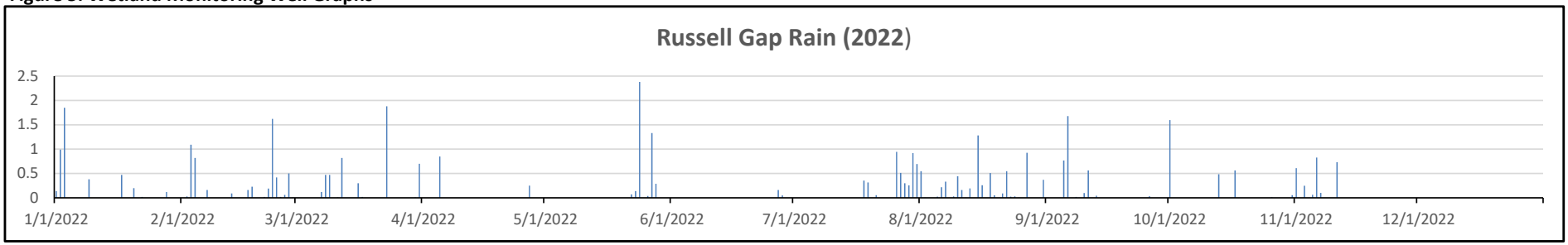


Figure 5. Wetland Monitoring Well Graphs



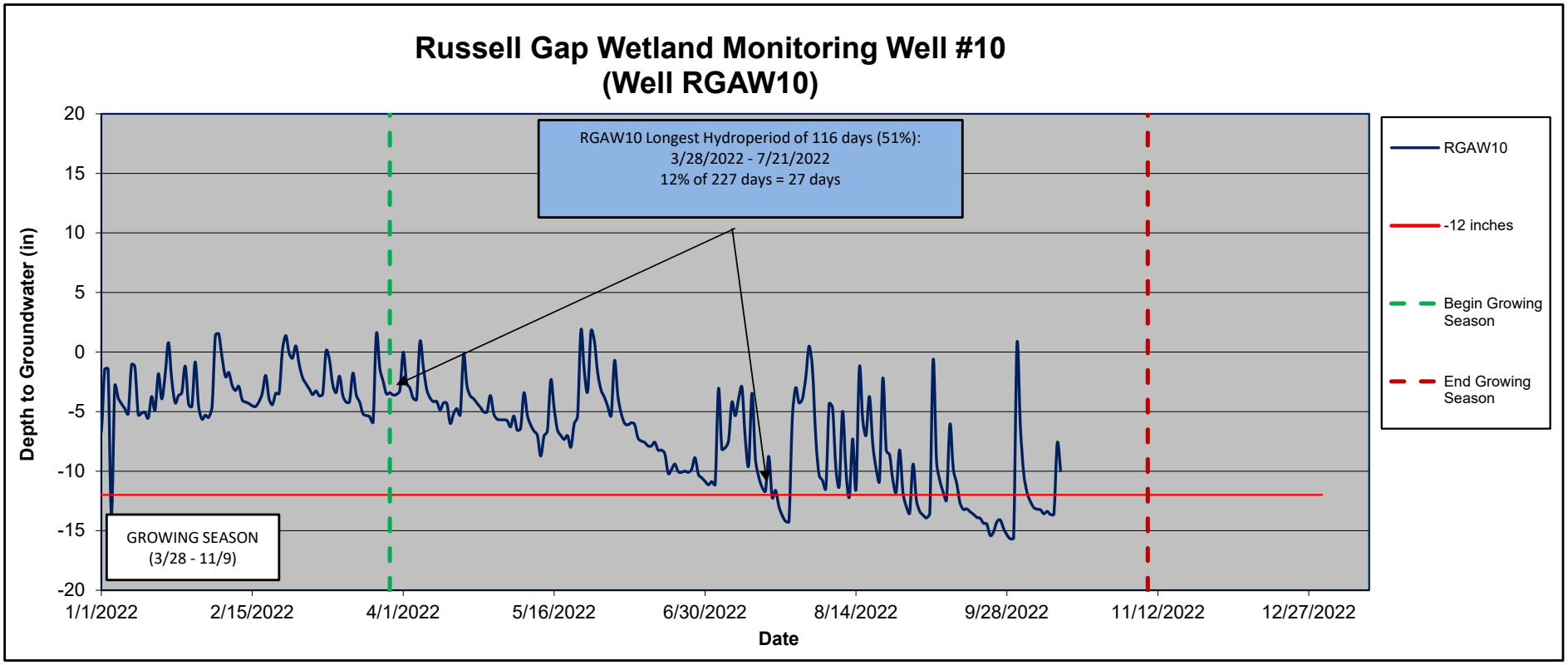
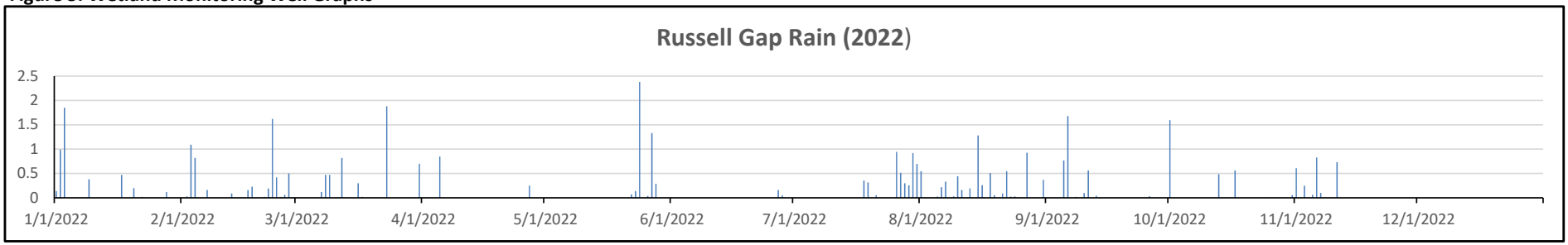


Figure 5. Wetland Monitoring Well Graphs



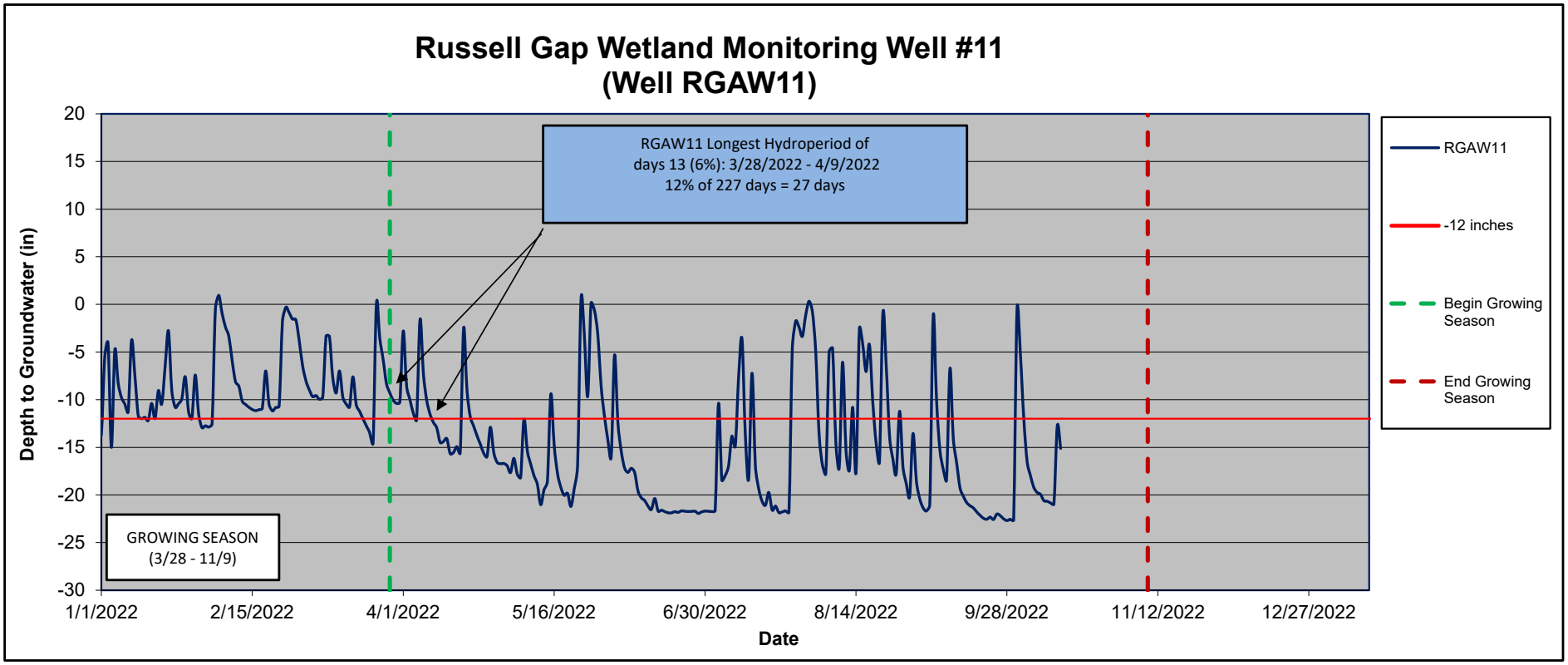
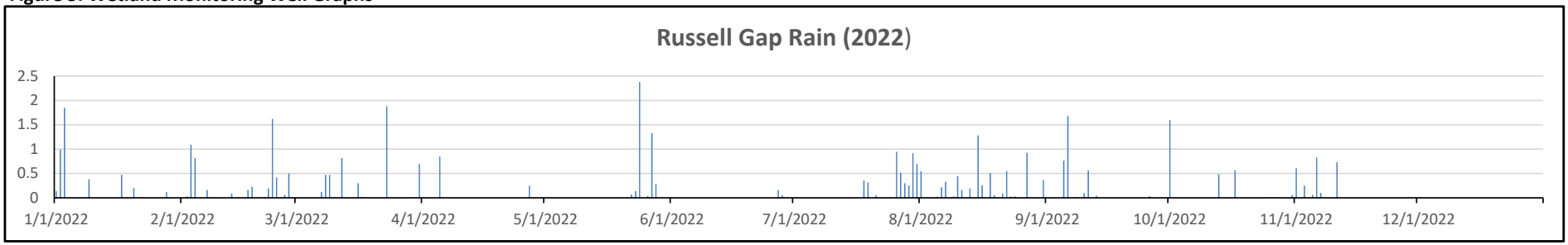


Figure 5. Wetland Monitoring Well Graphs



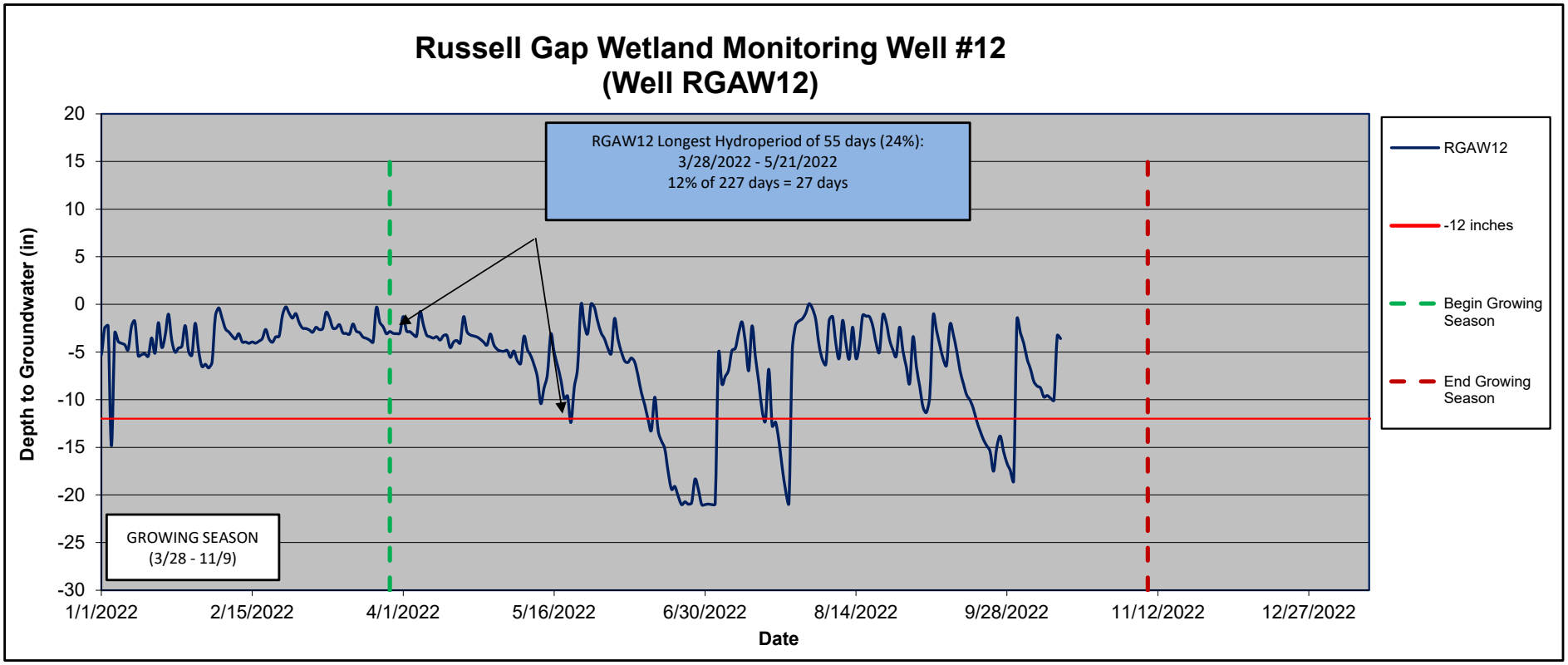


Table 11. Wetland Hydrology Summary Data
Russell Gap Stream Mitigation Project - NCDMS Project No. 100003

Well ID	Percentage of Consecutive Days <12 inches from Ground Surface[1]							Most Consecutive Days Meeting Criteria[2]							Percentage of Cumulative Days <12 inches from Ground Surface							Cumulative Days Meeting Criteria[3]						
	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)
Wetland Monitoring Wells (Installed March 2020)																												
RGAW1	16.0	10.0	4.0					59	22.0	9.0					66.4	31.0	27.0					150	71.0	63.0				
RGAW2	100.0	41.0	8.0					226	93.0	18.0					100.0	55.0	29.5					226	124.0	67.0				
RGAW3	100.0	49.0	36.0					226	112.0	81.0					100.0	64.0	64.0					226	145.0	146.0				
RGAW4	100.0	91.0	88.0					226	206.0	200.0					100.0	91.0	88.0					226	205.0	200.0				
RGAW5	38.0	24.0	0.0					87	55.0	0.0					92.0	49.0	0.0					208	111.0	0.0				
RGAW6	54.8	30.0	8.0					124	69.0	19.0					100.0	41.0	20.0					226	92.0	45.0				
RGAW7	100.0	57.0	1.0					226	130.0	3.0					100.0	75.0	7.0					226	169.0	15.0				
RGAW8	76.5	91.0	3.0					173	206.0	6.0					91.6	91.0	13.0					207	205.0	29.0				
RGAW9	100.0	56.0	8.0					226	127.0	19.0					100.0	68.0	34.0					226	154.0	77.0				
RGAW10	100.0	91.0	51.0					226	206.0	116.0					100.0	91.0	71.0					226	205.0	161.0				
RGAW11	100.0	58.0	6.0					226	132.0	13.0					100.0	90.0	24.0					226	203.0	54.0				
RGAW12	100.0	91.0	25.0					226	206.0	56.0					100.0	91.0	70.0					226	205.0	160.0				

[1]Indicates the percentage of the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
[2]Indicates the single greatest consecutive number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
[3]Indicates the total number of days within the monitored growing season with a water table 12 inches or less from the soil surface.
Growing season for Alexander County is from March 28 to November 9 and is **227** days long. 12% of the growing season is **27** days.
Not meeting success criteria =

Figure 6. Flow Gauge Success

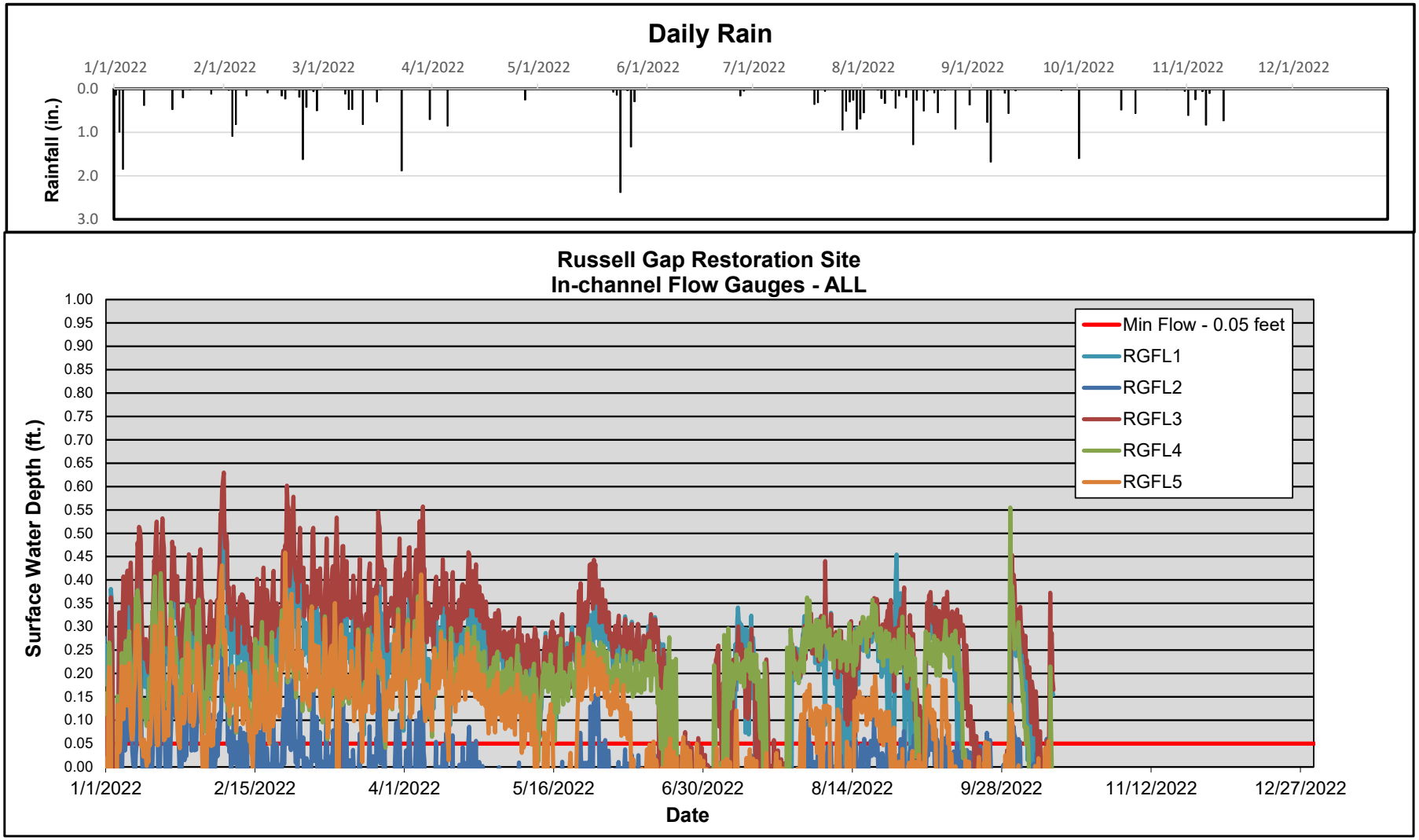
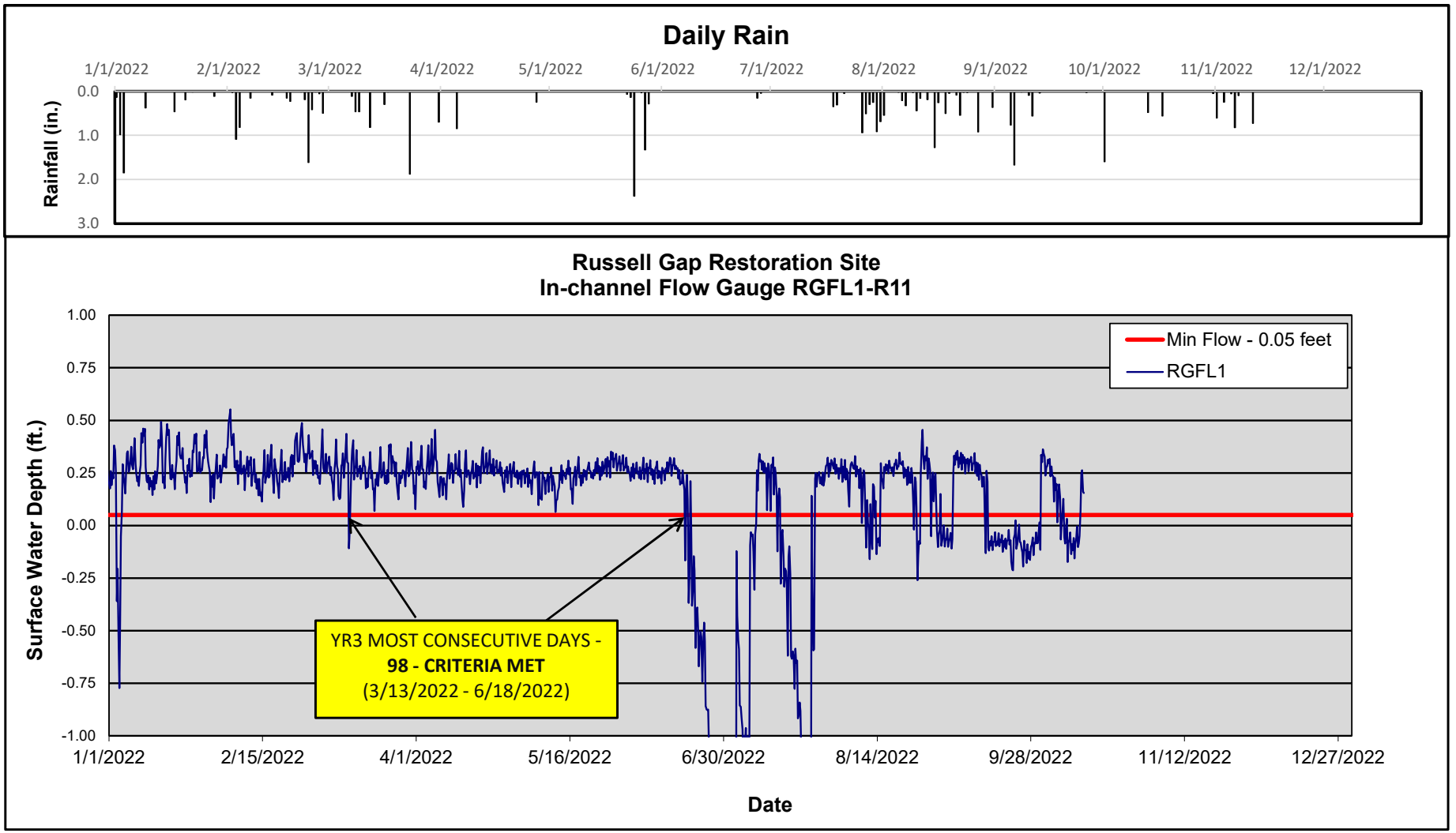


Figure 6. Flow Gauge Graphs



* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs

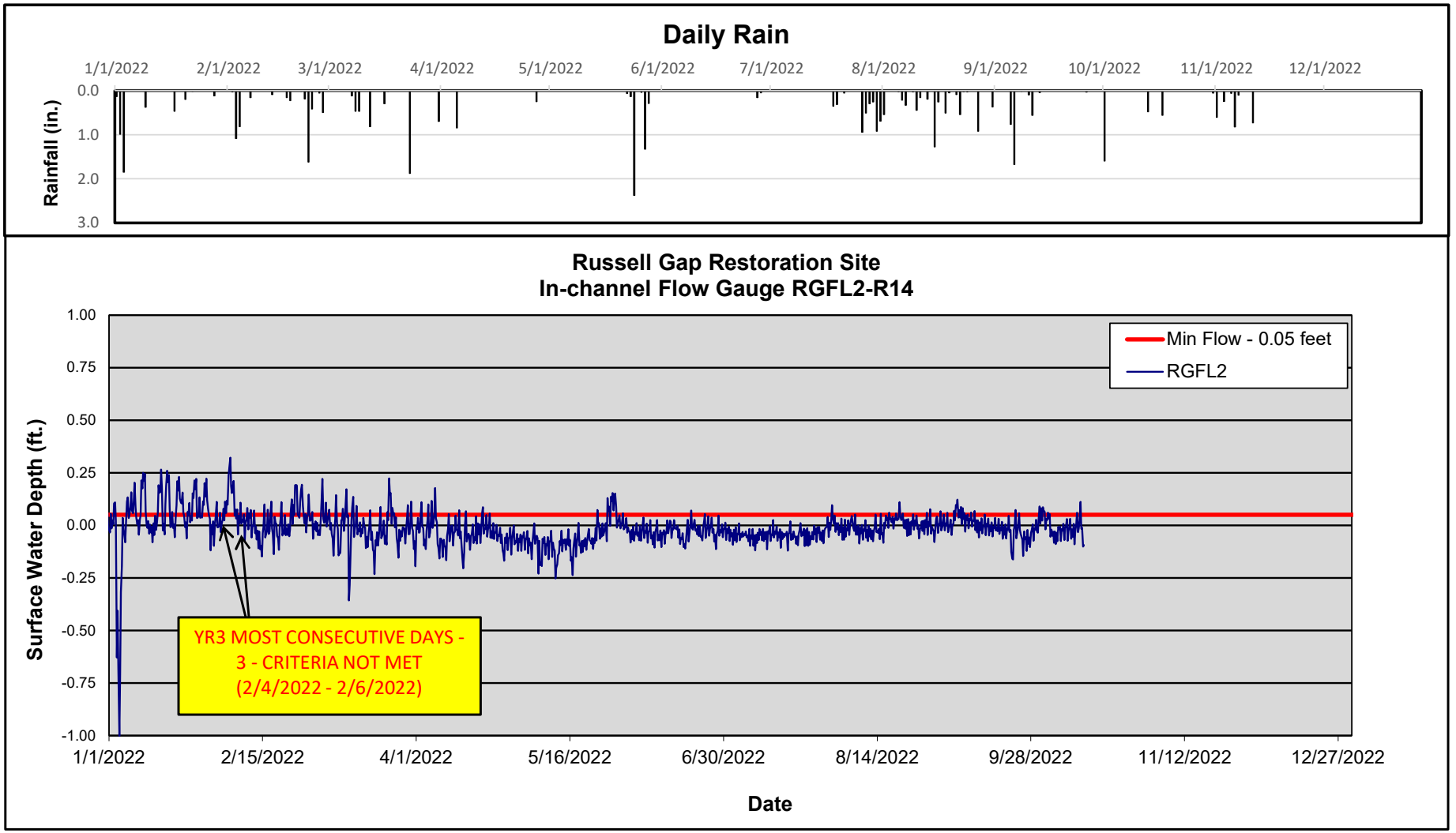


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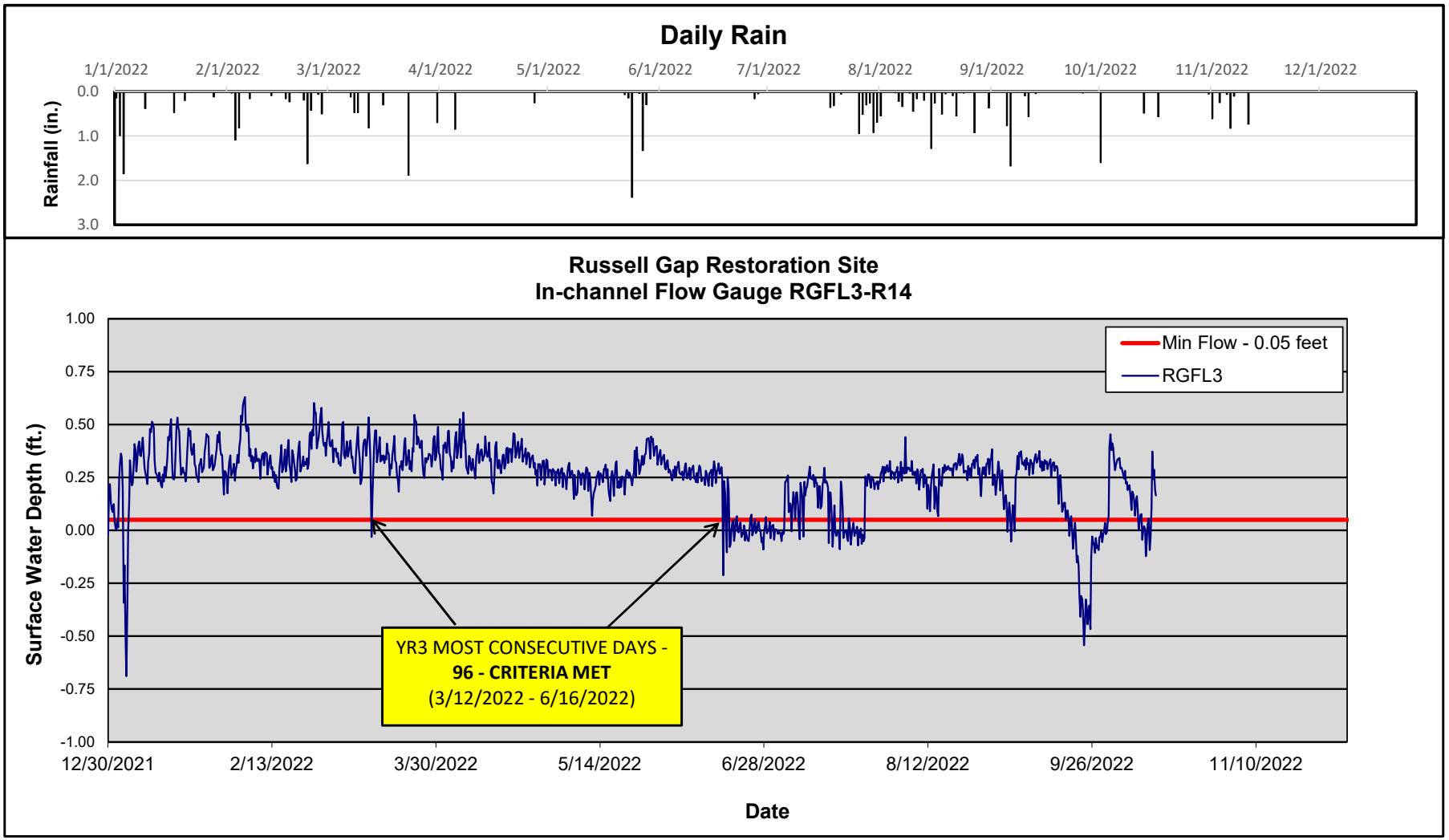
Figure 6. Flow Gauge Graphs



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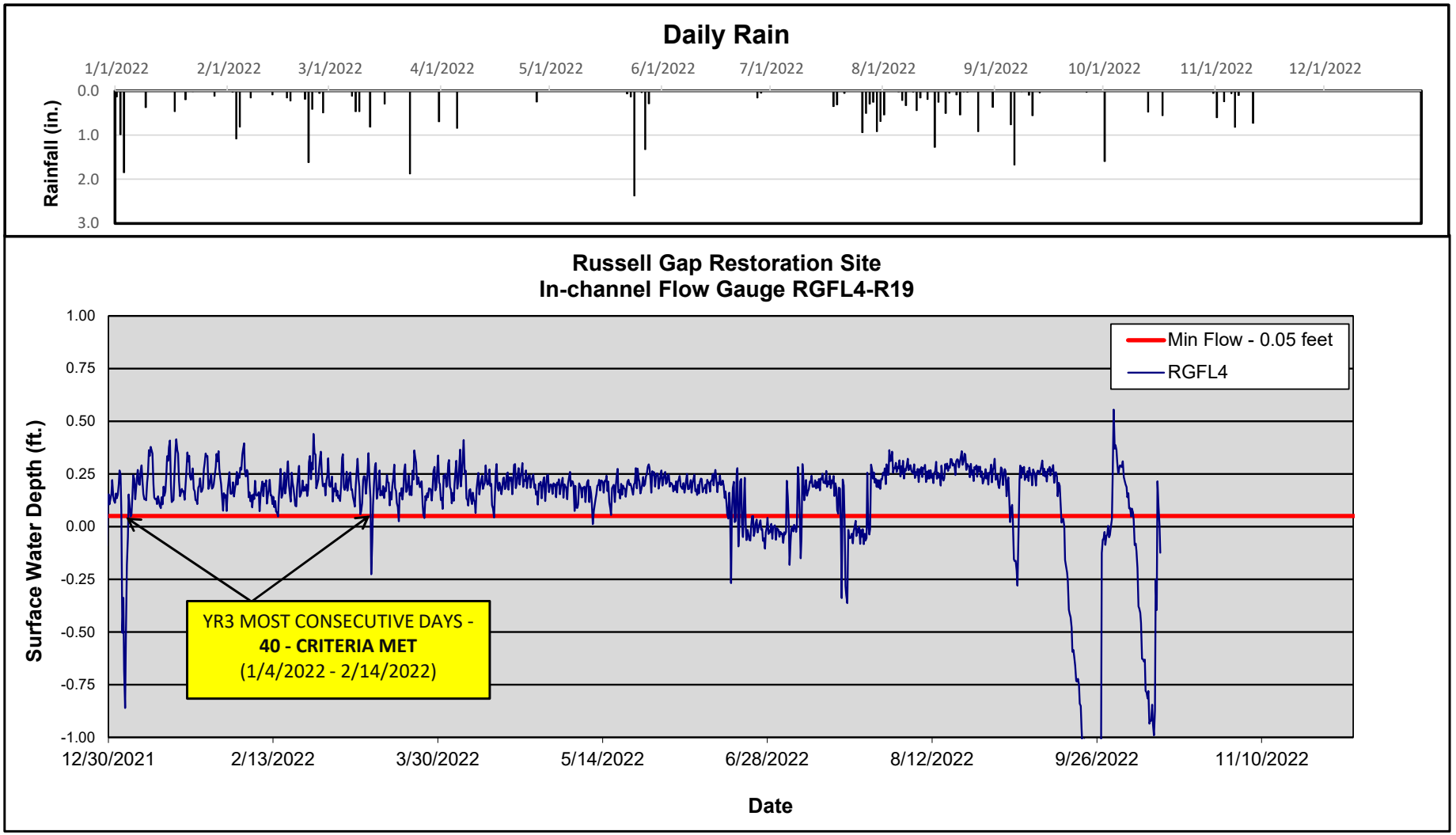
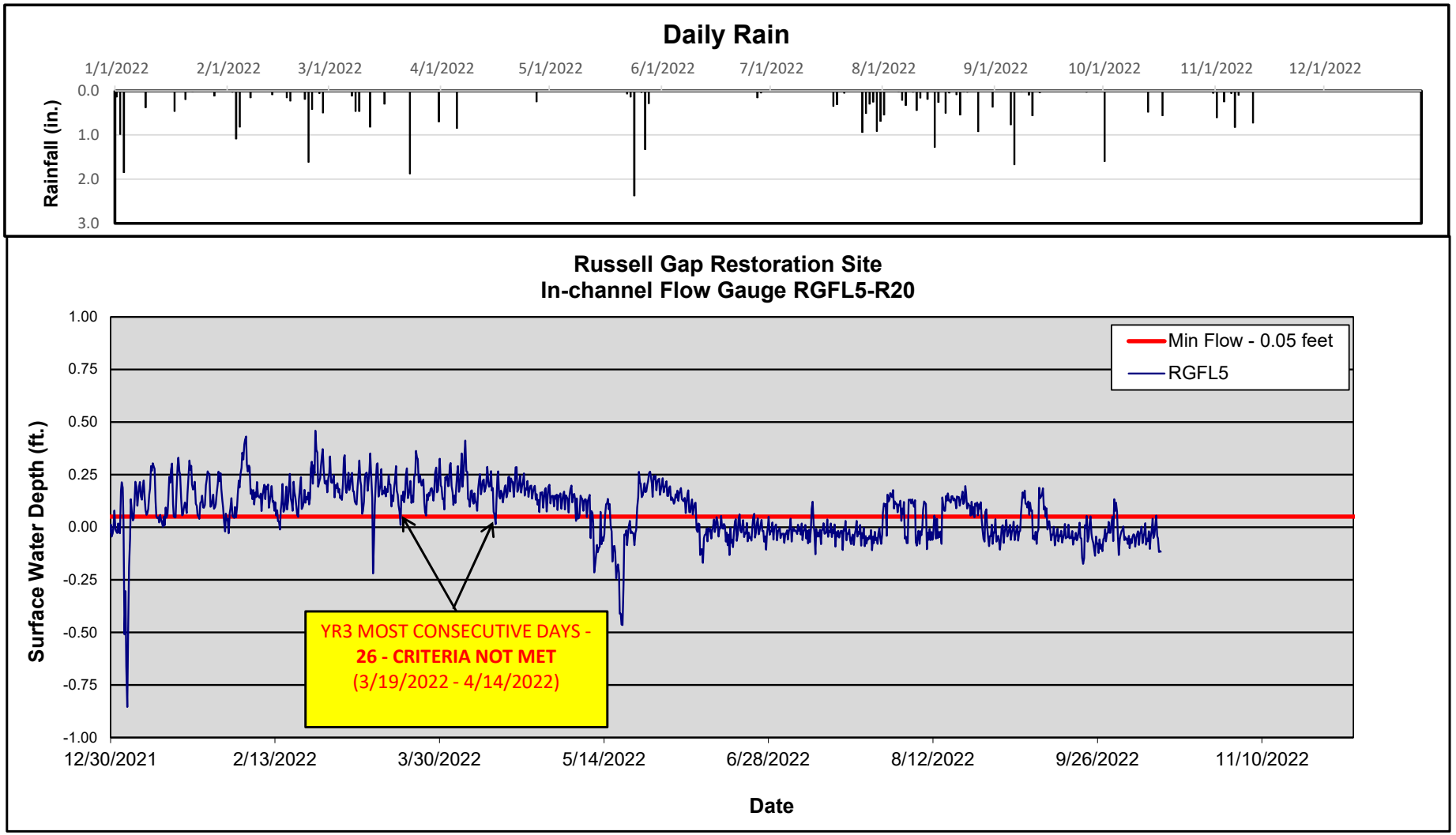


* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 6. Flow Gauge Graphs



* Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Table 12. All Years Flow Gauge Success
Russell Gap Stream Restoration Project: DMS Project ID No. 100003

Flow Gauge ID	Most Consecutive Days Meeting Criteria[1]							Cumulative Days Meeting Criteria[2]						
	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)
Flow Gauges (Installed March, 2020)														
RGFL1	64.0	103.0	98.0					209.0	146.0	207.0				
RGFL2	202.0	3.0	3.0					222.0	12.0	62.0				
RGFL3	232.0	42.0	96.0					232.0	93.0	231.0				
RGFL4	232.0	76.0	40.0					232.0	206.0	219.0				
RGFL5	232.0	38.0	26.0					232.0	214.0	138.0				

Notes:

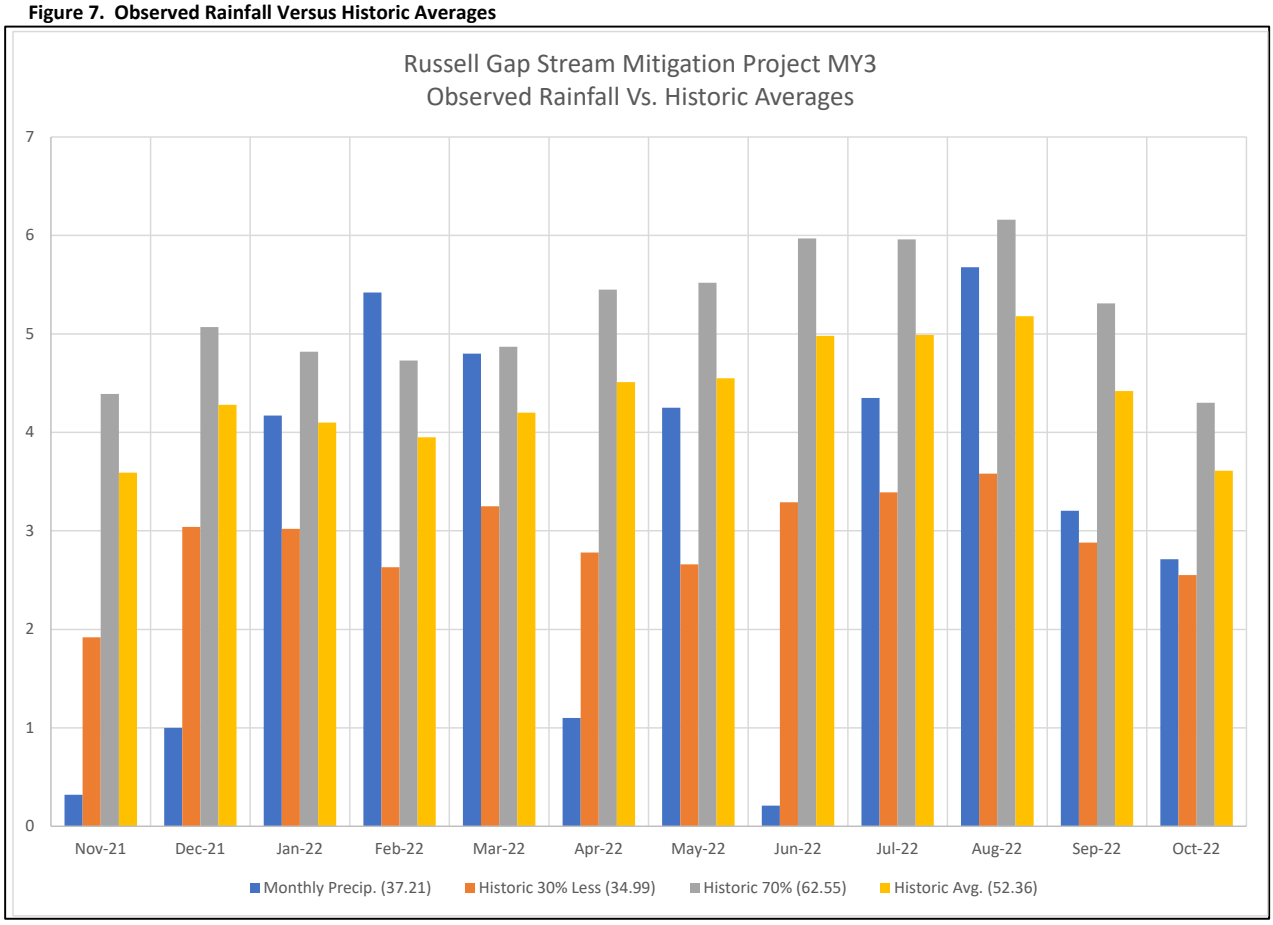
[1]Indicates the number of consecutive days within the monitoring year where flow was measured.

[2]Indicates the number of cumulative days within the monitoring year where flow was measured.

Success criteria will include 30 days of consecutive baseflow for monitoring gauges during a normal rainfall year.

Surface water flow is estimated to have occurred when the pressure transducer reading is equal to or above 0.05 feet in depth.

Figure 7. Observed Rainfall Versus Historic Averages



Note: Historic average annual rainfall for Alexander County, NC is 52.36 inches, while the observed project rainfall recorded a total of 37.21 inches over the previous 12 months (Nov. 21 - Oct. 2022). Project rainfall data was collected from the NC-CRONOS station TAYL.